Jno. M. Browne
Harvard University
1852

OUTLINES

OF THE

INSTITUTES OF MEDICINE.

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JOSEPH A. GALLUP, M.D.

OUTLINES

OF THE

INSTITUTES OF MEDICINE:

FOUNDED ON

THE PHILOSOPHY

OF

THE HUMAN ECONOMY,

IN

HEALTH, AND IN DISEASE.

IN THREE PARTS.

Should we build facts upon facts until our pile reached the heavens, they would tumble to pieces, unless they were cemented by principles.—RUSH.

BY JOSEPH A. GALLUP, M. D.

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VOLUME I.

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ADDRESS.

As the writer has been chiefly induced to undertake the labor of the following design, in consequence of two very courteous memorials addressed to him, from all the students present of two classes, at different Medical Institutions, requesting a publication of his Lectures, or the principles embraced in them; he has presumed, with respectful regards, to present these outlines to the Students of Medicine in the United States of North America, with a hope of their being in some measure useful to the science of medicine, and with best wishes of

THE AUTHOR.

PREFATORY REMARKS.

Considering that some introductory remarks had been made in the course of the following pages, it had been concluded to omit any formal preface, and to present the work to the candid consideration of the medical community, without note or comment. However, on further reflection, it was deemed proper to offer a few brief expositions.

It can be but of little use to assign motives to such a project as the present, which shall have preponderated over the numerous, and almost insurmountable obstacles, which stood opposed to its accomplishment. It is hoped, however, that other than mercenary, or ambitious views may be imputed to one, whose feelings, and condition in life, incline him to ease and retirement. But, still, the impression of a duty, which may be due from him to society, by attempts to reform errors of high import, in a profession to which he has been ardently devoted, impels to the enterprise. If he fails of accomplishing any portion of the object, the comfort arising from a cancelled obligation will remain.

An author, who suffers himself to be placed on the broad arena of public trial, has no right to offer apologies, neither can they be accepted, nor even can commiseration be extended to him for failures, when the fundamental principles of a science are the stake. The honest sentiment of the community of medicine must approve, or disapprove.

It has not been our wish to find fault gratuitously with the opinions or writings of others; or, surely no further than necessity appears to require. Still it is believed, many volumes might be filled with an examination of theoretical and practical errors now existing, saying nothing of the past.

We are well aware of the difficulties, which stand opposed to the establishment of cardinal principles in medicine. They ought to be framed from a comparative review of a long series of facts, and the inductions well supported by the united experience of many. Although the studies in relation to the human economy, come in near contact with numerous collateral sciences, yet they should be pursued independently of these. It is useless for the empiric to declaim against principles, or theory in medicine; for he also is wedded to, and practises on such as suit him, as strictly as does the severest dogmatist. It is a solecism to contend against theory in any art or science, for surely they can have no existence without their fundamental principles.

The science of life is based on principles, different from all those pertaining to inorganic substances, and should be studied independently of these. The fixed, immutable properties of lifeless bodies remain unchanged under all circumstances, and their motions become obedient to their sovereign affinities. But, not so as regards organized bodies. There is a presiding principle, which modifies, and even controls their movements; and if all other things are compatible, it is always directed to the preservation of individual existence, and to its greatest good. If nothing incompatible intervened, the movements of the human economy would arrive to the same undeviating results, as are observed in chemistry, mechanics, hydraulics, &c. In point of precision, it might not come behind the exactness of arithmetical figures.

But this is not the constitution of organized bodies; their composition is subjected to numerous modifications; and as a sequence of this, the presiding principle, which for the present we may call vital force, exercises only a conditional control over their movements, and consequently over their functional results. This force exists in so close a relation to the soundness, or integrity of the tissues of organization, that it is liable to frequent fluctuations; and the organic movements are prone to perturbations, or an excess of accumulation, when they are free to act.

If these premises are correct, there is no difficulty in apprehending the reason why, so great a portion of the labor of former coadjutors is lost, or has been worse than useless, in attempting the establishment of theorems in medicine too much interwoven with physical and mechanical principles. And what system even of modern date, is altogether free from the error?

Moreover, it is not only mechanical inductions in relation to vital movements, which have been thus unfortunate; but most modern theorems pretended to be inducted from the laws of living bodies, are tinctured with the errors of former times; and when imagined to be safe inductions from established facts, are little else than old theories in the liveries of new patch-work. We cannot here particularize. In consequence of the misdirected study of the science of medicine, if it can now be called such, it has loitered behind the mechanic arts, even at a sightless distance. And to add to the chagrin, it has been denounced by some of its devotees, as empirical, dogmatical, conjectural, or charlatanical.

It has even been declared, that *philosophical* empiricism has, and in future must direct all therapeutical applications in the treatment of disease. We are aware, that the empirical practice by random *trials*, as the term implies, has introduced some useful remedies. But these trials have been insufferably dangerous, and their benefits merely accidental. No doubt can be apprehended, but that much mischief has been done by them, and will so continue to be, unless their use is guided by correct therapeutical principles. Still the mischief continues in the use of many supposed remedies, merely because they are sanctioned by long usage. A little attention to just views of the true character of disease, and properties of the intended remedial agents, would exclude many of the incompatible substances now in use, from rational practice.

What shall we understand by *philosophical* empiricism? According to Dr Dunglison, *empiric* is synonymous with *charlatan* and *quack*. We might add, the makers and venders of nostrums, and patent medicines, &c. They all plead experience as their *magna charta* of perfection and confidence. But what philosophy do they need to employ? It can be no more needed, nor can it be more just, than the horse-doctor's lecture on the wonderful powers of his drench.

The experience and philosophy of ages may be reduced, comparatively, to a narrow focus, in relation to diseases and their remedies. When we trace the effects of the causes of disease to the primary lesions done the tissues, we find them to be few and simple. From a knowledge of these, the more complicated and resulting derangements will be the more easily investigated and understood. The more perfectly the character of disease is understood, the fewer and more simple will become the necessary remedial agents which need to be employed for its removal. And again, so long as the true character of disease is veiled in doubt and obscurity, so long will empiricism call to its aid, its burthensome number of expedients. Many must be *tried;* for it will be supposed the patient has as many isolated diseases as he has prominent phenomena. The patient may sink more from the weight of his remedies, than that of his disease.

In the following pages, we have aimed at an investigation of the hurtful agents exciting disease; to expose the simple character of the primary changes in the tissues by such agents; and to demonstrate that the remedial agents which are necessary for effecting its removal, are likewise few and simple at the onset. Although secondary local derangements do occur in the tissues and organs, yet the constitutional affection will remain, until the primary cause is removed.

In all our investigations, we have aimed at perspicuity, whilst we have studied to be brief. Some suspicions are entertained, that the aphoristical style used generally, may have left certain subjects not sufficiently explained; yet it is hoped, when the whole of the subjects are taken into view, there may exist no great obscurity. We will here make a humble request of the reader; which is, that he would read in the order the subjects are placed. The design cannot be understood by reading a part only, or by reading the third, or second part before the first.

Many appear to have wasted much time in their denunciations of every nosographic arrangement of diseases that has been published. The fault cannot so much be in relation to the mere catalogue of the modified states of disease, as in esteeming diseases to be independent entities, and altogether isolated in their features and essences. When this is the sentiment, it is supposed that it possesses a permanency of character, to be treated by a determined round of remedies, let the intrinsic nature of the diathesis become ever so much modified. If something like this should be the result of all nosologies, we agree that they are pernicious in their tendencies.

On the thesis, that the local determinations are mere concentrations of the morbid habit, which give a name to the affection, and which are liable to topical changes; we have designed a nosographic arrangement, which we humbly conceive will obviate all the objections complained of. The local affection is liable to suffer a change of place, and visit some other tissue or organ from that it did at first. In this event it receives a new name, whilst its intrinsic character, perhaps, remains the same. Or, if the character of the diathesis should also suffer change, it will take its place wherever it may belong in the diathetical scale. By this scheme, the real state of the affection may be investigated, and the medical adviser will always be at liberty to use the most appropriate treatment his judgment may dictate. It, however, becomes necessary to have a nomenclature of diseases, if only to be used in our communications in society; it at any rate becomes necessary, for indicating the tissue affected, whilst the physician prescribes for its present condition, instead of its name.

The *institutes of medicine* imply a broad basis, requiring a spacious superstructure. Although we have seemed to compress much into the stinted space of two ordinary volumes, yet much remains to be done. We are aware that the divisions of physiology and pathology need to be extended. Another volume at least ought to be added, in order to embrace a large part of the nosography we were compelled to omit. However, we have attempted some illustrations of the most important orders of diseases, by which we have developed many of our peculiar views of their character and treatment. Surely there is enough to ascertain an approval, or a disavowal of the work, by a discerning public.

The writing and publishing the work, has necessarily been delayed to a late period, and greatly so by circumstances beyond the control of the author. However, he considered this delay might give opportunity to some one of American citizenship, more able than himself, to furnish something that might deserve the name of a natural *system of medicine*. However, it must now or never, be offered to the public with all its imperfections.

It may be gratifying to some of his quondam pupils, and other former friends of the author, to be informed, that the lithograph is a fac-simile from a portrait taken about thirteen years since, and at the age of fiftyseven.

Whatever may be the fate of the following design, the author has been careful not to form hasty conclusions. More than seven septenaries of his life have been mostly spent, either in practical observation, or in the studies in relation to the science of life. He will enjoy a rich reward, if his labors can contribute something for the relief of suffering humanity.

Boston, January 1, 1839.

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OUTLINES

OF THE

INSTITUTES OF MEDICINE.

BRIEF DESIGN OF THE WORK.

Man may be viewed as an isolated being, placed in the midst of numerous sustaining and pernicious substances, and endowed with organs adapted to his own convenience, both in relation to external circumstances, and his individual subsistence.

He finds himself, on reflection, placed in a medium congenial to his susceptibilities, on ordinary occasions; he also possesses the faculty of forming intimate relations with substances composing the material world, through the instrumentality of his perceptive powers, and judging of their congeniality to his own necessities.—He contains within himself a series of organic apparatuses suited to modify and supply the increment as well as the inevitable waste of the system, and likewise to insure the perpetuation of his species.

The organic appetencies indicate the necessities of the system, and nutrimental substances are assumed; and these pass through various modifications in digestion and assimilation, and are ultimately applied as constituent vital molecules of the system. By this vital process health, comfort and vigor are dispensed to the animated system, whilst the effete molecules are eliminated by the emunctories as useless, if not injurious.

The play of affinities, catenations, and harmonies of action in the entire system display very astonishing phenomena of the properties of matter under the controlling influences of the vital forces.

To these organic apparatuses is superadded a still more refined tissue called *nervous* ; this is more tardily evolved, of more attenuated fabric, which affords to the conservative organs a more complete ability of functional exercise. The essential property of which, however, is, to transmit to the organs of locomotion and of respiration, an ability to perform these offices in an efficient manner, in aid of their innate irritability ; yet, above this, it is very apparent, although confounding to our apprehension, this nervous tissue composes the organs which are the seat of *intellect.*

By this extraordinary endowment, man not only looks within himself, and on the substances around him, but reviews the past, contemplates the present, and casts his thoughts upon the future ; it, also, enables him to claim affinity with kindred essences, as well as corporeal rudiments ; and in the exercise of organs destined to thought, he spontaneously rises in adoration to ken the attributes of the great First Cause, who formed him such.

In an harmonious and easy play of all the organs of nutrition and intellect, the mind is free and buoyant, the corporeal part is capable of activity, and both are engaged in arduous enterprises for the attainment of happiness. *This is the physiological state of man.*

Notwithstanding all these felicitous combinations, the very means that minister to the well being of the human species, when indiscreetly practised, in excess, or even extreme deficiency, as well as the atmospheric circumfusa by which they are encircled, serve to modify and disturb the natural and agreeable economy of their systems. The connection of all the harmonious associations may be broken ; a perturbed state of organic action, with inquietude, distress, and wasting, follow at any period of life. The relations of the intellect, as well as the organic harmonies, are severed, and man may then be viewed as the sport of contending impulses, and chemical contingencies ; and under an enervated influence of the vital energies, he falters, suffers distress, and sinks. *This constitutes the pathological state of man.*

In our researches into the diseased condition of the human system, we need to have particular reference to the healthy state, as it will undoubtedly be discovered, that the morbid phenomena are the results of the natural energies of the system, when under the influence of excessive stimulations. We need, therefore, in our studies in relation to *Therapeutics*, whilst estimating the extent of morbid changes, to make just comparisons with the physiological economy of the system.

Our conclusions, therefore, in relation to the *Therapeutic Treatment*, will be dictated by a consideration of the force of those agents, which modify the system, and cause it to depart from the ordinary standard, and having a just regard to the character and degree of such divergent action. This leads to a review of *Ætiology*, or the consideration of the causes of disease, as well as the changes brought about in the economy of the system, producing that catenation of preternatural actions which establish the character of disease.

The following out of these subjects in detail, constitutes the *science of medicine ;* but we must acknowledge that these pages comprise merely the *outlines* of these engrossing subjects.

ficiency, as well as the atmospheric circumfusa by which they are encircled, serve to modify and disturb the natural and agreeable economy of their systems. The consensus of all the harmonious associations may be broken; a perturbed state of organic action, with languidity, distress, and wasting, follow at any period of life. The relations of the intellect, as well as the organic harmonies, are severed, and man can then be viewed as the sport of unceasing impulses and chemical contingencies; and under an enervated influence of the vital energies, he falters, suffers distress, and sinks. *This constitutes the pathological state of man.*

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OUTLINES

OF THE

INSTITUTES OF MEDICINE,

FOUNDED ON THE PHILOSOPHY OF THE HUMAN ECONOMY, IN HEALTH, AND IN DISEASE.

The Institutes of Medicine may be defined, that science, which embraces a knowledge of diseases, and their remedies. As this requires the collateral aids of other considerations relating to the animal economy, the human system will be contemplated under three varying aspects. First, as it appears in a state of health; second, as affected by disordered action; and thirdly, in reference to remedial agents for the restoration of normal action.

For the purpose of obtaining the advantages of proper arrangement, the subject will be divided into the following distinctive appellations:—

DIVISION I.

PHYSIOLOGICAL NOTICES,

OR A CONSIDERATION OF THE NORMAL FUNCTIONS OF THE SYSTEM.

DIVISION II.

PATHOLOGICAL NOTICES,

OR A CONSIDERATION OF THE ÆTIOLOGY, AND CHARACTER OF DISORDERED ACTION GENERALLY.

DIVISION III.

THERAPEUTICS.

UNDER THIS DIVISION MAY BE CONSIDERED THE HISTORY, DIAGNOSIS, AND TREATMENT OF DISEASES, ARRANGED IN A TISSUAL, NOSOGRAPHIC ORDER.

DIVISION I.

PHYSIOLOGICAL NOTICES,

OR A CONSIDERATION OF THE NORMAL FUNCTIONS OF THE SYSTEM.

PHYSIOLOGY.

SECTION I.

1. *Definition.*

What we may have to observe on this subject may be considered, only a summary of the phenomena of the vital economy which more immediately concern the practical physician. The remarks, therefore, will be brief, very much to the exclusion of the form, and mechanical action of the organs, but having a more especial regard to vital susceptibilities and movements.

Physiology may be defined, the *science of life*; or, an exposition of the functional exercise of the organs of the living human subject, in a state of health.

However, as the normal action of the organs is very prone to assume a morbid condition, we may be led to take some notice of their pathological liabilities as we pass along.

2. *Synthetical Method.*

The reverse course of anatomical illustration will be pursued;—in this, the animal structure, in its entire state, is traced to its minute constituent organization; it is there pursued analytically. We must begin where anatomy stops; that is, in the ultimate fibres, and molecular compositions, and ascend by slow gradations to the formation of tissues, organs, and their united operations in the completion of the animated being;—like Haller, pursue the evolutions of the increasing *ens*, through its rising stages, to the completion of its economy. We shall, therefore, have to pursue the subject synthetically; and from the minutest, through more complicated circles of action, attempt to expose the veiled functions of the animal system.

In like manner, the perverted functions of organization may be traced, from the simple impression of minute causation on the primordial stamina, to the severest conflict of morbid action of complicated organs.

3. *Ultimate Composition.*

The process of destructive analysis of animal bodies exhibits various substances; such as phosphorus, the phosphate of lime, soda, magnesia, potash, manganese, sulphur, chlorine, iron, carbon, silex, alumine, and several neutral salts in small proportion. However, the phosphate of lime is very abundant, entering into the composition of the bones and giving them their solidity.

By analysis of the body, either spontaneously or by art, are found the following gaseous substances, making parts of the constituent elements; oxygen, hydrogen, and azote, which may be confined. There are also, certain evanescent essences, in the living state, not confinable; as caloric, light, electric fluids, various gases, and the principle of *vitality*. These have more or less feeble combination with living organic bodies, and become evanescent before decomposition takes place. The principal elementary ingredients, which compose all the soft parts in animal substances, are carbon, oxygen, hydrogen, and azote, in different proportions in the different organized elements; phosphorus and lime are the basis of the hard parts. Azote exists in the largest proportion.

Chemico-physiological researches indicate many other substances in the human body, which some think have been constituents ; yet they rather ought to be esteemed products, or secondary formations of vital organic influences. Many acids are found, as the sulphuric, carbonic, benzoic, uric, amniotic, oxalic, formic, acetic, malic, lactic, and rosacic, which last is found in lateritious sediment of the urine in fevers.

4. *Organic Composition.**

Upon a cursory inspection of the human body, it is found to give a moderate resistance to the touch ; to be composed of what may be styled plates, or animal membranes of different degrees of compactness, and pierced in all directions by apertures of very different calibres ; these constitute the *solids*. Within these openings or tubes, are discovered liquids, either red or white, which pass in different directions through the solid parts ; these are called the *fluids*. It would appear at first view, that the solids exceed the fluids by weight ; but, it is found on desiccating the body, that the fluids exceed the solids as about nine to one. However, they are quite different in different subjects.

The diffusive, invisible, actuating principle of animal bodies has its residence in both these solid and fluid substances, but is most eminently appreciable in the former. However, the

*The author wishes here to advise the reader, that his course in this arduous undertaking is intended to be a straight forward one; he cannot stop, *on ordinary occasions*, to give credit to various writers who may have richly contributed to improve the science of medicine; and indeed, he scarcely feels able, in numerous particulars, to designate, whether the deductions he may advance have been formed by himself, or derived from others. Neither can he often stop to refute what he may suppose to be the erroneous conclusions of others, and thereby interlard the work with contraries; but will endeavor to be satisfied, if he can arrange, and express his views in a manner to be rightly understood throughout the work.

fluids sustain an important office in the economy of the system, and bear around in their circuits the rich fluid animal matter that becomes attached to the solids to increase their growth, or supply their waste.

It appears to be ascertained at the present time, that there are at least four primary animal formations, which by coalescing in varied proportions, constitute the organization of animal bodies ;—these are *gelatin*, *albumen*, *fibrin*, and *mucus*; and some add *ozmazome*. These being vitally animalized molecules themselves, unite by a sort of peculiar formative affinity in the production of lines, or fibres ; and in their turn these lines unite, by various crossings and interlacings, in the formation of tissues, or membranes. Again, these last, by a sort of plastic, formative impetus, generate what are called organs. If the process is not so formal as first to form lines as suggested, they are found in such a state, although the parts may have been formed in tissues by a gradual accretion, or elongation. Each of these primary animal elements merits some farther consideration.

5. *Gelatin.*

All the four animal constituent molecules before mentioned, are composed of carbon, hydrogen, oxygen, and azote, but in different proportions. Some physiologists have said, that gelatin does not possess any azote in its composition. But it seems now proved that it does, but not to the amount contained in fibrin. It is contended by some also, that gelatin is not found in the circulating mass of blood ; however, this is shown to be a mistake, but it is found only in a small proportion.* The muscles, it appears, are first formed in the embryo, of gelatin, and afterwards receive an addition of azote, by which they are converted into fibrin, which renders them more capable of contractility.

* Berzelius.

Gelatin, or jelly, is extracted by boiling, from the tendons, bones, capsules of the joints, dura mater, cellular tissue, and all those membranes called by M. Pinel the fibrous membranes, of all which it is their principal constituent. They are called *fibrous* on account of their filamentary appearance. All these tissues seem to be formed by a condensed and modified state of the laminated or cellular tissue, for this is almost wholly formed of gelatin.

It is represented by many experimenters, who have minutely investigated the subject, that the molecules of gelatin are not so large as those of fibrin. The tissues of which it is a principal constituent, possess a contractile property, but not so much so as tissues formed of either albumen, or of fibrin. It is probable, however, further observation may be required in order to be satisfied, whether gelatin or albumen possesses the most contractility. That all the tissues are endowed with more or less contractility is very manifest, otherwise they could not aid in the organic functions.

The physical properties of gelatin are ; 1st. It is soluble in water, but not in alcohol. 2d. It liquefies by heat, whilst albumen hardens by heat. 3d. It can be made solid by cold, and drying, but readily putrefies with water. 4th. It may be again liquefied by heat, whilst albumen cannot be restored when once coagulated. 5th. It has a chemical affinity with tannin, and unites with it, by which union it becomes unliquefiable and insoluble. 6th. Uniting with tannin from the bark of astringent vegetables, in the skins of animals, it converts them into a dense, elastic state called leather.

6. *Albumen.*

This constituent of animal matter, receives its name from the albumen of the white of eggs, to which it is very similar. M. Cloquet says, it always contains sulphur, and subcarbonate of soda, besides the common elementary constituents. When in a fluid state it coagulates at about 165° of Fah.

Alcohol, the acids, muriate of mercury, astringents, &c., coagulate it. Subjected to the process of drying, after being coagulated, it forms a solid semi-transparent substance resembling horn, insoluble except sparingly by alkalies.

This substance is very abundant in nature, as it enters into the composition of both animal and vegetable bodies. In the human system it is found abounding in the serum of the blood, in the humors of the eye, and most of the secretions, particularly in the milk ; and, also, in the white tissues. It is esteemed to be a principal constituent of the nervous pulp, throughout the brain and nerves ; also of the glandular textures. It is easily extracted from other substances in combination, and its most delicate test is a solution of muriate of mercury.

It exists abundantly in the seeds of vegetables, as well as in their roots, stalks, and leaves. It is, likewise, an important constituent of most of the tribes of insects, reptiles, and crustaceous animals, as well as the infusoria. As it is readily decomposed when subject to warmth and moisture, it affords various volatile substances in the form of effluvia, more or less disagreeable, if not obnoxious. Old animals have in their composition the most albumen, whilst young ones possess the most gelatin. Seguin has shown it to be the most essential principle in the production of spontaneous fermentation of vegetable substances, thereby evolving the saccharine, alcoholic, and acetic products. This substance is of much use in clarifying liquids ; and, also, by inviscating poisonous substances in the stomach, may disarm them of their deleterious influences.

7. *Fibrin.*

This possesses the most vital susceptibility and contractility of either of the organic elementary substances. It is, therefore, a principal constituent of all the muscles, whether voluntary or involuntary. It is found in smaller proportions in the various mobile tissues, as in the vascular tissues, especially in those that transmit red blood. However, the large arteries and veins have essentially gelatin, but the heart and capillary systems are composed mostly of fibrin. The molecules of fibrin are said to be larger than those of gelatin or albumen. These molecules are of different sizes in different animals; they are insoluble in either warm or cold water. Fibrin is found in many vegetables, especially in the farinaceous seeds.

It is an important constituent of the blood, and has been called gluten, and lymph. It is more prone to take on the filamentary form than either of the other constituents; and as soon as the blood is taken from the body, the fibrin assumes the filamentary character, and contracts, and carries with it, in its healthy state, the red molecules or cruor, and holds them in a solid form. If, however, certain states of morbid tonicity exist in the vital actions, these filaments contract more tardily, but more firmly; and they firstly allow the cruor to subside, and then form a coagulum on its surface of a dense white color; but, again, in certain adynamic states of the system, lose their ability of assuming the filamentary form, and the blood then remains fluid, and without a coagulum. The fibrinous portion of the blood may be separated from all other matter, by agitating it in water; it will then appear in a white and solid filamentary form. It contains more azote than albumen or gelatin.

8. *Mucus.*

This is not admitted by some physiologists as a primary element of organic structures, although it is quite plentiful as an organic secretion. Yet it is found in some of the more dense tissues, as the nails, hair, scales, &c., and it is found in small proportion in some of the cellular portions. With water it forms a viscid, transparent, soft fluid, rather tasteless. In a dry state it is scarcely soluble in water. It appears to be rather a sort of cohesive cement in some tissues, than as contributing to contractility.

Ozmazome is found by the destructive processes in some of the tissues, especially the muscular. It is thought by some to be formed of fibrin in the process of chemical decomposition.

9. *Atomic Composition.*

It appears that Messrs C. Bell and Richerand recognise Copland's elementary constitution of the three animal substances, as follows :

	Carbon.	*Oxygen.*	*Hydrogen.*	*Azote.*
Gelatin, atoms	15	6	14	2
Albumen, do.	17	6	13	2
Fibrin, do.	18	5	14	3

In the process of assimilation and nutrition, there is the strongest analogical evidence, that the constituent atoms are changed, and modified in such a manner, as that the more simple molecules are becoming more complicated, and assume more and more the perfect animal character. And, also, that these forms of animal matter exist in varied proportions in different tissues, temperaments, and ages.

10. *Auxiliary Constituents.*

Analysis discovers, likewise, in the human body, certain undefined substances, which have been called *amorphous masses*, or diminutive cementing substances, which fill some interstices. Likewise certain products have been discovered, which are the results of organization, and seem to complete the animal formation ; such as urea ; zoohæmatin, or the coloring matter of the blood, containing iron ; osmazome ; picromel ; cholesterin ; the green matter of the bile ; sugar ; resin ; leucin ; stearin ; elain ; caseum ; uric, oxalic, lactic, benzoic acids, &c. Some of these are found in the solids, and some in the secretions. It may not be proper to mention the products of organic secretion, such as milk, bile, &c., in this place.

SECTION II.

OF THE TISSUES.

1. *Staminal Formation of Tissues.*

ALTHOUGH it is manifest, that the primary elements of organization form filaments, or what has been called the primordial stamina, or fibres, yet these are found in an aggregate condition in the tissues; and they can be only partially separated, and there is no determining when we may have arrived at the single ultimate fibre. Of course we have no means of appreciating their properties in an isolated manner. We are compelled to study them in an aggregated form, in their most simple combinations of webs, or tissues.

Notwithstanding what has been advanced, it appears that Dr. M. Edwards, as well as M. Dutrachet, and others, have satisfactorily discovered, by means of a powerful magnifier, that the molecules of animal fabrics arrange themselves in rows, or in a linear manner, which probably, by the aid of a kind of muco-amorphous matter, might be called fibres. They estimate the diameter of these globules to be 1-7500th of an inch. Even if this statement should be correct, we cannot learn any of the vital properties by observations made on such attenuated threads.

The innate cohesive properties of the molecules of animal matter, called vital affinity, first display themselves to the eye, in the production of lines, stamina, or filaments whilst under the influence of the formative process in the generation of telary expansions, and in the production of a lamellated structure called membrane, texture, or tissue. These products eventually, in the entire evolutions of structure, exhibit various degrees of thickness, compactness, extensibility, tonic and vital contractility.

Notwithstanding the primary formation of tissues has been represented as laminar, yet in the evolutions of organs they are of many forms, some round, others extended planes; others again are cylindrical, and indeed of many forms, as we see in the complicated organizations; and yet each texture of the organs retains its own *peculiarity* of properties.

2. *Simple Tonic Property of Tissues.*

All movable tissues possess a property of elasticity, which enables the fibres and vessels in their composition, to become dilated beyond their ordinary capacity, on occasions of turgescence, or plethora, which they sustain on ordinary occasions without injury, and again return to their usual state, and even less. However, on extraordinary occasions, the tissue, or organ may suffer immensely from ultra-distention, by the loss of elasticity, which occasions a retardation of function, and the tissue with difficulty regains its former physiological state. The property of elasticity is a physical property of texture, and not of vitality. It arises from the arrangement of the corpuscular particles of animal composition, and continues when the texture has lost all traces of vitality.

It is this property of elasticity from corpuscular arrangement, that gives to the more dense textures their extensibility, as well as elastic contractility, very different, indeed, from vital contractility. These are physical properties, and being modified by certain intervening amorphous substances in combination, are the basis of the temperaments. Thus we find the temperaments modified by parental lineage, by age, by certain habits of activity, by climate, aliment, and many other extraneous circumstances, which may modify the staminal fibres. As all the textures are more or less under the influence of vital impulses, those modifications which affect their extensibility, and contractility, impede their movements, and often injure the play of the organism. All the adventitious states of hypertrophies, hardening and softening of textures, affect the physical properties of the tissues, and secondarily the vital.

When any of the soft tissues are divided by the knife in the dead state, and especially in the living, they retract, and leave a space. This is the tonic contractility of their elasticity; and it is more apparent as the subject may be plethoric, and as he may possess a more dense compages of structure; whilst the opposite state of inanition, and flaccidity of structure will show less contractility. The muscular texture discovers the most of this kind of contractility, and the nerves the least. This property of all the tissues is not affected by excitants directly, and does not leave them after all the signs of death have appeared, until disorganization takes place. It is the *vis mortua* of Haller.

3. *Vital Tonic Property of Tissues.*

The animal molecules, and the tissues already alluded to in a very general manner, are all endowed with a property, which gives them their distinctive animal characters. The different tissues, and even the organs formed of them, possess this property in very different degrees; by which they possess different capacities of excitability, and respond to general exciting substances, and even to their own peculiar excitants in a varied and modified manner. This is the *vis nervea* of authors, and gives the tissues their vital tonic power.

It is owing to this property that animals possess an identity of character, different from, and even transcending any other of the works of creation. By this endowment the united organization becomes an isolated automaton, and converts all other substances in nature to its own advancement, and well-being.

4. *Gradations of Vital Force.*

This vital influence, sometimes so called, admits of three cardinal divisions, as will hereafter be illustrated, besides many subdivisions. It may now only be remarked, that some of the tissues are endowed with the force of one degree of vitality, some with two, and others with a third gradation. The result then must be, according to the fact, that some of them possess a greater, or higher degree of vital susceptibility than others; therefore they respond more readily and energetically to the various stimulations ordained to excite their movements.

It is this thesis of the plurality of the vital force that must serve as the basis of all our physiological order of functions; and, also, stand as the basis of nosological arrangement, to be disposed according as the locations of disease may be more or less impressive on individual tissues. However, before discussing the subject of vital force, we will notice the combinations of tissues in the formation of organs, and organic apparatuses, in a very general manner.

SECTION III.

ORGANIC FORMATIONS, AND APPARATUSES.

THE tissues already alluded to, will merit particular discussion in their places; we need now only to notice, that they combine in different organs in different proportions, according as the office of the organ may require for the performance of its individual function. For example, the lungs admit in their composition many tissues, such as the mucous, the serous, the muscular, the fibro-cartilaginous, the fibrous, the nervous, the capillary exhalants and absorbants, many sets of red vascular tissue, and finally much of the laminated cellular tissue, as a medium of connection, and extensibility. And, notwithstanding, the whole amount of fixed animal matter of their composition is very small ; this organ has many important functions to sustain, and therefore, its composition of tissues, and their susceptibilities, are greatly multiplied. This is more fully illustrated in the entire respiratory apparatus.

When several organs become necessary to accomplish some important design in the general economy of the system, their functions harmonize and act in a kind of subsidiary accordance for its accomplishment. This combination of organic agency constitutes what has been called an apparatus. Thus in the process of aeration of the blood in the lungs, the heart becomes an important agent, also the respiratory muscles, the trachea, &c. And so of digestion, many organs unite in its accomplishment, or it requires an *apparatus* of organs.

As we often have to allude to the vital force, so called, and as it is a subject of the highest order, it is necessary the student should form as correct views of it as possible, at an early period ; we may, therefore, be justified in attempting a discussion of it in this place.

SECTION IV.

ON VITALITY, IN CONNECTION WITH THE SUSCEPTIBLE TISSUES.

1. *Dissimilarity of Organic and Inorganic Substances.*

ALL the substances in nature are presented to our conceptions under two aspects ; viz. inanimate and animate, or unorganized and organized ; or, in other words, as possessing life, or destitute of it. The first obtain growth from an exterior accumulation of molecules, or atoms, upon a nucleus, and are united by what is styled chemical affinity, or by atomic adhesion. The latter receive accretion and growth by certain internal processes ; they are acted on by internal impulsions, and are distinguished from the former by a train of phenomena, which in all ages have been called *vital*.

Although this internal agent, or principle, has never been demonstrated otherwise than by its effects, yet it has been universally accredited as existing in all living bodies, and has been considered by all philosophers, either the *cause* or the *effect* of organization. This question may merit some attention as we proceed ; but, in the first place, let us recapitulate some of the phenomena which distinguish animate from inanimate substances. A mineral grows, and receives synthetical accretions of an atomic kind, or of a chemical character ; or it may remain stationary for ages. It is composed of inert matter, yet endowed with certain properties, as gravitation, elective affinity ; and perhaps with several others casually, as magnetism, caloric, galvanism, &c. Yet it does not possess contractility, which implies a pre-existing sensibility of some grade. Therefore it feels no adventitious impressions, nor has it the ability of repelling them ; it suffers nothing by a removal ; whereas vegetables are liable to suffer when removed, and deprived of constant nutriment, except as relates to their seeds ; and they are injured by numerous circumstances impinging their peculiar sensibility, or marring their organization, and thereby depriving them of the powers of absorption and assimilation.

But the most visible contrast may be noticed in animal bodies, which have advanced to some maturity, and then deprived of their vivifying agencies. In the more perfect orders, in the living state, there is an internal circulation of variously modified fluids, especially of red blood, all moved by the force of their envelopes ; a definite degree of heat is maintained in the interior under a wide range of atmospheric vicissitudes, being in man about 98° Fah. The muscular system is in play, and the intellect commands its voluntary movements. External sensation, and the manifestations of mind indicate a force within, urging proofs of a principle actuating the complicated machinery, and perceptible at every point in those emanations, called the mental expressions. This same vivifying agent, also, acts as a preservative, in preventing the materials composing the corporeal part from exerting their physical properties, and destroying its texture ; and in fact the force of what may be called *vital chemistry* supersedes the powers of the *chemical affinities*.

In the reverse state the contrast is very impressive ; that animated being which once walked erect, now lies prostrate and motionless, destitute of its former internal functions and caloric, as likewise of sensibility, of perception, of all indications of intellect and expression. The elements of its composition are left at liberty to exert their affinities, and the fabric, once fair and animated, becomes a chaotic mass of elementary substances.

2. *Synonyms.*

There appears then to be a notable contrast between animate and inanimate bodies, and it becomes an interesting pursuit in physiological inquiries, to attempt an investigation of this internal causation. It has been often spoken of as an agent, yet seldom in modern times acknowledged as an entity. It has been called *life of man*, *impetum faciens*, *archœus*, *thinking principle*, *vital tonic attraction*, *nervous energy*, *excitability*, *sensorial power*, *vital force*, *conservative principle*, *spirit*, or *soul of man*. The numerous appellations, with their definitions, and many crude notions advanced, serve but to expose the veil that has screened it from ordinary examinations.*

It appears that philosophers are required to have every thesis guarded, and supported by demonstrations drawn from tangible experiments, and so conclusive as to compel assent; that nothing can be taken on trust, or by analogical induction. These lines have of late been drawn so straight as to impede investigation on subjects, which in their nature cannot admit of mathematical or chemical demonstration. However, it may be noticed, that undeniable facts may be well shown by a series of circumstantial and analogical indications, which may compel the assent of the mind as certainly as direct testimony, and so it is now held and practised in courts of judicature.

3. *Vital Entity, what.*

The question now intrudes itself, what is it that exists in animated bodies, both vegetable and animal, which bestows on them their peculiar characters, and in its absence leaves them to decomposition? Is it an entity, or is it a nihility? is it the cause, or is it the effect of organization? Many and bold have been the speculations of physiologists on this sub-

*Since the present subject was put in manuscript, the writer has noticed the following remark of one of the greatest ornaments of the profession, Dr Rush, and the writer begs leave to insert it as an apology for the length of the present thesis: "In beholding the human body, the first thing that strikes us is its life. This, of course, should be the first object of our inquiries. It is a most important subject; for the end of all the studies of a physician is to preserve life; and this cannot be perfectly done, until we know in what it consists." (Med. Inq. vol. ii. p. 374.)

ject ; the reasonings and conclusions have been so vague, that it is necessary severe restraints should be imposed on the logic that is used. Some with an apparent view of getting rid of an entity, an *esse*, controling and modifying the matter of which living bodies are formed and actuated, tell us that vitality is merely the *effect* of organization. They hereby acknowledge the existence of an *animating something*, and yet consider it a mere sequence, an evanescent nihility as soon as the organism ceases to produce it. There may be but little use in this inquiry of naming such physiologists. However, this thesis is chiefly supported on the continent of Europe ; and even Dr Bostock in England considers it to be "the conjoined operations of many actions." Why do these philosophers use the term *vital force*, *tonic power ;* when, according to their own views, they acknowledge it to be only a *physical effect ?* M. Broussais is very adroit in styling it the "*unknown power*," although it exhibits more phenomena than any other power in the whole range of natural processes. In another place he calls it *vis creatrix naturæ.* Even in Dr S. Jackson's Principles, we find this trite expression : *vitality is, consequently, a product of nutrition.* And in page 100 : "Can it be supposed that the organic force, which imparts to organs their capacity for action, exists before the organs are formed ?" Many others in seeking for some sort of entity have evidently mistook the real one ; so Dr Wilson Phillip was satisfied he had discovered an identity of the galvanic and nervous fluids, as he supposed.

In reply to these vague suggestions, for they cannot considerately be esteemed otherwise than visionary, we would inquire, what power or influence presided over inert matter in the formative processes of organization ? This process seems to be as steady as that of gravitation. What then produced organization so uniform of construction, so intense in function as to usher forth the exquisite phenomena of sensibility, contractility, and of intellect ? The ordinary physical properties of matter never did, nor ever can produce them without a peculiar germinating, or adjunctive principle. These physical properties may all come in aid, but cannot be efficient causes of life. There is everywhere a marked distinction between the animated world of beings, and the world of inanimate matter. It will not do to say these phenomena are the effects of chance, for this implies nothing ; even the constantly determined forms of organization disprove this. It will be admitted that life cannot be supported without a free play of the organism ; but the question is, what power presided over their formation and evolution, by opposing the chemical influences, and which still continues them in play ?

Expecting never to obtain a solution of this question from the organists, we shall continue to support the thesis long since advanced, and in a degree elucidated by philosophers in ages gone by ; and the more so, as what has been since offered does not so well accord with facts, and analogy. It was advanced by Epicurus and Socrates, and enlarged on by Lucretius and others, that life is produced by an exquisitely subtle gas, or aura ; or rather, in deviating from those just named, it will be maintained, there is a principle pervading universal nature, and ready to attach itself to certain molecular forms of matter ; and when thus intimately united to such corpuscular bodies, affords them a new stimulus, additional properties, different capacities, and peculiar appetencies. Whatever this essence, aura, or gaseous spirit may be, it is different from all other known essences, auras, or gases in nature. It is governed by laws peculiar to itself, as we see and know all vegetable, and animal organization to be directed by their own peculiar, and inherent powers. It possesses influences and energies when united to certain forms of matter, transcending the force of certain other physical powers of natural bodies ; as, in a modified manner, gravitation, affinity, magnetism, oxygen, certain degrees of caloric, and electricity. It finally, in a limited manner compatible with organic textures, controls all these, and uses them as supports and subsidiaries in the astonishing display of its phenomena.

This power, this property, may hence continue to be known by the appellations of vital principle, vital force, vital energy, or simply animation, or life. Its peculiar influencies in the human system may hereafter receive much amplification.

4. *Its Origin and Source.*

If it should be inquired, from whence originated this principle ?—it might be answered by retorting the inquiry, whence originated light, affinity, gravity, and other properties and essences in nature ? That Creative Power who said, "Let there be light and there was light," said also, "Let us make man in our own image,"—"and breathed into his nostrils the breath of life, and man became a living soul."* If the *breath* used in the narration should be considered a figurative expression, yet an influence must have been diffused into the inanimate body ; and not only so, but coeval, and coextensive with the existence of matter, that all the other tribes of creation, both animal and vegetable, assumed portions of it necessary for their own individual economy.

If the pride of modern philosophy will not admit of proofs, or direct allusions from the record of inspiration, it is hoped it will stoop so low as to admit it in collateral support of a thesis partially founded on analogical facts. The pride of philosophy must be truly humbled in the view, that no greater advances have been made in the science of life since the creation of man, and of a subject constantly presented to the senses, and to the understanding also.

* Genesis ii. 7.

5. *Illustrations.*

It has been intimated, that this emanation of vitality is coextensive with the other properties of matter fixed on the surface of the earth, or floating in the air. It may be expedient to continue the illustration some farther. In the first place, a direct seminal influence, and sexual fecundation can scarcely account for all the phenomena of vitality noticed on the surface of the earth. Without being obliged to go into specifications of much extent at this time, it may be remarked, as sufficiently proved by the investigations of geology, that various species of vegetables have been found in the transition, and after formations of the crust of the earth, which have become extinct. Again, others now vegetating are of modern origin. So of animals; natural history furnishes evidence of species, and genera of animals that have become extinct, and others have somehow sprung into existence; and surely, so far as can be discovered, without a direct seminal origin. Where are the giants of old? Here and there a petrified skeleton is found deep in the earth; and also, many unknown animals of huge dimensions, besides the mammoths, the tapirs, and hippopotami.

We can form no conception of a seminal origin of the myriads of myriads of ephemeral insects that darken the air, or of reptiles which separate the foot of man from the surface of the earth. All springing into life at the same time, and simultaneously giving up the ghost, and becoming extinct. They appear again at uncertain intervals, and often having some slight modifications. A volume might be filled with facts on this subject; and indeed volumes have been.

Stagnant waters imbued with some portions of albumen, gelatin, or fibrin, and probably other congenial animal substances, and when exposed to a high atmospheric temperature, soon become loaded with innumerable animalcula of different genera and species, often visible, and often seen only by the microscope. Neither caloric, nor oxygen, nor water combined, can produce organic beings, without a vivifying principle besides them, and then they act as auxiliaries.

6. *Universal Generant Influence.*

It is believed, that those who have advocated the thesis styled spontaneous generation, have not gone so far as to designate very minutely the prolific principle, nor the substances it acts on. They commonly illustrate it by a rehearsal of facts. It seems expedient, therefore, to follow up the subject a little further, without intending to exhaust it.

In the first place let it be understood, that wherever scriptural allusions are made, it is not intended they should be received as strict philosophical evidence, but as collateral facts to aid the illustration of difficult subjects. We find then, that in the beginning, "the Spirit of God moved upon the face of the waters."* Let it only be noticed here, that the earth, and air both contain water. At this time, "the earth was without form." We will hardly dare to affirm, but have reason to presume, that a vital principle was at this time diffused in water, earth, and air. For, we are immediately informed of the command, "and God said, let the earth bring forth grass, the herb yielding seed, and fruit tree yielding fruit after his kind, whose seed is in itself upon the earth; and it was so."† There is no mention of *seed* from which the herb germinated, but *yielding seed*, which was in the herb.

The phraseology, *whose seed is in itself*, may justly be understood as an influence imparted, and of a general kind, to the terrestial elements, by the same Spirit which gave all the other properties to matter. The same breath which set these elements in motion, and determined the circuits of the heavenly bodies, also bestowed a principle of organic vitality,

* Genesis i. 2. † Genesis i. 11, and onward.

which is coeval with other properties of matter, and will be alike, or more enduring. It is as identical in its character as any other of the properties of matter, and none so fully displays the matchless beneficence of its Author. If the Pentateuch be admitted as a rule of faith in relation to divine subjects, why not in some degree respected in relation to subordinated correlative facts?

Again, the same Creative Power, said, "Let the waters bring forth abundantly the moving creature that hath life, and fowl," &c. Also, "Let the earth bring forth the living creature after his kind, cattle, and creeping thing," &c., and it appears that "God blessed them, saying, be fruitful and multiply." There is no intimation of there being either in the vegetables or animals any seed from which they took root in the beginning, but the vegetables yielding seed for the nutriment of man, and the green herb for the use of animals; and both were apparently brought forth in a spontaneous manner. Although the seeds of vegetables were secondary in formation, and made for the use of animals, yet they do, for the most part, contain germinating points, like cuttings, from which other series in succession are propagated. Admitting all that can be said in favor of a seminal propagation, it is no proof against a spontaneous origin of both vegetables and animals, under particular circumstances.

On the reverse, it will be insisted, and as fact, that innumerable instances are on record of the origin of vegetables, and animals in after periods, for which the ingenuity of man could not discover a seminal influence, unless it be on the thesis of a prolific aura pervading ocean, earth, and air; and together with the agency of other primary animal elements, manifesting life and organization to our senses. We speak of a spontaneous origin. All that can be meant by the term is, an origin without a visible germ or seed, and that it may be brought about through the agency of a widely diffused germinating aura, not cognizable by our senses. It is well known the most latent agents in nature elude the tact of the keenest philosophy. Indeed, a mere glance at the subject impresses the contemplative mind with the most sublime views of the transcendent wisdom, and power of a Creator; and teaches human intelligence its weaknesses, and man to be humble, and adore.*

Much evidence exists of there being a vivifying principle pervading water, earth, and air; and that it has been diffused through these bodies ever since the work of creation was finished. Although in its diffused state it is not cognizable by our senses, yet in a concentrated state it is as manifest as other attenuated bodies. Can we discover magnetism, caloric, oxygen, or electricity but in a concentrated state, and chiefly by their effects? Can we discover these at all? Then we can as easily apprehend vitality. Are these all light, invisible gaseous bodies? So is this. Are these all indestructible in their nature? So also it is with the spirit that is in man. Do these gases delight to dwell with particular modifications of visible matter? So does both vegetable and animal life. Do these etherial essences adhere with certain degrees of pertinacity to particular bodies? So does the subject of our investigation. The parallel might be extended.

The properties of unorganized atoms, and their compositions, afford certain evidence of existing predilections and antipathies. Similar and more legible phenomena exist in the vegetable kingdom; not only in organized molcule uniting with molcule, but a series of double affinities in motion; there being another influence added, and its effects seen in every

* Since writing the text, the author has noticed a pertinent opinion in relation to this subject, by that ingenious physiologist, Sir C. Bell. "Physiologists have, by a late sense of their own weakness, been at last humbled to this becoming, but unwilling acknowledgment, that this contractility of the muscles is an original endowment of this living matter, derived from the Creator, imparted in a way which we cannot know, and so attached to the organization of the muscular fibre, that where its organization is destroyed, this power is lost." Anatomy and Physiology; art. Mus. Power.

feature of the living plant; and, in a certain process, so apparent are the harmonious affinities, that Darwin was excited to compose chiming songs on "the loves of the plants." Are not all these manifestations more intense in the animal creation; and are there not even emanations of vital aura passing in a state of excitement, both of an attracting and repelling character? See the visage of lunacy, and of rage; and on the reverse, the aspect of eloquence, of love, and of adoration. If any one is formed of such a gelid temperament as not to feel these, let him experience the benumbing aura of the torpedo-ray, or the more thrilling shocks of the gymnote, or electric eel.* These are acknowledged as voluntary acts of the animal. Does not the charming of serpents and other terrific animals gaping for their prey, consist in an invisible emanating aura, which paralyses their victims? The facts already established in the history of animal magnetism, demonstrate the power of mind on mind, and of mind over the organism.

Some have conjectured, that the galvanic aura presides in the nervous tissues, and that it produces the phenomena of organic life. That this principle exists in animal structures as an adjuvant, or may be excited by them, is pretty evident from many phenomena shown by experiments, particularly some by Beclard and Beraudi. However, the inference is no doubt correct as drawn by them, that it is a subordinate agent, and controlled by a higher power, or a vital force peculiar to organic life. So light is a subordinate substance, and

* The hook'd torpedo, with instinctive force
Calls all his magic from his secret source;
And through the hook, the line, the taper pole,
Throws to th' offending arm his stern control.
The palsied fisherman, in dumb surprise,
Feels through his frame the chilling vapors rise,
Drops the vain rod, and seems, in stiffening pain,
Tame frost-fix'd wanderer o'er the icy plain.
Dr. Good's translation from Oppian.

frequently given out by animal and vegetable bodies by luminous, or phosphorescent phenomena. Caloric, likewise is a necessary agent, and under the control of the vital influence; and this, also, opposes the power of gravitation, and the chemical affinities.

Philosophers have spent much time in attempting to establish the hypothesis of the infinite divisibility of matter. Compound bodies are formed of varied proportions of atoms. It is probable that many of what we now call atoms in chemistry may still be divided, yet there is a *ne plus ultra* beyond which no division can take place; and these are the primordial atoms of nature. The more substances are divided, the more difficult they become of further subdivision. Hence the most attenuated bodies retain a permanency of character. Notwithstanding all that has been said, we do not mean to intimate but there may be a radical difference between spiritual, and atomic entity. Further remarks are deferred until we treat of the vital and nervous textures of animality in immediate connexion.

SECTION V.

ON THE GRADATIONS OF VITALITY.

1. *The subject of Vitality continued, by a consideration of its different grades of manifestation, emanating from different animated tissues.*

Hitherto vitality has been studied in its general phenomena: it now becomes necessary, in order more fully to develop its peculiar properties, to contemplate it under three physiological aspects.

1st. Vital phenomena, resulting from the action of the primitive stamina of animal structures.

2d. Vital phenomena, resulting from influences afforded by the nutritive, ganglial, or trisplanchnic system of nerves, and in co-operation with the respiratory nerves.

3d. Sensitive, motory, and intellectual phenomena, resulting from the susceptibility of the different spino-cephalic masses of nervous matter, or the nervous system of external relation.

The method to be pursued in all of the physiological arrangements, will be, to follow up the nervous tissus from their origin, into the several organic tissues they excite, and according to their periods of development. But, we have tissues apparently destitute of nervous matter, and yet exhibiting many of the phenomena of vitality. A consideration of these merits previous attention.

FIRST THESIS.

2. *Primitive Tissue. Vegetative Grade.*

In all the vegetable tribes, no nerves proper have been demonstrated; and yet a kind of organic sensibility does exist, which may be called innate, or perhaps vegetative. Their tender yielding fibres do contract, and visibly to the naked eye, on many occasions, when some impinging substance affects their economy. This sensibility must be estimated as rather intense, when we view it in relation to the movements of their fluids, their growth, secretion, flowering, and fructification.*

*The phenomenon is beautifully illustated by Mr Bilsborrow in lines addressed to Dr Darwin:

How the fair flower, by Zephyr woo'd, unfurls
Its parting leaves, and waves its azure curls;
Or spreads in gay undress its lucid form
To meet the sun, and shuts it to the storm;
While in green veins impassioned eddies move,
And beauty kindles into life and love.

In the first or lower grades of animality, such as the zoophytes, fungi, polypi, infusoria and many others, no nerves have been satisfactorily discovered in their most perfect state of maturity. However, certain physiologists have reported their having seen, by glasses, isolated globules of nervous matter; yet it might be required of them, to be sure it was not globules of albumen, which they might mistake for nervous matter, seeing the former is very abundant in the composition of these kinds of animal bodies. We shall take it, therefore, for granted, until better proved, that numerous animals of these grades have no nervous substance in their composition, or any more provable, than nerves in the hair, nails, claws or hoofs of animals of a higher order.

Notwithstanding this negation, these animals are endowed with certain degrees of organic, or rather nutritive action, suited to their own internal economy; such as imbibition or absorption, assimilation, and growth. Their apparent sensibility of external contact is but a short remove from that of some vegetables. In all the scale of animal existence up to the human species, we find different grades of organs and organic sensibility. That this vital force is similar in kind to that which pervades the nervous tissues, we infer from its performing very similar functions, so far as relates to nutrition; that it is expelled by similar agents; for hydro-cyanic acid, and other poisons expel it in vegetables and the lowest order of animals, as well as in those having the most perfect nervous systems. So the same may be expelled by lightning, and even so effectually that there remains no muscular rigidity, nor any coagulation of the blood. The vital force exhibits different phenomena as it exists in different tissues.

If we view the humble embryotic state of the human kind, it has nothing of exaltation above the lower animal tribes, and even unconscious vegetables, in point of vital gradation. Its economy consists in absorption, assimilation, and the evolution of the organism. There are as yet no nerves, nor do they begin to appear, even in points, for many weeks. The vital force acts on the primordial particles and fibres, and the *nascent ens* is ushered into form. Like the incarcerated chrysalis, it remains in seclusion a definite period ; and during much of this time, the process of accretion is governed by laws quite similar to those of the lower grades of animals, and this has been often styled the vegetative life of animals.

3. *Vis insita, Irritability, or Vegetative Force.*

The grade of vital susceptibility, which directs and governs all these movements, has been distinguished by the trite apellation of irritability. This term was first used by Glisson, but more fully illustrated by Haller under the appellation of *vis insita*, or inherent power. It was first used in the more apparent contractility of muscles, but has since been applied to express the ability of contraction of other tissues, and synonymously with *vis vitalis*, *inherent power*, and in combination with the nutrient nerves, *instinctive power*. This vital power acts independently of nerves, and often performs functions without them ; for it existed before their evolution, and exists in tissues after the destruction of nerves. It exists in the cellular tissue, which may be considered as the common generative tissue, even of the nerves. It exists in all tissues except the nervous, in the membranes where no nerves are discoverable ; in all the centrifugal and centripetal systems of capillary vessels ; in tendons and bones, and even in the hair and nails ; but in different degrees of force. So also it animates the blood, and secreted products, especially the seminal. The nerves excite, and increase its force in the tissues.

As it is the first vital force that exists, so it is the last to quit the animal tissues, as the sad history of Vesalius shows. He was an eminent physician in Spain, and had the misfortune to lose an illustrious patient. He was permitted, in due time to inspect the body. He was struck with surprise on discovering "the heart still palpitating." The Inquisition doomed him to death, but the king commuted the punishment to a visit to the holy land, from which he never returned. An account is given in Hecker's Journal, by Dr Trustedt, of a parturient subject, in which the uterine contractions expelled a full grown child eight hours after the mother was laid away as dead. Very similar facts are stated by M. Levert, Harvey, and Le Rouse. Abundant evidence is afforded of absorption and circulation in minute vessels being continued, in ordinary cases, for twentyfour hours or more after death. Instances of a similar kind are numerous; but it is not our design so much to particularize, as to generalize.

We can hardly, however, refrain from some further notice of the impressive phenomena attending the death, or loss of vitality in the superadded tissues of the entire nervous systems, whilst some susceptibility remains. For instance in cholera, the morbid impression being most intense on organs supplied by the nutritive nerves, these first cease, and surely with them the cerebral organs. Yet, the vegetatvie life remains, and various sudden movements of muscles follow after several hours. The muscular rigidity so constant after death by ordinary means, is a striking proof also. Yet the cause of death may be so violent as to annihilate vitality of every grade at once, as by lightning. The primitive tissues partake of this rigidity as well as the muscles. It is modified by various circumstances, and commonly continues until the physical state of the tissues becomes altered. Some tissues, and even organs retain a susceptibility of being moved by excitants after death longer than others. As stated by M. Beclard of experiments by Nysten, the left ventricle of the heart loses its susceptibility much sooner than the left auricle, and the stomach and intestines retain it longer than the heart itself.

4. *Case of long-retained Vegetable Life.*

In the American Journal of the Medical Sciences, Vol. XV. p. 211, an account is taken from a German Medical Journal, of a young man who appeared to be dead, so far as the absence of breathing, of any motion of the heart, or of action of all the functions of external relation could manifest. Yet, some artificial eschars showed signs of suppuration on the second, third, and fourth days; on the fifth one hand was found to have been turned round; and on the sixth and ninth days a partial perspiration bedewed the skin. The limbs remained pliant. The lips preserved their red color until the 18th day, a vital aspect. No signs of putrefaction on 21st day. *By Dr Schmidt.*

5. *Vital Gradations.*

The simple animal tissues possess a definite degree of vital susceptibility, and sufficient for all the nutritive processes of their own peculiar economy; but, surely not in the perfection of animated beings, which possess a superadded ganglial system of nerves. Those of a still higher order, and possessing the exquisite susceptibility of the superadded nerves of external relation, are rendered capable of performing far more exalted functions, as locomotion, sensation, and consciousness. To the head of this class is man, possessing the greatest proportion of nervous matter, and of the most intense sensibility. By this climax we may apprehend what man must have been, had he been deprived of these superadded structures. Indeed, we see instances in the case of acephalous fœtuses; and again in idiots of some deficiency of particular nervous organs, spoiling their intellectual powers.

When the functions of these superadded systems of nerves cease, we say, on a cursory examination, that life has ceased; and so it is in relation to them and their functions. But, the susceptibility of the primitive vital solids acts as a saving principle, for a certain indefinite period; for it adheres most pertinaciously to these, and peradventure, under certain favorable circumstances, may be restored back to those delicate superadded tissues. Therefore, vitality may exist in its first grade, after becoming extinct in the nervous systems of internal and external relation.

Some further illustration of the vital aura might be required, in relation to its affinity to animal tissues. It is probably the most subtle agent in all the works of creation, and pervades ocean, earth, and air; when aided by caloric, vapor, oxygen, &c., attaches itself to particular forms of grosser matter, and affords them a new, and peculiar stimulus; it controls the other properties of matter in combination, and assimilates them to suit its own economy. Thus matter takes on new properties, and that which was inert and without form, becomes vivified and organized.

6. *Origo Morbida.*

It may be suggested, and as agreeable to analogy, that the vital aura may concentrate in certain regions and localities, where congenial substances may abound, inviting its combination. Under such circumstances it manifests itself in the luxuriance of vegetation, and great increase of animalculæ. It being, moreover, an intense stimulus, and in a concentrated state in our atmosphere, may prove an inordinate excitant, even on the systems of animals. May not undue vital stimulation in the atmosphere produce that general morbid condition, which has been observed by pathologists from time immemorial, called by Hippocrates *to thion*, or divine something?

The fact has been noticed by many writers down to the present time, and they have designated this morbid state of the atmosphere by different appellations. Animal tissues are of such a fabric, as to endure excitations only to a certain degree, with impunity. It has been often, and justly remarked, that the highest health borders close on the margin of disease. This hint is merely thrown out here, but it may merit further attention in our œtiological review.*

The vital aura requires the support of other excitants for the purpose of forming, and maintaining the integrity of the organism; as caloric, oxygen, and certain visible substances, as albumen, gelatin, fibrin, together with the elements of their composition. Oxygen and caloric are so indispensable for the maintenance of life, that animal bodies are provided with an apparatus for their constant supply. The organism, when once in play, unites the elements of their constitution, and applies them in the process of accretion, by a kind of plastic vital affinity.

7. *Life and Death forced states.*

Although vitality appears to be intimately attached to animal tissues, it loses its attachment, if they are not suitably supported, and maintain their integrity by appropriate stimuli. So life has been said to be a forced state, and continued by constant excitation; and again, death may be called a forced state; for life adheres to the tissues with considerable pertinacity, and may not leave its congenial residence until the fibres have become rigid by age, or their texture marred by disease, or expelled by violence done the organism. It may withstand a long process in a slow conflict, but a sudden and violent impress, as by a blow, electricity, or prussic acid may expel it in a moment from every tissue.

* Histories of the plague inform us, that during the rage of this destroyer of hundreds of thousands, it is attended with an increase of sexual desire. As soon as it had passed by, "They had the courage, (says Dr Hodges, of the plague of London, 1665,) to marry again, and betake to the means of repairing the past mortality; and even women, before deemed barren, were said to be prolific." (Tytler, p. 553.)

8. *Reanimation.*

It is difficult to avoid the question, whether vitality can be reinstated in the organism after being altogether expelled? It is difficult in many instances to determine when it has left the primary tissues, as in the case of asphyxy. There may be some remains of it in these tissues, when all visible organic movement is absent. Many well authenticated instances show, that resuscitation has occurred under the absence of apparent life, for some length of time. In the instance of hibernating animals, the functions of external relations are dormant, those of nutrition greatly diminished; a state of profound and continued sleep.—In the case of seeds germinating that have been kept twenty, and even more than forty years in a dry state, as stated by naturalists; it is visionary to say they have had active life during such length of time. They have not the proper adjuvants of vitality; life has been suspended. Still this form of matter again assumes the vital principle under favorable circumstances.

The cotyledons of vegetable seeds contain those elements, especially albumen, to which the vital force becomes readily attached, when the auxiliaries of vitality, moisture, heat, light and oxygen are present, in compatible degrees, it takes its residence; the cotyledon expands, the corculum germinates, and all the phenomena of vegetable life and organism are developed. The same illustration may be applied to the reanimation of the eggs of animals. If in either case any change has taken place in the constituents of the seed, or egg, there will no animation be discovered. In the Philosophical Transactions for 1774, there is an account of snails being resuscitated after being dried, and kept fifteen years. Numerous instances occur of the resuscitation of insects, as that by Dr Franklin of a fly brought from Europe in a bottle of wine. Is it not reasonable, and philosophical, to assent to the position of a surrounding vital aura combining with congenial matter, and aiding, or even controlling the other agents in the development of life?

May we not be excused in tracing the springs of life to their fountain, even if cold and skeptical philosophy should accuse us of *feeling* after final causes? This is not a meagre subject to be reduced to a narrow circle. It embraces a wide extent of nature, and points to the immense variety, and numbers of vegetable growth that cover the visible surface of the earth, and even that hidden by the deep waters of the ocean. The insect, reptile, and finny tribes which encumber ocean, earth, and air ; the vast series crowding the zootic catalogue : as one species of these, the incalculable millions of human beings, which have existed, and which now press the surface of the earth, all declare a common vivifying power, which has gone forth quickening matter into life and motion, enforcing the symmetrical properties of organization, and astonishing the collected powers of the intellect of man. Unsophisticated philosophy appreciates a cause of organic formation as incomprehensibly extensive, and as apparent as any of the other inexplicable principles that bind together, or which agitate the elements of inert matter. This universal vivifying principle appears to be indispensably necessary, let the germinal influence proceed in any manner whatever.

SECOND THESIS.

Vital Phenomena resulting from influences afforded by the nutritive, ganglial, or trisplanchnic system of nerves, and in co-operation with the respiratory nerves.

This tissue of nervous matter is wanting in many of the lower order of animals, and in the human fœtus for about three months from its existence. However, it shows some appearance at about the end of the first month, in small points in the tissues. It is remarkable that it originates in tissues remote from its ganglia, which are afterwards formed and situated deep in the visceral cavities. They are first seen originating in the intestinal mucous tissue ; but they do originate in such tissues, as we say, in their description they are distributed to from their ganglia ; they rather terminate in the visceral ganglia.

This order of nerves grows out of the primitive tissues, and therefore may be esteemed as superadded, and possessing different susceptibilities in different tissues, something similar to the external nerves of sense. In saying this is a superadded tissue, we do not mean it is an isolated one, but harmonizes unconsciously by its peculiar sensibility with all other tissues of the vegetative grade. There is a very striking consensus existing between every tissue and organ of the system, by which all act as auxiliaries, and establish an exquisite harmony of action. As in the oscillations of stringed instruments, many intonations harmonize to produce melody, so a harmony of movement is manifest in the physiological state ; but when the train of natural harmony is broken, a new train of morbid phenomena arise.

10. *Nervous Ganglia, and Plexuses.*

These nervous filaments concentrate in the form of glands, knobs, or ganglia, called, by some, little brains. They are found in the head, neck, thorax, abdomen, and pelvis. They have considerable firmness as compared with other nervous textures. They are of a reddish, or light rose color, and embedded in cellular substance under membranes, and between muscles. They are abundantly supplied with blood vessels. These ganglia present two general divisions ; one series of filaments as already noticed, the other from the vertebral column, by filaments sent out from the spinal cord, and directly forming chains of ganglia on each side. These chains of ganglia present an appearance something like an ellipsis, one end of which being in the head, the other in the pelvis. The visceral division is situated on each side of the spine, and within the ellipses formed by the other chains.

The lateral ganglia have an intimate communication with all the spino-cerebral nerves ; whilst the central ganglia communicate in a direct manner only with one pair, the pneumogastric. However, there is an intimate, but indirect communication between the visceral, and spinal ganglia, whilst the pneumogastric has but one direct communication with the central ganglia ; viz., the fascia-communicans of Wrisberg, or as it is called nervous loop, between the pneumogastric, and semi-lunar ganglia. However, the filamentary distributions of this nerve is in the same tissues with those of the abdominal ganglia. It is directly distributed to the larynx, lungs, and stomach.

The sympathetic nerve then, or trisplanchnic, or ganglial, or intercostal, has obtained the epithet of *great*, from its extent and importance in the economy of the system, together with its numerous ganglia and plexuses. These may require some short notice. In the head is situated the ophthalmic ganglion, the spheno-palatine and submaxillary. In the neck the superior, middle, and inferior cervical ganglia. There are ten or twelve thoracic ganglia. Immediately below the diaphragm, near the spine, is situated the semi-lunar ganglia, which by some have been called the great abdominal brain, and with the solar plexus, has been estimated as the centre of harmonies of all the others. Several other ganglia are situated along the lumber vertebra, os sacrum, and in the pelvis.

Numerous branches, or filaments pass off from these ganglia to form plexuses, by which there appears to be an intimate association instituted, which forms a medium of harmonies between all the viscera, and in a limited degree with the organs of external relation. Filaments arising from ganglia, and other origins, communicate in common envelopes into meshes, and come out again to be distributed to different organs. One important plexus is from the cervical ganglia, and uniting with branches of the pneumogastric, go to form the great cardiac plexus, placed behind the arch of the aorta. There are many other plexuses ; the solar plexus being considered very important, by which intercommunications are established extensively. These anatomical notices are acknowledged as defective. *Those who wish for a short view of this extensive series of nerves, may consult J. P. Manee's map of the great sympathetic nerve, translated by Dr Pancoast.*

11. *Their Function Persistive.*

This system of nerves, and the organs they supply of circulation, secretion, digestion, assimilation, &c., are destined to the subsistence and recruit of all the tissues. This demand being constant and imperious, this series of nerves is charged with a very constant susceptibility ; however, having some remissions, it acts at the same time in harmony with the susceptibility of the primitive tissues, and their functions seem united into one more perfect in design. An action is now sustained by the aid of the pneumogastric, in the heart and lungs, more steady than the vestal fire, so long as animation continues ; yet not constantly of equal intensity. These functions sustain an independent position, from which they cannot be driven by another series of nervous organs of still higher grade, and concerned in the functions of intellect.

12. *Three orders of Sympathetic Nerves.*

As soon as the nervous fibrils and cords emerge from their ganglial plexuses, they are marshalled into three divisions.

The 1st goes to supply the muscles of involuntary motion, and forms a union with some cerebral nerves.

The 2d passes into the parenchymatous substance of all the organic viscera.

The 3d passes with the arteries, in their outer coat, throughout all their minute capillary distributions in the system. The peculiarities of vital susceptibilities of these divisions will be noticed in their places.

13. *Instinctive Susceptibility.*

With a view of being rightly understood, the following notice of terms, which may be much used, appears necessary. The vegetative excitability of the primordeal stamina, in unison with the susceptibility of the ganglial system of nerves, may be styled the *organic*, or *instinctive* susceptibility ; or aptitude of movements from excitations applied. A preference may be given to the term *instinctive*, on account of the resemblance these organic movements have to mental instincts, as respects spontaneity. And more especially as we discover a peculiar predilection, or appetency in many of the organic movements. For instance, as the chylous absorbents refusing to take up any thing but chyle ; also, the wants of the system, as indicated by the desire of food, and of respirable air, &c. Instinctive or organic movements are expressive of facts ; yet, are always understood implying some peculiar stimulation, either from the contained fluids, or from other associated organs in a state of excitement ; or from mental radiations, by the agency of thought, in the excitations of what are called the passions.

14. *Pneumogastric Nerve.*

From the middle rod of the spinal cord, at the medulla oblongata, the pneumogastric nerve arises by single roots, or fibrils, and without ganglionic bulgings. It soon divides into four important branches ; one goes to the larynx, one to the heart, and one to the lungs and stomach each. These nerves unite more or less in the plexuses, and then are distributed with the ganglial nerves. They associate the two great systems of nerves together, and help to unite the nutrient organs in a train of sympathetic harmony, both in health and in disease. Besides this nerve several others originate in its vicinity, and are distributed on the external and internal muscles of respiration, the most important of which is the phrenic to the diaphragm. Respiration being an important act in the process of nutrition, these nerves act in harmony with the ganglial system, neither being under the control of the will; neither does the pneumogastric reflect sensation from the viscera to the centre of perception, like the nerves of sensation. Visceral impressions are reported, but obscurely to the centre of perception in health, but more vividly in disease, and probably in part through the outer chain of ganglia, which connect with the spinal nerves of sense ; and partly by filaments from the nerves of sensation.

Demonstrations are needed to decide positively on the sensibility of the pneumogastric nerve in reflecting radiations to the centre of perception. It very probably furnishes the pulmonary sense indicating the want of respirable air. It may, like certain other nerves, possess a peculiar sensibility, and which is not transmitted to the seat of perception so vividly as by the nerves of feeling. In this it resembles the entire system of ganglial nerves. When this nerve is destroyed, or its function in any manner intercepted, respiration directly ceases, and digestion fails. Injuries done to the branch called the recurrent affect the speech.

15. *Distribution of Involuntary Nerves to Muscles.*

The sympathetic nerves going to the heart, lungs, and secretory organs may receive attention in treating of those organs ; but we can hardly pass some notice of the distribution of those nerves to the voluntary muscles and skin. They pass with the arteries, and are distributed in the long, voluntary muscles, and upon the same contractile fibres as receive the spinal nerves of voluntary motion, as we are taught by anatomists. These muscles are ordinarily under the control of the will, by the agency of the spinal nerves. Severe impressions on this order of nerves, or at their origins in the encephalon produce spasms of the clonic kind, or convulsions. But the locomotive muscles are affected with tonic spasm, or tetanus, and taken out of the control of the will, when certain kinds of morbid impressions are transmitted from other tissues supplied with ganglial nerves. This may be the basis of an important pathological thesis.

16. *Distribution to the Surface.*

Again, in relation to the distribution of the involuntary, or ganglial nerves to the dermoid tissue ; these nerves pass plentifully with arteries into the papillæ. These communications establish a prevailing harmony between the surface and interior organs, and membranes ; and this harmony is rarely noticed by the spinal nerves of sensation in the physiological state. However, in a pathological state it becomes very apparent. Hence numerous impressions on the skin, as cold, titillation, &c., are instantaneously, oftentimes, transmitted to internal tissues ; and the reverse. This sympathetic consensus has been the theme of every observer of pathological phenomena, and yet without the physiological illustration. In eruptive diseases, the harmony between the internal and external surfaces is clearly manifested, and through the agency of these communications. Almost every habit of disease injures the healthy balance of action, but it is rendered most manifest in malignant, and ataxic diseases. It is also manifestly shown in the action of cold either externally or internally applied, and in the operation of emetics, &c.

17. *Varied Susceptibilities.*

We say the nutrient, or ganglial system of nerves possesses a peculiar sensibility ; whilst it is confessed this is not defining it. The galvanic fluid scarcely excites motions in the involuntary muscles supplied from it, whilst it excites severe contractions in the external voluntary muscles. So certain animal fluids excite particular tissues, and not others. There is as great a difference of nervous susceptibility in the secreting organs supplied by these nerves, as in the external senses supplied by the nervous system of external relation. So certain poisons destroy the functions of some of the tissues and organs, which have little, or no effect on others. It is well established in therapeutics, that certain medicaments impress particular tissues more than others. These phenomena can only be discovered by experience.

18. *Effects of Excitations.*

It seems that certain agents, which we call stimuli, impress tissues possessed of the nutritive, or ganglial nerves, through a sensibility afforded to them by the incomprehensible vital power. This enables those tissues to commence, and reiterate motions. In some tissues these movements are discoverable by the naked eye; in others by glasses, and in others the effects only clearly indicate antecedent motions of the tissue.

The functions of the tissues are increased on the application of appropriate stimuli, whether as nutriment, or as medicaments, or locally applied in a more mechanical method ; or, finally, by the agency of thought, in tissues also having nerves of external relation. The effects are an increase of function ; fluids concentrate to a part when the excitation is local ; in this event there is an increase of heat, of turgescence, of color, and of expansion of fluids. If the stimulus affects the entire system, and in a tolerable degree only, all the functions will be increased. The fluids are seen rushing to the surface, and partly forced there by the nervous impetus of the interior series of nervous tissues. However, the same susceptibility exists in the exterior tissues, and they act in accordance; there follows an expansion of tissue; a turgescence of fluids; an increase of caloric; an additional muscular energy, together with a more vivid expression, and force of intellect, when not in too great excess.

It has already been suggested, that the vital tissues endure only a compatible degree of stimulation with impunity. If applied in an inordinate degree, their fabrics suffer an amount of contraction, which by altering their integrity, impedes the free play of the vital force, and a deficiency of function is immediately discovered. There is now rather a shrivelling of the surface, with paleness, and coldness. The circulations all lose in energy; muscular motion is feeble and tremulous; the features altered, and intellect is wavering. Sudden, and impressive thought; all external and internal high stimulation, with many agents, are liable to produce this train of phenomena. Whilst enduring these severer impressions, the instinctive efforts are excited to action, and after an uncertain interval usually prevail. When this takes effect, the phenomena of vitality appear in a high degree, and surpassing those already described; and this arises from the causes injuring the composition of the tissues, and leaving more permanent irritations. The condition is now a preternatural one; it is a morbid state. This condition is called reaction, or responding or repulsive action.

In pursuing the climax it becomes apparent, that very intense impressions make still greater alterations in the mobile tissues; even so that the vital aura ceases to influence them, and is expelled. No repulsive actions ensue, nor the phenomena of disease; a state of *paresis* is induced.

19. *Further Illustrations of the Vital Force.*

If it should be granted that vitality consists of an entity, although in the most attenuated form, how does it become attached to, and assimilated with the organism? or, is it rather secreted by the nervous tissues, and forms a nervous atmosphere, a halitus, which pervades the fibres of tissues, and stimulates them to action, as supposed by Lobstein, and many others? It is difficult to comprehend how permanent, and indestructible gaseous bodies can be formed by organic secretion. But, what power excites this secretion? Can an effect be a cause also? Besides, all analogy teaches, that secreted products are compounds, and if so, liable to decomposition.

If the nervous influence be a compound it is destructible, and must become a nihility, so far as relates to its characteristic properties. Philosophy can hardly admit such a thesis. It must go for hypothesis, and becomes very incongruous in its results. No one talks of the secretion of light, of galvanism, of magnetism, but of their concentration, and in a manner to manifest their existence, and clearly show their agencies.

If it should be conceded, that there is a vivifying essence diffused throughout the works of nature, and that it has a predilection to unite with certain forms of matter like other ethereal essences, the unprejudiced judgment might favor the suggestion of its uniting with the elements of organic molecules; and when so combined stimulate to the development of new phenomena, and such as may be compatible with their compositions and textures. When such excitable tissues are put into more intense action, they may draw to their influence a further supply, and more vivid phenomena be disclosed. The inference to be drawn from these remarks is, that certain elements of matter do in the first place combine by physical, or natural affinity, and in this state may be acted on by a superadded vital force, until the phenomena of vital molecules, of organism, and of animal life be manifested in their full perfection.

We are very sure that the vital force, whatever it may be, exists in different degrees in the tissues, sometimes deficient and at other times in excess. Or, in other words, it varies from the usual standard of mild and agreeable impression. It may concentrate in some tissues whilst others are deficient. If the organism becomes so modified as not to render it a suitable attachment, it leaves it. A severe shock of electricity, a hard blow, or concentrated prussic acid instantly expel it by changing the condition of the organism. The same happens in a slow change of the tissues by the common causes of what is called disease. In this instance the vital force may be extinguished by a low train of phenomena as in chronic disease, or by an exalted train as in pyrexy, and phrenzy. In all these instances the intimate condition of the organism suffers a modification ill suited to its residence.

There is no tissue so congenial to the residence of the vital force, or gives it an opportunity for its full manifestation as that which we call nervous, to be hereafter treated of. We know the fact, and that is sufficient for our present purpose ; yet we know it exists in other tissues, and even in vegetables. We know nothing of the manner it acts on the congenial nervous masses, or on the primitive tissues ; we only know that certain trains of phenomena indicate the existence of the vital force in the organism ; and oftentimes the state of the organism becomes greatly modified by it. The very stimulations of this power in excess, may be the means of altering the condition of the organism, and induce its expulsion, either in the form of protracted disease, or suddenly, as in apoplexy and cholera. The longer disease continues with a local concentration, the more the organism is liable to suffer changes of a pathological character.

SECTION VI.

THIRD THESIS.

Sensitive, Motory and Intellectual Phenomena resulting from the susceptibility of the different spino-cephalic masses of nervous matter, or the nervous system of external relation.

THE nervous tissue being considered as the most manifest residence of the vital force, and from which radiations pass to other tissues, affording them an increased susceptibility of sensation and motility, it seems necessary to give some of their structural, or anatomical characters. This will serve as a basis for a physiological arrangement of all the subordinate tissues, and at the same time establishes the order of a nosographical arrangement.

1. *Plurality of Nervous Functions.*

The discovery of the plurality of the nervous functions introduces the brightest era that ever enlightened physiological science. By its present coruscations, we are enabled to classify the nerves, and of course their dependent organs, and to follow up their specifications into many genera. By following this method, in connexion with their series of development, an arrangement of organic function is established that never ought to be encroached on. Having made some reflections on the vegetative grade of vitality in the primitive tissue, and on the nutrient system of nerves within the great cavities, we proceed to a consideration of the vital force as displayed in the system of external relation.

2. *Nerves of External Relation.*

Nerves are prolongations from nervous masses, or to speak more correctly in relation to their origin and extension, they are concentrations of nervous funiculi to the great glandular masses of nervous matter located in the encephalon. However, as the functions of nerves are diversified, some receiving, and others transmitting influences to and from the centres of vital movements, we say the nerves go from the centre of the great masses. A number of funiculi, or pulpy extensions united by telary investments, form fasces, and bundles of these form rods, according to Sir C. Bell. A simple nerve is where the funiculi of its formation arise in a line from the spinal cord ; a compound nerve is where funiculi forming the roots "arise in double rows, and each row from a different column, or tract of nervous matter. The ninth nerve is simple, a spinal nerve is compound." Many fasces of nervous fibrils bound together by a common covering called neurilema, constitute a nerve. Nerves, then, composed of funiculi of different susceptibilities, intercommunicate by plexuses, and interchange funiculi, according to the complicated function of the organ they are destined to ; and when arrived there lose their coverings, and each funiculus retains its own peculiar properties.

3. *Spinal Cord.*

The spinal cord originates in the primary tissues, and passing through various stadia, assumes its characteristic appearance before the other great nervous masses. Being divided by the mesial line, each half is subdivided into three rods ; the anterior gives origin to nerves of voluntary motion, the posterior to nerves of the sense of feeling, and the middle to the respiratory nerves. At the summit of this column, and within the cranium is situated the *medulla oblongata.* The nerves of the organs of sight, hearing, smelling, and tasting pass off from the same division at the top of the medulla oblongata, and communicate with the cerebrum. M. Flourins seems to have established this fact, as respects the nerves of sight and hearing, "for when both lobes of the cerebrum are removed, the animal becomes both blind and deaf." We may be allowed to infer the same in relation to the nerves of taste and smell, if the evidence could have been obtained from dumb animals. By continuing the experiment, in extirpating one of the tubercula quadrigemina, through which the optic filaments pass, the animal lost the power of vision of the opposite eye; and by the removal of the other, vision was totally lost.

Anatomical investigations reveal the fact, that the anterior and posterior rods, assigned to motion and sensation, pass up from the crown of the spinal cord, by the crura of the cerebellum and cerebrum to those nervous masses, whilst the middle "stops short" in the medulla oblongata. However, some anatomists allow it a slender connexion with the superior nervous masses. As this point is allowed to be the centre of all perception, and from which insensible radiations pass to the intellect, we may suppose the system of respiratory nerves do not give very thrilling responses to those organs; but rather obey stimulations of the instinctive sensibility.

Similar phenomena appear from experiments on the spinal cord, that are developed in the nerves. When irritations are made at any point of the nerves, or spinal cord, contractions of muscles follow below this point; but if the nerve be tied, no motion ensues. But, with respect to the nerves of sensation it is the reverse; no sensation is experienced, if the communication is intercepted above the point irritated. Neither the nerves nor spinal cord possess sensation, but only conduct irritations to the seat of perception, or of motion.

The fifth pair of nerves, or trigemini, are cranial nerves, but have been demonstrated to perform functions similar to those of the spinal nerves. They are distributed to the face and head, and perform the office of sensation and motion. By arranging these with the spinal nerves there will be thirty-one pair, and nine cranial. The spinal nerves originate by filaments ; those from the anterior rod are destined to muscular motion, and those of the posterior to feeling. They immediately unite in the form of nervous cords in one common covering, the posterior having ganglionic bulgings, the anterior are destitute. In their direct transit to the tissues of terminal expansion they form plexuses, by which each kind of nerves associate, and again unite according to the complexity of the functions in organs they supply ; yet each fasciculus retains its own distinctive character.

4. *Vital Entity.*

These brief anatomical references are introduced, chiefly for the purpose of furnishing a plan for the mind to rest on, whilst pursuing the study of the vital phenomena of the nervous forces. It is a proposition so self-evident as not to require proof, that organized bodies are endowed with an exciting *something*, which we call life ; as a synonymy we say vitality, vital principle, &c. It is equally evident it is of a substantive kind, and as well shown as that light, electricity, or magnetism are such. Otherwise it must be esteemed as the quality, or the mere effects of certain other bodies, and becomes an object of annihilation as soon as these certain other bodies cease to produce it. But it is expected our previous illustrations have established the thesis, that there is a kind of entity in this agent, although it exists in a very attenuated form.

As this vital essence in modified states, is the one actuating all organized beings, whilst united with organic substances, it appears to possess a controlling influence over all the others, in definite limits ; and over the physical affinities of the molecules of matter, and at the same time these affinities do exist in a subordinate state in the formation of the organism, and composition of fluids, with their fluid animal matter. This vital force may be accumulated, and does more essentially reside in the peculiar textures we call nervous. This is a kind of organization designed by nature for this purpose, and is produced by the influence of this same entity in the formative processes; although the manner in which this is effected we cannot investigate.

5. *Remarks on a supposed Nervous Fluid.*

The nervous funiculi are thought by some to form vessels, and that these vessels secrete the fluid we call nervous. But such vessels have never been demonstrated, nor has the product been shown to be a secretion; if so, it is a compound of elements, and liable to decomposition. The existence of these vessels has been inferred from loose hypothetical reasoning; yet there are serous vessels throughout the entire organism. We cannot say such vessels do not exist, yet until proved we are not bound to recognise them. We have no data to form a conclusion, in what manner vitality is combined with matter, by which the astonishing results of sensation, muscular motion, and the intellectual phenomena are produced. The extent of our comparative reasoning must end in a sort of analogical hypothesis. Electricity is said to rest on the surface of bodies suited to its concentration. Magnetism seems more intimately blended with the composition, for it will not concentrate in iron in the formation of the magnet, in any considerable degree, without a definite proportion of carbon in its composition.

6. *Attachment of Vital Essence in different degrees.*

There is but little difficulty in conceiving of an ethereal gas concentrating in the albuminous pulp of the nerves; and that it should combine and harmonize with great mobility remote parts; and having an affinity with a particular kind of animal matter, be retained there with a certain degree of pertinacity. It is apparent, that vitality has more freedom of play, and manifests more striking phenomena as the tissues to which it is attached are of a mobile kind, and in their entire integrity of composition. Thus it seems to display in young and mobile tissues, more intense phenomena than what we discover in the rigid and altered tissues of age. It, again, acts in a manner to display different phenomena in systems emaciated and worn down by exhaustion, from what it does in those well nourished and with a suitable distention of vessels. Finally, where the excitable organism is disturbed by the causes of disease, there arises a very abnormal train of vital phenomena.

Vitality pervades all the tissues when in a compatible conditition for its residence, but in different proportions, and of modified susceptibilities. This difference consists essentially in the texture of the organization, as destined by nature for the exercise of different functions answering the necessities of the whole. It casually arises from accidental changes by the causes of disease.

7. *Sensations.*

Certain organs are charged with the office of receiving impressions from external objects, and transmitting semblances of their existence, form, and certain qualities, to the centre of perception ; such are the organs transmitting the sensation of feeling, of hearing, of seeing, of smelling, and tasting ; although these organs are affected by different agents, and in a different manner, they all admit of impressions made on the tender pulp of nervous matter expanded in the several tissues destined to these functions. Although the system is formed of dissimilar parts, yet when combined into a whole, it exists as an unit, it is now one point of organized matter, and whatever affects one part affects the whole, yet in a modified manner.

If it should be inquired how the tissues came to be possessed of the ability of perceiving impressions, we only say this is one of the attributes bestowed on them by the vital agency. There is no great difficulty in conceiving that a body, or light, or sound impinging the mobile nervous pulp in an expanded state, should give a consecutive oscillatory motion along isolated lines. The difficulty consists in abstracting the notions we have obtained by our experience of rude and gross motions of matter, from the views we ought to entertain of the motions of the most subtle agents in nature. It is not the vibratory motions of stringed instruments. It is rather, undulations given to molecules in contact; but we have no simile in nature.

An impression that we cannot estimate from its minuteness, is made on sensitive expansions. Simultaneously an impression is given to remote parts of the chain of communication, even to the seat of perception, and in a silent manner without any proper vibratory motion. If the distance be small or great, it alters nothing; it is perceived as soon in the one case as in the other. If there are certain perceptive tissues seated deep in the organism at the remote ends of the chain of communication, the impulse there will be the same as that on the surface, for the nervous masses here are merely a continuation of the same tissue, assigned to the same office. We see here an instance of the liability of our understandings to be imposed on, by describing tissues and organs in an isolated manner, as if they had independent functions.

3. *Touch and Sight.*

In relation to the sense of touch; if the impressing body be of a smooth, obtuse kind, it is so perceived; if it be of a sharp and pointed form, the sensation communicated will be so perceived, and no dissimulation can prevail. So with respect to sight; the impressions in this instance must be through the agency of light; the distances, colors, and other properties of bodies are shown by different grades, and intermixtures of light and shade. Light, with its deficiencies, or shades, or beams of light severed into rays, with their peculiar colorings, being reflected, easily touch the retina. There need be no more said to show, that the same contact touches the seat of visual perception; and as the external impression contains nothing but matter of fact, so the internal conception is a *fac simile.*

9. *Hearing, Smelling, Tasting.*

Undulations of air, either heavy, sharp, or soothing, impress the expansion of the portio mollis of the ear. The seat of perception is as soon impressed; and every degree and modulation of such undulatory motions are recognised by the intellectual faculties. The same illustrations will apply to the senses of smell and taste. The nerves of external sensation transmit to the organs of intellect. The nerves of voluntary motion transmit the mandates of intellect to the muscles. It may, therefore, be proper to defer any remarks on their functions until we have introduced the cerebral masses, although they form a part of the spinal cord.

10. *The Cerebral Masses.*

The first threads of nutritive nerves in the primary tissues are hardly discoverable until the end of the first month of impregnation, and the organization of the superadded tissues is scarcely completed at the end of gestation. Agreeable to Dr Tiedemann's reports of his researches, as well as those of others, into the fœtal evolution of the nervous system, the brain is the last formed; and the cerebrum later than the cerebellum. The brain is not distinguishable in less than about two months after conception, being very minute, and then not without the fibres being hardened by alcohol ; at this time the spinal cord is very large in proportion to the brain. The brain can now be seen evidently originating from the two principal cords of the medulla oblongata, the pyramidal and olivary, whilst the superior part is wanting.

The cerebellum also, originates by an apparent flattened substance from the sides of the medulla oblongata, which soon unite in the progress of evolution ; and the crura also ; and yet the mass of the cerebellum is not formed until a later period. Strata after strata of cerebral matter enlarge the hemispheres of both brains, but the exterior convolutions are not formed until near the close of pregnancy, and then rather imperfectly. So the cerebellum and cerebrum are considered as efflorescenses from the medulla oblongata, or crown of the spinal cord.

The nervous substance appears, when examined by the microscope, to be composed of small, semi-transparent globules, connected into fibrillæ by a viscid substance. According to the researches of Dr M. Edwards, their diameter is equal to 1-7300th part of an inch. These globules are essentially formed of albumen. The nervous matter passes through different grades of density, from a fluid to some firmness. In the fœtus it is fluid ; in the infant state soft ; in the adult considerably firm. In the pathological state liable to suffer changes, sometimes very hard, and also very soft. In a healthy state, and after being macerated in alcohol, its fibres may be separated, and traced into the cortical substance.

11. *Cerebral Masses destitute of Sensibility.*

The medullary and cortical substance of the brain are destitute of apparent sensibility ; they may be cut and lacerated without exciting pain, there being no radiations to the centre of perception. At the tubercula quadrigemina, sensibility of relation is discovered by the subject experiencing tremblings and convulsions, and these are increased as the medulla oblongata is penetrated. These are the only portions of the brain that experience pain, or excite convulsions when injured, and it indicates that the tubercles form a part of the medulla oblongata, and nerves of motion and sensation.

12. *Cineritious Substance, and Blood.*

The cortical, cineritious, or gray substance of the brain is situated on its surface, covering the convolutions, or affording the matter of their formation. Towards the basis it intermixes in lines with the medullary white substance, and in the spinal cord occupies the central portion. The arteries of the brain do not anastomose, although a large proportion of blood is sent there. The blood is sent to the brain by the internal carotid and vertebral arteries, and these have intimate communications; and yet they do not form the minute inosculations of other arteries. About one fifth part of all the arterial blood is sent to the head, whilst the weight of the brain is only about one fortieth part of the whole body. The arteries pass through the pia mater in very delicate capillaries into the gray substance, and modify the color of this tissue. According to Gall, Bell, and others, the medullary fibres can be traced to their origin in the gray substance, and we may infer hence, that it acts an important part in the phenomena of intellect.

13. *Plurality of Function.*

The texture of the cerebral matter has hitherto bid defiance to attempts to separate, and identify its particular organization, so as to indicate individual functions. Notwithstanding we have analogy almost equivalent to demonstration, that this tissue possesses diversified susceptibilities, and performs different functions. From hence we infer that it is composed of a diversified organization. Some experiments go far to establish the thesis, as well as the analogy, that all other portions of nervous matter perform separate and diversified functions. The unison and harmony discoverable in every intellectual operation, both as respects the encephalic functions, and the influence of these in all other functions of the system, indicate a union, or concentration of organic prolongations by commissure, and this point must be where perception stops, at the summit of the medulla oblongata.

In the first place we will attend to the grand divisions of the brain, the cerebellum and cerebrum, and then make some reflections on individual functions.

14. *Experiments on the Encephalic Nervous Mass.*

About the commencement of the present century, M. Orlando instituted a series of experiments in order to ascertain the specific function of the brain. M. Flourens, in 1822, repeated them before a commission of the French Institute, who approved of the conclusions. They have since been repeated by M. Fouville, and Pinel Grand-Champ, with but little difference in the results. The cerebrum and cerebellum were successively penetrated, and indeed sliced off without giving pain, or exciting convulsions, as has been already stated; but as soon as the instruments touched the tubercula quadrigemina, or medulla oblongata, "trembling and convulsions began." It appears that this is the part where irritations produce convulsions "to the exclusion of every other."

When both the cerebrum and cerebellum were altogether removed in a pigeon, it could move, and tumble about, but had lost the faculty of regulating its motions; but when the cerebellum was half sliced off, its gait resembled that of a drunken person.

When the cerebellum was removed, and the parts above and below left entire, the muscular movements were as has been mentioned, that is, altogether accidental; and yet the animal would brace itself when only half of it was cut away; but when entirely destroyed, it moved in all directions when threatened or struck. Even in this condition it could see and hear quite distinctly; its head was erect, its air lively and spirited. The integrity of the cerebellum seems necessary to the regularity of locomotion, and if it be removed, the animal will never find the balance necessary to such motion.

The right cerebral lobe of a pigeon was removed, when it immediately lost the sight of the left eye. Notwithstanding the animal could not see with the left eye, yet the contractility of the iris remained. Next the other lobe of the cerebrum was removed. The sight of both eyes was lost, but not the contractility of the iris; for this depends on the instinctive susceptibility of the nutritive system of nerves, furnished from the ophthalmic ganglion. The severity of the impression from the experiment was such as to induce some general debility, but notwithstanding, the animal stood fully upright on its feet; it would not move unless forced or pushed; it would fly when thrown up into the air, but was unable to direct its way. When left to itself it remained motionless, like one able to move, but destitute of a will to direct, or sight to guide its way. As the cerebellum remained, it still had the power of balancing muscular motion, but volition being abolished, it could not be directed. In all the experiments on different animals it was shown, when the cerebrum alone was removed, they remained listless, but capable of moving, whilst memory, vision, hearing, will, and all perceptions by the external senses were extinguished.

On the other hand, when the cerebellum was removed, and the cerebrum left entire, the mental faculties remained, but voluntary movements were very feeble, and not directed to any object; they resembled the undirected action of muscles in decapitated animals; the regulator of motion was gone. In the process of voluntary movements it appears, that the determination is the result of the cerebral organs, or faculties; that the direction of these motions is the result of mental faculties seated in the cerebellum; and that the ability of motion resides in the spinal cord and nerves. All these phenomena indicate a plurality of function in the spino-cerebral mass, which are subjects of demonstration.

Further Proofs of Individuality of Function.

Pressure upon the brain, from above, downwards, produces stupor; whilst lateral pressure does not. It is supposedthe vertical pressure in this instance, affects the function of the medulla oblongata, the seat of the perceptions. A destruction, or severe lesion of one side of the cerebrum, is followed by an inability of function of the opposite eye, and of voluntary motion of the opposite side of the body. The commissures of the brain are numerous from one side to the other. It appears further, however, that a section of the fifth pair of nerves on one side produces blindness of the same side. So, also, a deep wound of the cerebellum occasions paralysis of the same side; or if slighter, a propensity to go backwards. And, again, if an incision be made deep from above downwards, the animal rolls over continually even for many days; but on making a similar incision on the opposite side he stops rolling, and remains in an even balance. If the incisions are not equal the animal may continue rolling, and always towards the side most injured. So in some pathological states patients show a disposition to roll, and always one way, in paralysis to the affected side. Experiments show the cerebrum to be the seat of intellect, and the cerebellum the regulator of voluntary motions. The pons Varolii is considered as the point between intellect and instinct. The experiments of Magendie, Serres, and Bellingeri may be consulted on these interesting subjects.

15. *Internal Cerebral Organization.*

The functions of the cerebral hemispheres clearly indicate a complexity of organization; for the nerves supplying the external senses can be traced into this substance, and probably reach the cortical. It is asserted by some physiologists, that the most intelligence is connected with the greatest proportion of cineritious substance; and it is proved, that in man this is far more abundant than in any other animal. With respect to the organs giving force to the internal functions, or as they are called faculties, we must speak reservedly, although analogy warrants their existence. All suggestions of identifying their particular location, in the present state of science, must be esteemed apocryphal; yet, there is a strong presumption of their existence, and that their fibres extend into the convolutions also. The cerebrum, although not advertising our perceptions of its secret economy, performs the most exalted offices of any tissue; whilst it is a labyrinth, it is also the laboratory of intellect.

16. *Relative Proportions of Nervous Matter.*

Certain axioms, or principles in relation to the brain appear to be well agreed on by physiologists. Such as that, *man derives his most perfect intellectual faculties from the relative volume of his cerebral hemispheres*, when not of a pathological kind. And again, the *larger the brain and the less the nerves, the more comprehensive will be the intelligence.* Of all animals man has the largest brain, and comparatively the smallest nerves. The brain of a horse, and of an ox is but half the size of that of a man, whilst their nerves are ten times more bulky.

17. *Of the Internal Senses, or Faculties.*

We assume it as an established principle, that the encephalic mass, especially the cerebrum, is the seat of intellect, and the affective movements; and further, that these phenomena indicate the existence of diversified organic tissues; and that by destroying or paralyzing this organization, the phenomena of mind cease. The number of the faculties, or functions, are differently estimated. Dr Good reckons five, being the same as the external senses, viz: perception, memory, imagination, reason, and judgment. A mass of evidence might be produced to show that some of these faculties, or internal senses, may be weakened or obliterated, like the external senses, and often admit of restoration. In dreaming and delirium, some of them are in a high state of excitation, whilst others are dormant. In the natural state, all these faculties may be in operation, and in perfect sleep all dormant. There is a defect of these faculties in the case of idiots, and Dr Spurzheim has demonstrated, in a few instances, the defection to be in the cortical convolutions.

Thus far we may go with some assurance, but in relation to the mode, or manner of existence of vitality influencing the organization, so as to produce the phenomena resulting from the intellectual processes, we are in darkness. Indeed the same may be remarked of all the vital processes. We have no evidence to raise a doubt, but that the same kind of vital force which actuates the vegetative, and nutritive tissues, incites also the encephalic organs; for it is one undivided property over all the tissues, yet astonishingly modified by their dissimilarity of tissue and susceptibility. With respect to the organs styled intellectual, we cannot describe how the vital aura acts on, or causes them to act in their functional capacity, to produce the phenomena constituting mind. There is a ne plus ultra to human investigation; and this is necessary to humble the pride of philosophy, and to teach man his weakness, and a view of that Creative Power, who spake him into organized existence, and breathed into him the breath of life, and "he became a living soul."*

The several internal, mental, organic tissues being endowed with certain capacities of perception, and susceptibility of motion ; perhaps we may be permitted to say, that exterior impressions are made on the medullary expansions of those organs located in the five external senses. These thrilling impressions are simultaneously made, and perceived in the internal organization, and their similitudes of impulse impressed, and retained there.

We now need the aid of attention, which some properly enough have ranked as one of the mental faculties, for the purpose of arranging, and fixing those impressions received from without. It must be understood there are no innate impressions, or ideas, notwithstanding much has been urged by very eminent writers ; for the subject knows nothing further than as simple impressions are made on what Mr Locke calls the *tabula rasa* of the mind ; and by comparisons of the relations of these impressions, in the production of what are styled complex ideas. These organs are voluntary, and active, and have a striking affinity in this respect, to the muscles of volition.

There are two other agencies quite manifest in mental processes, which have been also properly enough by some, ranked as faculties ; these are *thought* and *association*. Thought, or its proper excitant, appears to be a very active, voluntary agent, calling up, or commanding the service of other faculties, or organs on every emergency, and marshalling them in order. Association seems rather to be a sequent, or a resultant process, and when excited, instantaneously combines similar impressions already received, into a train in succession. It may have an affinity to the instinctive motions ; for instance, an impression of uneasiness made on the pulmonary

*Gen. ii. 7.

sense, excites a series of organs into action, without volition, producing complicated motions of the respiratory apparatus in the act of coughing, &c. So impressions, called ideas, of a similar character, are brought up by the excitement of the mementive tissue, or its faculty of association.

The series of mental processes are trained after the following manner, as indicated by experience. Attention being excited either by a mental, or corporeal stimulus, thought commands, or in some manner influences the other tissues, already furnished with impressive images, to a state of excitement, or mobile condition. The tissue of the faculty of memory now makes vivid the representations of objects retained, or ideas already implanted ; and these are defined by Mr Locke to be, "whatever a man observes, and is conscious to himself he has in his mind." Then the tissue of the faculty of imagination, being also in an excited state, adds to, or dimnishes, or offers new colors to the preconceived impressions.

The faculty of reason is excited also, and inquisition is made into all the relations appertaining to the agreement or disagreement, similarity or dissimilarity of the preconceived impressions ; and a harmony of associated motions chiming together, the judgment forms the results, indicates the conclusions, and decides what is most compatible for self-preservation, or the well being of ideal consciousness. Another active faculty must here be introduced, called the will, or the determination, which puts the mandates of the judgment into execution in controling all the other faculties, and by directing the voluntary corporeal movements.

18. *Entity.*

In scanning the mental processes, it should be recollected, that they are not the ultimate effect of organization ; this only being the medium of visible agencies. All these phenomena are dependent on that invisible agency we have long been animadverting on, and endeavoring to elucidate as the efficient physiological cause of every vital and intellectual movement. Unseen, and not heard, all organic nature is set in motion by it, and these motions are continued so long as the organizations render it a suitable residence. The cerebral tissues appear to be the emporium, or concentration, where it resides in all the dignity of individual consciousness. We will try not to be visionary ; we will keep pretty near the limits of physiology, and free from the shackles of the discordant metaphysics abroad, yet we can hardly refrain copying a few lines of Dr Good's translation of the poem of Lucretius, indicative of the residence of the spirit that is in man, but not descriptive of its sublime entity.

Far from all vision this profoundly lurks,
Through the whole system's utmost depth diffus'd,
And lives as soul of e'en the soul itself.

If we might be indulged in speculations aside from organization, there might be no great difficulty in showing, that self, personal consciousness, or the spirit which is in man, may have an independent existence, as well as his gross matter of organization. Indeed, we may say far more so, even beyond the things of time and sense. The one is composed of many primary and secondary elements, and is soon destroyed by the affinities of its own composition ; whilst the other may be supposed to consist of a more primary elemental character, and of far more sublime institution, and if we could express it, as emanating from Him who is the effulgence of the divinity himself. Long before it was recorded in sacred history, that the spirit in man shall return to Him who gave it, this sentiment became the creed of all the inhabitants of the earth, as if it were a universal traditional revelation. And with the exception of a few sceptics, is now embraced in every religion, even of barbarians.

Man, whilst existing in the present tense, is not estimated by his symmetrical organization, any more so than a hundred dollar bank bill is for its raggy composition. It is a trite remark that the mind makes the man. It is so indeed, in every view that can be taken. The corporeal part is continually changing; but mind is the same, as memory testifies, through every change. Organization cannot extend beyond certain limits, but mind can be enlarged by intellectual growth, extending throughout "nature up to nature's God." An extension of the foregoing views of the human constitution of matter and mind, together with their relations to other organized beings, might be a pleasant and interesting task, but foreign to this design.

19. *Prerogative of Intellect.*

In conclusion let us notice, that the volitions of mind are the functional effects of this last, and superlative endowment; meaning the nervous masses of external relation. The organs of intellect are supreme and independent, in a given sphere of action. Not that they control the movements of the involuntary organism, for they can only modify their instinctive appetencies and functions, in an obscure manner. But intellect can control all the acts of speaking, locomotion, and behavior. It may be provoked by the instinctive incitements, and by external impulses, but never compelled. It may give up its prerogative, and yield to motives, but this is not compulsion, it is only voluntarily complying to solicitation. The acquisition of knowledge relating to one's self, and as he is placed in relation to others, and an acquaintance also of the physical world, together with the laws established by God and man, all teach the moral conduct of human beings; and they are hence responsible for acts they perform. No instigations can prevail in the doing of good or evil, until intellect yields assent. Hence arises the accountability of man.

20. *On the Nerves of Volition.*

A consideration of the functions of these nerves as a part of the spinal cord, and as coupled with the nerves of sensation, was omitted, on account of their office being to transmit functional radiations from the cerebral centres, into the muscular tissues; whilst their fellows, the nerves of feeling, transmit from the surfaces to this centre. However mysterious these phenomena may appear, yet they are supported by facts well demonstrated, and serve as examples of the complexity, and admirable harmony of the organization; which although in descriptive anatomy must be separately noticed, yet serve to form a united congeries constituting a unity.

It was noticed, that these nerves originate in the tissues below, already in their formative state in the embryo; and as they increase do concentrate in the spinal cord, and that this has a union through the medulla oblongata with the cerebellum and cerebrum. Their office is to transmit the radiations of intellect from the internal senses, or faculties, to the long external muscles situated on the outside of the skeleton. This function they perform under the direction of the will, and by their contractions produce numberless modified motions of voice, and locomotion. So far appears to be matter of fact, but the rest must be conjecture as to the latent harmonious ties of connection between intellect, reason and organization. All the relations between the different nerves of the spinal cord and cerebral masses, so far as experiments show, seem to be intercepted at the summit of the medulla oblongata. Hitherto the inquisition may proceed, but here it is interdicted, and the "dark chamber of the mind" is hermetically sealed against intrusions. Another class of organic sensibility exists here, and no doubt of the most exquisite kind; yet we are not permitted to learn its character, except by the results of its functional acumen, as experienced in all the pleasures and torments of mind.

Experience demonstrates, that the internal faculties possess a high degree of voluntariness ; they are put in motion by thought, and this may be put in action by various external stimulations. When in a state of activity, radiations are sent along the nervous tissues leading to the locomotive muscles, exciting their contractions, and still under the guidance of judgment. In a pathological state, severe stimulations from internal causes reaching the summit of the spinal cord, induce abnormal contractions, or convulsions. We see how readily an extensive apparatus in other tissues, may be put in motion and continued, when not under the dominion of intellect. An excitation once made, an admirable catenation of collateral motions succeed. But, in the voluntary muscles, in a physiological state, the motions are constantly under the guidance of intellect ; unless habit establishes a kind of associated harmony of motions, of which the mind may not be conscious, in some particular routine of motions.

The spinal nerves of sensation that are partially bestowed on the locomotive muscles, transmit to the centre of perception, the condition of the muscles, as whether they are in a suitable state of mobility to perform the commands of intellect ; and it is very common for them to receive some preparation by stretchings and trials. The nervous impulse affords to the muscles the ability of contracting ;—of loosening them into a state of relaxation, and of fixing them at any given point. Various modified motions of the skeleton follow the contractions, as a sequence of their tendinous attachments.

The locomotive muscles receive four grades or different states of vital susceptibility ; 1st, the innate vegetative force, (irritability) ; 2d, the muscular branches from the abdominal plexuses, by the arteries ; 3d, some filaments of the spinal nerves of the sense of feeling ; 4th, the proper spinal motory nerves in profusion. All these correspond in harmonious subordination in health, but their abnormal motions are subjects of pathology.

Although in the physiological state the encephalic influence holds the entire control of the voluntary muscles, yet there are many pathological conditions, in which the movements are supremely directed by the involuntary, or ganglial nerves in their composition. For example; in the case of severe dyspnœa, the subject cannot use the vocal muscles, which are associated in the act of respiration; they are not in the control of intellect; for all the muscular energy is directed to the dilation of the thorax. Neither can the will stop these motions, for they are necessary for the preservation of life. So of many other motions which are indispensable; they are conducted by the instinctive impulses. These involuntary movements, like many other internal excitements, give origin to the *vis conservatrix naturæ*; a kind friend, and though often banished by prejudice, has never left her home, or been guilty of a dereliction of duty.

Whilst on the subject of the evolution and functions of the nervous tissues of external relation, and the organs under their influence, it ought not to be omitted to notice, that being the last in successive evolution, although of the most intense sensibility, it has the slightest attachment of vital force; that it is the most easily exhausted, and the first to fail. In all fatigue or exhaustion, the intellect suffers first and most; next the external senses, and voluntary motion. It is so in high stimulations, in disease, and in old age. Common daily exercise demands nightly repose, in which there is an obliteration of all the functions of external relation. The organic nutritive tissues have far more persistency of vital force, and seem scarcely wearied in keeping up a constant circulation. After these have all failed the susceptibility of the primary tissues is apparent for some time, as has already been shown. This thesis might admit of much illustration.

The subject of vitality, in connexion with the organizations, has already been extended beyond what was intended. Its prolixity may shorten other subjects. We do not intend to follow out physiology in detail, but chiefly to sketch the vital susceptibilities and harmonies, which appear more directly connected with the diseased conditions of the system. This topic must be abandoned, after making a few notices on phrenology.

21. *Remarks on Phrenology.*

In our brief review of the cerebral functions, we have not travelled into the domain of modern phrenology. We dare not go, at present, beyond a consideration of those organs, the functions of which are pretty well accredited, and constantly manifesting themselves to our apprehension; and even here some may think we have been too much groping in the mist. The specific cerebral organs can only be studied from the phenomena they exhibit in health, in disease, and by experiments; and even then conclusions must be tardily made by much observation and comparison. Some other additional sense seems needed to make inquisition into the latent meanderings of matter and mind, so securely invested in an osseous casket. It is impossible to designate how many specific portions of organization exist in the cerebral masses, in the present state of physiological advancement. There may be many, or they may be few. We are in favor of the thesis of a still greater plurality of organs than we have just specified; and that an increase, or deficiency of organic structure in any individual, may so modify his appetencies as to alter his character for morality, as well as intelligence.

It is probable that a strict study of the envelopes of the brain, may, in some degree, indicate propensities and intellectual character, and in a manner to be read by the scientific; but the scintillations of mind are continually bursting through the external senses, and emanating at ten thousand inappreciable avenues of the countenance, indicative of the qualities of their fountain, and so legible as seldom to be mistaken by an unlettered dolt, if not describable by an erudite Lavater.

The science of phrenology will probably advance with more precision, when physiologists shall have fully adopted the method of studying it particularly as relates to man, and by carefully comparing one part of the brain with another in the same individual.

However, we cannot conceal the sentiment, that physiology has not arrived to such a point of perfection as to illustrate the varied tissues, their locations, and functional relations with a precision, to entitle the study of phrenology to assume the entire garb of a science. Drs. Gall and Spurzheim, as well as many others, are entitled to the thanks of the community of science for the advancement made in anatomy, for the spirit of inquiry excited, and the zeal with which investigations have been pursued; and it is yet hoped, that demonstrations may elucidate much that is now only accredited on apocryphal evidence.

22. *On the Inherent Force in Structures endowed with the three different Grades of Vitality.*

It is truly difficult to make very just estimates of the amount of vital force bestowed on the varied tissues endowed with vitality; and yet upon a cursory view, it is distinctly discoverable that there is a difference. That there is a difference of strength between living, and dead structures, no one can doubt; and this property, or capacity, has been called vital tonicity; a property often modified in intensity, and most apparantly so in disease. It is equally manifest that different structures are possessed of different degrees of this vital force. This subject will be attempted merely as indicating a plan for future investigation.

1st. Vital force existing in the primitive stamina of animal structures.

2d. Vital force combined in the tissues of the nutritive structures.

3d. Vital force combined in the spino-encephalic mass of nervous matter, and relative organs.

In relation to the *first position*, we discover a vital force comparatively small, yet steady and persistive. The germination of plants, and the growth of the zoophytes appear to progress in a simple and easy manner, without manifesting very striking phenomena, when having arrived at their greatest limits, all their functions are comparatively small; and yet the force of the sap of vegetables has been computed as considerable, even that of three atmospheres. It is sufficient for all the purposes of circulation, nutrition, and growth.

The vital force both in the lower orders of animals, and in vegetables is very adherent, for it requires much time, and essential injury done to their structures to deprive them of life. In the simple tissues destitute of nerves in the complicated animal bodies, there is a steady, and persistive impress of vital action, and this continues after the apparent death of the more vitalized structures.

2d position.—In the nervo-nutritive apparatuses there is still greater force, but rarely the persistency as in the primitive tissues. To this grade belong the heart, arteries, and exhalants; and partially the veins, absorbants, with all the organism. We see tumors displacing bones, and spasms breaking muscles from their attachments. The first by the force of a morbid hypertrophy, and the last by the power of involuntary muscular contraction. We discover collections of matter in the interior of bones breaking them into fragments; distentions of cavities from exhalations bursting their parietes. The processes of digestion, assimilation, and nutrition going forward with force, and steadiness. The rounds of circulation going on against numerous opposing obstacles, and maintaining the conflict of disease, often to a great length of time. Here might be noticed the throes of the parturient uterus, and many other involuntary movements.

Assuredly herein exists a strong power in these vital actions, which indeed harmonize with the vegetative force, and they are persistive. With only the slight relaxations, for example, between the pulsations of the heart, and the respiratory actions, with the remissions of organic movements ; this force is continued during the life of the individual, with the modifications already mentioned.

3d position.—In this grade of vital structures we discover much force, or innervation in the voluntary movements, when directed by the most severe commands of intellect. The muscles are not possessed of great strength when deprived of vitality ; but, endowed with it, are capable of astonishing exertions. A man under excitement of intellect may carry a burthen of twice the weight of his own body ; and in walking, bears the weight of the triple burthen on a few muscles of the leg. Sir C. Bell remarks, "But such is the dependence of the muscle on this vital endowment, that the moment it dies its power is gone ; and the muscle which would lift a hundred pounds while alive, cannot bear the weight of a few pounds when dead."

The vital force of this grade is very intense, but not persistive ; it is soon exhausted, and can only be restored by rest and sleep. It may be increased for a short time by moderate stimuli, but the exhaustion will be more complete. The natural stimulus of voluntary action is that of the intellect, whilst the organism is in a state of moderate distention. Morbid excitations of the organs of intellect may excite it beyond the voluntary exertions. The intellectual faculties, also, in a state of excitation, manifest an eminent degree of brilliancy and vital force.

Upon a review, then, of the three grades of vital force, we discover a climacteric gradation from the first to the last evolved, or superadded structures. They might be distinguished as *vegetative*, *nutrient*, and *nervous* forces.

23. *A Synoptical View of the Tissues of Vital Susceptibility, and of the Nervous Systems, in the order of Evolution.*

DIVISION I.

The primitive tissue ; essentially the cellular, with its albuminous fluids ; called the generative tissue, or basis of all the others ; together with the resultant, elementary tissues, the fibrous, serous, mucous, muscular, glandular, osseous, dermoid, cornuous, pilous, &c., are all endowed with the first grade of vital susceptibility, the inherent power, vegetative force, vis insita, irritability.

DIVISION II.

As superadded to the above tissues, the ganglial, sympathetic, or trisplanchnic nerves ; which, together with the respiratory, constitute the entire system of nutrient force.

ORDER FIRST.

The visceral ganglia, with their plexuses.

a, encephalic.
b, cervical.
c, thoracic.
d, abdominal.
e, sacral.
f, spinal filaments, and their ganglia.

ORDER SECOND.

Respiratory nerves from the middle rod of the spinal cord ; of single origin, and irregular in their course.

a, the third, fourth, and sixth cranial nerves to the eye.
b, the portio dura of the seventh to the face.
c, the ninth to the tongue.
d, glosso-pharyngeal to the pharynx.

e, par vagum, or pneumogastric, to the larynx, heart, lungs, and stomach.

f, phrenic, to the diaphragm.

g, spinal accessory, to the muscles of the shoulder.

h, external respiratory, to the outside of the chest.

ORDER THIRD.

The pneumogastric nerve, and the sixth, are the principal of the respiratory nerves that unite in the plexuses. After the intercommunications, the divergent nerves have three modes of distribution.

a, the muscular branches, transmitted to the internal, involuntary muscles.

b, vascular branches, to the arteries, and with them distributed to the voluntary muscles, the skin, and many other tissues.

c, parenchymatous branches, sent into all the secreting, visceral organs, affording them specific, organic susceptibilities, like the organs of the external senses.

The foregoing divisions constitute the entire system of vital force, together with the appended tissues and organs, devoted to digestion, secretion, assimilation, nutrition, and generation. All their functions are constantly progressive without volition: and they, also, possess the instinctive susceptibility, and give origin to the conservative force. These tissues and the nutritive susceptibilities are the seats of all the phlegmatiæ, and of all the pyrectic diseases to which the human system is liable.

DIVISION III.

As superadded to the above susceptibilities and tissues, the nervous system of external relation, or, as often styled, of animal life. By this splendid superstructure, is bestowed a knowledge of external objects, sensation, locomotion, and intelligence.

ORDER FIRST.

Cranial nerves, destined to the specific susceptibilities of the external senses.

a, olfactory, to the nose, smell.
b, optic, to the eyes, sight.
c, portio mollis, to the ears, hearing.
d, lingual branch of the fifth, taste.
e, naso-palatine, to tongue and palate, } feeling.
f, first and second branch of fifth, to the face, } feeling.

ORDER SECOND.

Spinal nerves, symmetrical; destined to sensation, and locomotion, or voluntary motion.

Posterior rod, with ganglia, destined to the sense of feeling.
(Cranial, see above.)

a, 7 cervical.
b, 12 dorsal.
c, 5 lumbar.
d, 6 sacral. *Thirty pairs*, distributed to the papillæ of the skin, and more sparingly wherever the sense of feeling is perceived.

ORDER THIRD.

Anterior trod, without ganglia, destined to voluntary motion.
Cranial muscular, nerves; third branch of fifth to muscles of the jaws. Portio dura of seventh to muscles of the face.

Spinal, *a*, 7 cervical.
b, 12 dorsal.
c, 5 lumbar.
d, 6 sacral. *Thirty pairs*, to all the external muscles.

These nerves, and their organs the muscles, in their normal state, are subservient to the mandates of intellect, or function of the cerebrum.

ORDER FOURTH.

The encephalic mass of nervous matter.

a, cerebellum, and its appendages.

b, cerebrum, and its appendages.

The particular encephalic organs have not been satisfactorily demonstrated.

External impulses are transmitted, by the appropriate nervous tissues, to the internal organs ; impressions, images, or ideas are there implanted, called up, and compared.

For the effecting mental processes, certain functions or faculties are noticed, as attention, perception, memory, imagition, reason, judgment. The exercise of these is attended with thought, and a conviction of consciousness.

These functions prove the individual organs to belong to the order of voluntary movements. They act by volition, whilst the organs of external sense act from impulsion.

SECTION VII.

PARTICULAR TISSUES.

1. *On the Simple Elementary Tissues entering into the Composition of Organs.*

Many of the tissues called simple, are not strictly so ; as it may be difficult to point out one, except the cellular, which deserves this qualification. But according to the views of Pinel, and Bichat, there are certain tissues entering into the composition of organs, or lining them, which possess distinctive properties. It is necessary these modifications should be studied, as relating to their containing more or less of the different molecules of animal matter, particularly albumen, gelatin, and fibrin. Also, as to their cohesibility, density, vital susceptibility, and other properties. The physiological character of the tissues modifies the organs, and having a knowledge of these, we anticipate the results of morbid conditions.

Great discrepancies exist amongst physiologists, as to the number of tissues it becomes important to distinguish. Some have noticed many, others only a few. It will be in conformity to our design to notice chiefly those, which from their different vital susceptibilities, are liable to manifest diversified pathological phenomena. The organs, and their tissues manifest different degrees of morbid intensity, and its results, under similar impressions. All tissues are excitable by stimulations, in proportion to their vital susceptibility, or as it is usually termed excitability. It becomes necessary, therefore, to investigate the properties of the simple tissues, in reference to the formation of a pathological arrangement of the particular locations of diseased action. And especially as disease, at its onset at least, most commonly affects a single tissue of an organ.—*See nosographic arrangement.*

The nervous tissues have already been considered. With respect to the blood vessels, they must be esteemed as organs compounded of elementary tissues as much so as the lungs. The tissues then, which claim our present attention are the *cellular*, the *fibrous*, *serous*, *mucous*, *dermoid*, *muscular*, *parenchymatous*, *nutritive* and *osseous*.

2. *Of the Cellular, or Reticulated Tissue.*

This has been called areolar tissue, lamellated structure, mucous web, &c. It is formed of minute, whitish filaments, chiefly of gelatin. These combined, and by various crossings, form highly attenuated webs ; hence it often appears in a lamellated form. This is the first formed tissue from fluid animal matter, and has been considered the matrix of all the other tissues, and to be the web of the living *ens*, which by certain vital, plastic powers, absorbs nutritious substances, or takes them by imbibition, or endosmose. It is very abundant in the composition of animal bodies, and seems to be the common bond of union of its integral parts. It would give form to the body, if all other tissues were removed. It unites the fibres, and tissues of organs, and some membranes appear to be a mere condensation of its substance.

We are aware of the researches of Professor Fahmann and the Meckels, having terminated, in their opinion, in this conclusion, that "the greater portion of the umbilical cord, the transparent cornea and the conjunctiva, the serous membranes and the internal tunic of the vessels, consist almost exclusively, or *rather entirely* of a network of lymphatic vessels." Yet we do verily believe if all this were true, that these lymphatics may yet need some little ties to hold them in subordination. We are willing anatomists should settle their own accounts, and when they are well agreed we will not contradict them.

Not only does it unite all the parts of the organs, and cover them with condensed membrane, but it invests the whole body under the skin, and forms adipose cells containing fat, which renders a safer protection from injuries, and supports the entire organization when distended, and retains caloric. It has innumerable cells of the serous kind, communicating throughout. They contain an albuminous irrigation for lubricating surfaces. The fluid matter exhaled by the arterial capillaries, is taken up by the absorbants. Fat, which is composed of carbon and hydrogen, is deposited in the close adipose cells, and being absorbed, serves useful purposes in nutrition.

This tissue is very extensible, as shown in great collections of fat, or of serum, and in hypertrophies. It is, again, very contractile, so much so that Blumenbach speaks of a *vis cellulosa*. It may readily take its natural degree of distention after much extension, and even become shrivelled in atrophies. Its sensibility is of the lowest grade of animal tissues, partaking of the vegetative kind; it therefore, in wounds, unless in connection with other excitable tissues, gives slight sensation, or pain. As it is the most essential germinating tissue, it affords granulations to restore deficiencies of structure. It is the common seat of abscesses, and exhaled effusions of blood, serum, pus, and even gas.

Although this tissue in its peripheric distribution, as well as in connecting fibres and internal tissues, is often the apparent seat of phlegmatiæ, and abscesses, yet the morbid location is in the more sensitive contiguous tissue; and the matter of effusion is thrown into this extensible tissue as a reservoir. Erysipelas and rheumatism are examples. This tissue resists the processes of decomposition the longest of any. In extensive abscesses, after all the others are dissolved and removed, this may be drawn forth in masses or shreds. M. Andral remarks, "whenever an organ disappears, a greater or less quantity of cellular tissue is found in its place."

In the physiological state, irritations on this tissue afford no radiations of sensation to the centre of perception; no pain succeeds. But, in common with all insensible organic tissues, when in a state of excitation called inflammation, it transmits sensation; yet it does not admit of the degree of intensity of pain of many other tissues, especially those of the more dense fabrics, it being comparatively mild.

3. *Fibrous Tissue.*

A very firm, dense tissue; slightly contractile, but rather elastic; of a dull white color; M. Chausier styled it albugineous. To this tissue belong the tendons, ligaments, fascia of the muscles, capsules of the joints, periosteum, dura mater, cornea and scelerotica of the eye; the chorion of the skin, corpora cavernosa of the penis, middle coat of the large arteries, &c. Its composition is essentially gelatin, as analysis shows, with a portion of fibrin. Its filamentary composition is very cohesive, and endures great resistance. The fibres run parallel, most commonly, however, with crossings, and all united by cellular filaments.

Nothwithstanding the compactness and firmness of this tissue, in certain states of disease, it loses its density, and acquires the softenings common to other tissues, and may even become dissolved. It may be suggested, that a softening of the middle coat of an artery may give origin to an aneurism, or, in the abdominal rings to hernia ; when inflamed it is liable to become hypertrophied.

Although this tissue does not transmit red blood in its normal state, yet in a forced circulation blood is injected into it, and it becomes the seat of high vascular action, and intense pain.—A tissue that may be cut, and torn without the subject being at all affected, but after a few hours assumes the sensibility of external relation, and the centre of perception is notified of the injury. In wounds of the capsule of the knee joint, no pain is experienced until some thirty or forty hours, when it becomes intolerable, with inability to move, and the whole system is affected. During this interval, the whole system acquires a morbid sensibility, which is readily excited into action by slight exciting causes. In all locations of disease in this tissue, the intensity of pain, or of the morbid sensibility reflects irritations in a manner to increase the constitutional phenomena. So in gout, rheumatism, periostitis, &c., the constitutional diathesis is of the dynamic character. The whole system experiences the vibratory echo of the exquisite local irritation.

We have before stated it as a fact, that this tissue from a state of insensibility, acquires perceptible sensibility. How this may be produced raises an intricate question. However, if we reflect, as has been shown, that every tissue possesses a vital susceptibility, yet in very different degrees, we may conceive that some, as this very tissue, may possess so low a degree, the vegetative without nerves, as not to be radiated to the centre of perception, in a normal state. Yet, after a stimulus has been applied for some time, the flow of fluids to the part, along with the other stimulations, raises this grade of the vital force, so that it assumes a higher, and then radiates with the other tissues of higher order, to the centre of perception.

And, again, during this lesion of a part, the minute neighboring nerves of relation receive great stimulations from the distention, and other incitives, and their sensibility is increased ; so they respond more intensely to the centre of perception. M. Bichat states, that ligaments may be cut, torn, and stretched in a straight line without exciting pain ; but when twisted much pain was excited. All this might be from the act of *twisting*, drawing the neighboring nervous expansions of other tissues into the conflict. However, it is a fact well recognised, that excitations exalt the sensibility of the simple tissues to a high grade. May not all this arise from the instinctive motions to gain greater force to repel injuries ?

The degree of vital force is greater in the fibrous tissue, as acknowledged by M. Bichat, yet, we can scarcely credit him when he says, that, " it hardly ever contributes to the formation of pus." We would rather say, that it is the most common tissue that excites the flow of those exudations from arterial capillaries, which become converted into pus. So we find extensive collections of pus both above and below the fascia, and aponeuroses of muscles ; both above and below the periosteum, and in the internal fibrous membranes of bones ; below the skin, or fibrous chorion of the skin ; and indeed in the vicinity of the fibrous tissues in every part of the system.

This tissue has two adherent faces, and its connections are by the medium of the cellular tissue. The cells, and lamina of this tissue every where secrete a sero-albuminous fluid, and slight excitements cause an abundant flow of it ; and the very circumstances which increase its flow, change its character, so that a few animo-chemical changes convert it into pus. Now we are notified of the seat of the phlegmatiæ being in the contiguous fibrous tissue by the excess of pain, heat, increased sensibility, and the general sympathies, rather than in the less sensible cellular tissue. Yet the radiations of morbid actions excite a flow into its vicinity from the serous exhalants of this tissue, rather than from the fibrous, which is not supplied with similar exhalants to secrete the sero-albuminous matter. Its containing some fibrin, and its density, render it more excitable than the cellular tissue.

The reason why pure pus does not form in the instance of rheumatism, and wounds in the capsules of joints, is, that sero-synovial tissues exist in the vicinity of the fibrous tissue, and the secretions are not of the most ready kind to be converted into what surgeons call laudable pus ; but it is a mixture, some synovial secretion, some albumen, and some the matter exhaled from the cellular cavities. However, when the effects of the inflammation extend further, and severely along the fibrous fascia of the muscles, it seldom fails to excrete the matter suitable to be converted into purulency, especially when connected with a severe constitutional affection. In a mild state it may produce hydropic intumescence.

Although in following out the sensibilities of this tissue, we have been led too much into the domain of pathology, yet it seems necessary to say thus much here, for the purpose of this tissue asserting its right in the pathological arrangement, which may in due time be offered. This subject might be further illustrated.—*See note in nosography on the fibrous tissue.*

4. *Serous Tissue.*

A thin, diaphanous tissue; smooth on one side, and adherent on the other. It is found as a delicate lining over all the viscera of the head, thorax, and abdomen. It is, also, reflected, and lines all the cavities containing those viscera. It is found in its most delicate thinness in the inner coat of its own name, the serous cells of the cellular texture in various parts of the system, but more particularly by its subcutaneous aggregate. It is found lining the inner, or free surface of the fibrous capsules of the joints; and also, on the inner surface of all the arteries and veins. The pia mater, and arachnoides of the brain claim affinity, and many others. Its extended expansions in the thorax and abdomen deserve particular attention; also, the lymphatics and other absorbants. Not one of the cavities it lines has any external opening or outlet, except by the capillary absorbants and exhalants, otherwise than the slight one by the fallopian tubes.

The serous membrane is very thin and dense; it will endure much stretching, to which it offers considerable resistance, which may be seen in the pericardium, which consists of two layers connected by a little cellular tissue, whereby it offers two free surfaces, one on the thoracic side, the other on the cardiac. Its composition does not seem to be a compound, but simple, and has been esteemed to be a modified condensation of the cellular tissue. Like this it is essentially composed of gelatin, and is not readily affected by gangrene, nor by maceration in its dead state.

Blood vessels pass through the subjacent membrane of the serous tissues, and in a normal state only white blood, or the blood deprived of the red particles, penetrates it. But when in an excited state of action, it is penetrated by red blood, and in some severe states of inflammation, transudes with the serosity into its cavities, or sacs. Anatomists seem not to be well agreed in relation to what the serous tissue adheres to.

Some say it is a double membrane ; others that there is a condensation of cellular tissue on the outer surface of this, and others say it is a proper fibrous fascia everywhere covering the organs, and supporting the sacs. We are inclined to embrace the latter opinion, and to consider it as related to the fibrous tissues, believing this will accord with the morbid phenomena in many states of disease.

There is a constant exhalation from the smooth surfaces of this tissue, into the sacs, of a serosity, but without any saline particles ; and injections of the finer kinds also pass. The exhalation may be wiped off, and soon be again bedewed, in a living animal. It possesses merely the organic sensibility, as it is sometimes called, like the fibrous tissues. Whilst the mucous tissue endures a vast variety of heterogeneous substances, this tissue will not bear anything only its own matter of secretion ; even the contact of atmospheric air is very liable to excite it into a state of morbid incitation. When excited in the instance of inflammation, the sensibility seems to be of an exquisite kind, and the affection rapidly extends over a whole sac ; and not only so, but appears to draw into a kind of concatenation or harmony, remote tissues of a similar kind. It seems to give to the whole system, when so affected, a peculiar morbid tone ; and probably through its harmony with the inner coats of the blood vessels, and the serous tissues investing so intimately the brain. The train of morbid phenomena alluded to, are those denominated ataxic, or more properly adynamic ; or as more commonly enumerated, as the phenomena constituting the low typhoid diathesis.

As instances in reference to the above allusions, we might notice the morbid concentration affecting this tissue in the abdomen, called peritonitis ; in the thorax, pneumonia typhoides, in which this tissue suffers essential lesions. Also, in spotted fever the irruption leaves traces, on dissection, extending over the whole tissue. The instances of phlebitis and arteritis might be noticed ; as also, arachnitis, and many concentrations of diseased action in various pyrectic habits. Do the affections of this tissue disturb the economy of the nutritive ganglia, and plexuses, immediately outside of it? As these considerations of the elementary tissues are intended to have reference to a pathological arrangement of diseases, it may be remarked here, in order to be rightly understood, that the causes of disease make a general impression on the system, that the whole system is disordered, and locations in particular tissues are a constant sequence. When so located, reflex actions are more or less intense on the general system, as the tissues possess different sensibilities, and other modifying circumstances. These subjects will merit particular attention in the department of pathology.

The serous tissues, like all others, are subject to acute and chronic affections. In the former, the process is often very rapid, and various modified effusions are the results, such as a dense serosity, sometimes uniting the contiguous surfaces of the membrane together; sometimes forming a false parasitic tissue; sometimes a bloody serosity, with albuminous coagula. It is justifiable from analogy, to suggest, that the subjacent tissue of the serous, is a membrane partaking of the character of the fibrous fascia; and as the blood vessels ramify in it, this tissue is essentially affected in the severe states of disease, and is an important agent in affording these effusions. The visceral organs all have a similar fascia investing them, and affording them strong support, and when in an incited state afford effusions more or less dense. At other times large portions of serum are poured in, constituting dropsies. The serum will coagulate by a low degree of heat, by acids, &c. This tissue is subject to hypertrophies, tubercles, and many other lesions.

5. *Mucous Tissue.*

This is a tissue of very considerable extent, and of high importance in the economy of the system. It lines all the inner surfaces, which have external openings, as the skin lines the exterior. It unites with the skin at all the outlets; or, as some speak, it seems to be a continuation of the skin, between which exist many affinities and harmonies.

Its great divisions are into *gastro-pulmonary*, and *genito-urinary*, each having separate outlets, and no communication. The first division comprises the lining of the eyes, nose, all the passages of the internal ear, the fauces, and all of the aerial pulmonary passages, as well as all the ducts connecting with all the parts named. The other division has its openings at the glans penis in the male, and vulva in the female, and lines all the organs connected with urination and with generation, to their remotest points, through every avenue to the source of their organic secretions. It does not belong to the present design to follow out the anatomy of this tissue; however interesting it may be, it must be learned from other sources.

It is called mucous membrane from the numerous mucous follicles seated in its subjacent adhering surface, and opening upon the free surface, pouring out a soft fluid, which constantly moistens it, and defends it from various excitations to which it is constantly liable. The follicular glands are more abundant in some places, as the fauces, than in others. That this tissue should be defended by such lubrications, it being delicate and sensitive, is very apparent from the fact of its being an essential agent in the processes of vociferation, respiration, digestion, secretion, generation and excretion.

The adherent surface of the mucous tissue, and which constitutes its body, is of similar composition to the chorion of the skin, but much thinner, except in some parts of the mouth; and it is comparatively very tender, being easily torn. On the free surface are situated the villi; it is called the villous coat from its soft downy appearance. These villi are extremely numerous, and stand as projecting filaments, as fine as the finest hairs; they consist of an artery and veins, together with lacteals, and nerves. These prominences act a conspicuous part in the processes of digestion; they are turgid in a state of excitation, and again may be flaccid, and this circumstance causes a variation in their color from a deep to a pale red. In some diseased states, they become distended with carbonized blood, and exhibit a very dark color. They vary with the skin in complexion, as the subject may be affected with plethora, or inanition. In disease this tissue may be turgid, and livid, whilst the skin is very pale, and shrunk. This is very common in malignant fevers.

Besides the vessels of the papillæ or villi, there are a vast number of exhalants diverging directly in a short course from the capillary arteries, which open upon the inner face of this tissue. These vessels afford a constant exhalation, and in diarrhœas often pour out immense quantities of serosity. Leaving the controverted question, whether the lymphatic absorbants take up fluids by this tissue, we are assured that the venous radicles do, either from the inner surface, or after endosmose. Another set of vessels, arising from this tissue in the intestines are the lacteal absorbants; these need only to be named here. The mucous tissue itself is but slightly contractile, whilst its subjacent muscular, and fibrous tissues readily contract and leave the villous in plaits or folds.

It every where possesses the instinctive, or organic sensibility, and in many parts the sensibility of external relation, by which impressions, in a normal state, are communicated to the centre of perception. In this it has an affinity to the dermoid tissue. Its sensibility is therefore more intense than any other internal tissue. As the vital impressibility of this tissue is variously modified in the different portions of it, connected with the functions of different organs, it will be necessary to bestow some attention to each of them.

The mucous tissue of the external part of the eyes is plentifully supplied by the nerves of external relation, and is therefore very sensitive ; slight excitants produce pain, and an abundant secretion of tears, of the matter of exhalation and mucus. The tissue lining the nostrils, and surfaces connected with the sense of smell, is supplied with sensitive nerves of relation, besides the ganglial and olfactory. The mouth, fauces, and pharynx in like manner, with the addition of their specific sensitive nerves. In pathological states of these tissues there is an intense reflection of morbid harmonies.

Pursuing this tissue in its pulmonary route, we discover again intense sensibility in the uvula, and larynx. In following it into all the aerial arborescences of the lungs there are but few nerves of external relation, and but little notice is given of injuries, except from the larynx. Disease may make important changes in the pulmonary mucous tissue, without its being felt, unless other tissues become involved, and then the sensibility of relation is obtuse. Notwithstanding, this tissue, especially at the larynx, possesses a very discriminating sense in notifying of the necessity of pure respirable air. The glottis sometimes suffers contractions from irritations, even to suffocation. The functions of the pulmonary tissue are extremely important in the process of oxygenation and aeration. Irritating substances applied to any of these surfaces, excite a secretion of mucus, and the matter of exhalation, by which they may be expelled by the aid of coughing.

Each portion of the mucous tissue possesses an instinctive sense peculiar to itself, and which becomes subservient to the economy of the organ it stands in relation to. So with respect to the digestive portion, we discover in the mouth and pharynx, nerves of both taste and feeling, and these are necessary and perform indispensable functions ; but the sense of hunger, and the particular food or drink required, exists in the mucous tissue of the cardia and stomach. It is to this centre that radiations are made from even the nutritive tissues, indicating the wants of the system ; the gustatory sense harmonizes, and the centre of perception recognises it. All the nerves of relative sensibility communicate to the spino-encephalic mass, with sensation terminating in the medulla oblongata.

Whilst these sensations are in general distinct and constant, we find the tissue of the stomach and intestines enduring a vast many heterogeneous substances with impunity. It possesses a controlling power in subduing hard, acrid and foreign substances, and yet a lively sensibility to others, as the various medicaments used to excite its action for particular purposes. Some of these affect one portion of this extended tissue, and yet scarcely another portion ; when impressed in any considerable degree, other tissues are drawn into harmony of action for their expulsion by either outlet. All these motions indicate a modified state of sensibility in the organic tissues. Carbonic acid is refreshing to the stomach, but suffocating to the lungs. The succus gastricus is a secretion, the result of a specific sensibility in the organic tissues of the stomach. No *a priori* reasoning can have reference to these phenomena, they must be learned by experience.

It is said by some anatomists, that there are no nerves of external relation distributed in the lower part of the small, and upper part of this tissue in the large intestines. Affections strictly confined to it there, do not exhibit phenomena indicating their existence until far advanced. Lesions are discovered on dissection, which were not suspected. However, slow changes may take place in like manner, in almost any part. As we approach the anal portion, the sensibility of external relation becomes manifest. There is, however, a harmony of action throughout this tissue ; tickling the fauces excites nausea, and sometimes vomiting ; croton oil proves purgative before it can possibly reach the large intestines ;

gamboge and veratrum, in moderate quantities in the stomach, excite a flow of saliva, and of serosity into the large intestines at the same time, and before they can have reached in substance into the latter portion.

The sensibility of this tissue is no less striking in the portion of it devoted to urination. At the lowermost parts of this apparatus there are full supplies of the nerves of external relation, affording intense sensibility in health, but intolerable in a state of morbid excitation. At its superior part, the kidneys and ureters, it is regulated by the organic sensibility, and morbid states are but indistinctly indicated. The mucous tissue of the bladder endures the acrid mixture in the urine, whilst it becomes impatient under the influence of milder fluids. However, in a turgid state of incitation, it becomes impatient of even small quantities of urine, and voids it often.

The sensibility and harmony of excited motions in the mucous tissue of the genital apparatus, are no less specific, and by far transcend any of the other portions. At, and within the openings in either sex, there is a plentiful distribution of the nerves of external relation; whilst they diminish, and become wanting in the parenchyma of the respective secreting organs. However, congenial excitations produce movements, which are continued to the remotest points of the tissue by an instinctive process. In the male these motions begin at the secreting tissues, and are progressive; whilst in the female they begin at the outlets, and are retrograde, transmitting to their tissues of secretion, with no less intensity. In the state of excited erethism, radiations are transmitted to the centre of perception, from the entire genital apparatus of each sex, which under other circumstances might not be intense enough to be perceived.

There exists an intimate harmony of action between this internal tissue, and the skin, but they pass unnoticed in the normal state; it is in the pathological condition that they are made the most manifest. These must be subjects of pathology. In the mean time it may be noticed that this tissue, partly from its structure, partly as placed in opposition to the dermis, on which many causes of disease have a direct influence, and partly from its vital susceptibility, becomes the concentration of many forms of disease. Or in other words, it forms a place for the local phenomena of the diseased habit to become apparent in numerous instances. To it may be referred catarrhs, coughs, diarrhœas, dysenteries, gastric fevers, dyspepsy, all the varieties of hemorrhages, and many others which may be found in nosographical arrangements.

With regard to the character of the diathesis accompanying locations on this tissue, it commonly holds a middle grade, or not of the intensity of morbid action as those phenomena resulting from locations of more dense tissues. We can only speak generally ; there are exceptions, but usually the affections having a concentration of morbid location in mucous tissues, are attended with a general habit of diseased action often denominated synochus. The yielding state of the tissue, and readiness to discharges, mitigate the severity of distention, and its results. But these subjects require more illustrations than can be given here ; the remarks are premature.

6. *Dermoid Tissue.*

The skin presents first, the epidermis, or cuticle, an inorganic, scaly membrane, slightly attached by cellular fibres to the subjacent parts ; it may be easily separated by stimulations exciting a free flow of serosity, producing vesicles, or blebs ; it is insensible, penetrated by exhalants, and serves as a defence. Secondly, the rete mucosum, or reticulated membrane, of a delicate, cellular fabric, covering and defending the sensible papillæ. It contains a black pigment in negroes, but diaphanous fluids in whites. It is bedewed with aqueous fluids, which in a free circulation in warm weather, contributes to give plumpness and smoothness to the surface; but in cold weather, and in all instances depriving the skin of a free circulation, it shrivels and occasions a contraction of features. When over distended in the case of blistering, it is ruptured and injured. It is the seat of the cutaneous efflorescences and eruptions.

We next discover the chorion, or true skin; a dense membrane, which some divide into various lamina. It is composed essentially of gelatin, with a little fibrin, disposed in firm fibres, crossing, and interlacing, leaving foramina. It partakes very much of the character of the fibrous tissues. It is adherent like them, on both its surfaces; on the outside by the membranes just mentioned, and on the inside by numerous attachments of the subjacent cellular tissue; yet in some places, as in the face, by muscular attachments. It is penetrated, first, by the hairs, which originate in and below it. Secondly, by the mouths, or short outlets of the sebaceous follicles. Thirdly, by the arterial exhalants, which convey the fluid of transpiration, with saline, and other principles accompanying it. Fourthly, by capillary arteries, and their accompanying nerves of internal relation, together with the sensitive nerves of external relation, all which enter into the formation of the papillæ in the reticular membrane. To these may be added the returning veins and lymphatics. The inner surface in particular, of the rete mucosum is very vascular, beset with numerous arteries and veins encircling the papillæ, giving floridity to the skin, especially in a turgid state.

The dermoid tissue acts an important part in the economy of the system, and scarcely inferior to that of the mucous, as will be shown in the processes of exhalation, absorption, calorification, &c. Impressions on the surface are readily transmitted to all the internal tissues, and the vital harmonies are reflected from these very promptly in health, and often in disease into the papillæ, and reticular expansions. In a healthy subject, the balance of vital movements may be seen broken many times in the twentyfour hours, and with but little inconvenience ; it is in the diseased state that these phenomena are the most important. They are continually liable to variations, and especially to internal retrocessions, aggravating every phenomenon.

When floridity is present, it affords evidence, that the capillary absorptions of the internal tissues are free and active, and if there should have been much of a congestive state, it is now removed by the natural processes ; yet, when the surface remains pale, shrivelled, and cold, there is always an excess of blood in the internal capillaries, attended with more or less distress, faintness, and a liability to pain, and membranous inflammation. It is an essential desideratum at all times, in health as well as in disease, that an equilibrity of circulation be maintained.

In health, moderate exercise contributes, and is usually sufficient for this object, along with suitable food, and clothing, even in a cold atmosphere ; but, in the diseased state, it is often necessary to apply rather high degrees of caloric to the surface, with frictions, rubefacients, &c., and at the same time, caloric internally by means of liquids, together with evanescent stimuli. The varying states of the dermoid functions, therefore, become objects of primary importance in health, and also in every diseased state.

The harmonies of the external and internal tissues are evidently sustained by the system of nutritive nerves; the nerves of sensation transmit, more or less perfectly, these abnormal processes to the centre of perception. Changes in the density of the atmosphere, as indicated by the barometer, as well as heat and cold, alter the functions of this tissue.

The papillæ appear to be formed of the two orders of nerves, of arteries and veins, connected by the common cellular tissue, and stand slightly elevated on the surface. Their vascular structure gives them some erectile force, when excited by friction, by the stimulations of caloric, and other excitants, and a free circulation follows. They are extremely numerous, covering the whole surface, and are the medium of the sense of feeling ; and are more prominent on the extremities where resides the most discriminating sense of touch. This sense is very extensive, and seems to harmonize in an especial manner with all the other external senses. It brings together the united harmonies of all the external and internal relations, so far as their influence extends into the interior. Their immediate function is, to transmit radiations of sensations from the surface to the centre of perception. Allusion is now made to the sensitive nerves of external relation.

But, is there not another order of nerves, likewise, terminating in close contact in the papillæ, the internal nerves of instinctive sensibility ? So modern anatomists conclude, if they cannot dissect them to their ultimate termination ; neither can the others be so followed out. But, both are closely followed to the papillæ, the one in solitary filaments, and the other parasitically clinging to the arteries. What is the use of all this extensive display of the latter order of nerves in the arteries, and in the tissue of the skin ? Can the function of this order of nerves be directed solely to the arterial impressibility, 'or are they also charged with other functions ? We find that other vessels perform the office of circulation, without this display of nerves, which are destitute of a cardiac impulse too. Scarcely any nerves are found in the venous circle, which is double that of the arteries. So, also, in all the wide range of absorbants, all the white dense tissues, saying nothing of the pilous, and cornuous textures. We are bound to the thesis, that theirs is the instinctive susceptibility, and this is a part at least of their functional office.

May we not infer, that these internal nerves also radiate sensation ; not that of the spinal nerves, not to the centre of perception, but of another kind, to the organs of instinctive sensibility in the interior ? M. Lobstein insists, that this internal system of nerves extends over the whole body, "and connects the different parts in close union with itself." Now, how is this union effected, unless it is possessed of a sensibility by which radiations communicate ? There is then a sensibility peculiar, and ample for all organic movements and harmony, which is essentially independent of the spino-encephalic nerves, and of which the centre of perception is not advertised, except in excess of impulse, and then in an imperfect manner, by the scanty intercommunications of the nerves of this order.

With a full conviction of these physiological references, we are prepared to dissent from the views of M. Broussais, whose ingenious researches we have read with much satisfaction, when he says, "All these facts concur in proving, that stimulations exercised on the cutaneous sense, *can act on the viscera only through the medium of the brain* ; — that the movements determined in the muscles of locomotion by this organ, are *invariably* the effects of the sensations which it perceives secondarily in the viscera ;—finally, that the organic movements *are in all instances* influenced both by the sensation, and by the exercise of the muscular contractibility." *

We are well aware of the extent, and importance of the cutaneous sensation of external relation, that it is correct in its radiation to its centre, and that a wide range of harmonious actions, both muscular and organic, may be set in play by it ; the first by volition, the second by association. It will be granted, that touching the polished surface of "a female" excites motions through the agency of thought, and radiating thrills involuntarily pass through the organism ; they are excited to action, but the will does not control them, nor can it scarcely modify them.

* Phys. applied to Path. p. 64. 2d Edit. Philad. 1828.

Titillation is of similar explanation, except that it excites a double sensation, partly of pleasure and partly of pain. When slight, volition may silence muscular action, and the subject may sit still under it, but when intense it cannot. Resistance is made, even if the person tickled determines not to make any. The convulsive motion is not controllable; the most violent and involuntary efforts are made to avoid the contact, and if unavailable, convulsions may ensue, and the violence of these may derange the entire economy, and peradventure may terminate in death. These involuntary movements confirm an established law in physiology, as expressed by M. Lobstein, "that the voluntary muscles perform a *double*, and the involuntary a simple part;"—because the former have two orders of nerves, whilst the latter has but one. But we have not yet considered the proposition, *that the cutaneous sense can act on the viscera only through the medium of the brain.*

There is a sense existing in the skin, which transmits radiations directly to the viscera. There are numerous impressions made on the surface affecting the internal tissues and viscera, of which the intellect, and cerebral harmonies take no cognizance, nor the sensitive nerves any perception. Thus a person that sleeps in a cold place is liable to urinate often, and if a child, to do so unconsciously. One may sleep quietly, and presently be aroused by a tormenting colic, or tooth-ache, or, it may be, pleurisy or rheumatism. Most epidemic diseases become excited during sleep; a state when all the functions of external relation are dormant; it neither perceives nor does it issue mandates, or take cognizance of unusual impressions.

But, we have evidence of the excitation of the viscera without the *medium* of the brain during waking hours from cutaneous impressions. It is very common for people to receive an impression of cold damp air, by sitting in a room in which the cerebral cutaneous sense does not admonish the intellect of the sensation of coldness. Again, an epispastic may produce strangury without advising with intellect. The stimulations on the sensitive surface notify the centre of perception of uneasiness, and when they have done this they have performed their chief office. So the sensitive nerves of the trigone plane of the bladder, and of the urethra may perform their office too, but still the strangury continues. Indeed, the epispastic may have its effect on the surface, and irritations be set up in the urinary apparatus in paralysis, and apoplexy, whilst all the apparatus of external relation is totally unimpressible, and gives no alarm. Medicaments rubbed on the skin produce vomiting and purging, as well as titillation of the fauces. Cold, caloric, and the tepid bath, may be noticed as modifying internal tissues independent of the nervous system of external relation. So also, the iatrileptic applications.

With respect to impressions made on the internal surfaces, they are acknowledged by all to affect, oftentimes, the functions of the skin. The effects of nauseating medicines are visible ; as well as warm aromatic teas. The internal irritations in phthisis, and in numerous other states, excite sweats and chills.

These notices have been made for the purpose of arriving at the conclusion of there being some other *medium*, through which impressions affect the viscera, besides the nervous sensibility of external relation. This medium must be the terminations of the visceral or ganglial system of nerves, accompanying the arteries, and spread on the vascular tissue in the reticular structure, and papillæ. They have a peculiar sensibility, or instinctive susceptibility. Impressions on either surface radiate to various tissues, and their centre of harmonies is the semilunar, and other ganglia, with their plexuses.

It appears the attention of pathologists has been fixed too much on the more striking phenomena of the functions of external relation, whilst the more abstruse of the internal have been neglected, and by many esteemed as unappreciable. This is the great theatre of the tragedies of all the most destructive maladies ; the ataxic, dynamic, and adynamic fevers, apoplexy, tetanus, with a large proportion of the nomenclature of the modified habits of disease, affect the internal tissues, and their nervous susceptibilities.

It is not intended in this place, to notice all the functions of the dermoid texture ; they are pretty extensive, and many of them will be noticed as separate topics. It may be remarked, that this is rather a compound tissue, and might bear the appellation of an organ. However, it has commonly been treated of as a tissue. In a nosographic arrangement it will be considered as a tissue, and as a totality of function, although various simple tissues are in combination.

This tissue is thickly beset with red capillary vessels, and these intermixed with a dense tissue. It is also subject to numerous local excitations. It is often the theatre of the concentration of the morbid habit in the form of eruptions, and inflammations, and its physiological structure inclines the diathesis to be dynamic. It harmonizes extensively with all the internal tissues. There is a frequent retrocession of action from the surface, in disease, to the internal tissues, attended with paleness of the skin, internal turgescence, distress, &c. This thesis will merit an extension in pathology.

7. *Muscular Tissue.*

After what has hitherto been noticed, our remarks on this tissue will be brief and desultory. The contractile fibres are what give to muscles their peculiarity of tissue ; and this shortening, by moving the organs attached to their extremities, produces the phenomena of their functions.

Although we call this also, a simple tissue, yet many other tissues enter into the composition of muscles, whilst we have a principal reference to their contractile fibres. It has been seen that two sets of nerves pervade their entire texture, one from the spinal cord, the other by the arteries, like the dermoid tissue, from the system of involuntary nerves. Both these orders of nerves are superadded to the primitive, innate susceptibility of the simple tissue.

Besides these they are plentifully supplied with blood vessels, which give to most of the muscles a red color, which may be all washed off, and leave the muscular fibres white, and this is now found to be formed very entirely of fibrin. Like other tissues, they have veins, lymphatics, and much cellular tissue, which connects the whole together, and by their fascia formed of the same in a condensed state, holds the whole together in the varied modified forms. We see then, that the cellular tissue, composed of gelatin, enters the texture of muscles, and even the neurilema of the nerves is of the same element.

Here are organized tissues pervading muscles, and closely surrounding the muscular contractile fibrils, and their nerves of excitation. So it is also throughout the entire nervous tissues, even to the minutest fibrils of the encephalic masses. The blood vessels then, so intimately pervading these tissues, sustain them in their physiological functions, but when in a morbid excitation, cannot fail to give them undue stimulations, and essentially alter their functions. It is well known to all how readily the vascular system may be excited, and in fact in almost every abnormal state, is agitated, and astonishingly modified in function, attended with various pathological results ;—so all these simple, yet susceptible tissues, receive impressions from this source, greatly modifying and altering their functions. Hence the great influence the circulatory system has on the functions of the muscular and nervous systems.

Do the muscles possess the power of dilatation also, as well as contraction ? We know of no such power. The intestines, on a superficial inspection, appear to have this power, but it is only on account of another order of fibres coming into action, after a previous order have been in action, which offers the illusive phenomenon. So a worm in motion, shows a modification of form, by the action of a different layer of muscular fibres. The muscles are released, and fixed at any given point of their circles of movement by the act of volition. They are the instruments of intellect, subject to its orders and harmonies; and like this, soon become weary, and require repose.

The strongest argument in favor of the active dilatation of muscles is drawn from the active dilatation of the heart, it being a fact, that it will contract and dilate when empty. This appears to be on account of the peculiar origin and insertion of the muscular fibres of this organ. These have no solid osseous base for their origin or insertion, not any more than in the intestines, and yet their mechanical construction is very different. The heart is a dense organ, approaching in some parts to cartilaginous, and the muscular plates have their origin and insertion in this solid texture. The muscular planes run in so many different directions, that perhaps no anatomist has ever yet been able to dissect and unravel them. Even the investigations of J. F. Vauss have not unfolded the meshes of the cardiac fibres in a satisfactory manner; the subject is still overcast with dark shades. A portion, and no doubt a large portion, of these muscular planes, have insertions as well as origins in such a manner, that as they contract, they raise the parietes of this organ, whilst the actions of others depress them, and so produce the systole and diastole. This diastole has an influence on the circulation in the large veins, but has been greatly overrated by some.

The external voluntary muscles are an appendage to the nervous system of external relation; they stand in near relation to it, and the external organs of sense. Besides these there are no organs under the immediate dominion of these nerves, except in a limited and partial manner. Yet there being some nerves sent in connection with the nutritive system, there is a harmony of action existing; however, in many tissues very limited.

The force that the spino-encephalic mass gives the voluntary muscles is very great in the act of volition; it is still greater in certain pathological states when their functional exercise is not embarrassed, but free, and yet acting under the influence of severe excitations. Thus, in delirium, the muscular power may be double to what it could be in any voluntary effort. The same circumstances which induce this state of tonicity, also excite the energy of the visceral organs, provided their functional exercise is free. Or, indeed the state of tonicity may be so great as to embarrass their functional office. So, also, an excess of tonicity delays the absorptions in the encephalon, together with an overwhelmed state of the nervous function, and coma attends.

From whence arise the passions, and what their influence? A high toned consciousness of injury done, or of dangers threatening the well being of self, or objects dear to it. Thought, and the other faculties of intellect arouse all the animal, and also the instinctive motions. Intellect is impetuous; radiations of vital force are sent into all the organs of external sense, and here the muscles receive a plenitude of energy. Exploits are performed of no ordinary kind. The excitation does not stop here, but is extended into the viscera, and they perform actions, which afford evidence of function never seen in the easy state of indifference. These functional exercises are mild compared with those of external relation, because their nervous source from volition is scanty; yet, in co-operation with the instinctive force, the functions of organs become greatly increased, even to the pathological state. Hence, anger produces a flow of bile, or even blood; and fear may excite diarrhœa, or diabetes insipidus.

As some of the effects of these mental excitations, we may mention the contractions of external tissues, causing the hair to become erect, the skin to be filled directly with blood; the respiratory process more enlarged; the heart acting vehemently; the secretions increased, often of saliva, of bile, urine, &c. To these we may add involuntary discharges of semen, of muco-serous fluids, in sudden diarrhœa; inordinate sweats. Here, also, we are often called to witness the fact of abortions from the same source, and so synchronous as to leave no doubt of the fact. Hence the importance of mental tranquillity in all diseases of excitation, whilst mental excitement may be turned to good account in affections requiring excitants.

We need not stop to inquire by which particular nervous filaments these motions are excited, although we know some organs are more readily excited than others; so the heart receives most of the nerves of sensation, and it is the most frequently affected, and suddenly too. The whole system synthetically arranged, and taken from under the knife of the anatomist, is an unit. However, each part has its relations to every other part; so in all the great functional exercises, there are revolving circles within circles of organic motion.

Notwithstanding this harmony of motion, each organic function is limited to its own sphere of action. Although mental influences increase organic actions, it cannot control them, nor scarcely modify them. When once excited they continue by their own instinctive force; so the influence of these excitations may have very permanent effects. And again, it must be considered, that an excitation of a high grade, may overwhelm the organism, in a subject not well prepared for it, and cause sudden death. Again, on the other hand, although excitations may be very impressive, and yet consciousness is fully apprised that self cannot evade the evil, nor the selfish objects be rescued, a state of apathy succeeds; the muscles are relaxed, the circulation is in an irritative state of inability, in connection with other trains of phenomena of the depressing passions.

But this kind of digression has led us from our design. We will bestow a little attention to the pathological condition of muscles, in reference to their nosographic arrangement.

The principal we know of diseases of the simple muscular fibres, is, in relation to their spasmed and their paralytic states. Yet, the muscles are subject to soreness, pains, inflammations, &c., as occurring in the combining tissues. So imposthumations are found in them, thickenings, and softenings as in other tissues. In chronic emaciations the muscles become very thin, containing but little fluid matter. They lose energy in proportion, and may become adynamic when their nerves are free. The voluntary muscles always become paralytic when their communication with the brain is intercepted, whether by ligature, or by a compressing force in the cranium ; or, again, when any sudden force of stimulation so alters their integrity as no longer to transmit the vital impulses. Sudden strokes by weapons, by lightning, by excess of stimulations, have this effect.

The chief pathological notices we may further make will be in relation to their spasmed state. It has been long observed, that there are two very different states in which muscles are seen spasmed, and these have had many very singular comments by pathologists. They have been distinguished by the terms *clonic* and *tonic* spasms, and both confined to the voluntary muscles. The first is distinguished by sudden contractions, and relaxations ; the second by a fixed, spastic state. The first is excited by undue stimulations on the cerebellum, and medulla oblongata ; and the second, by stimulations on the abdominal ganglia and plexuses, or some tissue under the influence of the instinctive susceptibility, which includes the two first grades of vital force, the vegetative and ganglial.

As some illustration may be needed in relation to a novel thesis, it may be remarked, that the nervous force of external relation, always presides over diseases of periodical types, and its physiological character is that of action, and relaxation; whilst on the other hand, the physiological character of the nutritive, is a steady persistency of character. So we find located in these organs, or this fabric, all the phlegmatiæ and fevers. Dr Mosely says, the fevers in the West Indies, and tetanus, often alternate in the same patient; and so we have noticed in some cases. In traumatic tetanus, the injury is always in tissues under the instinctive sensibility. Again, in convulsions it has long been accredited, that stimulations in the mucous tissue of the first passages, in which there are many nerves of sensibility, do excite them. Patients affected with a certain variety of epilepsy, speak of a sensation, an *aura*, which they perceive pass gradually from an extremity towards the neck and head, and that moment they are thrown into a paroxysm. This proves an affection of the nerves of external relation. Further illustrations must be deferred.

The character of the morbid diathesis connected with diseases of the muscles, is diversified according as organs remotely involved, may be under the influence of the one or the other nervous centres. We find, however, in a great proportion of diseases located in the muscles, that the diathesis is distinctly of the synochoid character.

8. *Parenchymatous Tissue.*

Under this head will be considered the glandular functions, embracing the process of secretion. Glands are rounded, or conglobate bodies, consisting of an artery, vein, nerves, and excretory duct. They are of an agglomerated construction, and united by cellular texture. Their composition is gelatin and albumen. Their intimate structure is of a filiform kind, of late called primitive tissue, or formerly parenchyma, in which the process of forming the matter of the new product is effected. The convoluted structure of glandular bodies affords a longer distance, and a larger surface, for the chemico-vital changes of the secreted products to become perfected. This structural extension presents a striking analogy to that of the foldings of the digestive tube, for similar purposes.

The glands are simple acini ; or complex, when they are called conglomerated, many being included in a common envelope, and united by the common tissue. They chiefly consist of the lachrymal glands, the meibomian, the ceruminous, and salivary. Also, the mammæ, the liver, pancreas, kidneys, prostrate gland ; the testicles and ovaria ; to which may be added the mucous follicles, though not of a glandular structure, yet secreting a particular fluid animal matter. To these may be added the acini of the lymphatics. So, also, various membranous surfaces afford secretions of a peculiar kind, particularly the succus gastricus of the stomach ;—they are such as do not pre-exist in the blood. Another thesis is, that it is of a spongoid character ; and of late the opinion of Leuenhock has been revived by M. Edwards, Dutrochet, and others, of a vesicular structure, or a termination of arteries in cul-de-sacs ; and that fluids enter by endosmose, or a sort of simple imbibition.

Further, with respect to the intimate structure of these organized bodies, in which some of the most important phenomena of life appear, it has not been satisfactorily revealed. This is unlike any other of the tissues ; a gelatinous like-matter, rather a peculiar substance, is one description. It is probably a modification of the primitive tissue. Some membranous surfaces have been called secreting tissues when they are only exhaling tissues. Thus, the pleura, peritonium, &c. only appear to transmit fluid substances pre-existing in the blood. The sero-albuminous fluids lubricating the cavities may be found abundantly in the blood, like the fluids exhaled from the lungs and skin. The tissues these fluid matters pass make no change on them in health. So according to the common received opinion of changes made in the fluids by the secreting tissues, others not producing such modifications, ought not to be styled secreting tissues. If there are morbid changes in the blood, such tissues then exhale corresponding morbid products; or they may in this event suffer some change in passing the tissue. They are exhaling surfaces. Nerves enter the glands in a scanty manner. It is said some nerves of external relation enter, but not sufficient to bestow the sensibility of external relation, and they offer no harmonious relations, unless in a pathological state; and then, indeed scarcely perceptible. If, however, the investing membranes are involved in disease, the sensibility becomes very perceptible. So, also, in some high excitations of the physiological grade, as in the sexual erethism.

Branches from the plexuses of the nutritive nerves enter the parenchyma of glands along with the arteries, and we infer that these nerves are auxiliary to the secerning processes. The term secretion implies a separation of fluid matter from the blood; yet, the process consists in a change of certain portions of the blood, which is carried to these organs by the arteries. It there receives certain definite changes, by which a fluid matter is prepared very different from any of the elements of the blood carried to them; and experiments by injection into blood vessels, show it to be more or less obnoxious to the economy of the vital movements. These changes in the parenchyma of glands, appear to be effected by a process peculiar to this kind of organization, in connection with the *peculiar* vital force there existing, which has been happily expressed by M. Broussais, vital chemistry.

We are compelled to speak of these very secluded processes, in the most intricate tissues, in an indefinite manner; we say *peculiar* when not able to define a process. Is not every vital change and movement peculiar? We know more facts about some, than we do of others, and then speak with more confidence, and yet all have a more dense or rarer veil cast over them. The chemist puts vitriolic acid and alcohol into his retort, and distils off vitriolic æther; and he may undertake to explain all about the process; but can he tell why those two articles should possess affinities to unite, and form this new substance, altogether different?

Blood enters the liver from which all the art of the chemist cannot extort a particle of bile. In its egress from this glandular body, no bile can be detected; yet in its ducts and sacculated depot is found a new substance, daily emptied and recruited, the like of which is no where else to be found. We may call this process *peculiar*, or *specific*, and this may be as sufficient for every purpose as if we could approximate a little nearer to what we are interdicted. It appears, however, that M. Boudet has recently analyzed the serosity of the blood very rigorously, and has detected an acid which he considers a combination of oleic and margaric acid, and that it combined with soda, and "produced a solution resembling common soap." The same author thinks he has discovered cholesterine also, but concludes further experiments necessary to determine it. (Am. Jour. No. 28, p. 522.) But little reliance can be placed on these forced experiments. At any rate these are not hepatic bile.

Let us proceed then, to say with some confidence, that our inference from facts is, that nerves enter these tissues from one common source, the abdominal nerves. Let us now borrow from analogy, that the nerves of sensation arise from one common source, and are distributed to five different tissues; yet how varied are the susceptibilities and functions of these different nervous expansions in the organs of external sense? We may now infer that different branches of nerves arising from the abdominal plexuses do possess modified susceptibilities, and give a character to the physiological powers of the organs they inherit.

In every stage of life, the chemical affinities of every particle composing organization are exerting an influence on each other, but this effort is restrained, modified, and controlled by a higher presiding force. So far they may extend their influence and no farther. Just so far as the plastic formative force permits, they extend, and it uses them so far as is necessary to the perfection of the instinctive processes. These two forces then, in combination, may with much propriety be called vital chemistry. These processes are very extensive in the living system. Every glandular secretion is produced by the same materials from the common mass of blood, but surprisingly modified by a difference of tissue, and nervous impressibility. But, compress the nerves leading to a secreting organ, and then the secretion will be suspended, or essentially altered. Again, in the instance of disease being concentrated in a secreting tissue, the secreted products are more or less altered, and sometimes greatly changed. Moral influences, which must act through the medium of the intellectual organs, and secondarily on the nutritive, on frequent occasions, modify and alter the secreted products.

For the purpose of affording opportunity for these processes to have effect, it is necessary the fluid matter should be in a state of more repose than whilst circulating in vessels. It is the opinion of physiologists, which is supported by microscopes, that the blood suffers a partial stasis, after being deposited into the filiform tissue, or entered by endosmose. Here the changes take place necessary for the production of the matter of secretion. But, what next ensues? Various substances in commixture in the central portions of an organ; how are they separated? We must now have reference to the instinctive susceptibility, so everywhere present, and so essential in the vital economy. There is clearly a property existing in the secerning and nutritive tissues, which may be called *vital elective appetency*. The veins take up the red blood, the lymphatics the white, or albumen, and the radicles of the excretory duct of the gland, take or absorb the fluid of its secretion. Each tissue is susceptible to its peculiar stimulus.

As we must press into our logic general principles and specific properties, so the same parity of reasoning may be extended to every secreting organ throughout the entire economy. From all these considerations, which will probably endure the test of impartial scrutiny, we are forced to the conclusion of there being a presiding power in animal bodies, rather controlling the organization, than dependent on it. If any particular tissue is possessed of a sensibility so as to refuse all fluids except one, it must then be considered to possess a predilection for this one, to the exclusion of all others.

Do the glandular structures afford some specific fluid, which is necessary for the perfection of its own products? M. Beclard states, that cutting the pneumogastric nerves suspends secretion from the coats of the stomach. Digestion is then spoiled; and we must regard the stomach as a gland on the large scale, and from which some safe analogy may be obtained. These are subjects of inquiry, which the inquisitive may investigate. We have no doubt of the gastric fluid, and mucus of the intestines being necessary to perfect digestion; and that other convoluted tissues afford fluids in a similar manner.

The glands suffer remissions, and some intermissions in their functions, as the mammæ. They all have their appropriate stimuli to set them in motion, or to accelerate their secreting motions. Stimulations applied to the mouths of their excretory ducts accelerate their function. All the excretory ducts open upon the mucous tissues, and they are all lined with this tissue to their remotest terminations, or rather their origins.

The glandular functions, like the nutritive, are liable to suffer a paresis, or inability of function, at the commencement of acute diseases. When an irritation of much force affects the parenchyma, the properties of their secretion are liable to change. In some instances it may become acrid, and even poisonous, as in the saliva of the dog kind. The milk of a woman under the stimulations of pregnancy, is unfit for the nourishment of a child. When a glandular tissue is suffering excitation, there is an increase of functional exercise, and more blood circulates towards it and in it, so as to produce a state of erethism. When this prevails, the other glands, and indeed other tissues, suffer a diminution of blood and vital force.

All the glandular tissues are subject to various grades of morbid excitation; from slight irritations increasing their functions, to the most severe, in which their functions are suspended. Phlegmatiæ affecting their outer coats are attended with some pain, but when their inner parenchyma is affected, with little or no pain. So abscesses may occur in them slowly without being recognised, otherwise than by constitutional phenomena.

They are also subject, from chronic stimulations, to hypertrophy and indurations. Albumen secreted into the cellular spaces hardens, as it is liable to, and without softening for a long time; its thinner portions are absorbed, and the structure suffers a cancerous or scrofulous degeneration. Again, the parenchyma is liable to atrophy, and softenings, when the absorbing processes are over active, as has occurred in the use of too large quantities of iodine.

The character of the morbid habit, when the force of disease locates on the investing membranes as in the phlegmatiæ, is of the high sthenic kind; when in the parenchyma, it is mild sthenia.

9. *Nutritive Tissue.*

As this tissue cannot be distinctly exposed and demonstrated by the anatomist, it might be inquired where it is to be found, and what are its properties? Its existence is in part inferred from the necessity of the case, and well demonstrated by the magnifying power of glasses. It is one of the most intimate structures, not located in a single part, but existing in every part, and in the minutest points of the whole system. It has some similarity to the isolated tissue last treated of, in point of structure, and yet very different in function; for whilst in that, a new modification of movable animal matter is formed for foreign uses, this tissue modifies and applies the nutritive molecules for its own use, as nutritive matter for the growth of the body, or repairing the waste.

Whilst the anatomy of the intimate tissues has been veiled in so much obscurity, we may avail ourselves of the declarations of Drs. Dutrochet, Edwards, and others, of the vesicular cells of the minute structures, or a spongoid tissue, quite different from the vascular structure. It is alleged, that the solid, as well as movable animal matter is formed of organized vesicles; and that the secreting and nutritive processes are effected in a tissue situated between the terminations of arteries and absorbing veins. This tissue is supposed to favor the theory of endosmose, and exosmose. However, these subjects require further minute investigation.

Reference is made to this tissue at the present time, chiefly on account of its importance, and its liability to suffer in its function, in almost every condition of disease that the human economy is subject to. Placed as it is, in every minute point between the great exhaling and absorbing processes; or in other words, the capillary terminations of arteries, and absorbing radicles of veins; its functions suffer derangement in every embarrassment of these by the causes of morbid impressions. The illustration of these suggestions belongs to pathology.

The diverging ramifications of all the arteries have different terminations. There are branches having immediate inosculations with veins, which serve as protections to keep up the circulation, at such times as the capillary terminations may suffer impediments from sudden changes, interrupting their courses. These last then terminate in secreting organs, and in the nutritive tissues where the movements are slow. In this instance such portions of the circulating mass as are adapted for accretion pass by a kind of infiltration, or say endosmose, into a tissue called filiform, and areolar ; or it is most probable, interstitial spaces of cellular tissue, or primitive tissue. By M. Dutrochet esteemed vesicular.

The substances so abstracted, are chiefly fibrin and albumen. Some further impression is no doubt effected by the chemico-vital force, when the molecules easily become attached to similar matter, the composition of the tissue. It suffers various movements in the areolæ. It was vitalized in the blood, and in certain tissues no doubt becomes more intensely so, at, or soon after its fixation. Every molecule adds something in growth. But we know that there is a continual waste going on in every part of every tissue, more or less according to numerous circumstances. These seem to be whatever over-stimulates the minutest tissues, or impinges their fibres. For instance a forced circulation, either by too much food, stimulating drinks, undue exercise, or whatever induces a hurried circulation. In these cases there is far more waste, but the ordinary movements make some.

Along with the primary elements of animal matter attached to the tissues in the intimate structures, should be mentioned the agency of oxygen. It accompanies the arterial blood into them, but the blood is returned deprived of a large portion of it. It is changed from red to black blood, and evidently contains more carbon. These evidences prove essential changes to have taken place in the blood whilst passing the nutritive tissues, and these are the chemico-vital changes. We must speak generally, for the identical processes have never been revealed ; but, we learn sufficiently of this tissue, and the changes there made, to force a conviction of its importance in health, and in the derangements of perverted action. Nitrogen, and carbonic acid take some part in the play of affinities in this chemico-vital laboratory. The solids here receive contributions at the expense of the fluids. They are returned back to the centre less vitalized, and diminished in nutritive properties.

Those who assume but very little nutriment, and do not exercise much, suffer but little waste. It seems that slight injury done to the tissues render the molecules of their composition unfit for the influence of the vital force. These molecules are soon detached in a gradual manner, they are absorbed by the venous radicles, and thrown out by the eliminating organs in part at least, the principal of which are the kidneys, lungs and skin; and still before this, suffer some changes, or decompositions. They lose their vitality, and become foreign substances unless re-oxygenated. So man is doomed to constant decay and renovation in every part; and after some indefinite period, assumes a new body.

Similar processes of absorption take place in the nutritive tissues as those of the secerning. There is but little doubt but that, on ordinary occasions, in good health, and full nourishing, there are more molecules of nutrient matter prepared in the tissues than is needed, or used. Nature unprovoked is not prodigal in any thing, and every movement is in unison. It may now be suggested, and with earnestness, that the lymphatic vessels, so bountifully bestowed every where, take up the residue of nutritious molecules, and carefully transmit them back to the centre of circulation; whilst the veins perform the more servile part of taking up the excrementitious portions. Certainly this is no more mysterious than many other instinctive processes that take place.

The lymphatics always transmit a delicate fluid, of similar properties, but small in quantity; so they are often empty. They are as delicate as the lacteals, in their coats, in their contents, and in their appetencies ; whilst the veins are less fastidious ; for in the intestinal mucous coat, they will drink up even alcohol, and other poisons. It is true these substances unite, and mix at the centre of the circulation ; so does the chyle, and gross fluids transmitted by the portal circulation. Notwithstanding this, the nutritive and secerning appetencies make their own selections for their individual economy, from the so frequently returned blood.

It has been uniformly taken for granted, that the debris of the solids taken back to the circulation, are thrown out of the system as excrementitious matter. We have no evidence of this being the case, in an exclusive manner ; and it is very probable some of the detached particles of the solids, with those returned by the lymphatics, are again oxygenated in the lungs, and assimilated for further use in the nutritive tissues. This is more likely to be the course in health, than in a pathological state.

It has already been intimated, that the nutritive and secerning tissues suffer essential changes in disease. We cannot here enter into any considerations relating to ætiology or pathology. Let it only be remarked, that these tissues feel the force of the causes of disease as soon as the dermoid tissue does. The associability of the external and internal tissues is intimate, as has been noticed in relation to the mucous tissues, and it is no less so in these. An inability of function takes place, although produced by the most stimulating and tonic agents, which has always passed current under the hypocritical garb of debility, or atony.

The instinctive harmonies of the tissues is exquisite throughout. When the nutritive tissue is incapacitated in its function, the stomach refuses food. So again' there is no demand for the adjuvants of digestion, the bile, pancreatic fluid, &c. These are scantily secreted. If sometimes they abound, their presence is obnoxious, and excite nausea, or vomiting. Many other unpleasant phenomena attend, and some of them disturbing the sensibility of external relation. In perfect health, on the other hand, when the nutritive tissues are in free play, these processes add much to the enjoyment of life.

Having proceeded thus far, another train of associations is presented, growing out of a fact, which may be offered in the following proposition. That is, in ordinary health the appetite invites to the taking of more nutrimental substances, than is compatible with the best good of the general economy. The powers of the digestive apparatus are too hard pressed, when the appetite is fully gratified ; the nutritive tissues, and sanguineous system are liable to be overtasked. The results are plethora, and polysarca. The highest grade of health approximates closely to the domain of disease. Let the voluptuary beware, he had better stop and reason, before the inroads of disease demand retribution for abused privileges.

Again, it may be noticed, that without excess of plethora, when an organ is moderately excited above the natural range, whether by its exercise, or by some local stimulation, it is liable to an increase of volume ; and when having increased to any considerable degree, it constitutes hypertrophy, or an excess of nutrition. The tissue, or organ becomes embarrassed in its function, and may ultimately end in softening, or a decomposition. Or, again, it may become indurated, and end in cancerous degeneration, or more immediate phlegmatia.

It is in this concealed tissue, that the most momentous physiological processes transpire ; it is the great result of all the digestive apparatus terminating in assimilation and accretion. It is found in progression in the cellular, muscular, nervous, and every tissue. So again, its function remote, and not having the lively vital susceptibility of many other tissues, suffers a stasis of function in the morbid state ; a congestive state arises attended with all its consequences. Such a condition in a high degree, may soon be attended with destructive consequences ; in a moderate degree, may be equally destructive, with a long train of phenomena connected with the chronic morbid habit.

10. *Osseous Tissue.*

We cannot enter far into the anatomical and mechanical history of the bones. Their structure in the embryotic state is vascular, yielding, and gelatinous. They have many things in common with other tissues and organs, as arteries, veins, nerves, lymphatics, and the connecting cellular web. They have a fibrous membrane of investment, the periosteum. They have, in the hollow bones, a lining membrane, more delicate, of similar structure. The interior is filled with an oil, inclosed in laminated cells.

Ossification commences, and is partially perfected in the fœtal state. A secretion of calcareous neutral salts from the membranes takes place in a laminated form, which gives solidity and firmness to them. According to the analysis of Berzelius, bones consist of gelatin 32.17 hundredths, insoluble animal matter 1.13, carbonate of lime 11.03, phosphate of lime 51.04, fluate of lime 00.02, phosphate of magnesia 1.16, soda, and phosphate soda 1.20. Gelatin abounds in bones ; it predominates in young bones over old ones, and the phosphate of lime predominates in old bones. It has been commonly received, that cartilage differs from bones only in containing less phosphate of lime. However, its structure is quite different in containing white and small vessels, and albumen instead of gelatin, with only a small proportion of phosphate of lime. Recent analyses show albumen 45.5 phosphate of lime 00.05, water 54.

The bones have numerous cells, especially in their expanded ends, in which is oil, and a free circulation of blood. Mercury poured by a hole into a bone transudes at all points of the surface. The same of the oil in the cells of the bones, in drying of them. The centre of long bones is the hardest; it is here ossification commences. The ends are large and spongy, with numerous cells. There appears to be an order of blood vessels destined to the outer layer of bones, one to the inner, and one to the internal tissue.

The bones are endowed with the instinctive sensibility, or that of all other tissues not replenished with sensitive nerves of external relation. They feel not injuries in the physiological state. Yet their sensibility becomes changed to the relative, and is even highly exalted when inflamed. The internal medullary tissue is a very delicate membrane, lining the interior, and forming cells for the medullary matter. This tissue possesses the sensibility of external relation; the saw in amputations gives pain as it touches it.

This internal membrane is liable to be inflamed and produce purulency. One of the most severe phlegmatia we ever witnessed, was in the centre of the tibia, in which a large abscess appeared in the subcutaneous cellular tissue on the sixth day after attack, with extensive redness. On opening it, besides much purulency, several fractured pieces of bone of its whole thickness, were taken out, as they had only very slight attachments. The matter had burst the bone. Purulency, also, is liable to ensue on the inner surface of the periosteum, in the more common case of periostitis. It appears therefore, that disease affects the hard tissues, as well as the soft, and in some instances with much intensity.

The chronic affections of the osseous texture are numerous and complicated. We need only refer to some of them. Ossification sometimes proceeds luxuriantly, as it were constituting a hypertrophy. The periosteum becomes thickened, and layers of ossific matter extend nearly over the whole body, indicating an ossific diathesis. In some habits fractures, and other lesions of bones, are followed with large callosities. Ossifications occur in the arterial structure, and elsewhere. The saline calcareous substances sometimes predominate over the gelatin; the bones hence become friable, constituting the fragilitas ossium. In these instances the bones lose their sensibility, and cohesive firmness; they can scarcely become inflamed, but break very easily, and sometimes by the action of muscles.

On the other hand, there is sometimes a deficiency of saline calcareous substance; it is not excreted and crystallized, but the organs remain soft and yielding. The margins of bones seem to have nothing as boundaries of their growth, and they grow out of the ordinary shape. This constitutes the rhachitic diathesis. Again, the phosphate and carbonate of lime are sometimes absorbed, leaving the tissue soft and flexible, constituting the mollities ossium. Besides, the bones are liable to slow irritations and inflammations, injuring their textures, as occurs in the instances of spina ventosa, and hydarthrus strumatosus. All these arise from constitutional depravations, having locations in this tissue.

Aside from the modifying circumstances of the ossific depositions in bones, they manifest very similar phenomena, in the pathological state, to those of other tissues. They are subject to acute and chronic affections. The diathesis is quite uniformly of the sthenic character; in the acute, severe sthenia; in the chronic, mild sthenia.

SECTION VIII.

OF THE BLOOD.

Having made as many notices on the simple organic tissues, as appeared necessary for our design, we next proceed to review the blood, esteeming it the essential basis of the nutritive fluids, which form the tissues.

Our attention must be confined to the red blood, circulating in arteries and veins; the absorptions, secretions, and excretions require separate attention. On slight inspection, we discover a difference in the color of the blood ; in the arteries of the aortal, or long circulation, it is of a bright, nearly scarlet redness ; but after passing the capillary circulation of the nutritive and secerning tissues, it is returned to the centre of circulation of a dark modena red, and called by some black blood. Again, in passing from the right ventricle of the heart, through the pulmonary, or short circulation, the arteries transmit the dark blood ; and having passed the capillaries of the pulmonary tissue, the blood again assumes its red, vermilion color, and is now transmitted by the veins to the left auricle and ventricle of the heart. It is now replenished with a vivifying principle, of which it was robbed in the nutritive tissues.

The blood circulates very rapidly in the long circulation of arteries, but slow in the returning veins, and if by any means it is hurried in the veins it approximates more towards a bright redness. The quantity of blood in a middle sized person, of common replenishment, may be estimated at twelve or fifteen pounds ; but not half of it can be drawn off, as the vessels cannot contract on it, and a large proportion is retained in the intimate tissues. Blood drawn from a vein in a healthy person, loses its heat, being about 98° Fah., gives off a vapor, with some carbonic acid gas, and coagulates. In a short time the mass separates into two elements ; the solid part is called crassamentum, the fluid serosity. Each of these requires some notice.

The free circulating blood contains nearly all the proximate and ultimate principles of the solid tissues ; the gelatin, however, in very small proportion. The coagulated crassamentum contains an essential principle, the fibrin, or gluten, or coagulable lymph. It is the property of this to coalesce, partake of a filamentary form, when out of the vessels at rest, and sometimes within the tissues in some morbid states. Its filamentary composition contracts, and it inviscates the cruor, or red particles of the blood in the coagulum. The red portion may be washed out, when the fibrin exhibits its white color, and filamentary character. It appears on every examination, to be similar to the fibrin of the muscles, and some other solid parts. It is esteemed to be the most essential nutrient principle of the blood. Its quantity and quality are modified by nutritive substances which have passed the digestive processes; and again, according to the integrity of the assimilatory powers of the vascular tissues. It is again modified in disease, always being increased by strong vascular impulsion, so abounding in a sthenic diathesis. Messrs Whiting and Thackrah, estimated the fibrin to be one thousandth of the mass of blood in health, but in rheumatism a seven thousandth. Blood drawn in an intense state of vascular impulsion in disease, is longer in forming the coagulum. Dr Mills estimated in such cases that the coagulum would require seven minutes in forming, whilst in a reverse state, or in health, the coagulum would form in three or four minutes.

The cruor is composed of corpuscles of uniform appearance, all of the same size in the same subject, but of different sizes in different animals; having a colorless, spheroidal nucleus, and an envelope of red albuminous matter, as shown by the microscope. According to the analysis of Berzelius, as given by Copland, the coagulum of blood consists of coloring matter sixtyfour hundredths, and fibrin, with a little albumen thirtysix hundredths. The coloring matter incinerated, contains one third per cent. of oxide of iron; which is a constituent of the coloring matter, and cause of its redness. So Dr Good estimated, that forty men have iron enough in their blood to make a good ploughshare.

The serosity from which the coagulum is formed, consists of albumen, with various saline substances, and its water of fluidity. According to Marcet, about eightyone parts in a thousand of albumen, the rest water, and neutral salts. The albumen coagulates at 160° Fah., and if it be pressed, it yields the aqueous fluid more properly called the serosity, containing the saline substances ; such as lactate of soda, phosphate of soda, muriate of soda, carbonate of lime, and perhaps a few others. Chemists have seemed to detect various other substances in the blood, some of which may be inherent, and perhaps others accidental.

The morbid states of the blood are subjects of pathology. As a whole, circulating in the living healthy subject, it receives its impulsion from the heart, and vascular tissues. At the same time it is the incitor of these very motions, without which there could be no cardiac contractions, nor oscillatory movements in the capillary systems. The round of circulation is kept up by these two forces, which are in a degree antagonizing powers. Say the heart gives the first impetus, being excited by the stimulus of the blood on its vital susceptibility ; its contractions, in accordance with the elasticity of the large arteries, impels it into the capillary tissues, whether secerning, nutritive, muscular, or exhaling. The force of the heart is limited to these tissues ; and the blood, with all its products, is now propelled by the oscillatory motions of tissues endowed with the instinctive susceptibility ; except say, some small aid in the large veins without valves, by the diastolic action of the heart. We cannot stop here to adduce facts and arguments in support of this thesis.

In the course of the circulation, the blood suffers very important, and continued alterations. It is now red blood, and suddenly what has been called black blood. It receives fluid substances by the thoracic duct of chyle and lymph, and by the veins various more crude materials ; as also by the lungs gaseous substances. These all circulate together, forming an intimate commixture in the large arteries, where they receive much agitation. It it difficult to determine whether some chemico-vital changes take place in the course of arterial circulation or not ; but we may be assured it receives some preparation here that it cannot have any where else, and probably becomes more vitalized by agitation of its various recruits, as well as in the lungs.

As to the vitalization of the blood, we have too much evidence to be resisted of this being the fact. We will only mention,—it goes to the formation of vital tissues ; it coagulates ; it forms parasitic membranes in morbid exhalations, having a circulation, and at a time when the vital phenomena are all elevated ; and, lastly, the subtile secretion of the seminal fluid most certainly is vitalized. But, it must be particularly noticed, that this is a vitality of the first degree, as has already been illustrated in Sec. 5. The blood has nothing in common with the nervous tissues in respect to its vitality, only as it may receive vascular impulsion from these, but it is of that grade by some called vegetative ; and we use the term on account of the poverty of language. When fixed in solid tissues, according as the tissues may be, it assumes progressively higher grades of vitality. We know this result without being able to describe the process.

By combining all the facts and circumstances relating to the economy of nature, we discover the admirable associability existing in the human economy, constituting a unity of design in the completion of a whole. The vital force impressing both fixed and movable animal matter. The same matter now movable, then fixed ; now again movable, and traversing never ending circles. All these motions, and changes, tend to effect the great design of existence, and intellect, and consciousness, and spiritualized immortality.

SECTION IX.

ORGANIC TISSUES.

1. *Of the Heart and Arteries; or of the Centrifugal Circulations.*

We have been making some remarks on what we have thought proper to denominate the simple tissues. But, the critic might say they are not simple tissues. If they are not so in fact, we have considered them as such technically. It becomes necessary now to consider the heart, arteries, and veins as organs.

It comes convenient after speaking of the blood, to make some brief remarks a little more particular, on the forces which move it. In doing this we shall have to treat of the entire centrifugal circulations; together with the oxygenation of the blood, or its decarbonization. After these, the centripetal circulations.

There is no necessity of entering upon the anatomy of the heart and arteries, as it may be found in all the books, and supposed to be known to every one. The heart performs important functions, and it is a strong muscular organ; some species of animals have a circulation without a heart, and an instance is mentioned by Hewson, in which "the circulation had been carried on merely by an artery and vein." However, in the human species it is an important organ, and considered as the centre of the circulations; it gives an impetus to the blood which is not lost until it has reached the capillary vessels. The large arteries have but little or no muscular contractility, they have more of it as they approach the capillary tissue, and here they are chiefly muscular, and contractile.

2. *The Heart.*

It may here be remarked, that the heart is bountifully supplied with vital force. 1st, its inherent vital force ; 2d, its ganglial supply, in co-operation with the pneumo-gastric nerve ; 3d, many spinal filaments. Yet, in health, it does not possess the sensibility of external relation, or the centre of perception does not recognise its injury or movements. When disturbed by diseased action, however, it transmits imperfect sensations of uneasiness, called præcordial distress, anxiety. The adjacent dense tissues sometimes transmit a sensation of pain. Notwithstanding, thought, and the affections of intellect have a manifest influence on the movements of the heart, and on the entire circulations, even into the nutritive and secerning tissues. Instances are numerous, and daily presented, of the influence of mind upon the cardiac movements. It did not escape the attention of Shakspeare, in the instance of the cruelty of King Lear's daughter towards her father ; he says,

> ———She struck me with her tongue,
> Most serpent-like, upon the very heart.
> ———I have full cause of weeping ;
> But this heart shall break into a thousand flaws,
> Or ere I'll weep.

Although intellect cannot directly control the instinctive movements, yet it has a severe impressive influence on all the tissues. Let us for a moment particularize in the case of Mrs Seaver of Maryland. On beholding the mangled corpse of her husband, she became fixed in thought ; she did not weep, and her sorrow was dumb ;

> She stood,
> Pierc'd by severe amazement, hating life,
> Speechless, and fix'd in all the death of wo.

She had an infant ; but its fountain of nourishment dried up ;

it pined and died ; whilst the mother sunk beneath the burthen of her calamities.

The heart being a susceptible, active, and energetic organ, soon feels the hurtful impressions of the causes of disease. A feeble person stepping into a cold atmosphere for a few minutes, is liable to spasmodic palpitations. In all those affections, or derangements of functions called fevers, the heart is one of the organs first disturbed ; and the amount of its disturbance, by one train of phenomena or another, will be in accordance with the general impression made on the system, and the injury manifested throughout. So the pulse may be called the nosometer of the system, and its indications have been noticed in the diseased state, from time immemorial, however subject to numerous illusory modifications.

The direct course of the circulation from the heart as the centre, to every remote tissue internally, and to the periphery of the system, all serve to unite this organ in close harmony of function with all other tissues. If the larger arteries have less immediate influence from their structure and use, yet they carry in their outer coats numerous visceral nerves, which establish a permanent harmony between the heart and remote excitable tissues. Although the capillaries of veins as well as arteries are beyond the systolic action of the heart, yet, whatever excites the heart affects these also more or less, and even stimulations on the surface affect the heart also. The stomach likewise is bound by nervous cords to act and react in harmonious concert. Furthermore, the capillary red vessels enter, and make a part of the nervous tissues of external relation, embracing the entire spino-encephalic masses, and are intimately distributed there. So whatever disturbs the cardiac, and capillary circulations, cannot fail to affect the functions of this system of nerves. Hence in all morbid excitations of the heart, these tissues, and also intellect, sensation, and voluntary motion, are liable to suffer injury.

3. *Of the Aortal Circulation.*

The principal use of the larger arteries seems to be, to serve as conduits to transmit to remote parts. So the long nerves connect remote parts. We do not know why the blood that enters the coronary arteries of the heart, is not as perfect for the stimulation and invigoration of that organ, as it is distributed to the plantar muscles of the foot. Is not the portio mollis of the ear as perfect in its function as the remotest nervous tissues? In the case of the circulation, we may merely suppose there is an opportunity for a more intimate mixture of different substances, but these have been very intimately blended in the pulmonary circulation. The heart and large arteries direct the blood to the minute circulation in the tissues, and here is the great theatre of changes, of calorification, of nutrition, and of secretion.

The heart has only a limited control over the circulation, beyond the large arteries, their capillaries and inosculations with veins; it is then confided to other powers of movement. Yet, it is necessary the heart should offer a constant supply of fluid, as it may be removed from the capillary tissues. In health, this balance is well adjusted, but in disease may be broken. Suppose the heart to act suddenly in an impetuous manner; the tissues may be inundated; they cannot transmit fast enough for the heart to be supplied. The blood is now accumulated in the tissues, and the effect will be an embarrassed and tumultuary circulation.

The more frequent course may be, that numerous circumstances may conspire to retard the capillary circulation. The first impressions of the causes of disease, often have this effect. The sequence must be an accumulation of blood in tissues; in the dense tissues it may assume a darkened color; in loose tissues a manifest congestive state. The heart acts feebly because it has not a supply of blood to expand and stimulate it, and partly from the embarrassment of the vital force.

4. *Divisions of Circulation.*

However, before attempting an illustration of the abnormal conditions of the capillary circulations, we may notice that there are four great divisions of circulation, besides the minor ones. It is common to make use of the form of a tree as a diagram, to illustrate the divergence of the vascular branches. There are then four trees : 1st, the aortal tree ; 2d, the carotid tree ; 3d, the pulmonary tree ; 4th, the portal tree. Two of these trees have many communicant branches, viz. : the aortal and pulmonary ; it is more doubtful with respect to the communicant branches of the circulation in the head and liver. In this case, all the blood must pass by the capillaries ; it must be left at certain points by the force of the heart and arteries, and taken up by the venous radicles, and transmitted back by the converging circulation.

The blood moves slowly in the intimate tissues, to what it does in the arterial branches ; but, it has a broader surface to move in. It moves tardily in the veins compared to that in the arteries ; so the number and capacity of calibre of the veins is more than twice that of the arteries. The heart and arteries have a great preponderance of nervous susceptibility compared with that of the veins ; their outer coat being filled with the nutritive nerves, they receive into their tissue a full proportion of nervous susceptibility in their capillary subdivisions ; and all analogy, as well as experiments, demonstrate their greater vascular activity. This is plainly shown in wounds by the force of the hemorrhage. This establishes an important point in physiology, and the phenomenon assumes even more importance in pathology. It must be kept in mind, that the radicles of the portal tree have no influence of the heart and arteries, to expedite the movements of the blood. Their impetus is all lost in the arterial circuit of the cœliac and mesenteric arteries in passing through the several abdominal organs of their distribution. A centripetal circulation forms in the short vena portæ to be again distributed in the liver ; and then again converging before it reaches the cava, and thence the heart.

In this long round of double circulation, the three last divisions, being all venous trees, are performed with only a little direct nervous influence, and that arises from the distribution of the hepatic artery, which goes to nourish the liver ; and more scantily upon the vena portæ. Modern anatomists have discovered some nerves in the portal vein, which had been denied by those before them. However, the activity of this order of vessels must be greatly inferior to that of the heart and aortal capillaries ; and yet they will obey their natural stimulus, the blood, in their physiological state ; but, are liable to suffer from all the causes producing a retardation of circulation. The circulation in the vena portæ has been computed by some, as twenty five times slower than in other veins of the same diameter.

So again, with respect to the cephalic tree ; although there are many communications of arterial branches between the carotids and vertebral arteries, there are none between the arterial capillary branches and the sinuses of the brain ; so all the disproportional mass of blood sent to the brain, has to pass by capillary arteries the cortical portion of the brain, and its membranes, and again be concentrated by the absorbent veins. We know that slight causes produce some, more or less, disturbance in the cerebral circulation, in the physiological state ; and every medical attendant, and observer must appreciate the importance of every delay, or derangement of these circulations in the diseased conditions.

Let us now revert back to the aortal and pulmonary trees, which may be reviewed in connection. The blood has a more free transit here than in the former instances; for the communicant branches in the aortal tree serve, to a certain degree, as safety valves. In the pulmonary tree there is a more ready transit from all the arterial capillaries into the venous absorbants, on account of their short course, and the yielding texture of the lungs. Very coarse injections readily pass this tissue. Notwithstanding these provisions, the balance of circulation may be easily broken, and the organs suffer injury, even in the physiological state, and by circumstances disconnected with disease.

Let us suppose a person in a state of quietude, having a good temperament, with an equal balance of blood, with the heart and larger arteries and veins suitably distended, to be surprised by an enemy. He either enters into combat, or gives ground and is pursued. He now suddenly enters into severe exercise, which is continued. Exercise implies action of the locomotive muscles. It is well agreed that these organs are fully supplied with blood; their red color indicates this, and all experiments prove it. It is again, a fact that the alternate contractions and relaxations of muscles increase the capillary circulation. The contractions expedite the blood into the veins, and the relaxations invite arterial blood; so these motions, rapidly performed, are liable to fill the cavæ, even faster than the cardiac actions can dispose of it; so for a time these vessels suffer a surcharge.

It should be noticed, however, that muscular contractions expedite the blood more in the veins than in the arteries; and at the same time the capillary tissue can scarcely supply the veins for a length of time. The effect will be an accumulation of blood in the capillary arteries, so long as the large arteries supply them. These derangements embarrass the nervous energy, and muscular power diminishes. At the same time it should be noticed, the capillary circulation in the secreting organs, and nutritive tissues, cannot dispose of the blood so fast as it is forced there by the heart. The organs are inundated, and the blood is forced into tissues it is not accustomed to traverse, such as the white tissues, and even the nutritive tissues become engorged. Notwithstanding all these retardations the right side of the heart obtains a good supply of blood on account of the more rapid circulation from those sources which are free.

During the excited circulation, the mucous and dermoid tissues are distended, they suffer a capillary turgescence, and blood is liable to escape from the former at all the unprotected surfaces, as the nostrils, fauces, and internal pulmonary tissue. The external surface of the body becomes not only turgid, but red and heated ; at the same time the cutaneous exhalations are increased to a large amount, so that sweat runs from the surface, notwithstanding there is much evaporated by the heat externally. Animal caloric is always developed in proportion to the state of innervation, and rapidity of circulation, either generally, or partially. The fluids become rarified, and actually require a larger space than before, or in the state of rest ; and at the same time, the state of innervation implies a contractile condition in every vessel and movable tissue in the system. The result is, a temporary plethora ; and this might prove suddenly fatal, were it not that the mucous and dermoid tissues, together with the spleen, and dilatable cavæ serve as reservoirs.

Still more striking phenomena occur in the heart, and in the pulmonary tree. The blood urged into the cavæ, and thence into the auricle and ventricle, stimulates the heart, already in a state of innervation, into inordinate action. The first impulse will be to nearly overwhelm it ; we then discover a tremulous, irregular, and tumultuary motion. It may soon recover its ordinary rythm, and act with force ; its systoles may then be an hundred and twenty or sixty, whereas in health they may have been about seventy in a minute. The præcordial region suffers a sensation of distress.

The dark carbonized blood is thrown impetuously into the pulmonary arteries, and indeed in larger quantities than can pass the capillary tissue ; is becomes largely distended in its distributions in the pulmonary tissue, and the effect will be to compress the branches of what might be called the bronchial tree, or aerial cells. A sensation of suffocation is now excited ; vitality cannot be preserved without oxygenated air. The respiratory muscles are called into action to elevate and expand the thorax, in order that the lungs may expand and admit more air into the vesicular structure. An obstacle now immediately presents, if the subject continues in severe exertion ; for in this instance it is necessary, in order to sustain exertion, that the thorax be fixed at a given point by the respiratory muscles. These muscles are now held in requisition for both these functions. Their contractions must now be divided between the fixation of the thorax, and its dilatation. Their task is now severe, and each function is imperfectly performed, and in an interrupted manner ; and during this time vociferation is scarcely practicable. So much blood is now retained in remote tissues, and in the capillary tissue of the lungs, that the left ventricle suffers a deficiency ; it is not distended as usual, so the pulsations are small, frequent, and tremulous.

In consequence of the imperfect expansion of the thorax, and the vascular distension, the aerial cells admit of little separation, and a sufficiency of air is not admitted to supply the necessary oxygen, nor to eliminate caloric, carbonic acid gas, and other substances by expiration. A congestive state of the blood vessels takes place of dark carbonized blood ; there is liable to be exhalations of bloody serum into the bronchia, and into the cavity, or sac of the serous membranes ; the aerial cells are liable to ruptures, and engorgements of air producing permanent compression on other cells, or emphysema. Indeed fatal suffocation is liable to ensue ; but the respiratory muscles commonly become greatly fatigued, and relax their exertions in fixing the thorax, and are rather instinctively directed to the expansion of it ; and now respiration is performed in quick succession with severe panting. During all these processes the blood suffers alterations; it is deprived of too much of its water of fluidity, and there is an increase of fibrin ; much of it is forced into tissues where it suffers a stasis.

It may readily be inferred, that the foregoing illustrations represent a state of the system bordering, at least, upon the pathological ; so indeed, if it were continued, it must amount strictly to the pathological. However, the recuperative powers of the system will restore the lesions of moderate extent ; but, if any incidental cause of disease should co-operate with this state of things, and fix the accidental derangements in their perverted state, the consequence would be severe disease.

5. *Cardiac Quiescence.*

Upon a cursory inspection it might appear, that all the involuntary muscles were subjected to perpetual action, and untiringly perform their destinies. Yet, this is not the case ; they have short periods of repose, whilst the voluntary muscles require long periods. No muscle, therefore, either voluntary or involuntary, can be excited beyond certain limits, without danger of such a degree of exhaustion as to incapacitate them from performing their functions. There is a short period of rest in the heart between the contraction of the auricles and ventricles, and some longer between the systole of the ventricles and that of the auricles. It appears that Laennec estimated the rest of the heart too large when he says "that in twentyfour hours the ventricles have twelve, and the auricles eighteen hours quiescence." It is difficult to make accurate estimates on this subject ; yet, we must concede that the heart has rest ; and the slower the systolic action the more rest it has, and the reverse.

Severe excitation of the heart, from whatever cause, is liable to exhaust its vital susceptibility, producing a paresis, and consequently a cessation of circulation. Laennec mentions a case of palpitation in a subject of hypertrophied heart, in which the pulsations were between 160 and 180 in a minute, continuing eight days; we are confident of never knowing an instance of such frequency in acute disease in the adult, but that terminated in death within thirtysix hours, and often in six. Do not many pyrectec affections have a sudden and fatal termination at their commencement, from exhaustion of the nervous energy of the heart? At the onset, the pulsations are sometimes very frequent, with a general embarrassed circulation.

The circulations in different organs may admit of very considerable deviations within the range of health, when no morbid cause exists to fix them there. A tissue under the influence of excitants, invites the rush of fluids to that part. Even the agreeable stimulus of food increases a flow of mucus and saliva in the mouth; the same of the blood and secretions into the stomach in digestion. Every hour perhaps, on exposures to cold weather and exercise, the balance between the surface of the body and the internal tissues is broken. In summer, the circulations on the surface are permanently increased; in winter the internal tissues have hyperæmia. So we have sweatings in hot seasons, and increased urination in cold. In the instance of venereal orgasm, those organs suffer turgescence. Large suggillations are soon absorbed in health. Whilst one apparatus of organs suffers turgescence, some others have anæmia. However, an unequal circulation in the diseased habit is to be greatly deprecated. If the foregoing derangements of circulation should be fixed in their perverted conditions by cold, or any other cause of disease, a pathological state might soon be the result.

6. *Cardiac Vacuum.*

Some notices have already been made in relation to the suction power of the heart, and on capillary attraction. By way of recapitulation, we may remark, that they imply too much of mechanical principles to be in accordance with all other vital movements. The cavæ serve as reservoirs of blood in a limited manner, and suffer an undulatory motion as the right auricle contracts and dilates ; the blood rushes into the auricle and ventricle as they dilate ; and we freely admit that the heart is endowed with an expansive power. By this mechanism a suction force does exist, and is extended so far as the large veins extend without valves. But, it is contrary to all analogy, and all the laws of physics and of vitality, to infer, that any suction power of the heart, assisted by atmospheric pressure, can cause fluids to be absorbed by the mucous tissue of the internal viscera, or by the serous tissues. These circulations, and in the capillary systems, continue for more than twentyfour hours after a cessation of the heart, and respiration. So the sap in vegetables ascends only so long as they retain any portion of vitality. The veins fill, and become largely distended when ligatures are applied to them. Furthermore, capillary circulation can be expedited in numerous ways, without any agency of the heart. The absorbants take up congenial fluids, whilst mechanical suction might take up all fluid substances indiscriminately. Finally, there is as much evidence of a vital capillary action, as there is of such an agency in the heart itself.

Admitting, then, a limited degree of suction force by the active diastole of the heart, as influencing the circulation in the large veins without valves, and which are surrounded by an osseous encasement, we may admit another mechanical force, which has some influence on the same extent of circulation. This has reference to the process of the expansion of the thorax in the act of inspiration. The air rushes to fill the vacuum in the lungs, and a suction point is established in the whole thoracic cavity, and more space is given for the circulation generally. The jugular veins are seen to discharge their blood in the act of inspiration, and become turgid in expiration. The circulation through the lungs, also, is promoted by the dilatation of the chest, with the expansion of the vesicular tissues ;—hence the panting exertions in forced respiration. Surely, in the fœtal life, the blood circulates without this force of thoracic dilatation, or any suction power, for there is a circulation before the heart is formed.

7. *The Circulation modified by Age.*

There is a larger proportion of fluids in relation to the solids, in youth, than in old age. So again in youth, the arterial system contains a larger proportion of blood than in old age. This circumstance favors growth whilst the organism is developing. At length the activity of the arteries insures a state of condensation, with less mobility and distension of structure ; their capacity is diminished at a period when nutrition is less needed. The veins not being subjected to such severe action as the arteries, and having thinner and more yielding tunics, receive and retain a larger proportion of blood in old age than the arteries. The superficial veins, by not being compressed as the internal by a more rigid state, show a greater distention and become liable to varices. In age, both the capillaries, and the common mass of blood, acquire an undue degree of condensation, and deficiency of mobility. In consequence, not only is capillary circulation retarded, but so likewise are all the absorptions. Hence the liability of aged people to palsies, apoplexies, dropsies, dyspnœa, &c.

8. *Erectile State of Capillaries.*

All the capillary systems are subject to assume a turgid, or erectile state, in certain conditions of fulness and innervation, Some tissues, as the spleen, corpora cavernosa, and corpus spongiosum of the penis, the female nipple, clitoris, &c., have been emphatically called *erectile*. However, erection is common to all the tissues, only differing in degree ; it appears in the skin in disease, and in fright. A state of vital tonicity or innervation is necessary to its existence, and it cannot be maintained in any tissue without this. The structure of some tissues of a yielding distensible fabric, and at the same time fully supplied with blood and nerves, affords the fullest view of it. A contractile movement gives occasion to a turgescence of the arterial extremities as well as veins. It appears that Professor Muller of Berlin, has discovered a kind of sacculated appendage to the penal arteries ; a different termination from the nutritive arteries of the spongy bodies. The principal arteries furnish the blood of the venous caverns, also the nutrient arteries, and at the extremities of these is a sacculated termination of a contorted appearance, which he calls *helicine* arteries. These horned sacs are very small and numerous, projecting into the venous spaces, and are believed to act an important part in the erections.

The phenomena of the more visible erections reveal those of minuter tissues. An excitation, either by thought, or some physical impulse, is made on the vital susceptibility of a tissue. A tonic or dynamic state ensues, and the blood is not only invited to such part by the vital movement, but retained there by the same force for a certain period; and suffering vascular action. It is a physiological action, and as soon as the vital tonicity becomes exhausted the tissue returns to its former condition. Had the erection been connected with a morbid impress in any tissue, it might not subside, but give origin to inflammation. So we find similar circumstances of a morbid character continuing in the penal tissue, give origin to priapism. The uterus, also, affords similar examples.

The turgescence of the spleen, liver, cavæ, and the thyroid gland is rather of a passive kind.

9. *Capillary Arteries.*

If we were to take into view the whole capillary system of vessels, it might be nearly equivalent to a consideration of the whole of the organs, as they are chiefly formed of arteries, veins, exhalants, lymphatics, and the parenchyma of organs. There are large vessels traversing the organs, and these are embraced on every side by capillaries of some kind. It is the capillary arteries we now consider, which are direct continuations of the larger arteries, and carrying red decarbonized blood directly from the heart to the several tissues of their destination. As soon as they enter tissues, they assume a soft, contractile fabric, and at the same time an increased vital force from what obtains in the larger arteries. They now deliver over their red blood, in all the aortal circuit, to the secerning and nutritive processes, to be there deprived of its most vitalized parts; whilst the capillary arteries of the lungs receive back the blood, in a deteriorated state, to become there again revivified.

The red capillary arteries are very numerous throughout all the tissues, but abound vastly more in some tissues than in others. Whenever there is an organ destined to perform an important function, it is fully supplied with capillary arteries and red blood. Thus the cerebral organs, the great extended plane of the mucous tissues, the parenchyma of organs, the muscles, and the outer surface of the skin are bountifully supplied. These same tissues also, are proportionally endowed with nerves, either cerebral or nutritive, or both, according as their functions may require. The red capillaries give off series of white arteries, into the white tissues, transmitting blood deprived of the coloring principle; which tissues perform secondary functions, for which the red portions of the blood are not so much needed. The principal functions performed here seem to be nutrition and exhalation. These tissues are only scantily supplied with nerves of any description; some have none, and have a near approximation to the vegetative susceptibility. The capillary arteries again, give off the capillary exhalants, terminating in the internal cavities, and on the surface of the body.

In health, there is a certain balance observable between the containing vessels generally, and the contained fluids. In order that health be preserved, this balance in each individual should be maintained, although there may be a great disparity between different individuals, and which may be considered as depending on numerous circumstances establishing the different temperaments of men. So with respect to the common mass of circulating fluids in any particular individual, in a state of quietude, there is an equal balance continued between the heart and large arteries on the one hand, and the capillaries on the other; saying nothing of those discrepancies in the capillary circulation, which usually and habitually occur in the ordinary economy of digestion, nutrition, &c. If there is a plenary state of the larger arteries, the same will be manifest in the capillaries; and again, whatever diminishes the plenitude of the large arteries or veins, proportionally lessens the amount in the capillaries. The solids contract on the fluids in every tissue equally, whether the inanition is produced by withholding nutriment, or blood be taken from arteries, veins or capillaries. If suddenly abstracted, before the solids have time to contract equally, syncope will be likely to occur.

Sudden abstractions of blood from the general mass, are soon restored from the various capillary tissues; so a loss of blood from the large vessels excites a movement, or rather expedites the circulation in all the capillaries. If the abstractions are large, there will be less fluids pass by exhalation, and there may be an imbibition, or endosmose take place from outer surfaces, until a congenial balance is restored. These movements all arise from the instinctive appetencies existing in the system, regulating its best economy, when not perverted by incidental contingencies. Yet, although it may be said, that nature is sedulous in guarding the well-being of the human economy, numerous circumstances do conspire to thwart it; and it is the object of the art of hygieine to avoid them.

The arterial capillary circulation, like that of the heart and large arteries, is chiefly governed by the vital influence of the nutritive system of nerves, and the external superadded system has merely a modifying influence over it. Thought and painful sensations may prove excitants, under certain circumstances, but the motions of the capillaries depend mainly on this system of nervous force.

It is nevertheless true, that injuries inflicted on the spino-encephalic system of nerves, by which their functions are impaired, or even paralysed, produce an impaired condition of the capillary function. The cutaneous nerves lose their share of invigorating influence; the skin is not so florid, nor is calorification so perfect; transpiration is diminished.

It is not those causes on the surface of the body merely producing pain, which affect the capillary circulation of the skin, but rather such as excite the nerves of the capillary arteries which accompany them from the visceral plexuses. So, the *sensation* of cold does not destroy the balance of capillary circulation between the external and internal tissues, but its tonic influence. However, this balance is injured more or less, in almost every morbid condition. It is chiefly an excitation of the nutritive nerves which capacitates the capillary arteries and veins, to assume an altered and a morbid action. An altered action on the surface produces a harmony of altered action internally, and even simultaneously, yet in a modified degree. As cold, and atmospheric pressure, affect the surface more than the internal tissues, so their tonic influence diminishes the turgidity of the cutaneous capillaries, and increase that of the internal tissues. Hence at the attack of disease we commonly discover anæmia of the surface, and hyperæmia, or congestion, internally.

It has already been stated, that much inequality of capillary circulation, and organic force may obtain in a physiological state, and their functions become accelerated. The same condition occurs in the cerebral functions. Mental excitations occurring in a healthy condition of the system, invite a turgescence of the capillary tissues of the cerebral organs ; and it appears that the use of the fluids here, aside from nutrition, is, to sustain the functions of the cerebral tissues. When this takes place in a compatible degree, the force of intellect will be increased, and even sustained, beyond the ordinary period of repose. The circulations in such a state must be free or unembarrassed. However, this condition cannot be sustained beyond a certain point ; for either coma or delirium will be the result of incompatible excitation, or too long continued exertion of intellect. Such a state of the cerebral organs is very similar to that of other organs, sustaining excess of action. The capillary tissue, winding around the nervous fibrils, and entering into their intimate fabric, modifies the cerebral functions. From this may be deduced many pathological inferences.

10. *Relation between Nervous Sensibility and Capillary Action.*

There seems to be a mutual relation between the capillary and nervous systems. It has been mentioned, that an excitation of the nervous sensibility invites an afflux of fluids ; so, again, an afflux of fluids to a part always raises the sensibility of that tissue. Both these conditions exist constitutionally, in a particular manner in youth ; and they are always attended with a proportional disengagement of caloric. So the bodies of youth are better warmed than those of age, having less sensibility and capillary fulness. In febrile diseases both these conditions exist in an eminent degree, occasioning a disengagement of caloric. No adequate conception can be obtained of the capillary circulation in health by inspecting dead subjects ; it can only be learned, as relates to intensity, by observations, comparative experiments, and vivisections.

11. *White Arterial Capillaries.*

The cartilages, tendons, ligaments, fibrous and serous membranes, do not receive red blood, but they are traversed by white capillary arteries, transmitting albumen and gelatin. To these might be added the capillaries of the hair and nails, transmitting chiefly gelatin. No nerves exist in these tissues ; yet when excited sufficiently long, either by experiments or in disease, they admit red blood, and their sensibility becomes exalted, so that the sensation of pain is transmitted to the centre of perception. In the *trichosis plica*, or Polish mat, the hair enlarges to several times its natural size, admits red blood, and when cut bleeds, and gives exquisite pain. The hair and nails sometimes become equally sensible from wounds. The same of the internal membranes ; they admit red blood, become exalted in sensation, and afford morbid secretions. These notices are made to illustrate the obscure physiological state of these tissues. As soon as the preternatural susceptibility, or as it might be called, morbid tonicity becomes changed, the fluids are absorbed from the capillary tissues, and no more are admitted than in the physiological condition.

The tissues traversed by red blood, resemble a vascular network everywhere anastomosing. Injections thrown in by an artery, find their way into veins, excretories, and even on the serous tissues. So there seems to be a communication by capillaries with all the tissues of the system. In all these instances it passes by continuous vessels, by the exhalants into other tissues, and by continuous arteries into continuous veins ; but we cannot conceive of any injections in the living subject, even if they do in a dead one, passing from a nutritive, or from a secerning tissue into veins, for this must require the vital acts necessary for the process of absorption. By way of illustration, we might say, that injections may pass into serous cavities by the exhalants, but that they cannot be made to pass from those cavities by absorption, for this requires a specific vital action, the other being merely a continuous circulation.

In the dead subject, fluids pass readily by capillary vessels into other tissues, and on to the skin, and mucous surfaces, which could not occur during life, unless some peculiar pathological state were present. Vitality gives to all the solids, and even fluids, a dynamic state, which might be called vital tonicity ; it is apparent in all the organism, in the muscles, and the same in the capillaries ; and it is this force which retains the fluids in their proper vessels. When this force is abstracted, the capillaries yield very readily, and even the blood has a weaker crasis, and more readily conforms to ordinary impulses. Therefore blood permeates the mucous tissue of the lungs when life has ceased, that could not during the living state.

12. *Exhalations.*

In following up the centrifugal circulations, we must notice a broad surface, from which arise an infinity of capillary vessels, transmitting thin fluids from the red and white capillary tissues. These exhalants transmit at least two kinds of fluids ; one of which is a thin, sero-albuminous fluid, and deposited in all the serous sacs, as the ventricles of the brain, and arachnoides, the pleura, pericardium, peritoneum, tunica vaginalis, and all the cells of the subcutaneous cellular tissue. The other is an aqueous fluid, having in solution many saline substances, and excrementitious matter, with a small portion of albumen. This is deposited on the entire surface of the body, in the form of transpiration, or sweat; also, on the mucous tissues of the lungs and of the digestive apparatus. Materials that are not only useless, but obnoxious, are thrown out by these tissues, and hence they have been called depurating organs. To these ought to be added the urinary apparatus, for it conveys in like manner, substances already existing in the circulating mass, which by accumulating there would prove obnoxious, if not eliminated.

The exhalent vessels arise from the extremities of the capillary arteries, and by short courses deposit their fluids on the surfaces of membranes. Besides the saline substances exhaled, more or less, on all these surfaces, there is, also, acetic acid, ozmazome, carbonic acid, azote, caloric, and probably other gaseous bodies. The cutaneous and pulmonary exhalations have been proved by Dr M. Edwards as very similar; and we have many facts demonstrating gaseous exhalations, or exosmose, from the capillary circulation into the digestive canal. In the most perfect state of health these excreta are not very abundant; but, in the pathological state are often profuse. The aqueous matter sometimes is profuse, at other times greatly deficient; and so of all the others. Acetic acid is thrown out largely in some fevers, so that a sour smell is readily perceived.

Berzelius insists, that the fluids exhaled and eliminated from the system all contain an acid, whilst those secreted and employed for internal uses are all alkaline, or contain some alkaline principle. The milk, a secreted fluid of utility, contains lactic acid. Tiedemann observes, that the products of the secreting organs for future use, contain organized globules, whilst the depurations never contain any.

In the physiological state, these four depuratory surfaces, the skin, lungs, digestive surface, and kidneys, have a just balance, are in constant exercise of function, with only a little variation, and continually eliminating from the common mass, in the round of circulations, such substances as would be injurious if retained. But, exposed as the bodies of men are to the circumfusa, especially atmospheric vicissitudes, the vital actions suffer impressions, and changes of functions follow, in a manner to produce essential modifications. The skin, or expanded dermoid tissue, commonly first suffers change, and diminution of function; and in consequence of this the instinctive movements are directed towards some other tissue of the kindred functions, and discharges from such tissue may be very large.

In consequence of the vicarious discharges last spoken of, the general system is often relieved from a greater conflict of morbid action. Hence it is, that the cutaneous exhalation being suppressed, it is immediately followed by copious urination on many occasions; or, it may be a diarrhœa, instead of diabetes simplex. Again, it may be, especially in cold seasons, that the internal impetus is directed to the mucous tissue of the lungs, producing catarrh, or in a more aggravated degree, pneumonia. At any rate, when any of these depuratory exhalations are suppressed, and without any vicarious substitute, grave disease is very liable to succeed.

The analysis of the fluids demonstrates, that the foregoing substances, together with uric acid, exist in the blood; and all pathological observation proves, if retained there, they become injurious stimulants upon the vital susceptibilities.

13. *Gaseous Fluids.*

The gases have not been so much noticed in the circulating fluids, but they are proved to have an existence there, and probably act a more important part in disease than has been supposed. They go the rounds of circulation in a combined state, and the circumstances of their evolution and exhalation are not well understood. The poison of certain reptiles and insects appears to set them free. The attention of experimenting physiologists might well be further directed to this subject.

An extraordinary case of extrication of gas is related in the 18th Volume of the American Journal of the Medical Sciences, by Mr Raleigh, of India; of the extrication of gas "in the inferior venous system." The veins supplying the ascending cava were distended greatly, and especially the veins of the liver, kidneys, &c. On cutting into them gas rushed out with "a hissing noise." The heart also was greatly distended, and on opening the right auricle, gas rushed out and it suddenly collapsed. No gas appeared in the descending cava or its branches, neither in the arteries.

Gases are sometimes exhaled into the alimentary canal in large quantities, at the commencement of disease, exciting flatulent colic, especially after exposure to cold; at other times not until disease has continued some time, then producing meteorism, or tympanitis. M. Andral mentions gaseous exhalations, or as he calls them secretions, from the skin, the lungs, and the alimentary canal as a physiological process; and also into the cellular tissue, the serous sacs, and uterine cavity, and even into the blood vessels in certain pathological conditions. (Sect. xiii. 7.)

An aeriform fluid has been discovered on opening large imposthumations externally. Also, in cases of empyema. In one case in particular, it found passage by the canula of the trocar when there was no pneumo-thorax, or communication with the bronchia. Dr Forbes, in his notes on Laennec, mentions effusions of air. (Page 310.)

In our observations upon the phenomena connected with an exalted state of action, and in different habits of disease, we had long ago noticed, that the expansion of vital fluids was greater than might be supposed of other fluids, under similar circumstances of heat; whilst the thermometer indicated only two or three degrees above the natural standard, the volume of the mass of blood would appear to be greatly increased, and even when large evacuations of blood had been made. Do the gaseous expansions, even in a combined state, contribute to this phenomenon? Some physicians have undertaken to describe the gaseous pulse, as they call it; and indeed, it seems difficult to account for it altogether from the state of the solids, and without taking into the account a modification of the fluids. M. Lobstein noticed this great expansion of fluids, but referred it to a "nervous plethora." However, this must be a very untenable position, for he ought in the first place to prove that a specific nervous fluid exists at all. We may rather refer the phenomenon to an excitation of vital force, giving occasion to a greater evolution of caloric, and gaseous expansion.

14. *Serous Exhalations.*

As it is the design of the present work to bestow more regard to general principles than to the minutiæ of physiology, we pass over numerous facts and circumstances, which may be very essential, but are to be found in many modern works. So with regard to the exhalations; and yet we cannot avoid bestowing a moment's attention on the exhalations of the serous tissue of the brain, the arachnoides. M. Magendie has particularly called attention to it, though much neglected. This tissue covers the whole of the brain, cerebellum, and spinal cord, besides lining the ventricles. An albuminous exhalation constantly bedews it, and whenever atrophy of the cerebral mass occurs, the vacancy is filled by this fluid. This function acts a conspicuous part in all vascular excitations of the cerebral organs. This fluid is liable to be exhaled in excess, and that on slight irritations, and suddenly. In the normal state, absorption takes up the fluid; but, if the absorbants cannot act in the diseased state, or the exhalation should be too viscid for imbibition, its accumulation occasions a fearful train of phenomena in all the organs of external relation. The tissue becomes thickened, and some effusions attend, producing an inability of cerebral function.

15. *Function of the Kidneys.*

It becomes necessary briefly to notice the kidneys, as a part of the centrifugal circulation, and eliminating surfaces. The anatomy of these organs can be learned from the proper sources; and we shall only make such physiological references, as may be applicable to the present design. Although these organs have the glandular, parenchymatous structure, and actually secrete fluids, they are not of a peculiar character, for they merely contain substances that pre-existed in the common mass of blood, or with only slight modifications. In the circuits of the fluids, and their passing the secreting and nutritive tissues, and taking with them effete materials, the results of the vital chemistry continually going forward, the blood becomes charged with substances of a noxious character, which if retained would prove hurtful. The most characteristic substance eliminated by the kidneys is the uric acid and urea. This is destructive to animal tissues; and when not thrown out always injures the cerebral organs and functions. It is a combination of uric acid, carbon, and ammonia. It affords the peculiar urinous smell when urine is thrown on burning coals. It is a recrementitious product, and not necessary in the process of nutrition.

In the perfect economy of nature, it seems necessary that certain materials should be eliminated by organs adapted to the purpose of transmitting substances that might injure the sensibility of more delicate tissues; and they even might be highly offensive to the organs of sensation in passing off in the form of vapor. Besides the urea, the substances which pass by the kidneys are, a gelatinous animal matter, muriate of soda, either separate or combined in triple salts, phosphates of lime, and magnesia; also, phosphoric and benzoic acids. At certain times are found sulphate of soda, and of lime, the oxalate of lime, besides other saline bodies. In health about certain definite quantities of these bodies pass by the kidneys, although the amount of aqueous matter may be greatly diversified.

In disease, the urine is liable to suffer important changes from the natural condition, and merits particular consideration in pathology. The chemical changes then going forward, whilst the vital actions are scarcely able to restrain their heterogeneous affinities, give origin to various noxious compounds, which require to be eliminated before health can be restored. So we find copious sediments in the urine to be good pledges that a relaxation or perviousness of emunctories has taken place, by which the capillary tissues will be relieved of plethora ; and also, of the stimulations of injurious combinations, which may have taken place during the conflict of disease ; or, peradventure, have been instrumental in the production of it. Albumen passes with the urine in certain diseased conditions, especially in dropsies connected with a dynamic diathesis ; it will coagulate by heat and acids.

The kidneys are furnished with nutritive or ganglial nerves from the renal plexus, accompanying the emulgent arteries into their parenchyma. They do not possess the sensibility of external relation in their interior, but do on their exterior after moderate excitation. The vessels of their parenchyma are large and free. Injections by the arteries pass freely in these organs, not only into the ureters, but into the veins also, in the dead state, but it is doubted whether a vital tonic power would admit them. If the ureters are tied, the urea will be absorbed back into the circulation, and prove injurious, unless eliminated by some vicarious outlet, as has been known to take place by the skin, mouth, umbilicus, or even the ear, constituting the paruria erratica. If the kidneys be extirpated, urea will still be found in the blood.

The quantity of exhalations from the skin is modified by many circumstances ; the ordinary quantity of insensible perspiration may be about thirty ounces in twentyfour hours ; in the case of sweating, cutaneous exhalation may be very considerably increased. It is about twice as much in summer, and in hot latitudes, as it is in winter and in cold latitudes. Diseases of the skin are most prevalent in hot latitudes, whilst urinary calculi, and diseases of the urinary apparatus, afflict the inhabitants of the cold and variable latitudes. Tissues subjected to an excess of function, are liable to assume an increase of sensibility, by which they become impatient under ordinary stimulation ; and when the saline and stimulating substances of one of these tissues is thrown upon the other in excess, morbid excitation is liable to follow.

The urine of children contains but a small proportion of urea, and very little phosphate of lime, as the latter is employed in the formation of bones. In old people it is pretty abundant, and if not discharged by the kidneys, might produce deposits on other tissues. Urinary calculi are of great varieties of composition. M. Berard considers urea as the most azotized of all animal substances, and its excess requires elimination from the blood by the kidneys, as the excess of carbon is by the lungs. Animal food increases the relative proportion of azote in the blood, as vegetable food does that of carbon.

Having reviewed as many circumstances in relation to the aortal, or long circulation, with the eliminating surfaces of the centrifugal circulations, as our limits admit, we now advert to the pulmonary, or short circulation ; and this may require some notice of the lungs as an organ. Afterwards the centripetal circulations will merit attention.

SECTION X.

PULMONARY TISSUES.

1. *Of the Pulmonary Circulation.*

The respiratory apparatus performs very important functions in the human economy; it has reference to many movements of external relation, and also to the internal economy of many organs. In the former, the lungs stand related to all the modulations of voice, as in common language, speech, singing, hallooing, and various exclamations. To these may be added coughing and sneezing, excited by irritating substances on the mucous tissues. Laughing, crying, sighing, and sobbing, are expressions of the passions. The former are motions of volition, the latter of necessity. The lungs also stand in intimate relation to other organs as sustaining the entire force of the circulation through their tissue, equal to that of the aortal circulation. It is an imbibing and exhaling organ, as will appear in the sequel.

2. *Pulmonary Structure.*

This is so peculiar, it merits some notice.—1st, a fibrous tissue uniting the cartilages of the bronchia, and traversing the whole of each lobe, and affording some degree of elasticity. When the lungs are separated from the body, they retain their form by the force of this tissue.—2d, the internal mucous tissue, possessing something of the sensibility of external relation, and which has already been spoken of.—3d, the external, or serous tissue, possessing the instinctive or organic sensibility.—All these are connected, 4thly, by the cellular tissue, and liable to admit fluids and air by extravasation and effusion into its interstitial spaces.—In this tissue are imbedded, 5thly, the pulmonary arteries carrying black blood, and the pulmonary veins transmitting red blood.—6th, the bronchial arteries, one from the aorta, the other from the intercostal, transmitting oxygenated blood for the nourishment of the tissues.—7th, the lymphatic absorbants, and bronchial veins, together with innumerable absorbants and exhalants, besides the mucous follicles.—8th, the nervous tissues, to wit, the recurrent to the mucous tissue, and the nerves furnished from the cardiac and pulmonary plexuses to the blood vessels carrying both dark and red blood.

Such is the complexity of the tissues of this organ, of little specific gravity, and containing within its bronchial cells, or aerial superficies, a surface exceeding that of the whole periphery of the body. Here is expanded a large surface for the contact of atmospheric air, for the convenience of absorption and exhalation. Dr Horner has very well demonstrated, that these aerial cells are of a globular form, and that they all communicate together by lateral apertures of about one twelfth of a line in diameter.

All the vascular tissue, and the minute capillary exhalants and absorbants, are of a yielding and distensible fabric. Gross injections easily pass from the pulmonary arteries, into the pulmonary veins ; and also from the pulmonary veins back into the arteries, as there are no valves in the veins. Injections readily pass from the arteries into the aerial cells ; in disease, red blood often passes into these cells by the exhalants, and without any rupture of textures. In dead subjects, this appearance is very common. Again, fluids injected into the bronchial cells, have been absorbed in living animals, and found in the left chambers of the heart, in three or four minutes after being injected, as proved by unerring tests. The loss of the vital tonicity in the dead subject, affords opportunity for the blood to be transmitted into the aerial cells, which does not take place in the living. However, certain pathological states do allow it to pass.

3. *Exhalations from the Aerial Surfaces.*

In pursuance of our order of following out the centrifugal circulations, and exhalations, it becomes necessary, firstly, to bestow a little attention to these as appertaining to the short circulation.

The dark carbonized blood, thrown from the right ventricle of the heart, passes rapidly along the short pulmonary arteries, and by infinite subdivisions, is distributed on the delicate mucous tissue of the aerial cells. Many important functions are effected in this tissue; its surface being large, the exhalations of fluid matter are very considerable, and yet no exact estimate can be put on it. Richerand estimated it at about four pounds in twentyfour hours; and it has been estimated very differently by different experimenters. In warm latitudes, and in warm seasons it is less than in cold latitudes and seasons. It is called the pulmonary transpiration, and is quite similar to the cutaneous transpiration, but does not contain the neutral salts so manifest on the skin, and on the intestinal mucous surface.

The gaseous substances are eliminated from the capillary exhalants of the lungs, such as carbonic acid gas, azote, hydrogen, carbon, the aroma of ingested substances, as of the essential oils, of garlic, of onion, asparagus, cheese, &c., whilst the more gross saline bodies pass by the kidneys and skin. However, the volatile substances do pass, also, by these emunctories. This pulmonary surface is also the outlet of many adventitious substances, especially occurring in disease. The smell of mercury is discovered in the breath, and certain fevers called putrid, are attended with offensive effluvia. Alcohol also passes freely.

It is scarcely necessary to mention the former hypothesis of water being formed in the lungs by the synthetical union of oxygen and hydrogen; it is demonstrated as passing by very short courses merely through the mucous tissue, directly from the arterial capillaries, and probably by continuous pellucid vessels; or, may it pass by exosmose without continuous vessels?

This fluid is of essential service before it leaves the aerial cells, by diluting the mucus of the follicles, which otherwise would be too viscid to pass off in the air of respiration. By being thus diluted, the mucus becomes suspended, and is eliminated with the air of respiration, after it has lubricated the membrane. When the pulmonary exhalation is deficient, as often occurs in disease, the mucus becomes viscid, and tenacious, and then excites coughing for its expulsion. In warm weather the pulmonary vapor becomes suspended in the atmospheric air, and is invisible, but in cold and especially damp air, it is not so united, but appears in the form of vapor.

It is very manifest that caloric, instead of being absorbed by the lungs, is actually eliminated from the system by these organs. Like other exhaled bodies it is passing off from all point . and a due portion passes by the air of expiration. It is believed that Brodie's experiment of fanning the lungs with a bellows has been confirmed, by which the body cools faster after death than when it is not practised. Animal heat is no more evolved in the lungs than in other parts of the system. It is prone to accumulate above the wants of the system, and if not eliminated would become destructive; it is therefore necessary for the human species to exist in an atmosphere below the ordinary heat of the blood. This degree of temperature is found to be between 60° and 65° Fah., to relieve the excess of caloric, whilst that of the blood is about 98°. When atmospheric temperature is equal to that of the blood, it is necessary it should be accompanied with free sweats, the evaporation of which combines large portions of the caloric, and relieves the excess of heat.

It has been stated that oxygen is exhaled from the lungs; but this is in small proportion to what is absorbed by the mucous tissue of the lungs. Absorption will hereafter be considered ; but it seems necessary now to notice, that large portions of oxygen are absorbed. Atmospheric air may be estimated as composed of about 19 parts of oxygen, 80 of nitrogen, and 1 of carbonic acid gas. Say about half of the oxygen of the common air is absorbed in respiration, and it is found the respired air is returned loaded with carbonic acid gas, and nearly in proportion to what is required of oxygen to convert carbon into carbonic acid gas. A small portion of oxygen in a free state either passes by exhalation, or is combined in the vital processes.

There is then a large proportion of carbonic acid gas exhaled from the lungs, and which, according to M. Edwards, Collard de Montigny and others, is formed in the capillary system in the processes of nutrition, secretion, &c., and by uniting with the excess of oxygen. Large portions of carbon are taken in with vegetable food, and when combined with oxygen are readily expelled. But, before this takes place, no doubt the oxygen has served very valuable purposes by stimulating the vital solids, and increasing the vital force throughout every organ. We see the blood in the capillaries of the lungs immediately affected by it at its absorption, by which it is changed from a dark modena, to a bright scarlet color. The blood is now returned to the left auricle and ventricle of the heart enriched by a compatible stimulus, by which it excites the nervous tissues, and their organs to vigorous actions. Oxygen is not only a compatible, but an indispensable stimulus ; for the constitution of animal fabrics is such, that vital movements cannot be continued without it. But this topic will be descanted on when speaking of calorification.

The chemical physiologists have bestowed much attention to ascertain the amount of gases, and other excretions exhaled from the body in a given time. But there has been great discrepancy in their results, and no two can be found to agree in them with much precision. There are numerous circumstances which modify the imbibitions and exhalations ; some of these are the deviations of health of the slighter kinds in the individuals practised on; a difference in food assumed; the deviations of atmospheric heat, weight, and moisture; they are also modified by age, season of the year, by time of day, by exercise, and even affections of the mind. It may be noticed, that absorptions, and exhalations of gases and fluids take place by the skin, and intestinal surfaces also.

In the physiological state, the instinctive susceptibility possesses a tendency, or appetency to regulate and modify the economy of the vital movements, so as to preserve itself in a just and easy balance. This is not the direction of consciousness, but results from a harmony, or consensus of structural sensibility existing throughout the whole organization, by which the complicated machinery is reduced to a unity. It is by this property of the vital solids, that they assume more or less of extraneous, compatible substances, to suit the necessities of the system. And again, it is by the same instinctive economy, that useless and unwelcome substances are thrown out of the circulation by the exhalants, when they are not needed, or become oppressive; and the quantities of such substances so eliminated, will be varied by numerous concurrent circumstances in relation to the wants of the organism.

It is agreeable to this thesis, that animals existing in an atmosphere containing a plus, or minus proportion of oxygen of some considerable variation, suffer little or no inconvenience, only they make use of a more or less volume of air. The absorption is in proportion to the wants of the system, and this can be supplied in either event in the healthy state. However, when the tissues of the lungs have lost the absorbing powers, as in asthmatics, and dying people, the most congenial composition of air cannot satisfy their wants; they pant for more when a plus exists all around them.

The causes of disease are all such contingent circumstances, as interrupt this delicate harmony of moveme ts in the vital tissues, by impressions made on the nervous susceptibility, and thereby altering their movements from their normal condition. Many contingencies almost daily occur to numerous individuals, which produce deviations from the most perfect economy; but they soon become restored by the recuperative powers, and no further notice is taken of them, whilst some of the exhalations, and absorptions have been altered. However, let the morbid impression be of a more grave kind, by which the vital movements have been more permanently altered, and there arise more manifest phenomena in reference to the exhalations, absorptions, secretions, &c. In such instances the exhalations may be almost universally suppressed; they may be constrained in one tissue, whilst they are profuse in another; and the absorptions may suffer similar derangements. A continuance of this abnormal state gives origin to the diseased habit.

The process of endosmose, and even exosmose is very extensive in both animate and inanimate bodies. It seems to be a law of nature, that any substances placed in opposition have more or less a tendency to be diffused into each other, according to their degree of mobility. So gases and fluids pass through the tissues of the human system, and obtain just balances. Notwithstanding, if there should be a great excess of any one, as an accumulation of carbonic acid gas in a confined room, the excess might not only be prejudicial, but fatal.

4. *On Respiration.*

The mechanism of respiration has been well explained by some modern physiologists; it will require only some casual remarks in addition to what has heretofore been said. The lungs of the new-born infant are collapsed, and as solid as muscle, and sink in water. They have been compressed in a dense medium, and in the firm parietes of the uterus, so that the elasticity of the fœtal thorax has never had an opportunity to assume its destined position. On arriving in its new, and specifically lighter element, the thorax of the fœtus has a tendency to expand by its own elasticity, and to an extent far above the volume of air respired in ordinary respiration. This force, together with the necessities created by the new change of circulation, and want of oxygen, excite the muscles of respiration into contraction. By this process the capacity of the thorax is very considerably increased, and as the vacuum is made, the bronchial cells are filled with atmospheric air ; at the same time the blood rushes through the pulmonary arteries, which before passed direct into the left chambers of the heart, and aorta, by the ductus arteriosus and foramen ovale.

The respiratory motions are continued by necessity, as long as life continues ; and indeed, the vital forces cannot be kept in play any longer than absorptions, and exhalations of the aerial surfaces are perpetuated. Respiration cannot long be restrained by any voluntary exertion ; a man may starve himself to death, but cannot voluntarily suffocate himself ; for the respiratory sense is so intense and commanding, that it excites a train of involuntary movements, by which the thorax becomes enlarged, and the atmospheric air will, of course, supply the vacuum, and the wants of the system are satisfied. These respiratory motions are kept up during sleep, and in the condition of apoplexy, and even when the cerebrum and cerebellum are cut away, by the force of the superadded respiratory nerves. However, when the pneumogastric nerve is cut, the respiratory sense is lost, and although the thorax may be dilated, no absorptions take place.

On ordinary occasions, the voluntary muscles act by the determination of the intellect, through the medium of the symmetrical nerves, from the spine to the diaphragm and external muscles. The intercostal muscles approximate the ribs ; their curved position downwards, now by moving upwards enlarges the capacity of the thorax, with the aid of the two wings of the diaphragm, which simultaneously contract, and bring its superior convex surface towards a plane, and inspiration follows. During this time, the abdominal muscles are at rest; but during expiration, the abdominal muscles contract, and by pressing the viscera against the lower surface of the diaphragm, together with the elasticity of the thoracic parietes, this process is effected.

These movements of the diaphragm, and abdominal muscles are not alone necessary for the circulations through the lungs, but serve an essential purpose, also, by promoting the circulations in the abdominal viscera. Perhaps the tardy circulation of the branches of the vena portæ could not well be sustained, without this oscillatory aid. The influence of these motions extends still further, and affect the circulations in the cavæ, and many other portions of the venous, and absorbent systems; whilst the oxygen inspired, excites the arterial actions in the lungs and in every remote tissue in the circulatory system.

The outer surfaces of the lungs are in close contact with the pleura costalis, and of course they expand by the atmospheric pressure in proportion as the thorax is enlarged, for they have no active extensibility or contractility of their own. They never contract to their former fœtal state, not even when removed from the body. There is always a large portion of air filling the aerial cells even in expiration; so the absorptions are going on equally the same during inspiration and expiration. About sixteen or eighteen respirations ordinarily occur in a healthy adult in a minute, and the heart may be said to contract nearly four times during each respiration.

There is a very constant relation between the number of pulsations of the heart, and that of respirations. When the circulation becomes increased by exercise, by a pyrectic habit, or indeed any cause, the respirations are increased pretty constantly in a similar ratio. It appears there is a necessity of aeration of the blood in its passage through the lungs, and the more freely it is forced through these organs, a more frequent respiration becomes necessary. If there exists any mechanical impediment to a full dilatation of the parietes of the chest, or of the lungs, the number of respirations is increased in order to give the whole of the blood an opportunity for aeration. And further, as dilatation of the thorax expedites the circulation through the pulmonary vessels, so a necessity of increased respiration is produced.

Perhaps the amount of air, in a common sized man, contained in the lungs, may be estimated at 210 cubic inches in forced inspiration ; in mild, say 110 inches. In healthy, placid respiration only about one fifth part of this is expired, and again replaced in one respiration. But, respiration may be so forced as that half of the whole quantity may be thrown out from the lungs. This reservation of air in the lungs is very important, in the expulsion of any substances accidentally passing the glottis, for the purpose of expelling them without an inspiration ; and also, in some irresistible coughs. And, again, in the event of compressions of the lungs externally, or effusions internally, life could not long be sustained but by the displacement of the surplus air.

The necessity for free atmospheric air, and amount of oxygen required, may be appreciated by taking the lowest estimated quantity of air used at each respiration, say, 25 cubic inches, at a common temperature, at each respiration, allowing 20 in a minute, although we consider this large. In an hour 30,000 cubic inches would be required ; or 360,000 in 24 hours, equal to 46 hogsheads. Suppose only 8 per cent. of oxygen absorbed, the amount would be very great, which is required for the use of the human economy. The absorption of this gas has been abundantly demonstrated, for air without it is either useless or deleterious ; it changes the color of the blood instantly, and increases its quantity of fibrin ; some have insisted that it raises the temperature of the blood one or two degrees ; but this may be doubted. Deprived of oxygen, the whole mass of blood assumes a dark color, and ceases to afford the necessary stimulations ; the subject then falls into asphyxia.

Besides the instantaneous change of the color of the blood, in passing the capillaries of the lungs, its capacity for caloric is increased, according to Davy, as 913 to 903 ; it coagulates more quickly ; its serum is less abundant, and the proportion of fibrin increased. Hematization is begun, and no doubt greatly perfected in the lungs ; and this must essentially be effected by a vital process ; for, on a division of the pneumogastric, it is impaired, and ultimately destroyed, although the vital force of the lungs is not wholly dependent on this nerve. The impoverished venous blood meets with the chyle and lymph, just before entering the lungs, and the mass of fluids soon becomes thoroughly mixed, and with the oxygen forms chemico-vital changes, which enrich it for nutrition, and the disengagement of caloric. The oxygen, with a small amount of azote and hydrogen, enter the thin coats of the aerial parietes by endosmose, being attracted by a dense fluid. The gases pass into the blood and return, according as the necessities of the system, in health, may require.

The lungs of the fœtus being useless, the blood transmitted by the aorta and iliac arteries, to the placenta, is of the dark, venous character ; but it returns by the umbilical vein to the fœtus enriched with decarbonized blood, by the influence of the maternal blood in the placenta.

SECTION XI.

ORGANIC TISSUES—CONTINUED.

1. *On the Centripetal Circulations.*

Having bestowed as much time on the centrifugal or diverging circulations as our limits allow, together with remarks on particular organs in direct relation, we will now review the functions of the tissues which supply the common mass of fluids, by absorption, and their concentration to the common centre, or the converging circulations. It is expected the allusions already made will shorten this division of our subject. It will be difficult to avoid some remarks on organic structures, and certain functions not directly absorbing.

From the first moment of embryotic existence, to the last hour of life, all the substances required for accretion, and for the supply of waste, enter the great circulations by extended surfaces, and through tissues by certain passages, so minute as to elude the ken of anatomists. No vessels have been demonstrated as passing the epithelia of these tissues, but are found immediately below. By some the existence of vessels is inferred, but denied by others, who insist that substances pass by imbibition or endosmose. The process is usually called absorption.

2. *Two divisions of Absorbants.*

This process requires to be divided into two kinds ; 1st, as it occurs in the surfaces of external tissues ;

a, the dermoid tissue.
b, the pulmonary, faucial, and nasal tissues.
c, the digestive mucous tissue, by venous radicles and lacteal absorbants.

2d, as it occurs in the internal tissues, being supplied from extravasated fluids and capillary vessels ;

a, by the venous radicles.
b, by the lymphatics.

Each of these may require some passing remarks. However, it seems necessary, in the first place, to attempt some further elucidation of a subject still greatly controverted, and which is veiled in some obscurity. It appears that the progression of every branch of science has preceded the science of life ; that the laws of inert matter in the department of physics, have made gigantic strides, whilst those of life and organization have remained at a sightless distance. Even the application of those laws in the department of therapeutics, upon the broad scale of usage, has but little to boast over the by-gone years of two centuries. This is not from want of exertion, for no science has employed greater talent, and more industry than that of physiology. So Lord Bacon had occasion to remark, that medicine had been greatly labored but not improved ; that its advancement had been circular rather than progressive ; or in other terms, a repetition of experiments for the purpose of bringing the laws f vitality in subordination to those of physics, or explaining the movements of life by those of inorganic matter.

It will, nevertheless, be frankly conceded, that very many physiologists, since the middle of the last century, have made brilliant advances by explaining the phenomena of life on the principles of vitality as displayed in the organism. Yet, as the effects of mechanical views, we find some advocating still, that life itself is an effect of organic movements ; that the circulation is sustained by suction, and absorption by capillary attraction. It is acknowle ged that the laws which govern the vital phenomena are abstruse ; yet enough are made manifest to force the conviction, that organized beings are governed by laws peculiar to themselves, or to life ; so long as this ruling principle abides in the organism. When it ceases they become the sport of physical influences.

In the physiological state, the instinctive susceptibilities control the organic movements, and commonly for the greatest well-being of the united organism. When the sensibilities of the tissues are changed by hurtful impressions, a perversion of organic action is liable to occur; incompatible substances may be taken in by absorption, which otherwise might not have gained admittance. Such heterogeneous substances may produce commotion, when meeting with more excitable tissues, by their undue stimulations, and a train of perturbed phenomena ensue.

3. *Vital Character of the Converging Vessels.*

Some portions of the human tissues approximate the primitive of the lower orders of animals. It is worthy of special notice, that in all the absorbing vessels, and converging circulations, no nerves are discoverable; whilst in the diverging circulations they are everywhere found, even in the capillary tissues. We find nerves in the diverging portion of the vena portæ, answering to the hepatic artery of the same organ, but scarcely any in the converging portions of the portal circle; neither do they exist in the venous, lymphatic, or chylous absorbents. The vital susceptibility of the converging systems seems to be more, if not altogether of the character of the primitive or vegetative kind; whilst that of the diverging is under the domain of the nutritive nervous force in addition to it. How far the electro-magnetic force may render aid in these movements we cannot at present decide.

This anatomical state of the two different tissues modifies their physiological character. The vital susceptibility of the converging tissues, appears amply sufficient for all their functions. Indeed, it is a wise provision in design, that they should not be over susceptible to excitants increasing their action, whereby the vascular system might be inundated. We observe in them, therefore, a far more steady function than in the diverging; and although it may be capable of occasional and partial excitation, yet it is a steady and enduring action, not subject to the commotions of the highly nervous tissues. It is so far independent of nervous force that their functions are commonly continued, although less perfectly, after the paralysis of nerves, and a cessation of all the functions of organs dependent on nervous force.

On the other hand, the diverging circulations are all easily accelerated in function, and again more readily exhausted. If accelerated, the immediate rush of fluids to the periphery of tissues is not so much connected with fatal results; for their contents may be thrown out of the circulations on the exhaling surfaces. However, if the impetus should be specially directed to some internal organ, such tissue might suffer severely. These different physiological conditions of the tissues admit of extensive application in pathology. We need here make only a single allusion, and that is in respect to the internal absorptions, as the veins, lymphatics, &c. The altered state of function of the diverging capillaries commonly embarrasses that of the absorbing venous radicles; a state of hyperæmia may exist, and internal absorption is commonly impeded by it. This condition occurs in a great many instances in the morbid habit, and it becomes an important indication to adjust the balance between the diverging and converging capillary tissues. The even tenure of their function is interrupted in perhaps every state of disease.

4. *Equal Balance in Health.*

For the purpose of perpetuating an easy physiological, or healthy condition, it is necessary the *ingesta*, or absorptions, should bear a just balance with the *egesta*, or matter thrown out. If the former gain the ascendancy, the vessels will be subject to plethora, or a hyperæmia, with its concomitant evils. If the latter prevails, the vessels will suffer inanition, and the whole organism a state of atrophy. It is hardly necessary to notice, that this last condition may arise from withholding the proper nutrimental substances, or, from an inability of function in the absorbing tissues. With respect to the former, or state of hyperæmia, it is liable to arise under favorable circumstances for it, such as a full supply of compatible substances of nutriment, and an active state of the vital tissues. In every instance of compatible fulness of the vascular system, there is a certain degree of tonic force in the tissues and organs throughout the system, constituting health with adequate strength.

Suppose this tonic state to be increased, the exhaling tissues might obtain so much dynamic force as to retard the exhalations, and so much as they are retained they afford too great fulness of vessels. This order of vessels is more liable to respond to the stimulations, and acquire tonicity, than the absorbents, on account of their superior vital susceptibility over that of the latter. Whilst the absorbents, therefore, continue a more equal movement, the exhalants are impeded ; for, it is a well known fact, that tissues too highly stimulated become turgid, and transmit with difficulty by absorbing vessels.

5. *Process of Absorption.*

It is manifest that all the external increments, as well as the internal decrements of animal bodies, enter by the external or internal absorbing tissues ; meaning the dermoid, digestive, and pulmonary surfaces. The fact is indisputable, whilst the *quo modo* is problematical. The difficulty is increased on account of anatomy not being able to demonstrate the presence of absorbing pores in the tunics, and the inlets of the vascular tissues, if any such exist. We cannot therefore say any do exist. These are some of the intimate tissues, whose structure may never be revealed otherwise than by analogy. However, we have good demonstration that fluids and gases do pass through tissues, without direct porosity, when impelled by galvanic currents.

We have repeated some of the experiments of Dr Dutrochet, and are fully convinced, that rarer fluids and gases will permeate dead animal tissues, and displace denser fluids and gases. The blood and lymph are more dense fluids than ever enter as increments. There can be nothing unphilosophical in assenting to the proposition of fluids entering, and passing by endosmose, through the living tissues, or the thin epithelia of the organic tissues. Indeed, oxygen and other gases entering by the lungs are examples.

With respect to the manner of these incrementitious fluids entering the radicles of the absorbing vessels, we know nothing again only by inference. However, there may be no greater difficulty of their entering these by endosmose, than in entering and passing the interstitial spaces of the membranes. Or, if the ultimate tissues are *vesicular*, they may pass by the same impulses. Notwithstanding the embarrassments connected with these subjects, we may make many practical and useful inferences, even in the present state of our knowledge, when supported by observation and collateral facts.

Every day's experience indicates the utility of the tepid bath of water, by immersion, in all those affections connected with an internal congestive state of the venous radicles. It cannot be doubted, that an inability of venous absorption exists in such instances. The removal of this is indispensable ; and it is found to be greatly expedited by the tepid bath, which of itself possesses great density, compared with atmospheric air. Yet, when the bath is impregnated with saline substances, or starch, or, what is similar, an infusion of wheat bran, it is found to be more efficient. It is understood that other benefits attend the use of the bath, such as increasing exhalation, or exosmose, exciting the surface by caloric, &c., but all we now insist on, is, that one cardinal benefit of its use consists in promoting *internal* absorption.

6. *External Absorption ; 1st, by the Dermoid Tissue.*

The skin imbibes both liquids and gases ; and indeed solid bodies sometimes when transformed into the liquid state. Yet, it does not act so much as an absorbing tissue, as an exhaling one. It has been supposed that the scaly texture of the epidermis embarrasses its inhaling powers. But, why not one as well as the other ? Perhaps atmospheric pressure may make a difference. But, as the digestive mucous tissue may be considered a counterpart to the dermoid, it may be noticed they act inversely ;—the former absorbs bountifully, and exhales less ; the latter exhales much, and absorbs less ; so the necessities of the system are supplied. Remove the epidermis, and the skin readily absorbs ; irritate the mucous tissue of the digestive tube, and it exhales liberally.

Experiments demonstrate that persons, who have lain for some time in a tepid bath, are heavier than when they entered it. The sick have been supported for some length of time by a bath of nutrimental substances. The lives of sailors have been preserved by bathing in the sea instead of drinking water. The embryotic rudiments of the fœtus increase by absorption before there is any placental attachment. Whole ships' crews have been salivated by the vapor of mercury, in hot latitudes, when some jars were broken in the hold of the ship. If it should be said this might enter by the pulmonary tissue, we might add, that mercury, in its metallic state, has been found in the bones of persons, who had used it only by external friction. Blisters produce strangury, and odors of garlic, and numerous other substances, applied to the body, are detected in the blood, and the exhalations.

7. *Cutaneous Imbibition of Gases, or Endosmose.*

Whether gaseous substances are absorbed by the skin, and pass the circulations into the intestinal canal, producing meteorism, may be difficult to demonstrate. However, it seems to be a fact, that an impression from external cold, or in common parlance, on the taking of a cold, there is liable to be a flatulence of the intestines, and in movable habits very suddenly. Dr. Edwards considers the dermoid and pulmonary tissues as performing very similar functions; and Abernethy has performed many experiments indicating the respiratory action of the skin. (Sec. X. 13.)

It is stated by Count Chaptal, that limbs plunged into carbonic acid gas become benumbed throughout their whole extent. P. C. Collard has demonstrated this gas to be *actively* deleterious. In order to try its effects on the dermoid surface, he placed himself in a tub of fermenting grapes, with his nostrils closed, and a tube reaching from his mouth into pure atmospheric air. At the end of only five minutes, he felt a sensation of weight in his head, with indistinct vision In eight minutes, pain in the temples, tinnitus of the ears, with vertigo; in ten minutes, languor of the limbs, and increased action of the heart; in twelve minutes, slow respiration; in nineteen minutes, the tube fell from his mouth, and he escaped with much difficulty. Sparrows inclosed in carbonic acid gas, with their heads at liberty, on an average died in an hour and a half.

If it should be suggested, that carbonic acid gas acts directly on the cutaneous nervous tissues, in these instances, without entering the circulation; it might be answered, that we do not know of any experiments to support it; for all of them show it as existing in the circulation, and its surplus to be readily exhaled. This gas is not deleterious, except in excess. It is habitually assumed along with liquids, and liable to intoxicate. It has been injected into the jugular vein of animals, and if in excess and rapidly, according to the experiments of Nysten, it may kill by distention of the ventricles of the heart, or as a poison ; but, if slowly, according to Collard, its excess is found to be exhaled from the lungs. If it were not soon eliminated, it would be destructive. These experiments establish some important principles ; 1st, that gases may exist in combination with the blood ; 2d, that an excess of gas, above the wants of the system, is soon eliminated ; 3d, that carbonic acid gas is a narcotic stimulus, and not a sedative.

8. *2nd, The Nasal, Faucial, and Pulmonary Tissues.*

These must be ranked with the external tissues, for they are in constant contact with the air of respiration. The mucous tissues are of the most active kind in relation to imbibition. Many volatile substances pass the olfactory membranes, and manifest stimulating, and even intoxicating effects. From the travels of Baron Humboldt we learn, that the rude inhabitants of the Orinoco intoxicate themselves, by inhaling at the nose the powder obtained from the pods of the *acacia niopo;* it lasts for several days, with a ferociousness bordering on madness. So payment was demanded of the traveller, who said he was much refreshed by going into the cooking room, although he ate nothing. The membranes of the mouth and fauces absorb fluids, and even nutritious substances. Thirst may be suppressed by holding water in the mouth. A hungry person perceives the refreshing influence of the first mouthful of food, as soon as taken into the mouth ; and it is probable that some portion of it reaches the heart, through the medium of the absorbing veins, as soon as the solid morsel arrives in the stomach.

Many allusions have already been made in relation to *pulmonary* absorption. There seems to be no impropriety in using the word *endosmose*, to denote this process, without being strictly wedded to the theory which gave origin to it. The substances that pass this tissue must be of the gaseous kind; and these pass and repass with great facility, as the tissues are well adapted to the process. As the primary elements of the tissues are formed of gaseous substances, so the aeriform substances pass, in part, by the lungs, and go to form the solid tissues, and the blood.

Oxygen united with metallic bodies increases their weight, and it no doubt adds to the weight of animal bodies. Azote also, is a principal elementary constituent of animal tissues, and enters by the digestive membrane, and also by the pulmonary. When not a sufficiency enters by the digestive tissue, more enters by the lungs; when too much enters by the digestive tissue, the excess is thrown out by the lungs. The instinctive susceptibilities possess a great aptitude in rendering accommodations for the well-being of the general economy.

9. *Vital Properties of Oxygen.*

The fluids returned to the heart and lungs, by the centripetal circulations, are of three kinds; the dark venous blood, which has returned from the tissues deprived of an essential portion of its nutrient and vivifying principles; and again loaded with many substances it has obtained in its route by absorption, and convertible again into nutrient principles; 2d, the chyle, which has already undergone one digestion in the alimentary tissues; 3d. the lymph, returning as a surplusage from all the nutritive tissues. These all meet together at a little distance from the right chamber of the heart, on their way to the lungs, where they all in combination, receive the vivifying influences of the gaseous inhalations. This union appears to be indispensable; for without it, all the combinations of the other nutrient fluids, in the character of venous blood, would be vapid, and not capable of sustaining vitality. The aspect, and radical character of the blood becomes instantly changed in the capillaries of the lungs, otherwise, according to Collard, life could not be sustained more than four or five minutes.

In the process of respiration, the noxious and useless gases are exhaled by the pulmonary tissues, the chief of which is carbonic acid gas. It is supposed the loss of this improves the color of the blood, as well as its qualities. However, the great privilege of respiration consists in the imbibition of oxygen into the circulation, which was denominated by the ancients *pabulum vitæ*, as they knew nothing of oxygen. This, as an elementary principle of air, of water, and of arterial blood, appears to be a congenial and active agent in all the animal tissues, stimulating them, and co-operating, in an inexplicable manner, with the vital principle. By its union and immediate influence on the crude and vitiated venous blood, it becomes suddenly transformed into rich and pure arterial blood, without having to pass eighty thousand times the rounds of circulation, as Boerhaave supposed. It is now prepared to excite the action of all the diverging circulations, to effect nutrition, and the disengagement of caloric in all the capillary tissues.

It should be borne in mind, that oxygen is absorbed by other tissues than the lungs, but in less degree ; yet, sufficient under certain circumstances, to form carbonic acid gas in the capillaries ; and this may account for the phenomenon noticed by Nyston, Edwards, and others, of carbonic acid being formed by some animals confined in hydrogen gas. Oxygen is acknowledged to be the great acidifying agent, and the instinctive powers of the system appear to be very sedulous in finding expedients for sustaining its own economy. Some inferior animals might exist in this manner, and carbon be eliminated by its union with oxygen, for a limited time ; but, it is not likely the human economy could long be supported in this manner, if at all.

The functions of the lungs, therefore, bear an important relation with the entire economy of the system. They are important in the function of hæmatosis. They free the circulations of even noxious principles, whilst they imbibe the indispensable agent oxygen, which combines the heterogeneous mixture of the nutritive fluids into congenial and exciting agents ; and at the same time provide for the calorification of the whole of the tissues. However, in their impaired condition, other absorbing and eliminating surfaces act as imperfect substitutes to a certain extent.

10. 3d, *Absorption by the Digestive Mucous Tissue.*

The organs, and the process of digestion might be considered at length in this place ; but this embraces many organs, and diversified functions, which must be passed with only a few cursory remarks. It would be aside from our design, to treat of all the circumstances in relation to organs contributory to digestion, or to the process itself. This subject has been fully developed in many recent works on physiology ; and as a particular thesis by Dr. Beaumont, who has done much justice to it. We shall, therefore, be restricted to casual remarks, and chiefly to the absorbing processes of the digestive tissues.

The digestive surface may be associated with the external surfaces ; for, although it has an internal folding, it is constantly in contact with foreign substances, and even more so than the lungs, or skin. Solid substances suffer disintegration, and receive chemical changes in the digestive tube preparatory to entering the circulation by absorption, and becoming vitalized.

11. *History of Digestion.*

The peculiar sensation of the want of nutriment is seated in the stomach, and communicated to the centre of perception through the medium of the pneumogastric nerves. But this sensation is greatly modified by the necessities of the entire organic tissues. The instinctive susceptibilities are often so acute as to indicate the kind of nutriment most needed. This sensation instinctively directs to the prehension of such substances as are convertible into nutriment, and it rarely mistakes the object.

Nutritious substances may be assumed both in the liquid and solid form. The latter are approximated to the liquid form by manducation, and the commixture of saliva, and the mucus of the mouth and fauces. By voluntary movements they are thrown into, and through the pharynx, where they are no longer in the charge of volition, but subject to the organico-instinctive movements, directed by the nutritive system of nerves. The esophagus, therefore, by its contractile motions, impels the nutritive bolus into the stomach. It here remains three or four hours, according to the compactness of texture, or the state of the stomach, suffering a disintegration of its particles of composition, until reduced to a pulp; and this is effected partly by the agency of moisture, of caloric, by the undulatory motion of the stomach, and the influence of the secretion called gastric fluid.

That this fluid is accessory to the disintegration of nutrimental substances cannot be doubted from the evidence of Dr Beaumont's experiments, and his is a mere confirmation of those antecedent by many experimenters. It appears that this fluid possesses an avidity, if not an affinity for such substances as are radically nutrimental, in whatever form presented, and whether animal, or vegetable; such as starch, albumen, fibrin, gelatin, oil, sugar, &c. The stimulations of food, and of other substances, as the thermometer in the case of St. Martin, increases the flow of the gastric fluid into the stomach, where it is ready for the contingencies of digestion.

There remains scarcely a doubt, but that this fluid, or some parts of its constituents, combine with the nutrimental substances in the formation of chyle; or, it might be said, become accessory to the first stages of its formation. It is not complete until uniting with the other secreted fluids in the duodenum, or second stomach; viz. the bile, pancreatic fluid, and intestinal mucus. All these are accessory to the formation of the most perfect chyle, whilst the remaining portions of them, together with the residual matter of the alimentary substances are propelled onward, by the peristaltic force, to their anal exit.

In respect to order of time, it may be remarked, that whilst the disintegration of the nutrient substances is taking place in the stomach, the venous radicles of the mucous tissue of the stomach, and upper intestines, are absorbing the aqueous, odoriferous, saline and other portions of the nutrimental mass; together with a portion of certain substances in a fluid form already animalized, as well as certain portions suffering decomposition, called putrid. These are all seized by the interposing, absorbing veins, and carried directly to, and through the liver, and into the great highway of venous blood.

These substances suffer little or no change in the stomach, but immediately come under the dominion of the vascular influence in the branches of the vena portæ in the abdomen, and also in the liver itself. Experiments demonstrate, that alcohol and many other substances pass from the stomach to the liver within six or eight minutes after being taken in.

Although no experiments have fully demonstrated the internal economy of the liver; yet by analogy we are assured, that this great viscus performs other functions than merely the secretion of a little bile; and this, perhaps, by the hepatic artery, instead of the branches of the vena portæ. All those substances that can be subdued by the vital force of the liver, become changed towards nutriments, and pass into the venous circulation, a little after the chyle by the thoracic duct, to be ready to receive the impressions in the lungs bestowed also on other nutrimental substances;—whilst those which cannot be changed, such as the alkaline substances of vegetables, tartarized antimony, mercury, arsenic, with many others called medicines, and poisons, pass into the common mass of blood also, and exert their peculiar influences on the different tissues.

Again, whilst the intestinal venous absorptions are progressing, the gastric fluid, by forming intimate unions with the more fixed nutrient substances, is forming the basis of the chyle. This pultaceous compound, called chyme, soon passes the pylorus to be perfected into chyle. The venous absorptions are still continued, whilst the chyle is perfecting, and passing onward to be absorbed by its own peculiar vessels, the lacteal absorbents; as if in contempt of its other, or former company. Some experimenters have thought they had seen chyle straying in the mesenteric veins, but no other nutrimental substances but chyle in the lacteals. Madder will color the bones, but not the chyle. We may conclude that some portion of chyle may pass the radicles of the omnivorous veins.

From the moment the ingested substances have passed the pharynx, they are subject to the vital force and vital affinities; and they are no further under physical power, than permitted by this force. Or, in other words, the chyle is perfected, by the chemico-vital force of the digestive tissues. It is even not made perfect in the intestines, whilst in commixture with its residuary matter; it is not found there, and not until after it has entered its own peculiar vessels. It here receives impressions, which establish its character, but that character is not completed until it has passed many glands, and arrived through a long route to its destination, or union with venous blood.

12. *Properties of the Chyle.*

It appears to be convenient in this place to make some further notices in reference to the chyle.

Before it has passed the lacteal glands it is in its simplest form, a white homogeneous fluid. As soon as it has passed these glands, it has become albuminous, resembling milk, and coagulable. Before it enters the left subclavian vein it has assumed a light reddish tint, and possesses much the properties of the blood, except its color. It contains some fibrin ; and may we not expect the fibrin of the blood is essentially formed from the chyle ?

The chyle is modified by the kind of food made use of. Dr Marcet in his analysis, found that chyle from vegetable food, yielded about three times as much carbon as that from animal food ; that the chyle from animal food began to putrefy in three, or four days, whilst that from vegetable food could be kept for weeks, or even months without putrefying ; that the chyle from animal food is much like milk, and on standing a creamy substance rises ; its coagulum is opaque, and has a pink hue. On the contrary, the chyle from vegetable food is commonly nearly transparent, like the serum of of the blood ; its coagulum is colorless like an oyster, and no creamy substance rises to the surface. So the ingesta modify the chyle, and of course the blood also, and a knowledge of these facts lead to practical inferences.

Furthermore, soon after chyle is taken from the thoracic duct it spontaneously forms a coagulum. It separates into a solid, a serosity, and an oily pellicle, and its reddish tint increases on exposure to the atmosphere. It is difficult to estimate the amount of chyle produced in a given time ; perhaps a pound or two in twentyfour hours ; yet it is greatly modified by the ingesta, and integrity of the digestive powers. The lacteals are sometimes found empty, but commonly turgid in three or four hours after a full meal, and sometimes sooner.

For the anatomy of the lacteals, reference may be had to Leiberkuhn's description, by C. Bell, in his anatomy and physiology of the human body.

13. *Different Intestinal Absorptions.*

Our digressions have led us aside from the immediate subject of absortion ; but this could not well be avoided, as our course is to descant on the organs, and functions in connection. We might stop here and spend time on the subject of the liver, pancreas, mucous, follicles, and other subjects in connection with digestion and absorption, but conclude most proper to omit them.

There are at least two important absorbing tissues connected with the digestive surface, viz. the *venous* and *lacteal.* We have already been obliged to anticipate much in relation to these, especially the lacteal. With respect to this last, we have nothing to add further, or to the process itself, different from that of other tissues. Whether the absorbing mouths open on the mucous tissue of the intestines, or whether chyle enters by imbibition, or endosmose, may be decided by future experiments.

It will be noticed, that venous absorption is placed amongst the *internal* absorptions ; and there it acts the most important part ; but still it performs an essential process in the intestinal absorptions, which have been styled *external.* In this instance the fluids are taken from membranous surfaces.

For a long period after the discovery of the circulation of the blood by Harvey, it was the commonly received opinion amongst physiologists, that intestinal absorption, and all absorptions were performed by the veins. However, after the discovery of the lymphatic system, and the investigations of Moscagni and Cruikshank, it became the common belief, that these delicate vessels had to perform all the burthens of absorption. The writings of the Monroes, Hunters, and Bells, are full of this theory, even down to about the year 1820.

The lacteal system was esteemed a part of the lymphatic, and it was supposed, that all materials passing from the digestive tube into the mass of circulation, must pass this slender tissue, be they never so severe and disgusting.

At about the time last mentioned, the suggestion arose in France and Germany, that there must of necessity be some other route by which substances pass into the mass of blood, since various, as coloring, saline, odoriferous, and certain medicinal substances were detected in the portal blood, but never in the lacteal vessels. Besides, it appeared to be the honest conclusion, that these minute vessels could not very easily transmit the enormous quantity of fluids assumed by some, and which were found streaming from the kidneys and surface of the body. Therefore, a series of experiments were instituted to find some other course by which the blood vessels were replenished; at the head of these we find M. Magendie, Dupuytren, Tiedeman, Gmelin, Ribes, Adelon, Segalas, Fodera, with others; and in America, Lawrence and Coates, with some others.

The results of these experiments afforded the most conclusive evidence, that the lacteals essentially transmit only chyle, with its water of fluidity; whilst in the vena portæ and liver were found many heterogeneous substances, some of nutritious matter, others saline, others poisonous, as alcohol, etc. In consequence of this, the lacteals were freed from their cruel burthens, and a rightful dignity conferred on the vena portæ and liver. But, the investigations did not end here.

The internal interstitial absorptions were also examined; and we may in this place be permitted to remark, that the delicate lymphatics were relieved of a great task, that had for a long period been imposed on them. The results are, that the internal absorbing system admits of two divisions; one of red veins, the other of white veins, called lymphatics. These, with the lacteals, compose the entire internal centripetal circulation. They all perform similar, though not identical functions. They all have valves; all absorb fluids at their capillary origins ; all transmit slowly and steadily to the centre, by their innate vital susceptibility. They originate in different tissues, and transmit different fluids of nutrition ; viz.: the lacteals from the mucous tissue of the digestive surface ; the lymphatics from the internal white albuminous, and the nutrient tissues ; the red veins from the red sanguineous tissues and surfaces of membranes. These divisions will admit of some further remarks in their proper places.

More particularly we may notice, with respect to absorptions from the digestive surface, that chyle alone, in a normal state, passes the lacteal absorbents and thoracic duct into the blood ; that the radicles of the mesenteric veins absorb numerous heterogeneous substances as well as nutrimental, which pass the portal circuit ; and, as insisted on by some, that a certain set of absorbents take up nutritious particles, sometimes a little chyle, which they transmit to veins in the mesenteric glands. The experiments have been numerous and often repeated, which go to establish these positions.

14. *Second Division of the Centripetal Circulation, as supplied by the Internal Tissues; 1st, by the Veins.*

It has already been shown that the arteries have different terminations, and as this should take place in the different tissues, so the process of venous absorption may be modified. Some capillary arteries transmit to veins by inosculation ; so this blood has a direct course, and these veins can hardly be said to absorb. This is a wise provision to sustain the circulation in the contingency of certain states of disease, when the absorbing processes may be impaired. Arteries terminate for the most part, in the nutritive, secerning, serous, and erectile tissues, in which event the blood suffers a temporary stasis, and aside from the vascular circulation. It is one of the most imposing phenomena incident to the vital economy, that fluids are so uniformly, and steadily taken up by the capillary veins, as we are assured they are, and transmitted back to the centre of the circulations.

We may, again, include all the morbid accumulations, which take place in different tissues, as imposing burthens on the absorbing veins. False theory has hitherto, for the most part, assigned this office to the lymphatics, which is not supported by any direct evidence. The veins, then, take up all abnormal extravasations of fluids that are absorbed; whether in the interstitial spaces, on surfaces of membranes, in tumors either accute or chronic, in excavated ulcerations,* or in hypertrophied enlargements of parts wherever situated when removed. This thesis is now assumed; it will receive some illustration when on the subject of lymphatic absorption.

With respect to the physiological process by which the internal absorptions take place, we are mostly ignorant, except what may be obtained from analogy. It is most probable the incipient radicles of absorbing vessels suffer a degree of turgescence, of dilatation and contraction; and these motions may be alternated by momentary repose. This is a state common to many organs and tissues, as the puncta lachrymalia, even the heart itself, and almost every organ. The same process, whatever it may be, is common to the veins and lymphatics of the internal interstitial tissues. These two are the only internal absorbent systems we know of; although the lacteals are very identical, only originating upon what we have seen proper to call an external tissue.

Venous absorption is one of the most momentous functions in the human economy; it is sustained by the first grade of vital force, yet steady, and indispensable to ease and health. Although it has a tendency to a steady and determinate action, it may be interrupted by the numerous causes of derangement to which the system is exposed. Let this process be suspended, and the routine of movements necessary to

* Andral, Vol. I. p. 301.

health are suddenly interrupted. The blood may be thrown into the capillary, and interstitial tissues for a time, by the more excitable arteries, with their nervous impressibility; but this centrifugal force must soon be diminished also, or suspended. The heart and arteries are no longer duly supplied by the returning veins in such an event.

If we pursue the train of phenomena a little further, on the surface will be seen dark discolorations, from the accumulation of blood in the interstitial tissue; coldness from a deficiency of calorification, and some degree of insensibility from compression of the nervous expansions; or, the same circumstances and phenomena may be mostly concentrated in the internal surfaces, attended with venous accumulations, called congestions. Whatever increases an undue vascular fulness, or plethora, and undue tonicity, is liable to induce an inability of the absorbing processes. The causes of disease all conspire to produce this abnormal state, and hence the frequency of congestions.

The heart absorbs from the veins, and discharges its contents into the arteries; the capillary veins, or radicles, absorb from the arterial terminations, and restore it to the grasp of the heart. This circle cannot be broken with impunity; and how numerous the chances of disturbance in the expanded capillary and nutritive tissues. An equal balance is necessary to the continuance of health.

A preponderance of evidence seems to be in favor of the veins absorbing from all the serous surfaces, an office usually assigned to the lymphatics. As an evidence of this may be adduced the fact that ligatures on the large lymphatic trunks are not followed by serous collections; whilst ligatures on the veins are subsequently followed by such accumulations. Some, who have long been persuaded of the exclusive sovereignty of lymphatic absorption, have appeared very unwilling to abandon the hypothesis, and allow to the veins their legitimate functions. They have insisted that there are a series of lymphatics, very short indeed, which empty their absorbed fluids immediately into the small red veins. They are not proved to be lymphatics, any more than the radicles of veins, and why call them by that name ?

It has been advanced by Professor Lippi, that he has succeeded in detecting direct lateral communications between the lymphatics and veins. Fahman insists this to be an error, and that veins have been mistaken for lymphatics. Dr Rossi of Bologni, sustains the opinion of Professor Fahman, and has demonstrated the supposed lymphatics to be venous radicles. The conclusion must inevitably be, that veins absorb from the serous cavities the fluids thrown out there by the arterial exhalations, and transmit them back ; and that they take up crude and gross substances besides blood and serum ; such as pus, camphor, assafœtida, mercury, antimony, alcohol, and numerous other substances. All these have been detected in the veins, but never in the delicate, transparent, and half distended lymphatics. These perform a more chaste and enviable office, as may soon be shown. It is very probable the pus supposed to be found in the lymphatics by Andral, was in the venous radicles.*

We have reason to be persuaded, that experimenters have been deceived in many of their processes for the purpose of proving the normal causes of absorbed fluids. It can hardly be supposed, that many of the tests used for this purpose can obtain admittance by the absorbing vessels ; certainly not by the fastidious lacteals and lymphatics, if by the more voracious veins. For illustration, let us notice an experiment by Fodera, and repeated in this country by Lawrence and Coates, on similar principles ; in which he injected into the thorax of a rabbit, a solution of hydrocyanate of potass, and then a solution of sulphate of iron into the peritoneal cavity. At the end of three quarters of an hour, the parts were *uniformly* blue ; the coloration was not confined to any series of *vessels*, but

* Vol. I, p. 304.

the whole of the tendinous part of the diaphragm had imbibed the blue matter. So of all the other experiments performed with these severe, attenuated, diffusible substances.

Substances of this character do not pass the vascular tissues in their natural courses ; they penetrate animal tissues by infiltration, or transudation along the cellular connecting medium, rather than the vascular conduits. They sometimes tinge the fluids in vessels, but always the cellular tissue first, when the vessels have size enough to admit a discrimination. "At *first* a slight discoloration only, is observable in the parts, which gradually becomes deeper ; *afterwards* the liquids of the lymphatics, and of the blood-vessels become colored in its (*their?*) turn."*

In all these cases the coloration primarily affects the simple solids, and secondarily the contained fluids ; whereas if they entered what is called the mouths of the radicles of the absorbents with the fluids, these must be first colored. Some of these readily soluble, and diffusive agents may have found their way into the chylous and lymphatic vessels, but that they passed the same legitimate route of the chyle and lymph, remains to be proved. Besides, this process of coloration requires about an hour to show itself; and yet it will take place instantly by the aid of galvanism. It is apparent that no vascular absorption could be so accomplished. So dead animal substances are turned of a reddish color in a solution of nitrate of potash. No safe inferences can be drawn, therefore, from this kind of experiments ; the substances are incompatible with the vital susceptibility. The tender vital solids demand association with fluids of kindred composition ; yet, the sensibility of some tissues may admit of imposition, or suffer deception. Severe and forced experiments do show numerous communications between the different vascular tissues, of which we have no evidence of a normal circulation ; but, in a morbid state, fluids may pass them, as in the instance of

* Appendix to Richerand's Physiology, art. Absorption.

forced experiments with acrid, soluble substances. So fluids impregnated with acrid substances, pass dead tissues, which would be repelled by living tissues.

However physiologists may differ as to the manner in which absorption is effected, and the intercommunications of the several tissues, yet *venous* absorption is a very important and extensive process. Much of the supposed labor imposed on the lymphatics, by former physiologists, is now ascertained to be performed by the veins. Indeed, all absorption from the exterior surfaces, except the chyle, is performed by the venous radicles; and all the internal, except the lymph. We are now alluding to the normal action, being well aware that foreign fluids have many times been found in both the lacteals and lymphatics, in certain forced or morbid states.

We may refer then to the veins, all the absorptions from the dermoid, pulmonary, and digestive surfaces, whether of fluids, of gases, or of solid substances, except chyle. Again, with respect to the internal absorptions, the veins likewise absorb plentifully from the capillary tissues of red blood; from the parenchymatous and nutritive tissues; from the serous tissues they take up serum, and from the mucous tissues mucus, and aqueous bodies, and occasionally accidental bodies. These two last surfaces afford a broad extent for venous absorption, especially by including the numerous subcuticular cellular cavities. The veins perform the office of what has been called *accidental* absorption, that is, the taking up of foreign substances, such as extravasated blood and gases; of the decomposed substances from the nutritive tissues; of pus in any part of the system; of animal substances, as ligatures of silk, leather, catgut, &c. Even calculi deposited in the cellular tissue have been removed by venous absorption, and also emphysematous swellings. Hypertrophies of tissues, and the tumors of acute and chronic phlegmatiæ, are taken up by the veins, when removed.

It appears then, without at present taking into the account the lymphatic system, that absorption, whilst it is one of the most inexplicable, is one of the most exalted and indispensable functions of the animal economy. It gives support from the first moment of embryotic existence throughout life, and whenever interrupted is sure to be followed by disease : and such diseased state will be continued until the absorbing processes are fully established. It is not a function confided to the fickle sensibility of any nervous tissue, but to the persistive grade of primitive vitality.

2d, *On Internal Absorption by the Lymphatics.*

The lymphatics are a series of converging, absorbent vessels, very minute, of a delicate structure, transparent, and so contractile that when empty they resemble fine threads, and are difficult to be detected. They are distensible to a certain degree, beyond which they cannot be forced without rupturing ; and although their coats are very thin, they will bear a greater weight of mercury than the veins. They have valves about every quarter of an inch. They originate in every part of the system, unless we except the medullary part of the brain, and from the most intimate tissues, and yet the exact point of their origin has not been demonstrated. They are extremely numerous, and run in two planes, like the veins, one deep seated, the other superficial, resembling the veins. They run through many acini, or glandular bodies ; except this they resemble the veins in their courses, and office. They concentrate, and unite in the thorax with the lacteal absorbents, and both enter the blood vessels together. Their anatomical structure is identical with the lacteals, and of the same grade of vital force.

15. *The Lymph.*

Although the lymphatics are very numerous, all that Magendie could obtain of their fluids from a large dog, was one and a half ounce ; it is thinner than chyle, having some reddish, or yellow tint ; it spontaneously coagulates into a mass of albumen, and a serosity separates.

According to Shevreul, 1000 parts contain 926.4 of water ; albumen 61, fibrin 4.2, muriate of soda 6.1, carbonate of soda 1.8, a fraction of phosphate of lime, magnesia, and carbonate of lime.

16. *Remarks on Lymphatic Absorption.*

It does appear quite incredible, that physiologists should ever have suffered themselves to have been so deceived as they seem to have been, in ascribing functions to the lymphatics, which it is impossible they ever could have sustained. In order to perform every task imposed on them, they need not only to possess intelligence to be the "modellers of the form of the body while growing," of Mr. Hunter, but the maxillary strength of the ship-worm. They have been said to carry back from all the extreme points of the system the excrementitious substances ; also the matter of tumors, extravasated blood, bile, substances of an acrid kind from the intestines, and skin, such as mercury and cantharides ; also, exhalations into serous cavities, pus from every part of the body, and even to "nibble" away calculi and bones. These must be very imposing burthens for such delicate vessels, especially to transmit such gross substances through their fine wrought ganglia. Neither of these substances have been detected in the lymphatics, nor any other foreign substances, which had passed by their mouths ; and indeed it has never been shown that they have mouths suited to such voraciousness.

The same mistaken views which led to these absurd references, left the liver almost useless, except the secretion of a little bile, which might have been performed by an organ not larger than the pancreas. It might have been supposed that nature had mistook her purpose in forming the liver, and that it served only as a deposit of malignant humors, and the focus of almost all diseases. This organ has been much abused by such views; for post-mortem examinations show it to be comparatively but rarely diseased; and it has been robbed of its rightful office as an important assimilatory organ, one that modifies all the absorptions passing the portal circulation for nutrition.

The origin of the lymphatics, so far as they have been detected, is not on the surface of the body, nor from the internal membranes, but in the most intimate tissues, especially the white or albuminous textures. Mercury injected into the cellular tissue, in the dead subject, often finds its way into the lymphatics;—and when the trunks of these fine vessels are tied, there is no accumulation of serum in the serous sacs. We have some right to infer they originate, not only from the intervening cellular tissues, but from the nutritive, and filiform tissues also. They absorb and bring back to the common centre of circulation, certain albuminous substances, again to pass the process of aeration in the lungs, to commingle with the common mass, and to serve the purposes of nutrition. So the red veins and the lymphatics each, should be considered as independent series of veins; the lymphatics to transmit small quantities of white blood, whilst the red veins convey large quantities of colored blood, with certain other gross materials in suspension.

Whilst it has been insisted by some, that the absorbent systems, especially the lymphatics, are extremely active and devour much, others have supposed they keep a slow and steady motion, that they can scarcely be interrupted, neither retarded nor accelerated. Both these views are erroneous.

When not disturbed their function is very steady, and they never can be accelerated like the arteries. The lymphatics are probably less easily disturbed in their function than the veins. Yet their functions are often interrupted by the causes of disease ; we see the external veins do not fill, but remain flaccid and pale. This deficiency of absorption may be more or less injurious, on account of the large mass of central circulation not being supplied.

We say then the functions of the lymphatics are not very easily disturbed ; they continue action to a very considerable extent, oftentimes, when the functions of other tissues are injured by disease, or as we might say in fevers. So it often happens that in such cases the digestion is spoiled, the lacteals transmit no chyle, and yet the lymphatics may be free and transmit to the centre of circulation considerable of nutritious substances from the nutritive, and albuminous tissues. By their agency, then, the blood is partially replenished with nutrimental substances, although obtained from the resources of the system, instead of from external absorption.

Causes which produce a state of incompatible tonicity, and contraction of absorbing surfaces, embarrass the free action of the absorbents of every kind. And, again, whatever excites a turgescence, or plethora, has the effect of compressing the absorbing radicles, and impeding their action. It surely is an important indication to excite the absorbent actions. Tumors are seen to disappear in the dead body that could not be removed by any series of absorbents during life, when morbid tonicity existed. Intumescences can never be removed until the absorbing processes gain the ascendancy.

SECTION XII.

CALORIFICATION.

The subject of animal heat has purposely been delayed, until having gone through with what seemed necessary to be noticed on all the exhaling and absorbing tissues; supposing it might then be shorter explained, and better understood. But considering what has already been intimated, our remarks will be brief.

The organic movements could not be sustained without a certain amount of caloric, to render the solids pliable and mobile, and keep up the fluidity of the blood; neither could the play of the vital aura be sustained without it. This could not well be effected by external warmth, even in an atmosphere of higher temperature, for animal bodies are bad conductors of caloric; therefore, their economy is wisely such, that it is evolved by the several processes going forward in the internal tissues.

Although different species of animals possess different degrees of temperature, yet each species has a strong tendency to retain their own particular amount of internal warmth. The degree of internal heat seldom varies, notwithstanding the external may be very different, except in certain conditions of disease. The human economy requires about 98° Fah., but it would accumulate to a morbid point to be constantly in an atmosphere of that degree, were there not some provisions to conduct it off. In ordinary health it is found that an atmosphere of about from 60° to 65° Fah., keeps up an equilibrity; so that, as the system tends to a surplusage of caloric, this lower temperature about balances the excess.

Suppose a person to remain in an atmosphere of 98°, and to have sweats; the evaporation of the humidity, by being turned into a gaseous form, absorbs caloric from the surface; so the body is cooled. But, this may not be the only cause that intervenes to counteract an intolerable increase of caloric. Such a state enfeebles the nervous force, and the organic actions are diminished, by which circumstance there is not so much caloric set at liberty in the tissues, from a latent state. Some subjects are cold in the hot season of the year. So certain states of disease impairing nervous force, are attended with coldness. Again, there is not so large a proportion of oxygen in a warm, as in a cold atmosphere; and further, the pulmonary tissue partakes of the common inability, and may not take in so large a proportion of this active stimulus of organic tissues. These, and perhaps other circumstances are constantly present to counteract an intolerable excess of caloric. In the reverse, suppose a person in an atmosphere several degrees below 65°, without much evaporation, yet receiving the tonic influence of cold, he would retain the common temperature of body, especially when in exercise.

It is doubtful whether there is a larger proportion of caloric evolved in the lungs than in the other internal tissues; unless their great vascularity, and activity of function give occasion to it. Many cases are presented like one of Graves and Stoke, by the Dublin Reports, of extensive tubercular disease of the lungs, with only 14 respirations in a minute, and pulse 126, yet having much heat. The vascular action of the tissues generally, and of the lungs in particular, were intense without the usual supply of oxygen by the lungs; yet it might be supplied by other tissues; notwithstanding, the tissue may suffer great stimulations in the absence of the usual supply of oxygen. So it is with all other organs beside the lungs; for caloric is most abundant in such tissues as possess most blood, and have most functional exercise; and by increasing such actions, there will be a proportional increase of free caloric. Although the lungs admit oxygen, the most powerful excitations for the evolution of caloric are in the tissues; and the lungs act as ventilators, and eliminate its excess.

If these positions are just, we may conceive that caloric is evolved in every tissue in the system, but in some more than in others; and that it may be increased or diminished by numerous contingencies. But, these are secondary circumstances, and in a physiological view, it might be inquired, what agency organized beings possess over all other bodies in nature, to conduct all these processes with such astonishing exactness, whilst being counteracted by numerous obstacles?

We must answer by again making reference to the inexplicable properties of the vital force; a power ordained to control, within definite limits, all organic functions. Its *quo modo* may be said to be inexplicable; yet we may mark many of its phenomena. In the most intimate tissues there are continual mutations going on, combinations and decompositions, which may be said to be of a physical character. There are not only visible and tangible elements in circulation, but many kinds of gaseous bodies freely passing and repassing, without knocking for admittance, or taking a formal leave. But, it must be noticed, that whilst within the precincts of the living tissues, they have to act a subordinate part to what they might in the alembic of the chemist. In the tissues, whether combined with fluids or otherwise, they give stimulations, and the responding movements are by vital solids, not as from inert physical bodies. Motion in physical bodies extricates caloric, but far more freely, and in an inexplicable manner from vital tissues. In disease attended with free action, tissues are in an exalted state, and impressed by more than ordinary stimulations; so more caloric is set free, and heat abounds.

Caloric is unequally distributed in the system in health; whilst the internal heat may be 98° Fah., the surface and extremities may not be more than 50°, or even less in a cold atmosphere. In many pyrectic diseases of the dynamic character, the internal heat may be 102° or more, whilst the surface and extremities may be about 60°. Such organs as the disease impresses more emphatically may have an ardent heat, whilst other organs are diminished below the standard of health.

All these modifications arise from an excess or diminution of vital action in the capillary tissues.

We may conceive, according to the laws of chemistry, that every act of nutrition, by which fluid bodies pass to the solid, and especially in which gaseous bodies take the solid form, that caloric is given off in a free state to warm the tissues. In living systems these changes are constant and impressive, though not always of the same amount. Finally, we may sum up all that appears necessary to be said at present, or the chief we are able to say on this profound subject, by suggesting; that, the physical chemistry of organized bodies is subordinate to the vital chemistry; and that, the unperverted instinctive sensibilities direct the organic movements, in relation to caloric also, in the best manner to sustain the well-being of the united organism. Notwithstanding, all these salutary processes may be intercepted and perverted by overwhelming circumstances, and the very conservative principles of life and health, may administer to its destruction in the condition of grave disease.

However, when injurious contingencies are not in excess, we discover the same conservative principle in activity, in avoiding an excess of heat from external circumstances, that exists in avoiding an excess of fluids and gases by absorption. So a subject exposed to an overheated atmosphere suffers but little alteration of internal heat. The dermoid and pulmonary exhalations eliminate much of it. It should also be had in mind, that the human body is a bad conductor of caloric. The surface may be much heated, without suddenly affecting the internal temperature. The excess of stimulations, also, diminish the energy of vital actions which are necessary for the evolution of caloric.

ADDENDA.

In studying to be concise, we are aware that our physiological notices have been too brief. If we had intended to have exhibited a full view of physiology, many topics would have engaged attention that are now omitted, and indeed more extensive illustrations given on subjects now merely descanted on. From many omitted subjects we select the article of sleep, which seems to require a little attention by way of addenda.

On Sleep.

The phenomena of sleep are familiar to every one. It consists in a cessation of the functions of the superadded, or spino-encephalic organs. The external sensitive organs are dormant; muscular motion is quiescent; there is no perception of ideas, and the intellectual faculties are at rest. This is the condition of easy and natural sleep, when there is no corporeal incitation nor inquietude of mind.

All those organs which have relation to external objects, and internal reflections, depend on the nervous susceptibility for their ability of action, and these are the organs which become fatigued, insensible and quiescent in sleep. It is a law of the cerebral masses and their prolongations, the nerves, that their susceptibility becomes exhausted by thought, exercise, and various other incitations. The infant sleeps half its time, and the adult one third, or perhaps one fourth of his time. This, however, depends much on temperaments and habit.

The efficient and proximate causes of sleep have been exciting questions amongst metaphysicians, and Professor Stuart expressly says, "the investigation is beyond the reach of the human faculties." We approach this subject with the humble belief, that the mystery is capable of being revealed, and even so by the suggestions already made. We need have reference to one law of the animal economy which seems well agreed on; which is, that the energy of the nerves of external relation is rather quickly exhausted when the organs they are distributed to have been exercised for some length of time, or severely exercised for only a short time, or if stimulations of thought have been severe and protracted. Grief disposes to sleep; and criminals usually sleep the night before execution. The same phenomena appear from high internal stimulations by which the functions of these organs have been forced. Cullen styled it a state of collapse; Brown considered it an exhaustion of excitability, Darwin called it a state of diminution of sensorial power. The late anatomical discriminations of the nervous functions explain more fully the phenomena of sleep.

The functions above alluded to may all be quiescent, whilst the nutritive nerves and their functions continue their office. Nutrition continues during sleep and perhaps more perfectly than during the hours of wakefulness, whilst there is not so intense a state of perturbed excitation in the nutritive tissues. This placid train of vascular circulation is most congenial to the delicate process of nutrition, and the subject arises from sleep not only invigorated in intellect, but with increased strength and appetite. The ordinary exhaustion of nervous force gives occasion to a mild congestive state in the brain, which renders sleep the more profound. The congestive state may be rendered more complete by the use of narcotics, but every increase in this manner induces, more or less of a morbid state of sleep, approaching to coma. Such sleep is not refreshing, and when the subject awakes he is dull of intellect, and sluggish in motion, because the congestive state in part remains, being increased by the medicament.

We have assumed the thesis, that, in natural and easy sleep, all the intellectual faculties and operations are at rest as well as sensation and locomotion. This is in strict analogy with all other phenomena of the nervous system of external relation. The internal faculties are computed by some to be five, perception, reason, judgment, imagination and memory. If any wish to put down five others we will contend they are all dormant in the article of natural and easy sleep.

If these faculties or internal senses are dormant, there can be no intellectual operations, no exercise of them in the act of thinking. The negative of this is gratuitously assumed by some, who contend that the mind never ceases thinking, although they have no evidence that they do think. Mr Locke seems to have argued fairly and unanswerably, as well as quaintly, when he says, "If I think when I know it not, no body else can know it." So we conclude there is no evidence of the intellectual operations being in play during easy sleep.

It is a physiological fact of the highest interest, that all the nutritive functions may proceed in a great degree of perfection when deprived of the brain, and its most important appendages, as in acephalous infants, and indeed in the embryo in the first months of gestation. In apoplexy the whole of the organs of external relation are paralyzed. The diseases affecting the organs supplied by the two systems are of different characters, attended with diversified phenomena as may hereafter be more fully illustrated, and which are partly indicated in the nosography.

There are different degrees of soundness of sleep in different subjects, and at different times. Some may be roused from their slumberings much easier than others. In all conditions of predisposition to disease of the congestive kind, and especially when preceded by fatigue and cold, the sleep will be very profound, and may approach towards coma. But, when the vascular system approaches a state of irritation, and yet free from congestion, there may be a protracted watchfulness, and sleep will be foreign from the subject. So slight stimuli produce watchfulness, as tea, small quantities of alcohol and opium. But if taken in such quantities as to exhaust the vital force and produce a congestive state, they induce sleep, which, however, is liable to be of a morbid kind. For the purpose of keeping up a state of wakefulness in cases of necessity, the stimuli should be in very small quantities, and not very often repeated. Moderate emotions and passions excite to watchfulness, but when severe they produce exhaustion, followed by a congestive state, with sleep. Thus the loss of a small purse of money may keep a person awake, whilst a great calamity is usually followed by sleep.

For the purpose of enjoying refreshing sleep on ordinary occasions, the body should repose in an easy position, the health should be perfect, and the conscience not burthened with crime, nor the mind with inquietude; for it is said of sleep,

> Swift on his downy pinions flies from wo,
> And lights on lids unsullied with a tear.

The exercises of thought and motion, in the mass of mankind, exhaust the vital force of the nerves of external relation in twelve or eighteen hours, so that sleep spontaneously occurs, and often irresistibly. The night conduces to repose from the absence of light, noise, and many other excitations. The periods of sleep become more fixed by habit.

Vital Quietus; or, Entasia Acrotismus, of Good.

Although this topic may partake more of the pathological than physiological aspect, yet it is here introduced as a contrast to the quietus of the organs of external relation in sleep; and thereby demonstrating, that there may be a quietus of the nervous energy of internal relation, whilst the organs of external relation are active. Sleep makes a near approach to the pathological state, yet it appears periodically, whilst acrotismus arises accidentally.

This state cannot be considered as asphyxia, for common usage has applied this to failures in both the nervous systems. Acrotismus implies an absence of pulsatory action, with collateral inability of vital actions, whilst the nervous energy of external relation remains free.

This state has some resemblance to the incubus, or *ephialtes nocturnus et diurnus*; still it is different, for this is connected with a spastic sternalgia, the internal involuntary muscles are affected, and it suddenly disappears. In acrotismus there seems to be an impress on the semilunar, and indeed on all the internal ganglia and plexuses. Their functions are diminished, suspended, and often fatally extinguished. It may be styled a ganglial apoplexy.

A temporary suspension of these functions occurs in syncopy; it is often more persistive in a condition called trance; and there are too many well attested cases of apparent death, and actual interments, to be denied or made light of. In these cases consciousness often remains, but the individual is disenabled in locomotion and vocal expression. In another grade of it, speech is measurably free, together with the intellectual faculties. In the noted case of acrotismus of John Hunter, as related by Sir E. Home, which continued nearly an hour; he could, by a voluntary effort, speak, and was all the time conscious of what passed, whilst there was an entire cessation of cardiac action. "There was a suspension of the most material involuntary actions; even involuntary breathing was stopped; whilst sensation, with its consequences, as thinking and acting, with the will, were perfect, and all the voluntary actions were as strong as before." From the history of this case we may infer its connexion with sternalgia, affecting the muscles more than the ganglia. Many other cases are on record.

We will now refer more particularly to those conditions connected with impressions on the ganglial system. We have witnessed many similar states of the system, and especially at the attack of what have been styled malignant fevers, particularly of that form vulgarly called spotted fever, and in dysentery, in which some recovered, but far more proved fatal. There comes on a gradual diminution of the force of the cardiac action; and in an hour or two, perhaps all pulsatory and cardiac action cease. For an hour or two after their apparently entire cessation, the subjects sometimes converse rationally in a low and hesitating manner, often closing their eyes in gentle slumbers, and apparently without pain, except a slight precordial distress, with occasional sighing. In some instances, however, there is more distress. The countenance is only slightly pale, and the general aspect resembling a person falling into a placid sleep, whilst even in the article of death. After eternal rest has seized the subject, for many hours, the body more resembles a state of quiet sleep, than an ordinary cadaver.

We have seen cases of simple fever terminate, especially in cold seasons, in a very similar manner in enervated subjects, and after several days continuance, apparently from a concentration of morbid force on the origins of the trisplanchnic system of nerves. Do not many of the sudden deaths, called cerebral apoplexy, occurring in aged and enfeebled people, arise in a similar manner?

Surely these may be styled morbid contingencies, yet they show the independence as well as the mutual relations of the two great systems of nervous force.

There are many attested cases of revivification from trances, as we have witnessed in acrotismus. The rigid state of the internal tissues, which generally exist at the attack of disease, (Sect. xviii. 4,) may at length become relaxed ; at least so far that the vegetative, or first grade of vitality, may effect absorption sufficient to remove the congestive state oppressing the ganglia and plexuses, so that their lost functions may be restored.

Dreaming.

This too might be called a pathological state, for it stands opposed to easy and natural sleep ; it is an imperfect sleep. Whilst in the former all the functions of external relation repose in an easy quietus, in the latter condition, only a part are dormant, whilst the rest are awake, and perform incongruous motions and disjointed associations.

The phenomena of dreaming go far to establish a plurality and independence of functions in the internal senses, as we know exist in the external. It has been demonstrated that some of these may be obscured, whilst others are active, so we infer the same of the internal under particular circumstances. Again, as some of the external senses are less profound in sleep than others, as hearing and sight, so of the internal. Imagination is less liable to profound slumbering than reason or judgment.*

Dreaming is excited by some uneasy sensations of mind or body. Ideas are awakened but not arranged in just order ; for although associations follow, it is in a disjointed and broken manner ; they are not determined by the will, nor mar-

* It is an interesting pursuit for the philosopher, to observe the various operations of the intellectual faculties, brought into play by various incitations, giving occasion to numerous volitions and associations. Thus Darwin:

How thoughts to thoughts are linked with viewless chains,
Tribes leading tribes, and trains pursuing trains ;
With shadowy trident how volition guides,
Surge after surge, his intellectual tides ;
Or queen of sleep, imagination roves
With frantic sorrows, or delirious loves.

shalled by the judging faculties ; ideas are accidentally associated in an incoherent manner, forming caricatures, monsters, and nondescripts ; yet on a nearer approach to wakefulness become more symmetrical, and the factitious images may be brought to remembrance when awake.

The trains of excited ideas commonly have some relation to the circumstances that excite them, and such as press hard on the mind. Thus, the lover dreams of his mistress ; the miser of cash, or of thieves breaking in to steal; the recollections of the warrior are of battle and blood, whilst the sad mourner apprehends his departed friend in review before him.

The muscles in dreaming often suffer some agitations, but they are not directed to any object, because the faculty of volition is not in exercise nor under the direction of the will. Much anxiety is experienced on some occasions, when the imagination suspects an enemy close at hand, and yet unable to defend against him, or make an escape ; the subject suddenly awakes with much agitation. In these perturbed conditions of dreaming, there exists a pathological state of the respiratory muscles ; they do not act freely, but become fixed, and allow of an accumulation of blood in the heart and lungs, until the intolerable distress excites wakefulness.

DIVISION II.

PATHOLOGICAL NOTICES,

OR A

CONSIDERATION OF THE ETIOLOGY, AND CHARACTER OF DISORDERED ACTION GENERALLY.

PATHOLOGY.

SECTION XIII.

1. *Preliminary Remarks.*

Our illustrations will be conducted on the broad basis of investigations of the causes of disease, *Etiology* ; the phenomena, *Semeiotice* ; and the character of the morbid habit generally ; or more strictly *Pathology*.

The philosophy of medicine in all its relations, is of a peculiar character, and identical in its kind. It is in subordination to a force never found in purely physical matter ; but amenable to a power which presides over organized substances, and influences their movements ; alike persistive in the disturbed conditions of disease, as in the placid trains of the phenomena of health. This controlling influence is subject to various modifications from changes made in the organism by exterior circumstances, and the transition is often too easy from the normal to the disturbed state.

The phenomena of disease are so far more intense than those of health, that the sufferer, and peradventure the medical attendant, when ignorant of the structure and functions of the organism, may be led to suppose that some additional *entity* is thrust in, and that he has new forms and sensibilities within the body, which never before existed there. The natural conclusion will be that these must be removed ; and nearly the whole materia medica may be tried empirically for this purpose, and yet the suffering may still continue. This is only one of the many false views of the character of disease.

Neither does a certain assemblage of *symptoms* constitute disease. These are only the indicators of perturbed action going on in the tissues. They speak in legible terms to those who can read, and understand the language of physical impulses on vital tissues, and organs; and the responding motions excited, and displayed by an union of apparatuses, now show a discordance, which at other times were progressing in harmony. We cannot accord with the purblind views of those who say, "all physiology as far as it is hitherto known, is totally or nearly useless in explaining any thing which happens in fever." "In short, fever is a disease, the whole of the appearances of which have been in no ways accounted for." * Discouraging indeed for the long labors of the amphitheatre, and the tortures of vivisections.

Numerous have been the false views of disease, and often so entertained by whole communities, as well as individuals. Opinion has been marshalled against opinion, and of course the treatment has been as opposite as the antipodes. Public confidence has been impaired, and even personal opinion distrusted after tedious rounds of practical experience. Medical sentiments have been often neutralized, and of course made inert; or all theorizing has been abandoned, and the mutable symptoms of disease followed up as disease itself, with a blind zeal, when they are but the mere indices of their prototypes, or the injury inflicted on the organization.

In consequence of these jarring sentiments, a well grounded assurance in the treatment of disease has been weakened; the way opened for the entrance of impostures, and the science of medicine stigmatized as uncertain, visionary, and conjectural. Poor recompense indeed, for the labor and zeal of ages bestowed on that art, which Hippocrates esteemed di-

* Fordyce on Fever, pp. 18 and 20.

vine, and which was designed to relieve the distress of man, and prolong his existence.

Such views ought no longer to be tolerated by men of enlarged information, and who are in possession of the immense store of facts elicited by modern improvements, in all the collateral branches of medicine. There are materials for forming a new generalization of the principles of medical science; and there is the more need of this, since nothing efficient has been attempted for a long time past, and the labor and responsibility is so imposing, that it has been rather evaded by many most capable of undertaking the task.

In the outset, we indignantly repel the trite, sarcastic inuendos, which have so often uncourteously been cast by many; by direct allusions to theorems advanced, having been formed from lamp-light cogitations in the closet; and the bending of facts and analogies to support a favorite hypothesis. We have been inducted by another, and more hardy routine of study. And, from the full conviction of the insufficiency of every generalization hitherto attempted, have re-explored the chartless empire of medicine; and wishing to save it from the quicksands of empiricism, have made many comparisons in the open air, in the dissecting room, and at "the bed-side of the sick." Having a few incontrovertible data, as polar stars in view, we have *endeavored* to form inductions, which will not readily be dissipated by the fire of experiment. If the arrangement is new, it is supported by facts not altogether novel.

If we are not able on all occasions to offer a satisfactory explanation of every phenomenon of disease; yet, it is possible the outlines of a system may be designated, which, if it be not perfect, still may not be false.

2. *Expositions.*

The excellency of Sir I. Newton's improvements in physics, does not consist in having discovered the principle of attraction inherent in inert matter, but in having shown that attraction *acts directly in proportion to the mass of matter, and inversely as the distances.* Is it not possible to offer a clew, which may lead to an unfolding of the laws of organic life upon an axiom almost equally simple in character and construction, and which may serve as a guide to the pathologist, through the intricacies of his researches in relation to disease?

The vital force responds directly in proportion to the integrity of the organization, and is equivalent to the compatible or incompatible range of stimulations applied. The *integrity* of the organization is supposed complete in the physiological state. In this condition *compatible* stimulations produce normal actions. Suppose the *integrity* of the organization to be injured by excess of sensibility, and at the same time exposed to excessive, or incompatible excitations; there will then be abnormal movements, productive of pathological phenomena. And, even compatible stimulations will show similar phenomena, but perhaps of a lower grade.

An embarrassment arises from the fact, that the vital force is not fixed in the tissues of a constant amount, as attraction is to physical bodies; it is diminished or increased, as the organization may be impaired. It may be injured in a manner to produce very exalted, or elevated phenomena; or, in a manner to show enfeebled phenomena, below the normal grade. Its intensity of attachment to organization, is therefore, always conditional.

In all our investigations, therefore, into the laws of the vital movements in disease, regard should be had to the amount of vital force existing at the time, and the ability of the organization to maintain it. The degrees of divergence from the normal state should be carefully noted, and the facility and correctness of doing this will be learned by diligent observation and experience. The degrees of divergence may be sufficiently ascertained for all practical purposes, but never with geometrical exactness.

Very important inquiries may follow, for the purpose of ascertaining what intervening circumstances may have altered the state of the tissues, and modified the vital susceptibilities; and, also, in relation to the most suitable method of restoring the natural exercise of the functions. If it should after all, be suggested, that medicine is not one of the exact sciences, it might be replied, that the rule is as exact as any in Euclid, even if we are not able to estimate or measure the pathological aberrations, which may be present, except in a comparative manner by the judgment.

Our investigations will be directed by an attempt to develop the entire character of the diseased habit, and to expose the several relations which combine together the different tissues, organs, and fluids in a unity of perverted impulses; believing as we do, that mere pathological results of diseases, as discovered by autopsical inspections, and as lately practised by many, are of but little utility, when disconnected with the accompanying pathological phenomena, and antecedent causes, which excited the perturbed movements, producing such results.

SECTION XIV.

1. *What is Disease?*

A QUESTION easily asked; and without much reflection, it might be supposed to admit of a ready and laconic answer. Yet, there is scarcely an interrogatory in the whole round of science more difficult to answer in a lucid and satisfactory manner. If, in all our researches and illustrations, we can expose the character of the diseased habit, and make it familiar by its simplicity, and, also, disrobe it of its numerous false garbs, we shall have attained the full extent of our endeavors.

All that we have hitherto advanced, has been intended to form a basis, and point the way for a review of the numerous contingencies, which excite a new train of phenomena, manifesting lesions done to the vital susceptibilities, and to the tissues under their influence.

We speak of *disease*, in the singular number; and yet every nomenclature affixed to medical systems, is loaded with terms and definitions of many hundred diseases; and, indeed, it is necessary so to be. Although the morbid habit has many things in common, and sufficiently so, that we can contemplate the perturbed condition of disease in gross, yet it admits of various modifications in the different diatheses attending it, and the numerous locations of particular diseases in different tissues, and organs. All these are varied manifestations of the diseased habit, and require specifications; otherwise medical language would be altogether unintelligible.

A location of disease in the head requires some symbolic term to distinguish it from a location in the thorax. The misfortune attending nosographic catalogues, is, an attempt to isolate disease, and define the character of the diathesis by an assemblage of symptoms in connection, and affix it to the nominal distinction of the disease, as having a local origion, and isolated state. This is incompatible with just pathology, and on this account all nosographies have received merited censure, but ought not to be expunged. The short expositions ought not to be received as illustrating the entire character of the disease, but only the peculiar characteristics, and as emanations or phenomena of a common diseased habit.

Perhaps our language, when speaking of the common morbid habit, and the different locations emanating from it, may be unintelligible to some, and especially to those, who suppose disease very uniformly to originate at some particular point of irritation, and to radiate over the tissues. This subject will receive ample discussion in a separate section, in due time, and it is hoped, in a manner to convince and satisfy.

2. *Definition.*

With respect to a short definition of disease generally, or the morbid habit, we might say, that it consists in a manifestation of a series of phenomena, indicative of the repulsive powers of the instinctive energies of the living system. The phenomena are correct indicators of the existence of an abnormal state, and that the internal organs are suffering changes, which tend to alter their functions, and destroy their structural integrity. The history of the phenomena of disease in general will be attended to in due time.

These phenomena are not always identically the same in kind, or in degree, nor do they always appear of the same number at the beginning, in different cases ; yet enough are always present to convince the subject afflicted, of experiencing *bad ease*, as the word *disease* strictly implies. If not directly attended with pain, yet there will be an uneasiness ; and various phenomena are more or less present, indicating a general excited, perverted, and perturbed action in the system, with an altered state of function of some organs or tissues, in some or many parts of the system. Or, on some occasions, there will be an inability of functional exercise of organs at the commencement ; but, most commonly after existing only a short time, the phenomena all indicate a state of elevated movement, above the ordinary physiological grade.

3. *Remarks.*

The common morbid habit may exist for a short time before it manifests any very severe disturbance of any particular organ. When this does take place, however, many other phenomena are developed, and with greater intensity and precision, and the affection now receives its cognominal appellation. However, this assemblage of symptoms furnishing a particular name is not the whole of the disease, for this previously existed in the entire habit, and still exists after a location may be formed ; although a superficial inspection might incline an unwary observer to think the whole of the disease to be in the part, because he discovers not only pain and redness, but perhaps, a tumefaction of the part, with other occasional local phenomena. The same observations apply to internal affections.

There being many phenomena constantly present of a similar aspect or affinity, in almost every habit of disease, and certain physiological changes so uniformly connected with them, that some pathologists have contended for a *unity* of disease ; by this, meaning that all diseases consist of similar physiological changes at their commencement, although of very different degrees of intensity, by whatever cause excited ; and that the mode of treatment admits of much uniformity at the onset. It is also suggested, that the various aspects of diseased action at the beginning, are mere modifications, varied by the intensity of the causes, by the different conditions of predisposition, of temperaments, season, climate, and the sensibility of the different tissues locally affected, &c. And further, that as disease may have progressed, and new changes or morbid alterations taken place in the tissues, with other phenomena, so the treatment may need to be modified also.

Many pathologists, besides Dr Rush, have noticed a close affinity in diseases, or a strong relationship existing, and running through the whole of the morbid nomenclature, but have not been able to form a system of generalization on account of certain false dogmas, which in their minds demand precedence. Even so late a writer as Dr Southwood Smith seems to have unconsciously espoused the sentiment as relates to fevers, and comes very near admitting it in all inflammations, upon observing so "close," and "constant connexion between them." "Supposing the proofs hereafter to be adduced to be conclusive, that the events in fever and their order really are what has now been stated, how clearly and beautifully does this view of the disease enable us to recognize one and the same malady through all the modifications it undergoes, and therefore through the countless aspects it assumes." *

This thesis appears to be supported by too striking facts and analogy, to be hastily rejected, and yet it admits only of conditional assent. We do not implicitly admit, or reject it at present, but defer any further notices, until we have more thoroughly explored the mysteries of the morbid habit, and the circumstances inducing it.

It would be desirable to investigate the morbid habit, according to the succession of cause and sequence; and this course will be pursued as far as appears practicable. Yet, there are so many contravening circumstances, and mutual dependencies, that it is difficult to decide where to begin, and how to follow up the impulsive and repulsive movements to the best advantage. However, we will in the first place, notice some things very much in common.

* Treatise on Fever, p. 65, Am. Ed.

SECTION XV.

SOLIDS AND FLUIDS.

1. *Does Disease primarily exist in the Solids, or in the Fluids?*

ALTHOUGH the human system consists of dissimilar parts, yet it is a composition of apparatuses operating in unison, to effect ultimate designs of congenial character. All its parts therefore act in harmony, and with a unity of design both in its physiological and pathological conditions. Every component part is endowed with a vital impressibility of a certain grade, and every part may suffer injury by hurtful impressions; and again every part may become excited to repel them. It has been shown that the blood, and even other animal fluids possess a certain grade of vitality, and of course, are liable to suffer as well by the causes, as in the conflict of disease.

The contentions of the *solidists* and *humoralists* have served only as obstacles to the improvement of medical science. A great waste of time and labor has been made. It is quite immaterial in a practical point of view, whether noxious impressions directly affect the susceptible tissues, or whether they are admitted by absorption into the circulation, and affect the blood and the same tissues by their interna stimulations. Very similar phenomena will arise indicating the most suitable treatment in the one instance as in the other, and all manifesting lesions done to the vital economy. Neither can the phenomena be very dissimilar; for an injury is experienced in both solids and fluids very soon alike. The morbid condition of the fluids is in an exact ratio to that of the solids, for they suffer changes directly, if not primarily. On the other hand, suppose the fluids first to suffer change, then their unnatural stimulations immediately change the condition of the solids, and in either event there arises a perverted state of functional exercise, constituting the morbid habit. Notwithstanding, it is quite evident, that the noxious impressions are commonly first made on the vital tissues.

Let us suppose the ordinary means of replenishing the vascular system to be too abundant, by which a state of hyperæmia, or plethora, may be produced ; and as a consequence, the freedom of vascular action, and circulation, becomes impaired. This condition when once formed, will strongly resemble that disparity which is often produced by the contraction and condensation of the vascular tissues, by the stimulations of the external causes of disease. The diminution of the calibres of vessels produces a relative hyperæmia ; and the phenomena in either event are very similar, except in the one case it may be produced slowly, and in the other suddenly.

The solids make an impression on the fluids, yet not as inert bodies mechanically impress physical bodies ; but, by all the inexplicable attributes of vital force ; and this force is exerted on vital fluids also. The impulse and reaction are mutual, and in health harmonious. But, let either become altered, the vital impulsions will become changed, and the secretions, nutritions, and indeed every vital process, must suffer alterations also. We have much evidence which might command our credence, that morbid alterations in the tissues are more permanent, and not so readily restored as alterations in the fluids. The latter are more changeable than the former ; they can be evacuated, and the vessels replenished with other fluids in a short time, whilst changes in the solids must be more slowly produced. This remark applies more especially to confirmed habits of disease ; for, in the incipient stages the morbid movements of the solids can be more readily regulated, before there are any structural changes.

2. *Solids most to be regarded in Disease.*

That the movements of the solids are more to be regarded than the condition of the fluids, in the treatment of disease, can hardly be doubted; since the motory powers reside in them, and these powers claim attention in proportion as they possess higher conditions of motivity than ever can appertain to the fluids. This circumstance being constantly apparent in the phenomena, has led to the so common reception of the views in relation to modern solidism, to the almost entire exclusion of the participation of the fluids in the phenomena and treatment of disease. With respect to the inquiry, whether the causes of disease act primarily on the solids, or on the fluids, it might be briefly answered, that disordered action may be excited both ways. Yet it may be noticed, that as the solids possess a higher degree of vital susceptibility, so they are more exposed to hurtful agents, and are far sooner, and much oftener excited to perturbed movements, than the fluids are to lesions. It is in the tissues, then, that we chiefly notice disordered action, and to which the treatment must essentially be directed.

3. *The Humoralists and Limitarians.*

The opinions that very generally occupied the attention of the faculty before the time of Hoffman and Cullen, of disease being caused by a peccant state of the fluids, and the means used for its correction, have had an unfavorable influence on the improvement of therapeutics. They considered that the disease, or febrile state, was necessary to alter or concoct the condition of the fluids, and prepare them for expulsion. So the physician had little to do, but chiefly to look on, and watch the hoped for crisis. The modern views of the solidists, who adhere to the notions of self-limited diseases, are alike unfortunate for letting pass the precious opportunity of rendering timely and efficient aid. The expectant treatment is alike reprehensible in both instances; whilst a correct knowledge of the morbid economy cannot fail to excite the energies of the intelligent and conscientious practitioner to use means to modify, or to intercept the perturbed actions of the vital tissues, before organic lesions take place, and thereby render the morbid state both shorter and safer.

4. *Remarks on the Virus of Contagions.*

How does the virus of contagion, diffused in the atmosphere, find access into the system and excite disease? It is highly probable by being absorbed and producing an internal excitation. Let us suppose the variolus virus emanating from one subject to another. It does not come in immediate contact with nervous expansions, when absorbed, for they are everywhere covered with an epithelium. It is probably absorbed, and especially by the pulmonary tissue, or perhaps the intestinal. It now comes in contact with the absorbent veins, possessing only the first grade of vital force, as has been already illustrated. Now we find this manner of receiving the virus, is attended with much delay in showing its effects, from what occurs when the virus is applied directly to tissues with nervous expansions, as happens by inoculation, or placing the virus in contact with the dermoid nerves and capillaries. In the former case, two quarter lunations are required for the incubation of the virus, before the phenomena of disease occur; whereas in the latter they appear at about the end of one quarter lunation. We do not say the process proceeds exactly in this manner; it is suggested as an hypothesis, and merits further investigation.

However, if the suggestion should prove to be correct, the principle might be extended, and by it we might explain the fact of the virus of the viper proving so suddenly fatal when received by a wound; and also why it may often be taken into the mouth with impunity. The absorbents do not admit some deleterious substances; and, if it be true that the tissues of vegetative sensibility are not easily excited by them, we may conceive why the numerous kinds of sensible and noxious effluvia, with which the atmosphere is often loaded, so seldom produce disease. The nauseous air of the dissecting room does not produce disease, neither the touch of the putrid cadaver, unless in contact with a wound. So sedulous are the powers of the absorbent instinctive sensibility in avoiding hurtful agents, that we may infer the causes of disease most commonly to act on the nervous susceptibility; rather than through the medium of the fluids. Heat and cold as causes of disease, particularly affect the susceptible tissues; so, also, fatigue, surfeiting, mental affections, &c.

5. *Remarks on the Scorbutic Habit.*

The scurvy is a form of disease rather aside from the ordinary conditions. The most striking phenomena first appear in the fluids, or apparently so. Yet, a serious question may be raised, whether the solids have not primarily lost a large share of vital tonic power, and along with this much of sensibility also. But, as opposed to this, the disease usually rises from a fault, or deviation in the regimen. Too large a proportion of the muriate of soda may have been assumed, and without being eliminated from the blood, by the kidneys and skin, from cold, and a concurrence of other incidental causes. One proof of the scorbutic diathesis being produced by primary changes in the blood, is, that the too long use of mercury produces a very similar state, and if used in the treatment, almost certainly destroys life. Again, an alteration of the regimen, or use of vegetables, does much to remove the diathesis, or loose crasis of the blood. On the other hand, the excitation of the energies of the mind by invigorating the solids, has often cured the disease. Finally, on a comparative review, we may safely infer, that both the solids and fluids are alike in fault. The latter give unnatural stimulations, whilst the former return enfeebled oscillations.

6. *Phlogistic Diathesis.*

Opposed to the preceding crasis of the blood is that condition, which the pathologists of the preceeding century called a *lentor*, or siziness of the blood. It consists of a condensation, or increased tonic force in the tissues, as well as in the fluids, and constitutes the diathesis usually called phlogistic. It was supposed by the humoral pathologists, that this crasis of the blood existed antecedently to the manifestation of the disease, and that the *lentor* must have produced it; just as some modern pathologists say that tubercles are antecedently, somehow or another, formed accidentally, and produce phthisis. However, with respect to the *siziness*, or tonic crasis of the blood, from all the observations we have been able to make, the dynamic state of the fluids and solids progress nearly together. The changes in the blood seem to be modified, by the morbid impulse of the vascular tissues. Yet, when this state of the fluids exists, it offers serious impediments in the secerning and capillary tissues; it passes with difficulty, and is attended with many of the pernicious results in the circulation insisted on by the former pathologists.

It is very uniformly conceded, that a retention of customary secretions, for elimination, such as bile, urine, milk, menstrual purgation, &c., predispose to, and actually give origin to disease. No doubt they produce abnormal stimulations on the capillary tissues; yet it might be inquired, whether the tissues might not primarily be in fault, and occasion such retentions of the secretions? However, as soon as disease becomes manifest, the entire composition is involved in perturbed action, and morbid changes.

SECTION XVI.

SEATS OF DISEASE.

1. *Which are the Tissues and Organs most essentially affected in Disease?*

WHATEVER may be the causes of disordered action in the human economy, and whatever physiological circumstances may contribute to produce and modify the existing phenomena, we discover some traits in common to them all. One of these is, that every form of disease has a seat of concentration in some tissue, where its most essential character is discovered; in other words, every form of disease is chiefly manifested by some kind of local affection. We cannot in this section make any inquiry what the effects may be on the general habit, by the local condition affecting tissues of different grades of sensibility; nor, whether the local affection may be esteemed the cause or sequence of the morbid habit. We shall then be confined to the fact of the existence of local affections, and to an inquiry which those tissues are, and what pathological divisions they may admit of.

The phenomena and intrinsic character of disease appear to be essentially varied by the sensibility, and difference of structures of the tissues affected; and as the sensibility depends on the amount of nervous matter, and vital vegetative force bestowed on them, we may make some references to the physiological divisions already detailed, as the rule of the divisions of their morbid states. The tissues then may admit of three primary divisions of liability to morbid excitation.

1st. The primitive tissues endowed with irritability, or vegetative sensibility.

2d. The tissues and organs endowed also with the ganglionic visceral, or nutritive sensibility.

3d. The nervous tissues of external relation.

Each of these grades requires some particular notices.

2. 1*st*, *Morbid Susceptibility of Simple Vegetative Tissues.*

As respects an isolated state of disease exclusively in the simple primitive tissues, we have only to say, that so far as evidence extends, we may suppose it to be quite simple, and as presenting only a few phenomena, and these rather mild. We have but little evidence of the embryotic state, before the development of nerves, being attended with disease. The accidents it may meet with are rather of a mechanical kind. However, we are well persuaded, that in the more advanced state, and after the full development of the nervous tissues, those parts possessing the least vital susceptibility, are the least subject to disease, and often suffer extensive lesions without being attended with high morbid excitations. The cellular tissue, veins, and parenchyma of organs might be mentioned as examples. But, the nervous systems of both external and internal relation are so generally diffused, and interwoven in human tissues, it is difficult to make precise discriminations.

We might make reference to animals of the lowest order, without nervous tissues, as proofs of a low grade of sensibility, and suffering but little from injuries done to their textures. They may be mutilated and the limbs restored; some when cut into pieces, vegetate, and become perfect animals; others even live a long time when decapitated. Indeed they scarcely suffer disease in a manifest manner. Yet we may suppose the human tissues of simple irritability possess a higher sensibility than that of the lowest order of animals, or of vegetables, when it may be of a similar kind. Even the hair and nails may assume a high grade of sensibility, and admit of vivid radiations to the centre of perception.

It is in association with the nerves of the nutritive or instinctive sensibility, that the simple solids endowed with the first grade of vital force, show their co-operating influence; and these next claim some attention.

3. *2d, The Morbid Condition of Tissues, and Organs, endowed with the Ganglionic, Visceral, or Nutritive Sensibility.*

These tissues and organs possess a sensibility peculiar in itself, and suited to the apparatuses of its endowment. By this property the organs become associated in a harmony of function, and their movements are steadily performed, and essentially independent of other modifying influences, both in health and in disease.

These tissues and organs, in connection with the vegetative tissues, compose the principal part of the human system. It will be the shortest to say, they compose the entire corporeal system, except the spino-encephalic masses and their prolongations, the nerves. It is, however, to be kept in mind, that the respiratory nerves form a part of the nutritive system. Although the nerves of sensation are distributed in most of the tissues, more or less, they have but little agency in the processes of nutrition, or the repulsive processes in disease. Their office is to transmit sensations, and excite muscular contractions. They often notify the intellect of injuries inflicted, when they have taken no part in the annoyance. It should be remembered, that the vascular tissues of the nutrient system penetrate, and entwine the nervous system of external relation, not only in the minutest nervous prolongations, but throughout the entire encephalic masses, and thereby afford many modifying impulses to these nerves of external relation.

It may now be remarked, that most of the physical agents and impulses, that act on the system, altering the organic movements, and producing disease, do so by impressions on the instinctive susceptibility of the organs of nutrition, and in co-operation with the vegetative vital force. It is conceded that mental influences affect or modify the organic movements in a more or less permanent manner. But, these influences all act as causes, and if accessory to the production of permanent disease, always effect some change in the functions of the nutritive structures. Neither does pain excite permanent disease, although it may excite present commotion. In the instance of wounds, the pain arising from the lesion of the nerves of sensation soon subsides ; but, it may return, if the phenomena of disease afterwards arise in the organic tissues, from their own susceptibility. These subjects can only be intimated in this place.

Impressions then on the involuntary organs and tissues, excite the commotions in their functions, which produce the phenomena of disease. These are of two kinds ; the one having reference to the constitutional state of disease, the other to the amount of injury done locally to the organs ; and these phenomena assist, and unite in showing the whole amount of the morbid condition that exists. The organic tissues in their high state of excitation, assume an elevated state of sensibility, which transmits to the centre of perception some tokens of the degree of injury done them.

And, again, the high state of sensibility of the nervous tissues of external relation, radiates a sort of reflex action over the entire system, by a kind of consentaneous harmony, usually called sympathy, which is often productive of many anomalous, or fugitive symptoms, termed nervous, and yet forming no part of the idiopathic affection. On many occasions, and especially at the commencement of acute disease, both these series of nervous tissues suffer a diminution of sensibility, from changes produced in the simple tissues.

All the varied modifications of pyrectic diseases ; all the phlegmasiæ internally, or externally, acute or chronic ; and finally, all affections producing cardiac, or capillary excitations have their seats in these nutritive tissues and organs. Nor need we except what has been styled mental diseases, or affections perverting the functions of the organs of intellect. For, the vascular tissues traversing, and entwining the nervous expansions, and cerebral organs, derange their functions, when in a state of excitation. Again, all comatose, paralytic, and spasmodic affections have their seats in the morbid conditions of the capillary vessels traversing the nervous tissues of external relation ; and these capillary tissues are a part of the involuntary nutrient system of organs.

We see by these expositions, that the abnormal movements of disease are independent of any acts of volition ; that they rise, progress, and terminate by a series of impulses and vital actions depending chiefly on foreign exciting agents, the lesions produced, and the movements continued by the instinctive, repulsive sensibility of the organization. In these conflicts the organs are liable to suffer immensely, and traces of their spoliation may be discovered by post mortem inspections ; or oftentimes by a train of sequences in the living subjects.

A knowledge of the seats of morbid impressions in different tissues, and organs, forms a basis for arranging by affinity, the various modifications of disease ; and this is the only method to form a useful, and physiological nosography. These local affections then of the involuntary tissues, either external or internal, admit of various subdivisions into orders, and genera, so as to embrace all necessary distinctive appellations, and yet without being encumbered with an overwhelming mass of detailed specifications.

4. 3*d*, *Lesions affecting the Nervous Tissues of External Relation.*

The illustrations already given, may lessen what we might have to express on the subject of disease being primarily seated in this tissue. So far as we can discover, there are but few affections having primary seats in the cerebral masses, or their prolongations ; and indeed, whatever lesions are found here, appear almost inseparable from influences produced by morbid states of the system of the nutritive tissues. Let us review some of these.

In the instance of apoplexy, we have no evidence of a primary change in the nervous tissue of external relation, although it manifests very imposing phenomena; there exists merely a change of function. The inability of the exercise of intellect, and of motion is sudden, and manifestly a sequence of primary lesions, in the capillary tissue of the brain, attended with congestion, or effusion. Nothing different can be shown in relation to the various paralytic affections, unless they arise from local contingencies.

The agitations in convulsions appear to be produced by impressions made at the origins of the motory nerves by the capillary arteries. In a large number of cases inspected by Dr Sanders, he found the blood vessels of the neurelema, at the origins of the motory nerves, highly injected, and manifesting appearances of an active state of vascular incitation. The same has been demonstrated by others, whilst no lesion of the nerves could otherwise be found.

It might be supposed that neuralgia would present strong claims to some lesions of structure, for little or no vascular alterations can be detected in the tissues of the nervous expansions, the seat of pain; except a temporary turgescence during the paroxysm. However, even in these cases, some pathological changes have been found at the origins of such nerves as had been affected with pain, such as vascular turgescence, and sometimes hypertrophy, or thickening of the tunics of nerves. The neuropathic state seems to consist in an increased sensibility of the nerves of feeling; and it is fully probable, that this is produced by an active state of incitation of the capillary tissue of the neurelema, at the origin of the affected nerves. The remedial agents applied in the site of their origins go far to prove this; being such as relieve vascular turgescence.

We frequently discover a morbid sensibility of the nervous tissues of external relation, of the nutritive system of nerves, and even in tissues destitute of nerves; and if their sensibility can be excited to a morbid condition, without any capillary turgescence, it seems difficult to discover what those causes may be. There is scarcely any pyrectic state that can continue but a short time, without an increase of capillary turgescence, and of course increase of sensibility in all the nervous tissues, yet in some parts more than in others. The very circumstance of morbid sensibility becomes a cause of aggravation of all the phenomena.

Most of the instances of dysæsthesia, or depravations of the functions of the external senses, and the hallucinations thence arising, depend on a state of hyperæmia of the vascular tissues of the affected organs. The circumstances rendering this state of the capillary tissues so permanent, will hereafter be attended to.

In a state of general capillary turgescence, the muscles of voluntary motion, very frequently suffer an inability of function. This condition has too frequently been esteemed a state of debility, and treated as such. The turgid state of the vascular tissues of the muscles, where the nerves of muscular motion are distributed, goes far to occasion this condition of inability, by impeding the free exercise of the nervous force. But, again, the same state of the capillary tissues in the brain, produces the same effect of inducing muscular inability; and also a state of coma, or inability of the intellectual functions. In these instances, also, we must refer the primary changes to exist in the capillary tissue, rather than in the nerves of external relation.

This condition of the morbid economy most commonly exists at the commencement of pyrectic diseases; and along with the impaired function of the nerves of volition, the nerves of the sense of feeling lose a portion of their function, or have it perverted. But, as the capillary turgescence abates, and sensibility increases, muscular motion may become very energetic, and the sense of feeling more acute ; so, an exalted state of intellect may follow, amounting to delirium. In pursuing our illustrations, we have been led into this digression.

The nervous tissues become hypertrophied on some occasions ; and again, they are affected with atrophy, and ramollissement. All these states prove, that the nutritive capillary tissue plays an important part, and that the seats of disease exist in them rather than in the nervous fibrils. If we advert to the instances of insanity, with all the modifications of alienation of mind, there is a mass of evidence obtained from autopsical inspections to show more derangement of organic structure, than of primary changes of the nervous tissues. Nevertheless, as these changes of organic structure are not to be sufficiently discriminated in the cerebral organs, it becomes necessary in a nosographic arrangement, to have reference to the phenomena of the deranged functions of the intellectual organs, instead of their particular morbid states in the tissues.

Furthermore, there may be states of morbid innervation in the cerebral organs, by mere capillary turgescence, which soon subsides, without leaving traces of structural changes in the nervous tissues. And, again, it is an acknowledged fact, that severe mental incitations produce a high state of morbid innervation, perverting the economy of the intellect as severely, as that by diseased capillary turgescence. These mental incitations, producing an excess of innervation, seem to be merely a stronger impulse of the faculty of thought ; and when this happens, by any accident, to affect cerebral tissues already in a more than ordinary state of susceptibility, all the phenomena of mental alienation may be excited. This very condition, again, gives occasion to a capillary turgescence, which, by continuance, may produce structural changes.

We say then laconically, the principal seats of continued disease, exist in the involuntary nutritive tissues and organs. Not forgetting, however, the intimate connection, and dependencies of each and every part of the system, by means of united nervous tissues, which in health chime together in the production of pleasurable sensations ; yet, when perverted by disease, these harmonies become dissevered, the body and mind experience distress and anguish, and the entire system is involved in universal perturbed action.

SECTION XVII.

THE MORBID HABIT.

1. *What is to be understood concerning Universal, or Constitutional, or General Disease, or the Morbid Habit?*

In every scientific investigation, it is necessary to form as distinct a conception of the object of inquiry as is possible to be obtained. In our present pursuit, we have to examine one subject at a time, and each one stands in a certain relation to other topics in connection ; and many of these we have not yet arrived at. Something, therefore, is necessary to be taken for granted, until made plain by future illustrations.

Disease may be said to be a succession of causes and sequences, occurring in the economy of the human system, and manifested by a train of phenomena different from those of health. To describe all the phenomena which occur, or which may occur, would be going through the whole nomenclature of particular diseases. This is not our intention in the present section, but only to allude to those which indicate a general diseased state, and without reference to local tendencies, or the peculiar symptoms of individual diseased states of the system. That such a state may exist is very manifest to every observer, especially at the commencement of disease.

In order then not to be misunderstood, we may attempt an analysis of the common pyrectic habit; for it has been a common received opinion, that fever, in its most extensive meaning, consists in an universal affection of the entire system, whether there exists any local affection or not. Cullen, in his definition of fever, expressly adds, negatively, "without any primary local affection." Yet Broussais, on the contrary, maintains that all fevers are symptomatic, and originate from lesions done the *digestive mucous tissue*; whilst Clutterbuck refers the seat of irritations to the membranes of the brain. Although we have much in reserve to notice on these discrepancies, yet all we contend for now, is, that all pathologists agree in the fact of a common constitutional affection, let the causes or the precedence of phenomena be what they may.

2. *Phenomena of the Pyrectic Habit.*

Almost every disease to which the human system is liable, is attended by a train of phenomena, which, by common consent, is called fever, notwithstanding the phenomena admit of numerous modifications. Some prominent symptom may give a specific name to the disease, when it is essentially the state of fever that ought to be regarded. Yet when disease is very manifest in the absence of such prominent symptom, the disease is, by common consent, styled fever. Our constant experience confirms an important sentiment advanced by Dr. Southwood Smith; viz: "Perhaps there is no disease so little understood as the ordinary fever of this country, and none by the mismanagement of which so much life is lost."*

* Treatise on Fever, p. 18.

In most febrile affections, then, we discover an alteration of the general aspect, and oftentimes before the subject is aware of being diseased. This occurs most emphatically in the graver affections, called malignant, as cholera, spotted fever, plague, &c. Soon a lassitude is perceived, an inability of muscular motion and of intellect, always most erroneously called *debility*. Perhaps next in the order of succession, a sensation of chilliness in ordinary cases, where responding action takes place ; but when not, then permanent coldness on the surface. There are most commonly muscular tremors and rigors, with an internal sensation of distress. The pulse becomes more frequent ; or, sometimes less frequent at the commencement, or tremulous, yet always altered. Most commonly there is an increase of heat, yet sometimes a diminution ; or heat in some part, with coldness in other parts. There may be thirst, or there may be no thirst ; an increase or diminution of sweat and urine ; there may be vomiting, coma, watchfulness, delirium, or not. These phenomena are intended chiefly to designate the first stage of the pyrectic habit. They become modified after some continuance, more stable, and manifest.

By this time it will be discovered, that we speak indefinitely concerning the phenomena, and quite conditionally. This will be acknowledged ; and so long as we speak truth it must be so. There is not a symptom attending that diseased condition called fever, in its extensive meaning, but what may singly be absent ; and yet this does not disprove the fact of its existence. So inconstant are the phenomena of fever from different causes, and as affecting different temperaments, that no invariable definition could ever be made out ; and yet the disease exists, and enough of the phenomena are always present to convince every physician of the reality of the disease, and that it is *fever*, in the common acceptation of the term, however prone they may be to differ in other matters.

Most of the phenomena alluded to, fully indicate an universal and primary affection of the organs and tissues of the entire system; and the causes are commonly as equally extensive. In the instance of coldness in some parts, whilst there is heat in other parts of the system, it should be noticed, that the state of coldness is as much indicative of disease, as the state of increased heat. But, we cannot at this time dwell upon the analysis of symptoms. It must be further noted, that in every fever there is a change in the blood; the secretions and excretions are also in correspondence with the change in the vital tissues. The blood may be changed in the proportion of its constituents; it may suffer change in its fluidity; it may suffer important changes in its crassis; this may be too dense, or too loose.

3. *Phenomena of the Chronic Morbid Habit.*

Passing for the present what may be called the acute state of disease, we may notice, that every slow or chronic state of disease, has a train of phenomena very similar to those of the acute or pyrectic kind. All the difference consists in a slower accession, and a more obscure state of the phenomena; and attended with slower functional and structural changes. The phenomena denoting a common morbid habit, are legible in every feature of the diseased condition, by those who are accurate in discerning, and know how to read them. How often do we find chronic disease to be nothing more than a modified and protracted state of acute disease; a mere sequel of disease, only half cured by a doubting, temporizing treatment; although tardy in its progress, yet sure of its victim? In all the round of chronic diseases there exists a radical morbid habit, and without reference to their local affections; and these are liable to migrate from tissue to tissue as long as the common morbid habit continues; unless the structure becomes too excessively injured.

4. *Local Affections.*

If there is a single phenomena connected with the morbid habit that is always present, sooner or later, it is the existence of a local affection of some kind, and in some tissue. Whether the local affection is an antecedent, and has a share in the production of the morbid habit, or whether it be a sequence, will be considered in the following section, (18.) For the present we only say it always exists, and commonly very early. The particular disease never assumes a definite character, nor a specific name until it is manifested. So if fevers, or other diseases of a pyrectic character do not have *primary* local affections, they soon form. However, in some chronic cases, and in certain tissues they afford only slight indications of their existence. Here it may be remarked, that when a general state of disease continues without pain, and no essential disturbance of any organ, yet if emaciation attends, with an altered pulse, there is great cause of suspicion of some tissue suffering irreparable injury. So the lungs may suffer ; ulcerations may exist in the coats of the intestines ; or imposthumations may destroy, unheeded, the parenchyma of organs. This arises from the slow progress of the disease, the insensibility of the tissues, and the absence of pain in not indicating the state of the organ. The deceptive condition, however, may be learned from a vigilant inspection of the constitutional symptoms.

5. *Modified Diatheses.*

The character of the general morbid habit is of vastly more importance, in a therapeutical point of view, than that of the local affection. This, however, gives indications of the state of the morbid habit, and its severity assists in directing the amount of remedies. Furthermore, as the location may be on different tissues, and of different organic sensibility, so the reflex action of these tissues, disturbing the united harmonies of the natural economy still further, may, and do modify the common morbid habit. This, in connection with the specific impulses of the antecedent causes, lays the foundation for establishing the different diatheses, so called, and which are very manifest.

So we discover a particular state, condition, or diathesis, called the sthenic or asthenic, phlogistic or typhoid, &c. So again, in protracted, or chronic diseases, there are distinctive shades. We appreciate the scrofulous, the cancerous, the phthisical, the hydropic diathesis, &c. These are pathological distinctions arising from physiological conditions, and cannot be gainsayed by sophistical inuendos. They can only be considered as mere modifications of the morbid habit. In all these instances there is a primary constitutional, diseased condition; modified, however, by the cause of the particular disease, by the temperament of the patient, and the susceptibility of the tissue locally affected.

Although it is very difficult to form a definition of the common morbid habit, or of fever generally; yet, as we descend to specifications, we find more stability of character, and more permanent series of phenomena to discriminate, as in the instance of the diatheses. By proceeding further, and viewing diseases of particular locations, they assume more of a defined character, and admit of very constant definitions. Thus, a quotidian ague, pleurisy, and dysentery can be distinctively defined, notwithstanding the diathesis in each of them admits of important modifications in different instances.

SECTION XVIII.

STHENIA AND ASTHENIA.

1. *How ought we to appreciate the different States of the System in Disease, often styled Sthenia and Asthenia, Dynamia and Adynamia, Tonicity and Atony, or Strength and Debility?*

So much labor in medical science has been for ages lost; and being well aware if our own investigations are not rightly conducted, they will be entombed in the common vault of oblivion, we are determined to step with a mother's caution, and weave every thread with feelings of high responsibility. The conclusions of a medical attendant bear a close resemblance to an award on life and death. *As a man thinketh so is he*; and indeed, whether right or wrong, as an honest man's creed is, so will his conduct be. *O! Thou Good Supreme, teach us aright!*

2. *Prefatory Notices.*

The terms in the interrogatory appear to be synonyms, with their opposites; and they have been used to express opposite diseased states, when they express nothing but different physiological states of the system, and cannot, but very arbitrarily, apply to the pathological state. However, we may at present review them after the manner they have been used. It might here be remarked, that the phenomena of disease are often quite imposing, and liable to deceive, and many have been deceived. An excess of tonicity in animal tissues becomes a pathological condition, and very often diminishes vital energy, producing an inability of function.

Although the terms may be considered as sufficiently expressive of two opposite states of the diseased economy, yet what, or how far has the former, denoting strength, been appreciated, used, or applied in the ordinary states of disease, so as to insure practical utility? It appears, that these terms have been brought into use by the ingenuity of that class of pathologists, who have been called solidists, and who have, for about half a century or more past, been the expositors of the laws of the morbid habit. This in itself would have been justifiable, had they amplified and extended the boundaries of correct pathology. But, what has been the result? Although they set out on a more favored thesis, all mankind are presented with overwhelming evidence of a deterioration of practical results.

The former physicians, or the humoralists, were intent on the expulsion of peccant humors, and with this view they bled, vomited, purged, sweat, &c., when they did anything. By such treatment they relieved the condition of hyperæmia, so often apparent in disease; and at the same time did much to relieve the rigid state of tissues, which is commonly so apparent also, that it seems incredible it should escape detection by any tyro of the profession.

Although a superficial view, as well as a close inspection, shows a state of morbid tonicity to exist in by far the greatest proportion of diseases, especially those of the graver kinds; yet, so it has fallen out, that the weaker has overpowered the stronger, and meagre debility been transformed to a giant, in imagination. Every enthralment of organs, by a state of morbid rigidity, and congestion, or infarction of blood, producing an inability of function, has been construed, in theory, as some condition of potent debility; and remedies consistent with the error, applied, however injurious. The causes debilitating, the effect debility, the treatment adequate stimulation!

Notwithstanding a large proportion of practitioners have revolted at the results of the tonic, and incendiary treatment, in accordance with such sentiments, and in a great measure abandoned it; yet the creed remains, and most of the medical journals abound, more or less, in expositions on the principles of atony, and medical halls yet reverberate the echo. Is it not time a redeeming spirit was infused into the minds of honest students, to guide them in the courses of truth, and rescue them from errors as fatal as the pestilence itself?

3. *Recapitulation of some Modern Pathological Doctrines.*

Setting aside certain notions which a few still advocate, that all diseases have their primary seats in the fluids; it may be said, that the prevailing sentiments or theories in relation to the causes, seats, and character of disease, especially fever, may be reduced to two; and even these consist of direct contraries, and it might be said inconsistencies, in part at least.

One of these was introduced by Dr Cullen, and followed up by Brown and Rush, with some modifications. This thesis avers, that the causes of disease (fever) are of a sedative nature; that they firstly impress the brain, and quickly the whole system, and that they diminish the vital energies, leaving a universal state of *debility*. Also, at the same time a spasm is somehow formed on the surface; that this provokes the recuperative powers of nature, and a conflict arises, and in this strife the elevated phenomena of fever are developed. Local affections are soon formed, but none existed at the onset.

We might accord in the view of a general impression affecting the vital susceptibility; but, not that the causes are sedative, nor that a state of debility is induced. Again, a state of spasm incontrovertibly implies a state of rigidity, or tonicity, or fixity. A state of debility, or the reverse, must have reference to a state of weakness, of languor, and of laxity. How these different states can exist at the same time, in the same tissues, from the same cause; or, indeed, how one can produce the other, is quite paradoxical, and becomes a solecism that needs no reply. Dr Cullen's views of the causes of disease were very loose and undecided; but, his treatment was less exceptionable than his theory; for, in adapting it to the contingencies of particular cases, the phenomena and stages of disease, he was compelled to go adverse to his theory, and use debilitating remedies. He was so far inconsistent, but honest.

Dr Brown adopted the same views of the debilitating nature of the causes; of disease consisting of a state of debility, and without primary local affection. He amplified the theory, and his treatment was in accordance with it; and so far as he was consistent with himself, just so far was his treatment the more pernicious. He found a few exceptions; but, nineteen cases in twenty must be stimulated until the process of debility was subdued; and if the excitability of the nervous system should become almost worn out, the doses must be quadrupled or so, instead of giving it time to recruit by rest.

It is rather derogatory to the character of medical science, and its guardians, that this deceptive, yet enticing theory should so easily fascinate the minds of more than half the civilized world, at the close of the last century. However, the mental excitability is so far now exhausted in this country, that it will take more than the *double proof spirit* of Yates and Maclean to restore it.*

The sentiments of the yet lamented Dr Rush, were in accordance with the others, respecting the sedative nature of the causes, that disease was general in the system at the onset, and that the whole system suffered a state of debility. So far his practice would have been altogether inconsistent with his theory, had he not been convinced, by a kind of reasoning satisfactory to himself, no doubt, that this very condition of debility produced eventually a state of energy in the entire economy, as was abundantly shown to exist by the phenomena, and surely well proved by his treatment. As the pheno-

* Authors of a book called "The Science of Life, and Ultra-Exciters."

mena indicated a state of sthenia, so he met them with efficient asthenic remedies. We might say, his treatment was correct, whilst his theory, in part, was hypothetical.*

The other theory alluded to maintains, that all fevers, and indeed all diseases originate from local irritations, primarily excited in some tissues, or organs, by local causes ; and that the nervous system is the medium of radiating similar influences over the entire system, and thence producing the phenomena of fever, which they call symptomatic. Whilst one insists that the primary seat of local irritation is in the head very uniformly, another as often refers it to the entero-gastric mucous tissue ; and again, another to the heart and arteries, &c. Considering our present thesis is confined to the conditions of tonicity and debility, as constituting an essential feature in the character of the morbid habit, we shall defer any strictures on this theory at this time, and notice it in a future section, whilst on the subject of general and local affections.

4. *On the Nosodynamic State of the Morbid Habit.*

There is a poverty of medical language to suit the present state of improvement, although it is overloaded with a burthensome technology. The medical nomenclatures will ere long require revision, as has already been done in chemistry. We shall, however studiously avoid much of this ; yet, when we can find no term to convey an idea intelligibly, we must try to make out one. There has been no way, but by circumlocution, to express the intrinsic condition of the morbid state ; nor has it ever been very successfully attempted in any manner. Sthenia, dynamia, tonicity, innervation, strength, as well as their opposites, are all mere expressions of physi-

* Whilst being well protected by the mantle of charity, we freely say, if these remarks possess any shades of severity, the necessity of the case has elicited them. At the same time, we award a large share of merit, for the good these laborers in the field of science have done the profession. Whilst we respect characters, we must be free with principles.

ological conditions ; the former do not even express an *increase* of strength ; yet, perhaps it has commonly been implied.

5. *Definitions.*

The term *nosodynamia* might be used to express diseased or morbid strength, from *nosos* and *dunamis*. For this purpose it will be employed at present, and synonymous with morbid tonicity. The word *debility* ought to be stricken out of medical language. It has been too loosely, and too extensively used ; it is not sufficiently definite, and its use has been insufferably abused. The term is as loose as that of liver complaint ; a sort of catch-all. In the instance of apoplexy, for example, it would be very improper to say, the muscles are in a state of *debility*. This is not expressive of the fact, they rather suffer an *inability* of function. So of every tissue, and organ whilst suffering a state of paresis. To express a soft, loose, flabby condition, the word *laxity* might be used. For emptiness, or draining off, *exhaustion* might be employed ; and when applied to the vital force, *enervation* is quite appropriate.

6. *Disease is not Debility ; neither is Debility Disease.*

The word *debility* has been used to express a mere imaginary state of disease, and which can be shown to exist only by erroneous notions of the morbid habit. In all the instances of prostration of strength in acute, and even chronic disease, unconnected with extreme vascular exhaustion, there will be high or elevated phenomena, as soon as the enthralments are removed, which embarrass the vital energy and play of the organism. There is latent strength enough, and too much ; this is manifested as soon as the embarrassments are removed. Perhaps ten minutes before the most extreme prostration, the subject was in his full vigor of strength. The phenomena of disease evince energy as soon as the tissual embarrassments are removed.

7. *Remarks on the Primary Changes in Disease.*

Many of the common causes of disease may impress the system, excite some momentary commotion, and yet not produce disease. So fatigue, although carried to excess, does not *always* excite disease: neither does debauchery, nor watching, nor the most racking tortures of the inquisition, nor even extreme exposures to heat and cold. We can dwell on etiology, only for illustration. But, suppose three persons to be exposed to great fatigue, cold and moisture; yet only one of them may be made sick, attended with chills, inability of functions, followed by throbbings and fever, along with determinations to the joints, or to the throat, for instance. The inquiry is, what circumstances stand in relation with this case, which do not exist in the others? There is an evident change producing now what may be called the morbid habit.

The answer must be very obvious, as elicited by all the phenomena; that an extensive change has occurred in all the intimate tissues; not only on the surface, but in the tissues of the internal cavities, and even in the tegumentary tissues, oftentimes. The character of this change will be explained as we proceed. It is this change, whatever may be its character, which constitutes disease, and there will be no disease without it. It is of a persistive nosodynamic character in itself; or, it might be said, it is the property of the vital tissues to remain in this morbid condition an indefinite length of time, until some active exciting impulses remove it; or until the physiological derangements destroy the integrity of the organization, and expel the vital influences. So most diseases have some continuance. They may be prolonged by bad treatment, shortened by correct treatment; the notions about self-limited disease to the contrary notwithstanding. A favorable state of predisposition, and various collateral circumstances protected the others from contracting similar morbid changes.

This change in some of the vital tissues may continue a long time, and not destroy life. Notice the whole catalogue of protracted diseases; and yet recoverable, if the sequences have not, by long continuance, too greatly injured the tissues. Sometimes this morbid condition of tissues is suddenly removed. Notice the instances of the reports of authors, of the sudden cure of fever, of gout, and even of phthisis pulmonalis, by terror, excited by some violent mental or corporeal impression, or both together, as of falling into cold water, shipwreck, earthquakes, &c. In all these instances, the thrilling excitations which pass to the most intimate tissues, agitate the capillaries of the returning or centripetal circulation to a more perfect exercise of their function. They now act more energetically, being roused from their state of paresis. The impetus given to the vital susceptibility, serves to continue the now excited circulation; the natural absorptions become restored, and the congestive condition soon removed; the physiological processes now proceed as in health, the primary derangements being removed.

8. *Illustrative Cases.*

Let us notice a few short cases in illustration. A man, frequently subject to epilepsy, was riding in a single wagon with his wife, and as they were descending a hill, he was attacked with a paroxysm, and at the same moment lost the reins. His horse ran violently more than half a mile; the agitation was great over a rough road, besides that of the fit; the result was, he was free from injury, and he was ever after free from the disease.

A woman had been insane fifteen years. One night she secretly left her bed and husband, and travelled about fifty rods to a small pond, and plunged in with a view to commit suicide, as she afterwards confessed. She was no sooner under water, than she wished herself out, and by a great effort, did get out, and go home highly drenched, and perfectly sane. She had some febrile excitement for about two weeks, yet was sane, and has so remained for twelve years.

Another woman was made insane by the terror of her house being in flames, and it was burned down. So she remained ten years; during which time her husband and family removed to another state; and after a while this house burned down also; and from that time she has remained sane. In the 12th volume of the New England Journal, is a case of dropsy suddenly removed by fear; reported by Dr S. W. Williams.

Many are the instances of the severest forms of acute diseases, being entirely or essentially removed in twentyfour hours, by a co-operation of well adapted remedies, at an early stage especially. That particular, or preternatural state of the intimate tissues, or basis of the morbid habit, must be altered or removed, before there can be a return of physiological actions. Disease will continue until this is effected.

In disease the functions of the most intimate tissues are embarrassed more or less, and so continue until a change by some universal influence relieves them. In mild cases the physiological efforts often restore themselves; yet, in others certain universal excitations become necessary to be brought about, either by strong agitations of mind impressing the organism, or by certain remedial agents, which restore the capillary circulation of the nutritive tissues. See Sec. xlix. 2. f.

9. *Summary Remark.*

We freely accord in the sentiment of the causes of disease making an impression extensively on the vital tissues, and that the whole system is primarily affected, as we shall probably show in the next section; and also, that the local affections are of a secondary, and dependent kind, or receive their chief importance from the morbid habit. But, that the causes are of a sedative kind, and that they leave what has been styled a state of debility in the tissues, must be denied. That the reverse condition does actually exist, we shall now attempt to prove.

THESIS ADVANCED.

10. *In every preternatural condition of diseased action, of an active and permanent kind, there exists a state of nosodynamia throughout all the tissues, and even whilst there may accompany it, a very considerable degree of exhaustion, and occasional inability of organic function.*

If this thesis should appear to some as untenable, it is expected a little reflection will make it familiar. We shall illustrate it—

1st. By the causes of disease.
2d. By the phenomena.
3d. By the most useful treatment.
4th. By the collateral circumstances in connection with the nosodynamic state.

We have not much time to waste in bestowing strictures on proffered dogmas, advanced by many; such as, "the existence of a law, by virtue of which the power presiding over life reacts against debilitating causes.* Or as follows, "Debility, as often constituting what is, in the common language of medicine, *disease itself.*"† Neither the following, as well as many others;—"That debility is in general the first link of febrile action is undoubted, but the connection it has with the subsequent phenomena is yet unexplained."‡ These notions will be left as they are, to be supported by their own advocates.

* M. Broussais' Phys. and Path. p. 45.

† Dr J. Copland's Dict. Pract. Med. as referred to in Amer. Jour. of Med. Science, Vol. xv. p. 212.

‡ Barton's Cullen, p. 257, notes.

11. *1st, The Causes of Disease afford inordinate excitations to Vital Tissues.*

It may be said, and with some correctness, that every substance in nature coming in contact with vital tissues, are excitants, or stimulants. Some of these may be compatible with the healthy condition of living tissues, and actually support and nourish them ; others may be too insipid to afford sufficient excitation ; and, again, others are too severe, afford too much stimulation, and disturb the harmonious economy of the system, and in excess, or combination, may even paralyze the functions of organs. These last are the agents which may be called the causes of disordered action, and lay the basis of the morbid habit.

We cannot as yet enter upon the department of etiology, but only make some assumptions to be hereafter illustrated. It appears that some pathologists agree in the sentiment, that the imputed causes of disease are of an exciting and tonic character. We shall assert them to be incompatible excitants ; and, that they impress the vital tissues in a manner so as to alter their functions, and together with an increase of organic sensibility and energy, induce a new train of phenomena, as the tokens of suffering organs.

The principal part of the reputed causes of disease are, the various kinds of contagions, and the virus of the infectious diseases ; the supposed miasmatic gases, or malaria ; opium, stramonium, and the whole tribe of narcotics ; arsenic, mercury, the oxides of lead, and many other mineral poisons ; incompatible degrees of heat and cold, especially sudden alternations ; large proportions of nutriment, especially of much flesh meats and condiments ; alcoholic drinks of every kind ; whatever greatly excites thought, as manifested by the emotions ; wounds and contusions in combination with other causes, &c. In any considerable degree, and especially in certain combinations, these all become incompatible excitants.

The above either increase the volume of fluids, or produce a tonic oscillatory motion of tissues. In a moderate degree, and applied singly they may produce a mild state of excitation, called predisposition to disease. Largely applied, and often in combination, they suddenly exhaust the vital force, and induce an alarming assemblage of phenomena. Opium and alcohol may produce coma, and death;—a man has been known to be instantly killed by drinking a pint of rum; another by swallowing a wine glass of oil of spearmint. So, the causes of disease produce the alarming phenomena, which never fail to be manifested with equal severity in all severe epidemic diseases, and without losing their specific, exciting characters. In small quantities they excite the tissues; in large quantities they exhaust the vital susceptibility, and induce a morbidly tonic state of the tissues, with exhaustion of vital force. When the recuperative powers of the system become rallied, there arises an elevated train of morbid phenomena.

12. 2*dly*, *The Phenomena of Disease indicate an Increase of Tonicity in the Tissues; or the State of Nosodynamia.*

The very incipient signs of disease often show this; such as shrivelling of the skin, the papillæ anserinæ; also, paleness, from a condensed state of the dermoid tissue. The same condition exists in the internal tissues, and the capillary vessels every where compress their fluids, producing a relative plethora. The nosodynamic state may constringe the capillary exhalants and absorbents, so that they do not act, and blood accumulates in the venous radicles and nutrient tissues, producing a congestive state. This pathological fact is only announced here; it will be illustrated in its place. Sometimes the exhalants are not so far constringed, and the internal vascular force drives out a large proportion of the matter of exhalation; as takes place in excessive sweatings, and on the mucous tissue of the digestive tube in diarrhœ, cholera, &c.

All these embarrassments provoke the instinctive susceptibility in a manner to produce inordinate action ; or, the impress may be so severe as to paralyze, and produce a paresis of organs, or inability of function ; and even death.

If the recuperative powers prevail, as is most commonly the fact, there is manifested an exalted train of phenomena ; such as an increased force of cardiac and capillary action, heat, pain, &c. In these perturbed movements, there must be more or less of an exhaustion of vital force, and there may be an exhaustion of fluids ; yet, still the labor of the heart, arteries, and other organs will continue more or less forcible, so long as the nosodynamic state continues, or the vital susceptibility of tissues becomes exhausted, and a fatal termination ultimately follows.

We discover in the functions of the organs of external relation, an elevated state of intellect, and increased energy of muscular power, provided the organs are free to act, and not held in rigid durance by a contraction of tissue, with a congestion of fluids, as often exists in the first stage. The whole range of semiotice might be canvassed, and it would only serve to multiply the proofs.

13. 3dly, "*The successful method of treatment, shows the nature of the disease.*" (Hippocrates, and all antiquity.)

The mystery of debility will dissipate like a fog before sunshine, as soon as a distinction is made between it, and a state of inability of function from a nosodynamic state. We may now recapitulate some of the leading remedies adapted to the alteration, and removal of the diseased state, and compare whether they do not indicate a state of increased tonicity.

a. *Warm Bathings.*—These relax the tissues, and promote both exhalation and absorption. Water is an agreeable emollient, and caloric the most natural excitant to promote capillary action, and secretion.

b. *Cathartics.*—These not only diminish the contents of the first passages, but the whole of the vascular tissues. They always enervate a well person.

c. *Emetics.*—Vomiting is often a part of the responding and recuperative processes, and well adapted to elicit uniform action in the system, and restore absorption, secretion, &c., and yet it enervates, and thereby relieves pains and spasms. It always exhausts a well person, although the sick will endure it. Its use in relaxing the tissues in luxations, and parturition, is proof that it relieves the state of nosodynamia in fevers. Although often used to promote sweats, it must first relax the rigid state of the tissues. The beneficial effects of tartarized antimony, in diminishing the vibratory action of the heart and arteries, and promoting action in capillary tissues, have continued it in extensive use for about two centuries.

d. *Blood-letting.*—This in a well subject is always enervating, or weakening, when used to any considerable amount. Yet, in disease it is often invigorating, by removing the conditions of the nosodynamia. All will accord in the sentiment of its beneficial use in a high, free and expanded state of arterial action; and yet, there is not so great a weight of disease in such a state, as there is in some other conditions of disease, where the powers of the vital movements are constrained and smothered, and existing merely in an enthralled, and latent state. The testimony of a great many practitioners might be adduced to show the utility of blood-letting in such conditions; and its utility arises from relaxing the nosodynamic state. There are some, however, frail enough to argue, that the causes of disease are debilitating, that the tissues are debilitated, and that debility itself is the disease, and insist toughly, that blood-letting in its direct influence is invigorating, and therefore bleed to remove debility!

In some conditions of disease of the less severe grades, the recuperative powers of the system quickly arise in energy on the abstraction of blood, and quickly exhibit a distinct dynamic force. The absorption of congestions soon becomes active in such cases. Yet, again, in cases of greater severity of morbid impression, the absorptions are more tardy, and difficult to be excited. Taking of blood in such cases is liable to further prostrate the recuperative energy, if done hastily, or in excess, and the whole system suffers a still greater diminution of energy. In such cases detractions of blood should be slowly and carefully made, together with other adjuvants to excite absorption in the intimate tissues, or otherwise it may be injurious. It ought not to be practised very early, nor profusely, until the responding forces have time to become excited, or begin to make efforts.

e. *Sudoresis.*—The leading object in the treatment of disease in general, is, to restore the absorptions, exhalations, and secretions; or, in other words, the natural activity of the capillary tissues. So, as an adjuvant, commonly after blood-letting, recourse is had to the process of sweating. Although of itself it may remove many mild conditions of disease, yet not severe cases. This is a relaxing process, and whilst it has the effect of restoring the inability of functions in organs, and tissues, it increases calorification, and natural strength in the whole system, if rightly conducted.

14. *4thly, Illustration by collateral circumstances in connection with the Nosodynamic State.*

Probably enough has been advanced to show, that morbid strength exists in most conditions of disease; if not, we might add the appearances discovered in the traces of disease; such as, the effusions on the surfaces of tissues, and in the substance of organs. These are of various kinds, as fibrin, serum, blood, albumen, and various mixtures compounded of them. They demonstrate a state of inordinate vascular action, without a single proof that they ever occur as a sequence of enfeebled vascular propulsion, during life.

Let this morbid condition of the system be produced by whatever cause it may be, yet it preserves a very similar character, admitting however certain modifications, which we cannot notice here any further than to say, that it is sometimes attended with serous exhalations of tissues, but most commonly with a dry, rigid state of them. Cullen discerned it through a fog, when he thought he discovered a spasm on the surface; but it exists in all the capillary tissues. It has not precisely the character of the tonic spasm. There must always be an antecedent morbid state to produce spasm, and as soon as this is removed spasm ceases, and often before. Spasm may be accompanied by, or transformed into fever; it is only a phenomenon of the morbid habit, like convulsion. This morbid state accumulates slowly in many forms of disease, especially the chronic.

The continuance of the nosodynamic state, is one characteristic to distinguish it from spasm. Indeed traces of it may be found after apparent death. The constrained, rigid, and contracted state of the surface before death, and the contractions of the intestines, and of the common biliary duct, after death in cholera, may be considered as the effect of this condition, as well as the muscular rigidity so common in other diseases; all which phenomena continue as long as there may be any remains of vegetable life. Intussusceptions, also, in many states of disease, as well as priapism after apparent death, might be mentioned.

We cannot bring analogies from any bodies in nature besides, to illustrate the phenomena of organization, either in health or disease. We say then, the nosodynamic state is peculiar to animal tissues, that it is produced by noxious agents, that it remains until removed by the recuperative powers of the system, or by certain appropriate remedies, or until the sequences have destroyed the integrity of the organism.

SECTION XIX.

ADYNAMIA.

1. *On the Adynamic, or Subtonic State of the System in Disease, and on Enervation.*

It appears necessary to bestow some attention to the adverse conditions of the system in this place.

The above terms seem to have been used oftentimes synonymously, although, strictly speaking, they are of different import. Whilst adynamia implies want of strength generally, enervation has reference to a deficiency of nervous force. Subtonic has reference rather to the laxity of the tissues, and appertains to the phlegmatic temperament. However, in relation to the present subject, these, as well as atony, may be reviewed in connection.

2. *On the Movable Temperament.*

That these conditions do actually exist, and on many occasions become very manifest and perplexing, will readily be granted; but how far they have an agency in the formation of primary disease, will be the subject of inquiry. An habitual, relaxed, enervated, and movable temperament may give occasion, or liability, to become more easily impressed, by many of the common causes of disease, than other more stable habits; but, of itself can hardly be said to constitute disease. We notice many of these temperaments enjoying quite easy health, although as it were in a small circle. When they become affected by any cause, and have their natural economy disturbed, they are liable to exhibit a modified, and eccentric train of the phenomena of disease. But, notwithstanding this, the general character of the morbid condition is very much the same, but yet modified. Thus, when pneumonia, typhus fever, or measles prevail epidemically, these subjects are impressed with a morbid habit similar to others, but are yet liable to many anomalous or nervous symptoms. A less amount of morbid tonicity exists.

3. *Deficiency of Vital Force.*

Again, in all subjects, especially the movable, who become affected in the time of the spreading of epidemic diseases, we discover oftentimes, extreme variations of the vital energy. At certain times they may be affected with syncope ; at the onset of disease there may occasionally be a low train of phenomena, evincing a state of enervation, or adynamia. Still there is a general morbid habit, and it will show itself in the phenomena of responding action of less severity, as soon as the energies of the system become elicited. These *sinkings* as they are often called, or fugitive, anomalous symptoms, are not the disease ; they only manifest different states of the nervous force, in the process of responding action, and as laboring under derangements connected with the common morbid habit. These anomalies sometimes appear in the most robust, sanguine temperaments.

During the progress of fevers, especially those of a low grade of action, the phenomena of enervation are liable to occur on rising, and sitting up ; or when there has been a little exposure to cool air, or want of some suitable refreshment. The whole of the vital force may be lost at such times, and death suddenly follow. If cordials, or stimuli are freely given at such times of depression, although often necessary, the phenomena of the morbid habit will be far more elevated on the return of vital energy, and a free circulation. The same at the onset of disease with a feeble pulse, and low train of symptoms ; if much stimuli are exhibited, the subsequent phenomena will be more intense, unless so much is used as to exhaust the impressibility of the system, and death follows. In all these instances there exists a noso-dynamic state.

The term *sedation* has been used by some to express the deficiency of both muscular power, and the diminution of organic force in syncope, as well as lighter faintness. It can scarcely mean anything different from enervation. These are common phenomena in disease, often arising from unequal excitation. These phenomena are not peculiar to feeble subtonic habits, but are often present in the robust. They are most frequent in malignant diseases. Excess of stimulation may suddenly be followed by sedation, whilst general disease is present; it may be viewed as an accidental symptom. Yet, there are states of disease both acute and chronic, which require some mild tonics and stimulants, especially when directed to promote capillary circulation. Notwithstanding, so long as there remains a frequent pulse, with distress and general weakness, the primary cause of the disease has not been removed, and such treatment should be used with great reserve.

In the instance of a deficiency of red blood from hemorrhage, or very poor diet, as also from constitutional inability, the subjects are liable to contract a morbid habit, and the phenomena indicate a state of irritative excitation, rather than a definite phlogistic diathesis. These cases may be very severe, and terminate in death, as Dr M. Hall has shown of the order of diseases he calls *mimoses;* and also, as M. Andral has illustrated of the state of anæmia; and yet in the post mortem examinations, little or no organic lesions are found.

In all these cases, it is not the deficiency in the quantity of blood that excites disease, nor indeed the defect of red blood, and gluten, nor the state of debility so called. However, these subjects are more exposed to the ordinary causes of disease, and a morbid habit is liable to be formed. The phenomena of this morbid habit are considerably different from those manifested in full, sanguine temperaments. There constantly arises a state of increased organic sensibility, and again the sensibility of external relation is augmented. As the morbid habit forms, there will be local determinations to some organ, or apparatus of organs, simulating inflammation : at the same time a train of fugitive, nervous phenomena, which are very distressing, and serve to engross the whole attention of the patient, if not delirous, and liable to mislead the medical attendant. The low grade of organic movements seems to indicate a state that requires the exhibition of tonics, and stimulants ; but, whilst a general morbid habit exists, they only aggravate the disease, however useful they might have been before the accession of the diseased state.

On the inspection of the organs of those who are destroyed by such affections, the usual traits of inflammation are not found. An organ which had manifested severe phenomena during life, may show but little derangement ; no infiltrations, no exudations on the surface, or even vascular congestions. The crasis of the blood had not been sufficient in density, from the deficiency of red blood and lymph, to produce these effects, although the organ may have been surcharged and distended. Yet, as no infiltrations had taken place, the vascular distention is directly absorbed as soon as life ceases, and the vital tonicity has subsided. There may be some serous accumulations in cavities, and something more, in certain grades, but nothing to verify the existence of a real phlogistic diathesis.

Notwithstanding all this, there had existed a nosodynamic state of disease, with very unequal distribution of circulating fluids, with a constant tendency to anæmia of the surface, and hyperæmia of the internal tissues ; coldness of the skin, and internal heat. In all these instances, the system may be suffering ravages both in the form of acute and chronic disease ; and whilst laboring under disease in the chronic form, is liable to more severe attacks in the acute form, and suddenly to prove fatal. A severe local determination may concentrate in the head, the thorax, the abdomen, or even the muscular tissues, deranging, or destroying their functions.

As we are treating on an order of diseases, rather than any particular habit of disease, so our remarks must be very general. In the way of further illustration, it may be noticed; that, although a marked nosodynamic state of tissues exists, there is but little opportunity to meet and remove it by the common debilitating remedies; and again, it can but rarely be removed by direct stimulants and tonics.

The indications are, to establish an equal circulation throughout the entire system, by restoring the exhaling and absorbing processes, thereby removing the internal hyperæmia to the surface, and relieving the nutritive ganglia. This may be effected by caloric in the form of the tepid bath, by mild steam, rubefacients, frictions, &c. At the same time such internal stimuli should be exhibited, as are of a fugitive kind, and directed to promote exhalation on the surface, and internal secretion; carefully avoiding the whole tribe of narcotics. As such subjects often have some desire for food, panadas, warm broths, or beef tea, &c., are often beneficial. Perspiration with mild laxatives, commonly remove the morbid habit. When this is effected, as may be known by the subsidence of the pulse, return of sleep, and equal circulation, recourse may be had to carbonate of iron, and other tonics to some advantage; as they might have been used to insure some stability of organic action before the access of the morbid habit.

3. *Mere loss of Fluids does not excite Disease.*

Subjects who have lost large quantities of blood, and show an appearance of extreme anæmia and exhaustion, are nevertheless free from disease, and may soon recruit. So, also, at the close of severe fever, attended by great exhaustion, the restoration will be sudden and complete, provided the morbid habit be radically removed. Common nutriments are usually sufficient for this purpose, without the aid of tonic and stimulant medicines. So the state of debility, as it has been called, does not produce disease, but only gives occasion to its more ready access.

4. *Subtonic State in Periodical Affections.*

However, there are certain states of the system having a mild, yet sometimes a severe morbid habit, in which there is a periodical return of paroxysms. Examples of this may be cited in the instance of intermitting fever, and periodical epilepsy. These paroxysms cannot be intercepted by stimulants, so long as the general morbid habit continues of much force. If exhibited for this purpose in this condition, the disease assumes a continued form, with elevated phenomena. Yet as soon as the morbid habit is removed, and if the paroxysms continue, then tonics and stimulants afford a certain stability of functional exercise, and readily intercept their return.

5. *Adynamia at the onset, and close of Fever.*

In the forming state of disease, especially fever, there often exists considerable irregularity in the phenomena, with feeble responding action. In such cases, stimulants directed to promote circulation in the capillary systems, accompanied with caloric externally, are of essential utility. Still the irregularity of functions, and the enervation are not the disease, nor the cause of it, but only casual and anomalous phenomena.

Again, at the close of fatal cases of acute disease, we discover a train of phenomena indicative of adynamia and enervation. These are natural occurrencies, and always to be expected whilst there is an insupportable morbid habit existing. Although tonics and stimulants appear superficially to be indicated in such instances, yet all the *remedia sunt vehementes stimuli* of Brown, only hasten the fatal event.

By way of recapitulation then, it might be said, there are few or no diseases caused by adynamia, enervation, or debility; that these are rather accidental phenomena in connection with the morbid habit; and although they occasionally need to be alleviated, do not demand primary attention; nor can we find a place for a class for them in a nosographic arrangement.

SECTION XX.

MORBID LOCATIONS.

1. *Is Disease produced by extensive constitutional changes, and thence forming local concentrations; or, does it originate at some tissual point, and from thence radiate over the entire organization?*

2. *Preliminary Notices.*

Perhaps there is no inquiry in all the rounds of pathological research, of more importance than this, both as respects the correct science of diseases, and their therapeutical treatment; and, at the present time, there is none on which the guardians of the health of the community are more divided. Those who are vacillating in opinion will always be the agents of mutable and inefficient treatment; whilst those who embrace wrong theorems will use improper remedies. We humbly hope so to offer the facts in connection, as to convince all of candid minds.

If we were to give laconic answers to the interrogatories, we might answer both in the affirmative; but conditionally as respects one of them at least. They require some amplification, and separate consideration.

Suggestions relating to general disease being antecedent to local affections; in reference,

1st, to the causes of disease.

2d, to the phenomena of disease.

3d, to the fact of absence, and mutability of local affection, whilst disease exists.

3. *First—The Causes.*

Reference may be had to Sec. xviii. 7, for a slight allusion to the causes, which induce a morbid habit. Most of these will be found to be such as make an uniform, and universal impression on extended tissues. Thus cold, heat, contagions of most kinds, hyperæmia internally, passions and emotions, fatigue, watching, debauchery, together with various atmospheric circumfusa. These are very extensive, and affect the entire surface of the body externally, or the whole of the tissues internally. They all do, in some considerable degree, impress the vital susceptibility in a manner incompatible with health, and universally. Can it be supposed, that such wide impressions shall only affect primarily, some single tissual point, and in the most interior structures?

Their effects are, and must be, a state of general impression, and an excitation given to vital tissues widely extended; often, however, at first mild, producing a state of increased susceptibility, called predisposition; and next, by repetition, a distinctly morbid condition; and this is directly manifested by strong and elevated action in the corporeal, and in the mental functions. The causes acting in combination, however, may, by excess of stimulation, exhaust, or considerably impair the vital force; and even this shows an extensive application to vital tissues. The wide extended recuperative powers of the system do, however, most commonly gain an ascendency, in which event high action will be perceived universally, and in a more permanent manner than ever arises from any simple local irritation, without constitutional disease.

4. *Second—Proofs of Primary Morbid Habit, by the Phenomena.*

As relates to the phenomena of general disease, they were in part alluded to in Sec. xvii. 2. We may now only notice, that the altered aspect, the universal chills and heats, universal diminution of strength, and alteration of many, if not of all the functions, do indicate a general derangement throughout the entire economy. An inequality in the action of organs is quite characteristic of general disease. The centrifugal circulations are often very unequal, and the centripetal imperfect, so the blood partially circulates through the cold, and almost anæmic tissue of the surface, giving a sensation of heat and cold. The extremities are cold and nearly bloodless. This condition is as much indicative of general disease, as if the same parts were hot by a forced circulation.

Directly, then, the whole surface becomes morbidly hot, the heart and arteries throb, and numerous phenomena are presented, showing an universal affection. But, it may be said, during this time there has been some point of irritation, some local stimulation set up, which has produced all these general phenomena; or, certainly some excitation in the gastro-intestinal mucous tissue.

It might be answered, the subject was well a few hours before; he ate and drank as usual, and had no premonition of local injury, or point of irritation. Although now, or very soon he may be disturbed by a pain somewhere, as in the head, side, abdomen, or joints. At any rate, numerous instances do occur, in which no pain, nor any local disturbance can be discovered, until the disease has made some manifest progress, and this is a fact demonstrated by every day's experience.

We need not be compelled to bring much authority to show this fact; however, one may be taken from Dr J. Johnson, a man of extensive experience, to show we are not mistaken. In his treatise on Abdominal Affections, p. 33, he says, "I have known the fever run high for several hours; nay, for a whole day, before there is any local demonstration of dysentery, clearly showing that, in such cases, the whole system is first affected." A vast collection of facts might be gathered from writers perfectly similar. These are not speculative opinions, but a rehearsal of demonstrated facts. The case related by Dr Southwood Smith of his friend Dr Dill, is full of proof and interest.*

The paleness, and indescribable altered aspect that attends some subjects, laboring under an unheeded predisposition, just before an attack of some severe malignant fever, is most certainly proof of an universal diseased state. These cases are often noticed by the bystanders, before the subject is aware of illness, and thinks himself well. This state may continue several hours; the disease is now uniform throughout the whole system. No local determination has as yet taken place; the disease is, as it were, incubating, and in a well balanced constitution the local determination is not so quickly formed. But, in a moment not heeded, the local determination is hard pressed, by the accumulated weight of disease, to some important organ, and the consternation is great. So some may die very suddenly in severe epidemic seasons.

In such cases, if the determination should be to the brain, the death would resemble apoplexy; and Dr Rush speaks of the apoplectic state of fever; and every practitioner of much experience must have witnessed it. How often in malignant typhus, in yellow fever, in spotted fever, &c., this may happen. It is common for the local determination to form

* Treat. on Fever, p. 221.

early, but the longer it is delayed, the more severe it will be when it does take place.

In a mild state of predisposition, the first notice the subject may have of ailment may be a local pain in some part, or a hemorrhage from some mucous tissue, or a local spasm. Yet, as the local determination progresses, the phenomena of general disease become more developed. So, the patient will insist, oftentimes, that the pain was the first *thing* that ailed him, and he wishes to get rid of it, and supposes he would then be well. An unwary observer would take his word for it, that he was perfectly well until the pain began, as he did not see him at the time, nor investigate the subject. Yet, he very probably had the premonitory signs of disease, and one of these are unusual alacrity of mind, and energy of body. This is a fruitful source of error ; the secret stimulations often accelerate the physiological functions.

To illustrate the fact of general impressions affecting the entire sensible tissues on the surface, and concentrating to a point internally, and very suddenly, we might mention certain tissues internally, possessing a state of morbidly increased sensibility, such as a carious tooth ; an exposure to cool air will be felt in a few minutes ; the same of those disposed to neuralgia, to rheumatism, and an irritable bladder ; or again in the instance of puerperal women. These influences are transmitted to the internal part by the nervous tissues, and in all these tissues by a concentration of force directed through the medium of the arterial ramifications of the nutritive, or ganglial nerves ; and then the nerves of external relation notify the centre of perception of the injury done to the part locally affected.

As it appears to be a subject of great importance, to establish the fact of primary general impressions being made, and an universal state of excitation following, as arguments that diseases do not arise from mere local irritations, the privilege is taken of transcribing part of a letter from Dr James Sanders of Edinburgh, to Sir H. Halford, Nov. 1831. *Med. Chir. Rev.* v. 20. "We now come to the point of vital importance, I mean the state of the patient sometime previous to the overwhelming assault. I am convinced from ample experience, that such prostration of the vital powers never occurred unpreceded by a certain portentous state of the *whole* body, which was sketched by Hippocrates, and elegantly portrayed by Celsus. The signs of this state are concealed from the unwary, under the alluring mask of felicitous health; so that when there are unusual vigor, alacrity, and activity of mind and body; when the eyes sparkle with unwonted brilliancy, and the whole complexion is conspicuously improved; when every faculty and every function is exercised with facility, and a power that the person has seldom or never experienced, *let him beware;* he is on the brink of a precipice; and if an epidemic prevails, it has already seized him; his fall will be sudden and tremendous, in proportion to the exaltation which he enjoyed. This is the first stage of the *epidemic fever*, inadvertently called *the cholera.*"

5. *Physiology of Local Concentration.*

Having advanced far enough in showing that a state of predisposition, and even incipient disease may exist for a time without any local affection, and that it does soon form, it might now be inquired by what known process, or law of the human economy they do form. We need to make some physiological allusions.

PHYSIOLOGICAL THESIS.

The intellectual processes when most active, can contemplate but a single object at the same time; voluntary motion is capable of but one direction at the same moment;

and some one of the internal apparatus of organs is in greater excitation, for the time being, than the others are.

A man may have a complexity of business, and seem to attend to several topics at the same time, yet he does not. He has a place of concentration, or deposit in his mind, where every fact in relation to each topic is deposited. He may converse with three persons in one interview, and he turns his attention to each with the rapidity of electricity, and has a focal point of deposit for each, where all relating to one topic is placed ; or otherwise he would get confounded. His attention is concentrated on only a single item at the same instant. When the mind is absorbed intensely on one subject, it is with difficulty broken off.*

It is difficult to perform two opposite motions, destitute of an harmonious rythm, at the same instant. It requires much practice, until it shall become mechanical, to move one hand perpendicularly, and the other horizontally at the same time. The motions on musical instruments are a series of successions, and all in harmony.

The same law seems to prevail in the internal economy of the organs ; each organ, or apparatus of organs, has it turns of greater intensity of function than ordinary, serving as a focal point of organic force. This may be observed in mastication, digestion, lactation, procreation, &c. The nervous force, and capillary turgescence, are more concentrated on some one of these apparatuses, for a time, than on other organs, and during this time there is some deficiency of force in all the other organs.

In the morbid economy, it has been accorded, for a long time, but especially noticed by the Hunters, that the economy could not endure more than one series of diseased action at the same time, for both must have local points. The measles will interrupt the progress of the inoculated small-pox, and

* See Richerand's Phys. p. 21.

it is said the vaccine virus will interrupt the chin-cough. No two pains can exist of equal severity at the same time, for the major will absorb the minor, by drawing to its circle an excess of vital force. When counter irritations are severely inflicted, they often transfer the diseased location. A case of phthisis pulmonalis has been cured, by a severe scald on the thorax, followed by extensive soreness and much purulency.

The foregoing reflections have been made for the better comprehension of the following:

PATHALOGICAL THESIS.

6. *A general morbid habit, with increased excitation, can continue but a short time, without its principal force being directed to some focal point; and it is this concentration which establishes the local affections for the time being, in accordance with the physiological impulses.*

This focal point possesses more of the nosodynamic force than exists in any other part; and indeed, so much the less exists at the time in the entire system; hence paleness, chills, &c. However, disease is constantly accumulating, until arrested; so there may be a sudden increase in both. The focal point is most liable to form in a part either constitutionally, or accidentally the most sensible, or irritable. Notwithstanding, there is something in the remote causes of epidemic diseases, which inclines the subsequent disease to concentrate, very uniformly, on some particular tissue. It is as difficult to tell *wherefore*, as it is *why* certain medicines act on particular organs. So cholera embraces in its local affection, one tissue, small-pox another, pneumonia, a third, and dysentery, a fourth, &c.

Disease is often produced by sudden exciting causes in combination, without any perceptible state of predisposition; and in such an event, the morbid habit may concentrate on different tissues, according to the idiosyncrasy of each individual, and as many forms of particular diseases be produced. This may be noticed when many are made sick in company, by exposure to cold, heat, moisture, fatigue, &c. A fact is stated by Dr J. Johnson, in his treatise on the Influence of Tropical Climates on European Constitutions, which is in point, viz.: Twentyeight soldiers were employed at work in the neighborhood of an extensive marsh in America. Every one of them was made sick, but of different habits of disease. Three died of cholera, five of dysentery, four of what they called adynamic fever, with yellowness of the skin, and all the others had malignant intermittent fevers. These facts are full of instruction, and require no further illustration than has already been made.

7. *Local Affections produce Effusions, Hypertrophies, and Reflex Actions on the General System.*

The concentration of the nosodynamic force acts as an excitant of the part, and there is suddenly an accumulation of blood, with distention of the capillary tissues, turgescence, pain, heat, and effusions according to the severity of the morbid habit, the character of the diathesis, and the anatomical character of the structure affected. These effusions are usually from the surfaces of the organs, especially in epidemic diseases; but, they often occur in the substance, and parenchyma of organs, and in this event, constitute an order of affections which have been styled local inflammations, as hepatitis, &c., although erroneously; for these also depend on a general state of disease.

These local affections always attend chronic diseases in one shape or another, but in a mild manner. They are often so mild as merely to increase the nutritive economy of the part, and in this instance produce the condition of hypertrophy, so much noticed of late. However, they commonly produce indurations, which in time become softened, insuring a destruction, or important injury of the part.

Every tissue is liable to be the seat of some local affection, and as they possess different degrees of sensibility, or rather susceptibility, so the *reflex*, or sympathetic action over the general system will be of different degrees of intensity, and the morbid economy will become modified by it. When concentrating on dense tissues more pain is excited, from the difficult distention. This pain of a part excites the reactive energies of the system, serves to restore the general depression at the commencement of disease, and goes far to produce that state of the system, which has been styled phlogistic. When falling on more lax, and less sensible tissues, the reflex action will be mild, and the general economy not much affected by it. Yet, if it concentrates on some of the nervous tissues, it reverberates with great intensity over the system, unless it be so severe as to paralyze their function.

8. *Local Affections are liable to change of place, or Metastasis.*

These mutations are most common at the commencement of disease, or at its decline; but when the diathesis is strong as at the zenith of fever, they do not change; and again, when the effusion has been thrown into the substance of an organ, it cannot easily be moved, but its effects ought to be obviated by efficient treatment.

These mutations of local affections furnish an argument, that they are not primary, or antecedent to the morbid habit, as suggested in proposition 3d, at the beginning of this section; which we will now consider.

9. *Third—If the Local Affection pre-existed, and was sufficiently powerful to produce the Morbid Habit, it could not so readily move to and fro.*

The fact has already been alluded to ; and the instances of a change of topical affection are so common, that it is hardly necessary to specify. As the local determinations may affect different tissues or organs, so the disease assumes a new name, although the character of the morbid habit may remain very nearly the same. So Darwin says, he twice saw an elderly woman relieved from ascites, by insanity supervening. When the insanity abated, the dropsy returned. A man having the appearance of hydrothorax, with swelled legs, became free of those complaints on the approach of insanity. Volumes might be filled with similar proofs ; one case only of our own experience may be noticed.

In 1824, a woman about twentyfive years of age was attacked with the common phenomena of severe disease, and directly an intense pain in the left side, a little above the margin of the diaphragm ; full and frequent pulse ; dyspnœa, cough, &c. The affection might be called pleurisy. Six full bleedings were practised in seven days, together with other treatment ; at length a blister to the part. In four days after, another epispastic to the part. The next day the pain was totally absent, and yet considerable fever remained. The day following the head was attacked ; pain, throbbing, &c. Another bleeding from the arm also, relieved the head. In a few hours, however, the local affection had migrated to the blistered surface of the side ; severe pain, heat, throbbing, tumefaction, dryness. An emolient poultice applied to the now inflamed surface, was soon followed by a copious, purulent discharge. Every appearance of disease now immediately subsided, and health was restored.

If diseases are excited by primary local irritations, as they are called, and intense enough to produce the imposing phenomena of severe universal morbid action, it appears incomprehensible how the local cause can quit its hold so easily and travel to some other part. Consider the gout and rheumatism, with local affections, very constantly moving about, not only from one joint to another, but from the external to the internal tissues, and vice versa. Whereas, the phenomenon admits of easy solution on the thesis of a primary morbid habit giving origin to local concentrations.

Even M. Broussais, the exulting champion, at the present time, of exclusive local causation, appears to be in perplexity on this subject, as is shown in his Pathology, p. 37. "We see indeed that the viscera are super-irritated by the blood, and that they are too sensible to the action of external agents, which may equally happen without plethora; this is irritation. *But, we do not know why it abandons its first seat to fix itself where the abscess is about to form.*" It is wonderful, that a man so full of expedients could not propose some solution of the problem. Yet, only let him return to true physiological principles, and he might readily give a just answer; for the local affections are constantly under the control of the modifying influences of the general morbid economy.

Dr Southwood Smith appears to have committed an error from too little reflection, in considering the internal phlegmatiæ to have primary origins in the affected organs; and from thence exciting sympathetic fever; whilst he accords in the opinion of fever being antecedent to, and giving origin to the local affections connected with it. Fevers are usually connected in their origin with some extended remote causes, and yet both fevers and inflammations may arise from ordinary sporadic causes. In epidemic fevers, the local affection most commonly embraces the investing tissual surfaces of organs; in the instance of what has been styled phlogistic inflammation, the substance of the organs are affected, and with an interstitial effusion, liable to terminate in purulency. After all, he thinks they have a close connexion. "But though in the present state of our knowledge we are not justified in considering fever and inflammation to be the same, yet the *close*, perhaps *constant* connexion between them, is a fact of the utmost importance to be known, and requires to be incessantly before the view of the practitioner." (Treatise on Fever, p. 65.)

When he said of pneumonia, enteritis, hepatitis, "The earliest indications of disease that can be discovered have their seat in the affected organ itself," p. 63, he only committed the common error of not noticing the premonitory phenomena. And again, he seems not to have regarded the opinion of his countryman, Dr Jenner, who says, that "every pimple has an errand to do from the constitution." In the phlegmatiæ the diathesis is strong, the general depressions of malignant fevers are absent, and the locations are early formed; the early ravages of the organ excite severe pain, which is liable to arrest the whole attention of both patient and physician; and, again, the location is so strongly fixed that it cannot very readily migrate, yet it may at the beginning, or on a mitigation of the diseased habit.

Having progressed thus far, in answer to the first interrogatory at the head of this section, we will now attempt an answer to the second, viz:

10. *Does Disease originate at some Tissual Point, and from thence radiate over the entire Organization?*

We are free to concur with the localists in every physiological fact, or thesis that is just, having reference to local irritations, or lesions affecting the entire economy. We accord very harmoniously with M. Broussais, that "Impressions made by external bodies, agitate instantly the entire extent of the nervous system, and in this way reverberate into the viscera." We will even go farther, and say, we have seen a person laid prostrate in syncope by a bruise on the little toe; another by some offensive effluvia; another affected with hysteria, on hearing of distressing news. These, and similar instances are numerous. The nervous thrills may often be distinctly felt, diverging sometimes to the whole viscera, sometimes to one organ; but, still these nervous commotions are not disease, neither do they excite a permanent morbid habit, unless in co-operation with some conjunct cause, which impresses the nutritive tissues. Such commotions are transient, and the subject soon recovers his strength. However, if they should be constantly reiterated, they would contribute to the formation of a morbid habit, and this would have some local tendency when formed.

Pain of a part, let it be ever so severe, does not of itself excite disease. The centre of perception is merely notified of some divellication of the sensitive nerves, but disease is the prerogative of the entire nutritive system. A man may be flagellated until he faints, or indeed until the vital force is totally expelled, and until he is dead, yet he does not die of disease. So the tortures of the Inquisition do not produce disease, unless in combination with the very circumstances, which might excite it without the tortures.

12. *Extensive Wounds do not necessarily produce Disease.*

We may be justified in following up this subject some further. It may be asserted that extensive wounds, and even compound fractures are not *necessarily* followed by fever. It is true, that it very commonly falls out so, that the subject is affected with severe disease, and this greatly aggravates the local injury. The circumstances in connection with accidents, are usually such as may expose the subject to cold, and various other familiar causes, which contribute to form a morbid habit; and he may often have bad treatment. Still we do insist, if suitable precautions are taken in a subject free from predisposition, general disease may commonly be avoided, and of course the chief discomforting sequences of severe inflammation of the injured part.

We will assert from our own observation, that sundry cases of compound fracture, in some of which the bones of the leg have been thrust through the integuments, and clothing, and even into the ground, have healed by the first intention, and without fever, or abscesses. For this purpose rest, and the entire quieting regimen must be observed ; a tight roller ; elevated position of the limb ; and above all a strict regard to the avoiding the formation of a morbid habit ; by blood-letting ; laxatives ; perspiration ; spare diet, &c. as well as avoiding all exciting causes, with a freedom from predisposition.

This position will scarcely be credited by many ; for, it is the common belief, that severe wounds, and compound fractures must necessarily be followed by fever, from the irritation they give, with high inflammation and all its results. Now, those who esteem the local irritation the cause of all that follows, will rest contented in the use of certain local remedies, which cannot effect any beneficial influence on the general habit, and of course are of but little avail. They are incautiously led to supply the patient with opiates to relieve *local irritation*, whilst by their high stimulating properties, they invariably aggravate the common morbid habit, and the case is ultimately made worse for their use.

There are, however, certain cases of severe injuries, especially of the joints, which have continued long, until the system has become much reduced by discharges, and the morbid habit may have been removed ; yet there is liable to be a train of distressing, fugitive symptoms, called nervous. These cases are more troublesome than dangerous, and they may be greatly relieved by anodynes, for the purpose of inducing insensibility. If the injured part cannot be restored, amputation is a sure and proper remedy.

Wounds of the Dense Tissues.

Simple wounds are often followed by the most alarming consequences. How often is a small cut in the capsulary ligament of the knee joint followed by the most disastrous circumstances; and again, how often the subject escapes with impunity. What makes the difference? Surely, nothing besides this, that in the one case, he might have been laboring under some degree of predisposition, and now became exposed to the causes inducing a morbid habit; and in the other case he was protected from these circumstances, and of course the wound gave no trouble. In the unfortunate case, the subject experiences no trouble until about the third day after the accident. During this time the morbid habit forms, and its concentration of local impulse is sudden, and distressing from happening in a dense tissue, and its reflex action is severe.

It has been always noticed, that wounds touching the ligamentary, or fibrous tissues, in hot seasons and climates, are liable to be followed by trismus, or by general tetanus. Yet a large proportion of wounds of this description are free from this symptom. This result is precisely according as the system shall have been protected from a general state of disease, or not. It may occur at very different periods, as the subject may have been exposed.

13. *State of Predisposition important.*

Sir Astly Cooper remarks, that students, on first coming to London and attending to dissections, experience but little inconvenience from the wounds they receive in that business. But, after being there a few weeks, experiencing the excitations of the place, the labors imposed on them, with the new mode of regimen, then every trifling wound gave much trouble, and often became alarming. A state of predisposition has now been formed, and admits of similar explanation as before. And it goes to show that the fault is not so much in a supposed virus, as in the acquired habit. The success of all important surgical operations essentially depends on the general state of the system; hence arises the necessity of preparing a patient for such an operation, and scrupulous attention after it, as is now practised by all discreet surgeons.

Dr Lind, in speaking of a sickly season at Bengal, remarks, "at this time a slight cut of the skin, the least scratch of a nail, or the most inconsiderable wound, turned quickly into a putrid, spreading ulcer, which, in twentyfour hours, consumed the flesh, even to the bone."

14. *Remarks on the Virus of Contagion.*

In every contagious disease, the virus seems to be making secret changes in the system, until the entire economy becomes affected; and the very first phenomena that do appear are such as declare an universal affection. There can be no point of local irritation; for their specific locations do not show themselves until certain periods after a morbid habit has existed. All the difference there ever exists between the most malignant, or confluent small pox, the milder distinct kind, and that by inoculation, depends on the different intensities of the morbid habit.

The difference between a mechanical injury of a part, and a similar alteration of the same part as a sequence of a morbid habit, may be very great. Had M. Broussais considered this, he might not have been surprised that extravasated blood from local injury should be so harmless, when he had seen it so troublesome in disease. In Physiology applied to Pathology, p. 415, he says, "we learn from what has been said, that when blood is accumulated in a part of the body by any mechanical force whatever, it may be eliminated by extravasation; (*absorption?*) but it is *very remarkable* that inflammation does not take place in consequence." Now this appears to be no more *remarkable*, than that a wound by a sword passing the lungs, with blood effused, should heal kindly, by avoiding the supervention of a morbid habit; whilst a common hæmoptysis is a signal of alarm; because there always is an antecedent morbid habit. However, in such cases there often exists an antecedent local change of structure in the lungs, and this will make the case doubly alarming.

Our illustrations might be extended to a great length, but we have not time. Perhaps enough has been advanced to establish the following as an answer to the second part of the interrogatory.

RESULTING THESIS.

15. *Local injuries, or other irritations often radiate, more or less, over the system, and with different degrees of intensity; but, their influence is transient, unless a general morbid habit exists at the time, or directly supervenes; and in this event, they become the foci of the general diseased state.*

As brevity must be our constant director, it may be sufficient to say in this place, that a more absurd and misleading dogma never was published, than we find in the commentary to the 72d proposition in M. Broussais' Pathology; viz., "Thus one of the principal axioms of the physiological doctrine, that *all diseases are primarily local*, may be rigorously demonstrated. It is now understood why this demonstration was necessary to enable us to prove that the physiological doctrine had borrowed nothing from the modern Italian." And all this exultation, when he had proved nothing, only an attempt to pervert the just principles of physiology!

It becomes a subject of curious reflection, that the ingenuity of M. Broussais should have enabled him to detect so many lesions of the gastro-intestinal mucous tissue, which had for ages escaped the attention of numerous observers.* This is surely a subject of observation, and not of induction. For a great length of time the autoptical examinations had been conducted in the same place, and no doubt with precision, and the lesions of this tissue had been noticed, but not magnified above their real pathological importance, as they now seem to be. In almost every condition of the morbid habit, there is an undue proportion of blood concentrating to the internal tissues, with a proportional destitution of the surface. The mucous tissue is very vascular, liable to become turgid, and assume a state of hyperæmia above that of any other tissue. This state of turgescence might easily be mistaken for what some call sub-inflammation. The blood concentrates into this tissue after the death of the subject, and assumes a darkened appearance oftentimes. It is, however, nothing unusual for this tissue to suffer some degree of irritation, and even inflammation, along with other tissues in general continued disease.

However, it is often in a more important pathological state. Yet, a great proportion of these states ought to be considered as the sequences of a morbid habit, rather than as primary lesions provoking disease. Although this is a delicate vascular tissue, and possessing some sensibility of relation ; yet, it endures with great submission the burthens imposed on it. In the instance of excess in eating, and the use of alcoholic drinks, the hurtful influences are commonly greater in the common circulatory system, and remote organs, than in the digestive mucous tissue. The effects of alcohol are more striking in the muscular and nervous apparatuses, and even in the brain and liver, than in the alimentary canal.

Furthermore, most of the lesions detected in this tissue are

* Agreeable to M. Rayer's statement, 28,299 patients were admitted into the several hospitals of Paris, in 1807 ; of these 6,143 were treated for continued remittent fever, whilst six only were considered to be affected with gastritis.

undoubtedly the sequences of a determination to it, by the agency of the morbid habit. Many fevers are attended with large hemorrhagic discharges from this tissue, after some continuance; they might be esteemed critical, and ought not to be hastily suppressed. Or in other words, a change of local effort is made to this vascular tissue, establishing what Dr Cullen styled a *hemorrhagic effort*.

Again, turgescence, and even ulcerous lesions are often discovered in this tissue, in many cases of protracted disease, as in phthisis, typhous fever, &c. Perhaps no one will assert, in the case of phthisis, that the intestinal mucous tissue, follicles, and glands were primarily affected; and it never has been proved that these parts are primarily affected in typhus. M. Chomel expressly declares to the contrary: "Now if all the symptoms of the disease and its severity depended on the lesions of the follicles, there would certainly exist a relation between the phenomena during life, and the extent of the lesions after death." But, he says there is no such relation; and he sets them down as effects merely of the general morbid condition under which the patient labors.*

There is a mass of evidence showing, that the membranes of the head, lungs, and abdomen are also affected in typhus, and the phenomena indicate, that the affection in the head is oftentimes antecedent to that of the mucous follicles of the intestines. The vascular, erectile, and yielding state of this mucous tissue inclines it to manifest more prominent appearances, on inspection, than any other of the internal tissues; nor is it surprising that it should often be found softened sooner than other tissues; and it may even suffer some slight changes before death.

In justice to M. Broussais, we feel disposed to award to him due praise for having done so much in exposing the injuries resulting from the "incendiary treatment." Yet, if he

* American Journal of the Medical Sciences, No. 29, p. 139.

had entertained more enlarged views of the character of disease, he would have extended the treatment, and used more decided remedies, without losing so much time as seems required to extinguish local irritations. And all this might have been done with less prolixity, and without having several times exhausted the whole of his native language.

SECTION XXI.

CAPILLARY TISSUES.

What are the particular, and the relative conditions of the Centrifugal and the Centripetal Capillary Tissues, especially in the three great visceral cavities, in the state of disease?

1. *Physiological Recapitulation.*

THE heart is the centre of all the circulations. The blood is projected from the ventricles, in its diverging course, and permeates every organ and tissue by extremely minute vessels called capillaries. This kind of tissue is found in the short or pulmonary circulation; in all the organs and membranes where blood is transmitted by the aorta, both in the interior and exterior tissues of the system, as in the head, thorax, abdomen, muscles, &c. A double circulation is observed in the portal circle, the second of which is effected without the direct agency of the heart. The terminations of this series of capillaries is partly in the organs, and extended tissues, to be thence returned; and partly on the surfaces of tissues, and from thence eliminated from the body.

From the extremities of the diverging capillaries and interstitial spaces, arise a series of capillary vessels, or absorbent veins and lymphatics. And, also, another series from the free surfaces of tissues internally and externally, called pulmonary, serous, intestinal, and dermoid absorbents. These all transmit the different substances of their particular absorptions back to the heart, along with the venous blood, by the converging or centripetal circulation. The amount of extraneous materials taken by the external surfaces ought to be equivalent to what is eliminated. A continued, and quite equal circulation in all these tissues, is necessary to insure ease and health.

2. *Pathological Changes in these Tissues.*

It is in these intimate tissues that the inexplicable processes of the vital economy are effected ; and in disease they are the theatre of morbid perturbations. The causes of disease, whether of slow or sudden impress, are of a stimulating and tonic character ; yet of different degrees of activity. They impress the vital susceptibility of the tissues destined to nutrition throughout the system, and this implies the combined vital force of the ganglial nerves, and the innate vegetative susceptibility.

An impression then of an inordinate kind on those tissues, increases their force and contractility. By an increase of contractility the functional powers of the tissues are increased ; and there will immediately be perceived an increased force in the heart, together with a rigid, condensed state of the tissues, mostly discovered on the surface of the body, where there is a large share of capillary vessels. This manifests a morbid tonicity, and contractility of capillaries, which is always more or less of a persistive character.

The capillary vessels, however, of the internal tissues, are still more extensive, and suffer a similar change. It may be noticed, that on account of the minute calibres of the capillary vessels, every modification diminishing them still more, even if it be small, must have an injurious effect on their ability of transmitting their contents. This often appears plainly on the surface, attended with paleness and a suppresssion of sweat; and the same circumstances do clearly exist in the internal tissues, although a congestive state be present.

We may now make reference to the physiological fact, that the heart, and all the large and capillary vessels of the diverging circulation are supplied with visceral nerves, whilst nearly all of the converging series are destitute, and possess only the vegetative susceptibility.

In consequence of this disparity of vital impressibility, when a common stimulation is applied, the diverging circulations will be disproportionally accelerated, and there must be an inequality of function between these great and asssociated tissues.

This disparity of functiôn is liable to increase; and directly in the graver aspects of disease, the ganglia and abdominal plexuses suffer embarrassments very similar to the capillary tissues. Their physiology declares them to be freely supplied with capillary blood vessels. Now, the same circumstances that cause the other internal capillary tissues to become turgid, also occasion an accumulation in and around the visceral nervous tissues. Their function is now embarrassed, very similar to what occurs in the encephalon, producing coma. These ganglia, then, suffer an inability of function, and on this account, all the tissues under their influence, suffer, also, a diminution of function, which has so long, and so preposterously been called debility.

Whether this venous distention, called congestive, exists in the head, thorax, or abdomen, the accumulations soon diminish, on an effusion, or an exhalation taking place from the tissues into the serous cavities. If, in the head, or spine, they disappear, on an effusion of serum taking place into the ventricles, or theca of the spinal cord, and so of other tissues. If an inflammation concentrates on a tissue, they also disappear, yet arterial turgescence supervenes. They are most often found in suddenly fatal cases, and on an early inspection; for, as soon as the vital, or rather the nosodynamic force leaves the tissues, they become absorbed and disappear, in part at least.

3. *Origin of Congestions.*

There is now existing a nosodynamic state in all the tissues, yet having some different effects on the nerveless veins from what is has on the nervous capillary arteries. The heart and arteries very surely propel their fluids into the capillary tissues faster than the radicles of veins can dispose of them. The blood, then, is lodged in the incipient veins, whose coats are more distensible than those of the arteries, being destitute of circular fibres; and also, into the nutrient interstitial spaces, giving origin to congestions, petechiæ, maculæ, vibices, &c. These frequently appear on the dermoid tissue, but more frequently in the internal tissues; yet, often unequally in different sections of the system.

It now becomes necessary to attend more particularly, to some of the circumstances connected with the origin and formation of these venous accumulations. They always appear in the greatest abundance in those cases attended with the greatest prostration of vital force, and irregularity of function. This is equivalent to saying, they exist most in cases where there is the greatest weight of disease, although not the strongest state of vascular action. Those fevers, in which they most frequently appear, have been called by the former physicians, severe typhoid, malignant, ataxic, adynamic, or putrid.

We do not know of a single agent of a directly enervating kind that conspires to produce the congestive state, but have a knowledge of many which act as excitants on vital tissues producing it. With a view of assisting the illustration of an intricate subject, we might make some reference to certain experiments performed on living tissues by the vivisectors. Particularly to some which have been made by Dr Georg of Liepzig, with a primary view to ascertain the properties of many articles of the materia medica, and in these he seems to have outdone all others.

There has always appeared a strong analogy between the phenomena attending fevers of the graver kinds, and those attending the use of narcotics in some considerable degree, or so as to produce a state approaching that of narcotism. In the experiments we now refer to of Dr Georg, the prussic acid was used. He gave it to every member of a society of twentyseven persons, formed for the express purpose of ascertaining its properties in healthy subjects. It first produced a state of excitation of mind and body; but, it was sooner or later, according to the quantity, followed by enervation, or a state of exhaustion. On the animals he gave it to, it produced distress, stupor, death, with congestions. So, likewise, congestions of the brain are found in subjects destroyed by alcohol or opium, and other excitants.

Experiments on frogs, fixed under a microscope, afforded an opportunity to see plainly, the motions of the arterial and venous blood in the mesentery. "After the first dose, the blood continued to circulate regularly for several minutes; it passed more quickly through the *arteries*, and more slowly through the *veins*. At the end of about ten minutes, the course of the blood in the veins became still *slower*, in the arteries it continued the same, and did not alter for eight or ten minutes subsequently. There then occured from time to time, a *stasis* in both sets of vessels, but this happened more frequently and continued much longer in the *veins* than in the *arteries*."

"On the approach of death, retrograde movements of the blood took place, but of short duration. About fifteen minutes after death, the blood in the veins had assumed a violet hue, while at the commencement of the experiment, it was of a bright red. In the artery, on the contrary, the blood, which had been also of a bright red, became pale, almost white. The artery itself became more *contracted*, while the size of the veins was unchanged. In large doses the acid suddenly destroyed sensibility, and few or no morbid phenomena occurred.

These experiments are similar to those made by others, and go to prove, that excitants affect the motions of arteries more than those of the veins; that the former contract the strongest, and hold out the longest; that the blood ceases to move first in the veins. With these facts, and considering the veins more distensible than the arteries, the venous dilatations may be explained. The blood sometimes suffers a stasis in the interstitial spaces; also, there may be extravasations, forming petechiæ, maculæ, &c. In some of the severer grades of fever, the capillaries take on a high state of excitation, and exhibit an erysipelatous inflammation; on other occasions various kinds of effusions, but these subjects will come under consideration elsewhere.

4. *Different modifications of diseased Capillary Action.*

A difference in the combinations, and force of the causes; also, of the susceptibility of individuals exposed, modify the subsequent disease.

1st. They may make only a moderate impression comparatively, and the disparity produced between the diverging and converging capillaries will not be so great. The stimulations may be capable of awakening the repulsive energies of the tissues, and in a manner to enable the absorbent veins to take up the blood nearly as fast as it is furnished by the arteries. The excitations become uniform throughout. The blood is fast thrown into the capillaries, and quickly taken up; the veins are filled, heat is evolved, and the heart stimulated to forcible action. This state, only partially sketched, will manifest the sthenic diathesis.

2d. The causes may act in combination, and on a subject predisposed. The diverging circulations may be carried on for a time as above stated; but the absorbent veins are less capable of performing their office; the congestions increase their embarrassment. A great proportion of blood is retained in the capillary tissues of the interior; coldness prevails on the surface; the large veins are not filled, neither the ventricles of the heart supplied. The systolic action of the heart is often repeated, with a scantiness of blood, and the pulsatory vibrations are frequent, small, chorded, and retiring. The fortunate period of relieving such cases is before the vital force becomes too far exhausted.

This state of the system is very imposing; the inability of functions, and diminution of vital energy in the system of external relation, may be very considerable, whilst there may be a great weight of nosodynamic force existing in the entire nutritive tissues, although in a hidden, latent state. This condition is liable to continue, and make further derangements until all the capillaries are greatly embarrassed, and their functions cease. However, the recuperative powers oftenest prevail, and the circulations become established in their physiological courses sooner or later; yet only a few days, and sometimes as many hours, will decide this. This state of the system will be attended with what has been styled the typhoid diathesis, which will require further illustration.

3d. In a subject under circumstances quite similar to those mentioned in the first article, and who after exposure to particular causes, may have a concentration of the nosodynamic force to some internal organ, as the tissues of the brain, lungs, liver, &c., the vascular tissue soon becomes engorged; and a vibratory action becomes established in the part, rather independent of the heart. Directly, effusions take place into the interstitial spaces, and often on the external investing membrane; tumefaction, pain, heat and throbbing attend. This is the phlegmatiæ of Broussais, or the empresma of Good.

5. *Therapeutical Remarks.*

In such a condition, the absorbing veins are incapable of acting, and the local capillary excitation is liable to destroy the organ. The balance of circulation is mostly on the side of the diverging capillaries, and the intention should be to diminish this arterial force, and excite the converging, or venous circulation. When the latter obtains, a resolution will take place, yet never without it.

So, likewise, is the condition of every fever, of every diathesis, and of every grade of severity, let them be called by whatever names they may, and whether attended with local phlegmatiæ, or a tissual excitation and engorgement. So again, this is the condition of all the chronic phlegmatiæ, both internally and externally; they will persist until the absorbing processes obtain an ascendancy over the diverging capillary circulations. As soon as this force subsides into a state of moderation, and the capillary veins have obtained an ascendancy, with a little time, there will be a mitigation of pain, of soreness, of tumefaction, and finally of every morbid phenomenon. The nosodynamic force is removed in all these instances; the cardiac and arterial severity of action abates; the secretions and exhalations become established, and now the fever admits of what has been called a *crisis*, and the inflammation of *resolution*.

The foregoing illustrations have been made to bring the morbid habit into view, and show the importance of the capillary tissues in the process of disease, in its most extended sense. By it we learn the necessity of restraining the over balanced power of the centrifugal circulations, whilst suitable measures ought to be early taken to excite the absorbents of the centripetal circulations.

And furthermore, we learn the importance of seasonably reducing the nosodynamic force in the heart, and capillary arteries in disease; and, indeed, in all the absorbing tissues, before they can take on their accustomed functions. M. Magendie found by experiment, that, in hyperæmia, absorption takes place more certainly, and in one fourth part of the time after venesection that it did without it; by this, proving the existence of morbid strength, and that venesection diminishes it, and gives freedom of action. The particular management of this process belongs to therapeutics.

SECTION XXII.

ATAXIA.

1. *On Ataxia; or the anomalous state of disease.*

This term appears to have been used by Selle and Pinel to designate an order of fevers of the severe typhoid aspect, which were accompanied with formidable, yet anomalous symptoms; continually liable to vary, and especially affecting the functions of external relation, yet having their principal seats in the nutritive organs.

Viewing all diseases as manifestations of disturbed physiological movements, so they have a tendency to maintain a regularity of character; yet many intervening circumstances are liable to exist, producing a discrepancy of phenomena, and variation from their most fixed procedure. This is so much the case, that scarcely two diseases of the same species are exactly alike in every particular, in different individuals.

We wish, therefore, to extend our remarks on the ataxic state of disease, in a manner to embrace many of the eccentricities we meet, in different habits of disease ; otherwise we may never expect to discover or appreciate "the invariable concurrence of a particular number of events," so much insisted on by Dr Southwood Smith. It will, also, be discovered, that the anomalous forms of disease essentially modify the results of it ; and this circumstance cannot fail to derange the numerical method of investigating its character.

2. *Specifications of certain Anomalies.*

In the commencement of disease, or the formation of the morbid habit, the natural catenations of physiological movements are often interrupted from the common order of the pathological movements, and unusual anomalies may occur in many functions ; as in the circulation in the capillaries, and in the rythm and force of the cardiac actions. Neither is it confined to the circulatory system ; it often appears in the cerebral and other organs ; whilst one apparatus acts vehemently, another may be torpid, or altogether suspended. One part may be cold, whilst another is very hot.

So again, in the functions of external relation ; some of the organs of sense may be greatly increased in sensibility, whilst another is diminished. There may be coma and vigilance in succession ; in muscles, lassitude or convulsions. Disease has been said by some, to consist of a constant series of irregularities ; yet this is not true ; although it consists, in its disenthralled state, of an elevated state of action, it may have many anomalous, or accidental phenomena, not essential to its regular character.

3. *Illustration by Small Pox, and Measles.*

Let us view the disease of small pox, which we may suppose to possess an identity of character, and progressing with a train of definite phenomena. Yet, it is very common, especially in children, to see a paroxysm of convulsions before the eruption shows itself. This is an accidental or ataxic symptom ; not a necessary one of the disease, but arose from a part of the precordial distress emanating to the origins of the motory nerves, exciting the voluntary muscles into incontrollable actions. The disease still progresses in its essential course, and the accidental phenomenon by the convulsive percussions, may have been of use in furthering the eruption, which is a necessary sequence of the disease. The convulsion may be esteemed as a part of the reactive process.

A similar condition is often discovered in measles ; there is liable to supervene an intolerable oppression at the precordial region, with shortness of breath. This is often followed with vomiting ; and when it does occur, the eruption soon appears, and the disease pursues its destined round of regular phenomena ; whilst the precordial distress and vomiting were accidental phenomena in reference to the disease, although they never appear without cause.

So, also, the access of many pyrectic diseases is attended, oftentimes, with convulsion, or vomiting, purging, hemorrhage, coma, syncope, &c., from existing peculiarities of the individual, when they make no necessary part of the train of symptoms identical to the disease ; and these accidental phenomena may sometimes be of use, and at other times disadvantageous to the progress of the disease. Whilst we maintain, therefore, that every particular location of disease possesses a stability of general character, with regular cause and sequence, yet they are subject to many anomalies from individual physiological circumstances.

4. *In Chronic Affections.*

In chronic diseases of slow access, we often discover a train of anomalies before the disease becomes sufficiently developed to admit of a specification. Indeed, after it becomes established, and its location fully fixed in some tissue, still there may occasionally be many accidental phenomena, affecting some function of body or mind; they are often called nervous, yet the steady course of the disease may not be much affected by them, although the medical attendant may be liable to be led into error. These anomalies ought always to be distinguished, and if they merit some particular treatment, it ought not to interfere with that most appropriate to the essential disease.

5. *Anomalies in Pyrectic Diseases.*

It is in the comparatively mild grade of fevers called sthenic or inflammatory, in which we discover the greatest stability and succession of phenomena, and the maintenance of a definite character; yet these may have some anomalies. The circulation at the access soon becomes more equally established, and it is now maintained by a force that saves the depressions, and retrocessions of action from the circumference to the central tissues; which event when occurring, is liable to produce, not only a new, but a dangerous train of phenomena.

6. *In Typhus Gravior.*

If we turn our attention to the fevers called adynamic, typhoid, or malignant, we may discover far more irregularity than in any other aspect of the diseased habit. It is in these higher grades that the eccentric phenomena gave origin to the term ataxia. They are represented as presenting a continual aberration of character, both as respects the phenomena of mind, and of the organism. In some, the sensibility is highly exalted, and in the same individual in a short time as greatly diminished. Indeed, all the phenomena proceed in a manner very incoherent. At one time great coldness, and again intense heat on the surface generally. Soon, again, great heat in one section of the body, whilst there is a torpor of function and coldness in some other. Sometimes pain in the extreme, and soon followed by insupportable faintness; pulse variable, often small and frequent, as in spotted fever, and liable to a complete acrotismus. We need not repeat all the phenomena; we refer only to a few, as illustrations of the anomalies; whilst the particular disease is progressing with a fixed location in some part, often in the encephalon, with a destructive tendency.

The epithets, asthenia, adynamia, often bestowed on this order of fevers, ought not to influence the treatment. The high state of sensibility, and excessive vascular stimulations, must soon be moderated by a sedative treatment, or the case is lost, and perhaps immediately. Diffusible, and evanescent stimuli, with the aid of caloric externally to excite the absorptions, are indispensable. Correct treatment may soon harmonize the dissevered catenations of action, and the disease may then proceed with a regular train of events. It was these aberrations, and mutations, which led Van Helmont to the suggestion of an *Archeus* traversing the internal organs in disease.

7. *By Typhus Mitior.*

In the instance of low typhus, there exists, also, a nosodynamic force, which impedes the capillary circulations. A very constant tendency to coldness on the surface with plentiful congestions in the internal tissues of the head, abdomen, or thorax; mostly in one or other of the two former cavities; yet, always predominating in one of them. There may occasionally be heat on some parts of the surface, but there will be at the onset a prevailing disparity between the external and internal surfaces; with many fugitive phenomena liable to deceive, and yet not essentially connected with the identical character of the disease, and succession of cause and sequence going forward.

In this, and many other modified habits of disease, the most important desideratum is, to obtain a more equal capillary circulation, with an especial effort to excite the venous absorptions. No essential impression can be made to moderate, or arrest the force of the disease until this is effected, nor will it assume its own proper train of phenomena. From want of attention to this circumstance at the onset, the disease will continue intractable, and opportunity often afforded for the interference of empirics; who, by even an unadvisable method of sweating, have often rendered essential relief.

8. *By Rheumatism and Gout.*

These often afford illutrations of our thesis. The former possess something of an identity of character, like sthenic fever; whilst the latter, in a habit of more exalted sensibility, presents a protean aspect, representing many of the most formidable affections. Whilst the local concentration is steadily fixed in the arthritic tissues, it exhibits a regular series of sequences. No sooner has it migrated to some of the indispensable internal organs, than we discover a terrific train of anomalies which, if not suppressed, may directly prove fatal.

9. *By Cholera.*

In epidemic cholera we perceive an emphatic specimen of the ataxic state of disease. Whilst an universal nosodynamic condition confines the capillary circulation, there exists an aberration of organic sensibility, and the phenomena proceed with great incoherency. This is the only dangerous state of the disease; when disrobed of these spasmodic perturbations, it pursues a regular course of cause and sequence, and not of the most dangerous character. It might, perhaps, be insisted on, that these intense phenomena so constantly occurring at the onset, do actually constitute a part of the character of this intractable disease; yet, they do not constantly occur.

It appears, that instead of the chief force of the strong morbid habit concentrating on the encephalic organs, as in typhus gravior, it accumulates on the system of the nutritive nerves, and of course their subordinate organs. Whilst some are fixed in spastic rigidity, others act impetuously, yet very incoherently. The capillary circulation stops at the origins of the venous radicles, and a great part of the force of local tendencies appears to concentrate on the exhalants both of the digestive mucous tissue, and the dermoid, by which they pour out a torrent of serosity; whilst the nervous system of external relation, with its organs, is but little disturbed. Suppose the morbid concentrations to have been to the head, it would have been a case of ataxic fever.

As the sanguineous capillaries act but little in the intimate tissues, there will of course be a deficiency of vital heat, with an altered aspect. However, we cannot, in mere illustrations of a particular thesis, enter into the pathological minutiæ of isolated diseases; they will be noticed in their places. We only contend for the existence of a general morbid habit, attended with anomalous phenomena, not always essential to the disease, nor do they develop its true character.

SECTION XXIII.

REACTION.

What should be understood by the Conservative, and Recupurative Powers of the System?

Every animated being possesses properties, and certain abilities of self-preservation, of seeking good and avoiding evil, or threatened injuries, and of resisting them when present. This property is confided to the nervous apparatuses. It will therefore be considered under the two divisions of the nervous systems of external and internal relation.

1. Conservative Power of External Relation.

The organs of sensation act as sentinels to advertise the approach of evil, and guard the subject from injury. Every article of food and condiment is examined before use; and so of other circumstances. If any tangible substance is unpleasant, or hurtful, it is removed or avoided as far as ability permits. Personal assaults are indignantly repelled. These facts are mentioned merely to show the existence of such a property.

2. Conservative Power of Internal Relation.

It ought not to be denied, that the internal sensations often recognise injurious impressions, and that resistance is made to avoid them; and when admitted into the system, to expel them. We have noticed this property in Sect. v. 11, under the appellation of *instinctive susceptibility*. It is a property always present and active in different degrees. If any iritating substances affect the glottis, a train of involuntary associate motions is excited for their removal, by coughing. So of offensive substances in the stomach, by vomiting, diarrhœa, &c.

But, it may be said, all these irritations affect the nerves of external relation distributed on internal surfaces. Notwithstanding the nutritive tissues have their appetencies and aversions, they refuse many substances of an offensive character by absorption. If deceived, and irritating materials become absorbed, an excitation, either general or local, in the organs is raised to expel them. So all medicines that enter by absorption, and excite particular organs specifically, do act. So also of the causes of disease which may enter by absorption.

It may be said that certain morbid agents alter the internal tissues, and without any extraneous substances being added. Nevertheless, there is an embarrassment of function in such instances, or obstacles to a free circulation; and even these act as stimuli. So stimulations are applied to the most intimate tissues in an indirect manner, and these affecting the instinctive susceptibility of such tissues, excite inordinate action for their removal; and this may be shown by experiments, as clearly as that muscles contract when irritated. It is this kind of derangement in circulatory tissues which excites morbid action, or the restorative processes, or responding action.

We discover, hence, a resisting and repelling force in vital tissues, and this was long since properly enough called the *vis conservatrix, et medicatrix naturæ.* The term is significant, and synonymous with recuperative power, the efforts of nature, and sometimes simply *nature.* This very repulsive effort constitutes the *reaction* of medical writers, and is manifest in all the phenomena of disease. No removal of disease can ever take place without it, and the chief object of the practitioner ought to be, to *guide* and *assist* it.

Having progressed thus far, it appears expedient to bestow some attention to the causes of disease, and this will engage our attention for a time.

SECTION XXIV.

ETIOLOGY, OR PATHOGENY.

1. *Preliminary Remarks.*

HOWEVER difficult this subject may be, yet it must be approached; for none other in the round of medical inquiries is more interesting to the community, as well as to medical men. Here, again, the labors of the profession have been so ill directed, that but small advancement has been comparatively made in etiological researches. However, notwithstanding the immense expense and loss of time in establishing quarantines, in the founding *cordons* to fence against aerial afflatus, and the exploring ideal miasmata; yet we are not fully prepared to accord with an elegant writer in saying, "the laborers in this fertile field of inquiry have reaped little more, than if they had been tilling the sands of Africa, or ploughing the watery ocean." *

Hypothetical notions have too much engrossed attention, whilst common sense and plain matter of fact have been seated in the back ground. We do believe that some precision may be attained in relation to many topics of the causation of disease, and some advances may be made in the investigation of the more secret sources of the pestilence that stalks in silence through the broad atmosphere, and inflicts unseen lesions in the hidden tissues, as well as the more manifest ledantia. But, still, we must accord with Dr Abercrombie, that "it is one of the most difficult topics that can engage the attention of the medical inquirer." Dr Sydenham remarked, "were the attention of medical men directed as much to the prevention as the cure of diseases, many of those deviations from the healthy condition, now considered as the opprobria of our art, would be prevented."

* Dr J. Johnson.

However, the subject of causation is of more importance antecedently, and the being enabled to avoid the ledantia, than in the treatment of the diseases arising therefrom. The diagnosis of each particular case must indicate the treatment, let the agents be what they may which produced it. We find similar states of the system existing when induced by very different causes, and the treatment must be in accordance with the intensity of these, and as developed by the phenomena. For instance, when called to treat a case of narcotism, it would be about the same whether produced by alcohol or opium, notwithstanding one case might be inclined to be more persistive than the other. A phlogistic diathesis requires a certain amount of remedies, by whatever cause produced.

So, also, from the same variolous virus, one case may be distinct small pox, and the other confluent. Remedies ought to be employed to suit each individual state. Again, epidemics are often ushered forth suddenly when no one can demonstrate the cause; yet, the phenomena immediately reveal the character of the affection, and indicate the treatment. So, correct views of the pathology of disease generally, may, in a great measure obviate the defects of precision in relation to their remote causes. Yet the primary physiological changes, which we call the primary cause, require the utmost vigilance, as well as the secondary; for when disease stands in close relation with a structural lesion, it demands severe investigation. It is, however, at all times, especially as relates to chronic diseases, desirable to know the causes, and to ascertain the physical changes wrought in the tissues by them.

DIVISION OF CAUSES.

The subject of pathogeny will be divided into three orders of causation.

a. Remote causes.
b. Exciting causes.
c. Primary cause.

a. *The remote causes* have often been styled *predisponent*, and on the belief that they effect certain changes in the fluids and in the vital tissues, rendering them more than ordinarily susceptible of morbid excitations ; and when disease is excited, and actually exists, they afford a specific tendency to affect particular tissues, and in a peculiar manner. There are, also, many personal circumstances, or idiosyncrasies, which act as remote, or predisponent causes.

b. *The exciting causes* are such as produce some perturbation, or sudden change in the system generally, or in some particular part harmonizing with the whole ; by which a change of vital force and of function is produced. This excitation of disease is more readily brought about in a subject already predisposed, than in one free from such a state. A change more or less persistive is produced in the intimate tissues, and a morbid habit established.

c. *The primary cause*, as already intimated, is the first change made in the tissues by the preceding causes, altering their susceptibility, and the harmony of their functions. It constitutes the first link in the catenation of changes establishing the morbid habit. It becomes, therefore, the exclusive subject of pathology, and will not require any further attention in the present subject of causation.

2. *Remarks on Remote, and Exciting Causes.*

Our review then will be confined to the simple divisions of *remote* and *exciting* causes. However, these subjects cannot be viewed in a strictly isolated manner ; for in many instances it will be difficult to make the distinction. It might be contended, that in many instances, the remote cause may produce disease without any direct exciting circumstances, as in the instance of the acknowledged contagions and infections. It may be immaterial whether the virus be considered a remote, or an exciting cause ; yet, it is certain that it acts most energetically on a predisposed habit. It is further argued by some, that influenza, dysentery, pneumonia, spotted fever, typhus, cholera, &c., seize their objects without any intervening circumstances to light up disease, as exciting causes.

On the other hand, it is contended, that all the wide spreading diseases do require an exciting cause to bring them into action, by the formation of a morbid habit ; that the state of predisposition may be so intense as for disease to be produced by an intervening exciting cause not very appreciable, or not heeded, from inattention ;—and as confirmatory of this position, reference is made to the fact, that many have escaped the prevailing disease by a strict regard to precision in avoiding all the extraneous circumstances, which may affect the economy of the system, or such as may be esteemed exciting causes.

It may further be noticed, that many of the exciting causes, by being slowly applied, but repeated, may produce a state of predisposition, like other remote causes, and in their turn become exciting causes also. So watching, fatigue, surfeiting, alcohol, cold, heat, &c., by being repeated, create an increase of sensibility in the tissues, with an almost imperceptible alteration of function. On a further exposure, these same agents might excite severe disease, without any remote atmospheric afflatus, but more certainly when this exists. So heat and cold, by frequent alternations, often produce disease, and sometimes on a first exposure. The limits between remote and exciting causes are, therefore, difficult to be defined, although there is a manifest distinction, in many instances.

Finally, it appears quite certain, that all epidemic diseases, and many chronic, are lighted up, and assume their peculiar livery, by some exciting cause, by which the nosodynamic state becomes fixed; and yet, the excitation may be slight, as in the instance of cholera instantly seizing a subject on rising from bed, and stepping on to a cold floor.

3. *The Causes of Disease act by Incompatible Stimulations.*

In some former sections, allusions have been made to the thesis, that all the causes of disease, strictly speaking, are excitants; or, that they consist of agents producing an incompatible stimulation. It is the same both with remote and exciting causes. Although there be many circumstances which may produce an abstraction of vital force by withholding its supply; or by sudden excess of stimulation, deprive the tissues of their ability of rendering it a suitable residence; yet, these cases can hardly be styled disease, although they may have a place in nosographic descriptions.

There are many instances which occur in devastating epidemics, in which there are primary morbid changes in the tissues quite intense; these are sometimes so severe, that the usual exciting causes extinguish life before the phenomena of disease become developed. The subjects *appear* to die from want of stimuli, whereas death occurs from excess of stimulation; and indeed the effect is not very dissimilar on the tissues from that which occurs on taking a pint of rum at once; or, the tonicity induced on drinking cold water when the system is excited by heat. If it should be granted that one ounce of alcohol is an excitant, it must be very perverse logic to infer that half a pint is a debilitant. Further proofs will be advanced when treating of the exciting causes.

SECTION XXV.

FIRST DIVISION.

ETIOLOGY.

1. *Remote Causations.*

In this division we shall make some reflections,

1st. On the general atmospheric Pestilent Afflatus.

2d. On the local atmospheric contaminations.

a, Sensible,

b, Insensible.

3d. On the influences of climate.

4th. On Idiosyncrasies.

5th. On Aliment.

6th. On Exercise.

7th. On Clothing.

8th. On Alcohol, and other Narcotics.

9th. On Mineral Poisons.

10th. On Intense Thought.

These are copious topics, and require much in detail; we can do but little more than point out the method, as is hoped, in which they ought to be studied.

1st. *On the general Atmospheric, Pestilent Afflatus.*

I. Remarks.

The history of diseases from the remotest period, even down to the present time, affords sufficient evidence of the prevalence of severe diseases at particular seasons, and far exceeding the ordinary amount. These periods continue sometimes several years, involving different countries and latitudes, or their inhabitants, more or less, in severe calamities. In some cities nearly half the population has been swept off in a short time, by one form of disease, whilst another modification, under some other name, rages in another district with nearly equal severity; the loss may be one in ten, or one in three of the inhabitants. Man knows not where to flee for safety; nor can he escape its presence; for as the poet has expressed it, "a secret venom oft corrupts the air, the water, and the land."

2. Its Extensiveness and Effects.

There have been seasons when the vegetable productions were blighted with mildews by some secret taint; and although luxuriant, yielded but little fruit for the sustenance of man; when likewise, the beasts of the earth, and fishes of the sea sickened and died. At the same time, or in quick succession, an invisible something seizes on the bodies of men; they also sicken and are laid prostrate, and whole communities are filled with dismay. The picture is well portrayed by our medical poet Dr J. Armstrong, and ought to be preserved.

> Of every hope deprived,
> Fatigued with vain resources, and subdued
> With woes resistless, and enfeebling fear;
> Passive they sunk beneath the mighty blow.
> Nothing but lamentable sounds were heard,
> Nor aught was seen but ghastly views of death.

3. Ingenerate Origin.

The question has arisen amongst philosophers, what is the medium that sustains this noxious agent, and from whence did it arise? There are some facts, and much analogy in favor of its aerial existence; and this was the sentiment of the most ancient, as well as the modern pathogenists. But from whence it came, and what its entity consisted of, has been a subject of speculation and hypothesis; it has escaped every scrutiny, and every test. It received different appellations as the writer's modified views of its character dictated. Hippocrates called it *to thion*, or divine essence. Diemerbroeck styled it *pestilential germ.* Sydenham referred it to certain *occult qualities* in the atmosphere; whilst Rush and others, denominated it an *inflammatory* constitution of the air. The Arabs in allusion to the same thing as producing the cholera, call it *El Hawa*, the wind, or blast that passes. Or it may be styled a *pestilent afflatus.*

We will chiefly contend for the fact, that certain periods, embracing from three to ten years, or more, occasionally occur, in which destructive diseases prevail, and that there exists the strongest presumption of a wide spread contaminating influence in the common air, affecting the fluids, and vital susceptibility of all organized compositions, more or less; but, from what physical influences it arises, is yet a matter of conjecture. We know not much more, or different from the allusion of the Psalmist, when he spoke of "the pestilence that walketh in darkness, and the destruction that wasteth at noon day." Dr N. Webster has compiled a very useful epitome of medical history, in which he endeavors to establish a coincidence, and dependence of pestilent diseases on planetary influences, in connection with the agency of electricity. On a former occasion,* we were inclined to advocate the thesis; but on further reflection have grown more sceptical. From whatever source it may have an origin, it must be very extensive, as it embraces a wide range of aerial surface.

In Section vi. 5, a suggestion was made, with a view of exciting further inquiry, that an excess of vegetative life pervading the atmosphere might, by undue stimulation, affect organized beings. On the thesis of an all pervading vital aura, Sect. vi. 6, this suggestion is raised; and on the facts, that during the pestilent periods, and in districts suffering most, there is an excess of vegetative and animal life; that myriads of insects and reptiles appear; that the intellects of men are elevated, even to a degree of impassioned ardor,

* Sketches of Epidemic Diseases in the State of Vermont.

and too often attended with broils and wars ; that the procreative powers are increased ; and finally, that the entire organism shows signs of a more than ordinary state of excitation.* The effect has commonly been assigned as the cause, in the hypothesis of decaying vegetables, and putrefying animals contaminating the air ; whereas it is far more probable, that the same cause, which affords an undue increase of vegetable and animal life, may stimulate the living system to excess of action, and excite disease in some form. However, there is a great weight of testimony to show, that the decomposition of vegetables or animals does not excite disease, notwithstanding so much has been advanced on the hypothesis. Sickness often follows great scarcity of vegetation ; and again, a luxuriance accompanies, and follows severe epidemic diseases.

A considerable number of facts are put together by Professsor Chapman, in an essay on the causes, &c. of epidemics ; *Phil. Jour. Med. Sciences, No.* 18 ; which go to show very satisfactorily, that the effluvia of decomposing animal bodies do not produce disease, and nothing more than sometimes a temporary commotion. In the same work also, many facts are stated, showing an increase, and decay of numerous animals, of the lower classes, in seasons of devastating sickness. We may remark, that shallow waters have much albumen, and are filled with various kinds of vermin He also makes this pertinent remark, in a casual manner ; "It seems to me a much more rational conclusion ; that this unusual fecundity is owing to the state of things of which epidemics are the effect." And further mentions the fact as occurring in yellow fever, of "the black vomit being found, during the life of the patient, so filled with animalcula as essentially to constitute that fluid." For a still more extensive collection of facts on these interesting topics, Dr Webster's valuable

*See Tytler on the Plague.

work on pestilence, may be consulted with great advantage.

We shall not urge this subject at present ; but, if it be true, that there is an all pervading vital aura, which sustains the immensity of organized beings, (Sect. iv. 6,) we may by analogy assent to the suggestion of conditions of excess, or certain concentrations like galvanism, and the manegtic aura ; and in such an event, it may no doubt spur to excess the living tissues, producing disease ; and, also, cause the ocean, earth, and air to teem with life prolific, bringing into existence myriads of ephemera to flutter in the sunbeams, and stay just long enough to declare their Maker's power.

4. *Modifications of Remote Influences.*

Whatever may be the ingenerate cause which gives origin to the pestilent afflatus, it is very extensively diffused ; and also, in different periods, seems to possess some new modifications. It will not be contended but that local causes may produce some variations in its character and severity, yet we perceive it is quite persistive in its character for a time. For example, influenza and cholera retain their character in every clime through the habitable world, whether on high or low situations ; although there may be some difference in their severity at the access, height, or decline of the morbid period. Whilst the pestilent afflatus is very intense, the particular habit of the prevailing disease will sternly maintain its influence, to the exclusion of almost every other form of epidemic disease ; and it is an ancient remark, that even chronic diseases assume something of its peculiar livery.

However, this persistency of character does not usually last for a great length of time before certain mutations take place ; although it seems the late cholera afflatus might be a singular exception. It is far more common for one habit of disease to follow some other in succession during the pestilent period.

For instance, the spotted fever in the winter of 1810–11, in the Northern States, was changed in the winter of 1811–12 to wide spreading, and destructive pneumonia. The change was not uniform, however ; for as the diseases spread from north to south, there was occasionally one disease in one section, and the other in another, in a very irregular manner. In the course of a year or two after, they visited the Southern States, producing diseases of a modified character. This pestilent period continued about five years, and during this time, various other habits of disease prevailed, more or less uncommonly, in different parts of the civilized world.

The pestilent afflatus by altering the organic sensibility of the tissues, predisposes them to be more easily wrought upon by adventitious exciting causes. And furthermore, it always affects some one tissue more than the rest of the tissues ; and such affected tissue becomes the focal concentration of the particular disease, as soon as the morbid habit is formed. So almost every affection in epidemic periods possesses a similarity of character and phenomena. But, an inexplicable change may take place, and some other tissue may suffer a similar change, and in this event another form of disease may appear with other phenomena, and receive some other name. History informs us that malignant typhus often precedes the plague ; that pneumonia occasionally follows influenza, scarlatina, and spotted fever in quick succession ; and yellow fever again stands in close relation with bilious remittent fever. Many other facts might be brought to show, that all epidemic diseases possess a kind of affinity, however modified by circumstances.

There are noticed, again, other modifications, which also admit of no explanation ; only from the sequence we infer some change of properties suited to idiosyncrasies. Although in certain seasons no class of people are exempted from the morbid impression ; yet there are other times in which particular classes are affected, whilst others escape. The spotted fever in New England in 1811, chiefly affected children under twelve years of age, and young women ; whilst in 1812, the pneumonia principally seized on the most robust, middle-aged males. In some epidemics the blacks are exempted, and on other occasions they have been affected, to the exclusion of all others. Sometimes different families in relationship, although remotely situated. And again, particular nations are sometimes affected, to the exclusion of all others ; as described by our medical poet, in relation to the destructive sudor Anglicus of England, at about the end of the fifteenth century.

> It seemed the general air,
> From pole to pole, from atlas to the east,
> Was then at enmity with English blood ;
> For, but the race of England, all were safe
> In foreign climes ; nor did this fury taste
> The foreign blood which England then contained.

5. *Reiteration of Aerial Diseases.*

Diseases of aerial origin may be repeated in the same individual as many times as he may be under similar circumstances to receive an impression. The disease is never communicated from one subject to another. Thus, the influenza, plague, yellow fever, spotted fever, pneumonia, cholera, typhus, dysentery, scarlatina, intermittents, with all the diseases which have received names from the places they seem to originate in, are liable to affect the same subject at other periods, and even during the same period of sickness ; being liable also to relapses. Notwithstanding, a subject who has passed entirely through any of this class of diseases, is not so liable to them again as another, because he does not so readily again obtain a predisposition to light them up. These facts distinguish all epidemic diseases, or those of aerial origin, from those dependent on a specific virus. In these instances the disease is communicable, and the subject can have it but once, and he is not liable to relapses, although he may be to aggravations. These last, as the small pox, measles, whooping-cough, kine pox, &c., are the only self-limited diseases; and they are subject to so many modifications, that they are scarcely deserving the appellation. When the general atmospheric afflatus is present, the diseases of this order prevail more readily, and with greater severity.

6. *Remarks on the late Cholera Afflatus.*

A brief review of the late epidemic may afford some instruction on aerial influences, as it seems to be the most extensive, persistive, and destructive of any on record. It first appeared in Asia, and extensively in the region of the Gangetic Delta, in 1817; a country where it had for ages been known to be endemic. It appears now to have arisen with some new modifications of severity, and as if its source was inexhaustible. Our geographical allusions are intended more for atmospheric than for terrestrial boundaries. Reference may be had to various official reports from India of its extent and ravages. We can only remark, that it passed in all directions, but its principal line of march was from east to west. Its devastations have reached from 20 degrees south latitude from the equator, to 65 degrees of north latitude, and more than 100 degrees of longitude, before making its transit over the Atlantic ocean.

The particular routes of this destroyer of life have been quite irregular, but it progressed on an average about three or four miles a day westwardly. It has stopped and retrograded in its course; escaping some villages, whilst it revisited other cities, and at an unexpected time suddenly seizing on the favored ones; this is common to other epidemics. Its stay at different places was quite various, sometimes a few months, at others only a few weeks; yet hovering about, and occasionally becoming more aggravated. It loitered several years near the confines of Europe, and at length, as if it had gathered strength, in 1829 entered, visiting even the cold regions of Russia in summer and winter. In 1830 it reached England, Scotland, and made solemn progress in the south of all Europe. Before it bestrode the Atlantic, the most careful estimates of its victims amounted to fifty millions.

The people of this western continent rested securely in the protection of the waters of the wide Atlantic. But, to us it appeared a frail barrier. In March, 1832, in an introductory lecture, the following sentiment was announced : "Even England, with her high oxygenated atmosphere, is not protected from pestiferous blasts. The cholera at this very moment proves, that science has not purged the atmosphere of malignant taints ; it stalks triumphantly through every clime, and bends its proud steps towards the setting sun ; decides the fate of battles, and too often defies the tardy use of medicine. Shall we claim protection from its embrace, either from our physical condition or our moral graces ? Nothing short of Almighty clemency can shield us. This region has already experienced desolating sickness ; a new combustion of atmospheric gases might again light up the torch of pestilence ; in which event we might become the actors of other scenes and other times, as depicted by an elegant historian :

> Dire was the tossing, deep the groans ; despair
> Tended the sick, busied from couch to couch ;
> And over all death shook his cruel dart "

On the 8th and 9th of June following, (1832,) the Asiatic Cholera, as it has been called, showed its frightful aspect at Quebec ; fifteen sickened, and seven died on the ninth ; some of these were emigrants just arrived, and some were citizens. The belief of its communication from one person to another, by those who knew not its character, excited great alarm, as it had done wherever it had appeared. Its rapid spread to Montreal, New York, Detroit, the great West, and South, and even South America, cannot be detailed here, but may be learned from many excellent treatises written by American physicians. Finally, the cholera afflatus in a period of about seventeen years, had nearly embraced every section of the earth, destroying people of different temperaments and habits. In 1835 it still loitered in many places, but was not so severe.

One fact in connexion with the first appearance of the cholera on the American shore ought not to be omitted; which is, that there was an easterly or north-easterly wind, which prevailed very constantly for four weeks previous to the 11th of June, 1832, when it ceased. There was an almost continued dripping, and it might be called a rainy season, together with a degree of coldness which threatened to blight the prospects of agriculture. Surely the coincidence of so long continued wind, and the immediate appearance of the cholera, are worthy of notice.

There appear to be numerous circumstances which favored the progress of the disease in particular places, and amongst particular classes of people, which cannot be noticed now. Notwithstanding it followed the low courses of fresh water, and seized on the profligate and enervated, yet afterwards it did visit high and dry regions, and affect the most healthy and circumspect part of society. The local and exciting circumstances will be considered in their places; but none of these can produce the disease without the predisponent pestilent afflatus.

SECTION XXVI.

ETIOLOGY—CONTINUED.

2d. On the Local Atmospheric Contaminations.

Our reflections on this subject will lead to some inquiries directed to ascertain, how far vegetable and animal decompositions, separate or combined, affect the bodies of mankind, and produce disease. It will be necessary to consider,

a, Sensible effluvia,

b, Insensible effluvia, or miasm.

With regard to the *first*, the prima facie evidence gives forcible impressions of a noxious agency, which, by coming in contact with the living system, might produce disease; and therefore the stench of putrefying vegetable and animal substances has been viewed with horror, and avoided as far as possible; and the belief of its contaminating power has been formerly sanctioned by the faculty very generally. But, of late the subject has undergone a severe investigation, and the result is, that however offensive the floating gases of decompositions may be to the olfactory sensation, and although they may occasionally be attended with syncope, vomiting, and even fatal asphyxia, yet they are in no appreciable manner productive of disease, or the formation of the morbid habit. Their influence is chiefly on the nerves of external relation, and evanescent.

Nothing is more common than to read of the corruption of the bodies of the slain in battle producing, as was supposed, the plague, dysenteries, and other malignant diseases, when they depended on other coincidental circumstances. The most destructive diseases have prevailed, when their origin could not be imputed to the decomposition of organized substances; and again, where these processes have been going on in great profusion, there is no evidence of their occasioning the prevalence of disease in any form. They may exist in abundance without being accompanied by disease.

2. *Instances as Proofs.*

In support of this last proposition, we will briefly advert to a few out of many facts which might be presented.

a. In all parts of our own country, as well as in others, there are numerous slaughter-houses ; and at every such place there arises a stench very offensive to those not accustomed to it ; and yet, the people engaged in the work, or visitors, are not made sick by it ; and it is even confidently asserted, that those people are not so likely to be affected as others when sickness prevails.*

b. In the anatomical dissecting rooms, now numerous even in this country, and greatly multiplied in Europe, no disease has ever been assigned as originating from them, although it had ever been supposed, that decompositions of human organization afforded the most noxious effluvia.

c. In every farmer's barn-yard, in the country, in every house-yard, also, in villages and cities, there is usually going on decomposition in the warm seasons of the year, and often the effluvia are very offensive, and yet no disease prevails, perhaps, in six years out of seven ; but, if there should be disease, how familiar it is to refer it to these disgusting gases ? These offensive gaseous productions are chiefly hydrogen, sulphureted and carbureted hydrogen, ammonia, and carbonic acid gas ; none of which, separate or combined, ever produce a pyrectic habit, even where greatly evolved in chemical processes.

* Dr W. F. Edwards, "On the Influence of physical agents on Life, p. 186, Phil. Edit. states, that at Montfaucon, in one of the greatest slaughtering establishments of horses, dogs, cats, &c. in the environs of Paris, " that the cholera affected scarcely any of the workmen." Also, by the advice of M. Duchatelet, that the workmen and their families, " are in general remarkably healthy."

d. During the impulse of national fervor that afflicted revolutionary France, the existing powers authorized the breaking up of the graves of the ancient sovereigns in St. Dennis, as a kind of revengeful insult. It is represented by Mr Howard, that there arose from the tombs a thick dark vapor, extremely offensive, which produced sudden depression, and even fatal asphyxia in some of the wretches engaged in it, but no defined pyrectic disease ensued. All these kinds of gases impress the nervous system of external relation, without very essentially affecting the great system of nutrition, the seat of disease. (Sect. xvi. 3.)

e. Another instance has often been alluded to by etiologists, as occurring at Paris, and published by M. Thoset, in the Journ. de Physique, 1791.* It consisted in the removal of the cemetery of St. Innocens, which covered about two acres of ground in the centre of the city, estimated to contain six hundred thousand bodies, which had been accumulating for six centuries; it occupied two years in removing it. The stench was quite insupportable, and often the mephitic vapors affected some of the laborers with dizziness, syncope, tremors, and even asphyxia, yet no fever occurred, nor any endemic prevailed.

f. Other instances of the removal of cemeteries might be mentioned, and with similar results; and also, we might take into the account the manufactories of animal substances as the making of adipocire, candles, soap, &c. The extensive fisheries also; foul wharves, giving out complicated and disgusting effluvia, might be adverted to, and every reference would only confirm the fact, that neither endemic nor epidemic disease, has ever been shown to be generated by them, and that these gases exist in full profusion during the most healthy periods. Professor Chapman has done a service to medicine, in collecting many facts to support the thesis in his Thoughts on the Causes, Phenomena, and Laws of Epidemics, &c.

* Phil. Jour. of Med. and Phys. Science, No. 17, p. 376.

Having a presentiment that the enlightened community of medicine will readily assent to the foregoing positions, this part of our subject may be relinquished, whilst we enter upon the other, and by far more laborious part.

3. *Insensible Effluvia, or Miasm.*

Within about the last half century, much time and labor have been spent in the investigation of the marsh miasmata, or malaria, as they have been called ; and so many ingenious writers have favored their existence, and their efficiency as a potent cause of numerous diseases, that it has become almost an established creed. The coincidence of solar heat, the sensible effluvia, and disease often occurring at the same time, were very imposing circumstances, and it is not surprising that investigations should have taken the turn they did. Yet, after it had been well proved that sensible effluvia never produce disease, still the tenaciousness of opinion has led very many to adhere to an inappreciable cause, a something still called by its former name, which never has been demonstrated, or in any manner brought into a cognizable form, either by the efforts of chemistry, or the power of magnifiers, nor by legitimate effects. Every analysis of the air at the surface of the most suspected marshes differs not from that which is brought from the higher strata of the atmosphere.

The extensive experience of Dr Ferguson seems to have taught him only to discard one half of the errors of common opinion ; for, whilst he disclaims the noxious influence of all *sensible* effluvia, he still favors the existence of an *insensible* malaria. He says, "I shall not multiply facts, and illustrations of the same kind to prove, that putrefaction, and the *matter* of disease are altogether distinct and independent elements."* However, we are not able to discover a single fact or illustration he has given to show a disease-producing cause, but what may fairly be explained by an appeal to other, and more man-

* Phil. Jour. Med. & Phys. Sciences, No. 13, p. 9.

ifest circumstances. Had etiologists pursued the line of investigation indicated by Hippocrates, Sydenham, Huxham, Mosely, and many other former coadjutors, they would have been better rewarded than *tilling the sands of Africa*, or even of Holland, Spain, or the West Indies ; as Dr Ferguson, and many others seem to have done.

4. *Prefatory Exposition.*

It is true we have favored the existence of inappreciable, remote causes in the instance of the atmospheric afflatus ; but, here is no room for any other assignable cause, and the evidence of its existence nearly amounts to demonstration ; and the hypothesis has been sanctioned from the earliest to the latest records of medicine, and even without controversy. The hypothesis of an existing terrestrial miasm is of recent date ; it is altogether gratuitous, and not needed to explain any phenomenon in the history of causation. Whilst its advocates have been driven from their first assumption of its manner of existence, they have advanced another mode less tenable than the first.

Our instruction was in the school of the miasmatists, and we did not closely question the principle, until we had suffered a committal both in public,* and private. Yet, on a thorough review, and a conviction of error, feel ready to abandon it, and take a pleasure in advocating what we consider as truth.

5. *Negative Suggestions.*

1. It will be difficult to expose our views of the causation of disease, until we have an opportunity to discuss many subjects before us ; we can now offer merely some negative suggestions to the existence of malaria.

We make more particular reference to Dr Ferguson, because, so far as we are instructed, he was the first that ap-

* In Sketches of Epidemic Diseases, &c.

peared in public, and before the Royal Society at Edinburgh, in the early part of 1820, to advance the following sentiment of "vegetable and aqueous putrefaction;"—he says, "it is my intention in this paper to show from a narrative of facts, that they are unfounded, and that putrefaction, under any *sensible* or discoverable form is *not* essential to the production of pestiferous miasmata." "The marsh poison, is notwithstanding by far the most frequent and destructive source of fever to the human race."* It is not then any discoverable entity that produces disease, nothing that can in any manner be appreciated before hand; but something that eludes the watchfulness of the nervous tissues of external relation, and not disturbing their functions, until secretly fastening on the great system of the nutritive tissues, and like a poison paralyzing their functions. It may now merely be stated, that all the phenomena of the differently modified fevers may be accounted for without it.

2. It is not a little curious to observe the discrepancies of opinion amongst the miasmatists of the properties of their supposed agent. Dr Ferguson represents it as possessing "an uncommon, and singular attraction for the earth's surface;"—"it creeps along the ground;" and "the inhabitants of ground floors," are oftenest affected; "that it is certainly lost, and absorbed by passing over a small surface of water." In the same journal† Dr Chapman says, "the experiments of De Lisle show, independently of other evidence, their comparative levity."‡

On the other hand many contend, that it can be wafted to a considerable distance; and others to a great distance by winds, and still retain its noxious potency. In the 59th No. of the Edinburgh Review it is supposed to be transported in the air from Holland over the German ocean. "But the

* Phil. Jour. of Med. & Phys. Sciences, No. 13, p. 2.

† Idem, No. 16, p. 374.

‡ What experiments can show the character of inappreciable substances?

east wind has the power of transporting it to a considerable distance, and we have but little doubt that whenever it occurs in this city, (Edinburgh,) where it now is rare, the poison is transported from Holland."* In 1811, a certain writer on the spotted fever then prevailing in the valley of the Connecticut river, gravely insisted, that the cause was a miasm, wafted by the north-west wind from the northern section of the state of New York, and in the month of February, whilst the earth was sealed in frost, and covered with snow. Others, again, state that its influence extends only to a few feet.

c. But little less amusing are the sentiments of men of sober science on this grave subject. Dr Ferguson states his experience in South Holland, with the army, in 1794, on "a level plain of sand, with a perfectly dry surface, where no vegetation existed or could exist, but stunted heath plants. In digging, it was universally found to be percolated with water to within a few inches of the surface, which so far from being at all putrid, was perfectly potable in all the wells of the camp." This year there was severe sickness, because there had been "a very hot and dry summer." But, when he returned there in 1799, "with the army under the command of the Duke of York, which remained the whole autumnal season in the most pestiferous portion of that unhealthy country, without suffering in any remarkable degree," the assigned reason is, it had been a rainy season, and cold. Now in this case the surface was kept wet, and not scorched by the sun reflecting intense heat.

And further, "in 1810, a British army at Walcheren, on a soil as *similar* as possible, and certainly not more pestiferous, but under the different circumstances of a hot and dry preceding summer, instead of a wet and cold one, suffered from the endemic fever of the country to a degree that was nearly unprecedented in the annals of warfare."

We do not doubt a single fact here stated, but the reasoning and inferences are insufferable. It seems the miasmatists to

* Phil. Jour. of Med. & Phys. Sciences, No. 16, p. 374.

make out their case, overlook the most obvious circumstances which are presented, as altogether insufficient to excite disease, whilst they enlist such as never can be shown to exist. Is it possible for so powerful, and noxious an agent to be generated in a clean, dry, sandy soil, with pure water beneath, and where no vegetation exists? It is not even attempted to be explained in the present instance; only the troops were sick, and died in multitudes, and nothing could be capable of doing so much, except an invisible, untangible, ghostly something! This will be the fate of all armies, and even citizens until their attention shall be turned to look after the more obvious causes, and take precautions to avoid them. After being driven from the thesis of animal and vegetable putrefaction, they still do reverence to their imaginary idol, though not germinating from hay, wood, or stubble, or any thing else they have assigned as its origin.

d. We can only here remark briefly, that the heat of a scorching sun on a plain surface of dry sand in a low level, must be very intense, although no notice is taken of it in the history. It could not be less than 80 or 100° Fah. Such a heat in any climate, alters every physiological function of the system, and increases its sensibility to a high state of predisposition. Again, the contrast must be great between day and night on a soil filled with water just below the surface, and covered with sand, after some radiations have taken place. It is very common for the thermometer of Fah. to fall from 90 to 60° at night. Add to this the great evaporations of moisture by day, and heavy dews by night, and we have cause enough, without due precautions, to destroy both the armies of Spain and Walcheren; and without taking into the account the numerous irregularities of soldiers; provided they are exposed to the dews and night air. And, farther, every medical observer must be aware, that these circumstances have a sudden, as well as powerful, effect on predisposed systems.

e. Again, it is nothing remarkable, that the steady wet weather in such a climate as Holland, in 1799, should be called healthy. The sun is obscured a part of the time, and when clear the earth is not heated, but moist and cool. The contrast between day and night is not great; the inhabitants have not suffered extremes, nor sudden alternations of heat and cold. But, it has always been noticed, that the setting in of a cold, rainy season, after a hot and dry summer, was liable to be attended with severe sickness in some form. Yet, if the malaria causes the sickness, why did it not appear before? So, also, many are made sick by dysentery, or some other disease after a shower. And, in a similar manner, sailors lodging on shore only for a single night may all be made sick. There is no necessity of dragging in imaginary agents to excite disease. What? all seized by malaria in one night! Were they not rather affected by the extreme atmospheric vicissitudes?

Furthermore, it is very well agreed amongst the miasmatists, that the inappreciable noxious agent is most concentrated, and does the most mischief at nightfall, whilst through the day, when it is ascending, it is said to be perfectly harmless!

e. Every one knows that the precipitation of the dew, together with the increasing cold of evening, is liable to excite disease, and in all countries and places where dews exist; and the danger is the greatest in hot seasons, whilst there is the greatest contrast between night and noon, and this is in July, August and September. It has repeatedly been demonstrated by the thermometer, that the variations of temperature are greater in low situations, than in those considerably elevated. But let us inquire, why this potent agent should not fasten on the bodies of men whilst ascending so profusely, as they say; and especially, why it should be more virulent after being diluted in the atmosphere, and tossed by winds? Is it of so incorrigible a nature that it does not become dissipated, or neutralized, or subdued like all other gases in the great aerial laboratory? The same column of air that receives the gas at noon, cannot precipitate it, or the same vapor, as it is constantly moving onward.

f. Dr Ferguson says, "that form of fever to which it (malaria) gives rise, rages throughout the world wherever a marshy surface has been exposed for a sufficient length of time to the action of a powerful sun." We grant that fevers of different aspects are liable to prevail under these circumstances, whether the marsh be of salt or fresh water, even if on the top of a mountain; and there is nothing paradoxical about it; and the disease may prevail without malaria. It is enjoined that, "the marsh must cease to be a marsh," or dried up before it gives out its venom. Now this requires not only a "powerful" but continued sun; and when the moisture is mostly evaporated, the sun acts on a broad surface without a leaf to intercept its rays. Notwithstanding there is no water on the surface, still the aqueous exhalations are abundant, and at nightfall there are always very heavy and cold dews. Experiments have repeatedly shown, that moderately dry surfaces of the earth exposed to the sun's rays, afford more vapor of exhalation than moist ground, because the heat of the ground is so much greater, evaporation is more copious. All surfaces not shielded by vegetation or water, become very hot at 80° or 90° of Fah., and emit much of the vapor of water, affording dense dews; and Dr Ferguson says these are the only places which generate the poison. So also, the natives in Spain could have no idea of the real causes, nor could they appreciate the supposed poison, and said the troops had poisoned themselves by "eating mushrooms."

Surfaces covered with vegetation are not so greatly heated by the sun, neither is the contrast so great between noon and night, nor is there so much dew. The dews in Egypt are dense during their seasons of plague; and whilst the heat of the day is intolerable, the nights are so cold as to require several blankets to sustain warmth during the time of sleep. In

Spain, according to the statement, the sickly places were low soils of dried sand on a rocky substratum; and in the West Indies, the same with coral bottom, and all of them destitute of vegetation, having been covered with water. Most certainly these are the proper conditions to develop the true causes of disease, without the aid of any direct poison. The contrast of heat and cold is great, and the dews are heavy.

g. It appears to be a well proven fact, that those who sleep on ground floors are more liable to contract disease than those who lodge in the higher apartments. So long ago as 1742, Sir J. Pringle says, "it was then observed that such as lay in the upper stories, were much more healthy than those who were below on the ground floors, *which were all very damp.*" It appears he was able to divine the true reason at the time, and without the aid of malaraic poison. The ground floors are always more moist than the upper stories. Moisture, or damp air always conducts off more caloric from the body than dry air. Damp rooms are always cool; and this is what increases the disparity between the temperatures of noon and night, and these circumstances are always sufficient to create even yellow fever, after the subject has been exposed to a temperature of about 80° or 90° of Fah., for some length of time. The ordinary amount of sickness on high grounds, is nearly in proportion to those of the low in hot seasons, and in a ratio as the latter is hotter through the day, and colder with heavy dews in the night.

h. After due homage to malaria, Dr Ferguson remarks, "I am far from presuming to deny that there are fevers from pure excitement; for soldiers and others have been attacked and died of yellow fever before they landed in the West Indies, or could be exposed to the influence of land miasmata in any shape." Notice, *without land miasmata.* This admitted fact might seem to settle the question even against himself, since it might be considered, that the disparity of temperature between night and noon is never so great on the water as on the land; for the coolness of the water keeps up a greater equilibrity; and in vessels the people are better protected against chills and dews, nor are these so dense. And many instances might be adduced to prove, that sickness has been avoided by strict attentions in avoiding the heat of the sun, and the coolness of the evenings on land, as well as on shipboard.

i. Dr Combe remarks* in relation to the mortal sickness on board the squadron of Lord Anson, "the causes of disease lay entirely within themselves." In page 274, he contrasts the prudence of attending to his men, by the circumnavigator Cook; he says, "the Resolution performed a voyage of three years and eighteen days, *through all climates*, from 52° north, to 71° south, with the loss of only one man by disease, out of 112. And in his last voyage, so efficaciously were the same means put in practice, that his ship was brought home, after an absence of four years, without the loss of a single man by disease." It might wound the pride of the miasmatists, for any one to say, that the health of both citizens and soldiers on land, might be as well protected from disease of all kinds, by a judicious attention in avoiding the real causes, instead of succumbing to an imaginary one. If miasm is such a potent agent as represented, then hygienic attentions could no more evade it, than the small pox can be.

If it be true then, as Dr Ferguson suggests, that yellow fever may be produced on the water, without the supposed poison, and by mere excitement, why not on the land, where the predisposing and exciting causes are more intense? And if these causes are sufficient on a small scale, why not on a larger one, where the concurrent circumstances are increased?

It is stated by Dr O'Hallaran, on yellow fever, that what were called miasmal fevers, were far more severe on the hill Monjui, in Spain, 700 feet high, than on the marshy grounds

* Principles of Physiology applied to health, p. 271.

below. Dr Bancroft mentions similar facts at St Lucie, and Grenada. So also, Dr Blanc mentions facts of a like kind. Let severe disease prevail wherever it may, yet the cause must be miasm, in the opinion of all the miasmatists, and some explanation given, however frivolous.

The experiments and observations of Dr Potter of Baltimore, are ingenious and useful, in proving a state of predisposition to exist in most people during an epidemic season, and that the blood suffers changes anterior to the attack of disease; but prove nothing as respects these changes being produced by a miasmatic poison.

We have heard much of the malaria of the Pontine marshes; but are there not causes enough to modify the normal actions of health, and excite disease, without the aid of any malaria? Dr Johnson remarks,—"Italy, indeed, is very singularly situated in respect to climate. With its feet resting against the snow-clad alps, and its head stretching towards the burning shore of Africa, it is alternately exposed to the suffocation of the Siroces from the arid sands of Lybia, and the icy chills of the tramontane (winds) from the Alps, or the Apennines." Dr Clark states, that the mean temperature of the Mediterranean generally in the month of August, is at 80° Fah., and of course it is sometimes higher. Here are all the essential causes, with their different bearings, to produce disease of the severest kind, by exposure to them. The inhabitants often keep their houses until after the dew-fall in the fore part of the evening, and then go out without so much danger; but, who can say there is an invisible poison to be shunned; or, is it not rather the physical effects of the precipitating dew? Dr Mosely states,* that he has experienced "shivering and coldness, as in an ague," in passing the swamps near Kingston, Jamaica, and also the Pontine fens between Rome and Naples, early in the morning before sunrise; and

* Tropical Diseases, p. 39.

advises, that sailors never be permitted to sleep on shore, in low, damp soils.

j. We can scarcely avoid making some reference to the facts stated by Dr Chapman, in his Thoughts, &c., on Epidemics.* Speaking particularly of yellow fever, he says,—"The fever has, moreover, invariably appeared along the wharves, and rarely extended itself far into the city, or beyond the influence of this position." In p. 121: "Exactly the same thing happens with regard to the whole of the West India Islands." In p. 122: "It appears not to be limited to the foulest spots in the city;" he adds, "the nature of the cause which modifies exhalations in this position, so as to generate pestilential fever, *is wrapt in obscurity!*" Indeed, any explanation upon the miasmatic hypothesis must forever be wrapt in obscurity. Our author intimates there are greater sources of filth in the upper than in the lower part of the city. This accords with a sentiment of Dr. P. Donaldson, though not peculiar to him. "We observe the prevalence of the disease (yellow fever) in the most salubrious parts of cities, and the absence of it in the most noxious hovels and streets."†

The above quoted facts show a close connection with the history of cholera, except in the one case the condition of predisposition may be supposed to be chiefly obtained from an aerial influence, and in the other from many circumstances in connection with certain degrees of atmospheric heat. All the histories agree, that it makes its first appearance, and greatest severity in low and humid situations, along rivers, lakes, and savannas. So also, most commonly appear adynamic fevers, dysenteries, remittents, and intermittents; to these might be added the typhoid fevers of humid jails.

The solution of these phenomena become quite familiar, as soon as our minds are relieved of the delusive spell of contagion and infection. Whilst these have any place in the etio

* Phil. Jour. Med., &c., No. 17, p. 120.

† Syst. of Med. and Chirurg. p. 189.

logical creed, every explanation will be shaded with doubt and mysticism. The phenomena of the extraneous circumstances acting on the human system, must be subjects of other sections. We may now merely say, that low and flat locations in warm seasons are hotter than more elevated situations ; and at night the low situations, on account of the dews and water in the earth, are colder than high situations. Not that dew or water have any thing particularly deleterious in them, but that they are conductors of heat, and suddenly reduce the amount of personal caloric, as soon as the heat of the day is past. Alternations of heat and cold excite disease, and fix the morbid habit. These will admit of illustrations in their places ; but, in the mean time let us remember, that the older physicians were well aware of the annual and diurnal vicissitudes producing disease, as is well sung by the poet of health ;

> For while the effluence of the skin maintains
> Its native measure, the pleuritic spring
> Glides harmless by ; and autumn, sick to death
> With sallow quartans, no contagion breathes.

k. It is clearly shown by many writers of undoubted authority, that in the interior of the southern and middle states of America, yellow fever has prevailed an hundred miles and more from the Atlantic coast and cities ; and in a strikingly characteristic manner. In addition, and confirmatory of these, we may add the testimony of the late Dr Coventry, President of the New York Medical Society, in an annual address before the society in 1825. He had been conversant with diseases in Europe, and in the interior of the state of New York. And after his removal to the new and flat country of that state, he met with fevers attended with black vomit, and the intense yellowness as described in the phenomena of yellow fever. After a visit to the city, and making strict inquiry into the phenomena of the fever there in 1805, especially in Pearl street, he says, "I was as fully convinced of the identity of this disease, with the epidemic that had raged along the margins of the western lakes, as I was of my own existence." Dr Merrill, in his account of yellow fever at Natchez, in 1823,* states, that in the month of October, as the weather grew cooler, it began to decline in severity, "and not unfrequently assumed the type of an intermittent." The thermometer ranged from 80° to 93°, from the 1st of July, to 25th August; dry weather. Also, from Dr Cartwright's excellent essay, in the Medical Recorder, 1826, we learn that remittent and other forms of severe disease preceded, and followed the yellow fever at Natchez; and we infer that the latter was nothing more than an aggravated, or more malignant state of disease. The diseases were all modified by the different seasons of the year, and called by other names. This is a proof they could not arise from a specific miasm.

l. The character, and of course the phenomena of the family of fevers, suffer many modifications under different circumstances, both as relates to the intensity of the causes, and the personal susceptibilities of individuals exposed. So we see some epidemics of greater, others of less severity, although similar in kind. Some individuals in the same epidemic will experience more, others less severity. Sometimes the general acting causes are not so intense as suddenly to excite disease, but make certain impressions on the vital sensibilities, which imperceptibly alter the economy of the solids and fluids, and after an uncertain time induce disease, when the subjects are exposed to some, even slight, exciting cause. Thus, quotidian and tertian intermittents may be excited long after the formation of an incipient state of predisposition. It does not require so great severity of heat, and collateral circumstances, to induce these habits of fever, as those of the severe typhoid aspect. Neither can we discover why *intermittent* fever may not be induced without a

* Phil. Jour. Med. & Phys. Scien. No. 18, p. 255.

specific malaraic poison, as well as *hectic* fever ; they both have periodical paroxysms, coldness, heat, sweats, &c. And indeed, intermittents have sometimes been the precursors of phthisis. All pyrectic diseases are more readily excited in such localities as experience the earliest autumnal frosts ; these being low wet flats. Not that frost produces the disease, but only that it proves a greater degree of comparative coldness in such locations.

It seems to be a trait in the character of the human mind, in the investigation of philosophical topics, to overlook obvious and familiar circumstances, and seek for some remote, undefined, and inexplicable cause. Diseases of manifest domestic origin, and proved such on investigation, have been insisted on as brought from other countries. When the fire of investigation exposes these errors, they appear as sportive as the aerial flight of malaria from Holland to Edinburgh. The causes of disease are simple in their nature ; and the principles of diseased action will be found to be equally as simple, and depending on only a few elements, when correctly analyzed and exposed to view ; yet, there is more labor in removing the rubbish, than in erecting the edifice.

m. Our respect for the author just now referred to, Professor Chapman, induces us to notice one other thesis in No. 16, p. 383 : "In their operation, marsh effluvia are very wide and pervading. No section of the body escapes ; hence the number and diversity of epidemical and other diseases of which they are the source. Every variety and gradation of bilious fever, whether intermittent, or remittent, or continued—inflammatory, or typhoid, or malignant—as well as the several forms of intestinal disorder, cholera, dysentery, and diarrhœa, are, for the most part, distinctly to be traced to such influence." This sentiment may be common to all the miasmatists ; but, it reminds us of the rashness of Epimetheus in opening the Pandorean box, and scattering the many plagues upon earth. It is said that inspiring hope should ever remain at the bottom. Let us therefore take courage, that with perseverance, some of these evils may be mitigated.

It seems by the propositions, there are many specific malaria, engendering as many specific diseases, and as M. Broussais would say, they specifically affect some point in the different tissues, some way or another, and induce sympathetic fever ! So we seriously understand, whether right or not ; yet we hardly know, nor are instructed, whether rheumatism and phthisis thus originate ; or indeed influenza. But, we must consider, we suppose, the cholera to be produced by it ; and we may believe that the disease was produced by it at St. Petersburg in the winter of 1831–2, and at near the same time at Archangel, by the borders of the White Sea, in latitude 65° north ; places it never appeared in before ; although it requires 79° Fah. of heat to evolve the malaria ! We may, also, refer the winter epidemics of New England to the same agents, the spotted fever, pneumonia ; and why not croup, pleurisy, puerperal fever, and *iatro-insanity ?*

We feel bound to review this subject in a respectful manner, and with feelings of deep solemnity. Let us then be allowed to inquire, if each epidemic has a specific marsh virus, or infection for its origin, how can one epidemic, and individual cases in such epidemic, be transformed into other habits of disease ? The fact seems to be admitted by the Professor himself ; it is known by every observing physician. But, small pox, excited by a specific infection, never changes into measles or any other disease, neither does whooping-cough change to kine pox. In the instance alluded to in Sect. xx. 7, of the twentyeight made sick in a swamp, of four different diseases, must there have been as many species of malaria ?

n. Our design is not to admit of much extension of argument ; the present subject demands some attention, and it may briefly be remarked, that dysentery sometimes changes into typhus in the same individual, and remittents into continued fever, &c. In an epidemic season, the remittent fevers, with a little change of atmospherical phenomena, may be directly changed to yellow fever. These facts are well shown by Dr Francis Boot, in his Memoir of the Life and Medical Opinions of J. Armstrong, M. D. It is noticed in various places, especially Vol. I. p. 490. Also, he has brought together many interesting facts in the history of endemic and epidemic diseases, to prove, that they are modified by seasons, latitudes, and personal circumstances; he opposes the doctrine of the contagionists, but is an advocate of the existence of marsh malaria; an opinion not to be wondered at considering the school in which he was educated, and probably not having turned his attention so intensely to the subject as it merits.

In a comparative review of the fevers in the southern, middle, and northern sections of the United States, Dr Boot has collected many facts which go to show, that the fevers in the southern states, in warm weather, assume the intermittent or remittent forms; and as cool weather approaches, and in winter, fevers of a continued type prevail. In the middle states, continued fevers and intermittents prevail in summer, and the former in winter. Whilst in the northern states, especially in New England, intermittents are rarely found, even in the hottest season; but typhus, and fevers of a continued form. Numerous meteorological circumstances may exist in different locations, and take a part in modifying the vital susceptibilities, and in exciting those physiological commotions, which usher in the morbid habit.

It will be taken for granted, that no discreet pathologist will insist on the existence of terrestrial miasm in the winter season in the latitude of the New England States, and especially when the surface is frozen and covered with snow, which it often is for five months in the year. And yet we seem well warranted in stating, that there is nearly an equal amount of sickness and deaths in the six cold months, as there is in the six warm and temperate months, beginning on the first days of October and April. Indeed, in some winter epidemics the sickness exceeds that of the summer. Heat and cold, with their alternations, acting as remote and exciting causes also, along with an epidemic constitution of the air, may be considered adequate to the production of the most formidable diseases, without the aid of miasm, either in winter or summer.

o. Whilst contending against the existence of an inappreciable malaraic poison, and of as many grades and qualities as there are shades of difference in disease, we feel not disposed to deny, but that the gaseous exhalations of decomposing vegetable and animal substances, in close unventilated places, and excluded from the sun and air, as the holds of vessels and crowded prisons, may act as excitants on the nervous tissues, and co-operate with other agents in the establishing a predisposition to disease. Their influence may be feeble and transient, for very filthy places are only occasionally visited with sickness; yet, they may claim some share in the multiplied range of causations. The facts we have adduced rather militate against the suggestion, but we are willing to grant to them, in such conditions, all the potency they have not been shorn of. In the instances mentioned by Dr Ferguson, where disease prevailed on a dry sandy soil, without any vegetable or animal productions, and sweet water underneath, there could not be any gaseous extrications, and we find disease excited without them. And further, we have repeatedly seen dysentery, typhus, and malignant fevers prevail in very neat country places, where no filth could be detected, and on high ground.

p. Yet, again, there are other situations, in which the gaseous emanations disturb the sensibilities more poignantly than sleeping in an apothecary's shop, a distillery of ammonia, or a grog-shop. In either case the atmosphere is saturated with floating stimuli ; perhaps commonly harmless ; nevertheless, they may add to the weight of stimulations, when various other circumstances have increased the tissual sensibilities, and without possessing anything like the character of poisons. We can only say, if these gaseous substances ever become injurious, it must be in this manner ; and yet the inducements to cleanliness are so numerous, they ought to excite to first attentions for their removal.

We would willingly have ended this article long before now, had the subject been of any less importance ; and surely no satisfaction can be obtained in opposing the very respectable weight of opinion arrayed against us. Yet, so long as the notions of malaria are prevalent, etiology must remain stationary.

However, it seems necessary further to notice, that the miasmatic etiologists have proceeded from one hypothesis to another, until the subject has become systematized, and airy nothings made as palpable as Macbeth's ghosts. Two important divisions have been made, one called *kaino-miasmata*, or that which is common in the open atmosphere, and prevails in filthy, marshy districts, as Ferguson says "from perfectly dry surfaces ;" but as fable tells us, from too much water in marshes, and "Hercules, accordingly drained the Lernean marshes, and thus dried up this abundant source of pestiferous emanations."*

The other is denominated *idio-miasmata ;* and is said to arise from chemical changes in the personal excretions, retained in confined and unventilated apartments, as prisons, the holds of vessels, etc. A virus is supposed to be generated, which becomes contagious, or communicable from one person to another. Besides these, various other subordinate divisions have been made.

* Dr Eberle, Prac. Med. Vol. II. p. 35.

q. We only need to remark, that more evidence is required before these sentiments ought to obtain undoubted credence. That people confined in what is called an idiomiasmatic atmosphere, suffer a severe state of predisposition, we do not doubt, their whole exterior aspect proves it. So, also, with those, who reside near marshes. So the Cretins of the Alps are greatly modified by the extraneous circumstances, in which their bodies are enveloped. So, again, with every tribe, and nation on the earth.

Even the inmates of colleges and factories all have their peculiar aspects, which are indicative of internal changes of tissual susceptibility. Let the ordinary exciting causes of disease be applied, and we find the phenomena as different, as the predisposing circumstances have been. The highlander will have a different type of disease from one who has been steeped in the chilly damps, and fogs of marshes.

So, also, he, who has been long confined in badly ventilated and damp rooms, without much light, or exercise, and constantly steeped in his own, and his comrades' acrid exhalations, will no doubt have a different train of phenomena from either of the others, and they usually are of that peculiar group called typhoid. And yet, again, this group is not precisely similar to that which occurs amongst citizens at large, although they may both be called typhus.

The inmates of these filthy abodes are not sure to become sick, and scarcely more so than people at large, yet, in an epidemic season, with an atmospheric afflatus, they are liable to suffer much, and may be some of the first to become sick. Yet it is reported that the secluded in prisons, nunneries, &c. are not so often affected with the plague as those abroad, and more exposed to exciting causes. They often retain an ordinary state of health in such conditions for months and years, without having typhus ; notwithstanding, the effluvia of their rooms may be so great, that a visitor perceives it to be oppressive even at the outer door of the building, and quite insupportable within.

Again, when such inmates are affected with typhus, it is common for the same disease to prevail in high, dry, and clean habitations. We have known well characterized typhus prevail in a neighborhood, and especially go through a neat family of eleven persons, in four months, a few miles in the country from a filthy jail, the inmates of which escaped the disease through the whole year, and still longer. The etiology of typhus requires further, and more rigid investigation, and with reference to other causes than direct contagion, or idio-miasmata.

We cannot stop to follow out the subject of the doubtful existence of the miasmata in the minute details that it merits; but, will refer to a lucid article "*On miasm as an alleged Cause of Fevers*," by John Bell, M. D.*

SECTION XXVII.

ETIOLOGY—CONTINUED.

3d. On the Climatic Influences.

It is manifest that the human economy possesses a pliancy by which it becomes in a measure accommodated to the various external circumstances of different latitudes and climates. This adaptation, however, is more or less incomplete, and the physiology of man is liable to be distorted from the most happy standard, and receive numerous modifications; and yet not so great, but that different subjects, in different latitudes, attain to nearly the same term of longevity.

* Phil. Jour. of Med. Sciences, Vol. XI. p. 274.

The stature, form, proportion, features, and complexion may all be changed by the different impressive circumstances of climate and regimen. Not only the body, but the mind also, receives modifications in like manner from climatic circumstances. The slow, deliberate movements of northern intellects acquire expansion and celerity of movement after having been, as it were, sublimed in tropical regions.

Notwithstanding these modifications, the inhabitants of different regions possess nearly the same amount of general health, their diseases however, being different. Those of the torrid zone, are most liable to be of the acute, typhoid character ; those of the frigid zone are of a more slow, or chronic kind, with feeble, but continued morbid action ; whilst in the temperate latitudes, the diseases are of a mixed character, some seasons and locations admitting of the severe hypersthenic character, others of the mild typhoid aspect, with a host of chronic affections. The diseases are in accordance with the physiological conditions of the inhabitants ; for in hot regions the organic developments are sooner effected, and the susceptibilities are more acute than in the temperate zone ; the residents in this last circle possess a precedence in these respects, as is shown in the fact of females menstruating in hot climates at about twelve years of age, in the middle latitudes at about fourteen, and in the frigid about sixteen years.

The reason why the system bears the heats of the Indies, and the colds of Nova Zembla with impunity, is on account of the gradual manner that these, and all other of the peculiar extraneous circumstances are applied. The infant is nurtured and grows to maturity amongst them, and the whole organism, and their sensibilities become moulded, and modified to their peculiar stimulations ; and life possesses more congenialities in their particular locations, than on any other spot of earth. This is so much the case that removals from a round of congenialities, and particular grades of stimulations are liable to be attended with dangerous results.

When a change of climatic circumstances is suddenly made, the consequences are liable to be destructive to the healthy economy of individuals. It is therefore the suddenness of the change that is most to be dreaded. The southerner might go to the frigid regions to reside there, with but little risk of injury, provided he would pass gradually from one latitude to another, and stay long enough to become acclimated in each. His system must acquire the habit of dispensing with the intense stimulations of solar heat, and acquire that of evolving more vital warmth within himself; for it is observed, the internal maximum in both conditions is about 98° Fah. His sensibilities must suffer until habit slowly introduced, diminishes their acuteness. Until these changes are established, he will be liable to suffer from a new range of stimulations.

A sojourner in the southern from the northern regions, will be liable to suffer still more, on account of the stimulations being more intense, and acting on a system of density, of hyperæmia, and inusitation of solar heat. He also, needs to pass slowly from one grade to another. The air he breathes, as well as that which envelopes the surface, is more rare and expanded with caloric; heat accumulates in the system; the blood becomes expanded; and adds to the general state of fulness, and irritation. The whole system suffers a sort of erethism; his body indicates, by the thermometer, three or four degrees of increase of heat. Essera appear on the surface, and this is only an index to point out what is taking place in the alimentary canal, liver, and indeed in all the internal viscera. The appetite becomes capricious, and the digestion difficult, with indescribable uneasiness; occasional diarrhœa of a bilious appearance; lassitude, thirst, slightly furred tongue, scantiness of urine, and unrefreshing sleep. This merely constitutes the state of predisposition, and it will be the more severe as restrictions on regimen, and other prophylactic measures have been neglected. The organism acquires a morbid predisposition, readily transformed into disease.

Let such a subject now arrived in the torrid zone, be placed at night as a sentry in the open atmosphere, either on shipboard or on land, 15° or 30° colder than the day, we may then easily estimate his liabilities. In an hour's time, he may feel the effects of cold in every section of his system, although he may not perceive a great sensation of cold. But, there is wrought in the most intimate tissues a change, a state of contractility in the involuntary, instinctive tissues, and impeding the nervous force, and capillary circulations ; or finally, a state of nosodynamia. According to the severity of this condition, so will the subsequent phenomena appear ; either terminating in immediate death, or showing more or less of the phenomena of disease of one variety or another, as numerous incidental circumstances may direct. However, we are anticipating our subject in order to give a short illustration.

Our remarks have been very general, and chiefly in reference to the common level of low lands in southern latitudes. But, it should be remembered, that even within the tropics the high lands afford every climate of the north ; they present the perpetual snow-capt mountains, and every latitude thence to the vallies. Some mountainous passages have the coldness of northern Russia, and "in the conquest of Chili, many of the Spaniards were frozen to death sitting on their mules, in crossing the mountains that divide Chili and Peru."* It is the suddenness of the changes that breaks the harmonies of health, and excites the morbid commotions ; it is, therefore, the design of hygieine to direct the conduct so as to avoid disastrous sequences.

* Moseley, p. 6.

SECTION XXVIII.

ETIOLOGY.

4. *On Idiosyncrasies.*

There are certain peculiarities, which seem to have their seat in the nervous tissues of external relation ; such as faintness produced by the smell of a rose ; aversions raised by the smell or taste of cheese ; epilepsy excited by the presence of a cat in the room, although not seen or heard, &c. Our present inquiry in tracing remote causes, will be directed to those relating to the functions of the organism, in which they are assigned to be attended in particular cases, with a greater liability to disease, than exists in the ordinary habits of mankind. They may be divided into,

a, Constitutional.

b, Adventitious.

The constitutional peculiarities consist either, first, in malformations ; or, secondly, in an increased sensibility in some, or all the tissues, whereby slight excitations are attended with disproportionate organic movements.

Malformations act mechanically to impede the regularity and perfection of organic movements, or to increase in an inordinate manner certain functions. Thus, in the case of a distorted, and contracted thorax, impediments are offered to the free exercise of the heart, and lungs. In this event, the lungs probably suffer most, there not being sufficient capacity for the blood brought by the long aortal circulation, to pass freely the short circulation. The lungs cannot expand sufficiently to admit both the circulation of blood, and the aerial fluid. Both these circulations are straightened, and there is not so much room for a surplus of air to remain in the lungs as is necessary for ease and safety, in the event of accidents, or even hurried exercise. The subject is liable to dyspnœa on slight movements, and a very constant state of tissual excitation is apt to be present. This state of disparity may favor the progress of chronic diseases of the lungs.

A disproportion of blood sent to an organ by a malformation, is liable to keep such organ in a state of increased excitement. Suppose the carotid arteries should be only a little larger than ordinary, and the descending aorta a little smaller; there might be an unfortunate disproportion of blood sent to the head, whilst the rest of the body would suffer from a scantiness. The consequence of cerebral turgescence is readily apprehended; in other parts there is a deficiency of nutrition. Although the instinctive processes seem quite sedulous in producing a harmony in all the formative processes, yet the physiological symmetry is sometimes infringed on, and the most healthy economy may be interrupted. A slight modification may, in process of time, make essential changes, and these effects become causes of other alterations, and in some uncertain time, the general economy becomes affected, so that on the approach of any adventitious cause, very formidable disease is liable to ensue, and possibly without it.

Perhaps, there has never been a human system of perfect symmetry, since the days of mother Eve. We may conclude there was corporeal perfection direct from the hand of her Maker, and before extraneous circumstances had produced any disturbing passions; if Milton's fancy was just respecting her moral mein:

> "Grace was in all her steps, heaven in her eye,
> "In every gesture dignity and love."

Some disproportion is liable to obtain in some of the nervous, or the nutritive organs. Some local injury early done an organ; some manner of nutrition, or education, or certain excitement of particular passions may mould individual organs into a state of too great, or too little development;

according as these circumstances may happen, so the organism will be modified in their evolutions and future functions. These peculiarities are liable to be transmitted to offspring, and increase with increasing circumstances, favoring a further disparity of formation and function. So we find some habits far removed from the security of a healthy proportion of organic symmetry. The same thesis may be extended to the organs of intellect, and lays the basis of all phrenological distinctions and propensities. These malformations are liable to produce distorted intellects, insanity.

c. *Increased Susceptibility.*

Under the second division, we may notice the fact, of there being an increased sensibility of tissues, by which they become more than ordinarily susceptible of impressions. Some people, from childhood to their acme, and in their best conditions, are liable to cardiac perturbations upon the most trivial excitations of body or mind, connected with a constant increased pulsatory action. They are always suffering, and these commotions constantly sustain a state of irritation in the heart, lungs, and indeed, in the entire system. The functions, and sometimes the structures become impaired, and in the event of other accidental causes, such habits suffer particular injury.

The above may help to explain another circumstance in relation to the tissues, either specially or generally. There appears to be a sort of idiosyncrasy predominant in some habits, by which they take on a morbid action upon very trivial excitations. Thus, the lungs are easily affected, and a cough becomes excited upon very slight circumstances. Not only so, but they take on a peculiar morbid action, which imperceptibly ends in effusions that form into tubercles.

When this is once effected, these serve as conjunct causes for producing other derangements.

A state somewhat similar in the tissues, especially the acini, constitutes the state of predisposition to scrofula. When this exists, the unfortunate subjects are hurried into the development of that disease from slight exciting circumstances. The same may be said of many other constitutional liabilities to disease. The hereditary diseases all have their origin in a congenital, increased sensibility of some particular tissue of organic susceptibility.

There is an hereditary hemorrhagic disposition, which shows itself in the most trifling lesions, and the bleeding is scarcely capable of being stanched. There is also an acquired condition of hemorrhagic susceptibility. Some portion of the vascular tissue of the mucous membrane assumes an increased state of organic sensibility. Upon the event of slight circumstances it becomes turgid; something like what has been called an *hemorrhagic effort* takes place by capillary action, and blood continues to be poured out until the system is greatly drained.

Often have we noticed, that certain habits of thin, and rather slender fabric, are liable to form purulency whilst attended with only a moderate state of general excitement. Pus will be largely deposited beneath, or between the layers of membranes in a few days after the part shows only slight signs of local inflammation, and almost without its common phenomena. We have seen thirteen abscesses form below the periosteum, in different parts of the body, in a boy ten years of age, and in the course of five weeks. They all resembled the collections in periostitis, but with less pain. They would form in about two or three days so as to require an incision; they discharge freely, and readily heal. In chronic diseases, and especially phthisis, purulency in some idiosyncrasies forms very early, and copiously.

This *diathesis purulenta* is not of very infrequent occurrence. It has been noticed by many observers to occur under apparently different circumstances; and recently by Dr Watson of New York.* It often occurs in connection with wounds, but these are not necessary to its existence. It appears to consist in an altered state of the albuminous, and fibrinous portions of the blood, whilst this stands in close relation to an erythematic, irritative state of the serous linings of the arteries and veins. This affords an increased susceptibility, which is more concentrated in some parts than in others. The exhalant arteries pour out their fluids in such parts, which become more of the character of pus by passing the diseased tissues, whether through the coats of veins, or into the cellular tissue in any part of the body; a wound existing at the time is not so liable to afford purulency as the excited serous tissues in any internal part. A purulent effusion in this diathesis has often been discovered under the arachnoid tunic of the brain when little suspected; in many of the other viscera also. This condition is always attended with a frequent pulse, and other phenomena of an irritative pyrectic habit, very liable to a fatal termination. Until this state shall have become better understood, it may be esteemed as an adventitious idiosyncrasy. It requires for its correction a mild, bland, antipyrectic treatment, adapted to the circumstances of the case. Tonics and stimulants are pernicious. It partakes of the character of phlebitis, and arteritis.

Various conditions of disease from ordinary causes, may have a general morbid susceptibility, and in particular tissues also; so they may become the seats of future disease on the accession of a morbid habit by new excitations. These adventitious states of the tissues, now suffer the same liabilities as the hereditary.

Thus in numerous instances in different temperaments, we

* See American Journal of Medical Sciences, Vol. XXI, p. 37, 1837.

find the tubercular deposits not only in the lungs, but in other thin tissues in various parts of the body. We must refer their origin to a peculiar state of the diseased system and tissual susceptibility, which for want of more knowledge of the subject, we are induced to call a state of *tubercular* idiosyncrasy.

SECTION XXIX.

ETIOLOGY.

5th. On Aliment.

It is rare for disease to have its origin from a single cause alone; more commonly several circumstances concur simultaneously, or in succession, which co-operating together have a share in disturbing the most perfect physiological harmonies. Suppose a subject to assume more aliment than is suited to his well-being; its influence on the system may be greatly modified by his exercise, or his indolence; and if he should not assume a sufficiency to supply the ordinary nutrition required, the same circumstances might concur in altering the effects on the system. And more especially would the results, in either case, be modified as he might be exposed to extremes of heat or cold. However, we must study the agents that are liable to injure the economy of the system, in a separate manner.

Circumstances which might essentially injure one person, might not be perceived as detrimental to another; and yet every cause impinging the body may be supposed to act with the same amount of physical force, whilst the effects are very different. The various susceptibilities of different habits should always be taken into the estimate, when judging of the liabilities to injury from the use of food. Every temperament possesses a determinate degree of staminal, and vital force suited to its own economy, and it is capable of greater or less resistance to all assailing circumstances. Whilst one might endure severe fatigues, and vicissitudes of weather, another might be easily destroyed by them.

Similar disparities may be noticed in the assumption of food. Some of a like size and age require more than others; the internal assimilatory processes may be more or less perfect, and one may have greater excretions than the other. So one may obtain twice as much recruit from the same amount of ingesta as another. For a general proposition it may be stated, that in health, the appetite is prone to indicate the want of more food, than is compatible with the well-being of most individuals; and it is often indulged merely for the pleasure of eating. In such an event, the organs of digestion are too much burthened, and dispepsy is a natural result. Also, the assimilatory powers are too greatly forced, and hyperæmia is liable to be the consequence. The whole vascular tissue becomes inordinately distended, and too severely irritated by the hyperæmia.

In the case of too great alimentation, the physiological actions are liable to be spurred beyond the range of mediocrity, and a state of increased sensibility induced. These circumstances attend the commencement of a state of predisposition to disease, so that the exciting causes more easily affect the tissues. It is a common remark, that children who are restrained by necessity, or by rigid discipline in their diet, are not very liable to take cold, nor be made sick. For a person to pass through an epidemic season of almost any disease, strict regard should be had to regimen, that it be light, simple, and regular.

Notwithstanding, there are proper limits to be observed in respect to the amount of nutriment. Too great a state of inanition, and want of vital force, may render the system less able to resist the vicissitudes of weather, and various other circumstances, which are liable to disturb the harmony of the physiological actions. With regard to the amount of nutriment, and the choice of food, every person of intelligence ought to observe and be his own adviser. Nothing is more difficult than to advise another in health, further than general principles. Animal food is more nutritious and stimulating, than vegetable, whilst in moderate quantities, it is of easier digestion. It ought to be but moderately indulged in, in epidemic seasons. Milk is a very congenial nutriment after it has passed the first digestion, and but rarely makes disturbance in that instance.

With respect to the question, whether it may not be for the best good of all people to refrain from the use of every kind of animal flesh, as articles of diet? It may merely be remarked, that it is inexpedient to urge it, as the fashion, and wants of society never will admit it in practice. It is unphilosophical, also, to insist on it, as some habits would suffer from total abstinence from it. It becomes a necessary kind of aliment in cold latitudes. That too great a quantity is used in New England for health of body and serenity of mind, cannot be doubted. It is devoutly to be wished, that a restrictive system might be adopted, and made fashionable. In the mean time, we have no hesitation in enjoining on certain habits, nearly a total abstinence from meats; and such are, persons of a sanguine temperament; those disposed to hemorrhage, to phthisis, to mania, to gout and inveterate rheumatism, and to other habits of disease of the phlogistic character. A diet restricted to vegetables disposes to an excess of carbon in the blood, whilst a pretty strictly animal diet inclines to an excess of azote and ammonia; and excess of either will prove injurious.

Temperance in the use of animal food contributes to serenity of mind, and clearness of intellect. It ought, therefore, to be urged for the happiness of society in a moral as well as physical point of view; and, also, ought it especially to become general and approved by a nation engaged in mental improvements, by common literature ; also, in all the arts and sciences ; and especially, according to the fact, of our rising republic being pledged for the promotion of peace, and universal benevolence.

The blood is the recipient of nutrimental substances, and it must suffer alterations by the quantity, and quality of the food. It suffers changes as the digestive processes may be more or less complete ; and also, as the nutriment may be more or less saturated with muriate of soda, and other condiments. These are all stimulants without adding anything as real nourishment. Their excess is very pernicious, and it is always safest to use them in small quantities. In the instance of all pyrectic excitations, they ought to be omitted.

Nevertheless, we cannot, with M. Broussais, so much refer the injury done to the mucous tissue of the digestive apparatus, as to the stimulations received into the circulating mass. Excitations are awakened in all the tissues by excess of alimentation ; the gastro-intestinal mucous tissue receives only a part, and harmonizes in a limited manner with the centre of perception. The nutrimental stimulations are quickly absorbed, and we discover the heart and arteries excited, together with the capillary tissues every where disturbed, internally and externally, and extending into the nervous masses. In hyperæmia the organs suffer a turgescence, and are subject to all the sequences of distention, hypertrophy, and phlegmatiæ.

A proper regulation of regimen may, and will have great influence in the prevention of disease ; and when it supervenes, in its removal. But, reference must be had to approved treatises on hygieine for particulars.—It may be remarked, that although we have cursorily noticed aliment as a remote cause of disease, it may, nevertheless become an exciting cause also, when improperly used. This subject may meet with some attention under the head of exciting causes.

SECTION XXX.

ETIOLOGY.

6th. On Exercise.

"Toil and be strong," is an excellent adage ; yet, it must be remembered, that each one must toil in a manner suitable to his individual abilities for exercise. An amount of labor that would be borne with pleasantness by one, might destroy another. So different is the compactness of the stamina of different textures, and ability for toil, even under circumstances very similar in other respects. Exercise for the purpose of being useful, and giving firmness to the constitution, should be steadily and regularly performed. Severe efforts at protracted intervals may be very injurious.

The entire centripetal and centrifugal circulations always languish, and move slowly without a very constant, daily exercise of the locomotive muscles. And of course the blood is not being perfected in the rounds of circulation, nor sufficiently applied to the tissues ; these become flaccid, exsanguious and feeble in their functions. The countenance becomes pale, and indicates the state of internal tissues. The mind, also, bears the impress of the enfeebled organization.

In a state of indolence of body, and apathy of mind, the nutrimental substances are not perfected by digestion, for the supply of the system, nor applied to the tissues in a sufficient quantity to nourish, and afford fulness and strength to the muscles. In such a condition the appetite fails, and a suitable supply of nutriment may not be taken in. Besides these deficiences, the secretions are tardy and not duly performed ; the saline substances are retained in the circulation, as well as other excrementitious matter, and all serving to afford morbid accumulations with their stimulations, which become most obnoxious on the approach of disease, which is usually of a comparatively low grade in such instances.

The laborer in the field, or in the open atmosphere upon the ocean, enjoys a keen appetite, has brawny muscles, and ample strength, provided exercise be not extended beyond the range of constitutional ability.

> His habit pure with plain and temperate meals,
> Robust with labor, and by custom steel'd
> To every casualty of varied life;
> Serene he bears the peevish eastern blast,
> And uninfected breathes the mortal south.

When exercise is severe, and protracted to fatigue, and especially if then continued, the blood is forced into the capillary system faster than it is absorbed by the radicles of the veins. The organs suffer a turgescence, and become excited in function, with an exaltation of tissual sensibility. The circulatory force becomes at length partially exhausted in the tissues, and they are now easily affected by exciting causes, the principal of which is cold. In such a state, small variations of atmospheric temperature have a powerful influence on highly excitable tissues, and a state of nosodynamia is readily formed. A foundation is now laid for the perturbations of diseased action, and this is manifested by many discordant phenomena peculiar to the organs and tissues affected, by the local concentrations of the morbid habit.

We cannot stop here to trace the sequences of such a state of things, nor touch the remedial course to be pursued. The proximate cause of the diseased habit now becomes fixed, and the results will be modified by numerous circumstances; and the event may be disastrous, unless the secretions and absorptions are immediately restored to the normal state. This may usually be readily accomplished, before the organs react on themselves, producing secondary results.

Severe exertion of muscular force breaks the equilibrium of the circulation, retains the blood in the vital organs, endangers their integrity, and affords a liability to aneurisms, visceral hyperæmia, hemorrhages, and phlegmatiæ. Whenever a person is thus exposed, he should make use of some prophylactic measures of a very simple kind; such as reposing on a couch with a blanket laid over according to the temperature of the atmosphere. A mild cutaneous transpiration should be kept up by the use of pleasant aromatic drinks; pediluvy.

SECTION XXXI.

ETIOLOGY.

7th. On Clothing.

We are creatures of habit to a certain degree, with respect to the amount of clothing required for each individual. Notwithstanding, no force of habit can counteract the inclemencies of the higher latitudes, or the vicissitudes of the temperate ones. Aside from the moral purposes of clothing, its utility consists in retaining the caloric of the body in cold seasons, and defending the body in hot seasons from the scorching rays of the sun. In the former instance, the materials should be slow conductors of caloric, and of a dark color, thereby absorbing the solar heat; and in the latter, they should be ready conductors of caloric from the body, but of a light color, thereby reflecting the sun's rays. The friction of clothing on the surface in exercise, adds something by extricating caloric, as well as by exciting the dermoid tissue.

The great object of clothing is to maintain a temperate, but equable amount of caloric on the surface of the body. Although the internal organs possess peculiar aptitudes in maintaining a definite degree of heat, yet the surface and extremities are liable to great variations, so that there are severe disparities existing on some occasions, either from external cold, or an internal inability to evolve caloric. The important desideratum is, to maintain an equal distribution of heat in the system ; for without this, the physiological processes will be interrupted more or less. Every impression of cold admitted to the surface below the point of temperature that the subject has been accustomed to, instantly withdraws from the body a just proportion of its caloric, and as this is taken away, so in proportion there is an assault made on the regularity of the functional exercise ; although it may not amount to disease, yet the system is more exposed to other hurtful agents.

The effect of incompatible degrees of cold is, to condense, and contract the dermoid tissue, to embarrass the exhalations on the surface, and propagate a state quite similar, to the internal tissues. If heat is soon restored, and especially if the exhalations resume their course on the surface, but little injury may be done. However the subject often runs some risk in this, and a state of equilibrity ought to be maintained, and restored when broken. When incompatible degrees of cold are often reapplied, and followed suddenly by heat, the tissues acquire an increase of sensibility, by which they are more exposed to be acted on by a subsequent exposure, and indeed to other exciting causes. Hence arises a state of predisposition, and cold in this instance becomes merely a remote cause of disease. But, remote causes rarely produce active disease without some exciting cause, and on a repetition of exposure to cold, it may become the exciting cause.

Persons long exposed to cold and damp air, with little exercise, and scanty clothing, are especially liable to obtain a predisposition, and are readily excited to disease of various habits and phenomena. The importance of a sufficiency of clothing to keep up an equilibrity of circulation, and exhalation from the surface, is readily apprehended. Diseases thus induced are usually of the chronic character, as scrofula, scurvy, phthisis, &c. Those confined to studies should beware of such exposures.

On the other hand, an excess of clothing, by retaining too much caloric on the surface, especially in warm seasons, keeps up too great excitation, and affords a liability to cutaneous eruptions. The internal tissues, also, suffer a morbid susceptibility, by which the exciting causes again act with greater force. And furthermore, a habit is produced of much inconvenience, requiring more clothing than otherwise might be necessary for health and comfort. Yet there is no assigning rules for the amount of clothing for each individual; for much depends on the quantity of caloric evolved in the system, each one having a sort of idiosyncrasy in this respect, which needs to be modified by clothing to suit particular cases. A morbid sensibility affects some people; in which case they require more than ordinary clothing, but an excess of heat exhausts the vital force too much, and leaves a state of enervation. Changes of the quantity of clothing ought always to be made in a gradual manner.

Clothing should be modified to obviate the injuries resulting from sudden, often hourly changes of atmospheric temperature. Some are so exquisitely susceptible of changes, that an intervening cloud of a few minutes continuance, in a warm sunshiny day, will excite chills, and perhaps pain in some morbidly sensible organ. In such, great circumspection becomes necessary. Even the most robust should increase their clothing at nightfall, and not suffer the damp air of the evening to effect a morbid impression. There is much danger in such exposures, as the sensation of cold is but rarely perceived in proportion to its amount, and the changes it makes in the tissues.

SECTION XXXII.

ETIOLOGY.

8th. *On Alcohol, and other Narcotics.*

"Ah! sly deceiver! branded o'er and o'er,
"Yet still believ'd! exulting o'er the wreck
"Of human vows."

It is the physiological influences, chiefly, of those articles called narcotics, which must arrest our attention at the present time. These have been known by other terms, as hypnotics, anodynes, cordials, &c. Writers on materia medica have grouped together certain articles possessing somewhat similar properties when applied to the system; yet, their influences are not precisely alike; for some have a greater action on certain portions of the nervous systems than on others. They all agree, however, in adequate quantities, in producing a peculiar state of the system called narcotism. This is known by the following phenomena: at first, ease of body, a placid state of mind, and an increase of strength; then muscular weakness, heaviness of the head, imperfect vision, a diminution of sensibility, hallucination. This is soon followed by an entire loss of sensation and motion, and the subject lies prostrate as in apoplexy; there being a temporary paralysis of all the nervous systems of external relation, whilst the functions of internal relation still continue and are often increased. However, if the quantity taken should be considerably larger, the entire vital force will be expelled, and death ensue.

When the quantity is very large, some of the articles called narcotics may destroy life instantaneously, without a single physiological phenomenon accompanying the process. However, they are usually applied in small quantities to relieve ennui, and a morbid appetite for them; to diminish pain, or other perturbating phenomena attending disease. They have been called, and still may most emphatically bear the appellation of poisons.

Passing by all former speculations in relation to the modus operandi of these substances, they may be called *ultra-stimulants;* or such as impress the vital susceptibility of the system in an inordinate manner, and in an incompatible degree. In small quantities they are acknowledged to be stimulants; if so in small doses, why not in large? The diminution of energy which follows their use in excess, is a demonstration that the vital force has been exhausted by the inordinate stimulation; similar to an excess of exercise in the effect, or as any other stimulation leaves a state of prostration of strength and vital susceptibility. Essential oils applied to the stomach, and electricity to the whole body have the same effect; so, also, contusions, extensive burns on the surface, and excess of passion, &c.

Narcotics may be admitted as medicines in small doses, or as stimulants and cordials, in cases of exhaustion, but in a very limited manner, and seldom ought to be repeated. On account of their sudden operation, and their evanescent effects on the organs of external relation, they have obtained the appellation of diffusible stimulants by some, meaning such as soon pass away. Notwithstanding, they show, on careful observation, very permanent stimulant effects on the organs of nutrition throughout the system, for fortyeight hours or more. The impression on this system of nerves is not so sudden, nor manifest, but continues much the longest. This may be observed in subjects in health, but more decidedly in those suffering with a pyrectic morbid habit; provided the observer will discriminate between the phenomena of the disease, and those of the narcotic.

All narcotics show their most visible effects on the organs of external relation, although both systems of nerves receive stimulations. There is nothing extraordinary in this, for the same order of phenomena occur in the case of all other stimuli. The effects of exercise and of food are first discovered in the functions of the nerves of external relation. The intellect and the muscular systems collapse into a state of inactivity from exhaustion, whilst the internal organs are still acting under the influence of severe stimulations. The physiological functions of these two orders of nerves have been illustrated; it may only further be suggested, that the intention of administering narcotics for the purpose of allaying irritation, is a very dangerous practice in all pyrectic habits. Intellect and muscular motion cease from excess of excitation, and the organic system is spurred on in a manner, also, to be exhausted, and terminate in death, in co-operation with the stimulations exciting the disease.

Our further remarks may be confined to alcohol and opium, as being the articles in most common use as cordials or medicines.

a. Alcohol.

This is a chemical substance, the result of fermentation, and never found as the product of nature. It had long been known to exist in wine and cider, but never as a separate substance until the discovery of the art of distillation. It was first used as a medicine, in small quantities; since, however, as a drink for well people, and by its deceptive influences, has been the remote or immediate agent of destroying more lives than pestilence or wars.

The first taste of alcohol is disgusting, but a little use makes it pleasant, and it is chiefly sought after on account of its effects in producing hilarity of mind, and temporary energy of the muscles. The mind becomes relieved from care and anxiety, and indulges in pleasant revery, but disposed to anger upon slight, or even supposed provocation. The muscular system endures exercise on its use but a little time, before a kind of lassitude supervenes, and this demands a repetition of the dose. It is too often repeated, until there supervenes a state of imbecility of mind and muscles, called intoxication. The mind being weakened, it misjudges in relation to the sequences of the repetitions, and so the organic appetencies triumph over reason. There is danger of self-destruction, unless in some lucid interval total abstinence is religiously determined on and adhered to ; for a slight indulgence very commonly sacrifices intellect on the altar of organic appetency.

However, this article has been very extensively used in less quantities than to produce intoxication, but not without injury to the integrity of the physiological condition of the tissues, especially to the nervous tissues of external relation. Possessing no nutrimental matter in itself, it only excites and spurs onward the functions of organs, beyond the point of endurance ; their ability of action becomes exhausted after over stimulation, so they become languid, and but imperfectly perform their round of duty. In such a state, cold and other exciting causes have a greater effect in lighting up disease, as the morbid sensibility gives them a predisposition.

This need not be a matter of surprise, since alcohol easily combines with water, and is readily absorbed by the venous radicles of the digestive mucous tissue, although denied by the more chaste lacteals ; it passes the portal system to the common mass, and to the brain as well as every other organ. It has been distilled from the blood of the liver, and discovered in the cerebral tissues ; thus it injures every tissue in the system. However, it does the greatest violence to the nervous system of external relation, for this soonest suffers from every kind of excessive impulse, and demands a long repose to be restored to its pristine energy. The weakness of judgment, liability to delirium vigilans, and wavering gait of the tippler prove the injury done this order of nerves.

The whole system suffers ; a protean train of nervous phenomena appear. Of the collatitious viscera, the liver, and stomach bear a greater weight of injury than the others. If the practice is persisted in, the appetite becomes spoiled for food, and incontrollable as relates to alcohol. The unhappy victims cry aloud for it, and assume it with avidity, when even mixed with gall and aloes. The repetitions become exciting causes, and disease, in some form, progresses with terrific aspect; not admitting of cure, and scarcely of relief. Darwin has grouped some of these maladies, in personifying Vitis in the character of a nymph seducing the swains.

> "Drink deep," she carols, as she waves in air
> The mantling goblet, "and forget your care."
> O'er the dread feast malignant chemia scowls,
> And mingles poison in the nectar'd bowls.
> Fell gout peeps, grinning, through the slimy scene,
> And bloated dropsy pants behind unseen;
> Wrapped in robe, white lepra hides his stains,
> And silent phrensy, wreathing, bites his chains.

b. Libidinous Excesses.

Considering we have not allotted a section to the subject of debauchery, or excess of libidinous practices, as a remote, or predisponent cause of disease, a few remarks might be admitted here, as it may claim some familiar acquaintance with the preceding article, and perhaps some moral affinity also. It cannot, however, be under deep obligations, since alcohol only provokes desires, without adding ability to gratify them. However, let the provocation to the excess of venereal indulgencies originate from whatever source it may, the effects are dismal, and calamitous to the unfortunate debauchee, who eventually becomes a mere caricature of human dignity. Having lavished the most subtilized of the vital aura, and the first fruits of virile energy, the depreciated residue of corporeal being becomes an easy prey to the ten thousand awaiting agents of destruction that surround him. A certain amount of indulgence leaves an irresistible, irritative propensity, and the organism assumes control in defiance of voluntarity. After all this, there are instances, in which a morbid irritation locates in the generative tissues, without any previous mental depravity, or excessive indulgence of alcohol, and is attended with consequences equally disastrous. These unfortunate cases, happening ofteatimes in the most virtuous youth, ought to be discriminated, as they require the most sympathising, as well as soothing treatment.

c. Opium.

We have already spoken of narcotics being peculiar stimulants of the nervous tissues, of which opium is one of the principal. The term stimulus is very general, and every substance in nature may come under its auspices, from cold water to the flames of burning alcohol. When it is applied to the living system in a state of health, it ought to denote such substances as impress, and excite action above the ordinary standard, or beyond the common substances of nutriment. There are various substances of this character, and yet we find they act very differently ; some act mechanically, others chemically, whilst there are others, which make impressions on certain tissues in a manner we cannot comprehend, and we can only discover by their effects that peculiar impressions have been made. The vital force is the medium of transmission of impressions in the living system, so we infer that narcotics affect the whole system through the medium of the nerves, when applied to a part.

Narcotics give stimulations rather peculiar, and yet post mortem inspections reveal very similar states of the capillary tissues, to those which appear in fevers called congestive. Whether we can fully explain the modus operandi of narcotics, or of the causes of malignant fever, or not, there seems to be a strict parallel in the phenomena of each, both in the living, and in the lifeless state of the body. It is probable that certain excitations of the nervous susceptibility, although different in kind, are attended with similar results in their morbid effects on the nutritive tissues.

Small quantities of opium repeated in a well person, excite at first the milder phenomena of a febrile habit. There is a similar alacrity of mind, and activity of body that often precedes the more severe fevers ; then paleness, thirst, scantiness of excretions, furred tongue, heaviness or pain of the head, lassitude, increased frequency and force of the pulse. Let the quantity be increased, and oftener repeated, and the more intense phenomena of fever will appear, and proceed to delirium, coma, and death.

This being the result, we might by analogy infer, that less quantities of this article produce more or less excitation of the functions of the system, and this is the fact very manifestly. Those who habitually use this article constantly experience an excitation in the circulatory system ; they exist under a preternatural stimulation, and if this is withheld at the usual periods, they suffer ennui, and severe depressions. The whole order of the digestive, and assimilatory functions are depraved ; they are imperfectly nourished, and the secretions suffer a deterioration. A sallow complexion shows the state of the internal tissues. There is leanness, feverish heat, thirst, costiveness, and diminished excretions everywhere, unless perhaps, morbid sweats occasionally. This condition might aptly enough be called a state of poisoning. The subject experiences a constant morbid sensibility in the entire organism of internal, and external relation. Such may easily be affected by the common exciting causes of disease, and an intense morbid habit be the result.

The habitual use of opium is as obnoxious, and equally predisposes to disease as alcohol, and ought as sedulously to be avoided. It is, however, admissible in certain states of depression, and even here the quantity ought to be very limited; for, as soon as the repulsive powers of the system take effect, the morbid action will be the more intense, and an over-dose always combines with the cause of depression, and aggravates the disease in the event. It may be admissible in some of the subtonic states of the system, as in periodical diseases unconnected with a constant morbid habit. It is admissible in painful affections of the nerves of external relation, but should be no longer continued than until the neuralgic cause can be removed; for, it assuredly will induce a morbid habit, and render the case worse. It is, however, much less injurious in diseases locating on organs of external relation, than on the nutritive organs.

The practice of using opium in the treatment of low, continued and typhus fevers ought to be deprecated. It is rare that a single moderate dose can be given without ulterior injury, although the present composure may seem to justify it. No article is so liable to pass an imposition on the empirical attendant, the patient and friends, as this. The severity of the disease is smothered by the tranquillity it produces; but it will resume its authority as soon as the sedation ceases, and with more violence. The temptation is urgent for its repetition, and if done, the patient progresses into a still worse condition. The pretence held out by some is untenable, that any combination of other articles, as in Dover's powder, can neutralize and render innocuous the effects of the opium in its composition. Neither can the pure acetate of morphia be trusted in such cases with impunity, nor belladonna, stramonium, &c. There is a morbid habit existing in these instances, and a state of nosodynamia, which is aggravated by the stimulations of the narcotics.

Although Sydenham, and many others since his time, and even to the present period, have used narcotics in the treatment of febrile affections, it has been on the account of false notions entertained of the character of the morbid habit, and not from their ulterior beneficial effects. We find many, however, who have discovered their pernicious effects, and amongst these, Dr. J. Johnson in his treatise on derangements of the internal organs. "The narcotics, as opium, hyoscyamus, poppy, hop, and laurel water or prussic acid, are dangerous sedatives, since they too generally leave an increased morbid irritability, after their soothing effects have passed away, besides deranging the functions of the digestive organs, and confining the secretions."

In order to ascertain with some precision the effects of opium in such cases, let the trial be made in a patient that has passed several days with fever, and when he seems to be about as sick one day as another. Then use one common dose only, and note well the effects; making as accurate discrimination as possible between the phenomena of the disease and those of the narcotic, for fortyeight hours at least. But, this digression may have run to an unjustifiable length.

By way of recapitulation, we may notice, that the whole tribe of narcotics present allurements to the unwary, with all the suavity and meekness of the serpent of Eden, and the deception is too often equally as fatal. Behold the end, and avoid the consequences.

SECTION XXXIII.

ETIOLOGY.

9th. On Mineral Poisons.

Poisons and medicines are relative terms only; for, there is scarcely an article of the materia medica of much efficiency, but that by an abuse of its use, may become injurious to the economy of the system. Certain mineral substances, with their different preparations, called poisons, under discreet management, are found useful in changing the morbid action of tissues. But, they may be very injurious when used in too large quanties, and too long persisted in. Those in common use are mercury, antimony, iron, arsenic, lead, copper, &c., to which might be added, iodine, which is rather a vegetable acid.

Not being able to discriminate, we can only speak in general terms, that these are all excitants of the vital tissues through the agency of the vital susceptibility ; but each one has a peculiar impress on some tissues rather than on others. It is common with these, as all other excitants, that when used to an undue extent, they exhaust the vital force of organs, and leave them paralytic, after having increased their functional power. And besides, they leave in the tissues a permanent state of chronic excitation, but of an abnormal kind. The tissues have sometimes an increase of susceptibility. It is these conditions which render poisons liable to become remote causes of disease. A few remarks on each of the above articles may be sufficient for our present purpose.

a. Mercury.

Every preparation of this article acts as a severe excitant of the circulatory system, for it is readily absorbed. Its specific tendency is to the salivary glands ; but it produces a common sthenic diathesis, as is shown by the blood, and every other phenomena. It ultimately weakens the crasis of the blood. This is liable to be followed by a frequent pulse, emaciation, and a morbid sensibility of all the tissues, but especially of the salivary apparatus ; so that a repetition of the article easily re-excites salivation. So also disease in various forms is more readily produced by the common exciting causes, after this article has been used to the point of salivation, than before. Indeed it never ought to be used to this extent. The subjects are liable to pains in the fibrous tissues, and mercury has been found in its metallic form in many different tissues. It injures most the scrofulous, phthisical and scorbutic habits. Andral says, mercury acts on the blood similar to animal and mineral poisons.*

The vapor of mercury affects also the nervous system of external relation very injuriously; it produces in some tremulous palsy, called by Marat, *tremblement metallique*, which lasts for life; in others, symptoms not very dissimilar to the effects of lead, especially in the muscles of the arms and wrists. Convicts in the quicksilver mines where heat is employed, occasioning a distillation, nearly all die hectic or become paralytic, although their stay underground is only six hours in twentyfour. These subjects become so saturated with mercury, that a piece of brass plate put into their mouths, or rubbed on the surface immediately becomes white like silver. Mercury placed on a shelf in a warm room, in a bowl, will salivate the inmates of the room in a few weeks, even at moderate temperature. In addition to all this, clinical practice shows too much lasting proof of its improper employment.

The use of this article, and all its preparations, might be dispensed with as internal remedies, and others less objectionable, and equally efficacious, substituted. If gonorrhœa and syphilis can be cured without it, why not other diseases? It is because many have been so wedded to its use, that they have not so much as tried other measures. Judging from our best knowledge of its general use, we are disposed to believe that it has been of less utility than injury for more than forty years past, throughout the entire western continent. Drs Charmichael, Blackall, B. Bell, Broussais; also, Messrs Pearson, Mathias, and many others may be consulted on this subject.

* Path. Anat. Vol. I., p. 401.

b. Antimony.

It is only the excess, or too long continued use of this article, or its different preparations, especially in gastric irritations, which renders it injurious. It is one of the most useful, in the form of tartrate of antimony, of any which crowds the materia medica, by relaxing the rigid state of the tissues in disease, and promoting capillary circulation ; and yet it is liable to exhaust too much when very freely exhibited. When continued too long it adds irritation to the tissues, especially of the stomach, in a similar manner as when applied to the dermoid tissue for some time. The injury done by this article is, however, small, compared with mercury ; whilst its beneficial influences are far superior. It is only injurious in excess.

c. Iron, Iodine and Arsenic.

A long continued use of these articles in any considerable quantity leaves a state of increased susceptibility in all the tissues, after they have manifested their tonic effects. Iron is the most harmless, and seems to exert its principal influence on the digestive and assimilatory tissues ; iodine on the absorbing, and arsenic on the nervous tissues. The excess of arsenic especially, as well as the others is succeeded by a chronic irritation, or mild pyrectic habit, emaciation and liability to be converted into more severe disease by some exciting cause. With suitable attention, however, they are all useful articles of the materia medica, and the two first can hardly be dispensed with.

d. Lead.

We have to speak generally of stimulations on the tissues, not being able to discriminate the peculiar impressions of each noxious substance. They, however, impress vital solids quite differently, and metallic substances leave rather durable impressions. The stimulations of spices, of animal poisons, iron and lead are quite different. This latter article, or its oxides appear to possess an astringent stimulation. It enters the system in the form of gas, by the lungs, or of protoxide by the stomach, and often only in very minute quantities. It most ostensibly affects the spinal order of muscular nerves, and the abdominal plexuses, producing spasm, or rhachialgia, painter's colic. It is attended with severe pain, costiveness, emaciation, &c. The acetate of lead has been used extensively, both internally and externally, without injury. Notwithstanding, it does prove poisonous when it becomes changed to a carbonate, as is known by its crystals changing into a white powder. It has in this state proved poisonous, when used in lotions and poultices. It ought to be used with good vinegar in every mode, and it may then be considered harmless. The injury done by lead is by affecting chiefly the nerves of muscular motion instead of sensation; yet it does affect the ganglial nerves and abdominal organs.

We consider the articles just mentioned, as being but an inconsiderable part of those used sometimes as medicines with their various preparations, which are liable to injure the economy of the system, and render it more liable to disease. Look at the long catalogue of charlatanical nostrums!

SECTION XXXIV.

ETIOLOGY.

10*th*. *On Intense Thought.*

THE function of the cerebral organs, called thought, is either *voluntary*, or *impressive*. The first includes the internal processes of intellect ; the second is excited by external sensations.

a. Volùntary Thought.

The brain constitutes an apparatus of organs of volition. It determines the direction, and force of the locomotive muscles, and controls the process of thought ; it may be directed by the will to the clouds, or to the earth. Like the muscles, the organs of thought become fatigued, and repose is indispensable for a restoration of innervation. The mind engaged in severe thought whilst the muscles are at rest, occasions a turgescence of the capillary tissues of the brain, and similar to what occurs in the muscles when exercise is used without much intellectual operation. In consequence of the cerebral turgescence, which occurs in study with little exercise, the other portions of the system suffer a deficiency of stimulations ; they are not suitably nourished in severe and protracted thought. Digestion is liable to be imperfect ; hematization may be deficient, and the muscles enfeebled on account of too large a portion of vital energy being expended on the encephalic organs. Intense thought produces fatigue of body as well as of mind.

A subject applying himself severely to literature, to the study of the abstruse arts and sciences is quite sure to suffer physiological changes ; he becomes pale and emaciated, attended with weakness of muscles, deficient secretions and excretions, whilst the turgescence in the brain has created a state of abnormal excitation ; he is liable to watchfulness, with occasional pressure, inviting an apoplectic state. However, it more commonly induces a train of phenomena called nervous, with a disposition to hallucinations. Every form of narcotic, and tonic medicines increases the predisposition. In such a state, the exciting causes may readily take effect, and establish a morbid habit.

Impressive Thought.

Numerous contingencies from without, are liable to make severe impressions on the mind, through the medium of the external senses, which affect the well-being of the individual, and become objects of intense thought. They excite attention and thought in a ratio as they may be esteemed more or less conducive to one's prosperity, or adversity. Hence they become either pleasurable, or painful sensations ; the mind dwells upon them with intensity, in proportion to their importance, and often to that grade as to produce strong emotions and passions. Every severe mental excitation provokes the cerebral organs into vehement exercise, and radiates through the whole entire organism, and their functions are liable to suffer much perturbation.

Affections of the mind have often been known to cure diseases, both acute and chronic ; they also may cause disease. "Under uneasy circumstances of mind, gout will arise in persons strictly temperate and virtuous, active, free from hereditary predisposition, and in every respect qualified to claim an exemption from this great scourge of anxious refinement, and artificial society."* Perhaps there is scarcely any one, who has not perceived as the effects of surprise, a thrilling sensation pass over the system, and reaching the inmost tissues. Even sometimes the visceral organs are excited into vigorous actions. (Sect. xxxix. 4.)

* Ferriar's Med. Histories and Reflections, Vol. II. p. 54.

The passions may be divided into the *impetuous* and the *submissive*. The origin of the former consists in the sentiment of an ability to maintain one's rights, or regain them when lost. The sentiment cherished by hope, gives additional energy. The subject rushes onward in anger, rage, and revenge, quite regardless of consequences, for the intellect has entered the domain of the hallucinations.

The submissive passions are those where the sentiment of inability prevailed, without hope of avoiding evil, or obtaining good. Despondency, fear, and despair make up the train, and the subject becomes an easy victim to his adversary.

All the emotions and passions are attended with intense thought, and the physiological movements often become greatly modified, even so as to produce various and profuse excretions, hemorrhages, sudden jaundice, whitening of the hair, rupture of the cavities of the heart, &c. The celebrated author of the Zoonomia died in a paroxysm of anger, from a slight provocation. A matron had been informed her son was slain in battle ; yet, this was not true, for he suddenly came into her presence, and she died in his arms of joy. Cases might be multiplied. The severity of grief is well depicted by Shakspeare in relation to Richard II. on finding his friends had all gone over to Bolingbroke.

> Of comfort no man speak ;
> Let's talk of graves, of worms, and epitaphs ;
> Make dust our paper, and with rainy eyes
> Write sorrow on the bosom of the earth.

The passions, like poisons, might be turned to good account in the cure of disease ; but, they would require more skill and discretion, than to guide the lightning from the clouds in a stormy night. In the tardy chronic state of organic action, the thrill of surprise, and the impulse of anger have often been instantaneously successful in exciting the absorbing tissues, and eradicating a long delayed morbid habit. (Sect. xviii. 7, 8.)

SECTION XXXV.

ETIOLOGY.

SECOND DIVISION OF CAUSATION.

b. Exciting Causes.

SOME allusions have already been made in relation to these ; they may be esteemed to be, all such circumstances as excite abnormal motions, and in a manner to affect the intimate economy of the organism, either through corporeal or mental excitations.

The exciting causes are numerous, and to recapitulate them all would not only be attended with great difficulty, but, perhaps, might be impossible. When we turn our attention to the varied pursuits of life, and the unstable habits of many, we see mankind exposed to numerous contingencies, and agitations of mind and body. These commotions are extended through the tissues by the vital harmonies, and disturb the economy ; and although they may not always be followed by disease, yet when a state of predisposition exists from any of the remote causes, or a coincidence of some other disturbing circumstances, there is liable to take place a morbidly fixed condition, which may not spontaneously be restored. When this occurs, it may be esteemed as the primary cause of disease, and acts as the basis of the morbid habit.

Many of the remote causes already alluded to, by being often repeated, or again applied with severity, may also be considered as exciting causes ; such as surfeiting, intoxication, exercise extended to fatigue, &c. Our attention will be turned, at the present, to some of the most common.

1st. Heat and cold, with their alternations, and in connection with winds.

2d. Fatigue, watching, and surfeiting.

3d. Wounds, contusions, burns, and other lesions.
4th. Emotions and passions.
5th. Contagions and infections.
6th. Diurnal, and sol-lunar influences.

SECTION XXXVI.

ETIOLOGY.

1st. Heat and Cold, with their alternations, and in connection with Winds.

1. Both are Active Agents or Excitants.

We have constantly insisted, that the laws of organic life are peculiar in their kind, and although affected by physical force, are not governed by the same influences, nor do they exhibit similar phenomena. The expositors of the physical laws of nature insist, that all they know of cold is, that it is a negation of heat, and the attending phenomena are the results of a deficiency of caloric. The inference is, that cold is merely a negative property.

Notwithstanding, an expositor of the laws of organic life has a right to insist, that cold is a positive and active agent in relation to the vital movements of all organized beings. Each organized system possesses power within itself of maintaining a definite degree of caloric, when placed in a compatible temperature. If, however, the medium be far below in temperature, the radiations of caloric will deprive the body of its necessary supply, and cold makes a direct assault on its vitality.

The human system is found to maintain about 98° Fah. of heat, and as the vital actions are continually evolving it, there would be an oppressive accumulation, were it not eliminated from the body as fast as it is extricated. For this purpose it is found that a temperature between 60° and 70° Fah. is necessary to accommodate the sensibility of different habits. Very young children, invalids, and old people, not having the power of extricating so much caloric, and often possessing an acute sensibility to cold, do not require so low a temperature as the more robust habits. The above range of ten degrees is taken to accommodate the different habits.

Let us suppose there be added to the 70° Fah. of caloric in the atmosphere, 28° more, making 98°, or equal to the internal heat of the body. In this case certainly a positive agent is applied, the force of which would be intolerable, if there were no means by which the caloric could be conducted off. On the reverse, let the atmospheric caloric be reduced from 60° Fah., by taking 28° from it, and we arrive at 32°, the point of congelation of water. The human body, placed in such an atmosphere, also experiences a positive agent altering its susceptibility, and impressing its economy as an active agent. Increase the amount of cold, and it will destroy all vital movement, and fix the tissues in frost. We insist, then, that cold is an impressive agent in relation to the physiology of man.

Heat is the expanding and volatilizing agent of all bodies ; it renders the tissues more pliable, active, and extensible ; it accelerates all the vascular oscillatory movements, increases secretions and excretions ; it causes the fluids to expand, and the florid countenance indicates a turgescence of the capillary tissues everywhere. Yet, it must not be urged beyond a compatible degree. It is now shown to be an excitant.

On the contrary, cold is the condensing and solidifying principle of all bodies ; it produces a contraction and corrugation of the skin, with the papillæ elevated ; muscular energy is diminished if applied in an incompatible degree ; it is attended with a shrivelling of the entire surface, and a withered or sunken aspect. The fluids are lessened in volume, and circulated with difficulty, especially by the venous absorbents ; paleness appears, with diminished secretions and excretions ; sensation becomes blunted with numbness, and a torpidity of intellect attends. Cold acts on vital tissues rather as an astringent or tonic, than a direct stimulant. It relieves sudden faintings and loss of vital force.

The barometrical weight of the atmosphere has a co-operating influence along with heat and cold. In warm seasons, and hot latitudes, the air is more rarified, and does not compress the surface as in a cold atmosphere ; as a sequence of this the blood becomes expanded, the cutaneous capillaries are filled, and made active in their functions, whilst exhalation and the vital susceptibility are increased. On the other hand, in a cold dense atmosphere, the surface is compressed, the blood diminished in volume, and diverted in an undue proportion to the internal tissues. The economy is therefore modified by the barometrical changes in the atmosphere, and these changes are modified by heat and cold.

The two circumstances of innervation and circulation, are necessary to the extrication of animal heat. The circulations cannot be continued without the nervous force, and this cannot be kept up without the aid of oxygen, and a certain amount of external caloric. Whatever alters these conditions modifies the amount of ingenerate animal heat, although much depends on the susceptibility of different subjects.

Our remarks are chiefly intended for the inhabitants of variable climates, exposed to sudden vicissitudes of temperature, which are not met with in more northern latitudes ; yet, cold is there a tonic also. The fact that females do not so early menstruate, and that the venereal propensity is less urgent, is no argument in favor of cold being a debilitating agent. Although the flame of love is less intense from the absence of high heat, and the spiced diet of hot regions, yet the procreative powers are more steady and effective in the latitudes of Russia and Sweden, than in the torrid zone.

Beaupre states, that it is common in these places for a virtuous wife to present her husband with a family of twenty or more children for his maintenance. No doubt the intensity of cold may be so severe near the polar regions, as to greatly diminish all the vital functions, but still there exists a strong state of tissual tonicity.

2. *Cold considered Pathologically.*

One of the most unfortunate of all errors that has ever crept into pathology, is the hypothesis, that cold acts as a sedative on living animal tissues. ; or, that it debilitates them. It will on the contrary be contended, that cold is a positive agent, and acts on vital tissues as an astringent, or tonic. It is then quite easy to conceive, that an inability of function may be the immediate effect of its application, in any considerable degree. Yet, when high heat has been applied, the admission of cold becomes indirectly invigorating. Cold in an incompatible degree impedes the nervous energy, also the circulations and functions of organs generally. The condensation of tissues affects the minute nervous fibrillæ producing enervation, and insensibility to ordinary stimulations ; it produces an inability of nervous energy, whilst the simple tissues are condensed.

Cold applied to the surface, simultaneously affects the internal tissues. A state of enervation more or less is every where produced, yet often unequal. Innervation and circulation are impaired. Some tissues for a time may act in excess ; but, when the effects of cold are in any considerable degree, the deficiency of function may be so great, that the instinctive energies cannot prevail, and life may be extinguished, even whilst the inmost tissues are held in rigid durance.

The physiological distinction must here be kept up, between the nervous system of external relation, and that of the internal, or nutritive system. It is in these last that cold exerts its principal pathological influences, whilst the former merely feels the changes, and notifies the centre of perception of their extent, so long as they remain active. But, it perceives rather imperfectly the changes in the internal tissues. Many instances of sudden death occur, as in spotted fever, cholera, and other severe affections, attended with coldness, whilst the intellectual perceptions are but little disturbed; and yet the external nerves of sense do not transmit the sensation of coldness.

There being then, a tonic force added to the circulatory tissues; so, when the repulsive powers prevail, and capillary circulation becomes established, it will be in excess, and produce the exalted phenomena of severe disease, or ardent fever. If, however, the internal changes produced by cold be immediately relaxed, the secretions and excretions may be restored, and health soon follow; or, otherwise, the phenomena of disease will continue so long as the primary cause of the morbid habit may remain. It is always understood, that cold, like all other exciting causes, will more certainly affect the predisposed, and more probably establish a morbid habit in such.

A subject will bear severe cold with less injury, if the circulation in the capillary tissues is active when he approaches it, and especially with exercise. After exposure, he will endure another with ease, if he becomes effectually warmed. Hence, those who are much exposed by day to cold, should sleep in a warm place. The circulation in the capillaries is then sustained; something as it is in those who have been in a high heated bath, as in Russia, and by the aboriginal Americans; they will endure plunging into cold water, or snow, without injury, if not too long continued. The activity of circulation, and presence of caloric, do not admit the rigid state that often takes place under other circumstances, fixing the first link of morbid catenations; or in other words, the temperature is not yet reduced below the normal standard ; if this should take place, disease might follow.

In any other point of view the effects of cold appear contradictory ; and indeed it has been used as a very accommodating agent to suit different theories ; but, too many inconsistences often attend their expositions. Dr Cullen in his First Lines, remarks, "cold is manifestly an astringent." Also, "in certain circumstances cold becomes a stimulus to the living system." And again, "cold in certain circumstances has manifestly a sedative power." He also, considers it one of the occasional causes of gout, "which induce debility." Dr Brown, also, in his Elements of Medicine says : "cold equally as excessive heat, produces atony, and laxity of the vessels." And again, "cold as well as heat relaxes." Moreover, it appears, that all those writers, who esteem *debility* to be the chief element of disease, and that "there must be a weakening of the system before either fever, or inflammation can be excited in it," do necessarily infer, that cold must be a debilitating agent, since they make no distinction between structural tonicity, and functional inability.

Instances are very familiar in delicate, movable habits, in which on a moderate exposure to cold air, they suddenly grow pale, and experience lassitude, faintness with a sensation of sinking at the stomach, and often immediate vomiting. A superficial observer would say, this is a case of debility produced by cold. The real explanation is, the tonic influence of the cold on the surface retards the capillary circulations ; hyperæmia exists in the internal tissues ; a tonic and turgid state of vital tissues impedes the nervous force. An inability of function exists, and the vomiting is one of the instinctive, recuperative processes which help to restore the lost balance of circulation. These sudden depressions are usually quickly restored ; if not, the derangement may lay the basis of a morbid habit. Indeed, a large proportion of deaths which occur suddenly, and without the characteristic phenomena of any definite disease, are from this source, both in winter and summer. Death by drinking cold water in summer, when the body is heated, admits of similar explanation.

3. *Heat considered Pathologically.*

Although it is an intrinsic property of the human economy to resist the undue impressions of cold and heat externally, and to keep up an equilibrity internally, yet it is not able on all occasions so to effect it, and especially as relates to the surface. When innervation is deficient from any cause, there will be a deficiency of caloric extricated. On the contrary, when the vital forces are unduly excited with a free circulation, by internal stimulations, by exercise, and also by an atmospheric temperature from 80° to 98° Fah., caloric will exist in excess, unless it be dissipated in part by evaporation of the surface.

Solar heat operates intensely at the above temperature, on the surface, and also in the lungs ; and it accumulates universally in the system, the ingenerate heat cannot be sufficiently eliminated. The capillary tissues become distended, and their excitations radiate to all the tissues. The skin suffers much, it assumes a morbid sensibility, and after it has transmitted large and continued discharges, becomes dry, red, chapped, and subject to eruptions of different kinds. The aqueous portions of the blood have been largely expended, and the residue has become too dense and stimulating.

A continuance of this state of things cannot fail to exhaust, more or less, a portion of the vital force ; in consequence of this, the centrifugal circulations are not so well sustained, and there is an undue concentration to the internal viscera ; they assume a state of morbid hyperæmia and excitation. The organs, being surcharged with blood, have their functions increased, and are liable to pour out their excretions, and internal exhalations ; hence the liabilities to diarrhœa, and bilious discharges in hot seasons. Again, if a few degrees of cold have been applied to the surface, dysentery, hemorrhage, cholera, gastric, bilious and yellow fever, may readily be excited. At the same time, a liability is induced to fevers with concentrations to the head. A little more severe exposure is liable to produce great excitations in the cerebral organs, called coup de soleil, or sun-stroke.

4. *Animal Heat modified by Exhalation, and Evaporation.*

Were there no counteracting force, heat would accumulate to a destructive amount in the human system, when placed in an atmosphere of its own temperature. But, the external heat increases the action of the exhalants, and a large portion of fluid is usually thrown out. The body will be cooled in proportion as this is eliminated in the form of gas, by uniting with caloric. With this protecting process, many have endured high degrees of heat without injury.

If, however, the state of the skin and lungs be such as not to admit of much exhalation, as in ardent fevers especially, the heat may accumulate to a distressing amount ; perhaps 106° or 108° Fah. In such an event, the evaporation of water applied to the surface acts as a substitute.

There are four states of the air which modify the cooling process of evaporation in health. 1st, a moist and warm air ; 2d, a moist and cold air ; 3d, a dry and hot air ; 4th, a dry and cold air.

a. A moist and warm air.—This is always oppressive, and enervating. The air being already saturated with moisture, does not imbibe the vapor of sweat ; it accumulates on the surface, whilst the internal heat is retained. The blood is expanded in volume, and oppresses the muscular and circulatory powers. Neither are the caloric nor the exhalations from the lungs any better disposed of. The enervation is such that the skin is often cold, and the exhalation stands in drops, or runs off. There is now a high state of predisposition, and disease is easily excited by an exposure to dry and cold air, especially if in motion by wind.

b. Cold and moist air rapidly conducts caloric from the body, without evaporation of the moisture, and induces chills. A person passing suddenly into this from a heated atmosphere, is very sure to contract a severe morbid habit. Hence, sailors, who by some accident are obliged to tarry over night on cold damp land, and amidst heavy dews, are made sick immediately, and all the fault may be charged to malaria, unless a plea of *alibi* be entered. Those who dwell steadily in such an atmosphere, without changes of much heat, become disposed to diabetes, diarrhœa, dropsy, intermittents, cholera infantum, scurvy, scrofula, &c.

c. A dry and hot air is injurious, by dissipating the exhalations, and fluids of the body too freely, and leaving permanent irritation in all the tissues, with increased sensibility. There is liable to be a deficiency of oxygen, whilst the air is loaded with dust. The absorbents are excited, thirst attends, and aqueous fluids are greedily taken up. Diseases of the severest kind are easily excited by the common agents, after an exposure of some time to such an atmosphere.

d. Dry and cold air, also, dissipates the exhalations suddenly. The body is deprived of its caloric, suffers the sensation of cold, with a rigid state of the tissues. This state of air is very prevalent in the eastern part of North America, and is often attended with wind from the north-west. It is considered agreeable in the summer months, but rather intolerable in the winter. In spring and autumn it is too cold for comfort. This state of air disposes to catarrhs, rheumatism, pneumonia, and phthisis pulmonalis. Almost all the thunder storms in summer are from a westerly direction, and often followed by a cold, and dry atmosphere. This state of the atmosphere prevails in the winters of New England, and proves injurious to invalids, to old people, and to infants. Many statistical accounts prove the fact, of there being many more deaths of old people, and of infants in the cold season of the year, than in the warm. This ought to excite attention to the proper measures for such subjects avoiding the inclemency of the winter season.

5. *Winds as modifiers of sensible Heat and Cold.*

These are shifting currents of air, and come from every point of the compass ; and not only so, but the upper strata of the atmosphere are often precipitated, and mix with the terrestrial. There are often transverse currents in the upper strata. The air precipitated is often quite cold, after the lower strata are removed. An æronaut, Mr Lauriat, set off in a temperature of 76° Fah. ascended 1250 feet, and found the temperature 28° Fah., or four degrees below freezing. This was above the clouds. These are carried upwards sometimes, in thunder storms, suffer congelation, and precipitate hail, as well as cold air. Currents from the south, in this region, are warm and moist ; from the east chilly and moist. Air in motion removes the personal atmosphere, which is ordinarily warmer than the common atmosphere, and it is replaced successively by cold air, and greatly reduces the heat of the body. Yet the thermometer indicates no greater coldness in a current, than in a calm, unless it be often moistened.

6. *Alternations of Heat and Cold.*

The human system by a slow exposure, will endure great extremes of heat and cold ; but, suffers severely in respect to these, as in other instances, by sudden changes of habits of every kind. It appears to be the sudden application of cold, after heat, which most commonly fixes the tissues in their state of morbid rigidity. The sudden application of heat, after exposure to cold, is not so very injurious, although it is liable to induce a temporary exalted state of vascular action, which might have been avoided by a more slow application. The warmth promotes absorptions, and sustains the other circulations, and thereby rigidity and chills are precluded, and any temporary injury is removed by the sweats that usually follow.

We have hitherto spoken of heat and cold in a very general manner, without specifying the amount of either necessary to excite disease. With regard to this, it is altogether conditional. We find disease excited by cold in summer as well as in winter, although there is a vast difference of atmospheric temperature between the two seasons. Not so much depends on the actual amount of cold, as on the suddeness of its application after heat, and the state of the subject exposed. Besides any other predisposing circumstances, the heat of summer increases the tissual sensibility universally, so that the system is more readily acted on by many agents, than it is in winter. Hence the frequency of acute disease in hot seasons, and at such periods as manifest the greatest disparity of temperature between day and night.

Let us suppose a person having been for some time in an atmosphere of 90° Fah., to be transfered to an atmosphere in summer of 80° Fah., he will be as likely to gain a morbid impression of cold, as in winter to pass from 40° to 20° Fah., under circumstances otherwise equal. So we find disease excited in summer by a few degrees of difference in temperature. The variations of what might be called a temperate day, or going from sunshine and resting in shade, being often sufficient to excite severe disease. The medical poet has told it very well ;

> Hot from the field, indulge not yet your limbs
> In wish'd repose ; nor court the fanning gale,

Nor taste the spring. O! by the sacred tears
Of widows, orphans, mothers, sisters, wives,
Forbear. No other pestilence has driven
Such myriads o'er the irremeable deep.

The difference of temperature between noon and night, in New England, is often more than 15° or 20° Fah. It was even sometimes 37° in August; 45° in January, and 61° in February, in 16 hours in 1813.* And besides, the dews of summer have a controlling influence on the principles already mentioned. It is in accordance with all history of diseases, that the greatest number, and severest kind occur at those periods in which there is the greatest difference of temperature between noon and night, and during the presence of the heaviest dews. From about the middle of July, to the middle of September usually responds to these circumstances. Here are agents sufficient to excite disease, without miasm. The same circumstances continued, with a little modification, may excite disease at all seasons of the year; having, however, certain modifications also, of character and phenomena.

Rains in the West Indies, according to Moseley, greatly increase the disparity of temperature, and may excite dysentery in a regiment of soldiers in one night; he says, "cold is the cause of almost all the diseases in hot climates, to which climate alone is accessory." So thought Tissot, Cleghorn, Huxham, and many other observing physicians. But it may be said by some, there is another and better method of accounting for the origin of disease; that is, by malaraic excitation.

The inducements to intemperance in exercise, diet, and drink are so urgent amongst soldiers, and men of business and enterprise, that exposures will constantly take place; and especially as but few know, or will stop to learn the dangers that surround them, or the means of avoiding them. It may not be far from the truth to assert, that almost every person

* Dr Job Wilson on Spotted Fever, pp. 86, 88 and 90.

might remain free from disease, even in the severest epidemic seasons, if they thought and practised the means of safety with as much assiduity as they pursue the courses of pleasure, fame and profit.

We acknowledge there are numerous sources of exposure; but with diligence they may be shunned. We pass through many local atmospheres every day; from room to room, and sometimes underground rooms; from sunshine to shade; from exercise to a cool resting; from the heat of the sun, to shade of clouds and showers; from heated rooms in winter, to zero weather; from labor in a scorching sun, to the dews and breezes of evening, and perhaps, whilst much exposed in sleep; besides other contingencies innumerable. So a very constant attention is necessary to avoid impressions at sickly periods.

7. *Cold internally.*

As the circumstances just alluded to, primarily affect the external surface, and in quick succession the whole of the tissues; we might now make reference to impressions on the internal surfaces, suddenly reverberating over the entire system, in the instance of drinking cold water, when the body is in a high state of temperature. The hurtful effects usually occur in the predisposed, and that most commonly an alcoholic predisposition. The tonic action of cold water is primarily in the neighborhood of the visceral ganglia and plexuses; a state of nosodynamia is instantly induced, affecting these, and the entire tissues also; and of such severity, oftentimes, as to intercept all vital movements in the space of a few minutes. If not quite so severe, it is sure to implant the radicles of a morbid habit in the inmost tissues, which soon vegetate into either acute, or chronic disease.

8. *Remarks on Climate.*

In the torrid regions there is a preponderance of nervous susceptibility over the tonic state of the tissues; every thing relating to life and sensibility is on an elevated scale. The diseases are, therefore, of sudden access, of exalted action, and rapid termination. In the temperate regions many of the diseases of summer and winter are of a similar aspect; yet, a large portion are of a dilatory character, and range in the scale of chronic diseases. The aptitude to excitations is not so intense, and the hurtful changes in the tissues not so severe in such conditions. Although the temperature is almost constantly fluctuating in the middle latitudes, yet slight impressions only are often made in the tissues, but they are liable to be permanent. For instance, the primary changes made by alternations from heat to cold, and which terminate in phthisis pulmonalis, are often very slight, but unrelentingly persistive. It is the bane of temperate and changeable climates, and scarcely known in any other.

It appears that Dr Brigham, of Connecticut, has lately made some obituary expositions, showing the austerity of the disease, and its comparative clemency in the milder and more southern districts. In Portland, Maine, the deaths by phthisis pulmonalis were as 1 in 3.53; in Portsmouth, as 1 in 5.39; in Boston, as 1 in 5.79; in New York, as 1 in 5.89; in Philadelphia, as 1 in 7.17; in Baltimore, as 1 in 6.18; in Washington, as 1 in 8.51; in Charleston, S. C., as 1 in 7.08. It is rarely found beyond the Gulf of Mexico, whilst it has been for ages the scourge of Great Britain, and North America, as well as other places of cold and fluctuating temperatures. Hence, the means of avoiding it are very obvious, although difficult sometimes, and greatly neglected.

9. *Heat and Cold as Remedial Agents.*

The physiological influences of heat and cold being duly appreciated, we are led to many important practical results; which, however, cannot be dwelt upon here. It may be briefly noticed, notwithstanding, that as there is a coldness on the surface, and unequal circulation existing in a very large proportion of diseases of northern latitudes, the application of heat in some form, is a necessary and pleasant adjuvant in the treatment, particularly at their commencement. In many cases it is indispensable for the removal of the morbid conditions. It ought, however, always to be used with discretion, and not urged to excess. It may be applied by the air bath, by dry heat, by mild vapor bath, or the water bath. Each of these methods may have a preference in particular cases. In acute diseases, if necessary at all, it ought to be one of the first applications. In a large proportion of chronic diseases, its repeated application to the surface, in some of the above forms, will be found of singular utility, especially the tepid bath universally.

The application of cold to the surface by means of the air bath, or sponging with cold water, or by the shower-bath, may be so managed as to have a tonic effect in many chronic cases, attended with enervation, and mobility of habit, provided it be rightly conducted. It should not be continued a very long time, but should be followed by frictions on the skin and bodily exercise, in a manner to insure a free and direct circulation in the capillaries. But, it will be injudicious if there exists any internal local inflammation of an organ. It is also of doubtful use in persons so far enfeebled, that re-action may not suddenly take place, and such are in danger of perishing in the attempt, or contracting more severe disease.

Cold, by means of water or ice, has been a common application to the head, and sometimes over the whole body, in fevers attended with pain in the head, or delirium. If used indiscriminately, it is not only a doubtful, but a dangerous application. It should not be admitted in the early stage of fever, or pyrectic affections, whilst there is any congestive state present; neither in local inflammation internally in the head, for they are quite similar in pathological character. In such cases it should be deferred, and be made, perhaps, one of the ulterior remedies. After the necessary evacuations have been made, and to the point of relief, in the early stage of such cases as indicate a strong determination to the head, and the engorgements, both venous and arterial, are essentially removed, and there exists a free and equal circulation externally, with high heat, and probably delirium; in such cases, cold applications to the head are of essential service, and often relieve pain or delirium, very quickly. But, applied without these precautions, it is almost certain to aggravate the disease, and render it more dangerous, by adding strength to the primary cause, and fixing it in an aggravated state of inflammation. (See further expositions, Sect. xlix. 2 f.)

The same restrictions ought to be observed in the use of the *cold dash*, as it is called, to the head, or pouring water slowly from some height. As this is a more powerful agent, it ought to be used with more circumspection, and it sometimes may be very useful, after all the relaxing remedies of inflammation have been carried to a full extent.

After the capillary vessels have been relieved of their most turgid state, and admit a free circulation, with high heat, they then bear the tonic influence of cold, or cold water. The cold, also, by abstracting the heat, relieves directly of a large portion of stimulus; and in the absence of this stimulus, the turgescence of capillaries is permitted to subside still more. So, when the surface is hot, and raises the thermometer of Fahrenheit perhaps to 106°, as occurs in some states of scarlatina and ardent fever, cold water may be applied freely on the surface, to great advantage; provided, however, the preparations mentioned in the foregoing paragraphs have been made.

As the turgid tissues lose their excess of blood and caloric, they afford better opportunity for the exhalations and absorptions to take effect. This remedy should not be continued any longer than it manifestly affords relief. However, in ordinary practice, where we meet with one case of disease that will be benefited by cold, we probably find, in this climate, twenty that require warmth, especially at the onset. Much more might be added on heat and cold, both as causes and remedies. Many allusions to them will casually be made in the division of therapeutics. (Sect. xlix. 2, f.)

SECTION XXXVII.

ETIOLOGY.

2d. *Fatigue, Watching and Surfeiting.*

Some allusions have been made to these as remote causes of disease; and so of many other contingencies; they sometimes act as predisposing, and under different circumstances, as exciting causes. When moderately applied beyond the ordinary usage, they act as predisponent, and when vehemently applied as exciting causes of morbid actions; or in other circumstances, co-operate in producing a morbid habit of greater or less severity.

Fatigue implies a forced circulation, with an expenditure of muscular energy, and vital force generally. The blood is lodged in the capillaries, and the depreciated state of the system disenables the absorbents to take up readily, and slight degress of cold retard, and fix it there ; so disease may readily be excited. (See Sect. ix. 4.) Again, a person laboring under a state of predisposition, may be excited into disease by over-exertion, from the sudden agitation given to the general system. The state of perturbation continues, and becomes fixed, especially when associated with even slight degrees of cold. The Roman athletæ used the tepid bath, and aromatic ointments to secure themselves from subsequent disease after their severe exertions. Shall it be supposed the present age possesses less knowledge of prophylactics ? They seem not to be so circumspect, or vigilant in preserving health.

Watching is also attended with an expenditure of vital force, and leaves more or less excitation throughout the tissues. In severe epidemic seasons many contract disease by aiding the sick, especially when their intellect is not elevated by ardent affections. All the other extraneous circumstances impinge with greater effect in such conditions. A person deprived of sleep for one night, acquires an increased sensibility to cold.

Surfeiting adds oppressive stimulations to the digestive organs, and the whole system also. An agitation is every where produced, and so we find frequent instances of disease excited by it, on ordinary occasions ; but, at sickly periods, and in the predisposed, it is very sure to excite severe disease, or the prevailing epidemic. Many instances in the late epidemic cholera verify these remarks.

SECTION XXXVIII.

ETIOLOGY.

3d. Wounds, Contusions, Burns, and other Lesions.

In Section xix. 12, some observations were made on the influence of wounds, and contusions, occurring under various circumstances, and in connection with a morbid habit. Whenever a subject labors under a predisposition, wounds and contusions are far more likely to excite general disease, and become far more aggravated thereby. They excite perturbation, and the local affection usually concentrates to the injured part. This is liable to inflame, suppurate, or become gangrenous according to the prevailing diathesis.

Burns, and scalds on the surface, produce excessive stimulations, and an expenditure of vital force generally. Subjects become comatose from the loss of vital force, and are liable to sink by excess of stimulations. The more internal stimulants are given, the worse the case is made. If they surmount the first impressions, the stimulations reach the nutritive system and continue, and immediately establish a morbid, or pyrectic habit, especially in co-operation with an exposure to cold. Narcotics aggravate the case. Whatever destroys the sensibility of the surface, as a strong solution of nitrate of silver, does most service.

SECTION XXXIX.

ETIOLOGY.

4th. Emotions and Passions.

So many allusions have already been made to this subject, that it needs not to be dwelt upon. These may act both as exciting, and predisposing causes, according to their severity, and the present condition of the subject. They may excite a train of phenomena indicative of melancholic insanity, or of furious rage. In the former instance the circulations, secretions, and excretions become torpid; in the latter they are agitated, and the direct expenditure of vital force may be so great as to induce sudden death; or the perturbations may provoke general disease, attended with convulsions, hemorrhage, apoplexy, or fever.

Moderate excitations of mind enable the body to perform unusual labors, and sometimes to a great extent without injury; yet, they are liable in the end to produce exhaustion, followed by disease, perhaps insanity. A victorious army will endure great fatigue with an exemption from sickness, whilst a retreating one is liable to be overtaken by disease, if not by the enemy. The agreeable excitations of intellect impart vigor, and a repelling force to impinging extraneous circumstances. The reverse occurs in despondency.

The primary impulse of the passions is on the nervous system of external relation; soon, however, the nutritive tissues feel the impulse, and the capillaries distributed in all the nervous tissues are immediately disturbed, and their functions soon altered. An excess of fear, grief, anger, revenge, and even of love and joy, may suddenly destroy life, or light up the flame of disease. (Sect. xxxiv. 10, 6.)

5. *Resulting Remarks.*

The review we have made is not expected to embrace all the remote, or exciting causes of disease. They may be very numerous, and many of them obscure in their nature. The foregoing will serve as a basis to which others may be added. After disease has been established, and made some progress, there follow a succession of effects; so that the primary effects in the tissues from changes made by the exciting, and remote causes may be lost, or not easily distinguished, yet the secondary effects are commonly very prominent, as the sequences of disease.

The causes of disease have usually been treated in a lax and undefined manner, and without much of a systematic arrangement; and much uncertainty seems to have prevailed in relation to various diseases, whether they have an origin from contagion, or from extraneous circumstances, or as they may be styled, the circumfusa. We allege, that all the diseases usually styled epidemic, have their origin in the manner last mentioned; and, also, the sporadic, and chronic diseases, having regard to constitutional liabilities; excepting such as are known to be contagious, or infectious, and which belong to the next section.

To be more explicit, some may be mentioned; such as all the grades of typhus, mitior and gravior; the oriental plague; yellow fever; spotted fever; scarlatina; pneumonia; cholera; dysentery; influenza; intermittents; erysipelas; rheumatism; gout; phthisis; with all the phlegmatiæ, and chronic diseases, with the exceptions, however, mentioned above.

SECTION XL.

ETIOLOGY.

5th. Contagion and Infection.

THESE terms have nearly similar lexicographic definitions; and they have been used synonymously, in a manner to perplex the student. The late attempt to prove the *kaino*, and *idio*-miasmata to be contagious, has served to confound their use still more. We will attempt to designate the proper, and necessary use of these terms by the following definitions, and applications of them.

a. Contagion may be defined, a principle, or subtile virus, which excites a specific morbid action in animal bodies, of an acute pyrectic character, and limited duration; affecting the same subject but once; attended with internal visceral excitations, and for the most part eruptions; producing a similar virus by diseased organic secretion, which is communicable to other systems by *effluvia*, or by *contact;* whereby a disease of similar character is excited. To this division belong, variola; varicella; rubeola; pertussis; parotidea; the hybrid affection vaccinia, and perhaps some others.

b. Infection ought to be restricted to those affections communicable by *contact* alone, by a specific virus; of unlimited duration; liable to affect the same person more than once; for the most part of a chronic character, and without visceral excitations; producing a morbid secretion of a similar kind. To this division belong, syphilis; gonorrhœa; elephantiasis; lepra; psora; herpes; tinea capitis; trichosis; the virus of horse glanders; frambœsia; and perhaps some others. Under this division, also, may be placed, hydrophobia; the virus communicated by the bites of venomous animals; the acrid, poisonous properties of certain vegetables, producing affections of a more acute character, yet not agreeing in all the particulars.

We know but little of the origin, or entity of these contaminating principles; neither are we allowed to discern their modus operandi; nor what secret changes are made in the hidden tissues by the contagions, whereby the system becomes insusceptible of a reiteration. However, the practical laws of the contagions and infections, have become tolerably well established by slow experience.

The contagions have a precision of access not observed by the infections. The former when communicated by effluvia, require about two quarter lunations from the time of application, before a morbid action is excited; whilst those admitted by insertion, require only one quarter lunation. The different varieties of the infections are extremely variable respecting their period of incubation, and accession.

It appears that the exciting virus must reach the susceptible tissues, either by absorption or insertion, and accumulate, before an excitation is produced. (Sect. xv. 4.) When it takes effect, in all the contagions, and some of the infections, we discover a train of phenomena not very dissimilar to that of the common morbid habit of the acute character. This seems to prove the simplicity, and congruity of morbid action, and that disease has many things in common. Notwithstanding this, each of the affections has its own peculiarities, which go to establish its nosographic character, and these distinguishing traits are very constant by means of their local tendencies, and peculiarities of eruptions.

Notwithstanding the contagious affections are excited by a specific virus, and require a limited period to pass through the system; yet, the duration of the pyrectic state may be greatly modified by internal changes and extraneous circumstances. The morbid habit may be prolonged in them to an indefinite period, by certain combinations of the common causes and sequences of disease, especially with cold; and they may even terminate in severe chronic affections.

The distance that the contagious effluvia may take effect on the unprotected, depends on many circumstances. Various experiments show, that the effective virus extends only a few feet from the person affected, in an atmosphere free from currents. The atmosphere dilutes, and no doubt neutralizes it. The distance then depends, 1st, on the quantity of the virus in a given place; 2d, on the course of any atmospheric currents; 3d, on heat or cold; for contagions remain the longest active, and spread with most facility, in cold seasons. On the contrary, warmth appears to be more favorable for the propagation of infectious diseases. 4th, on the general pestilential afflatus in the atmosphere; for such seasons are far more favorable for the spread of contagious, as well as epidemic diseases. 5th, on the personal condition of the subject at the time of exposure; as whether his system is in an absorbing condition at the time, or in a state of increased sensibility; whether he has been exhausted by hunger, fatigue, watching, &c., or is exercised with fear, or any other depressing passion; all these circumstances favor the absorption of the virus. Prudence might, therefore, dictate the keeping the more safe distance of several rods.

There appears to be considerable evidence to create a belief, that contagions may originate in certain seasons favoring their virulency, without a positive pre-existing virus. No doubt many circumstances must conspire to produce them. When the diseases appear under these circumstances, they spread with nearly the celerity of epidemic diseases, and often possess unusual malignancy. So, also, the infections more manifestly have a spontaneous origin sometimes.

The virus seems to act as a chemical ferment, changing the fluid matter, and exciting the fixed matter of animal bodies into inordinate action. It multiplies in a ratio of the congenial substances existing in the individual affected; and therefore some receive far more severe impressions than others, and produce more of the peculiar virus.

The contagions maintain their definite characters, although their diatheses suffer essential changes, by which they manifest some new phenomena ; whilst the class of sporadic and epidemic diseases are subject to important modifications from the circumfusa, assume new liveries, and require other distinctive appellations.

SECTION XLI.

ETIOLOGY.

6th. On Diurnal and Sol-lunar Influences, as Exciting Causes.

Had not reminiscence rather casually recalled this subject, it would have remained at rest, like many others so little thought of since the engrossing topic of malaria has become the almost exclusive causation of disease. We cannot follow this subject out in the details it merits, but merely excite attention to it as a prolific source of excitations offered to the vital susceptibility of animal tissues.

However superciliously the influence of the bodies composing the solar system may have been regarded by some, as affecting the human economy, and exciting disease, yet it may be demonstrated they possess some controlling power in many of the other processes in nature.

Solar heat and light, with the reflected rays from the moon, and the diurnal motions of the earth, produce astonishing changes in the atmosphere every day and night, which also impress the entire animal and vegetable productions, modifying their economy. So, also, the annual revolutions of the causes and sequences of disease, especially with cold; and they may even terminate in severe chronic affections.

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Solar heat and light, with the reflected rays from the moon, and the diurnal motions of the earth, produce astonishing changes in the atmosphere every day and night, which also impress the entire animal and vegetable productions, modifying their economy. So, also, the annual revolutions of the earth in her circuit round the sun, change the aspect of everything about us. These are phenomena presented to the senses of every one ; but still, there are many of the hidden processes, which depend on concealed influences, meriting our attention. The attractions which bind the spheres in their circuits, must influence every substance, more or less, within the circle of their embrace.

The constant coincidence of the flowing and ebbing of the great movable waters, by the single and combined influence of the sun and moon, has become an universal fact. It is more than probable, if sufficient attention had been bestowed on the subject, that before this, similar and greater flowings and ebbings of our atmosphere would have been established. Many observations have been made showing regular currents, and stated changes of some of the imponderable elements existing in the atmosphere.

The barometer proves a variation in the pressure of the atmosphere, which must affect living bodies in some degree. These variations are the most conspicuous in the intertropical regions, where it is stated, the mercury has regular diurnal ascents and descents, which must depend, not on accidental, but permanent influences.

It is asserted by M. Saussure, that there is a regular minus of electricity at the latter part of the night, and that it increases to its plus with the sun at its height.

Mr Haustein has shown, that the magnetic fluid has regular semi-diurnal changes from the minimum to the maximum points. The magnetic needle vacillates towards the west as the sun rises towards its zenith, and towards the east as it declines.

Dr M. Edwards has shown that more oxygen is absorbed at certain periods of the twentyfour hours, than at other times.

Can it be supposed these influences are chiefly confined to inanimate substances, and that the susceptible tissues of living bodies should not, also, be affected by them ? The daily, and often periodical hilarity, and depressions of the most athletic show the contrary ; and far more so the hypochondriac, or movable habits.

The whole vegetable and animal tribes are intensely affected by the circumfusa of the atmosphere ; and are excited, depressed, moulded and modified by its varying impulses, both visible and insensible. Many of the aerial influences arise from the sun and subordinate planets ; but the moon, although a secondary one, is enabled by its proximity to possess considerable influence.

That these influences affect the physiological economy ought not to be doubted. The minor influence of the moon has not of late years received the attention it deserves. The ancients bestowed much attention to the subject, and no doubt they undertook to establish principles before an uniformity of facts warranted them. Yet some have been sustained, besides the regular movements of the ocean. In the female periods of depuration, certain classes have a very constant coincidence with the quadratures of the moon ; and, again, the periodical accessions of many diseases present striking coincidences.

If the study had been continued, and with more precision, there ought not to be a rational doubt, but many more pathological phenomena could have been found to have a correspondence with, and dependence on, the lunar attractions, in her different phases ; also, by her light in the night, and modifications in accordance with the sun by day, in the great play of affinities of the imponderable elements of our atmosphere.

We cannot attempt to repeat the numerous facts which are in reserve, of the coincidence of the attack of disease with the conjunction of the sun and moon, or the change ; nor of the exacerbations, nor crises of disease either favorable, or otherwise ; nor the accessions of periodical diseases. The attacks of insanity, and its exacerbations were found to be so coincident with the quadratures of the moon, that the affected were called lunatics. It has been particularly observed that hemorrhages are essentially influenced by the phases of the moon.

It is not unphilosophical to infer, that modifications of the intensity of the elements composing the medium in which man exists, should affect his nervous susceptibility, increase and expand the circulation, and the concentrations be directed to irritable tissues, establishing a local erethism in them, and thence exhibit the phenomena of disease.

As the advocates of sol-lunar influence from their own observations, we may mention, Aristotle, Galen, Avicenna, Hoffman, Diemberbrock, Van Helmont, Baglivi, Muschenbrock, Mead, Bacon, Pitcairne, Moseley, Balfour, Blane, Hunter, Gall, Spurzheim, and J. Johnson. Many others might be added.

Such a weight of testimony surely demands respect sufficient to excite inquiry ; and it seems that by neglect the present generation must be incompetent judges, and destitute of negative facts to oppose the thesis.

As observations on this subject ought to proceed on a large scale, may it not be suggested, that every Medical Society might do properly by enjoining it as a duty, for each member to make accurate observations on the subject, to record, and report them annually ?

Dr Spurzheim well remarked in his observations on insanity, that, " A philosophical treatise on the periodicity of the phenomena of nature in general, and of man in particular, in his state of health and disease, would be at the same time very interesting for anthropology, and very useful for practical medicine." But such a treatise cannot be made out without the elements.