PART II.
CRITICAL ANALYSIS.

I.

An Introduction to Comparative Anatomy and Physiology; being Two Introductory Lectures delivered at the Royal College of Surgeons, on the 21st and 25th of March 1816. By William Lawrence, F. R. S. Professor of Anatomy and Surgery to the College; Assistant-Surgeon to St Bartholomew's Hospital; Surgeon to Bethlehem and Bridewell Hospitals; and to the London Infirmary for Diseases of the Eye. 8vo. pp. 179. Callow, London, 1816.

We have much pleasure in embracing the earliest opportunity of introducing these eloquent and scientific lectures to the notice of our readers, who, we doubt not, will derive the same instruction and gratification from the perusal, which we have obtained. They were not composed, it appears, with a view to publication, but have been now printed in consequence of repeated applications to the author for copies of them. He has added, however, numerous notes and references, which greatly enhance the value of the lectures; in as much as they constitute an ample catalogue of all the best sources of information on the subjects here discussed.

The first lecture, which comprehends the "Objects and History of Comparative Anatomy," is rendered particularly valuable by this great store of reference to all the successive discoveries, and to the details of particular facts, which have been presented to the public in various countries and languages. It opens with a warm eulogium on the author's colleague and early preceptor, Mr Abernethy, and with an apology for the imperfections of
the course, from the short time for preparation, which had been allowed him, and then proceeds to state the value and objects of comparative anatomy. He observes, that the first step in the study of life, or the science of physiology, is to examine the organs which are the instruments of life; but that it is absolutely necessary to extend this examination beyond the structure of man or any one animal, to view them under all their modifications and combinations, in order to ascertain what is essential in each.

"The connection and mutual influences of the various organs oppose great and insuperable obstacles to our knowledge of the precise effect and importance of each. Here comparative anatomy comes to our aid: we find in the various classes of animals almost every possible combination of organs, and there is no organ which is not wanting in some class or other. The effect of such combinations and privations cannot but illustrate the nature and operations of the part in question. Fishes have no tympanum, nor external ear; insects no circulating system; many of the lower orders no brain nor nervous system." p. 10.

The author then remarks, that, if we confine our investigations to man, or the more complicated animals, we should be led to the most erroneous conclusions respecting the nature of vitality. A slight injury of the brain will destroy a man or a mammiferous quadruped; while the removal of the whole cranial contents is by no means suddenly fatal in the frog, turtle, and other reptiles. A tortoise lived six months after the skull was opened, and the whole brain removed by Redi. Frogs and newts lived three, four, and five days, after being deprived of their brain by Spallanzani, and leapt, ran, swam, &c., after their hearts were cut out, and lived forty-eight hours. The contrast in the state of vitality in the lower and more simple animals, with that of man and animals of more complicated structure, where the various organs are connected by numerous sympathies, is remarkably illustrated in the reproductive powers of the former, by which lost and mutilated parts are restored. In man and the animals nearly allied to him these powers, though limited, are considerable; as the union of bones and muscles divided by accident, and the restoration of their functions demonstrate; but in the lower order of animals there are scarcely any bounds to this reproductive power.

"The lower we descend in the scale of beings, the more surprising are the manifestations of this reproductive faculty. The large claws of the crab and lobster, and the entire limbs or tail of the newt, can be restored: the same holds good of the rays of the star-fish and
the arms or tentacula of the cuttle-fish. The entire eye of the newt, with all its coats and humours, has been extirpated, and in the course of ten months succeeded by a new and perfect eye-ball. The whole head of the common snail, with its four horns, has been reproduced after being removed in experiments in many instances. If the earth-worm or actinia (the sea anemone) be cut in two, each half will become a perfect animal. The fresh water polype may even be cut into several pieces, each of which will become a perfect polype." p. 19.

Comparative anatomy, however, has not only illustrated general physiology, but has thrown much light even on the functions of the human frame. The formation of the germ in the ovary, and its passage through the Fallopian tube into the uterus, could not have been discovered in the human subject. The nature and uses of the gall-bladder and of the secretion of bile, has been much elucidated by the anatomy of animals.

The importance of comparative anatomy, in reference to natural history, is also very manifest. For there is a close correspondence between the structure and the habits of animals, which mutually illustrate each other. Some striking exemplifications of this subject are quoted in a note from a valuable work of Cuvier. Every organized being, he remarks, consists of parts which correspond mutually. No one part can change, without the others being modified; and, consequently, each taken separately indicates all the others.

"Thus, if the intestines of an animal are adapted by their organization to digest flesh, and that in a recent state, the jaws must be constructed for devouring prey; the claws for seizing and tearing it; the teeth for lacerating and dividing its flesh; the whole apparatus of moving powers for pursuing and overtaking it; the organs of sense for perceiving it at a distance. Nature must, moreover, implant in the brain an impulse or instinct, leading such a creature to conceal itself and lay in wait for its victims. Such are the general conditions of the carnivorous regimen: every flesh-devouring animal necessarily unites them; for its species could not otherwise subsist. But besides these general conditions, there are subordinate ones, relating to the size, the species, and the abode of the prey: and each of these secondary conditions gives rise to differences of detail in the forms which result from the general laws. Hence not only the class, but the order, the genus, and even the species, are expressed in the form of each part."

We have not room to follow out this illustration into all the minutiae, which are here detailed. The author states, that the succeeding lectures would be a continued illustration of this point: for "no branch of natural knowledge is more interesting than a contemplation of the infinitely diversified organic ar-
rangements, by which animals are adapted to their respective places in the creation."

Having thus demonstrated the importance of the study of comparative anatomy, to the natural historian as the only just ground of classification; to the physiologist as the great source of his knowledge of the functions of life; to the physician and surgeon, who can only build their science upon the basis of physiology; and to the natural theologian, who discovers in these striking modifications of structure, in constant relation to the wants, habits, powers, and situations of animals, the strongest evidence of final purposes; he then proceeds to an able historical detail of the discoveries and works of the distinguished writers on the subject, from Aristotle to the present time. We cannot follow him, in the compass of a review, through this complete and interesting sketch of the progress of the science. He speaks with great praise of the immortal work of Aristotle, who not only knew and dissected a great number of species of animals, "but he studied and described them on a vast and luminous plan, to which none of his successors has approached, ranging the facts, not according to the species, but according to the organs and functions—the only means of arriving at comparative results." p. 33. He made the same grand division of animals which has lately been proposed by the French naturalists, only he incorrectly drew the character from the presence or absence of blood, which Lamarck has drawn from the possession or want of the vertebral column. The author regrets that the Romans had not an Aristotle, since that wonderful people had facilities of studying zoology, which have never since existed.

"The largest and rarest animals, brought from all parts of the empire, were exhibited in the triumphs, the public games, and the theatres, to amuse the inhabitants of the imperial city. They saw the hippopotamus, the two-horned rhinoceros, and the camelopard, which have not been brought alive into Europe since. Commodus exhibited five hippopotami at one time; and ten camelopards were shewn by Gordian III. Other foreign and remarkable animals were quite common, as the lion, elephant, panther, &c. Augustus shewed twenty-five living crocodiles at once." p. 36.

After tracing the progress of discovery in Italy, the author comes to the results of the establishment of the Royal Society in this country, and the Royal Academy of Sciences at Paris, referring also to the memoirs and collection of the other foreign institutions, and to the writings of distinguished individuals, who have contributed to the advancement of comparative anatomy; of all which he has given an ample and learned detail,
with references to their respective papers and publications. He then describes, (with the high praise so justly due to the talents of the band of French naturalists, who have shewn themselves so worthy to be the successors of Buffon, Daubenton, and Vicq d'Azyr, and so worthy too to possess the superb treasure of natural history at the Jardin des Plantes,) the proceedings of these eminent men, Lacepede, Latreille, Lamarck, Peron, &c., and, above all, of Cuvier, of whom and his invaluable works he speaks with becoming enthusiasm. He then proceeds to notice the productions and authors of our own country, paying a zealous tribute of admiration to " the glory of England in this century," Mr Hunter. "In vigour and originality of genius, in comprehension and depth of thought, in unwearied industry, he has been surpassed by none. He was one of those men who give a character to the age in which they live—whose names are associated to the great aeras of science—and who do honour to the country that produces them."

The second lecture is a specimen of the most clear and comprehensive logic that we have ever read. It is a general view of the functions of living beings as contradistinguished from the physical qualities of unorganized matter, and from those other phenomena, to which the appellations of magnetic, electrical, galvanic, &c. have been applied: and contains a most perspicuous refutation of the absurd attempts to establish the doctrine of a specific vital principle, which, indeed, nothing but an abuse of language or the blindness of prejudice could ever have supported. He begins, indeed, with a very appropriate exhortation to his auditors, to be particularly on their guard against loose and indefinite expressions: "they are the bane of all science, and have been remarkably injurious in the different departments of our own:" and also to be not less cautious with respect to the verity and authenticity of facts.

The term life, the author observes, is an expression which we use to denote the assemblage of all the functions and phenomena, which are the result of organization, and which distinguish organized and living, from inert and inanimate matter. In order to fix the meaning of the term, it is necessary therefore to investigate these phenomena, and to contrast them carefully with the qualities of inert substances; for it is only by such a comparison that we can expect to derive a clear notion of life. The first point of distinction is the nature of the composition of organized bodies. The term implies the possession of organs or instruments for accomplishing certain purposes; and a living body derives its character from an assemblage of all these parts. But the character of an inorganic body is found equally in the
properties of its integral parts: a single grain of marble has the same characters as an entire mountain. Inorganic bodies are commonly homogeneous; all living bodies necessarily heterogeneous, and composed of both solid and fluid parts, and resolvable into a multiplicity of volatile elements. Living bodies have a determinate form peculiar to the species; inorganic bodies have not. The particles which make up a living body are all dependent on each other: the component atoms of an inert body receive no influence from the particles near them.

These, however, are but passive qualities, the most impressive notions of life arise from the activity of organized bodies.

"We must observe them surrounded by chemical agents, yet preserved from chemical action; maintaining a composition apparently constant and identical, yet keeping up an incessant motion and change of their particles, in which the old materials are discharged and new ones converted into their own substance; producing new bodies, the seat of similar active powers with themselves; yet terminating their own existence by the very action of the principle that has so long preserved them." p. 127.

The superiority of the vital powers over the chemical affinities of surrounding agents, indeed, is so striking, that Stahl and his followers defined life upon this peculiarity alone, "putredini contrarium." But the author remarks, that this is only one of several phenomena, included under our notion of vitality. The uniformity of the animal temperature is another remarkable operation of the living powers, when contrasted with the speedy diffusion and abstraction of heat among all inert bodies. The human body has one and the same heat in the intense colds of Siberia and Greenland, where the thermometer has been observed above 100 degrees below zero; in the burning regions of Africa and America, where it has been seen to rise to above 120°; in the heated rooms of experimenters, where it has stood at 260°; and in stoves used for drying grain, where it has been as high as 290°, and where a heat of 270° was borne for a quarter of an hour. The author, in the notes, has given details of experiments and references relative to these facts. Messrs Duhamel and Tillet found that the girls accustomed to the ovens, could bear a heat of 258° of Fahrenheit for fourteen or fifteen minutes; that they could stay ten minutes at the height of 292°; and that when it reached 315°, they could not support it more than five minutes. The author observes, that as mercurial thermometers were not used, and alcohol expands irregularly in the higher temperatures, these numbers may be too high; but, at all events, it is to be remarked, that meat and
fruit were baking by the side of the girls, who undertook these experiments.

Another striking characteristic of living bodies, is the power of acting on other matter, of converting it into their own substance, while at the same time they are constantly throwing off, by movements in the internal parts, much of the old material; so that their substance, though preserving its identity, is never in any two successive instants the same. In all these points, the nature of inorganic bodies presents a complete contrast. They are exposed to the action of all surrounding bodies; and if they undergo any motion, they suffer an immediate change, losing their form and consistence, if the agent be mechanical, and their very nature, if chemical; and their increase depends solely on the addition or juxta-position of new particles on the outside of the old ones.

Having ascertained the phenomena, then, which result from vitality, we naturally wish to inquire for the origin of this power. But the mode in which this power is communicated is beyond our scrutiny. We only know that all living bodies have heretofore formed part of others similar to themselves, from which they have been detached; that life proceeds only from life; and that there exists no other vitality than that which has been transmitted from one living body to another, by an uninterrupted succession. Neither can we trace any connection whatever between the particular texture of the organization, and its vital power: for an examination of the structure of muscular fibres could give us no notion of their power of contraction, nor would any observation of the medullary substance lead us to discover its faculty of sensation. These, and all the other particulars that we know about the nature of living properties, are simply the result of observation; and, therefore, our investigation respecting the organic economy must be necessarily confined to its history, as in the other physical sciences. We can only observe the succession of events, ascertain their series and order, and refer the phenomena ultimately to those general properties or principles, of which the name does not indicate any independent existence, but is to be regarded merely as a generalized expression of the facts. This we refer to the vital properties of sensibility and irritability,—the power of feeling and that of contracting,—in our ultimate analysis of the functions, as the mechanician does to elasticity, in explaining the motions of a watch, or the astronomer to gravitation, in accounting for the course of the heavenly bodies. These words denote what are called the properties of matter, and what are said to be the causes of the phenomena in question. But the idea of a cause implies nothing more than the constant precession of one event
to another; and though we believe that the preceding event has a power of producing that which succeeds, yet, in reality, we only know the fact of succession. The author has put this matter in so clear and strong a light, and has demonstrated, both by direct arguments, and by the reductio ad absurdum, the error of referring to a specific principle, that we shall make no apology for the following long quotation, trusting that it will induce our readers to refer to the copious and interesting illustrations contained in the lecture itself.

"In the science of physiology we proceed on the observation of facts, of their order and connection: We notice the analogies between them; and deduce the general laws to which they are subject. We are thus led to admit the vital properties, already spoken of, as causes of the various phenomena; in the same way as attraction is recognised for the cause of various physical events. We do not profess to explain how the living forces in the one case, or attraction in the other, exert their agency. But some are not content to stop at this point; they wish to draw aside the veil from nature, to display the very essence of the vital properties, and penetrate to their first causes; to shew, independently of the phenomena, what is life, and how irritability and sensibility execute those purposes which so justly excite our admiration. They endeavour to give a physical explanation of the contraction of a muscle, and to teach us how a nerve feels. They suppose the structure of the body to contain an invisible matter or principle, by which it is put in motion. Such is the impetum faciens of Hippocrates, the Archeus of Von Helmont, the anima of Stahl, the Materia Vitæ of Hunter, the calidum innatum, the vital principle, the subtle and mobile matter of others. There are many names for it; as each successive speculator seems to have fancied that he should establish his own claim to the offspring by baptizing it anew. Either of the names, and either of the explanations may be taken as a sample: They are all equally valuable, and equally illustrative. Most of them, indeed, have long lain in cold obstruction amongst the rubbish of past ages; and the more modern ones are hastening after their predecessors to the vault of all the Capulets.

"The object of explanation is to make a thing more intelligible. Explaining a phenomenon consists in shewing that the facts, which it presents, follow each other in an order analogous to that which is observed in the succession of other more familiar facts. In shewing that the motions of the heavenly bodies follow the same law as the descent of a heavy substance to the earth does, Newton explained the fact. The opinion under our review is not an explanation of that kind; unless indeed you find, what I am not sensible of, that you understand muscular contraction better by being told that an Archeus, or a subtle and mobile matter sets the fibres at work.

"This pretended explanation, in short, is a reference, not to anything that we understand better than the subject to be explain.
ed; but to something that we do not understand at all,—to something which cannot be received as a deduction of science, but must be accepted as an object of faith.

**If animals want such aid for executing their functions, how is it that vegetables proceed without the same assistance? They perform vital motions, and exhibit some of the most important: do they accomplish them without an Archeus, or a vital principle? have they no subtle fluid of life?**

**If the properties of living matter are to be explained in this way, why should not we adopt the same plan with physical properties, and account for gravitation or chemical affinity by the supposition of appropriate subtle fluids? why does the irritability of a muscle need such an explanation, if explanation it can be called, more than the elective attraction of a salt?**

**To make the matter more intelligible, this vital principle is compared to magnetism, to electricity, to galvanism; or it is roundly stated to be oxygen. 'Tis like a camel, or like a whale, or like what you please. You have only to grant that the phenomena of the sciences just alluded to depend on extremely fine and invisible fluids, super-added to the matters in which they are exhibited; and to allow further that life and magnetic, galvanic, and electric phenomena, correspond perfectly: the existence of a subtle matter of life will then be a very probable inference. On this illustration you will naturally remark, that the existence of the magnetic, electric, and galvanic fluids, which is offered as a proof of the existence of a vital fluid, is as much a matter of doubt, as that of the vital fluid itself. It is singular also that the vital principle should be like both magnetism and electricity, when these two are not like each other.**

**It would have been interesting to have had this illustration prosecuted a little farther. We should have been pleased to learn whether the human body is more like a loadstone, a voltaic pile, or an electrical machine: whether the organs are to be regarded as Leyden jars, magnetic needles, or batteries.**

**The truth is there is no resemblance, no analogy between electricity and life: the two orders of phenomena are completely distinct; they are incommensurable. Electricity illustrates life no more than life illustrates electricity. We might just as well say that an electrical machine operates by means of a vital fluid, as that the nerves and muscles of an animal perform sensation and contraction by virtue of an electric fluid. By selecting one or two minor points, to the neglect of all the important features, a distant similarity may be made out; and this is only in appearance. In the same way, life might be shewn to be like anything else whatever, or anything else to be like life.**

**Identity or similarity of cause can only be inferred from identity or resemblance of effect. Which electric operation is like sensation, digestion, absorption, nutrition, generation? Which vital phenomenon resembles the attraction of bodies dissimilarly electrified, or the repulsion of those in similar states of electricity? What**
function resembles the ignition of metals, and the firing of gases, the decomposition of water, and the subversion of the strongest chemical affinities?" p. 165—172.

The author goes on to state his opinion, that this fiction of an invisible matter to explain the vital motions must have originated from that universal propensity of mankind to account for those phenomena, of which the causes are not obvious, by the mysterious aid of imaginary beings. Whence the ancients had gods for every operation of nature, to hurl the thunderbolt, and agitate the waves;—the people have their elves and fairies, and the theorist his Archeus, his anima, his vital fluid. These fictions are not out of place in the regions of poetry; but they deserve the reprobation which they have here received, when brought forward in the array of philosophical induction.

II.

Essays on Insanity, Hypochondriasis, and other Nervous Affections. By John Reid, M. D. Member of the Royal College of Physicians, London; and late Physician to the Finsbury Dispensary. 8vo, pp. 272. Longman and Co. 1816.

In order to give our readers some notion of the nature and character of these essays, it will be necessary to recal to their recollection the amusement which some of them may have formerly experienced from the perusal of a series of Medical Reports, as they were called, which appeared for a course of years in a popular journal, the Monthly Magazine of London, with the name of our author appended. As they were not addressed to the profession, so they uniformly discarded all grave medical discussion, and dwelt much upon the aberrations and derangements of the intellect, upon hypochondriacal and nervous disorders, and all the train of real and imaginary evils, which indolence, intemperance, and various moral and physical irregularities, committed chiefly by persons of leisure and cultivated minds, are liable to produce. Many of them, therefore, were rather moral disquisitions, than medical reports; and were delivered in brilliant metaphorical language, calculated to impress readers of this class, who would have shrunk from the perusal of mere didactic medical details. This was well enough,