

THURSDAY, MARCH 27, 1879

ORGANISATION AND INTELLIGENCE

Habit and Intelligence: a Series of Essays on the Laws of Life and Mind. By Joseph John Murphy. Second Edition, illustrated, thoroughly revised, and mostly rewritten. (London: Macmillan and Co., 1879.)

Life and Habit. By Samuel Butler. (London: Trübner and Co., 1878.)

THE first edition of Mr. Murphy's work was reviewed in NATURE, vol. i. pp. 288 and 315, a little more than nine years ago, and on reading the article we find little or nothing in the remarks and criticisms then made which require modification on account of subsequent discoveries. The present work is, however, very largely new, about one-third of the matter in the first edition, which treated of physical questions, being omitted, and replaced by a series of new chapters on biological subjects. It is to these new chapters that we shall mainly confine our present notice.

Chapter XI. gives a very good summary of the facts of variation from Darwin's "Domestication of Animals and Plants," and other works; and in Chapter XII. we have these facts discussed in regard to the sufficiency of natural selection for the origin of species. The greatest use is here made of the argument (said to be Prof. Tait's) in the *North British Review* (June, 1877), and which another writer has summed up as follows:—"The final establishment of the superior type is dependent at each step upon three accidents. First, the accident of an individual sort or variety better adapted to the surrounding conditions than the then prevailing type; secondly, the accident that this superior animal escapes destruction before it has time to transmit its qualities; and thirdly, the accident that it breeds with another specimen good enough not to neutralise the superior qualities of its mate." Put in this way, the difficulty staggers most persons who are not practical naturalists; yet it has always seemed to me to be really beside the question, and by no means of the importance which Mr. Darwin himself has given to it by acknowledging that the argument had not occurred to him. Even acute writers like Mr. Murphy do not see that individual variations or "sports" are of no importance whatever to the theory of natural selection, or he would never bring forward the argument at p. 380, that with an animal born of two parents "there is an almost overwhelming probability that the favourable variation is found only in one," and will therefore diminish in each succeeding generation till it disappears, unless the same favourable variation recurs again and again to counteract this tendency. In what may be termed normal variation, however (which Mr. Darwin has always considered the main agent in supplying materials for natural selection), none of these difficulties occur, and as it is very important to make this clear, I will give a few illustrations of it. There is no part, organ, or character of an animal or plant but what is sometimes more sometimes less developed in different individuals. The whole population of a species in any given year may therefore be divided into two equal portions, with regard to any such organ or character—the less developed and

the more developed. Thus, for example, all the foxes of the species *Canis vulpes* are necessarily divisible into a lighter and a darker coloured group; into a longer and a shorter tailed group; into a fleetier and a less fleet group; into a group with more developed and less developed canine teeth; and so on with regard to every character, external and internal. This can only be denied by asserting that there are characters which in the species in question are *absolutely unvarying*, an assertion which I am not aware that any one has made or attempted to prove, while it is certainly contradicted by the observations of all who have ever studied nature.

But if so, what happens when changed conditions occur, rendering the increased development of some faculty or organ beneficial? Can any one doubt that the one or five, or twenty per cent. of individuals which annually survive will belong, wholly or almost wholly, to the moiety in which that organ or faculty is better developed rather than to that in which it is worse developed? It matters not at all whether the *most* perfect individual or the twenty most perfect individuals survive or not; but the survivors will certainly be found among the better adapted rather than among the worse adapted half, and most likely will include a majority of individuals in the better half of the better half. And this process will be repeated *every year* without fail. There is thus no waiting for favourable variations to occur; no series of coincident improbable accidents is required; but the process goes on continuously with ever increasing power owing to the influence of heredity, till the species is modified up to the requirements of the changed conditions. By this process, leading to a decided advance *every year*, we can quite understand how any dominant species (that is, one which occupies a wide area and has a large population) may be modified quite as rapidly as is required by all ordinary changes of conditions, although extraordinary changes may lead to the extinction even of dominant species. It is hardly possible to conceive any improvement or modification of a species which might not be brought about by so powerful a selection as this, acting on variations which seem to us very trivial; while, on the other hand, the effect of greater individual variations or "sports" is very uncertain, and may perhaps never be used in nature as a means of modifying species.

These considerations also show the true bearing of "Delboeuf's Law," to which Mr. Murphy attaches much importance. It is proved mathematically that if, in any species, several individuals are in every generation born with any particular variation which is neither beneficial nor injurious to its possessors, and if the effect of the variation is not counteracted by reversion, the proportion of the new variety to the original form will constantly increase until it approaches indefinitely near to equality. But as, in every species, there are not one only, but hundreds of distinct variations in every generation, all subject to change in amount and direction in each succeeding generation, and as each of these will by the above law tend to equality with all others, the result must be that every slight recurrent variation will maintain itself in the species on terms of approximate equality with all other variations; and this will evidently be useful, by keeping up a vast stock of slightly varied forms within the species, which will be ready at any moment to furnish the material

on which selection may work when variations of a particular kind are needed.

The next three new chapters, on "Fixation of Characters," on "Effect of Change of Conditions," and on "Mimicry, Colour, and Sexual Selection," contain much interesting matter, with a number of suggestions of difficulties mostly dependent upon our total ignorance of the peculiar conditions or laws under which certain characters first arose. Such difficulties are of little importance, because they are always liable to disappear with an increase of knowledge. What, for instance, is the value of such a criticism as this: "The abnormal position of the left carotid artery in some groups of parrots is as good an instance as can be mentioned of a character which is constant throughout an entire group, which *must* have arisen suddenly, and *cannot* have been fixed by natural selection, because it *cannot* be useful." The three words I have italicised mark three positive statements which cannot possibly be verified, and which may very probably all be wrong. The parrots form not a *family* only, but a very distinct *order* of birds, and, from the occurrence in the miocene of France of a parrot of a living genus, are probably of immense antiquity. Not only do we know nothing of their early history, but, owing to their so rarely breeding in this country we know nothing of their embryology, and can therefore have no grounds for assertions as to what could or could not have been in the remote past, when they were developing into the varied forms that now exist, under conditions of which we are perfectly ignorant.

Another new chapter, on "Metamorphoses and Metagenesis" gives an interesting outline of the metamorphosis of insects, crustacea, and hydroids, illustrated by a number of excellent figures, and remarks on the difficulty of explaining many of the facts by variation and natural selection, the conclusion being that "many of the transformations, especially among the crustacea and the hydrozoa, do not consist in adaptations to any new or special mode of life, and consequently cannot be accounted for by the Darwinian or any similar theory, but must be due to a formative impulse impressed on living matter at the beginning."

The next chapter, on "Structure in Anticipation of Function," is not so good as some of the others, and here again objections are brought forward whose whole weight depends on our ignorance of the conditions under which certain structures were modified. Thus, it is said to appear impossible to account for the transition from the fin of *Ceratodus* to the simple fin-ray of *Lepidosiren* by any means which Darwinism admits, because it seems impossible that the loss of the membranes of its fins can be beneficial to a fish. But in this case there seems to be a difference of habits which may show how the "impossible" occurred. The *Lepidosiren* of the Gambia burrows in the mud, where it remains during the dry season, and for this "burrowing" the cylindrical rays may be better adapted than the broad fins of *Ceratodus*.

In the chapter on the "Origin of Man" Mr. Murphy replies to my argument that the brain of savage man is an instrument beyond his needs, by pointing out that "the real superiority of man consists in the faculty of language, and that the mental power implied in this unique faculty is represented by the very great excess in

the size of the human brain over that of the highest apes;" and he goes on to say: "If, then, the Darwinian theory is true of man, the difference between the highest ape and that of the lowest man is due to the exercise of the brain during the period while the power of language was in process of evolution, aided by the natural selection of the largest brains, in which, of course, this new power would be most highly developed." This appears to me a very forcible objection, and I must acknowledge that it is "a sufficient answer" to my argument, so far as regards the difference between the brain of savage man and apes. The question remains, however, of the latent powers in the brain of savages; and Mr. Murphy maintains that the languages of many savages—of the Kafirs, for example, are so much in advance of their needs that they could not have been evolved by natural selection. In most other respects he agrees with the arguments in my essay on "The Limits of Natural Selection as applied to Man."

This concludes the new matter in the physiological part of the book; but before passing on to the psychological portion, I must notice one passage embodying a very common source of confusion as regards the geographical distribution and mode of origin of species. Referring to the marine lizard of the Galapagos, *Amblyrhynchus*, Mr. Murphy remarks: "This singular species is found nowhere except in the Galapagos, and consequently has, most probably, been evolved there; but on Darwinian principles, how can so peculiar and aberrant a form have been evolved during the geologically short time that has passed since these islands first rose above the ocean?" The difficulty thus raised, with many analogous cases, I have endeavoured to explain in the February issue of the *Nineteenth Century*. The idea that this peculiar lizard has been "evolved" in the Galapagos really implies spontaneous generation; for what was it evolved out of? A remote ancestral form *must* have reached the islands from the main land, if there is to be any "evolution" in the case, and if a remote why not a near ancestor? It appears to me, not a mere probability but almost a certainty, that the generic type, if not the actual species, was "evolved" in America; that it was once an abundant, and, in fact, a dominant group; that it then spread to the Galapagos; that the entire group then died out on the main land, but was preserved in the islands, *owing to the absence of enemies and competitive forms*. On this principle almost all the supposed difficulties of geographical distribution may be rationally explained; and this mode of explanation is in accordance with palæontological evidence whenever it is procurable.

The remaining chapters form the psychological part of the work, in which the author develops his theory of the organising intelligence in animal forms. The only new chapter here is that on "Automatism," in which the various questions connected with the automatic motions of plants and animals, and with the instincts and the habits of animals, are set forth and commented on; and here it is very interesting to compare the conclusions arrived at with those of Mr. Butler in his very original and suggestive book on "Life and Habit."

Mr. Murphy says that the actions of a sea-anemone in seizing on its prey with its tentacles, or in closing itself

when left uncovered by the receding tide, are probably purely automatic, and completely independent of sensation, consciousness, or will; and further, that there is probably no difference whatever between these motions and those of the leaves of *Dionæa* and *Drosera* which crush insects to death and suck their juices. But though independent of consciousness they are not independent of intelligence: they are instinctive, and instinct is intelligence unconscious of itself. All such actions as these are classed as *primarily* automatic, having no relation to consciousness; but there are also actions which are *secondarily* automatic, which were once conscious actions but have become unconscious through habit. These habits may become hereditary, forming instincts, and can then in some cases not be distinguished from primary automatism. Elsewhere he speaks of "a principle of intelligence which guides all organic formation and all motor instincts, and finally attains to consciousness in the brains of the higher animals, and to self-consciousness in the brain of man."

We will now turn to Mr. Butler's work, and see how he deals with these and analogous facts. He first discusses acquired habits, showing that, as we do things more and more frequently we do them with less thought and effort, till at last, when we do them perfectly we also do them unconsciously. He then shows that the same law applies to knowledge and beliefs, which are only complete and unwavering, when we have ceased to doubt or to think of reasons or facts in support of them, when, in fact, they have become unconscious. We then come to habits acquired at or soon after birth, as walking, or eating, which, though they continue to be voluntary, are often performed quite unconsciously. Swallowing and breathing, though very complex acts, are acquired by the infant a few minutes after birth, and thence performed unconsciously, and we endeavour to explain this by the terms "hereditary instinct," and the "experience of the race." Mr. Butler concludes that these terms are unmeaning, and that, because we see that all actions when performed sufficiently often become automatic, we ought to conclude, whenever we see actions performed automatically, that there *has* been this repeated performance of them somehow or other. He thus sums up his facts on this phase of the question: "We are most conscious of, and have most control over, such habits as speech, the upright position, reading and writing, which are acquisitions peculiar to the human race, and always acquired after birth. We are less conscious of, and have less control over, eating and drinking, swallowing, breathing, seeing, and hearing, which were acquisitions of our prehuman ancestry, but which are still, geologically speaking, comparatively recent. We are most unconscious of, and have least control over, our digestion and circulation, which belonged even to our invertebrate ancestry, and which are habits, geologically speaking, of extreme antiquity." These principles are then applied to a great variety of facts in biology with extreme and, as some may think, perverted ingenuity, of which we can only give a single illustration: "We say of the chicken that it knows how to run about as soon as it is hatched. So it does; but had it no knowledge before it was hatched? What made it lay the foundations of

those limbs which should enable it to run about? What made it grow a horny tip to its bill before it was hatched, so that it might pick all round the larger end of the egg-shell, and make a hole for itself to get out at? And is it in the least agreeable to our experience that such elaborate machinery should be made without endeavour, failure, perseverance, intelligent contrivance, and practice? In the presence of such considerations it seems impossible to refrain from thinking that there must be a closer continuity of identity, life, and memory between successive generations than we generally imagine." This is the "unconscious organising intelligence," says Mr. Murphy, ultimately becoming conscious in the complete animal. "It is the result of often repeated conscious acts," says Mr. Butler, "which are now performed unconsciously after countless repetitions."

At first sight we seem to have here only the "ancestral experience" which has already been objected to as unmeaning. But this difficulty is overcome by the strange assumption that "it is the same chicken which makes itself over and over again; for such unconscious action is not won, so far as our experience goes, by any other means than by frequent repetition of the same act on the part of one and the same individual." Let no reader throw the book aside on coming to this astounding sentence, till he has read the two succeeding chapters on "Personal Identity," which are full of curious facts and subtle reasoning, and which lead to the conclusion that life is the one great personality, of which all living things are but differentiated offshoots still retaining a latent memory of a long succession of ancestral habits and experiences. This idea is carried further in the next chapter, on "Our Subordinate Personalities," in which it is shown that the highest authorities maintain the distinct individuality of the countless cells or physiological units of which our bodies are composed, and Mr. Butler remarks: "With the units of our bodies it is as with the stars of heaven, there is neither speech nor language, but their voices are heard among them. Our will is the *fiat* of their collective wisdom as sanctioned in their parliament, the brain; it is they who make us do whatever we do. When the balance of power is well preserved among them, when they respect each other's rights, and work harmoniously together, then we thrive and are well; if we are ill, it is because they are quarrelling among themselves, or are gone on strike for this or that addition to their environment, and our doctor must pacify or chastise them as best he may."

Passing on to Chapter IX.—on the "Abeyance of Memory"—it is shown that we remember best two classes of phenomena, either very unfamiliar objects or combinations—as if we were once in our lives shipwrecked on an iceberg, or very familiar object or acts, which produce their effect by repetition. These last, however, are apt to become unconscious, or to be wholly lost sight of, except when the usual conditions call them up, an amusing illustration of which is given as follows:—"Men invariably put the same leg first into their trousers—this is the survival of memory in a residuum; but they cannot, till they actually put on a pair of trousers, remember which leg they *do* put in first; this is the rapid fading away of any small individual impression." It is on the same principle that every act of growth of cells

and organs is said to be unconsciously remembered, when the same or analogous conditions recalls it to the dormant memory.

In another very ingenious and suggestive chapter entitled "What we might expect," it is maintained that the preceding facts and principles lead up to and explain all the curious phenomena of growth, reproduction, variation, and heredity, as set forth in the works of Darwin, Spencer, and other writers; and the same principles are applied in succeeding chapters to the phenomena of instinct, and the theories of Lamarck, Darwin, Mivart, and others. The argument is then summed up, and the conclusion arrived at that "Life is that property of matter whereby it can remember. Matter which can remember is living; matter which cannot remember is dead. The life of a creature is the memory of a creature. We are all of the same stuff to start with, but we remember different things. As for the stuff itself of which we are made, we know nothing save only that it is 'such as dreams are made of.'"

Such a brief notice as this can give no adequate idea of the originality and the logical completeness of Mr. Butler's remarkable work, which is far less known than it deserves to be. It may be truly said of it that it is more amusing than most novels, while it contains more material for thought than is to be found in most books of double the size. It will be seen that there is a certain agreement with Mr. Murphy, but Mr. Butler goes much further, in tracing the former writer's vague and unlocalised "unconscious intelligence" to the physiological elements of all organisms; and, however wild and improbable the theory may seem, it receives, strange to say, considerable support from the views of Haeckel and other German physiologists of the most advanced school. If the reader will turn to NATURE, vol. xix. p. 115, he will find Haeckel maintaining that "in the *Infusoria* a single cell performs all the different functions of life, including the mental functions." . . . "By the same right by which we ascribe an independent 'soul' to these unicellular *Infusoria*, we must ascribe one to all other cells, because their most important active substance, the protoplasm, shows everywhere the same psychic properties of sensitiveness (sensation) and movability (volition). The difference in the higher organisms is only that there the numerous single cells give up their individual independence, and like good state citizens, subordinate themselves to the 'state-soul,' which represents the unity of will and sensation in the cell-association."

We have here an extraordinary agreement with Mr. Butler, although, as we are informed, he was quite unacquainted with Haeckel's works when he wrote his book; and this fact should induce us to give a more careful consideration to the views of a writer who, although professedly ignorant of all science, yet possesses "scientific imagination" and logical consistency to a degree very rarely found among scientific men. The want of a practical acquaintance with natural history leads the author to take an erroneous view of the bearing of his own theories on those of Mr. Darwin. There is really nothing to prevent their harmonious combination, and they may even be said to be in great part complementary to each other. Mr. Butler's book is so full of strange fancies and witty conceits, as to have led some

readers to look upon the whole as an elaborate jest. Beneath this sparkling surface there is, however, much solid matter, and though we can at present only consider the work as a most ingenious and paradoxical speculation, it may yet afford a clue to some of the deepest mysteries of the organic world.

ALFRED R. WALLACE

RODWELL'S ETNA

Etna: a History of the Mountain and of its Eruptions.

By G. F. Rodwell, Science Master in Marlborough College. With Maps and Illustrations. Pp. 142. (London: C. Kegan Paul and Co., 1878.)

IN this little volume Mr. Rodwell has essayed to do for Etna that which the late Prof. Phillips accomplished so successfully in the case of Vesuvius, namely, to write a popular and at the same time accurate account of the past and present conditions of a mountain, which from the very earliest periods to which human history and tradition go back, has powerfully arrested the attention and excited the imagination of mankind. The scope and aim of these two works being so nearly the same it is hard to avoid drawing a comparison between them.

The first and fifth chapters of the work of Mr. Rodwell, which deal with the past history of the mountain and the record of its eruptions, indicate much learning and careful research on the part of the author, and indeed these portions of his volume may compare not unfavourably with the equivalent parts of Prof. Phillips' work; higher praise than this can scarcely be given to it. Almost equally praiseworthy are the second and fourth chapters, which give a general sketch of the physical features of Etna and an account of the origin, the past history, and the present condition of the numerous towns which are crowded about the flanks of the great volcano. The third chapter, giving details concerning the author's own ascent of the mountain, though sufficiently interesting in itself, is perhaps better fitted for the pages of a popular journal than of a work like the present, since ascents of Etna are now sufficiently common and every-day occurrences.

It is when we come to the more purely scientific portions of the volume that a comparison of the work of Mr. Rodwell with that of Prof. Phillips places the former in such a disadvantageous light. It is rather startling to find the more general and popular descriptions occupying five chapters, including 113 pages, while the account of the geology and mineralogy of the mountain is condensed into a single chapter of 29 pages, and when these pages are read we cannot help feeling that the questions treated of in them are handled in a somewhat imperfect and perfunctory manner. Any one turning to a treatise professing to deal with the geology and mineralogy of Etna might fairly expect to find a fuller and clearer account than Mr. Rodwell gives us of the exact relations of the volcanic masses to the stratified and highly fossiliferous deposits with which they are so intimately associated. Equally disappointing is it to find that the important question of the elevation hypothesis of von Buch is so summarily dealt with by Mr. Rodwell, especially when we remember that in the discussion on this subject which took place between Élie de Beaumont and Dufrenoy