greatest difficulties may be successfully overcome, and consolation under failure, by showing how often the best directed efforts may prove abortive and unavailing.

We have ventured in the introductory observations of this article to point out what appears to us to be two great drawbacks to the practical value of this work, the one being a too great deference to artificial classifications, the other a redundancy of statistical calculations in reference to facts of little practical import. The former deprives many of the subjects treated of of their full value and interest, the latter sorely perplexes and confounds the reader who seeks to elicit from its pages the *point* and *spirit* of the work. We trust that the future historian of the practice of the Dublin Lying-in Hospital will guard against both these tendencies, and that he will bear in mind the excellent admonition of the late Dr. Gooch to those who are engaged in the study of midwifery—advice which appears to us to be as applicable to authors as to students:—"Watch cases attentively, and take notes of their important particulars, and not lengthy notes containing a *diffuse description of unimportant trifles*, which from the time that they occupy, will soon cease to be written, and if written, are sure never to be read; but a short description of the leading circumstances, with an equally short mention of the reflections which they suggest."

REVIEW X.

The Works of John Hunter, F.R.S.; with Notes. Edited by JAMES F. PALMER. Four Vols. 8vo. Illustrated by a Volume of Plates in Quarto.—London, 1835.

THE late re-interment of the remains of John Hunter has naturally recalled his memory to the public mind, and more especially and more vividly to the mind of that profession which he did so much to enlighten and to elevate. The publication of a collected edition of his works, now more than twenty years since, accompanied with introductory essays and explanatory notes, by men eminently qualified for the task, might well have been supposed to have made his labours thoroughly familiar to the profession, and to have rendered superfluous any further attempt to exhibit the greatness and the peculiarity of his genius, to vindicate his opinions from misrepresentation, or to point out the benefits which he has conferred on various departments of medical science and practice. According to our observation, however, these effects have been slow in following. In a general way, the name of Hunter is invested with all imaginable honour; but his views are still very imperfectly understood; several important results of his inquiries are frequently ascribed to others; he is praised for discoveries that he did not make, and censured for tenets that he never held; and, on the whole, if the broad question were proposed, "What did John Hunter achieve for science, to entitle him to the lofty posi-

tion which is so universally conceded to him?" we apprehend that few even of his professed admirers would be prepared to give a categorical answer. Under these circumstances, we are induced to deviate somewhat from our ordinary track as reviewers of cotemporaneous authors, and to give as distinct an outline as we are able of Hunter's doctrines and opinions, and of the scope and results of his researches.

The particular discoveries of Hunter in anatomy, physiology, zoology, pathology, and surgery, would afford sufficient ground for assigning to him a very high rank among the contributors to each of those branches of science; and there certainly never was any one man who contributed so much to them all, taken collectively. But it was not on his particular discoveries, great as they were, that his claims to our admiration and gratitude principally rest; his vast and profound generalizations from the observation of innumerable facts, throw both his own and all other individual discoveries into the shade, and entitle him to rank as one of the greatest of inductive philosophers, and as the first who brought the inductive philosophy to bear efficiently and profitably on the science of life and the study of disease. There is one great department of his labours which, though in extended and beautiful relation to all the rest, and shedding over all a broad and majestic light, stands in some measure apart, as a thing altogether peculiar in the history of human research and human industry, and as the work which bears the strongest impress of his individual hand, and in which the character of his mind is most singularly manifested in all its power and all its comprehensiveness—we allude to his museum.

We propose, therefore, to dwell briefly, first, on Hunter's general doctrines and opinions; secondly, on his particular discoveries; and, thirdly, on his museum.

In order to arrive at any just estimate of Hunter's general doctrines, we must have acquired an accurate conception of his views of life. These views were for a long time much misrepresented and misunderstood; and even to this day we too frequently find the name of Hunter associated with a mysterious hypothesis of the vital principle, which is supposed to have pervaded, and in some degree obscured, all his reasonings. Such a notion, however, can be entertained only by those who have no comprehensive acquaintance with his writings, and the fact of their prevalence shows how little familiar those writings are to a majority of our profession. Hunter, though he would himself probably have laughed heartily at the suggestion, had in him several of the elements of a poet, and among these, a strong tendency to figurative modes of expression; but there was another element of the poetic character which he certainly did not possess, namely, a felicitous flow of language; on the contrary, his style of writing, generally more or less involved and embarrassed, was sometimes so obscure as to be barely intelligible. We quote a curious passage in which he falls into this peculiar kind of phraseology, and at the same time endeavours to account for and to excuse it:—

"This disposition to coagulate when out of the vessels, or when retained in

them without motion till the consciousness of the use of motion, and of course of fluidity, is lost, is one of the effects of the life of the blood. I have used the word *consciousness* because we have no language existing answerable to all my views of the animal economy, and to coin words would not answer the purpose, because then I must have a dictionary of my own. I have not a word for expressing the cause of those actions which take place in the body, as if it was conscious that such and such things were going to take place. There are actions in the body which come nearest to consciousness of the mind of anything that I can conceive, and therefore I make use of this word, but it is commonly applied by philosophers only to the mind.”*

Taking into consideration these unfortunate peculiarities in Hunter's manner of expressing his thoughts, it is not to be wondered at that the analogical illustration of his meaning should sometimes have been mistaken for the meaning itself,† and that many should have derived from a partial and inattentive perusal of his works, very erroneous impressions of his opinions. Of all his writings, the ‘Treatise on the Blood, Inflammation, and Gun-shot Wounds,’ is the one that has been most generally read, and from which, therefore, the prevalent notions of his opinions have been chiefly derived; but this abounds, more than any other, in the figurative expressions and obscurities of style just adverted to, and is therefore especially liable to be misconstrued by the reader who is unacquainted with the general scope of his writings. Again, the ‘Lectures on the Principles of Surgery,’ in which he enters more explicitly than elsewhere into his views of the nature of life, were not published at all till within the last thirty years, and have probably never yet been perused by many who affect to be offended at his “hypothesis.” In the introductory portion of these lectures, there is a passage which we think it well to quote, because it is very directly to the purpose, and shows at once how widely those have erred who have attempted to father upon John Hunter a doctrine in which the vital principle is endowed with a kind of personality and intelligence; though in truth if he had entertained such a notion, any one who is at all conversant with the history of physiology will not require to be informed, that it would have been no peculiar notion of Hunter's, but one that had floated through the speculations of physiologists from the days of Aristotle to those of Stahl.

“Animal matter is endowed with a principle called in common language, life. This principle is, perhaps, conceived of with more difficulty than any other in nature, which arises from its being more complex in its effects than any other; and it is therefore no wonder that it is the least understood. But although life may appear very compounded in its effects in a complicated animal like man, it is as simple in him as in the most simple animal, and is reducible to one simple property in every animal. I have observed that animal matter may be in two states; in one, it is endowed with the living principle, in the other it is deprived of it. From this it appears that the principle called life cannot arise from the peculiar modification of matter, because the same modi-

* Lectures on the Principles of Surgery, p. 236.

† Even Abernethy, from whom such mistakes were little to have been expected, has been at the trouble of defending and enforcing what he considered as Hunter's view of the identity of the vital and electric forces; whereas Hunter assuredly never entertained any such view.

fication exists where this principle is no more. The matter, abstracted from life, appears at all times to be the same, as far as our senses and experiments carry us. If life arose out of this peculiar modification, it would not be destroyed until the modification was destroyed, either by spontaneous changes or by some chemical processes; and were it destroyed by the last, it might sometimes be restored again by another process. Life, then, appears to be something superadded to this peculiar modification of matter; or this modification of matter is so arranged that the principle of life arises out of the arrangement, and this peculiar disposition of parts may be destroyed, and still the modification from which it is called animal matter remain the same. If the latter be the true explanation, this arrangement of parts, on which life should depend, would not be that position of parts necessary to the formation of a whole part or organ, for that is probably a mechanical, or at least organical arrangement, but just a peculiar arrangement of the most simple particles, giving rise to a principle of preservation; so that matter so arranged could not undergo any destructive change till this arrangement were destroyed, which is death. This simple principle of life can with difficulty be conceived, but to show that matter may take on new properties without being altered in itself as to the species of matter, it may not be improper to illustrate this idea by such acquirements in other matter. Perhaps magnetism affords us the best illustration we can give of this. Iron appears at all times the same, whether endued with this property or not; magnetism does not depend on the formation of any of its parts. A bar of iron without magnetism may be considered like animal matter without life; set it upright and it acquires a new property of attraction and repulsion at its different ends. Now, is this any substance added, or is it a certain change which takes place in the arrangement of the particles of iron giving it this property?*

It will be observed that there is only one positive affirmation respecting life in the whole of this passage—namely, that it is universally reducible to one simple property—a position which, in the present day, will be questioned by many, but hailed by some as the foreshadowing of a great generalization to which we are gradually approaching. All the rest is here advanced by Hunter as mere conjecture. To this we attach no more importance than to any other conjecture; we merely adduce the passage as conclusive evidence that Hunter entertained no definite opinion as to the essential nature of life, but was content to acknowledge his ignorance upon the subject.

There is another point of view, however, in which this passage is not without interest. Hunter here evidently expresses the notion that matter may acquire new properties in virtue of molecular changes taking place within itself, apart from any perceptible alteration in its composition; in other words, the notion of what is now called “allotropy;” and he conceived that there might be a kind of vital, or rather vitalizing, allotropy, by dint of which animal matter became living matter.

Hunter followed Harvey in the belief that the principle of life existed in the impregnated ovum prior to the formation of any part of the future organism, and they both attributed the power by which the impregnated egg resists putrefaction to the presence of this principle. But Hunter, still making the egg the subject of experiment, discovered

* Lectures on the Principles of Surgery, chap. ii.

a new power, at the same time that he obtained an additional confirmation of the preceding. He found that the impregnated egg would resist a greater degree of cold than the unimpregnated, without being frozen; but that, when once frozen, and thus deprived of its vitality, it had no greater power of resisting putrefaction than the unimpregnated egg. Like Harvey, also, Hunter believed that the living principle displayed its activity more especially in the blood; and this led him to a train of investigation on the vital properties of the blood, to which we shall presently have occasion more particularly to advert. There is another point which we have to notice respecting Hunter's general views of life. He was fully aware of a very important truth which had escaped preceding physiologists—namely, that life was not a self-acting power, but one which is called into action by appropriate stimuli.

"I shall carry my ideas of life further than has commonly been done. Life I believe to exist in every part of an animal body, and to render it susceptible of impressions which excite action; there is no part which has not more or less of this principle, and consequently no part which does not act according to the nature of the principle itself, and the impressions thence arising, producing thereby infinite variety both in all natural and diseased acts."*

The truth thus plainly announced by Hunter was, however, lost sight of by succeeding physiologists, or remained without any general application, till it was taken up by Tiedemann and others, and brought to bear luminously on every department of physiology.

On the whole, then, it appears that the positive tenets of Hunter respecting life in the abstract, were few and simple, and that of these the only two peculiar to himself were, that relating to its power of resisting temperature, which he proved by direct experiment, and that relating to its power of reaction on the application of stimuli, which is now universally recognised as one of the most important principles in physiology.

In his inquiries into the effects of vital causes, Hunter discarded all hypothesis, and starting from the plain and intelligible postulate, that as the vital phenomena are not explicable from the ordinary laws of matter, they must acknowledge some laws different from these, he devoted his energies to the elucidation of the unknown laws of life. In entering on this pursuit, his sagacious and comprehensive mind soon perceived that there were as yet no sufficient data for his investigations, and that general laws were not to be unveiled by studying only their partial applications. The common properties of life being manifested through such an infinite variety of organic forms, he felt the necessity of becoming acquainted with all these forms, or at least with as many of them as possible; and as the phenomena of life are exhibited as modified by an endless variety of external conditions, he felt the necessity of becoming acquainted as far as possible with the nature and influence of those conditions. The profound recognition of such truths as these was, with Hunter, the starting-point of all his laborious thinking, and endless observation, and diversified experiment.

* Treatise on the Blood, &c., p. 2-3.

Inspired with a genius altogether peculiar and original, he entered on the domain of life as on a region almost unknown, which it was his mission to explore, and with unwearied step he tracked the manifestations of the vital force through all the developments and activities of organized bodies, through all the apparent anomalies of organization, and through all the modifications of function in disease, as well as in remedial efforts and processes.

Great discoveries in physiology had been made before the days of Hunter; but they all stood aloof and isolated for want of general principles to connect them. Even the grand discovery of the circulation, though its influence is now everywhere so perceptible, had remained comparatively barren of results. Several hypotheses had been maintained respecting the vital power; but they all aimed rather at discovering what it *was* than what it *did*; and their authors accordingly wasted their energies in vain speculations. It never seems to have occurred to any of them, that the laws of life might be determined, though its essence should for ever remain a mystery. Now, this is precisely what did occur to Hunter. One step in the right direction had indeed already been made by Haller, who had established the existence of two distinct modifications of vital power—namely, sensibility resident in the nervous, and irritability in the muscular fibre; thus suggesting the method of investigating the phenomena of life, as influenced by the tissue in which they are manifested. But nothing had yet been done in the way of comparative physiology, which was a name and a thing unknown until the genius of Hunter called it into sudden and gigantic existence, and in the space of one short life enriched it with such an accumulation of facts and inferences that even now, more than half a century after his death, we are far from having arrived at the full understanding and appreciation of his labours in this department.

As before observed, Hunter was not the first physiologist who held that the vital principle resides in the blood; though, in the limited extent of his own reading, he doubtless believed himself to be so. Harvey had entertained the same belief, but he merely speculated upon the subject, and bewildered himself in a maze of confused and contradictory conjectures. Thus, at one time he considers the blood as the instrument of the soul; at another, he makes the soul an act of the blood; then the blood itself is the soul; then the soul is the *calidum innatum*; and, lastly, the soul is held to be pre-existent, and to create both the blood and the *calidum innatum*.

Hunter went to work in a very different spirit. Convinced of the fundamental truth of the life of the blood, he engaged in a most comprehensive and searching experimental inquiry into the properties of this fluid, whether in health or disease, in motion or at rest, contained within the vessels or extravasated from them. But the time was not yet ripe for many of the conclusions at which physiologists have since been enabled to arrive. Organic chemistry was in its infancy, if, indeed, it can be said to have existed at all; and the microscope was yet a rude and imperfect instrument, available but to

a small extent for the purposes of scientific research. Hunter's view of the coagulation of the blood as a vital act has never been substantiated, but is rather discountenanced by more recent inquiries. His belief that the coagulated blood on the surfaces of wounds might become, like the lymph, the seat of the formation and inosculation of vessels, doubtless tended to confirm him in the notion of the vital character of the coagulating process; and this supposed fact would, if true, sufficiently prove the accuracy of his opinion; but his belief in this respect seems to have been the result of imperfect observation, nor does there appear any reason to suppose that such formation of vessels in coagula ever really takes place.

One very important conclusion was certainly arrived at by Hunter with regard to the blood—namely, that its vital properties reside principally and primarily in the colourless portion. This he established by the observation, that in the embryo of mammiferous animals the red particles are entirely absent, and that the blood is consequently in the same apparent condition as in the invertebrata when fully developed. So late as the year 1832, this fact was brought forward by MM. Delpech and Coste as a new discovery, doubtless in ignorance of Hunter's priority.

On the whole, Hunter's researches into the vital properties of the blood are perhaps more valuable as suggesting important points of inquiry, than as establishing valid conclusions respecting them; to which, as already remarked, it was simply impossible that he should have attained, in the absence of adequate implements and means of investigation. But in this their suggestive tendency, they cannot be too highly estimated; and, whether considered in relation to their immense extent, the penetrating sagacity with which they were conducted, or the important pathological inferences immediately deduced from them, they must be admitted to have formed one of the most remarkable series of investigations in which any single inquirer was ever engaged. Hunter, then, is unquestionably entitled to the merit of having been the first to promulgate a rational and consistent doctrine of the life of the blood, and to lay a broad and sure foundation for future inquiry into its vital properties and uses.

Among the vital phenomena connected with the blood, and the vessels which contain it, those of inflammation naturally presented themselves to a mind like Hunter's, as a highly interesting subject of inquiry. On this subject all had been till his time mere conjecture, and scarcely a single really philosophical observation had been made upon it. Hunter, as is well known, referred inflammation mainly to an increased action of the vessels of the part; but this, not as many have supposed, in the sense of an increased contraction, but in the sense of an action the result of which is an increase of their capacity.

"We must suppose it an action in the parts to produce an increase of size to answer particular purposes; and this I should call an action of dilatation, as we see the uterus increase in size in the time of uterine gestation, as well as the os tincæ in the time of labour, the consequence of the preceding actions, and necessary to the completion of those which are to follow."

It was probably his notion of common, or, as he first called it, healthy inflammation, as being essentially a restorative and not a morbid process, that led him to this view of the action of the vessels. But whether Hunter were right or wrong as to the nature of the action going on in the vessels, and whether we regard their dilatation as an active state induced by an effort of the vital force, or a passive one resulting from diminished contractility, the fact of their dilatation admits of no dispute. Nor is there so much practical difference as might at first be imagined between the views of Hunter and those of Vacca, Allen, and their followers; for Hunter distinctly states his belief that both the muscular contractility and the elasticity of the vessels are diminished.

"The power of muscular contraction would seem to give way in inflammation, for they certainly dilate more in inflammation than the extent of the elastic power would allow; and it must also be supposed that the elastic power of the artery must be dilated in the same proportion."*

This is very badly expressed, but Hunter evidently means to say that the muscular power is diminished, and that the elastic coat of the vessels is dilated beyond what its usual elasticity would admit of. All the hypotheses seem, therefore, virtually to agree as to a diminution of contractile power in the vessels; only those based on Vacca's seem to regard this in the light of a sort of paralysis and diminution of vital power, while that of Hunter refers it to "an action of dilatation," which appears to us merely a strange mode of expression for an organic increase of size, or actual growth of the vessels.

On the question, whether there be an increase in the number of the vessels of the inflamed part, or whether the appearance of increased vascularity depends merely on the dilatation of the ordinary vessels, and the unusual quantity of blood they contain, Hunter professes himself uncertain. But in considering the state of the vessels, he did not lose sight of the state of the blood itself; and he arrived at the conclusion that there is a tendency to separation in its constituent parts, and a disposition among its red particles to cohere and separate themselves from the general mass.

"In all inflammatory dispositions in the solids, whether universal or local, the blood has an increased disposition to separate into its component parts, the red globules becoming less uniformly diffused, and their attraction to one another becomes stronger, so that the blood, when out of the vessels, soon becomes cloudy or muddy, and dusky in its colour, and when spread over any surface it appears mottled, the red blood attracting itself and forming spots of red. This is so evident in many cases that it is hardly necessary to wait till the whole coagulates to form a judgment of it. When the blood has not an inflammatory disposition, the stream has a degree of uniformity and transparency in its appearance; but it is only an eye accustomed to it that can make this distinction."†

The accustomed eye of Hunter here led him to conclusions which the microscopic eye of more recent observers has confirmed. The only

* On the Blood, &c., p. 324.

† Lectures on the Principles of Surgery, p. 235.

point connected with the phenomena of inflammation in which Hunter was in error as to the facts of the case, was his belief that the blood moved quicker than usual in the inflamed vessels; whereas it is now well known that it moves much slower, and sometimes ceases to move altogether. The fact, however, that the velocity of the blood is really increased in the vessels immediately adjacent to those which are the seat of inflammation, renders this error of the less importance.

Setting aside this one error, then, it would appear that Hunter's actual conclusions respecting the proximate cause of inflammation were, that the vessels of the part are dilated, and contain more blood than usual; that the blood has a tendency to resolve itself into its constituent parts, and that the red corpuscles acquire an increased attraction for each other. On the whole, we believe this will be found to be pretty nearly the amount of our positive knowledge on the subject up to the present time.

A very important feature in Hunter's view of inflammation, consists in his division of it into the *adhesive*, the *suppurative*, and the *ulcerative*, a division founded on the most scrutinizing observation of its phenomena, whether in the progress of disease, the limitation of morbid processes, or the reparation of injuries.

It seems not a little singular, and it is moreover much to be regretted, that Hunter did not include mortification as one of the terminations of inflammation, and that a subject so congenial to the general tenor of his inquiries as the state of the vessels in gangrene, and the processes instituted by nature for the separation of sphacelated parts, should have received so small a share of his attention.

But Hunter's discoveries were not confined to placing adhesion, suppuration, and ulceration in their true practical relations to inflammation. He investigated each of these processes minutely, and entered fully into their pathological details. His observations on suppuration were regarded at the time, and for a long time after, as proving that pus was a secretion from the inflamed vessels; but the recent progress of inquiry is unfavourable to this conclusion, and we have been led back, by one of those singular retrogressions which sometimes occur in the history of science, to a view of the subject which approaches more nearly to that of Boerhaave and some of his followers, than to that of Hunter. But the observations of Hunter on the organization of lymph in the adhesive process stand fast, allowance being of course made for an unacquaintance, which was then universal, with the intervention of cells in the earlier stages of the formation of parts. And he was the first to establish the true nature of the ulcerative process, which, from the times of Galen to his own, had been regarded as an erosion of the solids by the fluids of the part; but which he proved to be effected by the action of the absorbent vessels. He was the first, also, to show the manner in which nature operates in the formation of granulations, and the filling up and cicatrization of abscesses, and other solutions of continuity which are not directly repaired by the adhesive process.

The mind of Hunter was too comprehensive to allow him to rest contented with views, however luminous, of so important a process as

that of inflammation, till they were extended to the modifications which it undergoes, as influenced by the peculiar vital endowments of the different tissues in which it is developed. The study of general anatomy had not yet taken the definite form, or the particular designation, which it was destined shortly after to assume in the hands of Bichat; but the principle prevails throughout the writings of Hunter, and it is impossible to compare these with the writings of the French anatomist, without arriving at the conclusion that Bichat either borrowed very largely from Hunter without acknowledgment, or that he had no acquaintance with his works; the latter would be the more charitable conclusion, though we fear the former is by far the more probable one.

Hunter, however, fully recognising, if he nowhere formally announces, the "doctrine of the tissues," carefully describes the phenomena and effects of inflammation as exhibited in the mucous, serous, and synovial membranes, in the cellular and cutaneous textures, in the osseous and fibrous structures, and, in fact, in every tissue throughout the body.

He recognised, also, every variety of inflammation with which we are now acquainted—acute and chronic, healthy and unhealthy, phlegmonous and erysipelatous, common and specific. He described it as modified by the gouty and scrofulous diatheses. He was familiar with the fact, that erysipelatous inflammation invades other textures beside the cutaneous, and he well knew the tendency of this kind of inflammation to become indefinitely diffused, in the absence of that adhesive disposition by which healthy inflammation sets limits to its own progress. The particular phenomena attending inflammation of the veins were altogether unknown, till Hunter gave a full and accurate account of them; notwithstanding which, the subject seems to have been nearly as much neglected as before, till the publication of Mr. Hodgson's treatise 'On Diseases of the Arteries and Veins,' in 1815, which drew more general attention to it.

Not only did Hunter thus variously illustrate the processes of inflammation in their local effects, and in their modifications in different tissues. His observations on the constitutional disturbances arising from them were of at least equal value. That various febrile and nervous disorders attended local inflammation, wounds, and injuries, must have been a familiar fact from the earliest times; but Hunter was the first to describe these distinctly and faithfully, to associate particular forms of local and constitutional disease, to expound the sympathies of different organs and systems on which they depend, and to bring physiological reasoning to bear directly and profitably on the phenomena of disease. All these topics have now become so much a matter of course, that it is not easy to imagine a period of our art, comparatively recent, in which they were either altogether neglected, or made the subject of crude hypotheses, founded merely on conjecture, or hasty and imperfect observation. Yet such assuredly was the state of things when the genius of Hunter arose, and shed a new and permanent light on the progress of surgery. The late Mr.

Abernethy, who lived when these great changes had only just been brought about, and who, having been himself an ingenious and successful labourer in this newly-opened field of inquiry, must be esteemed a highly competent witness, thus expresses himself on the subject :

"An evil seems to me to have arisen from the artificial division of the healing art into the medical and surgical departments. This division has caused the attention of the physician and surgeon to be too exclusively directed to those diseases which custom has arbitrarily allotted to their care. The effects of local disorders upon the constitution have, in consequence, been too little attended to; and, indeed, I know of no book to which I can refer a surgical student for a satisfactory account of those febrile and nervous affections which local disease produces, except that of Mr. Hunter."*

Indeed, the very term "constitutional" appears to have come into everyday use, in consequence of the general recognition of truths which Hunter was the first to explain.

"In his pathology," says Mr. Green, "Hunter, by contemplating life as an agency working under the control of law, remained true to the principle already secured in his physiology; and it enabled him to regard the living body in disease, no less than in health, as a living whole and an organic unity. Thus we find him not only recognising the living body as a constitution by virtue of which it forms a system of interdependent parts, and of balanced forces mutually reacting and combining to one end; but also raising into notice the fact that these powers may and do exist in various degrees of intensity, and relative subordination, the result being, in each instance, the constitution of the individual, with its marked peculiarities. And if, from this vantage ground, he was led to determine the pathological significance of the terms 'susceptibility,' 'disposition,' 'irritability,' and the like, and to penetrate the nature of 'hereditary tendencies;' it also induced him to devote a large portion of his lectures to a consideration of sympathy, the term being intended to express the community, and as it were consent, of feeling and action, which preserve the bond of interdependence in all the parts and actions of the living body in their conspiracy to an organic whole. He saw it was from a knowledge of morbid sympathy that we are enabled to anticipate the immediate and remote effects of injury to the living frame; and that it is under the conditions of sympathy that we have to study the nature and end of constitutional irritation in its various forms. And as many of the actions excited by sympathy are for the purpose of effecting processes which tend to the repair of injuries, and to the removal of disease, the principle which he establishes supplies an intelligible meaning to the so-called *vis medicatrix nature*, as the law of integrity, or the ever-present tendency to integration, which, in all life, having produced a whole, ever tends to preserve and restore that which it has produced."†

We have quoted this passage because, though somewhat peculiar in its phraseology, it appears to us to be very full of thought, and to take in much of the general scope of Hunter's views of the animal economy.

Considering, then, that we owe to Hunter the true knowledge of inflammation throughout the wide range of its phenomena, and the original and masterly illustration of the constitutional effects of local

* On the Constitutional Origin and Treatment of Local Diseases, p. 1.

† Address delivered before the Royal College of Surgeons, March 29th, 1859, as reported in the *Lancet*.

disease and injury, it is evident that he is justly entitled to be regarded as the father of pathological surgery, and as the first who raised surgery from the rank of an art to that of a science. If this had been all he ever did, what name in the annals of medicine could have had a prouder claim to distinction?

The first approach to an accurate knowledge of the anatomy of the lymphatic system, and the establishment of its true functions, are due to the conjoint labours of William and John Hunter. The existence of lymphatic vessels had long been known; and, somewhat earlier than the time of the Hunters, conjectures had been thrown out as to their absorbent action; but their relation to the lymphatic glands, and their connexion in one entire system permeating the whole animal frame, and ministering to an important general function, were brought to light for the first time by the researches of these distinguished brothers.*

John Hunter showed that an injection of mercury, forced into the substance of the lymphatic glands, would fill not only the glands, but all the lymphatic vessels proceeding from them; and it was his intention to have traced the lymphatics in this manner throughout the body, and to have given a complete description and figure of the whole absorbent system; but he was prevented, by a long illness, from prosecuting his design. His brother William bears witness to these facts, and Cruikshank, who perfected the anatomy of the absorbent system, distinctly acknowledges the priority of John Hunter. An immediate application of the physiological views developed by his own and his brother's researches was made by John Hunter in his beautiful theory of the action of the lymphatics in balancing that of the nutritive vessels, and modelling the different organs of the body into their just shape and proportions. Still more important was the use which he made of these discoveries in explaining the process of ulceration, which constitutes "perhaps one of the most successful efforts that has hitherto been made by any pathologist to apply the knowledge of a living function to the explanation of morbid appearances."†

Among the general subjects on which Hunter exercised his versatile powers was the venereal disease. In the investigation of this, however, he fell far short of the excellence which he attained on most other subjects involving the illustration of general principles, and the application of vital laws to the elucidation of morbid actions. Still, he was undoubtedly the first who cultivated this subject in a scientific spirit; and there is one point of view in which his treatise may be considered as particularly valuable—namely, as the earliest attempt to illustrate the laws of morbid poisons. Many of Hunter's theoretical views of syphilis have been proved, by more recent observation, to be erroneous, such as that of its invariable tendency to go on from bad to worse, and that of its incurability by any other than a specific remedy.

* It must be confessed, however, that they fell into a great error in denying the absorbent power of the veins, which was then generally admitted; and that they thus made a step backward, as well as one in advance.

† Thomson's Lectures on Inflammation, p. 369.

But Hunter did not excel in pure theory; his mind was not of a logical cast; and his hypothetical reasoning was often—nay, almost always—vague and inconclusive. His *forte* lay in seizing with amazing sagacity on those points of a subject which afforded scope for anatomical demonstration, or physiological experiment—in bringing to bear on such points a most exact and comprehensive knowledge of comparative structure—and in devising, with the most subtle ingenuity, experiments directly adapted to solve the point at issue. The venereal disease was not a subject which afforded much scope for these qualities, and therefore, as truly remarked by Dr. George G. Babington in his preface to the treatise, it “was less adapted than many other subjects to the peculiar genius of John Hunter.” It is not to be denied, however, that Hunter brought to the illustration of the venereal disease the same laborious observation of facts which characterizes all his works. His delineation of its local and constitutional effects is given with a masterly hand, and his precepts for its treatment have in the main held their ground amid all subsequent fluctuations of opinion. Before he took the subject in hand it was quite out of the pale of scientific inquiry, and the treatment of the disease was altogether empirical and unsatisfactory. He left it enriched with copious and correct observations, and with sound views of treatment; so that his treatise on this subject, though it will not bear a comparison with his greater works, is still of no ordinary merit, and must be regarded as the production of a very great pathological and practical surgeon.

The observations of Hunter on the nervous system were perhaps less extensive than might have been expected from so ingenious and indefatigable an inquirer. This seems to have been one of the few instances in which speculative views occupied him too much, to the exclusion of that inductive method of research which usually guided him to such sound and beneficial results. On some points, however, following his accustomed modes of inquiry, he arrived at highly important conclusions. He distinctly showed that organs which are endowed by one nerve with a special sense, derive their common sensation from another nerve having a different origin; and he determined this nerve of common sensation, in the case of the eye, the nose, and the ear, to be the nerve of the fifth pair. He extended the same reasoning to the organ of taste, though he did not verify it, as in the preceding instances, by anatomical demonstration. Hunter, therefore, unquestionably originated, and pursued with no trifling success, that method of inquiry into the functions of the nervous system which Sir C. Bell afterwards carried out to so large an extent, and with such brilliant results. Another observation of great interest, both in a physiological and psychological point of view, was first made by Hunter—namely, that nerves adapted to the reception of peculiar impressions convey such peculiar impressions to the brain, though merely a mechanical stimulus be applied to them; and he instances the sensation of light produced by a mechanical impression on the retina, and that of sound by a similar impression on the acoustic nerve. Later experiments have extended this observation, by showing that if

the stimulus be of a chemical or electrical, instead of a mechanical nature, the nerve will still convey its appropriate impression.

There is no function which Hunter has more largely illustrated by an appeal to comparative structure, than that of digestion, and the preparations in his museum displaying the anatomy of the organs which minister to this function, from the lowest animals up to man, form a most beautiful and truly instructive series. The power of living matter to resist the action of the gastric fluid had already been incidentally remarked by Grew; but Hunter adduced a most interesting illustration of the fact, in the case of the stomach itself, by showing that in some instances this organ is partially dissolved after death by the very fluid which it secreted while living. This fact has been disputed, and the phenomena referred to morbid actions going on during life by Cruveilhier and others; but the experiments of Dr. Carswell have set the matter at rest, and established the correctness of Hunter's views.

That the act of vomiting is performed by the diaphragm and abdominal muscles, while the stomach itself is passive, was a position maintained by Hunter, though M. Magendie imagined that he was the first to discover the fact.

To John Hunter we unquestionably owe the resuscitation of the study of transcendental or philosophical anatomy. This study did, in truth, originate with Aristotle; but that extraordinary man was, in this respect, not years only but two thousand years in advance of the age in which he lived; and neither Hunter, nor others far more learned than he, had any conception of the physiological treasures sealed up in the writings of the "mighty Stagyrte"—treasures which have fully come to light only within the last thirty years.

In Hunter's descriptions of his drawings illustrative of the development of the chick, is the following very remarkable passage:

"If we were capable of following the progress of increase of the number of parts of the most perfect animal, as they first formed themselves in succession from the very first, to its state of full perfection, we should probably be able to compare it with some one of the incomplete animals themselves, of every order of animals in the creation, being at no stage different from some of those inferior orders; or, in other words, if we were to take a series of animals from the more imperfect to the perfect, we should probably find an imperfect animal corresponding with some stage of the perfect."

Surely never was an original and magnificent conception so poorly clad in language! But here is the unequivocal announcement of a theory which, though too absolutely adopted by some writers, has exercised, and is worthy to exercise, no small influence on the reasonings of philosophical anatomists.

The subject of monstrosities engaged much of Hunter's attention. He framed a classification of them, and produced them artificially by curious and well devised experiments on living animals. He arrived at the conclusion that such deviations from ordinary structure were not, as it was then the fashion to term them, *lusus nature*; for he observed that every species had a disposition to deviate from normal

development in a manner peculiar to itself—a position virtually the same with that which M. Isidore St.-Hilaire makes the basis of his celebrated treatise on the ‘Anomalies of Organization.’ Hunter explained congenital defects by a reference to the transitory structures of intra-uterine life. It was thus that he solved the question how the intestine came to be in contact with the testicle in congenital hernia. He observed the position and relations of the gland in the abdomen of the foetus; traced its descent into the scrotum; found that it carried along with it a peritoneal pouch like a hernial sac; and showed that, in the event of the simultaneous passage of a portion of intestine, this pouch must remain a common receptacle for the intestine and the testis. He then went on to show how the abdominal position of the testis, and the transitory condition of the tunica vaginalis in the human foetus, are permanent conditions in the lower mammalia.

Of Hunter's labours in the field of zoology it is now impossible to form a complete estimate, because that portion of his manuscripts in which his observations in this department were especially recorded, was destroyed by Sir Everard Home. Sufficient however remains, collected in his museum, and scattered through his published writings, to prove how great must have been the entire amount of his contributions.

He made several attempts at a classification of animals based on their anatomical structure. One of these he derived from the distribution of the nervous system; another from the reproductive organs; and another from the structure of the heart. The first was not carried out to its full extent; the second was relinquished as unsatisfactory; and the third was only an improvement upon that of Linnæus. Hunter, however, made very important advances towards a perfect classification of animals according to the distribution of the nervous system; and there was a stage of his inquiries at which, if he had not been deserted by his usual acuteness, he would assuredly not have left for Cuvier the grand division of animals into *vertebrata* and *invertebrata*. Hunter notes the aggregation of the nervous system into spinal and cerebral masses, as distinguishing fishes from those animals which are now called mollusca and articulata; but he did not perceive that the existence of this cerebro-spinal axis is equally characteristic of the classes above fishes; neither did it occur to him that, wherever there is a cerebro-spinal axis, there is also a bony case for it.

The study of what is now styled *paleontology* was in its infancy in Hunter's days. But there is a paper of his on some fossil bones, presented to the Royal Society by the Margrave of Anspach, which shows that he had much larger and more enlightened views on the subject than any which were then generally entertained. Professor Owen has given an analysis of his paper, which we here transcribe, as being more to the purpose than anything which we could offer.

“In this paper, we may perceive that Hunter appreciated the value of the study of fossil remains, and their application to the elucidation of many important objects. First, with reference to the extension of our ideas respecting the zoology of this planet, we find him comparing the fossils which are the

subject of the text with their recent analogues, and he shows that they differ both from them, and among themselves: his observations and comparisons are, it is true, too general and summary, and it was left to his successors in this field of inquiry to pursue the comparison with the requisite minuteness and precision, and to give names to the distinct but extinct species. Hunter next briefly alludes to the different situations and climates in the globe to which animals are more or less confined; and this subject, or the geographical distribution of animals considered in relation to fossil remains, elucidates, amongst other interesting questions, the changes of temperature to which different parts of the earth have been subject at different epochs. Hunter points out more distinctly, and with more detail, the evidence which extraneous fossils afford respecting the alternations of land and sea of which the earth's surface has been the theatre; and by his frequent allusion to the 'many thousand years' which must have elapsed during these periods, seems to have fully appreciated the necessity of an ample allowance of past time in order to account philosophically for the changes in question. Lastly, he treats of the nature and causes of the different states in which the remains of extinct animals are found: and many of the fossil bones which are the subject of his chemical experiments are still preserved in his museum."*

Having thus taken a cursory view of Hunter's doctrines and opinions, and of the general principles which he sought to establish, we proceed to notice some of the more remarkable of his particular discoveries, and these we shall take in the order in which they suggest themselves.

1. He discovered and described the organ of hearing in the sepia—a discovery which has been attributed by Cuvier to Scarpa.

2. He first described the semicircular canals in the cetacea, the observation of which Cuvier claims for himself.

3. He preceded Camper by a short time in the discovery of the air-cells in the bones of birds, though there is no reason to doubt the originality of Camper in the same observation.

4. He discovered the peritoneal canals, or openings, in the eel, salmon, and cartilaginous fishes, as also in the crocodile.

5. He described the continuation of the peritoneal canals into the corpus cavernosum penis in the chelonia—an observation brought forward as new by M. Isidore St.-Hilaire and Martin St. Ange.

6. He discovered the motion of the blood in insects, describing correctly the action of the dorsal vessel, and the relation of the circulatory to the respiratory systems—points on which Cuvier was subsequently in error.

7. He first observed the bi-auricular structure of the heart in the caduci-branchiate batrachia.

8. He discovered that the tubuli uriniferi extend to the surface of the kidney.

9. He first described the renal organ in the snail.

10. He discovered the circular arrangement of the nervous ganglia round the oral aperture of the mollusca, as also the double abdominal nervous cord of the articulata.

11. Conjointly with his brother William, he ascertained the true nature of the connexion between the placenta and the uterus. How much of the merit of this was due to each, it is impossible to deter-

* Note to Hunter on the Animal Economy, pp. 479, 480.

mine, as each claimed the whole, and the dispute gave rise to a bitter feud between them.

12. He discovered the lymphatics in birds.

13. Amongst the most important improvements in practical surgery of the age in which Hunter lived, and which may be classed among his discoveries, was the operation, first suggested and practised by himself, of tying the femoral artery for the cure of popliteal aneurism. Considered simply in the light of an operation for the cure of aneurism, in which a ligature was thrown round the artery above the aneurismal tumour, leaving the tumour itself unopened, Hunter's operation was certainly not new, because Anel had performed at Rome, in 1710, precisely such an operation on the brachial artery, for the cure of an aneurism at the flexure of the elbow, and with complete success; but considered in the light of an operation based on the principles that the collateral bloodvessels would enlarge and carry on the circulation when the main trunk was rendered impervious, and that the aneurismal tumour would be gradually removed by the action of the absorbents, Hunter's operation was entirely new. It was new also in respect to its application to popliteal aneurism. The claim of priority which has been set up for Desault is absurd, for in his operation the artery was tied in the ham—not in the thigh; and though he did not open the tumour, it burst of itself, so that the operation affords no parallel with that of Hunter, and as regards results, was altogether inconclusive.

Several other of Hunter's particular discoveries have been already mentioned in connexion with his general doctrines and views, and more might be cited, but the foregoing may answer the purpose of the present brief survey.

We have thus endeavoured to give a sketch of what Hunter did for science, derived chiefly from an examination of his writings. But he has left a record of his thoughts and his discoveries far more interesting and impressive than any writing, in that museum, which is viewed by all capable of appreciating it with daily-increasing wonder. This is in reality by far the most remarkable of Hunter's works, and is, to our apprehension, utterly different in its whole scope and meaning from everything else that it ever entered into the mind of man to conceive or into his plans to execute. Anatomical museums, previously to that of Hunter, had been merely the repositories of certain objects calculated to convey information as to particular facts, or to exhibit points of individual interest or curiosity. Each object spoke for itself, and it spoke of nothing further. A museum which should carry out an abstract physiological principle through an almost endless series of forms, each exhibiting some new adaptation of structure to its manifestation, was a thing which had never been even dreamed of. Yet such was Hunter's museum. In the physiological portion of it at least, there is scarcely a preparation which stands alone. Each stands in relation to that which precedes and that which follows it, and each forms a link in an unbroken chain of investigation into the develop-

ments of the vital force. The whole is one continuous train of what may be called visible and tangible reasoning. It addresses us in an extraordinary symbolical language, in which the powerful but peculiarly constituted mind of Hunter delighted to embody its conceptions. As we have already hinted, he had in his composition some of the elements of a poet, and we may now add of an exceedingly great poet. That he was a man of vast imagination cannot be doubted, otherwise he never could have formed so stupendous a design as that of thus turning to shape the universe of life and giving it a local habitation. The German Fichte has maintained that the whole universe is the development of a "divine idea," which it is the province of poets and philosophers to interpret to man; to which view the practical objection is, that none but a mind commensurate with that of the deity could take in the idea, or be equal to the task of expounding it; but assuredly, as far as life was concerned, Hunter appears to have been possessed, more than any other mortal, with some such divine idea, and being gifted with scarcely an ordinary command of language, he was at once driven by a natural deficiency and guided by the singularity both of his genius and of his subject, to the adoption of a mode of expression of all others the most suitable, and compared with which all verbal description or illustration would have been poor and unemphatic. His tongue was not fluent of speech, and his pen was not that of a ready writer, but his hand, long skilled in dissection, became the readiest and the most faithful interpreter of his thoughts.