cases, I have but little doubt that it would succeed in those of greater extent.

London, 9th March, 1828.

PART II.

I.

I. *The Elements of Physiology.* By FRED. BLUMENBACH, M.D., F.R.S., Professor of Medicine in the University of Gottingen. Translated from the Latin of the Fourth and last Edition, and supplied with copious Notes. By JOHN ELLIOTSON, M.D., Cantab; Fellow of the Royal College of Physicians, &c. &c. Longman and Co., London, 1828.

II. *A Disquisition on the Nature and Properties of Living Animals. With an Inquiry how far our Knowledge of Anatomy and Physiology is Consistent with the Belief of a Soul and a Future State; and on the Intellectual Difference between Man and Brutes.* By GEORGE WARREN, Surgeon, pp. 144. Longman and Co., London, 1828.

BLUMENBACH's Elements of Physiology are so well known to the Profession, as to render it quite unnecessary to give an analysis of them here; but the copious and interesting notes attached to this edition, call for some notice on our part. It is seldom that an opportunity is afforded us of reviewing works on physiology, we therefore hail the present with some degree of pleasure, especially when our remarks have to apply to the production of two such learned and scientific characters as the author and translator of the present volume. However valuable practical experience may be in the treatment of diseases, and however important to the profession and to the public at large, that all the facts connected with particular maladies should be faithfully recorded, still, unless this experience be associated with a knowledge of physiological principles, and unless the facts can be accounted for in a manner compatible with the recognized functions of the different organs, the healing art can never make much progress. Independently of the usefulness of the study of physiology as regards medicine, there is perhaps no science capable of affording the student more real pleasure, or of adapting his mind for forming more liberal ideas of human nature. Astronomy, adorned with all her sublimity, can elevate his views no higher than the stars of heaven; but physiology, although confined within a more limited boundary, leads him, nevertheless, to examine the attributes of a power associated with the nature of man, whose flights frequently extend beyond the range described by the eye of the astronomer. The properties of the human mind come as much within the range of physiology as those of the body; and he alone who understands the relative situations and the functions of the various organs constituting the animal machine, can expect to add any thing useful to the science of moral philosophy.

Every physiologist finds it necessary to take into consideration the properties of LIFE before he can proceed with his subject, but it is curious to notice the different views which authors appear to hold respecting the causes which give rise to vital phenomena. It is unnecessary to inquire at present into the different opinions which have been entertained by philosophers at different ages relative to the nature of life, or to the powers which have been more particularly attributed to it under the different appellations which it has received. It is sufficient to notice, for our present purpose, that all those who have treated of life, under whatever appellation, may be ranked in one or other of the three following classes: *first*, those who have considered life specially to consist in the function of each organ, and, generally, in the sum total of all the functions; *second*, those who have maintained that life consists in some subtle, mobile fluid, or other principle pervading the whole system, and directing the operation of every organ; *third*, life has been considered by another class as a mere *power*, either emanating immediately from the Deity, or presiding in some other inexplicable manner over the functions of the various seats. The definitions of life under these forms have been further variously modified and reduced into diverse orders. Many of those who confound life with the organic functions do not attempt to explain in what manner, or by what power, these functions are carried on. They rest contented with attributing the operation to some secret powers, either connected with the chemical combinations of the materials which constitute the structure, or to some other hidden properties not worth inquiring into. "The essential nature of life," says Dr. Elliotson, "is an impenetrable mystery, and no more a subject for philosophical inquiry, than the essential nature of attraction or of heat." We may also say, that the *essential nature* of oxygen, is a mystery quite as impenetrable as that of life. The essential nature of light, electricity, carbonate of lime, and of all the most subtle, as well as the grossest forms of matter, is equally as mysterious; but do the *properties* of these substances, for all that, become less a subject

for philosophical inquiry? If life consists of a subtle fluid pervading the structure, let us inquire what the properties of this fluid are; how it acts in the formation of the different tissues; by what kind of properties it promotes the growth and nutrition of these tissues; how its modifications differ in the different organs, so as to adapt each for a particular function; what is the nature of the changes which take place in it while under the influence of disease; whether it be liable to a change of form, like other modifications of matter; and, lastly, what are the properties which render it liable to decay, and to cease to exist as a vital agent? These inquiries do not relate to the *essential nature* of life: they relate to properties, which, if such a thing as life exist, are essentially connected with it; and these properties, although merely objects of inference, come as much within the range of philosophical inquiry, as those of oxygen, carbon, electricity, or any other form of existence. Again, if life be a mere nominal effect, depending upon causes connected with the chemical combinations of the gross materials of which the textures are composed, let us inquire what the peculiarity of these combinations are in the different tissues; in what way they are affected by disease; in what way they contribute to the growth, nutrition, and the preservation of identity of the different organs; what way their forces become weakened in old age, and, ultimately, destroyed in death? Whatever view we take of the nature of life, there are numerous inquiries suggested concerning its properties besides those which are applicable to its phenomena, manifested in the performance of the animal functions.

It is curious to notice the inconsistency of the arguments of those who maintain that life has only a nominal existence. Dr. Elliotson says, that "the *organic functions* depend on *life*, in the proper acceptation of the word. The word life, should be regarded, like the word attraction, or repulsion, as merely an expression of a fact. In this point of view, it may be as easily defined as any other expression. By life, we *generally* mean the *power* of *organised* matter, to preserve its particles in such chemical relations, as to prevent other chemical relations from inducing disorganisation; or even to increase or decrease by internal appropriation and separation; to produce peculiar matters for its own purposes, &c." So the organic functions depend on *life;* life depends upon a certain *power*, which power depends upon *organised matter*. We will ask, where is the organised matter to be found on which the life of an egg depends? There must be some power here, to draw together the organic particles, in order to form the organised matter. Upon what does this power

depend? Does it not depend on life? If not, upon what else? for there is here no organised matter. Let us propose the same questions respecting the human ovum. What gives a certain quantity of fluid, secreted in the ovaria and testes, the peculiar property of developing a heart, a liver, a brain, muscles, intestines, &c.? There is here also no organised matter, but are these effects not dependent on life? Can any organic function be pointed out where vital properties are more clearly manifested than in the organic formation of the structure? yet this process, as in the ova of birds, as well as in the human ovum, is carried on independently of any *organised* matter, further than that, in the latter, this modification of matter conveys materials for some other power to act upon. It would be absurd to maintain that an egg, from which, by the mere application of a certain degree of caloric, a chick may be produced, does not possess life; and it is for those who attribute life to the inherent properties connected with the chemical combinations of the structure, to show how a substance, possessing nothing resembling organisation, can preserve its life, and by what sort of process this structure is converted into organised matter, according to their view of vitality. We do not deny that life acts by means of properties analagous to those which govern the affinities of tangible matter; but that there is, in living substances a principle *not depending on* the organised form of these substances, yet *connected with* the structure, when arranged, appears to us quite positive, so far as inference can render any thing positive; because the structure upon which life is said to depend, could never be originally formed without such a principle. By principle, we here mean a particular modification of matter, possessing properties peculiar to itself; like every other modification. We do not inquire into the "essential nature" of this modification more than into that of matter in a visible and tangible form, in our chemical researches; for such an inquiry would be useless, inasmuch as we know no more what the essential nature of matter is in one form than in another. Its properties constitute our only subject of examination, and we find these different in each modification or form. In one form, it presents all the characters of muscular fibre; in another, it exhibits those of cerebral substance; but neither of these will indicate any thing like vital properties, although to all appearances perfect in condition, without the addition of another modification, possessing properties different from any of those essentially connected with matter arranged in the form of these tissues.

It appears extraordinary at first view, that none of those who argue in favour of life being a part and parcel of the structure, or

dependent on this structure, attempt to explain the manner in which the structure itself is produced; but when we consider that to account for its production would be impossible, unless it be admitted *that a thing can produce itself*, our wonder ceases that this part of the business of life is passed over unnoticed by these physiologists. Dr. Elliotson observes, that "by attributing life, the power of attraction, &c., to subtle and mobile fluids, we not only do not advance a single step, for we have still to explain what these fluids are, and how *they* obtain *their* powers, just as we had before in regard to common matter; but we make the additional mysteries of their being united with ordinary matter, and so united, that life appears a power possessed by *it*." Now the first remark which we shall make on this passage, is, that no analogy can be traced between *life* and *attraction*. Attraction is a property connected with matter universally, in every state or condition; whereas life is associated with it in very few conditions. Attraction is never lost when matter changes its form from one state to another, but bodies endued with life lose their vital properties frequently even before they change their form. With regard to "what these fluids are, and how *they* obtain *their* powers," the question is easily settled. Respecting what they are, it is enough to say, that they are modifications of matter; and they obtain their *powers* from their properties, like every other modification of it. As these properties are peculiar to these forms, their *powers* must, of course, be also peculiar. Whence does oxygen, carbon, and all other substances obtain their powers but from their properties? and the properties of each of these are as peculiar to it, as those of the fluids in question are to these fluids, if they may be called by that term. By ordinary matter is, we suppose, meant gross or tangible forms of matter. If this be the case, we make no mystery by supposing a more subtle form of it to become united with grosser forms. We find an analogy to this in the union of the electric fluid with different bodies. The phenomena which these bodies manifest in the electrified state is never attributed to any properties inherent in the bodies themselves, because they are known not to possess such properties in their natural state. In the same way, any properties which the structure is found to possess when not in alliance with life, are inherent in it, and belong to it; but if, by the addition of life, it can do that which it could not before, the properties which enable it to do so are attributable to life, and not to the structure itself. As for life, by its union with ordinary matter appearing a power possessed by this matter, we have only to remark that electricity, in the same manner, when

united to bodies, *appears* as if a property inherent in these bodies; but we are not to take this *appearance* as a sufficient test of their being so, because it can be demonstrated, in another way, that they are not. If it be asked what advantage we gain by admitting that life consists in a principle *sui generis*, we reply, that we gain the advantage of being able to account for the formation of the structure, for its growth, nutrition, and the reproduction of some parts of it; for the phenomena of disease, and for death, produced under various circumstances, when the structure appears to retain all its integrity. We shall not stop at present to shew these advantages to be real, but some remarks upon this part of the subject may be referred to in the late Numbers of this Journal.

We fully agree with the learned translator of this volume, in the following opinion: "That fluids, as well as solids, are susceptible of life, I cannot doubt. There is no reason why they should not be so, although a person who has not thought upon the subject may be as unable to conceive the circumstance, as a West Indian to conceive that water may, by cold, become solid. It is impossible to deny that the male or female, or both, or united, genital fluids are alive, because, from their union, or the one influenced by the other, a living being is produced, which partakes of the vital qualities of each parent." We say that we fully agree with Dr. Elliotson in the above opinion, but how he can reconcile this remark with that part wherein he says that life is nothing more than the power of organised matter to preserve its particles in chemical relations, &c., we cannot tell; for nothing like organisation exists in the fluids; yet were there no vital properties evolved in union with the seminal fluid, where are they to come from to the embryo? There is no resemblance between the seminal fluid and muscular fibres, yet each possesses life, which they could hardly be supposed to do if life depended upon the chemical combination of the structural materials. There is as little resemblance between the texture of the brain and that of vegetables. In the chemical world we never find substances so dissimilar in their internal characters possess properties so analogous as those of living beings of every description. We are not going one link further than is necessary, in attributing life to some other principle than the organised structure, for as this structure cannot produce itself, something else must produce it; and this something, which must necessarily be different from the structure, we infer to be life. We, moreover, infer this to be a principle or modification of matter, possessing properties peculiar to itself, by means of which it is capable, pro-

bably by affinity, of arranging materials into the form of organised tissues, and of producing, in union with these tissues, all those phenomena observable in living beings.

According to this view of the properties of life we may account for all the phenomena manifested by it; the different tissues must be regarded as depending upon the union of vital and material properties. Every organ is made up of tissues possessing separately very different properties, but all these contribute to produce one effect. The phenomena of nature universally, so far as our knowledge extends, are carried on under the influence of opposing forces, and the functions of living objects appear to form no exception to this rule. If we take the function of secretion as an example, we find the necessity for a particular form of structure for the production of each fluid; for nervous influence; for blood; absorbent vessels, &c., the properties of each of which are very dissimilar from those of any of the others, yet, by their union, they tend to bring about one determinate end.

A particular phenomenon connected with the function of life, is *sympathy*. No satisfactory doctrine of sympathy has been as yet promulgated, for although this phenomenon has generally been traced through the medium of the nerves, yet it frequently subsists between parts not immediately connected by nervous communication. As an instance of this, we may notice titilation of the nose producing sneezing, by calling the diaphragm into action; the translation of gout from the toe to the stomach, or to the cerebral membranes, may be also noticed as an example. In fact, sympathy can neither be traced to nervous communication nor to continuity of surface in many cases; it must, therefore, be sought for in some other powers associated with living parts. Before we can point out these powers we must refer to what has been advanced above, and in former numbers of this Journal, but in order to render these remarks understood, it may be here noticed that life is considered a heterogeneous principle, differing in modification in every tissue, having, consequently, different properties in each, and that upon this heterogeneity depends the different forms of structure of which the body is composed. It is obvious that tissues which are most nearly allied in structure, are endued with most analagous properties, and it is between such tissue that we most commonly observe the phenomena of sympathy take place. We may mention as examples, the metastasis of rheumatism from one joint to another; of gout; of affections of the mucous and serous membranes of distant seats sympathizing with each other, and partaking of the same disease. This may be accounted for upon the principle that similar properties have

similar affinities, and that they are, consequently, liable to be acted upon in the animal-system by similar causes. Whether these causes derive their source from the outward world, or from operations going on internally, and changing, by a chain of causes and effects, those relations naturally subsisting between the different tissues, or between life and structure, and thereby giving origin to a new form of matter, capable of acting further, by a similar process, as a morbific cause to particular forms of tissue. Blumenbach notices this sympathy dependent on *analogy of structure and function*, but he does not attempt to explain the cause of it. Although, as he observes, "the primary and most extensive cause of sympathy must be referred to the *nerves*, and indeed chiefly to the *sensorial reaction*," still numerous instances present themselves where the phenomenon cannot be attributed to this cause; where the sympathy subsists between seats having no nervous connexion, except through the medium of the nervous centre, and where, often, there is no reason to infer this centre to exert any influence in producing it.

Dr. Copland, in his interesting notes to the last edition of Richerand's Physiology, divides sympathies into the *reflex* and *direct*, the former being chiefly referrible to the cerebral nerves and to the reaction of the sensorium, and the latter to the ganglial system of nerves. No classification will, perhaps, appear more correct than this, when we consider the difference of function which these two systems of nerves have to perform—that the former presides over the animal functions, and that the latter governs the operations of life in the organic department. From the intimate relation of the two sets of nerves, we frequently observe instances where the sympathy partakes partly of the character of the *reflex* and partly of the *direct*, and this is more particularly the case in that modification of sympathy depending on morbid action.

Bichât divides the properties of the living body into *sensibility* and *contractility*, and each of these is subdivided into *animal* and *organic*. Animal sensibility is accompanied, or rather followed, by mental perception; and animal contractility is the result of this perception, conveyed by the act of volition to the voluntary muscles. Organic sensibility is attended by no perception, and is followed by contraction quite independent of the will. When the definition of a term is given it can lead to no misunderstanding, otherwise that of *organic sensibility* does not appear to us quite expressive of the cause which gives rise to contraction in parts not under the influence of the will. The action of the heart,

which is generally adduced as an instance of contraction, dependent on organic sensibility, caused by the stimulus of the blood, is, perhaps, as bad an example as could be produced, inasmuch as this organ will continue to act when not a drop of blood exists in it. The heart will be found to contract and dilate its cavities for some minutes after being totally removed from the body; its action cannot, therefore, be attributed to the *sensibility* of any impression made upon it. It, in fact, takes place from inherent properties connected with the life and structure of the organ itself, independently of the presence and impression of the blood on the lining of its cavities. How far all the other involuntary organs will contract from inherent properties is a question which we are not fully capable of answering, but that some parts of the intestinal tube, particularly the rectum, will do so, we have had opportunities of witnessing. Before a part can be said to act from sensibility, it is necessary that it should receive the impression of some cause which it is to be sensible of, for it cannot shew itself *positively* sensible of *nothing*. We have, perhaps, no term that will strictly express the cause of contraction in these *self-acting* tissues, unless *irritability* will do so, but the idea here must not be associated with that of the properties of disease. Dr. Elliotson uses the term *excitability*, but this is liable to the same objections as sensibility with regard to the properties of the involuntary organs, for although these organs are *excitable*, still they will contract without being *excited* by any evident cause.

Organic functions are common to all living beings, and may be traced down from man to the most simple form of vegetable life. It may be asked, how far these functions are necessarily dependent on nervous influence? Dr. Copland, in the notes already referred to, attributes all the properties manifested by the organic life to the influence of the ganglial or great sympathetic system of nerves. This system, in the higher order of animals, combines with the cerebro-spinal, and is distributed to every part of the body; but he considers more particularly that nervous filaments proceed from the cardiac plexus, and follow the course of the arteries to their very extremities, forming a kind of sheath round these vessels, and imparting vital properties to them, as well as to the blood itself moving through them. This view will appear more correct when we consider that, as we descend in the scale of animated beings, the cerebral and cerebro-spinal nerves become gradually less perfect, and that in the lowest order these nerves are altogether wanting, whereas the ganglial are found to exist either in filaments, or in nervous globules, from the highest to the lowest degree

of vital perfection. An objection might be raised here, because vegetables, although endowed with life, still possess no ganglial or other nerves. But such an objection will be found invalid when we consider that life must be viewed according to the class of beings with which it is allied. The properties of organic life may be allied with the ganglial nerves in beings supplied with these nerves, and although vegetables are devoid of nervous filaments, still analogous properties may be here more generally and homogeneously diffused throughout the textures of the body. In like manner, the procreative function is carried on in the higher orders of animals by means of certain organs, namely, the testes and ovaria; whereas, in lower grades, properties destined to produce a similar end, are generally distributed through the system, and the embryo grows from the surface of the parent, or the parent itself, when divided, will multiply itself into almost any number of animals, each enjoying the same perfection and integrity of parts as the original. Again, in animals devoid of kidneys, the blood undergoes as perfect a depurration as in those that possess these organs, although the latter would soon cease to live if deprived of them. In fact, life appears so differently modified in different classes of living beings, as well as in the various tissues belonging to each class, as to confer properties belonging essentially to one organ, or one system of organs, in one class, on the textures generally, or on some particular tissues of which these textures are composed, in another class.

Admitting, however, the ganglial nerves to preside over the functions of organic life, still we cannot admit that they are the only, or the primary source of life. Neither the seminal fluid nor the secretion of the ovarian cells can possess any thing like nervous arrangement, yet these fluids, by properties resulting from their union, are capable of forming this arrangement, as well as that of the other textures. That they are not the only source of life is probable from the circumstance that parts which are scantily supplied by them are as much alive as parts which receive a more liberal quantity of their influence. The life of the brain cannot be denied, yet it is supplied with no ganglial nerves. The ganglial nerves appear to bear the same relation to the automatic organs as the cerebro-spinal bear to the voluntary organs. They form with them a cause capable of producing a certain effect, which consists in the organic movements; in the same manner as the other nerves contribute to bring about voluntary movement in their relation to muscular fibres. Each set is endowed with vital properties peculiar to itself, for the reason that any other proper-

ties, in relation to the same modification of structure, could no more produce that effect, than *four* and *two* could produce *seven*, or any other odd number. But, if the structure be different in relation to properties also different, it may tend to produce the very same effect, in the same way as *five* and *three* will make eight, as well as *four* and *four*.

We shall now proceed to consider the animal functions more particularly, and these lead us to the moral department of our nature. To these we owe the sources of all our pains and pleasures, and all our social relations with the external world. By means of these functions the eye associates with colour, the ear with sound, the tongue with those properties of bodies which constitute taste, and the same with the other senses. This power of the senses, of forming relations with the external world, Bichât calls *animal sensibility*. The power of the brain, by which it takes cognizance of this relation, may be termed *perceptibility*. It is doubtful how far what Bichât calls animal sensibility does actually exist. We have no proof of its existence; we have no proof that light affects the optic nerve, or that sound affects the auditory nerve, independently of the brain. If either of these nerves be divided, the organ of sense which it supplies shows no longer any sensibility, though the natural stimulus be applied to it. Preternatural stimuli, such as the galvanic fluid, will, however, excite the cerebro-spinal nerves when their continuity with the brain is destroyed; but the nerves which are affected here are probably those of motion only. Query, will the galvanic fluid run from the extremities of the nerves *towards* the brain, as well as in a direction *from* the brain towards the extremities of the nerves? After death, when the muscles still manifest properties of contractility under the influence of the galvanic fluid, will the galvanic current flow in the contrary direction, and excite the *perceptible* properties of the brain? If it can do this, why does not the brain, like the muscles under such circumstances, perform its function, and display the phenomena of thought and volition, if it be the natural function of this organ to do so? Mr. Warren, the author of one of the works whose titles stand at the head of this article, states that—

"In parts endued with sensibility, the nerves are pervaded by electric fluid, and the circulating blood does excite to action this fluid at the extremities of the nerves, and thereby occasions an electric vibration throughout the whole course, up to that part of the brain or spinal marrow in which is seated the perceiving power. Such a state constitutes sensibility, for any further impression falling upon the part occasions a sufficient further motion, to impress upon the perceptibility of the animal a sensitive idea. It is to be understood that the nerves are conductors of vibrations, and not that they do themselves actually vibrate.

"In support, it is to be observed, that experiment proves the nerves to be conductors of electricity, and they are enveloped in a condensed membranous coat, which is a non-conductor of electricity; so far the natural arrangement appears conformable to the proposed truth. The next question which naturally arises is, whether an electric shock be capable of producing that variety of sensation which the animal is capable of experiencing. Here the proposition has the required support, since an electric shock passed through the skin, gives the sensation of an impression of contact through the eye of light, through the ear of sound, through the tongue of taste, and through the nostril of smell."

If we can find no stronger proof in support of the opinion that sensation is dependent on electricity, than that it gives a sensation of contact when the shock is passed through the skin, of light through the eye, &c., we may say, with the same degree of propriety, that a *piece of rotten wood* is a conductor of sensation, for it has all these properties in relation to our senses. If electricity be the conductor of sensation (we mean the *immediate* conductor, by its motion through the nerves,) how is it that the sensation conveyed through the different organs produces such a different impression on the brain? We are not aware that there exists more than *one* modification of the electric fluid, and if this be the case, we can see no reason, according to this electric theory, why the olfactory nerve should not be as susceptible of colour as the optic, or why the optic should not convey sound to the brain as well as the auditory; or why sound should not excite the electricity of the nerve of taste as well as it does the nerve of the seventh pair. We can no more comprehend how the nerves can conduct vibrations without vibrating themselves; for something must vibrate before there can be a vibration, and if the nerves do not vibrate what is it that does?

We shall find the sum total of Mr. Warren's arguments in the following paragraph:—

"'The opinions afforded by the foregoing reasoning are—that in every living animal there are certain faculties or attributes, to which, when considered abstractedly, may be appropriated the term 'anima' or 'soul'—that life consists of a relation between *such attributes* and the physical *laws* of the material world—that the body is the medium or instrument by which such relation is accomplished—that sensibility, muscular contractility, the organic movements, and animal combinations, depend upon the agency of electric fluid—*that the ulterior use of food-taking is the supply of electric fluid*—that the rapid circulation in animals is always in accordance with their degree of sensibility—that in the operation between the arterial and nervous systems, as well as in muscular

contraction and organic movements, heat is evolved—*and that the use of the lungs is to cool the body.*"

Mr. Warren does not attempt to account for the formation and growth of the structure. As the use of the food, according to his view, is the production of electricity merely, which is to act as the medium of relation between the soul and the material world, we suppose that the body derives its growth solely from the *air* which it inhales, for we know of no other materials than air or food which it can convert into that purpose. If electricity is life, as Mr. Warren and many others maintain, why, in the name of fortune, should we ever die, when we have the means of supplying ourselves to our heart's content with this principle? He who identifies electricity with life must be a very narrow-minded philosopher indeed. Because, forsooth, electricity can excite the muscles into action, and can substitute the properties of life in one or two more things, electricity must, therefore, be life; or, which is the same thing, life must be electricity. We may as well assert that spirits of wine, because it finds its level, is limpid, will moisten substances, &c., is absolutely nothing more nor less than water, for does water not possess the very same properties? Electricity is life, because it appears in the form of light to the eye; so does fire the same; electricity is life because it imparts the sense of sound to the ear, so will also the collision of two bits of iron; electricity is life, because it gives an impression of taste to the tongue; so will citric acid; it is life because the nose can smell it; so it can a rose; it produces a sense of contact with the skin—will not every other substance do the same thing? and, as we said before, are not all these properties found connected with rotten wood, or rotten fish? But it is said that electricity excites the muscles into action; will not a bit of salt, or the prick of a needle do the same thing? Will it keep the body alive, let it be ever so intense, after all the blood is drained from the vessels? Will it keep it alive after the spinal marrow is divided in the neck? because the electric fluid will run through just the same when the two ends are brought into contact. Will it re-establish the relations of the brain with the external world after natural life has become extinct? If electricity cannot do these things, and a great many more, we see no reason to identify it with life. But the most extraordinary property of this electric life is that it becomes extinct when another quantity of the same principle is added to it. The identity of lightning with electricity is universally acknowledged, yet lightning has, somehow, the property of destroying life without inflicting any mechanical violence on the structure. It is rather

strange that it should do this if the two principles be the same. The volume or sum total of any other substance increases according to the quantity added to it, but it appears to be quite the contrary with life in this case. In fact, the absurdities of identifying life with electricity are almost without end, besides that the electric fluid could not, by any known property connected with it, build up the various tissues, and arrange them into their natural and relative situations. It is absurd to suppose that electricity, *or any other homogeneous principle*, could produce such a diversity of effects as are observable in a living body. What resemblance is there between the contraction of a muscle and the secretion of urine? Or between the contraction of the urinary bladder, and sensation, or volition? Electricity, in relation to inanimate bodies, never manifests such dissimilar properties, however dissimilar those of the bodies themselves may be.

The organs of the animal functions, like those of the organic functions, must possess, each, vital properties peculiar to itself—properties depending upon a certain modification of vital principle. The terms *organic* and *animal*, can only be considered in a relative sense; for the life of the brain, or of the cerebral nerves, is as much organic to these tissues, as those of the liver are to that organ, or those of the glanglial nerves are to those nerves. The brain is preserved, nourished, and the corpuscules of which it is made up, are renewed under the influence of its own peculiar modification of life, in the same way as the heart, kidney, or any other organ is by a different modification; in a similar way, also, its functions are performed by the united properties of this form of life, and those of the cerebral mass, whose particles have been previously arranged by the affinities of the former properties. The life of all the organs act by analogous, but not identical, properties. That of the nerves of sense is adapted for sensation, and even here life is modified according to the kind of impression which the organ is intended to receive, for we know that the olfactory nerve has no relation to light, nor has the auditory any relation to odours.

Having offered these remarks, we shall now inquire into the office of life in relation to the brain, and we cannot explain our views more clearly than in Dr. Elliotson's own words.

"The animal functions demonstrate mind. This is seated in the brain, to which the spinal marrow, nerves, and voluntary muscles are subservient. Mind is the functional power of the living brain. As I cannot conceive life any more than the power of attraction, unless possessed by matter, so I cannot conceive mind unless possessed by a brain, or by some nervous organ, whatever name we may choose to give it, endowed with life.

I speak of terrestrial or animal mind; with angelic and divine nature we have nothing to do, and of them we know, in the same respects, nothing. To call the human mind positively a ray of the divinity, (*Divinæ particula auræ, Ex ipso Deo decerptus, Ex universa mente delibatus*) appears to me absolute nonsense. Brutes are as really endowed with mind—with a consciousness of personality, with feelings, desire, and will, as man. Every child is conscious that it thinks with its head, and common language designates this part as the seat of mind. Observation shows that superiority of mind in the animal creation is exactly commensurate with superiority of brain; that activity of mind and of brain are coequal; and that as long as the brain is endowed with life, and remains uninjured, it, like all other organs, can perform its functions, and mind continues; but, as in all other organs, when its life ceases, its power to perform its function ceases, and the mind ceases; when disease or mechanical injury affects it, the mind is affected—inflammation of the stomach causes vomiting, of the brain, delirium; a blow upon the loins causes nephritis or hæmaturia; a blow upon the head stuns; if originally constituted defective, the mind is defective; if fully devoloped and properly acted upon, the mind is vigorous; accordingly as it varies with age, in quality and bulk, is the mind also varied—the mind of the child is weak and very excitable; of the adult vigorous and firm; and of the old man weak and dull, exactly like the body; and the character of the mind of an individual agrees with the character of his body, being equally excitable, languid, or torpid, evidently because the brain is of the same character as the rest of the body to which it belongs:—the female mind exceeds the male in excitability as much as her body; the qualities of the mind are also hereditary, which they could not be, unless they were, like our other qualities, corporeal conditions; and the mind is often disordered upon the disappearance of a bodily complaint, just as other organs, besides the brain, are affected under similar circumstances. The retrocession of an eruption may affect the lungs, causing asthma, the bowels, causing enteritis, or the brain, causing insanity;—phthisis and insanity sometimes alternate with each other, just like affections of other organs; the laws of the mind are precisely those of the functions of all other organs; — a certain degree of excitement strengthens it, too much exhausts it, physical agents affect it, and some specifically, as is the case with other functions, for example, narcotics. The argument of Bishop Butler, that the soul is immortal and independent of matter, because in fatal diseases the mind often remains vigorous to the last, is perfectly groundless, for any function will remain vigorous to the last, if the organ which performs it is not the seat of the disease, nor much connected by sympathy, or in other modes, with the organ which is the seat of the disease;—the stomach often calls regularly for food and digests it vigorously, while the lungs are almost completely consumed by ulceration. All the cases that are adduced to prove the little dependence of the mind upon the brain, are adduced in opposition to the myriads of others that daily occur in the usual

course of nature, and are evidently regarded as extraordinary by those who bring them forward. An exact parallel to each, may be found in the affections of every other organ, and each admits of so easy an explanation that it may be always truly said 'Exceptio probat regulam.'"

It will be said that the above passage savours strongly of materialism. The object of every rational being ought to be to arrive at truth, without any regard to popular opinion or prejudice. If the physical facts are as stated, all the cry of materialism in the world cannot alter them. They only show that, as the Deity is omnipotent, he can display his power through the medium of matter as well as through that of spiritual existence. If any one rests his hope of a future existence solely on the belief that the mind is immortal, he perhaps places it upon an insecure foundation. If the ground pointed out by Dr. Elliotson in the following passage is not safe enough to support our belief, we fear that we cannot have a safer shown us, either from scripture, or from the power of reason.

"In contending that the mind is a power of the living brain, and the exercise of it the functions of that organ, I contend for merely a physical fact, and no Christian who has just conceptions of the Author of Nature will hesitate to look boldly at Nature as she is, lest he should discover facts opposite to the pronunciations of his revelation; for the word and the works of the Almighty cannot contradict each other. Lord Bacon accordingly, in a very memorable part of his writings, directs the physical inquirer to be uninfluenced by religious opinions, as the more independently truth is pursued, the sooner will it be gained; and the sooner will the real meaning of the divine statement of natural things, and the conformity of this to physical fact, be established.

"The assertion, however, that the mind is a power of the living brain, is not an assertion that it is material, for a power or property of matter cannot be matter.

"Neither is it an assertion that this power cannot be a something immortal, subtle, immaterial, diffused through and connected with the brain. A physical inquirer has to do with only what he observes. He finds this power, but attempts not to explain it. He simply says the living brain has this power, medullary matter though it be. Seeing that the brain thinks, and feels, and wills, as clearly as that the liver has the power of producing bile, and does produce it, and a salt the power of assuming a certain form, and does crystallize, he leaves others at liberty to fancy an hypothesis of its power being a subtle, immaterial, immortal substance, exactly as they fancy life to be subtle fluid, or, perhaps, though very extraordinarily, the same subtle fluid (if subtlety is immateriality and immortality), elucidating the subject no more than in the case of life, and equally increasing the number of its difficulties; as though we were not *created* beings or not altogether ignorant what matter is, or of what it is capable and incapable; as though matter

exhibited nothing but extension, impenetrability, attraction, and inertness; and as though an Almighty could not, if it seemed good to him, have endowed it, as he most evidently has, with the superaddition of life, and even of feeling and will.

"Nor does this assertion imply that the resurrection from the dead is impossible or even improbable. The physical enquirer finding the mind a power of the brain, and abstaining from hypothesis, must conclude that, in the present order of things, when the brain ceases to live, the power necessarily ceases—that in the language of scripture, dust we are, and unto dust we all return,—that our being is utterly extinguished, and we go back to the insensibility of the earth whence we are taken.' Our consciousness of personality can afford no reason for imagining ourselves immortal and distinct from earth, more than brutes; for this the fly possesses equally with the philosopher about whose head it buzzes. The moral government of the world, the sublime reach of our acuteness, the great improvableness of our characters—

> '———this pleasing hope, this fond desire,
> This longing after immortality,
> ———This secret dread and inward horror
> Of falling into nought,'

have been thought to completely harmonise with a life hereafter, but certainly fall so short of proof, as to have left the wisest of antiquity — Solomon, Socrates, Cicero, &c. — in uncertainty, when they saw how death reduces us to our pristine elements. The hope of immortality inspired by such reflections, assisted by the desire of explaining every thing in some way or other, first, I apprehend, made men attempt to find, in the imagined ethereal essence of the soul, a reason for our not totally perishing as our senses would lead us to suppose. But, because we refuse to listen to a mere hypothesis respecting spirit, we are not *necessarily* to deny the resurrection. For if a divine revelation pronounce that there shall be *another order of things* in which the mind shall exist again, we ought firmly to believe it, because neither our experience nor our reason can inform us what will be hereafter, and we must be senseless to start objections on a point beyond the penetration of our faculties. The scripture so pronounces, — not that we are naturally immortal, but that 'in Adam (by nature) all die, — have our being utterly extinguished, and in another order of things—when the fashion of this world shall have passed away and time shall be no more, that in Christ (by the free, additional, gift of God, granted through the obedience of Christ, but, consequently, *by a miracle*, not by our nature,)— we shall all again be made alive. St. Paul declares the resurrection to be a '*mystery*:' it must in truth be a *miracle*, and therefore the enquiry 'how can these things be,' altogether fruitless. The miracle of Christ's resurrection, to which the scriptures refer us as the foundation of the hope of a future state, would not have been necessary to convince us of a necessary truth, discoverable by sense and reason. That the promises of the New Testament are the proper and only foundation of our hopes of immortality

was the opinion of the late Regius Professor of Divinity in the University of Cambridge, whose powerful intellect and sincere love of truth render his opinions weightier than the decrees o councils. "I have no hope of a future existence," says he, "except that which is grounded on the truth of Christianity." While those are wrong who think there can be any thing like an argument against a future life in another order of things, if declared by a revelation, it is strange that others shou'd think it necessary to attempt rendering the pronunciations of scripture more probable, and that by an hypothesis, which is at best but the remains of unenlightened times, and should require any assurance besides that of the gospel, which they read, "has brought life and immortality to light." They should reflect that the belief of an immaterial substance removes no imagined difficulty, as it is the peculiar doctrine of scripture, in distinction to that of all the heathen philosophers and people, that the resurrection will be positively of *body*—that in our *flesh* we shall see God, and that therefore our minds must appear as much a property of body hereafter as at present.

"Thus only, the christian doctrine of a future state is reasonable. The heathen doctrine was grounded on the supposed inherent immortality of a supposed substance distinct from the body. The christian doctrine teaches the resurrection of what we obviously are—bodies, and that through a miracle of the Almighty."

Blumenbach classifies the faculties of the mind into *perception*, *attention*, *memory*, *imagination*, *abstraction*, *judgment*, and *reason*, in the first or *intellectual* order. There is another order relating to *appetency*. This consists of *desire*, *aversion*, and *volition*. This is, perhaps, as imperfect an arrangement as could well be contrived. Dr. Copland gives a more extended arrangement in the notes already mentioned. This contains all the mental faculties as they are manifested in their compound form, but as the classification is founded upon purely metaphysical principles, if the brain be really the organ of the mind, it is liable to all the objections applicable to similar arrangements. Whether the phrenological *system* of Drs. Gall and Spurzheim be perfect or not, it appears to us that the *principle* on which their doctrines rests, is the only one founded on nature, as relates to the faculties of the mind; for unless these faculties can be traced to some *physical* organ, it is not likely that their seat can ever be discovered by *metaphysical* researches. So much has been said on this subject, as to render it fruitless to attempt to adduce any new argument either in favour or against the doctrine. Its truth or fallacy must be decided by facts alone; and so far as these have been hitherto adduced, every one divested of prejudice, and who takes the trouble to examine them, must confess that they tend to confirm the truth of it. Dr. Elliotson has

given a long note in favour of the phrenological classification of the mental faculties, and he shows that the experiments of Majendie, Fontana, Fleurens, Rolando, and others, do not tend to invalidate that arrangement.

We shall next proceed to the doctor's notes on the motion of the blood, and here the principal subject of discussion is the thoracic vacuum, so much insisted on by Dr. Carson, of Liverpool, and several other physiologists. Dr. Carson, supposing that the weight of the blood, the length of its course, the various obstacles from angles, friction, &c., with which it meets in the vessels, renders it necessary that some other power than that of the left ventricle of the heart should assist in the circulation; has assigned that power to a vacuum which he supposes to take place in the chest during inspiration. As a further assistance still, there is, moreover, a vacuum supposed to take place in the cavities of the organ itself during each diastole. It is useless to build any theory upon a suppositious fact, when that fact can be either proved or disproved by a simple experiment. To show that the propelling power of the left ventricle, or, at least, some power situated between the left auricle and the right auricle, in the line of circulation, *is sufficient* to carry the blood round to the latter cavity, *without any suction power* to attract it in this direction, let a ligature be placed round the root of the inferior cava, close to the heart; then let an incision be made into the vessel, close to that ligature, on the further side of it from the heart, and it will be seen that the blood will not only run out by the force from behind, but it will be thrown to some distance from the orifice. This will happen let the animal be held in any position we like. This experiment we have several times performed on rabbits, and we never noticed any lack of *vis a tergo* to make the animal bleed to death in a few seconds. This fact, alone, proves that there is no *necessity* for a suction power to carry the blood round, which is one step towards proving that such a power does not act on it, for nature seldom does things in vain. In the next place, is there a vacuum produced by the expansion of the right auricle? and if there be, can it have any influence on the blood in the veins? Before the first question can be answered, it is requisite to decide whether or not the auricle *dilates itself*, or is *dilated* by the blood being driven into it? We must keep in mind that the right auricle is scarcely any thing more than a membranous receptacle, or sinus, possessing but few muscular fibres. Admitting, therefore, that it expands by the elasticity of this structure, (which is the only inherent power of dilation that it can possess, for there is no mechanical contrivance connected with it for that purpose,) the force with

which such a structure could do so, would be very trifling; not enough, indeed, to overcome the pressure of the atmosphere on it communicated through the lungs and diaphragm; for it must be remembered that the auricle expands during expiration, when it is acknowledged that no vacuum exists in the thorax. Now, we have frequently taken hold of the heart during its regular action, at least, as regular as it could act immediately after opening the chest, and from the very small degree of pressure exerted by the *ventricles* even against the hand, we are fully satisfied that the dilating force is next thing to nothing. It amounts to no more than a mere relaxation of the fibres, caused by the elasticity of the structure, after this elasticity has been reduced below its medium, by the vital contractility of the muscular fibres. If the dilating force of the ventricles is so small in degree, that of the auricles must be, at any rate, ten, if not twenty times, smaller, if we may infer from the quality and thinness of their walls. Indeed, when the auricle dilates, it hardly produces a *sensible* pressure against the hand, when no blood is allowed to flow into it, as when the two cavæ have been secured by ligatures; still it has enough force to dilate a little, but not nearly to the extent that it expands, or rather is expanded, when the blood is allowed to flow regularly through it. When a ligature is tied round the vena cava inferior, close to the heart, the force from behind is sufficient to dilate the vessel below that ligature very considerably beyond its common diameter, and as the right auricle partakes a good deal of the qualities of veins, the same force will expand that cavity much beyond the point it can attain by its own inherent power of dilatation when void of blood. Any one, who will take the trouble to do so, may satisfy himself of the truth of these facts, and few experiments are less complicated, or attended with less difficulty.

It would appear then, that the suction power of the right auricle, if anything, is next to nothing, and that the blood will flow into that cavity, and would flow beyond it by the mere propelling force of the left ventricle. But it has been said that the *right ventricle* adds to this suction power; for, as maintained, the right ventricle, in dilating, forms a vacuum, and draws the blood from the auricle; consequently the column from the veins follows, and supplies the place of this in the auricle. Those who suppose they can discover this power should consider, that, when the *dilatation* of the *ventricle* takes place, the *auricle contracts*; the column from the veins cannot, therefore, enter the latter cavity while the supposed suction power of the former exists. During the dilatation of the right ventricle, the blood in the cavæ, far from

being drawn into the auricle at this time, regurgitates, from the contraction of this cavity, and produces a regular pulsation in these veins; and here the pulse is sensible to the eye, owing to the highly elastic property of the veins in the transverse direction, whereas it is not visible in the arteries, the root of the aorta excepted. It is doubtful, however, whether this venous pulsation is produced by *regurgitation*, in the strict sense of the word, from the auricle; for the venous diastole is more probably produced by the force from behind propelling the blood towards the auricle at the very instant that this cavity is shut, distending, consequently, the venous trunks a little beyond the medium of their elasticity; and as soon as the systole of the auricle is over, the coats of the venous trunks resume their medium of calibre, and with the assistance of the regular and continued *vis a tergo*, press the column into the auricle, so as to dilate it in the same manner as the veins were dilated the instant before. The auricle at the same time, being now in a relaxed state, the contractile influence having ceased for an instant, has a tendency to expand a little, from the inherent elastic properties connected with its structure.

Now, with respect to the thoracic vacuum. We shall not at present inquire whether or not a vacuum does take place in the chest during inspiration, but will admit the fact, and see what influence it can have over the motion of the blood in the veins. In man, the veins connected with the superior cava would, most of them, during by far the greater part of his life, empty themselves by the force of gravitation, so that very little more power is necessary here, from the left ventricle, than is sufficient to carry the blood to the capillaries. This is certainly done against the force of gravity, but no thoracic vacuum is required to return the blood from this part of the venous system. Such a vacuum, therefore, if it have any effect, is more particularly required by the *inferior* cava and its branches. Now the atmosphere presses in all directions, with a force equal to about fifteen pounds on every square inch. There are very few human bodies whose surface is more than 3,500 square inches. Taking the surface at this measurement, and allowing that 15 pounds presses upon every square inch, the whole weight of atmosphere supported by the body, will be 52,500 pounds. Now the next question is, how many square inches are the whole surface of the air-cells of the lungs equal to? Lieberkühn makes the surface of these cells equal to 1,500 square *feet*, or 216,000 square inches, being nearly *sixty-two* times greater than the surface of the whole body, bearing, therefore, a column of atmosphere weighing sixty-two times greater than the surface of the skin does. Lieberkühn's calculation is, probably, however, considerably exaggerated respecting the extent of surface possessed by the air-cells. When we consider the minuteness of the air-cells, and that they are so numerous as to be able to contain 200 cubic inches, or more, of atmospheric air during inspiration, there is some reason to infer hat their surface is equal to, if not greater than, that of the skin, and that they consequently bear a weight equal to that which presses on the surface of the body. We will allow it to be equal only, but the probability is, that it is greater. Now as soon as a vacuum is formed in the chest, the pressure of the atmosphere on the surface of the air-cells expands these cells *at the very instant* that the ribs are raised, or that the diaphragm descends, and the vacuum is filled up. In fact, we cannot expand the chest without taking in air, for if we close the mouth and nostrils, and attempt to raise the ribs, the diaphragm is pressed up involuntarily by the abdominal muscles, and a vacuum is prevented from taking place. If, as we said before, the quantity of pressure be allowed as equal on the surface of the lungs and on that of the skin, there is still the weight of a column of blood, reaching from the extremities to the heart, to be raised against its own gravity by the pressure on the latter surface. If, therefore, we take the *absolute* pressure on both surfaces to account, the blood in the lower cava must necessarily stand still upon its own gravity, unless moved by some other power. But the fact is, that, although the pressure of the atmosphere be equal to 52,500 pounds on the surface of the body, still, supposing that a *perfect vacuum* did take place in the chest, the propelling pressure of the blood in the cava, where it enters the chest, *will be only as fifteen pounds to the square inch, according to the diameter of the calibre of this vessel;* and as a transverse section of the inferior cava, when quite full, would not present a surface equal to three-fourths of a square inch, a weight here equal to about eleven pounds and a quarter, even in a perfect vacuum, would balance all the pressure of the atmosphere on the surface of the body. But of these eleven pounds and a quarter, we have still to deduct the weight of the column of blood. Let us suppose the body to contain ten pounds of blood, and that it is equally distributed in the arteries and veins. There is generally more in the veins, but we will take it as equal. Out of the five pounds contained in the veins, we will suppose three and a quarter (which, if any thing, is less than the exact proportion) to be in those connected with the *inferior* cava. Now, when these three pounds and a quarter are deducted from the eleven pounds and a quarter, it leaves a balance of eight pounds in

favour of the pressure of the atmosphere against three-fourths of a square inch of *vacuum* (for we still suppose the thorax to be in a state of vacuum). As the pressure of the atmosphere on the surface of the air-cells in the lungs, is equal to fifteen pounds to the square inch, it imparts of course a weight equal to eleven pounds and a quarter to every three-fourths of a square inch. When we now deduct the eight pounds (the weight to which the pressure in the inferior cava is equal) out of these eleven pounds and a quarter, (the weight on equal surface in the lungs) it leaves a balance of three pounds in favour of the pressure in the lungs, over that on the blood in the cava. It follows then, that the vacuum produced in the chest, during inspiration, is filled instantaneously by the pressure of the atmosphere in the lungs, with a force equal to eleven pounds and a quarter, whereas the force with which the pressure on the surface of the body drives the blood towards it, through the vena cava, is only equal to eight. In other words, the proportions are as 3 to 0 in favour of the vacuum being filled by air, rather than by the blood from the veins, even if these vessels did not possess any property of resisting the pressure of the atmosphere by the elasticity of their coats. We have here also only taken the simple *weight* of the column of blood into calculation, whereas its friction against the vessels and the angles, and the counter-streams which the current meets, ought likewise to be taken into account.

Our limits will not permit us to follow this subject further at present, otherwise we could show, both from experiments and from deductions founded on natural laws, that the influence of this vacuum on the motion of the blood in the veins is a thing next to, if not a perfect, nullity. It should be considered in this inquiry, that the blood, like every other fluid, will find its level in the vessels; that, as these vessels adapt their calibre to the quantity they contain, so as to preserve themselves always full, the fluid will rise in the veins to the same height as in the arteries, namely, up to the heart, by the same laws as it does in any other vessels which communicate, or in subterraneous canals; and that, consequently, the force required of the left ventricle to move the blood through the vessels situated *below* the level of the heart, is not necessarily much more than sufficient to overcome the inertia of the column, and the obstruction which its motion meets with from the angles and curves of the passages.

We cannot follow Dr. Elliotson through his very interesting and instructive notes on the chemical changes which take place in the blood in the lungs; on the source of animal heat; on growth, nutrition, absorption, secretion, conception; on the difference of the sexes; on the genital functions, and

numerous other very interesting subjects. His remarks on the varieties of mankind, are also both entertaining and interesting. He considers it probable that all the human race are descendants of two individuals, and that the varieties now observed on different parts of the globe, have been caused by accidental circumstances; by the nature of the soil, climate, food, &c.

"In favour of the opinion that we all are brothers, it may be urged—1. The universal simplicity of Nature's causes would induce us to imagine that, as, if the varieties among us are accidental, two individuals were evidently sufficient for the production of the rest of mankind, no more than two were originally created. Nor should I deduce a contrary presumptive argument from the length of time during which immense portions of the earth must have thus remained unpeopled. One of Nature's objects seems the existence of as much successive life as possible, whether animal or vegetable, throughout the globe. For this purpose, every species of animal and vegetable possesses an unlimited power of propagation, capable of filling the whole world, were opportunity afforded it. The opportunities of exertion are indeed very scanty, compared with the power: climate, soil, situation, may be unfavourable; one vegetable, one animal, stands in the way of another; even the impediments to the increase of some, act through them as impediments to others. The incessant tendency of the power of multiplication to exert itself, seizes every opportunity the moment it is presented, and thus, though every living object has a fixed term of existence, and may be carried off much earlier by innumerable circumstances, all nature constantly teems with life. The slow increase of mankind could not interfere with this apparent object of nature; the deficiency of our race must have invariably been fully compensated by the opportunities which it afforded for the multiplication of other existences: for that man alone was not designed to enjoy the earth, is shown by the vast tracts of land still but thinly peopled. The infinitely rare opportunities afforded for the maturity of the intellectual and moral powers born with every human being, may afford still greater surprise than the extent of country unoccupied by man.

"2. *Analogical and direct facts* lead to a conclusion that none of the differences among mankind are so great as to require the belief of their originality.

"Animated beings have a general tendency to produce offspring resembling themselves, both in mental and corporeal qualities.

> 'Fortes creantur fortibus et bonis;
> Est in juvencis, est in equis patrum
> Virtus: nec imbellem feroces
> Progenerant aquilæ columbam.'

"An exception occasionally occurs, much more frequently, we are told, in the domestic than the wild state,—the offspring differs in some particular from the parents; and by the force of the general tendency transmits to its offspring its own peculiarity.

By selecting such examples, a breed peculiar in colour, figure, the form of some one part, or in some mental quality, may be produced. Thus, by killing all the black individuals which appear among our sheep, and breeding from the white only, our flocks are white; while, by an opposite practice pursued in some countries, they are black: thus a ram accidentally produced on a farm in Connecticut, with elbow-shaped fore-legs, and a great shortness and weakness of joint indeed in all four extremities, was selected for propagation, and the ἀγκὼν breed, unable to climb over fences, is now established: thus some breeds of hares have horns like the roebuck: the Dorking fowl has two hind claws; and fowls, in short, are bred in every conceivable variety. Individuals, distinguished from others by no greater differences than those which thus spring up accidentally, cannot be supposed to belong to a separate species. Upon the comparison of these differences, depends the analogical argument first employed by Blumenbach. Finding the ferret *(mustela furo)* to differ from the pole-cat *(m. putorius)* by the redness of its eyes, he concludes it is merely a variety of the same species, because instances of this deviation are known to occur accidentally in other animals; but he concludes the African elephant is of a species distinct from the Asiatic, because the invariable difference of their molar teeth is a description which naturalists have never found accidental. Now there exist among mankind no differences greater than what happen occasionally in separate species of brutes.

"The colours of the animals around us, horses, cows, dogs, cats, rabbits, fowls, are extremely various—black, white, brown, grey, variegated.

"The hair of the wild Siberian sheep is close in summer, but rough and curled in winter; sheep in Thibet are covered with the finest wool, in Ethiopia with coarse stiff hair; the bristles of the hog in Normandy are too soft for the manufacture of brushes; goats, rabbits, and cats of Angouri, in Anatolia, have very long hair, white as snow and soft as silk.

"The head of the domestic pig differs as much from that of the wild animal, as the negro from the European in this respect; so the head of the Neapolitan horse, denominated ram's head on account of its shape, from that of the Hungarian animal remarkable for its shortness, and the extent of its lower jaw; the cranium of fowls at Padua is dilated like a shell, and perforated by an immense number of small holes; cattle and sheep in some parts of our own country have horns, in others not; in Sicily sheep have enormous horns; and in some instances this animal has so many, as to have acquired the epithet polyceratous.

"The form of other parts is no less various. In Normandy, pigs have hind legs much longer than the fore; at the Cape of Good Hope, cows have much shorter legs than in England; the difference between the Arabian, Syrian, and German horses, is sufficiently known; the hoofs of the pig may be undivided, bisulcous, or trisulcous.

"These are regarded by naturalists as but accidental varieties, yet they equal or surpass the varieties existing among mankind. We are consequently led by analogy to conclude, that the differences of nations are not original but acquired, and impose no necessity for believing that more than one stock was at first created.

"3. *Direct facts* harmonise with this conclusion. All races run insensibly one into another, and therefore innumerable intermediate examples occur where the distinction between two varieties is lost. Again, no peculiarity exists in any variety which does not show itself occasionally in another. Many instances of these facts have been already related. The difficulty of regarding the negro as of the same stock with ourselves vanishes, on viewing these circumstances, and on reflecting that he and ourselves are two extremes, one of which may have sprung from the other by means of several intermediate deviations, although experience may not justify us in supposing any single deviation of sufficient magnitude. Lastly, both the males and females of all the varieties breed together readily and in perpetuity—an assertion which cannot be made in regard to any different species of brutes."

The following account, given by Volney, and confirmed by Mr. Crompton, a friend of Dr. Elliotson's, of the power of climate upon the generative function, is very curious and singular.

'"During five hundred and fifty years that there have been Mamlouks in Egypt, not one of them has left subsisting issue; there does not exist one single family of them in the second generation; all their children perish in the first or second descent. Almost the same thing happens to the Turks; and it is observed that they can only secure the continuance of their families, by marrying women who are natives, which the Mamlouks have always disdained. Let the naturalist explain why men, well formed, and married to healthy women, are unable to naturalize on the banks of the Nile, a race born at the foot of Mount Caucasus! and let it be remembered, at the same time, that the plants of Europe in that country are equally unable to continue their species! Some may refuse to believe this extraordinary fact, but it is not on that account less certain; nor does it appear to be new. The ancients have made observations of the same nature: thus, when Hippocrates asserts, that among the Scythians and Egyptians, all the individuals resemble each other, though they are like no other nations; when he adds, that in the countries inhabited by these two races of men, the climate, seasons, elements, and soil possess an uniformity no where else to be found, does he not recognize that kind of exclusion of which I speak? When such countries impress so peculiar a character on every thing native, is it not a reason why they should reject whatever is foreign? It seems, then, that the only means of naturalizing ani-

mals and plants, would be to contract an affinity with the climate, by alliance with the native species; and this, as I have before said, the Mamlouks have constantly refused. The means, therefore, by which they are perpetuated and multiplied, are the same by which they were first established; that is to say, when they die, they are replaced by slaves brought from their original country."

We wish our limits had permitted us to notice more of the subjects treated by Dr. Elliotson in these notes, but we are compelled to stop short against our inclination, as we have neither time nor room to proceed further.

With respect to Mr. Warren's work, it is particularly interesting, and it proves the author to possess an ingenious mind, although we think many of his views are founded in error.

II.

Researches into the Causes, Nature, and Treatment of the more Prevalent Diseases of India, and of Warm Climates generally; illustrated with Cases, post mortem Examinations, and numerous coloured Engravings of Morbid Structures. By JAMES ANNESLEY, Esq., of the Madras Medical Establishment, late Surgeon to the Madras General Hospital, M.R.C.S. and M.R.A.S. In Two Volumes. London: Printed for Longman and Co., 1828.

INDIA presents to the medical practitioner a wide and ample field for pathological observation, and it might be supposed from this circumstance, that medical science would have reaped great and numerous advantages from the exertions of those to whom these opportunities are afforded. That the science of pathology is duly cultivated by practitioners in India, cannot be doubted; still, in proportion to their number, and the opportunities which are presented to them, their literary productions are not so numerous as might be generally expected. This circumstance may, however, be easily accounted for, when we consider the excessive heat of the climate; the debilitating effects which this produces on the constitution of the most active and vigorous, and the mental as well as corporeal languor resulting as a necessary consequence from the high temperature of the atmosphere. This work, however, affords us an ample proof that where talent, and a spirit of industry and perseverance are happily combined, even the perpendicular rays of an intertropical sun cannot check their ardour. Without an association of

these qualities, such a mass of valuable information as we here witness, could never have been gathered together under such circumstances, and placed before the public with such order and regularity. The extensive opportunities afforded to Mr. Annesley during twenty-five years practice in India, of witnessing disease in all its grades, and of examining the morbid changes which it produces in the structure, have enabled him to lay before the profession a greater number of practical facts than could fall to the lot of many practitioners to do; and we have sufficient evidence that he has not neglected that opportunity. But we apply ourselves to the work before us.

The present volume is divided into three books, or principal heads, and each of these is subdivided into chapters, sections, and sub-sections. In the first chapter, we have some remarks on the digestive and assimilating functions, embracing those of the stomach, liver, pancreas, spleen, duodenum, and the small and large intestines. These we shall pass over, and come to the second chapter, wherein the author gives a general view of the causes chiefly productive of diseases in warm climates, particularly in India, and, first, of those causes of disease which proceed from the soil, situation, and vegetation of a country.

The soils and situations most favourable for the production of miasmata, are those which are low and marshy; those which are subject to inundations, and consequently to become saturated with organic matter. "Argillaceous soils, and the deep and rich alluvial earth which is found in the bottoms of valleys or ravines, and on the banks or at the mouths of rivers, are also productive of miasmata whenever they are exposed to the action of a powerful sun, particularly after they have been inundated, and when they abound with the remains of a luxuriant vegetation."

"A most important circumstance which goes far to account for the much greater unhealthiness of moist and marshy situations in warm countries, is the quantity of animal matter, in a state of decomposition, which they present. The same circumstances which render vegetation quick and luxuriant, tend also to generate immense swarms of reptiles and insects; the exuviæ and dead bodies of which, mingling with vegetable matter in a state of decay, and combining with moisture, give rise to miasms of a much more noxious description than those resulting from vegetable decomposition and moisture alone. In the course of our experience in warm climates, we always have considered the number of insects and reptiles with which a place abounds, as more indicative of its unhealthiness than any other circumstance; for in it there is a most powerful cause of disease in its worst forms, superadded to those already in existence; and, as the one cause is extensive