

## PART II.—REVIEWS.

*Aristotle; a Chapter from the History of Science, including an Analysis of Aristotle's Scientific Writings.* By GEORGE HENRY LEWES. London: Smith, Elder, and Co., 1864.

MR. LEWES deserves our gratitude for having appreciated one of the greatest needs of science in these days, and for having attempted to supply it. Unquestionably, one of the gravest evils under which our men of science—and especially the cultivators of medical science—at present labour, is the general ignorance which prevails amongst them as to the history of scientific opinions; prevails, indeed, to a greater extent than was ever the case, at least in the higher ranks of the medical profession, in any previous period of scientific activity and reformation like the present. Less than ever do medical men seem to remember that opinions always have a history and an organic growth, and that unless their embryonic forms be studied carefully there is little prospect that their maturity will be understood. In the insolence of our success, we of the nineteenth century are apt to believe that the triumphs of our modern science are all-important, and that the student would be only wasting time who should busy himself with inquiries as to what took place in the “darker” periods, when as yet the machinery of scientific investigation was miserably imperfect. It is interesting to separate the truth which this notion undoubtedly contains from the fallacy which lurks beside it. In one sense the sciences, and especially the natural sciences, may be said to be the growth almost of yesterday, since the machinery for exact observation, without which the inductive method cannot be adequately applied, only existed in very recent times; yet in another, and we take leave to say a higher sense, the advanced knowledge of to-day is distinctly the fruit of ages far removed in the past. Nay, more, our boasted science, ready though it be to treat with disdain the deficiencies of the older systems, is yet content in its careless ignorance to accept an inheritance which of all the bequests which antiquity could bestow is the most dangerous, the inheritance of a phraseology ill-understood, and of which we have lost the key.

It was, therefore, with pleasure, and with agreeable anticipations, that we proceeded, after reading Mr. Lewes's preface, to study the

body of his work. He has rightly regarded Aristotle as the father of ancient science; and as the historical development of scientific opinion is too vast a subject to be treated in any single work of moderate dimensions, he has doubtless acted wisely in selecting Aristotle's labours for illustration in the first instance. And we may say that so far as his conception of the proper mode of dealing with his subject allows, Mr. Lewes has executed his task most creditably. The amount of hard work to be gone through was necessarily very great; for, in regard to the biological treatises which form the greater part of the scientific works of Aristotle, it may be said that the classical scholars (at any rate in England) who have ever read them once through might be counted on one's fingers, and the difficulties of translation into intelligible and definite English are rather increased than diminished by such commentaries as exist. As far as we can judge, Mr. Lewes has brought to his task sufficient scholarship to enable him fully to master the literal sense of Aristotle's words. Whether he has always been equally fortunate in appreciating his ideas is perhaps more doubtful, as we shall hereafter endeavour to show. But there is another respect in which we must speak of this work, and that the most important one, in which we freely confess it has disappointed us not a little. Viewed as a first instalment of the much desiderated history of the growth of science it discourages us as to the prospect of so comprehensive a scheme being worthily carried out by our author; for, notwithstanding the principles clearly laid down in the preface, there is comparatively little to be seen, in this volume, of the true influence of Aristotle upon succeeding philosophers and men of science. It is true that Mr. Lewes favours us with a rather diluted Comtian exposition of the development of scientific thought from the earliest to the most recent times; and that he likewise devotes two consecutive chapters to the consideration of the general influence exercised on the progress of science by the methods of Plato and of Aristotle, in which, as might be expected from the declared principles of the writer, the elder philosopher fares badly. But even in these chapters, where the methods of Plato and Aristotle are expressly compared, we find no adequate appreciation of the influence of the master on the pupil; one of the first and most important objects, surely, in an examination of Aristotle as the chief representative of science in his own day, and the chief ruler of its progress for centuries after his own death. Yet this influence is constantly conspicuous in Aristotle's works, and in none more so than in some of the biological treatises which form the principal subject of Mr. Lewes's volume; and our author might have done good service by carefully illustrating this fact, and pointing out its effects, not only on the biological speculations of Aristotle themselves, but also on the mode in which they were interpreted by

subsequent philosophers. What we do get from Mr. Lewes is an accurate appreciation of the degree in which Aristotle's information in scientific matters, and particularly as to biology, forestalls or foreshadows the advanced science of the present day; in this respect the book is full of interest, and as it would be quite impossible to give sufficiently detailed illustrations, we can only recommend the author's observations in this matter as most candid and impartial, and in most instances, we believe, strictly correct. There are two chief features which our author remarks, in virtue of which the biology of Aristotle may be said to stand upon a level with the most advanced modern science, viz., his general conception of the nature of life, and his speculations with regard to the function of generation. The two treatises—the 'De Anima' and the 'De Generatione Animalium'—in which the views referred to are chiefly embodied, are particularly suited to bring out the qualities of a critic; they have tempted our author to show himself at his best, and also, as we venture to think, not unfrequently, at his worst as a commentator; we propose, therefore, as the subjects concerned are precisely those most likely to interest our readers, to make some remarks on Lewes's criticism of these treatises.

I. *Theory of Vitality*.—Mr. Lewes echoes the observation of Sir Alexander Grant, that a common misconception of Aristotle's  $\psi\upsilon\chi\eta$  has arisen in modern times; but it may be doubted whether he is right in ascribing the origin of this misconception to the influence of so modern a writer as Descartes, as he seems to do. He justly observes that the word cannot be fitly translated by the Latin word *anima*; its meaning is more comprehensive than this, and in some respects may be considered to include the meanings both of *anima* and *animus*. But he is not justified, we think, in his further statement, that Aristotle taught that mind is "only the highest form of life—one of the special forms of organic activity;" and, at the risk of seeming tedious, we must endeavour to show that in reality his doctrine was more complex.

The biological system of Aristotle's master, Plato, as expressed in the 'Timæus,' was obviously little more than a fanciful sketch; nevertheless, it doubtless embodied opinions which were current at the period, or which were, at least, to be found floating in the atmosphere of contemporary speculation. It marks very strongly that conception of life as *an entity or entities inhabiting the organism* which is characteristic of the metaphysicians, and which was afterwards adopted by Galen, and by his powerful influence established as a cardinal doctrine of physiology. The double, or rather triple soul of the 'Timæus' might have remained a mere fancy had it only been embodied in the spiritual philosophy of Plato; but in the hands of the stoic-materialist, Galen, it assumed a rigorous and definite shape, and henceforward nearly all medical and physiological

literature is full of allusions to the natural force, the life-force, and the animal force. And this tendency to the definite *embodiment* of vital principles was doubtless much increased when, at the revival of classical literature in the fifteenth century, Plato received fresh honours, and the 'Timæus' found commentators who were already acquainted with Galen's physiological dogmas.

In a certain sense the great pupil of Plato was free from the theoretical dogmatism of the metaphysicians, and he occasionally caught glimpses of the conception that life is not to be considered as any entity or series of entities resident in the organism. He speaks of the vital principle as the primary reality of the organism (*ἐντελέχεια ἢ πρώτη σώματος φυσικῶν ὀργανικῶν*), and this expression appears to us to have a higher meaning than that which Mr. Lewes would seem to affix to it, if we may judge from his own definition of life (as the "dynamical condition of the organism") which he puts forward as the expression of that advanced modern thought with which "Aristotle is on a level" as to this question. With submission to our author, we believe that Aristotle's meaning was more philosophical than this. When he says that *ψυχή* is the "primary reality of an organized natural body," he appears to indicate that life is the sum of the tissues, *and* of the forces acting in them, as we should now express it, which compose a living creature. He expressly states,\* on more than one occasion, that tissues *without forces* cannot be called an "organism" at all, however symmetrical may be their arrangement, and implies that it is the body (or the organ) *plus the forces* that can alone receive that appellation. And life is not *in* the organism, but is *identical with it*, for it is the first *ἐντελέχεια*, the first reality or completeness of the organic tissues, which previously had only the *δύναμις*.†

Such is the conception of life which we believe to be the highest result of Aristotle's speculations; but he is by no means always consistent in the expression of it. He holds language which would make us believe that he recognised, after all, three distinct vital principles, the threptic (or nutritive), the orectic (or emotional), and the noetic (or intellectual), and he certainly seems to imply, in more than one place, that these principles, or some of them, are nourished by the inspiration of the *πνεῦμα*, a word which, in his writings, may sometimes be translated by its common meaning—breath—but sometimes also clearly means something different from this. What this something was, however, we know not, for the treatise on the *πνεῦμα* is lost. It is probable that the "Ether,"‡ which Aristotle

\* 'De Anima,' ii, 1.

† *Ὅτι μὲν οὖν ἐντελέχεια τις ἐστὶ, καὶ λόγος τῶν δυνάμιν ἔχοντος τοιοῦθι εἶναι, φανερόν ἐκ τούτων.* ('De Anima,' ii, 2.)

‡ On this matter consult the 'De Generatione Animalium,' ii, 3; where he speaks of the generative heat of the sperm.

seems to have treated as a fifth element, is that which (when it has been inspired) he speaks of as the *πνεῦμα*, and which he says is the intermediate agent between the soul and body, which resides in the heart, and is by nature peculiarly fitted to cause movement. And yet there seems to be an obvious contradiction between such a notion as this and the simple and philosophic idea of life as the primary reality of the organized natural body."

Scarcely less perplexing is the language which Aristotle holds concerning the *νόος*, or intellect, and yet to our mind it is clear that his opinions were, on the whole, in favour of a different conclusion from that which Mr. Lewes seems to credit him with. When our author represents the Aristotelian idea of mind as being "only the highest form of life," he appears to directly contradict the plain sense of several passages which he himself quotes; more especially of one from the 'De Generatione Animalium,' in which the *νόος* is distinctly asserted to be separable from the body, godlike, and coming from without into the body. And there are many passages which speak unequivocally to the same effect, especially in the fourth and fifth chapters of the third book of the 'De Anima.' However desirous Aristotle may have been to simplify the facts of mind by treating them as a mere phase of the general life of the body, it is plain that he thought this simplicity could only be gained at the expense of truth. Man alone, he says, has anything of the Divine in him, or at least he has far more than any other animal possesses; and this Divine part he speaks of, repeatedly, as something which cannot perish, but is eternal. And he expressly declares, in the passage already referred to (De Gen. Anim. ii, 3), that the actuality (*ἐντελέχεια*) of the intellect has nothing in common with corporeal actuality. How are we to reconcile this statement with the theory that Aristotle regarded mind simply as the highest form of life—one of the special forms of organic activity? Mr. Lewes has failed, apparently, to appreciate the distinction (to which Sir Alexander Grant calls attention) between "the two modes of intellect which Aristotle recognises—the *νόος παθητικός* and the *νόος ποιητικός*. These two modes are necessarily opposed to each other, as matter is opposed everywhere to form, and to all that gives form. The receptive mind (*νόος παθητικός*) which is as matter, becomes all things by receiving their forms. The creative mind (*νόος ποιητικός*) gives existence to all things, as light calls colour into being. It transcends body, being capable of separation from it, and from all things; it is an everlasting existence, incapable of being mingled with matter or affected by it, prior to the individual mind. The receptive mind is necessary to *individual thought*, but it is perishable, and by its decay all memory, and therefore all individuality, is lost to the higher and immortal reason." In short, although there is a certain superficial truth in Mr. Lewes's statement about Aristotle,

that he lacked "a sense of the ineffable," it is certain that in presence of the great facts of consciousness his sceptical spirit was completely overmastered. We think it a great injustice to Aristotle to represent him as dealing with the universe like some haberdasher's apprentice, bent on tying up the various articles in his employer's shop into convenient parcels, and content to resign those which he could not manage to the care of any one who might have a larger stock of packing-paper, or a longer hank of twine. Yet something like this is what Mr. Lewes describes as the habitual attitude of his mind. To tell the truth, if we were inclined to accuse any one of "lacking a sense of the ineffable," it would not be Aristotle, but Mr. Lewes himself. There is about the whole of his chapter on the 'De Anima,' a certain hard dryness of treatment which fails, as we cannot but think, to give any just idea of the manner in which the Greek wrestles with difficulties which sometimes force him into apparent self-contradictions.

There is far less uncertainty in the position assigned to the emotions and appetites, and to sensation, of which they are the necessary consequence. Aristotle clearly thought that all this portion of the  $\psi\upsilon\chi\eta$  was perishable, and inseparable from the material body. It is the strongly material aspect of the passions which leads him, in the first place, to undertake the examination of the  $\psi\upsilon\chi\eta$  from the physical side; and it is probable that the superficial study of some passages which express this view strongly, has sometimes given rise to the mistaken notion that Aristotle's general position is materialistic. A curious fact which Mr. Lewes only briefly touches on in a foot-note might well have received a more careful examination in connection with this part of Aristotle's biology, viz., the undoubted predominance of materialistic views on the nature of the soul in the Christian Church during the first three centuries of its existence. Even Justin Martyr, whose Platonic tendencies are strong, and who makes a distinction between the "spirit of life," (which ceases to exist on the death of the body), and the soul proper, endows the latter with sensation, which remains after death. In fact, the exigencies of the Christian doctrine of punishments and rewards, as it was understood by the imperfect lights of that day, appeared to necessitate a belief in the materiality of the soul; and it was only very gradually that its immaterial nature came to be received, after the general belief had passed through a variety of modifications. In Tertullian we recognise pure materialism; in Origen we find the admission of a "comparative immateriality" of the soul; in Nemesius we arrive at a much higher stage of development; and in Augustine we have the doctrine of immateriality completely expressed. No sooner was Aristotle revived by the Arabians, than this tendency to immaterialism was greatly strengthened. Nothing can be more distinct and accurate than the opposition

between the Aristotelian and the *primitive* Christian theory of the separation of body and soul. The former supposes the capacity for suffering and enjoyment to cease at death; the *νοῦς*, which alone is separable from the body, being destitute of sensation and appetite. The latter maintains the complete persistence of these faculties, independent of the fleshly body. But in later times, when Aristotle was forced into the service of the church, the ecclesiastical standpoint had entirely changed, and Aristotle's immaterialism only reinforced opinions which, through the Pauline teaching of Augustine and Athanasius, more especially, had become generally diffused throughout Christendom.

In spite of all its apparent contradictions, the psychology of Aristotle appears to us a work which, in its broad grasp of principles, is hitherto unapproached even by the latest systems which have been elaborated in the full light of modern analysis. The vigorous force of the conception of life as the *completeness of the body*—the sum as it were of the material and dynamic elements of its healthy function—is unequalled by anything which has been said on the subject before or since. And with regard to the apparent contradiction involved in the distinctly immaterial character which Aristotle ascribes to the *νοῦς*, we may call attention to a parallel fact which has, in our eyes, a very high interest. The battle between "organicisme" and "spiritualisme" has been lately renewed in France, as our readers are probably aware, with great vigour; on the one side we hear the more literal adherents of positive philosophy asserting a coarse materialism which excludes the idea of mental freedom altogether, while, on the other hand, by a mere rebound from this excess, the spiritualist party have been encouraged to invade the domains of science, and threaten seriously to re-establish, in a dangerous degree of favour, the metaphysical method of studying biology. Amidst all this uproar it is a matter of satisfaction to observe that some cooler heads preserve their judgment. M. Rostan, a most distinguished physiologist, and an "organiciste" in the strictest sense of the term, has declared in his latest work his unshaken confidence in the immateriality and immortality of the thinking part of man; which he regards as established by evidence with which physiology proper has nothing to do: in short, this philosopher of the nineteenth century, than whom no one more frankly accepts the necessity of a positive spirit in purely physiological investigations, recoils, as did the hardy and daring intellect of Aristotle, from the rash confidence of those who would limit the operations of mind to the narrow groove of a materialistic necessitarianism. No scientific physiologist can be ungrateful to the founders of the positive philosophy—a philosophy which has given so great an impulse to the best kind of biological investigation; but many of the wisest and most liberal would deprecate the impetuosity of some neophytes

which leaps to a complete and simultaneous solution of corporeal and mental processes, and insists that everything shall be explained in accordance with the phenomena observed on one aspect only of the object of inquiry. It is this impetuosity\* that provokes the senseless reaction (as we cannot but call it) which is displayed in such productions as the recent clever and plausible article—"La philosophie de l'esprit"—which appeared in the 'Révue des deux mondes,' and still more in the ill-starred effort to rehabilitate the doctrines of Stahl which is at present agitating a portion of the scientific world in France. The mention of these disputes recalls us to the gravest defects of Mr. Lewes's volume. What our men of science need to know concerning Aristotle is not so much the extent or accuracy of his information as compared with modern knowledge, but the exact influence which he exercised upon successive generations, the detailed steps by which the numberless contradictory theories for which scientific theorists have made him responsible were extracted out of the Aristotelian writings or traditions. It is true that this could not be done within the compass of such a volume as that now before us; but even if he were unwilling to attack the whole subject at once Mr. Lewes might at least have given useful indications as to the special parts of Aristotelian biology which afterwards became metamorphosed into some of the most famous and influential medical doctrines.

For it was by no means Aristotle, *at his best*, who became influential with the physiologists of the dark ages of science. Such a philosopher, for instance, as Nemesius,† who may be said to have given the first foreshadowing of the merits and the demerits of that ecclesiastical influence on physiological teaching which was to become so powerful, would naturally approach the perusal of Aristotle with certain predetermined principles of eclecticism; and accordingly we find that he extracted from Aristotle's writings the theory of the vital spirit being drawn from the venous blood by the suction of the arteries, and circulated in the latter vessels; a doctrine which he would be the more inclined to adopt, because it fitted well with the teaching on the subject of the vital principle which the first Hippocratic school—and subsequently the pneumatists,—had made popular, but which in fact had been earlier enounced by Heraclitus, and in part even by Pythagoras. The rage for reconciling Aristotle's doctrines with those of Plato, which especially beset the Neoplatonists and Arabian commentators on the former, also aided to give an abnormal prominence to those parts of Aristotle's writings which

\* As a sample of this quality, we may instance the review of M. Rostan's work, which appeared not long since in the 'Union Médicale.'

† Bishop of Emesa, 4th century, A.D., author of the 'De Naturâ Hominis,' which was at one time absurdly said to contain an anticipation of Harvey's discovery of the circulation.



appear to favour the conception of the vital principle as a distinct entity or entities superposed upon the organism. The powerful influence of Galen's philosophy of life (which was developed from a combination of the doctrines of Plato with those of Hippocrates) doubtless strongly predisposed subsequent commentators to find this kind of meaning in Aristotle's biological teaching. The consequence of all this misrepresentation or partial representation of his views was most unfortunate for science, for it strengthened precisely that tendency of physiology which was its greatest bane—the tendency, namely, to regard the principle of life as a proper subject for investigation apart from an accurate knowledge of the bodily organs. The student of medical history is familiar, in a general way, with the lamentable results which have flowed from this fundamental error in every department of medical science; but it may be questioned if many have yet realised the extent to which we are still trammelled by the inheritance of phrases representing ideas which were the pure inventions of a metaphysical biology. The most remarkable and lasting influence of this kind was probably exerted by the Arabian physicians, a fact which is specially interesting in connection with their well-known reverence for Aristotle whose opinions—so far as they knew them—were, in many cases, the acknowledged models of their own physiological speculations. The additions made by the Arabians to scientific physiology were trifling, if any; but as continuators of Aristotle, especially in regard to his doctrine of the *pneuma*, these writers deserve careful attention, for it was through them, more than in any other way, that his opinions exerted their powerful influence on the course of biological speculation. The eclectic principles on which the Arabians dealt with such portions of Aristotle's writings as they were acquainted with, is well shown in the works of Thophail, of Avicenna, and others. "Siehe da" (says Sprengel, after quoting Thophail's description of the *pneuma* and its part in the functions of life) "die Verbindung der Alexandrinischen Philosophie mit dem Peripatetischen System!" This is a most suggestive observation. It is by their combination of Aristotle's pneumatism with the supernaturalism of Alexandria and the East that the Arabians form a true developmental link between the ancient physiology and that great reformation of medical philosophy in the sixteenth century of which, with all their errors, Paracelsus, and Van Helmont were the leaders. For this doctrine of the *pneuma* will be found by the student to underlie all the great problems of physiology as they were agitated in the dark ages of physiology, before anatomical research had received the impulse communicated to it by the great anatomists of whom we reckon our Harvey the chief. It must not be forgotten, either, that the Arabians, though they cannot be said to have originated many scientific ideas, were great coiners of scientific phrases, and many of these

phrases have enjoyed a permanence altogether out of measure with their true value : a fact which can be readily ascertained by reference to the works of Avicenna, or to the 'Index' of his commentator Palamedes.

We have said enough to indicate a large field of inquiry which Mr. Lewes might usefully have opened, and which, in a work intended to illustrate the relations of Aristotle to modern science would, in our humble opinion, have advantageously supplied the place of much which we find in the volume before us. The personal opinions of Aristotle on the deep questions of life are highly interesting in themselves. But for the purposes of a history of science we submit that it is really quite as important to trace the modifications of Aristotelian biology in the hands of his principal and most influential commentators, such as the Neoplatonists, the Arabians, and the Schoolmen ; for these are the means through which his influence really came to rule the scientific world.

II. *Theory of Generation.*—Mr. Lewes has, we think, found a task more suited to his genius, and to his studies in natural history, in the criticism of the wonderful treatise on generation, than in analysing the singularly complex speculations of the 'De Anima.' His own views on generation and development happen to be interesting, and he has found a congenial task in proving these views to be the result of our most advanced knowledge, and at the same time indicating that the extraordinary prescience of Aristotle had to a considerable extent forestalled some of these conclusions of recent science. Among the most remarkable instances of this scientific foresight he has justly placed Aristotle's unhesitating enunciation of the doctrine of *Epigenesis* in foetal development ; that is to say, the doctrine of "a primitive amorphous germ becoming an organism through successive modifications, each modification being the cause of others—part being added to part, not simply in the way of addition, but each being the product of some predecessor, and the cause of some successor." This theory has only acquired the support of the facts necessary for its proof in the exact researches of recent embryologists, yet Aristotle's description of the successive developmental stages of the embryo is substantially correct. He speaks of the embryo living at first the life of a plant, and only subsequently acquiring the sensitive and intelligent soul. The embryo is the representative of the sperm and the seed, which respectively contribute to its formation, the sperm also being the primary motor of development, the influence of which continues long after the primary impulse has ceased. We have heard it remarked, by one whose opinion is well worthy of attention, that one of the most surprising features of Aristotle's genius is the circumstance that even in speculations where of necessity his primary observed "facts" were incorrect, his conclusions are right and good :

and though this may be considered an extreme statement, it certainly derives a plausible support from the results to which he was led in speculating with most imperfect means of observation, in the processes of generation. For instance, it is extremely singular to remark the process by which he arrived at the conception of the respective shares in the work of conception performed by the male and the female; for he was without any knowledge of the true function of the ovary, or of the nature of the ovum, and regarded the catamenial fluid as the female analogue of the sperm. This idea was of course incorrect, the catamenial fluid does not, *necessarily*, contain an ovum at all, at most it is the *accidental* attendant of the discharge of a mature ovum, and is in no way essential to that process. Yet the influence of the mistake was rather fortunate than otherwise, since it confirmed him in the belief to which other observations inclined him, that equal though different shares are borne by the male and female in the work of reproduction. And we distinguish the same power of scientific imagination in the description which he gives of the fœtus, while still only potentially an animal, deriving its food from the uterus by the ramifications of the umbilical vessels, as a plant derives its food from the earth; this recognition of the uterus as a place of nutrition for the fœtus, which he establishes by reference to the non existence of the organ in oviparous animals, is a master-stroke in its way, and considering the general tone of scientific speculation in Aristotle's time. But his most consummate effort of this kind is the explanation which he gives of hereditary transmission. After describing most ably the principal variations in the transmission of parental features, and the circumstances under which they occur, he observes that the cause of all these variations is the resistance opposed to the motor impulse by the material moved; just as the edge of a tool is blunted by that which it cuts, and the heating body is cooled by that which it warms; and he proceeds to demonstrate in the clearest way that no variation of hereditary transmission ever gives the human offspring other characteristics than those of its species; thus the monstrosities which sometimes occur, in which there is an appearance of the blending of the characteristics of some other animal with those of the human race (like the "pig-faced lady" of our day) are never really animal in any one of their limbs or features; they merely present the results of a too greatly arrested development. "How impossible it is for one animal to have the parts of another is evident from the differences in the periods of gestation of men, sheep, dogs, and oxen. Each can only be formed in its own definite period."

The theory of generation propounded by Aristotle is a splendid and consistent whole, the value of which is not seriously diminished by such errors as crept into it through his imperfect means of observation. There is less of gratuitous teleological speculation in

it than in almost every other work of his with which we are acquainted, a characteristic which is closely related to the greater fulness of real knowledge displayed in it. But it was impossible that Aristotle could free himself, even in this noblest of his scientific works, from the universal tendency to metaphysical explanations of vital processes; and accordingly we find that in his theory of the nature of sperm the pneuma plays a great part. Not that Aristotle originated the doctrine which he here propounds—that the sperm contains a spirit\* analogous to the element of the stars—on the contrary, it had already been put forward by the Pythagoreans: but the weight of his confirmation greatly assisted to give it that prominence which it constantly assumed in subsequent biological systems. Here again the *post-nati* have been true to their usual ill-luck as commentators on the Stagyrice, and have conserved this bit of metaphysical biology with jealous care, while almost wholly neglecting the store of genuine observations and philosophical reasoning which the treatise on generation contains. This doctrine of the quasi-divinity of the sperm gave one more excuse to neo-platonic commentators to declare that there was no disagreement between the physiological system of Aristotle and those of the Pythagoreans and of Plato. It came out with great force in the biological theories of the Stoics; it was adopted with lively appreciation by the Arabians, to whose Oriental spirit it was particularly congenial; and it reappeared in the *Summa* of Thomas Aquinas, in which it is represented by the “*principium corporis formativum*.” On the minds of those who represented physiological science in the melancholy period which intervened between the death of Galen and the great revival of anatomy, the notion of this spiritual character of the sperm exercised an extraordinary attraction, from the mystery which enveloped the subject on every side. And thus all minds were prepared to receive without surprise the extravagant developments of the Pythagorean theories as to the sperm promulgated by Paracelsus and by the Rosicrucians and other mystics of the 16th and 17th centuries.

Such are the important relations of Aristotle's pneumatism to the progress of the theory of generation. We must again express our feeling that Mr. Lewes commits an error in limiting himself to the record of Aristotle's own opinions: with regard to this very subject of generation, for instance, it would have been far more useful, if time and space would not serve for both purposes, to have traced out thoroughly one or two leading ideas (like that of the pneuma) by means of which Aristotle's influence was carried down to his successors, than to limit the discussion to questions as to the exact amount of science which he possessed.

Our space will not permit us to discuss Mr. Lewes's criticisms on

\* Πνεῦμα, καὶ ἡ ἐν τῷ πνεύματι φύσις ἀνάλογον οὐσα τῶν ἀστρῶν στοιχείῳ.  
VOL. XI. 8

the 'Parva Naturalia,' but with regard to one of these treatises—the 'De Memoria'—we must declare our opinion that Sir W. Hamilton's estimate of its meaning and value, though doubtless exaggerated, was much nearer the truth than the contemptuous flippancy with which it is treated in the volume before us, and which makes us gravely suspect that the author has not given to this difficult but most interesting treatise that careful study which we willingly admit he has bestowed on other parts of his task. The whole subject of the ancient doctrines, and particularly those of Aristotle, with regard to memory, is worthy of being taken up entirely afresh by Mr. Lewes, or by some competent scholar and physiologist; and we would counsel the individual, whoever he may be, who shall undertake this task, to put himself through a severe preliminary training, with a view to the eradication of habits of neat and effective writing.

And now we must hasten, before concluding this notice, to make some observations on the general estimate of Aristotle's scientific worth which Mr. Lewes presents to his readers. It appears to us that our author is agitated by two contending influences, the action of which upon his mind was inevitable, considering the point of view from which he approaches his subject, but the effect of which has been somewhat prejudicial to the complete appreciation of Aristotle's science. He is not destitute of generous sympathy for the prodigious intellectual efforts of a great man fettered in all his inquiries by the want of an efficient apparatus of observation, and he has penetration enough to see that the scientific genius of Aristotle enabled him to perceive the necessary conditions of that very inductive philosophy of which we moderns boast as the peculiar glory of our times. But he allows his inordinate veneration for the modern school of positive philosophers to seduce him into a forgetfulness of the difference between *conceiving* and at once *correctly applying* a method which leads him occasionally to give expression to a condescending pity for the labours of the great philosophers of antiquity, and similarly even for those of Bacon, which is unjust and uncalled for. Although himself a professed exponent of the doctrine of organic development of scientific principles, he ignores too much the services of those who broke up the rough ground and prepared it to receive the seed of science. As he is unjust to Plato's splendid labours in the analysis of the subjects of philosophical inquiry, so he is unduly contemptuous of Aristotle's experiments (which we believe were most necessary and most useful even when barren of immediate practical results) in the employment of teleological speculation; and so, also, he pronounces judgment with too little consideration on Bacon's "neglect of the process of verification." Moreover, he manifests a certain inability to comprehend the "inconsistencies," which doubtless are a feature in many of Aristotle's greatest works, which is hardly worthy of a

philosophical critic. The world has been so long in arriving at a general recognition of the fact that truth is many-sided, that it can ill afford to be seduced, at this time of day, into the belief that it has now attained to the one and only true method of knowledge, and that the great minds of antiquity are to be convicted of imperfection on the evidence of their painful balancing of views which seem to us mutually antagonistic, but which we may even yet learn to recognise as but the golden and the silver sides of the shield. There is something specially English, we fancy, in the tendency to believe in a best of all possible philosophies; it is a peculiarity which resembles the tenacity of belief with which we venerate our present political constitution and our present fashions in cookery. But our space is exhausted; and in taking leave of Mr. Lewes, we desire to express our sense of the great value of his book, a value which cannot be measured adequately by a merely critical estimate of its contents. For although we can hardly regard it as a complete and final settlement of Aristotle's relations to the progress of science, still there is so much matter in it that will be quite new to many readers, and which when read can hardly fail to stimulate their interest in the origin and development of scientific opinions, that we anticipate the best results from its publication. It is almost superfluous to say that the work is written in a clear, lively, and pleasant style. Mr. Lewes is a thoroughly skilled litterateur; and we need hardly add that Messrs. Smith and Elder understand as well as any one the art of turning out a handsome volume, and that the present work is an excellent sample of their skill and taste. That the combined attractions of intrinsic worth and of a pleasant external form may recommend the work to a numerous public, and thus aid in diffusing a taste for inquiries into the history of science, more especially among medical men, is devoutly to be desired; and with that aspiration we will conclude this paper, in which we have given but a feeble expression to suggestions which we nevertheless believe might be developed and expanded with lasting benefit to the ideas of the medical profession as to the true development of science.

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