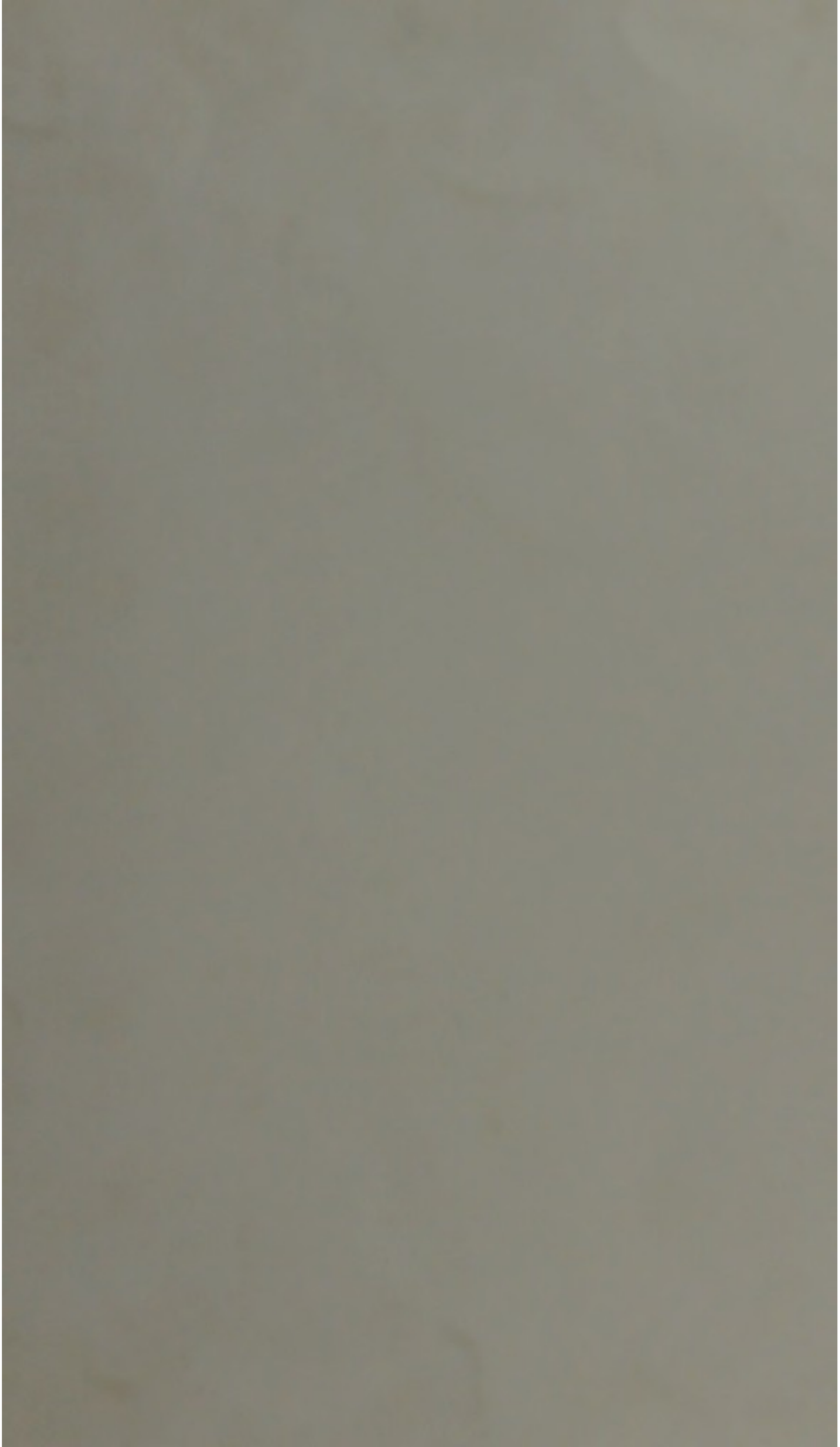
**A comparative view of the more intimate nature of fever : deduced from physiological analysis, and illustrated by critical remarks and practical observations / By James Black.**



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# PREFACE.

THE following View of the more intimate nature of Fever contains, not only, a modified analysis of febrile phenomena, but also the Author's endeavour to collate shortly some of the various opinions, that have, from time to time, been entertained on this very important department of disease; he being persuaded, that the ambiguity and logical distinction of language have had some influence in creating more differences, apparently, among several theories, than really existed in the minds of the inquirers on the subject.

Investigations into the nature of fever have, moreover, it is presumed, been embarrassed and influenced by the notions, that some have held about the necessary difference in kind, as well as in the degree of physiological movement, by which the several species of fevers were essentially occasioned; consequently different motive processes were supposed to obtain with the varying characters of fevers. This accommodating doctrine was farther supported by the idea, that the

state of fever is, exclusively, either an asthenic or a hypersthenic commotion of the whole assemblage of life. Another important reason for thus considering fever, was the *post-factum* argument of medical treatment; for it was reckoned the truest philosophy, as it was certainly the most specious and practical, to decide on the nature of a disease, from the nature, excitant or antiphlogistic, of the remedies, that were successfully, or with a different issue, employed.

To consider the *febrile act* in either of the above exclusive views, is not only attempted to be shown unnecessary, but to be injurious in a therapeutical application; besides, as it also seems to throw impediments in the way of strict pathology, and to have promoted controversy; the following pages are, therefore, with much deference to many eminent opinions on this subject, submitted to the press;—in the hopes, that the more particular doctrine of the compound or binary nature of febrile action will be found to be as legitimately deduced from the known laws and data of life and disease, as it will be allowed to involve the stricter principles of therapeutics, without advocating professedly the restricted use of any class of remedies.

To those, who have perused the Author's Short

Inquiry into Capillary Circulation and Inflammation, this View of fever will form a consecutive induction and argument; as all pathologists are nearly agreed about the necessary connection, which there should exist, between the doctrine of the nature of fever and that of inflammation.

That the Author has no claim to originality in many parts of his research into the generative essences and identities of these diseases, the literature of medicine and his own text will testify; and where he has advanced any thing, that is new, and, at the same time, merely hypothetical, in what may be considered as peculiar to the following View, he cannot, reasonably, be surprised to find it undergo a similar fate, to what the observant Sydenham had prepared for many a preceding hypothesis.

"Cujus jam loco is novam quamdam substituit Hypo-
"thesin, majori adhuc verisimilitudinis specie innixam,
"et magis affabré concinnatam; quod tamen posterius
"figmentum pari cum superiori illo fato fungetur,
"quoties Tertius aliquis se objecerit, qui Secundum
"istum tantum ingenio vincat, quantum ille sibi præ-
"cedentem devicerat."

*Bolton, September*, 1826.

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A

# COMPARATIVE VIEW

OF THE MORE INTIMATE

# NATURE OF FEVER,

&c. &c.

## SECTION I.

### INTRODUCTION.

THERE is no subject in medicine, on which so many opinions have been held, and on which so much has been written, as on that of Fever. It has served, from the earliest times in the study of the healing art, to excite the speculations of the reflecting and ingenious, and to engage the renewed attention of every practical inquirer. Its importance as a great influential or efficient agent, in most of the departments of disease, has attracted, and will continue to command, the observation and inquiry of every rational follower of the profession. Its nature also, or the essentials of its proximate action, cannot fail to awaken in his mind, from time to time, fresh motives for research and investigation, and for the exercise of his reasoning and inductive faculties; in

spite of the clouds of theories, that have swept the field of his study, and have already melted into contempt or forgetfulness. The fate of many very ingenious and useful hypotheses, that have thus passed away, with scarcely a remembrance of their existence, save in the supercilious quotation that serves to round a period, has perhaps deterred some from attempting patiently to ascertain, how far what has been advanced by others is consonant to observation and induction; while others have rested contented with the mere study of symptoms, and with combating them, according to their insulated urgency and violence: having as much dread of professing to follow a theory, as some sensitive christians have of enlisting themselves under the banner of any doctrinal designation. Notwithstanding this avowed repugnance to theory, it is easy to discover, that the most practical empiric tacitly follows some *a priori* conception of the nature of fever; and in the act of extracting blood, in a case of it where there is no topical disturbance, he will at least express his dread of inflammation, either as existing in some organ, or as about to supervene. It is moreover difficult to see how the practice of medicine can at all be pursued without some allusion being mentally made to the supposed cause of the morbid and obvious phenomena; though it depends entirely on the depth and extent of the individual's reasoning and inquisitiveness, how far upwards in the scale of causes and effects, the

the theoretical process will proceed. While some repose in the solution of the last links of the catenated action of disease, as many once did in the easy belief of a convenient occult cause; others have, with a persevering ingenuity, run up the chain of sequences, until fair and legitimate investigation has been lost in the unsubstantial mazes of an airy hypothesis. Perhaps the generality of even rational theorists have endeavoured to explain too much, and to grasp all possible phenomena in the embrace of their general principles; being distrustful of the truth of any theory, or of any inductive principle, except it was proved to be a key, that would unlock every mystery. Not so have the chemists or the modern geologists conducted their inquiries. They have remained satisfied with a few well defined principles—the result of repeated observation and experiment on a certain number of bodies; without venturing to apply these principles to substances unexperimented on, or to say, that they are the ultimate principles, by which even the bodies investigated are corpuscularly governed.

But as this subject has already been touched upon in the Introductory Essay of a former Publication, I shall proceed to attempt a proximate view of fever and its phenomena, as being deducible from known data and observations; some of which have already been propounded in my Essays on Capillary Circulation and Inflammation. As the subject is not intended to be treated in a systematic nor historical manner, it

is not professed to enter on any nosological detail. The more particular object of inquiry, is the *febrile act itself*, under whatever circumstances it may occur; and to see, how far what has been elsewhere confirmed and advanced may avail us in the investigation of that obscure process of nature.

To what length the conclusions that will be deduced, may accord, or be at varience with the chief theories already promulgated, or how much they may be modifications of them, some notice shall also be taken; for it may fairly be hazarded, that in the most celebrated of the theories on the nature of fever, there is much that is true; and that their dissimilarity is sometimes as much owing to the imperfection and different acceptation of language, as it is to the real difference, that exists among the notions entertained on the subject. The main distinction, which has divided the crowds of theories into two great classes, is the opinion, whether the state of fever in general depends, on an increased tone, or on a debility of the whole, but especially of the sanguiferous system. A further consequence of these opinions regarding the nature of fever is, that they have resolved themselves into the distinctive ones, of inflammation or irritation, in some part or organ, being always the radical cause of fever, and of fever being merely occasioned by some inappreciable disturbance or want of equilibrium among the respective systems and functions of the body—the

efficient cause of which has been generally attributed to debility, either partial, relative, or absolute. The liability to the unconscious confounding of the state of inflammation with an increased tone of the animal fibre has, it is presumed, had no little influence in our reasonings on disease, and has tended to modify, if not to mould, the fabric of several theories. When once inflammation was detected in the progress of a fever, it was immediately made the co-efficient to the whole equation of phenomena, which then received their separate values, and the solution of the whole was supposed to be satisfactorily elicited.

In conducting any analysis in pursuits strictly physical, men have arrived at some principles or elements, which have been termed ultimate, only in respect to the extent of the discovery, and not to what nature herself has been limited to: so in attempting to investigate the phenomena of disease, we should, as far as possible, endeavour to assimilate our researches to a strict process of the above nature; however much all reasonings on disease necessarily partake something of an ethical nature. But it cannot be said, that data of a defined and appreciable character are altogether wanting in our inquiries into the more intimate nature of morbid action. Even in fever, one of the most unsubstantial, though the most important of human ailments, we are possessed of some principal data; far short, it is granted, of the simple elements, by which nature may operate; but when their relative

and reciprocal forces are considered and weighed, they assist very much in explaining the subsequent phenomena, if they are not thereby the necessary and essential links in the catenation of nature. The motive physiological constituents of the system in health, must also be pathologically affected or efficient in the state of such general disease as fever; and these are well known to be, the *blood*, the *heart* and *blood-vessels*, the *brain* and *nerves*, and the powers of *volition* and *muscular life*, or that life which seems common to the organization of all animals whatever. Some of these may be shown to be of primary importance, in the constitution of fever, when compared to others; which perhaps are only involved, along with minor principles not named, in a secondary manner, according to the strength or extent of the original disturbance. But, before attempting any thing like a synthetical illustration of their reciprocal and synchronous affections, it may be more relevant to the professed tenor of this essay, first to examine somewhat minutely the sensible state of fever; though what has been dilated upon in my published Essay, on the subject of inflammation, will anticipate much of what we may arrive at, in this department of inquiry.

## THE PRIMARY STAGE.

The first general symptoms of idiopathic fever being, more or less, languor, listlessness, chills and

tremors, shrunk skin, anxious pale countenance, depressed spirits, smallness or slowness of pulse, diminished heat, and prostration of muscular strength —often most disproportioned to the shortness of the indisposition; our natural inquiry is, how are these occasioned, or what is the link which connects them with a state of health. The same physiological elements as above enumerated, and which are associated with a sane state of the body, are at work in most of the instances of fever;—no sensible nor preternatural evacuation has taken place from any part, nor have the powers of digestion or assimilation been suspended or impaired in many instances, until the above phenomena have actually commenced; and moreover, no apparent violence has been inflicted on the body or any of its organs. It is plain, therefore, that the morbid change has not resulted from any appreciable increase nor diminution of the solids or fluids of the body, but has arisen from some less tangible source: and besides the fluids and solids, there are no other elements in the body, save the different powers of mind, motion, and life; it is presumed, that some lesion or affection of these imponderable essences has given rise to the elicited phenomena. It is, at the same time, not forgotten, that great evacuations and injuries of the solid textures have often laid the foundation of severe fevers; yet as febrile action is not an invariable sequence of them, they form only a part of a cor-

relative argument, and are placed among those causes that may excite, but do not necessarily involve the catenation of fever.

In some affection of the three powers above mentioned, the *primordium* of febrile movement is then placed. It is, however, a matter of experience, that no voluntary effort of the mind, however powerful, can produce or prevent a fever, or cut it short in any of its stages; though as an exciting cause, it may operate either beneficially or injuriously on the powers more intimately concerned in the constitution of fever; and fever often obtains, though the mind is unconscious of its presence. The powers of volition, or the nervous system of voluntary motion, are the next to be considered, and how far the original seat of fever resides in them. Experimental physiology* has however demonstrated, and practical pathology has corroborated the observation, that the nerves of voluntary motion and sensation possess no other properties, but those of transmitting the sensorial stimuli or irritations to the muscles acted upon, and of conveying back the impressions made on the sentient expansion at the extremities of the nerves. These nerves are then the conductors, not the residence, of any specific vital or animal powers of an independent

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* Vide Bichāt, *Recherche Physique sur la vie et la mort*; Dr. Philips's *Exp. Inquiry, passim*; *Recherches Physiques, &c. par M. Flourens. Arch: Général: de Médecine*, 1823.

nature ; and it is questionable, if they can of themselves either originate a morbid action, or control it, when it has commenced. In fevers, their characteristic properties are not particularly injured; they transmit the commands of the will, and the impressions of sensation, though the muscle acted upon does not respond, or if it does, it is with weariness and pain ; while in palsy, the muscle is often capable of acting, but the cord is impeded in its function from pressure or disorganization. Like the strings of a musical instrument, the nerves are inoperative, unless they are excited by volition or sensation, which may be compared to the hand and fingers of the musician. The nerves are besides not among the primary elements of animated organization ; the blood of the chick *in ovo* is seen to circulate long before any rudiments of nerves can be detected, and in some inferior animals they are altogether wanting.* The nerves seem more connected with the organization of loco-motive animals, than they appear essential to animal life, generically considered. It is very common, however, to speak of the nervous power, and of the strength of the nervous system, as if we considered the nerves themselves to be exclusively possessed of those powers and properties, which we see manifested in muscular

* Fœtuses born without either brain or spinal marrow, show that these organs are not necessary to mere growth and organization.

motion, and vascular activity: but as these functions depend radically on other sources, than on the powers of the nervous cords themselves, as the history of experimental physiology has shown; the nerves, strictly speaking, are but the *media* through which those powers are excited and regulated. The celebrated experiment on the digestion of the food being promoted by the transmission of galvanism through the eighth pair of nerves, previously insulated from the brain, supporting a proof, that galvanism was identical with the nervous power previously supplied, only proved how fitted the nerves are to convey a stimulus to their distal extremities. The early phenomena themselves of fever show how little connection it has with the nerves of volition. They evidently exhibit an influence much opposed to that of these nerves; and have a more plausible association with the nerves of sensation, or that portion of the nerves which are subservient to the sentient principle. But granting this sentient property or portion of the nerves, for late research has partitioned the voluntary nerves into two distinct sets of fibres and functions, to be primarily and essentially involved; it still remains to be considered, by what means, and what kind of morbid sensation has arisen, in order to be transmitted, and in what more remote texture and function the sentient lesion has originated.

The brain and nerves of involuntary motion have been resorted to, as affording the most probable

seats for the *mobilia* of fever. That they are very intimately implicated in all full-formed fevers, there can be no doubt; but that they are primarily so, or that a lesion in either of them is the generative and necessary cause of the febrile catenation, is not so fully confirmed, nor so consonant with general facts and observation. Some infectious fevers certainly evidence themselves, first, by some obscure affection of the brain, expressive of what is called an impaired energy, or of a partial excitement; but if a strict inquiry be instituted, some other functions, as of the skin and the stomach, if not of the heart, will be found to have experienced a contemporaneous, if not a prior change. And where the cerebral phenomena have much preceded the others in fever, it is owing to some local determining cause, or, at most to a specific type of disease; and they will be found, in these cases, to hold their predominance during the ensuing fever. Another presumption against the brain or the nerves of involuntary motion being, essentially and exclusively, the original seat of fever, is the supervention of symptomatic fever, from the local irritation of an ulcer or wound in the extremities;—the pulse becoming frequent and quick, before any cerebral or other visceral disturbance has manifested itself. According to the Cullenian theory, a diminished energy of the brain produces a spasm of the extreme vessels; and supposing this to be the case, the inquiry is, how is the diminished energy induced by the

local irritation. There is a link wanting here to connect the partial injury with the general disturbance, which, if it had been supplied, would have completed the chain of sequences more perfectly. Indeed, it may be concluded, that if a correct and satisfactory rationale could be given of the nature of this important primary link in the catenation of symptomatic fever, it would go far to explain the inceptive movements of every febrile action. We witness, for instance, a wound, ulcer, or some local injury existing in the body, without fever or any sensible disturbance of the general nervous or sanguiferous systems, on one day; and on the next, or even in a few hours, we shall find the pulse quickened, or more frequent, some thirst, and an altered state of the skin, generally of a dry and hot nature;—but still the functions of the brain may be found unimpaired, and the patient sometimes will not, at this early period, be sensible of the morbid change which has taken place throughout his frame. Fever has, however, commenced, and the desideratum is, what is the unseen sequence, which has connected the topical lesion with the general commotion. The involuntary or ganglionic system of nerves may in this case be thought to be very presumptive seats of this initial disturbance, as they are distributed particularly on the vital organs, of which the heart is the chief; and it is well ascertained, that these nerves may be involved in the midst of much disease or disorganization, and yet the individual be little or not at all sensible

of the extent of the injury, which he is suffering in his own body. The difficulty still in a good measure remains, as we cannot bring the topical lesion of a limb in direct catenation with a morbid commotion or injury of these nerves, except through the circuitous medium of the sensorium commune; and the known irritations and lesions of these nerves produce diseases of a totally different character from fever, such as chorea, hysteria, palpitatio, tetanus, &c.

There is, however, another most important power in more immediate connection with the matter of our bodies, than either the brain or the nerves; which power is coeval with the first rudiments of our identity, and adheres to the animal fabric, after the brain and nerves have been separated from the body or their powers annihilated, until it gives place only to chemical decomposition. Abstaining, as we formerly professed to do, from speculating on the exact or probable nature of this power; it is sufficient to hold it as one of the ascertained principles of animal organization, without which there is no one property or structure of animalization performed, nor completed. It has received various names, all of which are more or less designative of its properties; for of its exact nature, the most eminent philosophers are as ignorant, as they are of the essential nature of gravitation. Of these properties of nature it also appears, that the one attached to animal matter, is the better ascertained of the two. The mere certi-

fying its existence and non-existence in the same body and form of matter, is a proof superior to any thing that the science of gravitation affords ; besides, there are other proofs which animal life displays, of superior satisfaction, to render this power a fully recognized and independent element. From what has been said in my "Short Inquiry, &c." ; when speaking of the properties of this power, which we shall continue to call the muscular power, or materia vitæ; and from what has been written on the subject, from Haller to Hunter and downwards, it is not necessary to attempt any detailed description of its properties, as applied to the whole phenomena and range of the animal kingdom ; it being more appropriate to confine our observations to the bearings, which this power is supposed to have on the subject before us.

It is a matter of observation, that this power, though incorporated with animal structure, is yet so far distinct from it, that its quantity or strength is not always commensurate with the volume or weight of the organized matter ; and that it may be in various proportions or forces, in the same body, or in the same parts of the system, at periods sometimes very near, as well as at others more remote. The animal fabric cannot increase without some corresponding increase of the muscular power also ; but the quantity or strength of this last may be more or less quickly diminished, without the bulk of the part, or of the whole animal body, suffering any thing like a cor-

responding diminution. The effects of blows, poisons, hunger, and electricity or lightning, are all illustrative of this proposition; and experiment has shown, that this power gradually leaves the body, and continues in some ratio, after sensorial death, corresponding with the mode or quickness of its previous expenditure. Experiment has also ascertained, that it is a power independent of the brain, and of the white system of nerves; and that upon it depends most especially the circulation of the blood through the heart and vessels,—giving natural vigour to these, where it is in due quantity, and leaving them in torpid collapse or distension, when its quantity or powers are lessened or impaired. The contractile vigour of a muscle also depends on it, and not on the nerves leading to the part; and though Dr. Philip endeavoured to draw the conclusion, that the nerves are the efficient cause of secretion, yet his experiments, abstractedly considered, appear to prove, that secretion depends as much on the muscular power, as the circulation in the capillaries does; and that the nerves in both functions are only the *media* through which the respective stimuli are transmitted.

The above-mentioned preliminary phenomena of fever are referred, then, to some condition of the muscular power; as many violent affections and injuries of the sensorial and nervous powers sometimes take place, without the induction of fever; and the morbid phenomena, which they produce, are very

different from the symptoms above enumerated, as taking place in the first and necessary instance. Among the illustrative morbid affections of these two latter powers, are epilepsy, several results of cerebral wounds and compression, and all the class of neurotic diseases, which may all obtain to a great, nay to a fatal extent, and yet no fever will accompany them, nor ensue.

The attempt, then, having been made to show that the muscular power, or materia vitæ, is primarily involved in the earliest links of febrile catenation; the next inquiry is, to what condition of it are languor, lassitude, anorexia, &c. to be referred. It is plain, they cannot be attributed to an excess, or preternatural quantity or power of it in the organs themselves; for in that case, an exaltation of all its subordinate functions would take place, and not as we see, a depressed or impaired state of them. To a deficiency, then, these atonic symptoms must be referred. Capillary circulation is affected among the very first *mobilia* of fever; and this capillary affection consists of an impaired or a diminished action, which, it is known from strict physiology, can only happen from a decrease of the motive and vital powers of this system,* where no sensible lesion has otherwise taken place. The lassitude or weariness of the muscles, where no undue exertion,

* Vide *Essay* ii. in my *Short Inquiry on Cap. Cir., &c.* and the works and experiments there referred to.

nor even any, has preceded, can only be accounted for, by the fibres being deprived of the healthy proportion of the materia vitæ: in fact, they are, in one sense, in the same condition, as if they had been exhausted by severe exercise. The nerves of volition transmit their ineffectual stimuli to both conditions of the fibres; but in the one case, the irrespondence excites no surprize nor uneasiness, while in the other, we have the apparent anomaly of weariness and the pains of exhaustion, without previous exercise. A cold and shrunk skin with the sensation of chilliness, is also referred to the partial absence of superficial vitality and to diminished capillary circulation, while the nerves are ready to transmit to the sensorium the changes taking place at their extremities; not forgetting, that the more internal vessels, having also lost their tensiveness, are, in this stage, relatively overcharged with blood, and giving the sensation of pressure and of greater heat to another set of nerves;—which increases the relative sensation from those arising from the surface of the body. The small and frequent pulse arises from the oppressed and diminished action of the heart, occasioned by an undue load of blood and impaired muscular power; the consequence of which is, that the heart does not fully contract and empty itself, but the imperfect systole more frequently takes place, to get rid of the same quantity of blood in the same section of time; and besides the capillary (reticular) circulation being almost neutralized or

stopt, the blood must make its circuit in a shorter period of time, else it would become more or less congested in the vessels. To an impaired muscular power over the whole system, at least to the extent of embracing the heart in the lesion, the initial phenomena of fever are attributed ; but in what exact manner this is accomplished by poisons, cold, stimuli, and contagion, it is not attempted at present to inquire. A negative condition of this power, it is inferred, may physiologically be granted to be an essential condition of the first cognizable symptoms ; it is therefore taken as an ultimate fact, in the present stage of pathological investigation ; and it is left to other and future research to carry the solution of causation farther up the scale of nature.

It may be said, that all fevers do not commence with these supposed symptoms of debility or impaired muscular power. It is granted, that in all cases, as in some very acute inflammatory fevers, they are not equally observable, nor do they often remain for any important period of time ; but if the history of the most synochal fever be strictly inquired into, some sensations of obstruction and chilliness,—some symptoms of repressed muscular power and debilitating uneasiness, will be found to precede reaction. The excited state of the body and circulation, from ardent stimuli and severe exercise, might be thought to lay the best and most favourable foundation for a permanent state of excitement. There are thirst, heat, and a quick and

frequent pulsation, which are some of the chief constituents of formed fever; yet it rarely happens that fever follows from such an artificial exaltation of the system. These phenomena of excitation soon subside almost universally into the composure of health; and if fever at any time follow, an intervening stage of some atony or impaired vitality will be found to have preceded the period of formed fever. It is therefore extremely problematical, whether the high symptoms can ever be the primordial ones in fever, without that previous link above-mentioned having obtained; or that such a fever as the synocha of Cullen ever existed.

That the topical inflammation of any organ or tissue, preceding and giving rise to general fever, does not affect the order of causation, or exclude the supposed necessary preliminary of a diminished or repressed muscular power, is also moreover inferred; as I have attempted formerly to show, that local inflammation itself depends primarily on a lesion of this power, which is a constant constituent of the part affected. An interesting example of this order of febrile catenation, arising from local injury, is related, by Giannini of Milan; by whom it is mentioned, that an intermittent fever was repeatedly induced by the painful introduction of a bougie; and that such fever could only be cured by reiterated recourse being had to the cinchona.

The atonic and precursory phenomena of fever are observed to be of more or less intensity, from the mild

and fugitive chills and slight anexoria, which precede what is called a common cold or an ephemeral pyrexia, to the deep and general paralyzation of all the functions, which is the prelude to severe typhus, or the severer plague; in which last, not unfrequently, the stage of reaction never arrives,—the primary *anéantissement* terminating forthwith in dissolution, before the chance of a fever is left for the patient. In the remittent endemic of the Tropics, the suddenness and severity of the primary impression are often very remarkable;—the sufferers, who were a short time previously in the best of health, having compared the first invasion of the fever to the being knocked down by a blow. The history of the plague is still more pregnant with such examples of the primary violence of the attack. All the above variety of the precursory phenomena appears to be essentially owing to the slowness or rapidity, joined to the extent to which the muscular power of the whole or the chief part of the body is, at the time, diminished. That it is so diminished or repressed in all in these instances, cannot otherwise be concluded; and yet the weight and volume of the solids and fluids may remain the same. As a further corroboration, it is found, that the muscles, after death, of those persons, who have been struck off by these sudden and primary invasions, do not contract to the application of stimuli as those of others dying, under different circumstances, do; their blood also is then generally found fluid and uncoagulated, as may be

farther seen, from several autopsical cases related by Morgagni and others.

Having, then, resolved the above-mentioned initial symptoms, whether mild or more severe, into a relative diminution or lesion of the muscular power, as regards the healthy constitution of the part or function, and into an absolute deficiency or lesion, as regards the whole vascular system, at least; we shall now more particularly examine the pathological conditions of some of the parts and organs, at this period of primary atony and debility.

If no local disease has preceded, the whole capillary circulation, but especially that of the periphery of the body, is more or less arrested or impaired; the external vessels of this system are in a state of empty collapse, not of spasm or constriction, as has been alleged,—the erectile tensiveness being lost or diminished; while the circulation is carried on through the larger vessels of the leading order of anastomoses, and not through the expanded net-work of this system.* The capillaries

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* To avoid difficulties in physiologizing on the capillary system, it is most important to advert to the distinction, which I have endeavoured to point out in my Short Inquiry, that exists between the laws and habitudes of the *capillary plexus or net-work* and those of the *capillary leading vessels*. A gentle stimulus throws the former into *erectility* and *tensiveness*, if they have previously been collapsed or in a state of depressed circulation, and the latter class of vessels into *contraction* or a *tension* preliminary to it; and the dilatation with active circulation, which some stimuli

of the visceral cavities, from the laxity of their parietes and of the tissues in which they are ramified, may however be found in a state of venous congestion, which is atony with distension ; and there is no doubt, both from pathognomony and *post mortem* research, that the larger vessels in the neighbourhood of the heart are, at this period, very preternaturally overloaded. The frequent yawning, and oppression of the præcordia, are very indicative of the involuntary *nisus* of the lungs, to relieve the pressure from the heart and from the large pulmonary vessels. When abdominal symptoms of sub-acute inflammation form any characteristic of the general fever, as in some species of typhus, the capillary system, and even the larger vessels in the cœliac order of vessels, will be found to be in a relatively higher degree of this atonic distension. The determining cause of this atonic collapse or disten-

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instantly cause, without inducing any previous contraction, is this *erectility* or *tensiveness* of the ultimate *plexus*, which is a condition of highly active vitality.

I have also endeavoured to show, that *collapse* and *contraction* are two opposite physiological conditions, though both are attended with a diminished volume of blood in the vessels, as *passive dilatation* and *erectility* are opposed to each other; but as, in inflammation, the vessels are *all* overloaded with blood, the effect of a stimulus is, either to bring the vessels, of both the *reticular* and *leading* class, to their normal or physiological state, or to exhaust still more their muscular power, and so to increase, in this latter case, the inflammation, or the debility of the vessels.

sion taking place in one cavity or order of vessels, more than in another, is entirely owing to the relative extent, to which their tensive power is reduced; and this again most probably depends on the constitution or predisposition of the part, as it is affected from previous disease, exercise, and original organization; all of which modify the tenacity of the part or organ to the vital constituent of life. Secretion is also found to be generally diminished, if not suspended in many organs; as for instance in the skin, where it depends on the capillary net-work being in erectile activity. The secretions of the mouth and palate are repressed; the taste being vapid, the tongue clammy, and its papillæ inerectile; while nausea and vomiting arise from the impaired gastric juice and a diminished muscular power—the food being allowed to follow, in some measure, its spontaneous decomposition, which soon proves offensive. The obscure head-ache, sometimes dull and heavy, at the pyrexial invasion, is referred to a congestive fulness and torpor of the capillaries of the brain, especially of the veins, and not to their active distension; and the pain of the back and loins is very strictly referred to the diminished vitality of the muscles which support the spine; while the continual but scarcely conscious calls of the will are stimulating them into constant and ineffectual, and of course, into painful action. The mental spirits are not exempt, at this period, from the general suffering; gloomy forebodings, fretfulness of temper,

and *tedium vitæ*, with insomnium and disagreeable dreams, show that the cerebral mass is impaired in activity and excitement from an atonic circulation and an impaired muscular power, which power it is not intended to confound with the supposed nervous fluid :—the former is a primary constituent of animal organization, the latter is not, as before remarked, so definitively ascertained.

This primary stage of general fever has been attributed to various efficient causes, and has received different names, as they were intended to express the pathological condition of the system. By some, it has been thought, that this atonic period is an unnecessary link in the febrile catenation, and that full febrile action, with heat and a quickened pulse, may be the very initial movement; while others have supposed that idiopathic, synochal, or inflammatory fever does only exist, from the previous local irritation arising from an inflamed part or viscus, either apparent or obscured.

It may not be irrelevant then to point out the analogical conditions of the system and its functions, which some of our pathologists have given to this period. Sydenham supposed nature to be oppressed and dejected at the onset, and the expulsion of the morbific matter to depend on the regulated reaction about to take place. According to Boerhaave, all the primary symptoms were owing to a deficiency of the nervous fluid, "nervosi liquidi vel spiritus cerebelli,"

and its various irregular influxes and retrocessions; and that muscular debility was occasioned by its "impeded influx and pressure on the muscles." The highest analysis, at which this celebrated physician arrives,, is this final cause;—Aphor. 573. "igitur "affectio vitæ (febris) conantis mortem avertere, tam "in frigore, quam in calore."

The well-known impaired energy of the brain, with a spasm of the extreme vessels, partook equally of the improved theories of Boerhaave and Stahl on this subject. The theory of Dr. Cullen must, however, be acknowledged as a very considerable step in the pathology of febrile movement; and though many observations and a deeper study of physiology and disease have, since his time, shed additional light on so intricate a subject, yet, after all, the rational plausibility, by which he explains the sequences of febrile catenation, is worthy of much attention and admiration. His great *primum mobile* in fever being spasm of the extreme vessels, the whole process of pathological reasoning was, consequently, easily deduced. Notwithstanding he was fully of opinion, that debility lays the foundation "of every fever,"* yet he acknowledges the difficulty, in attempting to make this debility the cause of spasm, which in itself implies some tone of fibre. He, therefore, threw himself upon an occult cause, to account for this spasm, which he reckoned to be the first catenated effort that the supposed guardian

* *First Lines of the Practice of Physic. Par.* 41.

of the constitution makes, in consequence of the infliction of certain sedatives applied to the nervous system; which, diminishing the energy of the brain, thereby produce a debility "in the whole of the functions, and "particularly in the action of the extreme vessels of the body." The turning point of this theory rests on the spasm being supposed to be, not the direct effect of debility, but a part of the sanatory reaction, or of the operation of the *vis medicatrix naturæ*. The adoption of the term spasm, perhaps, led its rationale to be thus assigned; and indeed it seems to him to involve some difficulty, for he also supposes, that there is an atony of the extreme vessels during the whole course of fever, which atony was not, nor could it be, attributed to any part of the *renixus* of the *vis medicatrix*. Atony and spasm, then, according to our author, stand not only in the relation of mere sequences, but as contemporaneous conditions of the same vessels, and not in the strict order of cause and effect; for the one is held to be the result of the application of sedative powers, and the other to be the vanguard of a supposed positive principle. The alliance of the terms is rather unfortunate, and the adoption of others of more modern acceptation would, perhaps, have obviated some of the difficulty, and introduced their expressed states in closer association, than as connected effects dependent on different causes. The symptoms of debility in the stomach, he presumes, are derived from an atony communicated from the muscular fibres

of the extreme vessels of the surface of the body to the muscular fibres of the stomach; and not from a simultaneous deprivation of nervous power inflicted on both, from a diminished energy of the brain. He no where enters into the direct effect of atony of the extreme vessels, as stopping the secretions and transpiration; and, thus accumulating the volume of the blood, and, by degrees, the temperature of the body. In supposing the spasm to be caused by the *vis medicatrix*, he seems influenced by this improbability, "it is not "very obvious, in what manner the debility produces the spasm."* The supposition, that the state of the vessels was spasm, it is thought, created the difficulty of attributing a supposed effect to an irrelevant cause; for if the term collapse with its logical connection had been put in conjunction with debility, the objection to the obviousness of the causation would have likely been very much removed. In Par. 59, he says, "In "*every* fever, a power was supposed to be applied to "the body, the tendency of which was to hurt or de-"stroy it," and again, "to render our doctrine of fever, "consistent and complete, the remote causes of fever, "viz. human and marsh effluvia, seem to be of a "debilitating or sedative nature" in opposition to some physicians, "who supposed them to be direct "stimulants fitted to produce the increased action." Our author also agrees with Brown, in supposing cold

* *First Lines of the Practice of Physic. Par.* 42.

to have always a power "more or less directly sedative" on the system; but again, he says, "it is equally "manifest, that in certain circumstances, cold proves "a stimulus to the living body." This last mode of its action on the body is not considered by him in that simple and philosophical light, in which his ingenious antagonist has treated it; who confined himself to the direct effect, which he alleged was sedative in every case, while its apparent stimulant or indirect effect, was attributed to the contingencies of the atmosphere, along with the existing temperature of the body.

Such are the chief explanations of the Cullenian theory on the primary phenomena of fever; the period of reaction will afterwards be brought under review. The difference, which they involve from the rationale above attempted, consists in spasm of the extreme cutaneous vessels being the initial febrile movement, and in its succeeding to, and subsisting along with atony induced by the sedative effect of the remote cause. Instead of which, it has been endeavoured to be shown, that nothing allied to spasm takes place; but that the condition of the extreme vessels is atony, or an impaired muscular power—the direct effect of the above causes; and, that it is not the sensorial or nervous energy, strictly speaking, but the materia vitæ or muscular life of the system, which primarily suffers.

The theory of Dr. Brown, which has been far more talked of, than practically followed, or perhaps

generally understood, throws but a mazy light on the rationale of the first symptoms; and it would not be any instructive task, to descant much on what has been so repeatedly criticised. It is well known to those, who have studied his doctrine, that he divided fevers, like all other diseases, into the two classes of *sthenic* and *asthenic*. In the first, he supposed the excitement to be produced by the undue application of the exciting powers to the excitability existing at the time; and in the latter class, the excitability was supposed to be accumulated from a deficiency of the above powers, producing a diminished excitement: or, in other words, the more low the type, the greater the relative quantity of the excitability to that of the exciting powers,—as food, stimuli, &c.

Amidst many loose abstractions, it can be gathered, that he attributed the sensation of cold, in the commencement of fever of the sthenic class, to diminished or checked perspiration, occasioned by an exquisitely strong *sthenia* affecting the extreme vessels of the skin,* which are for the time endowed with great excitement and density of fibre, that diminish their diameters,—and not to spasm or constriction from the cold. In *asthenic* fevers, again, this cold arises also from diminished perspiration, which is produced by a weakness of the heart and arteries.† Lassitude and

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* *Elements of Medicine by Dr. J. Brown, Lond.* 1804. par. 154.

† *Ibid.* par. 178.

muscular debility, in fever, are also somewhat analogically explained; for, while in sthenic fevers, they arise from a higher degree of excitement in the brain and fibres of the muscles, than can conveniently be borne by the excitability,*—in fevers of the opposite class, the reverse takes place.

Not to descant farther on the relative parts of this theory, it is observed, that Brown's favorite abstract idea of excitability,—(a property or a substance, he does not say,) however beautiful and ingenious it was in explaining many of the phenomena of life, was certainly injured by its author making, upon many occasions, a too meretricious use of it, when a more exact reasoning was requisite. In establishing it as an individual property or substance residing over every part of the system, and which could not be impaired in one part without suffering a general diminution; he did not preclude it, in local diseases, from abounding in any one part in preference to another, to account for the greater or less vitality of the parts. This principle, however analogous in some general respects to the Hunterian one of vitality, and cannot entirely be overlooked in any philosophical study of disease, yet differs in being supposed to be accumulated in a morbid excess, when vitality is always reckoned to be deficient:—viz. in cases of excessive cold, famine, and pure debility.

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* *Elements, &c.* ut supra, par. 336.

The moment of death, on the one principle, being reckoned the period of the utmost accumulation of this supposed property, when it takes place from the want of the supports of life; while on the other, the vitality, upon which the phenomena of life depend, is then held to be exhausted. So far these two principles disagree,—excitability alternately assuming an apparent positive and negative property, while vitality invariably is supposed to be a positive principle in the part or system. Excitability also was supposed to be in an inverse ratio to the vitality exhibited; except when the excitement was sustained by undue stimuli, and then it was thought to be liable to exhaustion;—thus at times involving an idea, somewhat similar to that which Newton held about æther; which he supposed might exist in a very high ratio of density, in proportion as it was distant from matter and receded into space.

We shall next notice the dialectical and more refined ideas of Darwin on this intricate subject. He attributes the first atonic phenomena of simple fever from cold, to a torpor or collapse, and not to a constriction or spasm of the capillary vessels of the surface of the body; and that the heart and large vessels are also, for the time, rendered torpid and comparatively inactive, from want of that sympathy, which he calls the sensorial power of association, and which governs the distant actions of remote organs. During the time, in which this torpor obtains in the capillaries, their sensorial power of irritation, as so termed by

him, is increased, or becomes accumulated; so that the action of the vessels is again gradually excited, and the reactive stage is produced. When again the contagious matter, mixed with the saliva, is swallowed, the stomach is rendered torpid, and the heart and arteries act more feebly; because the sensorial power of association is not now excited,—the stimulus of the heart being only kept up by the sensorial power of irritation, or that power which is strictly the property of the heart, independent of any sympathetic motion from the stomach.* He also supposes, in the commencement of all fevers, except in those from cold, that a torpor of the internal capillaries precedes that of the cutaneous. An important condition in any theory of fever, is involved in his idea, "that the organs may "become torpid by the great expenditure of the sen- "sorial power of irritation in an *instant of time*, "as paralysis frequently follows instantly too great an "exertion of voluntary power."† Again he says, the contagious material of some fevers, when swal- "lowed into the stomach, may produce there great "irritative motion, like arsenic, which might not be "perceived, and yet might render that organ paraly- "tic or inirritable in a moment of time; as animals "sometimes die by one single exertion, without a "second struggle; as by lightning."‡ According to

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* *Zoonomia, &c. by Eras. Darwin, M.D. &c. Lond.* 1801. *vol.* 4, *p.* 363. † *Ibid. vol.* 4. 389. ‡ *Ibid. vol.* 4. 425.

Darwin, the different sensorial powers are, however, increased in synochal fevers, and are expended or diminished in those of a typhoid type; but if the muscular power or materia vitæ is substituted for his sensorial power of irritation, in many cases, his respective link in the febrile catenation might be said to be, thus far, substantially the same with that above advanced; for according to him, a torpor or collapse, in all or some of the organs or tissues, is the first morbid physiological aberration from the state of health.

But the great distinctive feature in the theories of both Brown and Darwin is, the accumulation of excitability in the one, and of the different sensorial powers in the other, during the period of inactivity, torpor, or collapse. With much deference to the ingenuity of these philosophers, it is presumed, that the subsequent evolution of heat and reaction was taken by them as a proof of increased vitality, or of the powers of life being essentially augmented; and that such acquisition of additional vigor was supposed to be obtained by the animal fibre during the period, and in proportion to the duration, of the torpor and collapse. Now, without entering into the metaphysical subtilties of the animal economy, it appears, that an effect, in this instance, is ascribed to an unphysiological cause; for in the period of torpor, the above powers do not exhibit any thing, but what is short of the standard of health, and yet they are assumed as having accumulated. Be-

sides, the reactive stage depends, not on a fresh acquisition of the powers of life, as we intend to show, but on the relative degree to which different parts and organs of the system have suffered in their vital properties; for reaction would never take place, if the brain and heart suffered the same proportional torpor and collapse, which at times affect the extremities or less important organs. In proportion as a part or tissue suffers a lesion of its materia vitæ, or, according to others, its irritability, and the heart at the same time preserves a greater share of its muscular life, so, *cæteris paribus*, will be the danger and violence of the subsequent reaction. If all equally suffered, in proportion to their importance and function, a very feeble or moderate reaction would ensue, as takes place in several low and cahectic fevers, where the heat is never above natural; while in the ardent endemic of the tropics and in inflammatory typhus, the stomach, bowels, or brain, generally seem to be the organs, which are unduly deprived of muscular power at the onset; —and so, in proportion to the strength and plethora of the constitution, is the subsequent violent reaction. Contusions, frost bites, and concussions of the brain, are all illustrative of the balancing forces of the system. Though it is admitted by all, that, during rest and sleep, the powers of animal life or the materia vitæ are refreshed, renewed, and accumulated, from the silent elaboration of the food and blood; yet these quiescent conditions are very different from the vital inactivity

or torpor of the system, in consequence of cold or sedative impressions, wherever applied. If the powers of life were all accumulated in these latter states, we should not have permanent disease; nor even perhaps any morbid result whatever, but a mere exaltation of life and action. It is, therefore, to be more than presumed, that no accumulation of any of the powers of sound life and motion takes place, in the period of febrile collapse or torpor, but a real diminution of them, and to different extents in different organs and systems; except when all equally suffer, and to that severe degree, when no one organ has power to act upon another,—or, in other words, when death is the consequence of the universal lesion.

Dr. Jackson has some very profound ideas respecting the remote causes of the endemic and contagious fever of the West Indies; being of opinion, that its appearance is very intimately connected with the cause of vegetation, as a remote cause, and that its first effects on the system are, "from a cause of irritation, "disturbing, but *not increasing in a natural manner*, "the action of the moving fibre; on the contrary, "interrupting, impeding, and, as it were, suspending "the operations essential to life and health, by which "means, the expression of its effects principally con- "sists in *debility and impaired energy*."*

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* *Outline of the History and Cure of Fever, &c. by R. Jackson, M.D.* Lond. 8vo. 1798.

Mr. Currie, a writer in the American Philosophical Transactions, Vol. iv., was of the opinion, that in the first symptoms of marsh fever, the vessels "of the "surface are rendered *powerless and atonic*, the "brain and heart sympathize with the extreme vessels "and veins, and the power of every function of the body "declines, till the heart is roused by the *accumulat-* "*ing blood*, reacts with increasing velocity, and is "relieved of the unusual burden."

In Dr. Philip Wilson's "Treatise on Febrile Diseases, London, 8vo. 1797", we have a much altered version of the Brownonian theory; though I do not know, whether the same talented physician continued to retain all his propositions in their original strictness and force. According to him, "the proximate cause "of fever, is a change in the laws of excitability, in "consequence of which, the same agents no longer "produce the same effects;" and, "fever may be "either a state of excessive excitement or debility of "all the functions, without any local affection."— Therefore, according to him, as fever may be owing to two very opposite states of the animal fibre and its moving powers, we can attribute the primary symptoms in one kind only, to *debility* and *atony*. In the "Inquiry into the Laws of the Vital Functions," 2d Edition, there is no mention of such distinctive foundations of fever; as, after speaking of the nature of inflammation, it is said, p. 307, "According to this "view of the subject, fever must be regarded as a

"state of general inflammation;" and again, "are "not all the other symptoms of fever equally the con- "sequence of this state of the circulation,—the symp- "toms of excitement arising from the general effort of "the sanguiferous system to excite the capillaries; "those of debility (in opposition to the symptoms of "stronger reaction) from the state of the latter vessels, "and the consequences of the ineffectual, or but par- "tially successful efforts to restore their due action."

In his excellent practical work on typhus, Dr. Armstrong does not put much belief in the doctrine of diminished energy being the radical cause of simple typhus, but attributes to the sanguineous system the source of the morbid condition of the brain and nerves. He seems also to consider simple excitement of the circulation a lesser degree of the same essential action or condition, as that which occurs in inflammation—the one increasing or degenerating into the other. He thinks if there is any loss of balance in the system, it is between the arteries and veins.* In speaking of the nature of typhus, he says, "that the genuine typhus so far from being of "an asthenic nature, is most certainly an affection of "excitement, or of congestion in its first stages, de- "manding at such times, the decidedly evacuant "plan." To account for the debility, he again says,

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* *Treatise on Typhus, &c. by J. Armstrong, M.D.* 1816. *p.* 21, Note.

"the debility is merely apparent, and chiefly depend-
"ent upon the preternatural accumulation of blood
"in the vessels about the head, heart, and liver, and
"other internal parts, while there is less circulating
"upon the surface of the body than in a natural
"state. In the second stage, the debility is still only
"apparent, being then the consequence of over-ex-
"citement of the heart and arteries."* The term collapse he uses in a different sense from that of Darwin and some others, and from that in which it is applied in this and my former essays. By this term Dr. A. means the third or exhausted state of fever, after the high excitement is past.

Adverting even to the pathological deductions, that have already been made, it will be easily seen, that if they be correct, simple excitement of the circulation is not only different in degree, but in kind, from febrile commotion; and that the loss of balance is not primarily between the arteries and veins, but between the solids and circulating blood, and the vital or muscular power of the part or system at large. Again, the debility in fever, is not only apparent, but it is real, though not in the sense, in which it is commonly understood;—that is, in a simultaneous diminution of muscular strength and fibre, along with a paucity of blood. The real debility, in

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* *Treatise on Tÿphus, &c. by J. Armstrong, M.D.* 1816, *p.* 17.

fever, is held to exist primarily in only one of the important departments of the general assemblage of life; and may, notwithstanding, as can be shown, require and be practically consistent with great and general reduction of the fluids of the body.

The primary symptoms of idiopathic fever have been attributed, by another class of pathologists, to the direct effect of a stimulus or an irritant acting on the capillary and nervous fibre; producing a tonic constriction of the extreme vessels, which drives the blood from the circumference to the centre of the body, and so occasions all the phenomena of chills, rigors, &c. In this view, cold and what are called febrile miasmata are stimulants, and their primary impression on the system has the usual effect of stimuli—namely, contraction, or, as applied to the capillary system, constriction. Others again allow, that fevers of different types are produced by exciting causes acting differently; and, that, while those of a strong reactive character are produced by agents, acting as stimuli, others are occasioned by causes, acting sedatively or by debilitating impressions.

As embracing some of the principal points in these opinions on fever, Dr. Park, in his Pathology of Fever, has reduced the primary causes to these three.

"First, Local inflammation which acts by vas-
"cular sympathy: a change of action in the injured
"vessels, exciting participation in those which are
"sound;—

"Secondly, Direct irritation, which excites inor-
" dinate contraction only when internal to the vessels,
" and thus acts periodically, producing intermittent
" fever; and,—

"Thirdly, Primary debility, which disposes the
" vessels to a state of morbid distension, whenever an
" accidental cause occurs to excite increased circula-
" tion; such appears to be the nature of fevers pro-
" ceeding from contagion."*

Waiving all collation of the above first cause with that which has been deduced in this essay; as it is founded more on some of the catenated sequences, short of the analysis which we have attempted, than perhaps on a condition radically different; we shall only notice the other two definitions of the primary causes. Of these, the latter—primary debility, is the most important, and relatively to our view requires to be more immediately noticed. This limited cause so far agrees with the initial lesion, which has attempted to be verified in this essay, as applied to the *primordia* of all fevers; but Dr. P. appears, neither in this definition, nor in the context, to restrict this debility, originally and essentially, to any particular part or class of function, but infers, that it assails the system generally. It is also to be

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* *The Pathology of Fever, being the subject of the Gulstonian Lecture, delivered before the Royal College of Physicians, by J. R. Park, M. D. &c.* London, 1822.

observed, that he does not make the fever a necessary sequence of this debility; but that its supervention depends on a contingency—an *accidental cause exciting an increased circulation*. This notion of the reaction of fever, though exceedingly plausible and practical, is not only different from the generally received opinions on the nature of febrile catenation, from whatever inceptive causes this is inferred to be derived, but it is also at variance with the reasonings to which we have been led. Observation on this subject has shown, that debility, however extreme, of *all* the parts and functions of the body, entails no necessary nor consequent production of fever; and it has been endeavoured to be shown, that, except there is a relative debility or want of balance, induced between the muscular power and its functions, and the solids and moving fluids, the phenomena of fever will not take place, however much the whole may be simultaneously reduced.

It may be said, that it is somewhat hypercritical to descend into these distinctions of debility; and that the apparent debility in fever has so little affinity with what is called apyrexial debility, that any confounding of them together is excluded from their want of physiological analogy. The term, however, is so very indiscriminately applied to both conditions of the system, without a distinguishing regard being paid to the wide difference that exists between them; that, in speaking or reasoning on this subject, our

pathological and therapeutical opinions and indications are sometimes unconsciously influenced by its use, and so the distinction is required to be kept in view. In making the distinction, we shall also not be deterred from the use of antiphlogistic means, through the fear of adding to a state, the physiological expression of which is debility; neither shall we falsely presume, that such a condition is to be brought to its lost integrity, by the sole administration of tonics and stimulants.

As to the theory, that fevers begin their primary movements by a tonic constriction and excitation of the capillaries, it is so far sufficient to challenge the proof of such a state ever taking place in the great *reticular* expansion of the capillary system; for, as far as my limited experiments, corroborated by the more ample and conclusive ones of others, have led me on this subject, the state which is predicated of spasm or constriction, is not a positive or active contraction of fibre and bulk, but it is a state of collapse and subsidence, from the absence of vital and sanguiferous action.

The direct effect of a moderate stimulus, as I have elsewhere shown, is to produce a *tensive erectility* in the capillary *net-work;* and, if it is very strong, the *leading* capillary arteries will be preternaturally contracted for a very short period, to give place again to a morbid dilatation.

However different may be the character of fevers,

yet to account for their dissimilitude, it is not necessary to suppose, that their initial movements are as different in kind, as they are in degree; and, in fact, it accords with actual observation, that however different they may be in severity and type, yet some atonic phenomena, or symptoms of repressed action, are the precursory movements in almost all fevers whatever. It is therefore a fair conclusion to make, that such movements are in all cases essentially the same, as far as the relative condition of the muscular power, to the sanguiferous fluids and the solids, is concerned; let the modifying powers, as miasm, cold, contagion, or exanthem, be what they may. To those again, who are proselytes of the more modern doctrines of fever being always occasioned by, or is symptomatic of inflammation, either detected or masked, of some viscus or tissue in the body; it may be said, that such theories, whether of Marcus, Clutterbuck, or Broussais, only shift the difficulty of the question. In reducing fever to an effect of inflammation in all cases, the advocates of its local origin have also observed the stage of repressed or impaired vital action to have generally preceded the evolution of fever, whether in their views held symptomatic of inflamed brain, or any other organ.

As it has been attempted in a former essay to reduce the generative movement of inflammation itself, to a debility or loss of muscular tension in the capillary system, the ground, on which the Broussaians and

others of a similar creed have erected their theories, is referred to that foundation, which we have been led to assign to inflammation and fever of any kind; and the more intimate pathology of the catenated action in this view is by them neither increased nor diminished; as it is resolved into the analysis of irritation and inflammation, of which alleged origins of all febrile action we shall afterwards take more notice.

In concluding, therefore, this brief collation of the above opinions on the nature of the primary phenomena of fever, as considered to denote vigor or debility, we may conclude with Dr. Good's summary on a correlative notice of fever, "That fever "in its commencement or earliest stage is character-"ized by debility of the living fibre,"—"cannot for a "moment be doubted by any one, who accurately "watches its phenomena,"* and further "The first "symptoms of inflammatory fever, like those of all "others evince, as I have already observed, debility "or languid action in every organ,—let the debility "be distinguished by what epithet it may.

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* *Study of Medicine, Vol. 2, p. 52.*

† *Ibid, p. 55.*

## SECTION II.

## THE SECONDARY STAGE.

HAVING then endeavoured to show the nature and seat of the lesion, upon which the primary phenomena of all fever depend; it next remains to investigate, in a generical sense, as has been done with the first, those subsequent links in the febrile catenation, which constitute formed fever, and to which the great majority of therapeutical means are applied. The primary stage is either so evanescent or so feeble in many fevers, that it either escapes, or does not obviously demand a particular and practical attention; but the phenomena, which more or less quickly succeed, are far more obvious in their character, and are generally urgent in their claims on our skill and attention. Our remedies also are mostly all applied, not to the essential lesion which constitutes fever, but to what are called its reactive conditions.

The chief of these reactive phenomena, are, increased heat; redness or turgescence, and dryness of the skin; headache, or pain in some other part of the body; thirst; paucity of urine; looseness or

costiveness; watchfulness and weariness; often delirium; and above all, an increased frequency, with quickness, fulness, or smallness of the pulse. All of these symptoms do not take place in every fever, and others, not mentioned, are sometimes present; but one general character of febrile movement, with the most rare exceptions,* is the increased frequency of the contractions of the heart;—indeed Boerhaave places his definition of fever entirely on the increased action of the heart; for he says, Aphor. 573, "Causa "ergo velocitatis hujus (cordis) proxima est pariter "causa febris; sic cognita, proxima." Muscular debility may be reckoned another constant symptom, though it is also an attendant on many apyrexial diseases.

The mediate efficient cause of these phenomena, according to the Cullenian theory, is referred to the conservative principles of the *vis medicatrix;* and the immediate link in the chain of causation, is the spasm in the extreme vessels. This is supposed to act as an irritant to the heart and arteries, exciting them to a morbid excess of movement, which is said to continue, till the spasm is, by these means, "overcome;"—thus making a cause to continue until it is expelled by its effects. This increased action is

* A few cases of diminished frequency of the pulse are mentioned in the histories of some extraordinary fevers; but these cases seem to have been noted in the stage of depression, before reaction took place, or in the ulterior period of exhaustion.

also said to continue "till they (the heart and arte-"ries) restore the energy to the brain, extend this "energy to the extreme vessels, and so restore their "action."* It has been presumed, that effects are here attributed to inadequate causes; and it is not easy to see, how the energy of the brain, when deficient, as it is previously allowed to be, is to be restored by the febrile movements of the heart and arteries, which, on the contrary, are generally reckoned the most obvious cause of disturbing, if not of impairing that energy. The secondary symptoms were attributed, by Brown, to the two several states of excitability: in sthenic fevers, to an increased excitement from inordinate stimulation; and, in asthenic ones, to accumulated excitability from deficiency of the ordinary stimuli; but this theory no where enters beyond the surface of pathology, and never descends into the more exact operations of the animal economy in health or disease.

The more acute and ingenious author of "Zoonomia," however, with an imaginative analysis, ransacks the whole field of animal nature; and he refers all the symptoms of reaction to the two different sensorial powers, which had accumulated, during the previous stage of collapse or torpor. This renewed action in the smaller vessels, is, however, supposed to

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* *First Lines, &c. Par.* 46.

be solely constituted by the sensorial power of irritation, which was accumulated in the capillaries themselves, which are thereby supposed to act independently; while the heart and arteries are increased in their movements, by what he terms the principle of associability, or the sensorial power of association, which had accumulated during the stage of capillary torpor. A renewed and increased action of all these orders of vessels, was termed by him, "febris irritativa"; but if the increased action took place in the capillaries from the accumulated sensorial power of irritation, and torpor still remained in the heart and arteries, from a reverse sympathy with the external vessels, or from a defect of associability, then another kind of fever was held to be generated, namely, "febris inirritativa." In either case, it is seen, that Darwin attributed the hot or reactive stage to the accumulation of the sensorial power of the extreme vessels, exciting increased heat and motion, and "not "to the renovated action of the heart and arteries "which follows," according to him, "the renovated "activity of the capillaries."* When an internal organ, as the stomach, is first made torpid, as by swallowing contagious matter, he says, "the torpor of "the stomach occasions a diminished action of the "heart and arteries by direct sympathy, and may

* *Zoonomia, ut supra. vol. 4, p. 383.*

"be said to occasion an increased one of the cuta-
"neous capillaries by reverse sympathy."*

Without inquiring, at present, to what other proximate causation modern writers have attributed the symptoms of excitement, we shall proceed to carry on the investigation of the reactive stage, in a method as conformable to the procedure which has been already adopted, as the nature of the subject, and the fair application of our pathological principle, will admit.

The increased heat and frequency of pulse, being the most constant characters of the second stage, become more particularly the objects of our inquiry.

*Frequency of pulse*, being solely occasioned by the heart contracting more often in a given time than in health, must necessarily result from this organ becoming more acted upon by its appropriate or contingent stimuli; or from its becoming more susceptible to the natural force or quantity of its ordinary stimuli. Now, as the blood is the natural stimulus of the heart, and as no contingent stimuli of an artificial kind are held to be essentially or generally present in the onset of fever; we must look for this phenomenon in the relative conditions of the heart, and of the blood which acts upon it. From what has been stated, respecting the muscular power in the initial stage of

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* *Zoonomia, ut supra. vol. 4, p. 368.*

fever, it will be seen, that the whole solid and fluid organized parts of the system are, to some degree, deprived of this essential principle of life; the immediate consequence of which is, that these solids and fluids are indued with, or are now possessed of, a less proportion of their living and motive powers, than they had during health, or than can be compatible with their sane equilibrium and function. The volume of the blood is large in proportion to the power or quantity of its materia vitæ; and the heart, with every other organ and tissue, is more or less in a state of undue bulk and density, as compared with the quantum of this vital associate of their organization:—oppression and struggle among the unbalanced powers are, therefore, the physiological result. On this turning point of impaired muscular power or *materia vitæ*, as compared with the *materia corporis*, depends the main feature in this exposition of fever; and which, it is thought, is legitimately deduced, not only from the examination of all the separate symptoms, but also from the synthetical application of the *juvantia* and *lædentia*. The frequency of the systole is accompanied with a relative atonic state of the muscular power of the heart; so that, at the commencement of the hot stage, it does not fully contract, nor empty itself; while, at the same time, the enervated blood is pressing with an increased volume on its cavities. The primary frequency, then, arises from the heart becoming sooner filled, although only the same

quantity of blood may have passed through it as before, in the same proportion of time. The increased weight and volume of the blood, pressing on the heart, become an inordinate stimulus to it; and even the natural quantity would prove so, in its newly acquired atonic state. The heart, therefore, burthened at first, gradually exerts more force and acquires more freedom, as each successive contraction expels a greater quantity of blood; and this augmenting action may even proceed beyond the natural extent to which the ventricles are emptied in health.*

When the full reaction is established, there is more of the blood in the distant vessels and in the larger capillaries, and less about the heart, than when reaction began; the heart therefore beats freer, contracts more on its contents, and is more enabled to obey the stimulus of the blood, now increased from the additional heat it has acquired. The heart itself, however, still labors under its impaired materia vitæ; and it is, like all weakened organs, more easily excited to undue excitement from proportionably less

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* "When the motion of the heart is affected, the quantity of "blood transmitted by it may either remain the same as in perfect "health, or be diminished or increased. Supposing it to remain "the same, the pulse, if more frequent, must be weaker, and "the heart must either never be filled, perhaps on account of "too great irritability, or never be emptied, from the weakness "of its muscular powers."—*Med. Literat. 2d Ed. p.* 624.

stimuli, or to inordinate action from the same stimuli. If the pulse becomes also quick, the systole is then performed with agility, and the velocity of a single contraction is added to the frequency in which it is repeated. In inflammatory affections of the heart or neighbouring viscera, the frequency of the pulse probably depends on the heart never suffering itself to be filled; from the additional irritability acquired from the irritation of pain, or pressure of the associating nerves.

Simple revulsion of blood to the heart, as from the cold bath, will not produce frequency of pulse, beyond a temporary fluttering and irregularity; neither will ardent stimuli, nor violent exercise be followed by a frequent action of the heart, beyond a short period of general heat and excitement: the chief cause of which appears to be, that the heart has not, in either case, sustained any material injury to affect its vital condition. It is obvious then, that there is something essentially different in these causes, or in the condition of this organ, which produces frequency of its action in fever; as this cannot arise from mere excessive stimuli applied to the heart, either through the means of the blood or otherwise, except the condition of its muscular power is also affected or impaired. This frequency, which takes place in fever, however goes on, if dissolution is not the result, until the appearance of health and recovery obtain; when the physical organism is brought down, by abstinence or evacuations, to

the normal proportion with its vital associate, or until the latter is brought up, by the gradual elaboration of the food, blood, and air, to the requisite standard. The fulness, strength, and hardness of the pulse seem to depend on the nature of the constitutional fibre, and on the plethoric state of the system at the time, and a good deal on the extent, to which the heart has suffered in its vital lesion; as compared with the lesion in other parts of the body, and especially with that of the cutaneous and membraneous tissues.*

*Increased heat.*—This phenomenon is always connected with an increased frequency of the pulse, if not with an augmented velocity of the circulation; and, during its progress to the maximum temperature,

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* "In this state (when the quantity of the blood transmitted "by the heart is smaller than in health) the pulse must be small "and weak, and the arteries being partly exhausted, there will "probably be a paleness and chilliness of the extremities; until "the blood, which is accumulated in the veins, has sufficient "power to urge the heart to greater action, and perhaps, from "the vigour which it may have acquired during the remission "of its exertions, even to a morbid excess of activity. Hence "a contrary state may arise, in which the quantity of blood "transmitted by the heart is greater than in perfect health; the "pulse will then be full and strong, the arteries being distended, "so as to be capable of exerting a pressure sufficient to maintain "an increased velocity, and to overcome the consequent increase "of resistance; a state which perhaps constitutes the hot fit of "fever."—*Med. Literat. 2d. Ed. p.* 625.

it is also attended with a dry skin. In former times, this increased heat was attributed to a self-generating property, similar to what takes place in fermentation; and latter theories assigned it to the increased velocity and violence of the circulation; as if the ordinary temperature of the body resulted from either the extent or force of any friction between its fluids and solids, abstractedly considered. More modern physiology has, however, found it to depend on the vital principle in the first instance, and its ordinary evolution upon the state of the exhalant and secretory surfaces. The invasion of idiopathic fever having been shown to consist in a lesion or diminution of the muscular power, with an impaired state of every function dependent on it; the cutaneous secretion, depending, above all, on the tensiveness of the capillary system, is necessarily much, if not altogether, suspended in the cold stage, and, in the greater part of the hot, remains still repressed. The reactive circulation, in the heart and large vessels, does not necessarily command the tonic reaction of the capillary tissue; as this, as has been shown, is independent of the power of the heart, though it partakes of a similarly diffused principle;—the consequence of which is, that the capillary *tissue*, the seat of transpiration, remains in its collapsed or atonically distended state, though the circulation in the leading capillaries, which are more directly under the influence of the propulsive columns of blood, may be in a brisk cir-

culation. According to Thenard, the average quantity of perspirable matter, secreted from the skin in a minute, is equal to eighteen grains, troy weight; all of which is thrown off in a state of insensible vapour, besides a very appreciable quantity of carbon in the state of carbonic acid. By these secretions, the body is chiefly preserved in the medium temperature of health; and by considering only the chemical effects, which the evolution of so much matter, in a state of vapour, must have in extracting the caloric of the body, we can see how the heat of the body must accumulate from even a moderate repression or suspension of this cutaneous process; provided no vicarious evacuation has in the mean time obtained. It is by this function of the animal economy, that we withstand a higher temperature, if the atmosphere be dry, than when it is loaded with moisture; which last condition represses the transpiration, and so more painfully accumulates the corporeal heat. In increased febrile heat, we have, then, an increased frequency, if not a velocity, in the heart's action—a dilatation of those capillary vessels, which are subject to the more direct pressure of the blood—an atonic or collapsed condition of the minute capillary *plexus* and transpiring tubes—and an accumulation and repression of the gaseous products of the blood, by which, in health, the superfluous caloric is extricated from the system. The physiological consequence of such conditions is, that the heat gradually accumulates, (if no

vicarious discharge takes place,) in a ratio with the times, the forces of the circulation, and the plethoric state of the blood, which is also expanding with the degrees of the increasing heat, until the collapsed exhalants yield to, or are excited by the distending momentum of the heated blood; when sweat partially or universally ensues, which more or less perfectly carries off the accumulated caloric of the body.

That such are the causes of the increased heat, is corroborated by the heat being moderated and lessened by whatever reduces the action of the heart, and preserves the blood in its temperate condition of heat and volume, and also by any other designed or spontaneous evacuation, that may at the time take place; while, on the contrary, the heat is further increased by additional stimuli, applied to the heart through the medium of the stomach, and by a high temperature of the ambient atmosphere. It is also further observed, that the duration and height of the hot period are, in some ratio, to the degree and length of the atony or collapse that has previously taken place, and to the force by which the heart is enabled to react; for if this last continues weak and oppressed, the bodily temperature may continue natural, or below par; but it will sometimes rise to ten degrees above the natural standard, if the reaction be violent, and the previous atony very great. So reciprocal are many actions in the human body, that what are effects, become, at times or in other conditions, causes; thus

the heat, which is in this manner produced by the renovated action of the heart and by obstructed perspiration, becomes, when accumulated, a very potent provocative to the excitability of the heart itself, and to the disturbance of all the functions; for this heat, be it remembered, is not significative of really increased vitality, any more than the frequency or velocity of the heart's action is a proof of its innate vigor and activity. They are both the results of unbalanced function, the fundamental cause of which is debility, either absolute or relative.

*Redness and turgescence* of the surface are obviously owing to capillary dilatation, and an augmented volume of the blood from accumulated heat; and in continued fevers, one or both of these symptoms remain until the physical bulk of the whole body is reduced to an equality with the powers of organic life, or of the materia vitæ; when comparative shrinking and attenuation, often to a great extent, take place in the convalescent termination; but, in fatal cases, this subsidence obtains only in death.

*Dryness of the skin* is embraced in the explanation of the increased heat; and *thirst*, *costiveness*, and *paucity of urine* are plainly assignable to the want of secretion, the prior link to which is atony or collapse of the secretory tubes of the respective tissues, with or without distension of their capillary vessels; though thirst is no doubt very much increased, in the palate and mouth, by the air, that is returned in expiration

being less impregnated with the aqueous vapor which is secreted naturally by the lungs.

*Pain*, in all parts, may be always assigned to pressure on the sentient nerves, either from preternatural distension or compression.

*Vigilantia* and *delirium* appear to arise from capillary distension, or from the irritation of sentient organs or tissues within the cranium from accelerated and heated blood. Indeed, fever being once constituted, it has never been found so difficult to assign the secondary and posterior phenomena to their respective links in the chain of causation, as it is to ascertain the nature of the *prima mobilia* of the febrile movement itself. For instance, nausea and vomiting are referable, in the first onset, to the impaired tone of the stomach; and, latterly, to its ordinary food, its own juices, or even its own capillary congested blood, becoming its inordinate stimuli. Increased respiration is referred to the accelerated column of blood pressing on the pulmonary vessels; looseness, when it occurs, to a capillary afflux or atonic relaxation in the mucous membrane of the intestines; and continued languor, weariness, and muscular debility, to the innate want of materia vitæ and tonicity in the muscular fibre,—which, however, is still solicited to act, by either the conscious or the unconscious demands of the different nervous systems.

*Sweat* is another ulterior phenomenon in the direct line of catenation, which enjoins a more particular

notice ; aud, especially, as it may be said to be, in all regular paroxysms of fever, the concluding link to the whole sequences. Sweat or sensible perspiration alone being the proposed subject of physiological analysis ; I shall not consider the other morbid, nor the fatal terminations of fever as strictly coming under the object of this essay,—their antecedent and generative causes being principally the aim of the disquisition. It has been said above, that this phenomenon of febrile sweat was the result of the distension of the larger capillary arteries, when filled with an increased volume and momentum of blood ; but whether it is more immediately effected by the pores of transpiration being forcibly distended by the pressure *a tergo*, or whether the quantity and increased heat of the capillary blood prove a stimulus to the collapsed pores of the skin, and thus provoke them to a renewed and redoubled display of their natural functions, it is not easy in all cases to determine.

Anatomy has thrown so little light on the structure of the exhalant tissues, and of those minute outlets to the serous and aqueous parts of the blood, that it cannot be said, whether these outlets are strictly descending continuations of the visible capillary vessels, terminating by open mouths ; or whether they are peculiarly organized, like some of the glandular fabrics ; —or whether they are mere valvular apertures in the sides of the capillary vessels. In whatever way they are constructed, it is however a physiological fact, that

their function depends on their resident vitality; or, in other words, when the tissue in which they are situated is weakened, the transpiration proportionally is diminished, or becomes colliquative; and when it is strong, both states being abstractedly considered, the secretion or transpiration is increased:—the vital integrity of the function always consisting in a tensively permeable state of the secretory tubes.

On a subject, therefore, in which we have only these physiological conditions to guide us, without the exact knowledge of the intermediate sequence; recourse must be had to analogy, which is certainly in this case of a very proximate character. Capillary circulation, in the healthy state, being ascertained to depend chiefly on a *tensive* or *erectile* condition of the capillary tissue; and where this circulation has ceased or is depressed, a collapsed or an *inerectile* state more or less prevails,—not a spastic or positively constricted one, as has been supposed; and finally, the inflamed or preternaturally turgid state of the capillaries is owing to the pressure of the column of blood *a tergo*, surpassing in relative force the vital tonicity of the vessels which are dilated. The velocity of the blood in this last case is diminished, though its momentum may be increased; as the velocity, *cæteris paribus*, in health, depends on the tonic tensiveness and medium diameters of the capillary tubes. Now, it seems, the safest reasoning is, to attribute the different conditions of the exhalant orifices, producing the different states of perspiration

and sweat, to analogous, if not to identical physiological conditions in the perspiring and sudorific apparatus. These secretions will then depend, not on one single power, condition, or function of life, but upon the relative states of the momentum of the capillary blood, the tensiveness of the capillary vessels, and of the vital condition or the muscular power of the secretory tissue itself. Therefore perspiration is repressed in the cold, and in the first part of the hot stage of fevers; because the cutaneous and capillary tissue is reduced in its vital tensiveness, and it is only when the accumulated heat and the capillary activity become so great, that a sufficient excitement or pressure is given to the torpid and collapsed exhalants, so as to provoke them to expansion or erectility. When this is once accomplished, atonic dilatation of these exhalants may follow, according to the power of the *vis a tergo*, the relative weakness of the exhalant vessels, and the contingencies of external temperature. This rationale is further supported, from the subsequent sweats in fever being always in a ratio with the previous intensity of the collapse, or length of the atonic stage, and with the force and momentum of the reactive or hot period. When the atonic depression is slight and short, the exhalant apparatus requires a very little excitement to restore the perspiration, as in common colds and ephemeral fevers; but when the precursory atony has been severe, and the subsequent reaction feeble, perhaps no sensible perspiration will

take place; but the fever will remain, with a continued increased heat, irregularly exacerbating, until some vicarious secretion obtains,—as hæmorrhage, diarrhœa, or a copious diuresis. Several fevers, again, of a low type, weary themselves out, between partial reactions and renewed collapses; till an equilibrium of a low standard is accomplished, or else effusion takes place in some more relatively weak organ or tissue. Others again, by medical superintendence, are brought to a quicker solution; and salutary sweats are anticipated by warm diluents, which render the blood more aqueous, and produce a sympathetic action on the skin, *per consensum* with the state of the stomach and intestinal tube. Opium and ammonia, in certain doses, also stimulate the surface, and by this means provoke diaphoresis; while the warm bath is a very general and efficacious stimulus to the cutaneous function. It is a fact, however, that, in many cases, both blood-letting and cold drinks will anticipate and excite sweating. Yet they only thus act, when the heat of the body is very great, and not in ordinary increments;—the one by reducing the excessive momentum of the blood, which is incompatible with much healthy secretion, and the other by inducing an erectility in the mucous villi of the stomach, which erectile condition is transmitted by sympathy to the skin, so that both surfaces are analogously situated. Besides, cold drinks assist in reducing the excessive action of the heart, by the mere abstraction of the

stimulus of heat;—thus diminishing the pressure on the capillaries, by which means these are enabled to acquire their medium diameters, so necessary to their healthy and tensive circulation.

Dr. Darwin has some ideas on this subject, very unaccordant with what has been advanced; for he says, "The perspirable matter is secreted is as great "quantity during the hot fit of fever, as towards the "end of it, when the sweat is seen upon the skin. "But during the hot fit, the cutaneous absorbents act "also with increased energy, and the exhalation is "likewise increased by the greater heat of the skin; "and hence it does not appear in drops on the surface, "but is in part also re-absorbed, and in part dissipated "in the atmosphere." "But during the sweating "stage, the absorption of the sweat is diminished, "whilst the increased secretion of it continues for "some hours afterwards, which occasions it to stand "in drops upon the skin."*

Now the *postulata* here taken,—the increased action of the absorbents and of the capillary vessels at the same time, and the diminished action of the absorbents, while that of the others continues, are not of that physiological clearness, as to make us acquiesce in the conclusions. Absorption is a vital function; and it is quite a matter of practical pathology, that this function is much impaired or arrested in all

* *Zoonomia, ut supra, vol.* 3, *p.* 24.

febrile movements ; and it is only on the cessation of these, that is remedially or nutritively much calculated upon.

Allowing the sweating process, then, to have been accomplished, by which, if it were the final cause of nature to expel some morbific matter from the system, or to bring about this process for some salutary end, the fever more often ought to cease ; or if accumulated excitability were the motive principle of the active febrile phenomena, it would now be expended, and the natural or appropriate quantity would remain. If, again, fever essentially depended on the inflammation of some organ or tissue, the local affection ought to be cured or much remedied by such a critical secretion, (to which we would almost trust the issue in many known topical inflammations of short standing) and the general fever ought consequently to be brought to the convalescent stage, and no fresh paroxysm or exacerbation ought to take place.

The contrary result, however, more frequently follows ; and the same catenated and morbid phenomena again run their *curriculum*, with more or less distinctness of character. The generative cause of fever, therefore, still remains ; and, as it has been attempted to be shown, that this consists in an impaired or minus state of the muscular power of the system, and more particularly of the part first affected ; it remains, that the catenated cold, hot, and sweating stages, are not essentially the restoratives of this lost or impaired

vital power, but only the necessary sequences of the original lesion. Indeed, the more violently the stages are allowed to elicit themselves, the more injury they add to this original lesion; for the heart becomes more exhausted from the undue excitement of the sanguiferous pressure, and the capillaries and exhalants are likewise more enfeebled, from the pressure *a tergo*, and the stimulus of increased heat and distension, long acting on their impaired vitality. Copious sweat is, therefore, in weak systems, followed by more exhaustion and by renewed collapse; until the accumulating reflux of the blood on the heart, and the increase of other stimuli, which often follow a periodical maximum, again excite that organ to a fresh struggle, and renew the catenated phenomena. This will be also more or less perfectly, and still frequently reiterated, until the volume of the fluids and the bulk of the solid fibre be brought down, by absorption, secretion, or evacuation, to the *par* of the actual muscular power; which point of equilibrium may be hastened and promoted, and, in some slight cases, solely accomplished, by assisting the generation of this essential of life, by appropriate food and stimuli.

*Symptomatic fever*, succeeding to topical injury or inflammation, arises from no other initial source than what the idiopathic genus, in the above view, is made to acknowledge. As has been shown in a former

essay, the effect of an injury is to impair, according to its extent, the muscular power of the part or system; and topical inflammation having been held to arise from local impaired vitality, or a negative state of it, in regard to that of the system at large; the consequence is, that the muscular vitality of the system may be, and that of the heart is first necessarily, by proximity, nervous sympathy, or continuity of texture, brought to an impaired state also. The general atonic condition of this individual power is very considerably assisted by the presence of pain in the part affected, which debilitating sensation is propagated to the heart and sensorium. Continuity and identity of texture are very remarkably the seats of extended or metastasial inflammation; which will often confine itself to the fibrous, mucous, or serous textures, lying at great distances from one another, and from the original seat of the disorder. On this subject Dr. Smith and Bichat have amplified with much discrimination and utility. To resume, however, the subject, it is attempted to place the above fever, whenever the heart first feels the morbid impression, in the same atonic state, as has been attributed to others. The reaction is, however, generally more violent, and stronger measures of repletion are found necessary. This arises, partly, from the greater relative muscular atony of the part or organ inflamed; to save which from death or disorganization, the general system at times must be seriously reduced, or until it is nearly brought on a

level with the general force or quantity of the muscular life throughout the whole frame, if not with that of the part affected.

Exhaustion or expenditure of vitality, commencing in a part, and being propagated by continuity or similarity of texture, by nervous conduction, or even by the blood itself, to the heart, if not to the brain, then throws the vascular system into this negative state of its muscular power; which state becomes the generative condition of a series of febrile catenations, that must necessarily follow, though under many modifications and associations, resulting from the specific characters of the initial lesion. The induction of symptomatic fever would, however, appear to require only the heart and blood vessels to be reduced in their materia vitæ, as the brain is not commonly at first much affected.

This adynamic state of the muscular power, giving rise to symptomatic fever, may appear to be contradicted by the observation of this fever being induced by direct excitement, or what is commonly called irritation; and that, consequently, in many of these cases, it must be an universal sthenic phenomenon. Irritation and excitement, however, must not be confounded; they are not, properly speaking, the same nor different degrees of the same vital movement; and it may safely be advanced, that the highest degree of mere excitement is not disease, but that the least shade of irritation partakes of morbidity. Before excitement produces fever, exhaustion or lesion of some

vital power of a part, or of the system, must obtain, however trivial, or short-lived it may be; but which lesion becomes, in our notions of strict pathology, the initial condition of fever. Irritation, however, is a morbid condition, in the part or system, already commenced, in whatever manner the vital forces and the blood are considered to be concerned in its establishment. By those, who hold inflammation to be an *hypersthenic* vitality of the part affected, irritation is considered a lesser degree of the same supposed increased vitality. But, if this were the condition of a part in irritation, inflammation, and in their consequent fevers, we should surely expect some of the physiological effects of increased vitality to appear, such as an increase of sane perception and sensibility, accretion of the naturally living solids, and augmented muscular strength and activity; instead of which, derangement and decay of function, topical *inorganisms* or mal-accretions, loss of strength, and emaciation, are the consequences of irritation and its fever.

Though the French modern pathologists in general, and Boisseau, particularly in his highly-valued Treatise on Inflammation,* ascribe inflammation to a higher degree of the state, termed irritation; which is held by them to be an increase of the nutritive powers of the tissue, "le surcroit d'action nutritive du tissu,

* *De L'Inflammation, par. F. G. Boisseau, M. D. &c. &c. Paris,* 1824.

"vers lequel il (afflux du saug) a lieu"; yet in order to account for all the actual phenomena and consequent fever in many cases, where debility was unquestionably marked, both in the general and local phenomena, recourse has been had, even by Broussais himself, as well as by others, to the unprecise idea of a state of negative irritation, and to the adoption of the term *sub* or *sus-irritation*. This mode of defining the pathological state of irritation, from the general disorder and events, and not from the insulated study and analysis of its nature, is certainly hazarding a vagueness in medical philosophy, and encouraging cacophony instead of science. If irritation were considered, not as a simple and independent process, but as the condition of a part or tissue relatively impaired in its muscular power, or materia vitæ, while the momentum of its fluids is increased; it is presumed, that there would be little difficulty in applying its compound or binary constitution to every instance of its existence, in the debilitated, as well as in the plethoric state of the body. Simple vascular excitement is the singly efficient process, which is often mistaken for irritation, and which consists in an increased sane sensibility and tensiveness of the capillary system, with a quickened circulation through the part; all of which, however, subside to the normal state, on the withdrawing of the exciting cause. Not so do the phenomena of irritation, as we have elsewhere attempted to explain. Irritation, however, may exist in one part or tissue of the

frame, and temporary excitement in another part, more or less distant; being produced by the nervous conduction of pain or pressure from the seat of irritation; which painful sensation may act as a stimulus on organs and tissues, yet in their physiological condition.

The doctrine of irritations has, in France of late years, almost absorbed or banished every other pathological creed, wherever the least phenomenon of inflammatory or febrile action has appeared; and the rationale generally given of the induction of fever from local irritation, whether situated in the stomach, duodenum, or other intestines, is, that the general commotion is merely an extension of the hypersthenic action of the vitality of the part originally affected—the existence of such entities, as idiopathic or essential fevers, being altogether denied. This doctrine has, however, receded from the high ground of morbid anatomy, on which, at first, it was erected and advocated; and has been forced to take refuge in a metaphysical and symptomatic pathology. Even the doctrine of the local origin of fever, which has chiefly prevailed in this country, is obliged to intrench itself in the symptoms exclusively;—the autopsical proof, in many instances, having failed to substantiate the alleged pathology.*

* "In short, every case of what is called *idiopathic* fever is a "mere effect of topical inflammation of the brain." *Dr. Clutterbuck on the Seat and Nature of Fever, Preface to second Edition. p.* xii.

The general doctrine of local irritations, being the generative nature of fevers, has, however, many to impugn it among the French pathologists themselves; as well as the more restricted creed of gastro-enteritic irritation, upheld by Broussais, has met with many more to dispute its validity. How long this modern doctrine will continue to reign, and influence the rising profession in that part of the continent, or how far it may even affect the changing pathology in this country, it is difficult to say; especially, as the expression *irritation* is not restricted, as it used to be in pathological language, to an obvious condition of

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"For sufficient has been afforded, that dissection is not "always capable of shewing the previous existence of inflamma- "tion in any part; inflammation consisting in disordered action "only," *Ibid.* xiv. "They prove unquestionably that *dissection* "is by no means an unexceptionable guide, while the evidence "afforded by symptoms may be relied on," *Ibid.* xx. The "essence of disease, in short as has been before observed, con- "sists in something far more subtle and fleeting than the gross "changes, that can be detected by the knife of the anatomist." *Ibid.* xxi. As Dr. Clutterbuck makes inflammation to consist "in disordered action only," and that fever is merely the effect of this disordered action, thereby identifying the essential nature of inflammation and fever; a parallel of some analogy may be presumed between this notion of fever and that propounded in our essay. If the disordered action had been allowed by Dr. C. to originate generally, as well as according to him, of necessity, locally, the parallel would have been so far the closer,—however different the separate analysis of the essential nature of this disordered action may have been.

the red capillary, but, with much convenience by the apologists for the high doctrine, to presumed states of the colourless or serous vessels of the mucous and other membranes; entirely out of the field and argument of anatomy and observation.

To give a faint sketch of the excitement, which the doctrine of *Irritations* has generated among the French medical world, I shall briefly notice, as connected with our subject, the opinions of a few of their respectable writers.

M. Foderá says,* in commenting on his opponent's doctrine of irritation being the cause of so many diseases, "N'est ce pas personnifier le mot *irritation*, "en créer un étre, en fair un entité, que la faire "marcher, courir, se transporter d'un lieu â un autre? "—c'est l'etre *irritation* qui desorganise—qui fait le "spectre ambulant!" M. Foderá also takes great and legitimate advantage of the Broussaians admitting that the doctrine of gastric *irritation*, being the cause of fever, is to be founded chiefly on the symptoms during life, whether *post-mortem* research may have detected a gastro-enterite to have previously existed or not; for if the symptoms alone are to be the data for the doctrine, then there are many fevers, where the general symptoms precede the local ones of the first passages; and since it is granted to be impossible

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* *Examen des Observations Critiques du Dr. Broussais, Par M. Foderá, A Paris,* 1822, *p.* 44.

to verify the local affection, otherwise than by the symptoms during life, he then says, "admettre que "la fièvre essentielle est absolument, et dans tous les "cas, l'effet d'une gastro-entérite n'est qu'une opinion."*

Dr. Gendrin, in his very elaborate work on Fevers,† has, also, given an exposition of fever, with professed opposition to the new doctrine, and says, "Nous "croyons avoir demontré, que la fiévre en général "consiste dans *l' altération de l'ensemble des forces* "*et des facultès vitales de l'organisme;* puisqu'elle "n'est autre chose que la trouble simultanè de tous les "systèmes et appareils de l'economie ; trouble qui n'est "que secondaire dans les fièvres symptomatiques, et "que sera prouvé etre primitif dans les essentielles." Vol. 1. p. 10.

Dr. Gendrin divides idiopathic fevers into three classes, the nervous, vascular, and the humoral; and the immediate exciting cause of these several fevers is said to be, either a *sur-excitation*, or a *sedation* of the three respective systems, nervous, sanguineous, and humoral. He details several interesting cases with dissections, where the high typhoid symptoms of cerebral and meningeal inflammation appeared, and yet

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* *Examen, ut supra. p.* 40.

† *Recherches sur la Nature et les Causes Prochaines des Fièvres, Par A. N. Gendrin, &c. a Paris, 2 vols.* 1823.

no preternatural morbidity in the brain or membranes was found on dissection, "*ni dans leur couleur, ni* "*dans leur consistance, ni dans lear epaisseur.*" In cases No. 4 and 6, which displayed many of the above symptoms during life, "*le cerveau, le cervelet, la* "*moélle épinière, et leurs annexes* ne présenterent "absolument rien de contraire á l'état physiologique."

In Vol. ii. cases 23, 31, 45, and 47, of acute fevers, are brought forward by our Author, and they are well attested by other Physicians, as demonstrating, how conspicuous the symptoms of active disorder in the mucous membranes and in the brain may be, and yet the most careful dissection after death could detect nothing deviating from the natural structure; and where any deviation was observed, it was in tissues not apparently much affected during life,—such as in the bladder. In reply to the doubts, which M. Broussais has expressed as to the faithfulness and scientific discrimination of those, who discovered no unnatural appearance in the bodies of many who died of fevers, he says, vol. 2. p. 207, "*Nous affirmons n' avoir ren-* "*contré, sur des cadavres morts de fièvre, aucune* "*trace d'inflammation, soit dans le tube intestinal,* "*soit ailleurs, pas meme de rougeur, à plus forte* "*raison d'epaississement et d'ulcèrations d'aucun* "*organe.*"

As to the great question, whether "*une phlegmasie,* "*cause d'une fièvre devenue funeste,*" can so far disappear during death, as to leave no trace of its exist-

ence in the organs affected; after speaking of blisters, erysipelas, and ophthalmia, he says, "the evident result of all his observations on external *phlegmasies*, whether affecting the skin or mucous surfaces, is, that they "*laissent constamment des vestiges après la mort*, "*pour peu qu'elles aient existé plus de quelques* "*heures.*" The same, he considers himself entitled to infer, as to internal inflammations, and concludes, "Nous défions qu' on nous cite un seul fait d'inflam- "mation bien évidente, qui se soit terminée par la "mort sans laisser des traces tres-prononcées et tres- "profondes, parfaitement en rapport avec l' intensitè "des accidens par lesquels elle s'est manifestée."

M. Boisseau, in his systematic and elementary work on fevers,* has taken a different view of their pathology from M. Gendrin, and denies the essential nature of what is called idiopathic fever, while he presents a more practical and probable modification of the doctrine of Broussais;—making all fevers to depend on primary local irritation or inflammation, existing in some organ or tissue. Thus, he makes inflammatory fever to depend on "d'une *sthénie*, d'une *excita-* "*tion*, d'une *irritation*, d'une *angioténie*, d'une "*inflammation*, termes synonymes qui tous désignent "un excés d'activité vitale dans la partie ou les

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* *Pyrétologie Pathologique, ou Traité des Fièvres, considerées dans l'esprit de la Nouvelle Doctrine Medicale*, Par F. G. Boisseau, Docteur en Medecine, &c. &c. 2me. Ed. Paris, 1824.]

"parties malades;" and this species therefore arises directly from plethora affecting and irritating, primarily, some organ, which excited action is thenceforth propagated or radiated to the system at large. Gastric, bilious, and mucous fevers are attributed by him to a *gastrite* and *gastro-entérite;* the different degrees of these irritations producing the many varieties of those fevers; while the higher states of the same irritations, in weak subjects and in peculiar circumstances, produce adynamic fevers.

Ataxique fevers are only the simultaneous irritations or inflammations of the encephalon and some other organ; and that the cerebral irritation is generally secondary; and ordinarily arises from a *gastro-entérite;* but that every other inflammation might also occasion "it; and "que la phlegmasie primitive du canal "digestif ou de toute autre organe peut cesser et ne "pas laisser des traces, celle de l'encéphale continu-"ant jusqu' à la mort; que les traces de cette dernière "peuvent elles-mémes disparaitre avant l' ouverture "du cadavre, ce qui explique les cas où l'on n' a rien "trouvè." *Pyr. Pathol. p.* 318.

As to typhus fever, Dr. Boisseau allows that there is, in the first instance, a period of *sedation*, which may be sufficient, in some cases and varieties, to carry off the patient, without any reaction having taken place; but that, the fever when developed is either "une "gastro-céphalite, une entero-céphalite, une pneumo-

" céphalite, une pleuro-céphalite, une hépato-céphalite, " et tantót une encéphalite primitive." *p.* 367.

Dr. B. endeavours to be very explicit in his physiological principles, and considers *irritation* to be " une " surcroit ou l'exaltation de l'action vitale,"—" exces " de ton,—hypersthénie," wherever situated; and it is essentially a topical lesion. This *sur-excitation*, and its contrary *l'asthénie* ou *sous-excitation*, constitute the primary state of all diseases. He also says, if the asthenia of an organ can provoke irritation, the former ceases as soon as the latter is established; there can be no *irritation asthénique*:—and again, asthenia, the effect of the want of stimuli, is quickly followed by an exaltation of vitality.

We shall conclude this brief notice of this author, by expressing a perfect concurrence in the following precept, as far as it is therapeutically considered, and not pathologically, " Il faut surtout ne point se livrer " au chimerique espoir d'accroitre l'excitabilité d'une " maniere absolue, ou comme on le dit, *de redonner* " *des forces*, on ne peut que regulariser l'action vitale, " exaltée dans une partie, diminuée dans une autre."

Another late French author, M. Michu,* has also entered on the contested field of modern pathology, and, though not adhering to the strict institutes of the

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* *Doctrine Médicale Expliquée d'aprés les Théories enseignées depuis Hippocrate jusqu' a M. Broussais.* Par M. Michu, M.D. &c. &c. A Paris, 1824.

symptomatology of the science, as M. Chomel has done in his valuable practical Elements,* yet he keeps, with a philosophical caution, free from the broad doctrine of *irritation*. This author, after remarking on the definition of fevers by several others, interrogatively proposes this formula; "ab irritatione capillarium loco "pertinente, aut plethora generale, atque repulsu cordis "arteriarum (que) nascitur febris?" After admitting that the majority of diseases are caused by irritations; he makes a distinction between those irritations which are attended with fever, and those with none; hence there are febrile and non-febrile irritations.

He very properly distinguishes between excitation and irritation, the former of which he calls the effect of a cause tending to augment the action of vital phenomena, within the limits of their physiological condition; beyond this line, excitation becomes irritation, and disease then commences. He objects to the denominations of *sur-irritation* and *ab-irritation*, used by Broussais, as expressive of a diminution and augmentation of vital phenomena, for in that case health would be the intermediate state, or a *positive irritation*. M. M. however, allows that the physiological state may be in one of the opposite conditions, *sub-action* or *sur-action*; ready to give rise, when either of these states is passed, to diseases of asthenia or

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* *Elémens de Pathologie Generale, Par A. F. Chomel, M. D. &c. &c.* 2de Edition, a Paris, 1824.

irritation. The irritability of Haller he designates by the term *myotilité ou force motrice;* and attributes many diseases to a primitive lesion of this power, without the intervention of the nerves. What he calls the muscular power is different from the *vie organique*, and is applied merely to the contractility of muscular fibres. He criticises Bichàt for not distinguishing between that prostration of strength, which is only secondary, and that primary debility, which is the result of an essential *adynamia;* and it is for want of this distinction that Broussais has considered the phenomena of adynamic fever, as being only the result of a gastro-enterite. Of diseases in general, he says, it is not the form of the tissues which is changed, it is the force or tonicity, which is proper to them, that is altered.—p. 127.

As he divides the elements of physiology into three systems, the nervous, muscular, and the capillary; so he places the seats of nearly all diseases in the different degrees, with which these systems are conjunctly or severally endued or deprived of their general pervading power, which he terms tonicity. He then concludes in this manner, "that in considering the nervous "system, (cerebral and ganglionic) the muscular, and "capillary (red and white) systems, as the elements "which predominate by turns, and primitively in "every morbid action, whether in surpassing or falling "short of their normal or physiological state, my de-"sign has been to separate diseases, which were

" united by Broussais." " I have purposed, as has been " seen, to place the etiology of febrile diseases, both " convulsive, typhoid, adynamic, and lymphatic, on " a basis sufficiently broad, that the stomach and its " irritations may not bear the whole weight of all dis- " eases, which the physiological doctrine attributes " to them."

No where, however, does M. Michu define irritation and inflammation to be any thing but " *l'exaltation de* " *toutes les propriétés vitales*," relatively considered, not absolutely; and, that in a part irritated or inflamed, there is an accumulation of vital tonicity at the expence of that power in other parts of the body; but again, he says, p. 396, " Envisagée comme prin- " cipe de maladies, l'irritation n'est pas un état positif " qui reclame un mode de traitement uniforme:— " l'irritation est la maladie en germe." In his concluding pages, he pays a complimentary deference to the views that had previously been taken by M.M. Gendrin and Boisseau, in their works above-mentioned; and when they have agreed with him on certain points, he claims the " vis unita fortior."

To resume, however, the more particular tenor of our subject, we have to notice, in what are called inflammatory and symptomatic fevers, one pathognomonic symptom, which has always attracted much attention, and upon which great reliance has been placed by

many, as a diagnostic sign of inflammation and of the nature of the fever under review. This phenomenon is the buffy coat of the blood.*

The causes of the buffy coat being intimately involved with the causes of the coagulation itself; a satisfactory rationale of these is necessary to explain this adventitious appearance of the blood. While some, after Hunter, have attributed the coagulation to the vital principle; others, as Thackrah,† have made the loss of vitality the cause of this phenomenon; and others again have contented themselves, with stating the several physical concomitants of the fact;—the chief of which is, the making the extrication of carbonic acid gas an essential condition of the coagulation.‡ The whole subject being of too extended and detailed a nature for our present inquiry; I shall only state, in what general cases of disease I have observed and noted down the buffy coat to be most exhibited. It has been seen chiefly in the early periods of inflammation arising in strong and ple-

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* The following observations on the blood are the substance of what has appeared in my essay on Inflammation; but as they are also illustrative of our present subject, they are here made use of, with the additional note on the times of coagulation.

† *An Inquiry into the Nature and Properties of the Blood, &c.* By C. T. Thackrah. Lond. 1819. p. 80.

‡ *Essay on the Blood, &c.* By Charles Scudamore, M.D. F.R.S. Lond. 1824.

thoric constitutions, when there were also heat of skin and a quick full pulse, and more especially in cases of pneumonia and rheumatism. In inflammatory affections of the mucous membranes and of the abdominal viscera, it was less observable; and in some violent inflammations of the stomach and bowels it has not at all appeared. When there was much nausea or vomiting accompanying any inflammation, it has not been very obvious; and in pneumonia, its quantity seemed more connected with a full and quick pulse, than with a small or contracted state of the circulation; though, in this latter case, the condensation and cupping of the coagulum were more perfect. Finally, it seemed very much connected with the shortness of time, that active disease had remained after its supervention to vigorous health, and with the energy of the stomach and chylopoetic viscera during the disease.

Reckoning, also, this buffy appearance to be attended with a slower coagulation of the blood, than that which takes place when drawn in health; and that it is promoted by the blood being taken in a full stream, by rest afterwards, and by being received in deep vessels, of slow conducting power, in regard to caloric;—which circumstances are granted by all observers.* And allowing, moreover, with Hunter and

* With the view of providing myself with some data concerning the coagulation of the blood from neutral sources, Mr. M. Robinson and Mr. Ferguson, Surgeons in this town, have

some others, that coagulation depends on the vital principle, (or the muscular materia vitæ which pervades the whole body) and that it depends also on the

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kindly favoured me, by lately keeping a register of 86 cases of venesection, as they occurred in their several courses of practice; and the observed and averaged results of these cases are;

| | Min. | Sec. | |
|---|---|---|---|
| 30 wherein *no* buff appeared | 8 | 23 | Time between opening the vein, and the commencement of coagulation, as observed by Mr. F. |
| | 3 | 31 | Time between closing the vein, and the commencement of coagulation, as observed by Mr. M. R. |
| 23 wherein *little* appeared | 8 | 53 | Time as above, as observed by Mr. F. |
| | 4 | 15 | Time as above, as observed by Mr. M. R. |
| 33 wherein *much* appeared | 10 | 5 | Time as above, as observed by Mr. F. |
| | 5 | 30 | Time as above, as observed by Mr. M. R. |
| 86 | | | |

So, the average ratio of the times in which, *none*, *little*, and *much* buff, made its appearance in the above cases, and which, from the different complaints for which the blood was extracted,

gradual *loss of it;* or in more correct language, that it depends on what muscular power still adheres to the drawn blood, but which is gradually diminishing in an inverse ratio with the times, in which the blood has been separated from the body, until it is entirely expended;—the following conclusions can not be deemed unwarranted. First, the buffy coat depends on the vitality of the blood being diminished, before extraction, relatively to its extent or volume; which negative condition causes a slower coagulation, and so permits the denser red parts of the blood to subside, before the lighter fibrinous part begins to coagulate;—which coagulation a more vital tone would have anticipated, and so involved both parts in one homogeneous crassamentum. Secondly, the quantity of this fibrinous crust depends on the abundance of fibrin in the blood at the time, in which the vital lesion took place; and that this excess is in proportion to the atony of the capillary secretion of the molecular matter of the body, compared with the vigour and absorption in the chylopoetic functions. Thirdly, the thick-

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may be reckoned a general ratio in other cases, will stand thus. Blood, wherein *no* buff appears, coagulates as 1.; wherein *little* as 1-13; and wherein *much* appears as 1-375:—and that these differences arise from the greater or less vitality of the blood, at the time it is extracted, conjoined with the greater or less quantity of fibrin then existing in the blood, are positions in physiology, which are far from being hypothetical to maintain.

ness and condensation of the buffy coat are in proportion to the quantity of fibrin in the blood, and the relative reduced degree of its vitality to a certain extent; while the cupping and the inverted edge depend on the softness of the subjacent clot, and on the more or less complete separation of the fibrin; by the degrees of both which, their mutual cohesion is lessened, and so retraction takes place to the surface of purer fibrin. Viewed in this light, the buffy appearance has no absolute connection with inflammation; it is more a criterion of the suspension of fibrinous accretion, or of an excess of fibrin in the blood, from the supply surpassing the natural demand; and above all, it cannot be held as a mark of increased tone and real vitality. Its appearance in the first cup, and less or none at all in the second or third, seems to arise from the first drawn blood being more *de-vitalized*, from its remaining longer in the atonic capillaries, than the rest which comes more directly from the heart,—the chief seat of the materia vitæ or muscular power. In healthy pregnancy, there is always an excess of fibrin; no doubt to supply the uterine demand, at the expence very often of the muscular accretion of the pregnant body. In phthisis, the stomach and primæ viæ are often in tolerable, and sometimes in good assimilating function; while the blood must necessarily be kept down in general volume, from the diminishing capacity of the lungs, by which the aortic capacity must be regulated; therefore fibrinous blood will ge-

nerally appear in this disease. As acute rheumatic fever affects the very solids, which in health take up almost the whole supply of fibrin, a very remarkable excess of it is to be expected in this disease; while inflammation or lesions, which affect the stomach and assimilating organs, exhibit less and sometimes none of this fibrinous coat,—as the laboratory where the fibrin is formed is neutralized or disordered. Lastly, from a complete loss of vitality in the blood, as by lightning, poisons, especially animal ones, and fatal blows on the stomach, or even in some very asthenic diseases, coagulation will not take place; but the blood will remain fluid, dark, or greenish and dissolved, and no fibrin will make its appearance.

Having then endeavoured cursorily to analyze the several leading phenomena of fever, as they successively arise as sequences of one another; and having inferred, that the primary series of the whole catenation originates in a relatively impaired or diminished state of the muscular power or materia vitæ of the body, as compared with the *inertia* and volume of the solids and fluids; and that such a state may even be consistent with the relatively greater, if not with the healthy integrity of the systems, called sensorial and nervous; I shall briefly sum up what may be considered the theorems of the previous inquiry and argument.

First. A fever essentially and primarily consists in a negative state of the muscular power, as compared

with the physical organism or substratum of the body; and it appears, that it is sufficient to constitute the febrile act, for the heart and blood-vessels to be alone involved in this relative condition.

Secondly, This negative state may be produced, either by exhaustion, as from heat, violent exercise, or stimuli; or it may be the direct or instantaneous result of an injury, or of the application of debilitating powers,—as of some poisons and contagions.

Thirdly, A stage of atony, torpor, or collapse, however short, and sometimes obscure, but at least to embrace the heart and blood-vessels, is the initial condition of every symptomatic and inflammatory fever, as well as of those of the lowest and most contagious type.

Fourthly, This negative state of the muscular power is, in the first instance, either quickly followed by death, or, sooner or later, by increased frequency or quickness of the pulse, arising from the stimulus and pressure of the increased volume of blood on the heart, now relatively reduced in its vitality. This frequency of the heart's action is also promoted by accumulating heat—the consequence of repressed secretion and perspiration, and by the sensation of pain or irritation being transmitted through the nerves to the heart, or sensorium, or to both,—thus exhausting the muscular power and increasing the mobility of the moving fibre.

Fifthly, All fevers, commonly so called, are the

constituted sequences of a prior condition; they are strictly physiological reactions.

Sixthly, The reaction in any case, will be as the previous strength and plethora of the constitution, joined to the quickness and the degree to which the materia vitæ has been affected,—provided it has not suffered to an immediate irretrievable extent: and the mildness of a formed fever will be proportioned to the small extent to which the muscular power has been injured; while the lowness and putridity of the type will again depend on the depraved or reduced state of the body, previous to the disease, added to the greater or less universal lesion of the muscular power.

Seventhly, A fever will recur and continue, at least until the *inertia* and bulk of the solids and fluids of the body be brought on a par with the powers of the muscular life, either by the reduction of the former, or by the increase of the latter;—which equilibrium not being obtained, dissolution must follow.

Lastly, the exact causes of idiopathic fevers, assuming the different periodical types, or being continued, are obscure; as we are, in one regard, ignorant of the nature of the exciting causes, beyond perceiving that they have generically a debilitating effect on the muscular principle.

It would moreover, perhaps, assist to condense any definitions in this view of fever, if pathological nomenclature afforded a term similar to those,

which Giannini and Pinel used,* and which would express the two-fold condition of the system, as it is supposed to exist in fever;—the impaired state of the materia vitæ, or muscular power, joined with a reactive condition of the heart. The science of chemistry is full of such useful and intelligible compound terms, and from what I have alluded to in speaking of the nomenclature of inflammation, some such analogous terms might be found expressive of the state of fever. The difficulty of finding such terms may not be so great, if the doctrine, which they embrace, be granted to be correct; as it is of far more importance, in any science, that its doctrines and principles should be established, than that terms should be prematurely invented,—which generally affect a pretension to system, which, in the present state of medical science, is in some measure discouraged.

If the doctrine of fever, here propounded and thus attempted to be pathologically defined, be founded in nature, it may be alleged, that it will be much corroborated by autopsical proof and observation. It is unnecessary to state, how very confidently morbid

* From what I have gathered of the attempts and opinions of the Italian Physician, from a hasty perusal of some translated extracts of his works into French, for I have not seen his original writings, he made use of the term *nevrosthenia*, to denote the condition of diminished *nervous* energy, conjoined with an excited circulation.

dissection is appealed to by the generality of authors on this subject, in support of their respective theories of fever; and it may be advanced, that the view of it, entertained in this essay, has a very superior support from this ultimate test of validity. But the great difficulty lies, in many cases, in discovering what are effects, and what are causes or primary sequences, before an uniform pathology can be accredited by all parties. And what is remarkable, some of the modern advocates, for the local origin of fever in every instance, both in this country and in France, have shrunk from the *experimentum crucis of post-mortem* dissection; and have asserted, that inflammation and irritation may be, either of them or both, fatal, and yet no trace of such lesion may be discovered after death.*

There is another source of fallacy, however, to which the above proof is sometimes subject, and that is, the surviving action of the capillaries after sensorial death. This *post-mortem* vitality is seen, from the experiments of Haller, Dr. Philip, and others, to be capable of removing blood, that was simply congested for a previously short period, and of unloading the gorged capillaries, while the large veins became distended; and it is also proved, that the blood, in newly dead vessels, is considerably under the influence of its own gravity, and seeks the inferior

* Vide *Dr. Clutterbuck on Fever, 2nd Ed.* and the works of the Broussaians.

side of the corpse, however it may be placed. Still, in what is called high inflammation, and above all, if there are any of its known concomitants and effects, as effusions, impactions, accretions, or pus, there is always sufficient evidence to decide upon the assemblage of disease; if not upon the respective priorities of the parts and functions, which have been affected by it.

That the gorged or loaded state of the vessels found after death, in cases of idiopathic fever with alleged topical inflammation, depends generally on this *post-obit* gravity and capillary derivation, is strongly supported by the appearance of the vascular turgescence itself, and from the experiment of laying the body immediately after death in the prone position.* The turgidity is almost always confined to the veins, without much ambient suffusion into the reticular plexus, and without fibrinous or purulent effusions,—the characteristic correlatives of strict inflammation.†

That *topical* lesion or inflammation is no ways essential to the constitution of fever, is not only accordant with the doctrine dwelt upon in this essay; but it is so far confirmed by autopsy very often failing to discover any morbid lesion, which, as a generative

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* Vide *Shaw's Manual of Anatomy*, 2nd Edition, p. 201.

† "That excellent anatomist, Dr. Macartney, states as the "result of his anatomical examinations of persons who died of

local cause, can account for the previous disease and its catastrophe.* To bring forward any individual cases of fever, with dissections, to support the doctrine of fever, which we have comparatively exposed, would seem to be erecting its merits on a restricted basis of the author's own finding and depiction, instead of en-

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"typhus fever, that the morbid appearances are not those of "common visceral inflammation. According as the head, lungs, "or abdominal viscera, were engaged in the disease, he met with

"First, Fulness or distention of the vessels of the brain, "especially of the veins; and some water was effused on the "surface, and into the cavities of this organ.

"Secondly, The same species of congestion in the lungs, and "different degrees of effusion into the cavities of the pleura and "pericardium.

"Thirdly, Venous congestions in the liver, spleen, or ali- "mentary canal; sometimes a blood-shot appearance or spots of "extravasation in the mucous coat, more particularly in the sto- "mach and first coils of the intestines. In some instances a more "generally pulpy, or swollen and discoloured state of the mucous "coat of the alimentary canal. These congestions were always "of a purple or venous color, and the blood throughout the "body appeared to be accumulated in the *venous system, and "had little tendency to coagulate.*"

*Notes by the Editor, Cooke's Morgagni, vol.* ii. 593.

"In the greater quantity of those who die of fever, the in- "testines appeared gorged with blood—not inflamed; but on "opening the lower part of the small intestines, we generally "discover small ulcers, with thickened edges." *Shaw's Manual of Anatomy. 2nd Ed.* 1822, *p.* 44.

"I am therefore inclined to consider the fulness of the vessels,

deavouring to establish it on the general phenomena, which are observed by practitioners, and recorded by many writers. The view, which has been taken of the properties of the muscular materia vitæ, and of the capillary circulation, with the nature of the blood, will almost anticipate every explanation, which might now be given of the morbid appearances of inflam-

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"in the greater number of cases, to be in a great measure de-
"pendent on the position of the head after death; and this, par-
"ticularly after cases of fever, for, in such cases, the blood,
"*not coagulating*, flows freely up by the deep veins (to the head),
"in which the valves are so imperfect, as to permit it to pass."—
*Ibid.* 198.

In examining the state of the lungs, it is of much importance
"to distinguish between the effect of gravitation of the blood,
"and the consequence of previous inflammation. From the body
"lying in a horizontal position after death, the blood is often
"accumulated at the posterior part of the lungs—giving them
"there a deeper color, and rendering them heavier.—*Ibid.* 247.

* "In most of the cases selected from the papers of Valsalva,
"it may excite surprise, that, after violent febrile affections, or
"those which were destructive to life unexpectedly soon, scarcely
"any morbid appearance is discoverable, which bears any pro-
"portion to their violence; and sometimes there has been no
"apparent lesion."

*Morgagni, Translated by Cooke, Epist.* 49, *Art.* 1.

"but I have lately attended a most severe and protracted case of
"synochus, in which I was never able to detect any local affec-
"tion."—*Ibid. notes by Editor, vol.* ii. 595.

See also, *Revue Médicale*—Professor Recamier—M. Martinet. *Tableau des Maladies Observées à l' Hotel Dieu pendant* 1823.

mation, congestions, turgescence, and extravasations, which may be found after death from fever of any kind. The principle point of *post-mortem* research, which would bear more strictly on our view of febrile movement, is the probable state of the muscular power before death; and though the generally observed morbid appearances throw no palpable light on the essential nature of this element of life, yet the previous lesion and derangement, which it experienced, and as the blood and the solid fibre are consequently affected, may be deduced from evidence strictly and fairly pertaining to itself.

It has been very generally remarked by morbid anatomists, from Morgagni down to the present time, that the blood, after death in cases of fever, is in a fluid, dissolved, or uncoagulated state; that the solid fibre is softened and ecchymosed; and that putrefaction very early takes place;—showing that the muscular power had been at a very low standard before death. That this does not necessarily arise from extreme extenuation and universal debility of the system, may be inferred from the blood being found coagulated, and the muscular power surviving much longer, in cases of death from phthisis and apyrexial exhaustion. These appearances of impaired muscular power and this early decomposition are proportioned, in some measure, to the previous asthenic nature of the fever; and their general or local extent seems to depend on the degree

of lesion, which the vital principle had suffered, and on the volume of the fluids, which existed at the onset of the disease, and were retained in the body during the course of the fever. The quantity of fibrin in the blood, at the commencement of fever, will also modify very much its subsequent and *post-mortem* condition. In short, the fibres and the blood, in protracted cases of milder, or in short-lived cases of deeply congestive and adynamic fevers, are found after death in a condition, somewhat similar to what they are in, in consequence of death from lightning, mortal blows on the stomach, and from some poisons;—where in extreme cases, it seems, the extinction of every phenomena and principle of all life immediately takes place.

Such is, then, the brief outline of the evidence, and of the doctrine of the more intimate nature of fever, that has been attempted to be deduced; and, though its apparent simplicity may, at first view, be thought to require no further examination, for to show its want of essential connection with the varied and extensive operations of nature; yet a nearer inspection of the categories, which it embraces, will, it is presumed, show the depth, extent, and circumspection of study, which its practical application requires. Though simple in its primary elements, its coefficient and contingent conditions are so manifold, and so diversified in degree, that the multiplied and reacting

sequences, which constitute the symptoms, may be so important and imposing, as entirely to engross the attention, and obscure, for a time, the primary efficients. Let these mediate or resulting phenomena be, however, ever so great or numerous, their relative bearings and values will be more justly estimated, by keeping in view the radical constituents of the whole morbid disturbance ;—and it may, therefore, be deemed somewhat just and subsidiary to the theory, which has been deduced, to apply shortly the therapeutical bearings of the most generally approved and adopted remedies.

Laying the generative causes of fever in a state, which may be termed that of debility, the rare Brownonian may presume, that the supposed revived doctrine of excitability must be met by the canonical regime, which was prescribed by its ingenious author ; while the modern disciple of the inflammatory school may, at first sight, predicate of this view of fever, as leading to all the practical horrors of inflamed and gorged viscera, hæmorrhagies, and putridities, which marked the catastrophe of fever ; when bark was the chief febrifuge, and cold steel not so much in repute. A closer inspection of the doctrine above deduced will, however, serve rather to repress much faith in the hasty adoption of the stimulant and nutritive plan ; and it will tend to moderate every expectation of recruiting the system, except by adding to its real tone, or by reducing the physical system to a par with the

vital principle;—which last mode is well illustrated from slight fevers being spontaneously cured by rest and starvation.

That some fevers have been carried off, by a diffusible stimulus being administered in the very commencement; and that the same kind of fevers have also been cut short, by an early evacuation of some fluid from the body,—only prove that, in either case, the lesion of the muscular power had been so slight, that, by a timely and gentle excitation, the remaining powers of life, through the medium of the nervous system, were solicited to the trifling reparation of the vital power that was expended;—or that the abstraction of a little blood, on the other hand, brought the sub-stratum of the body to an equilibrium with its vital associate. Looking, then, on an impaired state of this vital power alone as the foundation of all febrile movement, we run no danger of confounding a high state of reaction with a real increase of physical strength and vital tone; nor will we be led to impute substantial debility to languor, oppression of the vital functions, and to prostration of muscular strength. We shall also be prepared to treat fevers, not according to any fixed line of practice; but on a therapeutical principle, which must be applied to individual cases, or at most, to the general characters of a species only.

In the atonic or cold stage of Intermittent fever, the collapse of the superficial capillaries is often fol-

lowed by congestions in the spleen, which lead to enlargement from repeated paroxysms; and, but very seldom, to inflammation. This primary stage may be shortened by anticipating the necessary catenation, or what are called the efforts of nature,—an expression, by the bye, which often implies as clear, what is very obscure. The hot stage, being again an evolution of fictitious vigour and action, seldom calls for any reduction of the system; except, when an important organ happens unduly, from some previous weakness which it possessed, to feel the reactive momentum of the circulation.

But the great indication in this genus of fevers, is to prevent the return of the paroxysm, which, experience has shown, is best accomplished, by such medicines and diet as have a tonic and invigorating effect on the animal fibre. The sanative powers of bark and arsenic seem to act on the capillary expansion of the mucous membrane of the stomach and bowels, by either obtunding the sensibility to noxious impressions, or by increasing the tenacity of the materia vitæ to its substratum. That debility is the initial link or movement in intermittents, is highly corroborated, by the fact of the periodicity of the paroxysm becoming more frequent, as evident symptoms of debility have increased; until a continued or merely a remittent fever supervenes, when every sign of debility is still more obvious The retrograde succession of the types have also been remarked to take place,

according as the system acquired more and more vigor. That the approach of the new paroxysm depends on the debility always augmenting, until it reaches its acme in the height of the cold stage; may be inferred from the paroxysm being hastened in its return, even to some hours, by the patient taking a severe purge, or having been subject, in the remission, to some depressing agent. If any remote inference could be drawn, from the different characters of intermittent and continued fevers, as to the chief or primary seat of the vital lesion, it may be supposed, that the capillary vitality of the surface of the body is most affected in the intermittent; and that, that of the interior is most, if not primarily, injured in the continued form;—and this may very probably be the cause of the greater distinctness and more external evolution of the several stages in the former, than in the latter section of fevers.

In the first stage of Typhus and of the ardent remittent fever, symptoms of internal atony are among the earliest indications of the disease; and in many cases most serious congestions have taken place, before the reaction has been constituted. Congestion in the portal system of vessels very readily takes place, as the veins are not provided with valves; and this part of the circulation is out of the reach of the direct motive power of the heart, and depends entirely on the muscular power, or materia vitæ, of the vessels and their contained blood. A deficiency or injury

to this moving power is followed by distension of the vessels; as the leading arterial capillaries, direct from the heart, must preserve their propelling power, for a longer time, than the above isolated set of vessels can do; and as the blood in the veins can make no direct reflux to the great sanguineous cavities, the consequences are, paralysis and congestion of the vessels and of their blood. That the same morbid changes do not not take place, to the same extent, in gastritis, enteritis, &c. arises from these affections being local or circumscribed injuries, or negative states of the muscular power; while the general system is only involved by sympathetic extension, or by nervous sensation. The reaction, or the effect of the unbalanced powers, is therefore to be more dreaded than the original atony of the vessels, which, in these local inflammations, bears a relatively greater proportion to the muscular power in the system at large, than it does in low congestive and idiopathic fevers.

Though debility to a very serious extent may have taken place in congestive fever, and though no inflammation has yet commenced, it by no means follows, that venesection is inappropriate or inadmissible; on the contrary, the indication is often imperative; but its desired remedial effect depends, entirely, on how far the abstraction of blood from the aortic system can relieve the congested and insulated vessels of the portal circle. If these have yet retained a good share of their tonicity, the lessening of the momentum of

the blood, on the distant columns of either extremity of the circle, will enable the vessels to act on the contained blood, and so to renovate the suspended function. If this desired effect do not take place to any extent, then congestion will increase; and the issue will be, obscure irritation, sub-acute inflammation, and at length dark hæmorrhagies from the intestines;—if the liver cannot be made to elicit this congestion in a copious secretion of crude and vitiated bile. General venesection may thus fail to fulfil our indication, yet it will generally be of more or less service, as the fluids, in other parts of the system, are in excess to the powers of the materia vitæ, at the commencement of the fever;—and perhaps the brain or lungs may require the pressure on their delicate tissues to be also watched and regulated, if they themselves are not in a state of congestion. On the idea, that inflammation alone demands venesection, we may be losing much precious time in entirely deferring it, until full reaction takes place in these fevers; which, when it does obtain, may be the effect of our procrastination, or the consequence of the irritation of blood, that has been allowed to pass from the congested into the semi-coagulated state.

Allowing venesection to have relieved the congested or the inflamed vessels, if inflammation has had time to supervene, the fever is not however cured; nay, its course is generally not arrested; as, by depletion in this indication, we have only preserved an organ

from deeper lesion or disorganization, and not, at the same time, repaired the original injury, which the part or system has received in its muscular power. We have only more nearly equalized the different forces and parts of the system, and brought them in a more favorable condition for the physiological equilibrium of health. If, however, the fever depended on the local congestion or inflammation, a different degree of effect would, at least, follow; for these morbid individualities being relieved or subdued, as can be, with every functional proof, ascertained, the catenated or resulting fever ought, *pari passu*, to decrease, or altogether cease. That such would be the physiological consequence, is ascertained from the habitudes of those fevers, which are strictly known to be symptomatic. Concomitant inflammation may materially modify the course, and even decide the issue in idiopathic fevers, commonly so called; but inflammation is not, it is inferred, legitimately and necessarily, their antecedent cause, whether the brain, spine, the mucous membrane, or any other organ or tissue, be the seat of this alleged inflammation. As to the origin of this supposed inflammation, I have elsewhere endeavoured to show, that it acknowledges no other initial change from the state of health, than what is found in all fevers and inflammations, except so far as this change is chiefly affected by locality.

It is moreover a matter of practical observation, that, in the atonic stage of some severe congestive

fevers, abstraction of blood cannot at first be effected to any useful extent, on account of syncope and further collapse taking place; though deep congestion may be present, and will soon uncontroled elicit itself in terrible reaction. The reason of this seems to be, the atony or paralysis of the internal vessels is so great, that, in this stage, venesection only diminishes the quantity of the circulating blood, and so quickly abstracts from the remaining stimulus of the heart; without, at the same time, relieving the congestion, or restoring the suspended activity of the paralyzed vessels. In these cases, as before noticed, the tepid bath and a smart mercurial stimulant to the bowels very materially anticipate the reaction, when blood may be taken away to a wonderful extent, without syncope ever following. There are five other agents, whose action on the living system in fever may be briefly noticed, as far as they relate generally to the subject under consideration; and these are, the application of *cold*, *purgatives*, *emetics*, *opium*, and *mercury*.

The first of these, is the application of *Cold*, and, notwithstanding the many apparent proofs of its being alternately a stimulant and a sedative, and the flexible style of reasoning which is sometimes used to account for such different effects, its action may at all times be considered, in its primary effect on the animal fibre and fluids, as a direct sedative. During the atonic stage of fevers, it is very obviously so, as its application increases both collapse and congestion;

and in the hot stage, its chief effect is the abstraction of redundant heat, by which the volume of the fluids is diminished, and the strong provocative of heat to an excessive reaction is moderated;—so that the distended capillaries may be enabled to regain their medium diameters, wherein their tensive state principally consists. Applied in the hot stage, it also, by repressing the reaction in the capillaries, preserves their muscular power from hurtful expenditure, promotes an earlier equalization in the system, and favors convalescence, if the fever is not immediately arrested by it. As fevers, even of the idiopathic species, are mostly accompanied with some tendency to topical atony or inflammation, superadded to the general lesion, the application of cold is not in every case applicable, as the first repressing effect would be to weaken still more the relatively debilitated vessels. Or, if the fever was of a strong reactive nature, as those called inflammatory are, its sedative effect would be more than overbalanced, by its rendering the vessels more easy to be distended, and the system more sensible of its ordinary stimuli afterwards; by which means febrile commotion would be increased;—as we see, that some external inflammations are aggravated by the application of cold,—the heat and pain being subsequently augmented.

*Purging* is the most general, as well as the most ancient remedy in the treatment of fevers; and, whatever may have been the theories entertained about

their proximate nature, it has been always more or less insisted upon. Setting aside the obvious utility of purges in cleansing the bowels from loaded or vitiated secretions, they serve, on the view which we have taken of fever, to detract from the volume of the general fluids, and to excite the tensiveness, if not the erectility, of the capillary expansion of the intestinal tube. Even when inflammation of the bowels is present, they act by promoting the serous and mucous secretions, and so seem to unload the distended capillaries. If the nature of the vessels in this affection was an increased action, it is presumed, that any degree of such stimulation would augment the existing disorder, instead of relieving it. The disgorging of the liver is another most important effect from some kind of purgatives; and it is easily seen how this must detumesce the portal congestion, and allow the vessels to regain their medium diameters. In affections of the head and in some dropsies, the action of what are called revulsive purges appears to be, that, from their severe stimulant and exhausting effect, they produce a temporary atony in the mesenteric circle, by which the fluids are more voluminously solicited to the bowels, and so the distant distension or turgesence subsides, or is relieved;—not reckoning on the reduction of the general fluids by the alvine discharges. Still, however, the administration of purgatives requires to be moderated in many fevers; as they sometimes have a very debilitating effect, and might easily

add very considerably to the previous impaired state of the muscular power of the system, from the proximity of their action to the heart and stomach. Their general physiological action, then, is, to excite the tensiveness or erectility of the vascular and secretory capillaries, when they are given in moderation and with judgment; and to debilitate the same textures and vessels,—and perhaps to produce a temporary contraction in the leading capillaries, to end forthwith in dilatation, when severe or drastic ones are administered.

The action of *Emetics*, when given in fevers, would appear very applicable to relieve or disperse that primary atonic or congested state of the vessels, wherever situated; whereas, if the condition of the vessels were an increased vigor and action in their fibres, their beneficial result ought not to be so decided. They have always borne a high character in the outset of fevers; and their physiological action would appear to be—a wholesome concussion of the system, and a renewed degree of the natural and vital functions; so that the capillary congested fluids are put into quicker motion, and the vessels are enabled to embrace tensively their contents. The different *vires a tergo* are, at the same time, moderated, and for the time more or less retarded,—by which means capillary action is promoted, and the hydraulic pressure is diminished in the leading vessels.

*Opium* and *Mercury* are the two other remedial

agents, which have, particularly of late, been a good deal administered in fevers attended with inflammation. Mercury, in its constitutional effect, excites all the secretions, promotes capillary heat and circulation, quickens somewhat the action of the heart; reduces, in many cases, adventitious tumours and vascular enlargements; and increases very powerfully the action of the absorbents. These are all effects, with only one exception, in which the capillary tissue and circulation are concerned, and not the great organs or functions of the nervous and sanguineous systems. Without enlarging much further the corroborative illustration, it may be inferred, that the action of this remedy has principally to do with the corpuscular organization, and, of course, with the muscular power of the body; and the effect from it appears to be, an increase of tension and tone in the capillary vessels and blood; or it is a peculiar stimulus of some permanency to the capillary system—which is particularly governed by the muscular power. Opium, on the other hand, seems primarily to have little to do with this power or its appropriate tissues; its effects are principally displayed on the mental and nervous systems, exciting or quieting their actions and functions, according to the dose, and the circumstances under which it is administered;—while the only effect, which it seems to exert on the capillary system, is through the medium of the nerves. Confining this analysis to its narcotic or sedative effects, it diminishes pain, by

suspending or obtunding the sentient transmitting properties of the nerves; it suspends the inordinate effects of volition; and renders one organ or part, for a time, insensible to the disturbance that resides in a distant or neighbouring one. If the dose be increased, even healthy volition is impaired, and the sensorial power becomes wrapt in insensibility; while in all these cases, the action of the capillary system, and the powers of the materia vitæ may be little, or not at all, impaired or suspended. But if the dose be still greater, the materia vitæ itself becomes finally involved in the injurious lesion of the other powers; and then complete and fatal suspension of every principle of life may follow. Reasoning then from these physiological data, the action of opium may be referred chiefly and primarily, and to all practical purposes, as affecting the nervous system. Here, then, we have two powerful agents, severally applicable to the two chief powers of animal life; and in considering our indications, according to the above view, it is not difficult to say, when the one or the other, or both may most probably be beneficial. We also see how febrile movement is incompatible with the physiological action of mercury; as the one appears to be a condition of impaired or debilitated muscular power, with a corresponding capillary atony;—and the other produces, in some permanent degree, an excited state of the same power, with a tensiveness of the capillary vessels and blood.

The administration of opium is better suited to symptomatic fevers, or when topical congestion and inflammation accompany the idiopathic genus, than it is to simple and general fever; because, as its operation is remedial, chiefly by suspending or moderating the nervous transmission of morbid and painful sensations from one tissue or organ to another, or even to the brain and heart themselves; so, in general fever without topical lesion, the necessity of cutting off these intercourses is not so apparent, nor does it perhaps exist. Opium, if given alone in these cases, may likely injure more by its stimulating and narcotic effect on the sensorial and nervous systems, than it would otherwise benefit; since the morbid conditions, to which it is more applicable, are not present. Combined, however, with mercury, and given in fever with topical sanguineous disease; it represses the inordinate expenditure of the muscular power, by its composing or benumbing effect on the nerves; while the mercury is allowed to act, with less disturbance, with its specific excitation, on the corpuscular fibre and its vital associate. In this manner, the part and system are brought to an earlier equilibrium, by the increased action of the absorbents removing the hurtful or superfluous depositions and fluids, the volume of which is hence diminished in the capillaries; while the mercurial stimulus gives these vessels renewed tensiveness and activity, by which the evolution of the materia vitæ from the blood, ingesta, and air, is promoted.

## CONCLUSION.

Of the theory, to which we have arrived in this inquiry, it is finally shown ; that, besides the analogical bearings which it has to some other views on the same side of the general doctrines of life and animal motion, febrile movement appears, as far as the doctrine of vital forces is implicated, to be essentially of the same physiological nature, in whatever individuals, or under whatever circumstances of any individual, it may arise. Its generative condition consists principally in a lesion, of a negative nature, of the materia vitæ, or the muscular vitality of the body ; and fever seems fully constituted throughout the system, whenever the heart and large blood-vessels become involved in this lesion, through the medium of the blood, nervous transmission of pain or irritation, or by the continuity of texture. In thus viewing a case of fever of the most reactive appearances, we shall not treat it, as if we had nothing to do, but with a *hypertonicity* of life and a superabundance of fluids ; on the contrary, we shall see in all this, only an excessively fictitious vigor, temporarily displayed, which requires to be moderated and repressed, to preserve the weaker organs from giving way to inflammation or disorganization. We shall also not consign a case of the lower species of asthenic or nervous fever to the unqualified exhibition of stimuli and tonics ; remembering, that we have even here the same relative conditions to combat with ; and though the more general and obvious indication may be to

support and nourish the muscular power, yet the *inertia* of the fluids, &c. may, occasionally, exceed the normal standard, and impede our object,—and so a partial reduction of these may be further, or at times, remedially necessary.

To render, however, our therapeutical and prophylactical indications more philosophically complete, some more perfect knowledge of the nature of some of the exciting causes of fever, as of contagion, is requisite; and, above all, a more intimate acquaintance with the muscular power is of the highest consideration. The more these important objects are investigated, as they relate to all classes of animals; the more will medical men be enabled to reason on the nature of their relations to each other, and on the consequent and contingent lesions of the above animal principle; and the less will they be under the temptation to speculate. To renounce such investigations, from the despairing belief, that we can never arrive at any ulterior principles of either much certainty or utility, is to place an insurmountable value on the progress which the human mind has made in physiology, during little more than half a century,—which ultimate stage of advancement would, prospectively, be denied to it, in any other branch of science, however far it may yet have reached. Or, it is next to uphold, that the phenomena of disease are the fortuitous and fantastic arrangements of disorganised matter; and that they only become proper objects of attention, when they are palpably elicited on

our frames. The study of medicine has, however, long since aspired above this gross and impressive sphere; and observation has also traced the germs of many diseases, not so much to the infusion of new principles or of new materials, as wide in their natures from those of health, as the diseased and disordered effects are different from the sane phenomena of the body, as to the disturbed and unbalanced state of the very principles and elements, which are the constituents of health.

The Supreme Author of all moral and physical existence has, it seems, permitted disease to be as catenated in its causes and phenomena, as vice is the necessary consequence of the unbalanced state of the passions and sentiments of man. The origin of moral evil is as obscure, as the final causes of the diseases which afflict our species; but that there is a class of principles which govern the permission of the one, and the dispensation of the other, is as clear and consolatory, as that health and virtue are the necessary results of sound principles in body and mind, and will, throughout and eventually, bring their own enjoyment and reward.

THE END.

PRINTED BY J. GARDNER, BOLTON.