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APRIL 19TH, 1870.

DR. BERTHOLD SEEMANN, V.P., IN THE CHAIR.

THE minutes of the previous meeting were confirmed.

John Colam, Esq., 105, Jermyn Street, St. James's; and David Mitchell Henderson, Esq., 1, Carden Place, Aberdeen, and Old Calabar, West Africa, were elected Fellows. Dr. D. Lubach, of Kampen, Holland, was elected a Corresponding Member.

Mr. A. L. LEWIS exhibited two Australian Skulls, lately placed by him in the Society's Museum.

A paper, by Mr. ALFRED SANDERS, was read "On Mr. Darwin's Hypothesis of Pangenesis as applied to the Faculty of Memory." (The paper will appear in full in the *Journal of Anthropology*).

[*Abstract.*]

The first question to be asked was—Is thought a function of the brain? The author answered it in the affirmative, and cited facts and appearances in physiology, anatomy, pathology, and physics in support of his opinion. Thought could not be considered as a product of the brain-cells any more than light could be produced by the cells of the retina, yet the brain-cells were necessary for the communication between the mind and the external and internal world, and were exhausted in the process of thinking and willing in the same manner as the cells of the retina were exhausted and required renewal in the process of seeing. Passing to the consideration of the faculty of memory, the author combated the theory of Mr. John Stuart Mill, that the mind is a series of feelings and nothing more, and that memory is an ultimate fact incapable of explanation. The remainder of the paper was devoted to the application of Mr. Darwin's hypothesis of Pangenesis, which the author maintained was capable of explaining the difficulty raised by Mr. Mill; it being granted that the mental faculties depend upon the brain, and that the brain-cells give off self-propagating gemmules indefinitely, everything becomes plain. After

describing in detail the action of external impressions on the brain at different times in the life of an individual, some of the many conditions favourable or the reverse to the retention of such impressions, and the dormant and active states of the brain-cells, the author entered into a consideration of the growth of the supposed gemmules, their action at maturity, and their power of self-propagation.

Mr. KESTEVEN stated that he had undertaken to read Mr. Sanders' paper in his absence, simply for the reason that it contained many purely technical expressions, probably unintelligible to many present, which he, as a member of the medical profession, would be ready to explain, if requested so to do. He then remarked that, as he should have occasion to dissent entirely from the author's views, and to give the reasons for his difference of opinion, he thought it would be but right that he should, in the first place, put before his hearers a clear statement of what Darwin's hypothesis of Pangenesis is, that they might be able to judge how far it is possible to apply it to the explanation of the phenomena of memory. Mr. Kesteven then read the following extracts from Mr. Darwin's work\* :—"Everyone would wish to explain to himself, even in an imperfect manner, how it is possible for a character possessed by some remote ancestor suddenly to reappear in the offspring; how the effects of increased or decreased use of a limb can be transmitted to the child; how the male sexual element can act, not solely on the ovule, but occasionally on the mother-form; how a limb can be reproduced on the exact line of amputation, with neither too much nor too little added; how the various modes of reproduction are connected, and so forth. I am aware that my view is merely a provisional hypothesis or speculation; but, until a better one be advanced, it may be serviceable by bringing together a multitude of facts which are at present left disconnected by any efficient cause. As Whewell, the historian of the inductive sciences, remarks :— 'Hypotheses may often be of service to science, where they involve a certain portion of incompleteness, and even of error.' Under this point of view, I venture to advance the Hypothesis of Pangenesis, which implies that the whole organisation, in the sense of every atom or unit, reproduces itself" (p. 357). "The cells or units of the body are generally admitted by physiologists to be autonomous, like the buds on a tree, but in a less degree. I go one step further, and assume that they throw off reproductive gemmules. Thus, an animal does not, as a whole, generate its kind through the sole agency of the reproductive system, but each separate cell generates its kind. It has been often said by naturalists that each cell of a plant has the actual or potential capacity of reproducing the whole plant; but it has this power only in virtue of containing gemmules derived from every part. If our hypothesis be provisionally accepted, we must look at all forms of a sexual reproduction, whether occurring at maturity or as in the case of alternate generation during youth, as fundamentally the same, and dependent on the mutual aggregation and multiplication of the gemmules" (p. 403). This "provisional hypothesis" assumes that the

\* *The Variation of Animals and Plants under Domestication*. By Charles Darwin, M.A., F.R.S., etc. Vol. II. 1868. Pp. 357 and 403.

development of each being "depends on the presence of gemmules thrown off at each period of life, and on their development at a corresponding period in union with preceding cells." This is wholly different from the hypothesis put forth by the author of the paper, which assumes the giving off of gemmules at irregular periods, in irregular numbers, and without further development, or organic relation, and union with other cells. There are, it is true, within the brain, as shown by the microscope, countless cells,\* cell-nuclei, together with nerve-fibres and blood-vessels, but no trace of the alleged gemmules have been seen under the highest powers of the microscope. This is one reason why he must decline to adopt the conclusions of the author. Mr. Darwin, true philosopher as he is, with the caution of the philosophical naturalist, suggests a possible state of things to explain a known series of phenomena, but this is widely different from the transfer of what is thus modestly put forward to express a generally felt difficulty, to the confident and unhesitating explanation by a gratuitous assumption of one of the most obscure phenomena of mind. Mr. Kesteven further observed, as a reason for demurring to Mr. Sanders' explanation, that, in his opinion, it by no means so clearly and closely accounts for the phenomena of memory as that view which is now generally held by physiologists, viz., that there is truly a memory existing in every portion of the body. This has been well put by Dr. Maudsley in his lectures recently delivered before the College of Physicians. "In every nerve-cell there is memory, and not only so, but there is memory in every organic element of the body. The virus of small-pox or of syphilis makes its mark on the constitution for the rest of life. We may forget it, but it will not forget us, though, like the memory of an old man, it may fade and become faint with advancing age. The manner in which the scar of a cut in a child's finger is perpetuated, and grows as the body grows, evinces, as Mr. Paget has pointed out, that the organic element of the part remembers the change which it has suffered. Memory is the organic registration of the effects of impressions, the organisation of experience, and to recollect is to revive this experience—to call the organised residue into functional activity." All the phenomena of reflex nervous action show it. To mention one instance: a frog that has had its head cut off will, if any irritant substance be applied to its hind legs, make the ordinary efforts to wipe off the irritation. In injuries to the head, in fevers, and in delirium, as mentioned by the author, thought and memory are suspended and held in abeyance. But this is not all—in fevers, in delirium, in insanity, words and language have been known to have been recalled, although all memory of them had been lost for many years, or for nearly a whole life before. This revival of dormant mental impressions constitutes those mental states that have been somewhat metaphorically called "brain photographs." The speaker here related several cases of this kind, and again quoted Dr. Maudsley in support of his view. "In a brain that is not disorganised the organic registrations are never actually forgotten, but endure while

\* Mr. Kesteven had on the table a microscope and numerous sections of brain, spinal cord, etc., to show their structure.

life lasts ; no wave of oblivion can efface their characters. Consciousness, it is true, may be impotent to recall them ; but a fever, a blow on the head, a poison in the blood, a dream, the agony of drowning, the hour of death, rending the veil between our present consciousness and these inscriptions, will sometimes call vividly back, in a momentary flash, much that seemed to have vanished from the mind for ever. In the deepest and most secret recesses of mind, there is nothing hidden from the individual self, or from others, which may not be thus sometimes accidentally revealed." Mr. Kesteven concluded by expressing his regret that Mr. Sanders was not present to defend his thesis, since, for the foregoing reasons, he could not but regard it as wholly wanting in proofs, inconsistent with known facts, and a misapplication of an hypothesis legitimately advanced by Mr. Darwin (provisionally only) to explain the known facts of reproduction.

The Rev. DUNBAR I. HEATH said that this paper contained a well-considered application of Darwin's theory of Pangenesis. Now, the first necessity would, of course, be to understand what this famous theory really is. When the theory itself is mastered, the application of it will more easily follow. The essence, then, of Pangenesis is that, instead of the embryo or ovum being the production of a gland called the ovarium, it is the production of the whole body. Every unit of the body produces its seed or gemmule. The genesis is not ovarian genesis it is pan-genesis, or the genesis of the whole. The conception that a gland should secrete out of human blood the seed of a human being is rude and rough ; and, moreover, it affords no explanation at all of the likeness of each being to its ancestors. We have been made familiar lately by Dr. Lionel Beale and others with some of the phenomena of protoplasmic units. They live, they grow, they die. Add, then, the further conception that they propagate, or throw off gemmules. These gemmules are free gemmules, circulating by thousands of millions in the blood. It will be said that if this be so they will be cast out of the body with other useless or used matter. But no matter is cast out except by its proper method. Carbonic acid by the lungs, perspiration by the skin, and so on. The refuge or landing stage for the gemmules is in the ovarium. Here the same reasons which constituted neighbouring protoplasmic units in any part of the body to be neighbours would cause the gemmules deduced from those units to be neighbours also. The muscle unit, the nerve unit, the bone unit of the finger, for example, send out their free gemmules, and muscle gemmules, nerve gemmules, and bone gemmules become neighbours in the ovarium, and are surrounded by albumen and fat, and thus form the germ. Ancestral gemmules, actually derived from the blood of ancestors, find their way into this resting place, and account for atavism or ancestral likenesses. Whatever may be thought of this theory, said Mr. Heath, it is at any rate the only one hitherto given to account at all for the facts. This property it has, in common with Darwin's other great theory of change of species by natural selection, no other theory worth speaking of exists to account for the phenomena. The application of this theory made in the paper to the phenomena of

memory is simple and comprehensible, and it, too, is alone in the field as the phenomena have never otherwise been accounted for.

Mr. GEORGE ST. CLAIR was convinced that Mr. Darwin in his theory expressed a great truth ; but he thought that the author of the paper did not support the theory in the right sense.

The discussion was further sustained by Dr. Langdon Down, Mr. Dendy, Dr. Ellis, M. Robert Des Ruffières, and the Chairman.

In reply to the several speakers, Mr. KESTEVEN stated that he declined the challenge to discuss the nature of mind in the abstract ; the author of the paper having narrowed its limits to the materialistic view, it would be beyond its scope to open up the metaphysical argument. To the statement that thought is a function of the brain, it had been objected that, if it were so, it should be subject to measurement in like manner as the blood and the air, with reference to the functions of the heart and lungs. He would remark that thought, as the function of the brain, was capable of measurement, inasmuch as the gradual manifestation of mental acts was traceable *pari passu* with the appearance of traces of a nervous system, and that with the greater development and complication of this in accordance with increasing complexity of surrounding conditions, the more distinct becomes the manifestation of mind, until the highest form is reached. That where no brain or its analogue exists, there is no thought, and that where brain is oppressed, as in disease, or by injury, thought is effaced or suspended. Therefore, in this sense of the word, thought is susceptible of measurement. He might, therefore, affirm that it was physiologically exact to say that thought is a function of the brain. Referring to the experiment with the decapitated frog, allusion was made to the statements recently made in the newspapers as to the mental phenomena said to have been exhibited by the heads of decapitated criminals. The answer was that, even if true, they were but instances of the reflex or involuntary movements to be seen in the lower forms of animal life : but it could not be said that such movements were signs of mind, or proofs of consciousness of pain. It should, however, be borne in mind that as Mr. G. H. Lewes had stated—other like experiments had altogether failed to produce any such results.

There can be no doubt that the influence of Mr. Darwin's writings and researches had been immense—indeed incalculable—but some limitation should be put to the appropriation of his authority by every wild theorist. The doctrine of “natural selection,” for instance, is widely different from his provisional theory of “pangenesis,” and is so treated by Mr. Darwin himself—the one he lays down as his deliberate conclusion from a vast array of facts ; the other he hesitatingly puts forward as a suggestion that may, perhaps, solve a difficulty. Even in this hypothesis the gemmules are restricted to the reproduction of their kind—*i.e.* of the structures whence they emanate ; they are not by Mr. Darwin charged with the function of giving rise to a train of phenomena wholly of another kind, as is the case in the application thereof by Mr. Sanders, an application which, after all, does but restate the abstruse nature of that endowment which we term memory.

Mr. GEORGE C. THOMPSON contributed the following note on "Conguineous Marriages":

The question to be solved is—"Is there any occult malign influence in the fact of blood-relationship between parents, the effects of which exhibit themselves in the offspring in a variety of ways?" If the arguments, by which the theory of the occult influence are supported, are examined, they will, I think, be mostly found to come under one of the following types:—

1. A and B, being cousins, marry, and have so many diseased children.

2. In such and such an asylum  $n$  per cent. of the inmates are children of blood-relations, while marriages between such relations are (assumed to be)  $m$  per cent. of all marriages—( $n$ , of course, being a much greater number than  $m$ ).

Instances of the first type are calculated powerfully to affect the imagination, but can hardly be considered of much scientific value.

With regard to the second type, the blood-relationship of parents appears to be regarded in a very wide sense on the one hand, and on the other there appear to be no reliable means employed of ascertaining the value of  $m$ ; and there is nothing to shew that if relationships as distant were recognised in one case as in the other, there would be any discrepancy between  $m$  and  $n$ .

Some time ago the French prefects were directed to register the degree of relationship (where any existing) between persons marrying. I am not aware if the results have been published; but they could no doubt be obtained on application to the proper quarter. From a daily examination of the marriages announced in the *Times* for a period of about two months, I found that in just about one per cent. of the whole number the family names of bride and bridegroom were the same. To arrive at the percentage of cousin marriages, this figure (after making a small deduction to allow for those cases in which identity of name is fortuitous) must be multiplied by some number expressing the ratio of the whole number of a man's marriageable cousins to those of them bearing the same surname as himself. What this number may be is not very easy to calculate; but, taking the above data for what they are worth, there would appear nothing improbable in marriages of cousins, up to children of the same great great-grandfather, being eight or ten per cent. of all marriages. This is a much higher figure than that assumed by Mr. Mitchell, who says the average of cousin marriages in Great Britain is probably not more than one in sixty or seventy (see vol. ii, *Memoirs Anthropological Society*). If, however, after every verification has been applied, the number  $n$  is still found to be greater than  $m$ —this does not necessarily prove the existence of the occult influence, as the phenomenon may be accounted for by the principle of inheritance. Suppose one hundred families, or tribes, two of which are tainted with a certain tendency ( $x$ ) which, when inherited from both parents, becomes some specific evil, say ( $x^2$ ). Suppose, further, that each tribe contains one hundred men, and that these marry—one within his own tribe, and the others into each of the ninety-nine stranger tribes.

Then, there will be in all ten thousand marriages, of which one hundred, or one per cent., will be between relations, so to speak ( $x^2$ ) will occur in four instances—once in the marriage within each of the tainted tribes, and twice in the intermarriages between them—that is, *half* of the persons exhibiting ( $x^2$ ) will be children of relations, while marriages between such relations are only one per cent. of the whole.

I believe the way to the solution of the problem lies in the collection and examination of crucial instances bearing upon the following points :—

1. When the defects commonly attributed to relationship of the parents are exhibited, are the germs of these defects traceable in the parents or their families ?

2. When the medical pedigree of the parents is faultless, are the children sound and healthy ?

3. When any particular excellence occurs in the parents' family, is it transmitted to the children in increased force ?

Some of the members of the Society could probably supply materials for an investigation based on some such principles as I have indicated, and I trust the importance of the subject may lead to its being undertaken.

Dr. LANGDON DOWN said that, after an examination of five thousand persons with reference to the question of interbreeding, he had arrived at the conclusion that the practice was not only not necessarily injurious, but that, by methodical and judicious selection in the marriage of relations, an improved race of men might be obtained. He had examined closely into the antecedent histories of a large number of cases, in which the supposed cause of deterioration was consanguineous union of parents, but in nearly all he had been able to establish sufficient cause for the deterioration other than the relationship. Doubtless, where there was constitutional taint, the intermarriage of relations tended to intensify the evil in the offspring.

Capt. BLAIR cited in support of that view the case of a people on the Ganges, while other speakers adduced conflicting evidence.

The papers for the next meeting, May 3rd, were announced, and the meeting adjourned.

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That resemblances may be found to exist between the Australians and almost any other race of mankind, which are made the bases of hypotheses, is not at all questionable.

Professor Virchow next endeavours to make a comparison between the ancient skulls of the caves and those of modern so-called Malay populations, and also of the modern races of the Philippines. He acknowledges that his materials for such comparison are inadequate. Still, as far as they go, they lead him to conclude that the cave skulls do not agree with the so-called Malays of the Indian Archipelago, nor with the Bisayans of the Philippines.

Another series of six skulls, taken from another cave at Nipa Nipa, Virchow finds to belong to a distinct category. They have a more modern appearance, and are distinguished by presenting unequivocal marks of syphilis. Hence, it is probable that they belong to a period soon after the Spanish conquest.

This memoir of Professor Virchow could not be entirely passed over, although we have here considered it very imperfectly, as it forms an important supplement to Dr. Semper's description of the Negritos.

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### ART. III.—MR. DARWIN'S HYPOTHESIS OF PAN-GENESIS AS APPLIED TO THE FACULTY OF MEMORY.\*

BY ALFRED SANDERS, M.E.C.S., F.A.S.L.

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MEMORY, being one of the faculties of the human mind, falls naturally within the scope of anthropological science, which is devoted to the study, not only of man in general, but also of the man in particular, and I have, therefore, the less hesitation in laying these few remarks before the Society, hoping to elicit during the discussion some views or opinions which may serve to throw some light on a difficult and obscure subject.

It is necessary for my purpose that I should first of all take into consideration this question, Is thought a function of the brain? This, I think, can only be answered in the affirmative.

\* Read before the Anthropological Society of London, April 19th, 1870.



One fact out of many may be cited as being sufficient to prove it. I allude to the fact that a small spicula of bone pressing on the brain annihilates all thought and feeling; this is the invariable result of any pressure on that organ, however produced. As an illustration of my meaning, I will take the case of a person struck with apoplexy; in this case, a small quantity of blood being effused in or near the ventricle, the person becomes immediately insensible and practically dead to the external world; he may either die in reality, or recover his senses wholly or partially; in the former case, the damage to the brain is too great to allow the machine to keep on going; in the latter, either not any, or very few, fibres are broken, but only pushed aside, the person returning to health or remaining more or less imbecile. The sense of vision gives a good representation of the relation of mind to the brain. We have here an apparatus, the retina, calculated to receive impressions or pictures of the external world; a commissure, the optic nerve, conveying these impressions to the inferior ganglia of the brain; another commissure, the diverging fibres, conveying them thence to the peripheral cells, where the mind first becomes cognisant of them, but how is a mystery too deep for our present powers, and which I have not time here to examine. This being the process gone through in seeing, let us now cut through the optic nerve: total blindness is the result. The apparatus, the eye, is perfectly healthy, and able to represent external impressions; the ganglia at the base of the brain are perfectly healthy, and able to receive and transmit those impressions to the peripheral cells; the external force, light, is there, still capable of giving those impressions. Where, then, is the fault? The conductor is broken, the electricity cannot pass, no communication can be made, and no impression can be received.

Now, let us draw the parallel between this case and that of the clot in the ventricles. We have here, also, an apparatus, the peripheral cells, calculated to receive the impressions of the mind, and to transmit them through a commissure, the converging fibres, to the ganglia at the base of the brain; thence, through the medulla oblongata and the nerves, which may also be called commissures, to all parts of the body. In the former case, we cut through the optic nerve; in the latter, we have a clot of blood breaking through one of the commissures: all the

rest of the apparatus, the receiver and transmitters, may be perfectly healthy, yet there is no apparent thought or mind ; the machine is out of order, the conducting wires are broken ; but as, in one case, the light continues to exist although the sufferer cannot see, so, in the other, it is just possible that mind may still exist although the sufferer cannot feel or think. Thus, it will be seen that thought is not considered to be a product of the brain-cells, any more than light can be a product of the cells of the retina ; yet these brain-cells are necessary for the communication between mind and the external and internal world, and are used up in the process of thinking and willing, in the same way that the cells of the retina are used up and require renewing in the process of seeing.

Having thus considered the question whether thought is a function of the brain, I will now turn to the consideration of that faculty of the mind which is called memory. Sir William Hamilton, as quoted by Mr. John Stuart Mill, regards memory as the mental representation of events passed away, and the representation only, as it is self-evident that what is past cannot be present, and that the trust in memory is entirely a belief, there being no mode of verification. Mr. John Stuart Mill,\* in his theory, considers mind to be a series of feelings, and nothing more, and looks upon memory as an ultimate fact incapable of explanation, which appears to me to be a great defect ; for, surely, a theory expressly framed to give an explanation of mental phenomena ought to include memory, which can be no more an ultimate fact than mind itself, and if one is capable of explanation so ought the other to be.

Let us now see what light can be thrown on the opinions of one philosopher by those of another. I allude to Mr. Darwin, whose theories, however much they may be opposed or controverted, certainly mark the commencement of a new era in the history of the study of the organic sciences. Mr. Darwin's hypothesis of Pangenesis, at first sight, seems rather startling ; but the more one considers it, the more one feels convinced that it points to the right direction for solving the problems of which it treats. It also seems capable of explaining the difficulties of Mr. Mill's theory. It being granted that the mental faculties depend upon the brain, and that the brain-cells may give off

\* Mill upon Hamilton, pp. 212 and 213.

self-propagating gemmules indefinitely, everything becomes plain. In contemplating a beautiful landscape, or listening to a strain of music, the mind becomes cognisant of the landscape or music by means of brain-cells arranged in an appropriate manner. In after times, when we recollect the landscape or music, the mind recognises it by means of cells bearing an hereditary resemblance, in arrangement and form, to the original cells which gave the first impression; hence the possibility of representing to the mind the landscape or music when they are not present. This hereditary likeness is supposed to be caused by the gemmules which the original cells give off, in greater or less number, according as the impression is greater or less; while the gemmules remain dormant, the landscape or music is forgotten; but when they meet with the partially developed cells, or gemmules which precede them in the regular order of growth, they become developed, and the landscape or music is recalled to mind; in other words, when one thinks of something which puts one in mind of the landscape or music, the cells which cause that thought are the cells which immediately precede the gemmules of the original cells in the order of growth, and are those with which the latter have affinity. This explains why, when we try to think of something we have forgotten, and which we wish particularly to remember, we are obliged to do it indirectly, and must go through a long and tedious process, thinking of everything which has the remotest bearing on the subject, until, at last, we think of something which recalls to mind the thing sought for. In this case, while one group of cells after another grow to maturity and die off, as one thought after another passes through the brain, the gemmules in question lie dormant because the cells which precede them in the proper order of growth have not yet appeared; but, as soon as the group of cells arises which cause that something to be thought of which recalls the thing sought for, then the gemmules find their affinities, grow to maturity in their turn, and the remembrance sought for is complete. This process occurs successively for each thought as it arises during the whole series.

Things are forgotten on the supposition that the mind cannot recognise the gemmules until they arrive at the proper size, and become units. If memory depended on direct descent of units from each other, growing to full size by self-division or budding,

nothing would ever be forgotten. It might be objected that, if these gemmules were like those of Mr. Darwin, children ought to recollect what occurred to their parents; but these gemmules must be supposed to have a different nature from those of Pangenesis, which are assumed to have an affinity for the generative organs, and to be principally collected in the zoosperms and ova. The gemmules which cause memory are much more perishable, and have affinity only for the units of the brain substance; they are more perishable, inasmuch as one forgets most of the things which happen, and remembers only the most prominent events. Moreover, I think that they are derived more from groups of units than from single ones, as one generally forgets details—as, for instance, in reading a book, one remembers only the general tenour of the argument, forgetting the words. If the attention is very little excited, the gemmules are very small in number, and soon perish, their ancestral cells having small vitality or too short existence to give origin to them; in this case, the thing is irretrievably forgotten. On the other hand, the gemmules may lie dormant for years, simply propagating themselves as gemmules until the proper units appear, causing them to grow to maturity, and then the picture of some long past event comes before one without any apparent cause. This may occur in revisiting places; and very often in fevers, when these hidden away gemmules are most likely to find their affinities, the wild thoughts coursing through the brain presenting every possible combination of units, so that, if there are any gemmules in existence, they are almost sure to meet with cells preceding them in the regular order of growth. This hypothesis explains also the fact that very old people remember better the events of their youth than the events of yesterday, for the brain-units participate in the general decline of vigour in the units of all the rest of the body; but, in youth, when all the ideas are fresh and vigorous, the brain-units give off gemmules endowed with great vitality, which may enable them to survive the weaker ones given off at a more recent period.

Memory can be cultivated; for the more the attention is fixed on any matter, and the more it is thought over, the greater number of units are engaged in it—perhaps, several generations, propagated by cell-division or otherwise, each generation giving off its gemmules—so that there would be a much greater chance

of their surviving, and finding units to which they would have affinity. In learning their lessons, schoolboys have a habit of saying them aloud; in this way, the brain receives a greater number of impressions: not only the units connected with the organ of sight, but also those of hearing and motion, are called into action, and a greater number of units give off a greater number of gemmules, and the lesson is consequently remembered better than if only those of one organ were engaged.

The brain, then, on this hypothesis, consists not only of the cells of ganglia, or grey substance, together with connecting fibres, but also of gemmules, or extremely minute particles of germinal matter, derived from previously existing cells, scattered throughout the brain, which have an affinity for cells descending from ancestors, whose position in the brain was immediately contiguous in time and space to those from which they themselves are derived.

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#### ART. IV.—MYTHOLOGY AND RELIGION.\*

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THE appearance of Mr. Cox's work forms an epoch in the development of the Science of Religion. With infinite labour, the author has brought together the myths and popular tales of the Indo-European peoples; and, by application of the principles of comparative philology, has shown, not only that they embody the same ideas, but also that these ideas have a purely physical basis. This was, of course, not possible without frequent reference to the labours of other writers; but Mr. Cox has availed himself of their researches in no servile spirit. The result is, unquestionably, a great triumph for the comparative philologists, although whether their method alone is sufficient to explain the source of Aryan mythology is open to doubt. This we will consider, after we have described the system which Mr.

\* *The Mythology of the Aryan Nations.* By George W. Cox, M.A. 2 vols. London: Longman, Green, and Co. 1870.

*The Origin and Development of Religious Belief.* By S. Baring-Gould, M.A. Part I.—Heathenism and Mosaism. Rivingtons: 1869.

"Lectures on the Science of Religion", by Professor Max Müller (*Fraser's Magazine* for April, May, June, July, 1870).