

forgiving me all my short-comings, and for the inestimable benefit which you have conferred on me by giving me your friendship.

In the evening a large number of the Fellows and their guests dined together at the Hôtel Métropole. Among those present being M. Marey, who attended officially as President of the Paris Academy of Sciences.

DR. DUBOIS' "MISSING LINK."

THE opening scientific meeting of the session of the Royal Dublin Society, on November 20, was of especial interest, owing to the presence of Dr. Eugene Dubois, who exhibited the famous remains which he discovered in Java. The chair was taken by Prof. W. J. Sollas, F.R.S. Dr. Dubois read a paper "On *Pithecanthropus erectus*: a transitional form between Man and the Apes," which will very shortly be published by the Society, and which was illustrated by a number of lantern slides made in Dublin for this lecture. He said that when he was invited by Prof. Cunningham to read a paper before the Royal Dublin Society, he did not for a moment hesitate to comply, as he was anxious to get as much criticism as possible. By order of the Dutch Indian Government he conducted, from 1890 to 1895, explorations of a fossil vertebrate fauna, of which some remains had been discovered many years ago by Junghuhn and others. These vertebrate remains, which were found abundantly at Trinil on the southern slope of the low Kendeng Hills, were obtained from beds of cemented volcanic tuff, consisting of clay, sand and consolidated lapilli, which were rearranged by fluvial action. The whole formation attains a maximum thickness of over 350 metres. In these strata the Bengawan River has cut its channel 12 to 15 metres in depth. These beds lie unconformably upon beds of marine marl, sand and limestone, which have recently been determined by Prof. Martin to be of Pliocene age. In August 1891, Dr. Dubois came upon a very rich layer of fossil bones, in which the remains in question were found; this occurred in the lapilli deposit, or fine gravel, about five inches above a bed of coarse gravel, which rests on a black clay. The layer of bones lies a little below the dry-season level of the river. The river-bank was excavated with such care that the position of each specimen was accurately known. In September a wisdom tooth was discovered, and a month later the skull-cap was found about one metre distant, and at precisely the same level. The work was interrupted by the rainy season, but was renewed in May 1892; the left femur was found in August, at distance of about 15 metres from the calvaria, and in October a second molar, at a distance of 3 metres from where the skull-cap was found, and in a direction towards the place where the femur had been dug out. Among the associated animals may be mentioned large numbers of *Stegodon*, specimens of hippopotamus (*Hexaprotodon*), hyæna, several species of deer, *Bubulus*, a gigantic pangolin three times as large as the existing Javan form, &c. The four remains were all in the same state of fossilisation as the animal remains, the weight of the femur being nearly three times that of a recent femur. Doubt had been expressed whether the four remains belonged to the same individual; Dr. Dubois himself had no doubt on this point, as he had often found bones from the self-same skeleton, and even fragments of a single bone, at similar distances apart; never had he found a complete skeleton. He had good reasons for believing that the animals perished in volcanic catastrophes, and their corpses were brought down a large Pliocene river, so that before the bones were finally deposited and buried they must have been separated by the rotting of the flesh; and there are evidences of crocodiles having preyed upon the carcasses.

The femur is so human-like that nearly all anatomists did not hesitate to declare it to be human; but up to the present no human remains had been found in the Lower Pleistocene, the oldest only reach down to about the middle of that period. Nobody had the slightest doubt that the bone must have belonged to a form with an erect posture. Only Virchow repeatedly maintained, even after seeing it, that it belonged to an ape, probably *Hyllobates*, because it has, in his opinion, a straight, shaft such as never occurs in man; but the audience could easily see that the shaft of the fossil was by no means straight, and Dr. Dubois demonstrated some features which he had never seen in human femora, but which he believed to be simian characters.

For normal human proportions the capacity of the cranium

was too small for the femur; but microcephalic skulls of the class which may be regarded as atavistic can be even relatively smaller, while the height of the body is more than that of *Pithecanthropus*, as computed from the length of the femur. Such was the case of the microcephalic idiot, Joe, described by Prof. Cunningham. The length of the Java cranium is 185 mm., its breadth 130 mm. The same dimensions in an average female chimpanzee's skull are 132 and 91, and those of a *Hyllobates* 95 and 69. The internal capacity he estimated at 1000 cubic centimetres. The largest skulls of the anthropoid apes average about 500 c.c. Normal human skulls are known of an equal or even less size than the Java cranium; but these small skulls are always associated with a small body. The chances are enormously against this being the skull of an idiot, and no microcephalic skull shows such a flattening of the parietal region. The orbital part of the skull is quite different from that of man, but the inclination of the nuchal plane is far more human than simian. From the genus *Hyllobates* he could only find a difference in size and in the downward slope of the occiput; the resemblance between the two was most striking if the former was enlarged two diameters.

A divergence of opinion also prevailed as to whether the teeth were human or simian; they were larger than human teeth, and the cusps showed a relative development which was characteristically simian.

From the whole geological and anatomical investigation it followed that in each of the four specimens they had evidence of a form intermediate and transitional between man and anthropoid apes. The problem was as to the exact position of this creature in the tree of genealogical descent.

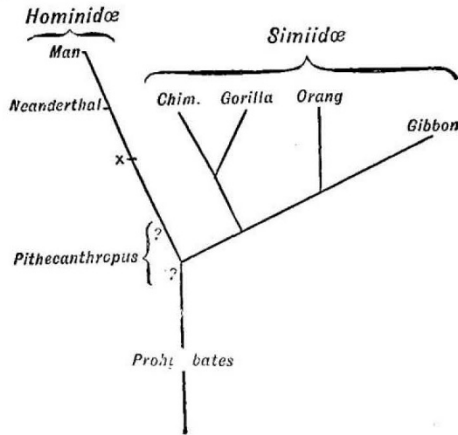
Dr. D. J. Cunningham, Hon. Secretary of the Society, believed the specimens to be of supreme importance. Discussing Dr. Dubois' memoir at a previous meeting of the Royal Dublin Society, he had expressed the view that the cranium was distinctly human, and he still held that an unbiased study of the published description and figures could lead to no other conclusion. Now, however, when he was brought face to face with the actual specimen, he failed to see in it any decided and leading human feature, except its capacity of 1000 c.c. He agreed with Dr. Dubois in considering that it most resembled the cranium of *Hyllobates*, although he was of opinion that Dr. Dubois slightly exaggerated the relative height and quality of the cranial arch in *Hyllobates*. In this respect he considered that, if fairly tested, the fossil cranium would be found to be superior to any known ape. Certainly the cranial arch was vastly superior to that of a gorilla, chimpanzee, or orang, and he believed also that it was relatively fuller and loftier than the most highly-arched *Hyllobates* cranium. Dr. Dubois placed some stress upon the inclination of the nuchal area of the occipital bone, and thought that in this there was a human characteristic; but he (Dr. Cunningham) thought that this region of the cranium was extremely ape-like, and, further, he did not altogether consider that the means which Dr. Dubois had taken to determine the degree of this inclination were calculated to yield absolutely trustworthy results.

With regard to the femur, he had nothing to add to what he had previously said on this subject. It was a human bone, and while he fully appreciated the distinctive points alluded to by Dr. Dubois, he thought that Dr. Dubois had not made sufficient allowance for the variation to which this bone was liable. It was, to say the least of it, strange that a thigh-bone of such undoubted antiquity should exhibit none of those characteristics which we were in the habit of associating with prehistoric femora, as well as with the femora of rude and savage races of the present day. It showed no signs which would indicate that the individual to whom it belonged was in the habit of assuming the squatting attitude.

In so far as the two molar teeth were concerned, he still held that the features which they exhibited were more human than simian, although it could not be denied that they also exhibited some very decided ape-like characters.

The question as to the place which should be assigned to the fossil form on the genealogical tree was a most interesting one. On this point he differed entirely from Dr. Dubois. Dr. Dubois placed *Pithecanthropus* below the point of devarication of the anthropoid apes from the human line. Dr. Cunningham, on the other hand, placed it on the human line, a short distance above the point at which the anthropoid branch is given off. In urging this view, he stated that he could not believe that an ape-form with a cranial capacity of 1000 could be the progenitor of the man-like apes, the largest of which had a capacity of only 500.

Such a supposition would necessarily involve the assumption that the anthropoid apes were a degenerated branch from the common stem. This view he explained by means of the accompanying diagram.



Prof. Haddon said: Ever since the evolution hypothesis had shed such an illumination upon nature, biologists had believed in the previous existence of forms intermediate between man and the lower animals; and it was with a fearful joy that they heard of Dr. Dubois' discovery, and then they subjected the remains to a searching criticism, with the result that all agreed that the individual to whom the cranium belonged was transitional in character between the apes and man—some thinking him more ape-like, and others more human; balancing the one set of opinions against the other, they could only come to the opinion that it was an intercalated type. Whilst agreeing with Dr. Dubois in all his statements of fact, he concurred with Prof. Cunningham in thinking that the size of the cranium was an insuperable difficulty in the way of placing the individual to which it belonged below the point in the genealogical tree where the anthropoids branched off. Palaeontological evidence points to the fact that in the evolution of any series of mammals the brain tends to increase in size; at all events, there is no known case of a brain decreasing to less than half its original dimensions. Nor did it appear to him to meet the case to suppose that by doubling the body of a gibbon the brain would be equally doubled in size; there was no such proportion between body growth and brain growth.

Dr. Pearsall, a leading dental surgeon in Dublin, made some remarks about the teeth, and said that the human characters of the teeth were very striking.

Prof. Sollas agreed with the preceding speakers as to the invaluable evidence afforded by these fossil remains. They indicated an organism which was either a pithecoïd man or a remarkably human ape; which of these alternatives might prove to be true was a matter of secondary importance, the fact remained that we had before us traces of the most simian ancestor of the human race yet known.

The materials for determining its geological age were abundant, but not yet fully worked out. Dr. Dubois, however, stated that the associated mammalian fauna stood in close relation to that of the Nerbadá beds and the Upper Siwaliks of India; and so far as it might be possible to correlate the Javan deposits with those of Europe, they would appear to be older than our river-drifts, and possibly on the same horizon as the forest-bed of Norfolk. In this case the intervals in time, and the differences of structure which separate the Javan fossils from the race of Spy, and this from existing man would be, so to speak, proportional.

In the Miocene times we first meet with a few modern genera struggling to the front from a crowd of competitors; and in the Pliocene a few modern species emerge, and thus, in the case of the human race, we might expect to find the existing species *Homo sapiens* replaced by some earlier representative, say *Homo innocens* in the Pliocene, and the genus *Homo* by allied though different genera of the family *Hominidae* in the Miocene. While, however, *Hominidae* are not yet known from the Miocene, remains of anthropoid apes (*Dryopithecus*) are, and thus what palaeontological evidence exists lends no favour to the view that

the anthropoids are degenerate descendants from the human stem. Thus Prof. Sollas was less inclined to agree with Dr. Dubois than with Prof. Cunningham in estimating the human characters of the Javan fossils.

Dr. Dubois thanked the Society for the honour they had done him and for their kindness. He explained why he placed Pithecanthropus in a different position in the genealogical tree from that assigned to him by Prof. Cunningham. They knew very little about the laws of evolution, which in some cases proceeded slowly and in others quickly.

The proceedings then terminated.

SCIENCE IN THE MAGAZINES.

SEVERAL articles on more and less scientific topics appear in the *Contemporary*. Mr. Herbert Spencer contributes the seventh of his series of articles on the development of professional institutions, the subject this month being the teacher. It is shown that the primitive conception of the teacher is the conception of one who gives instruction in sacred matters, so that the priest and teacher were identical. The priesthood is, for a long time, the sole source of knowledge, but in the course of evolution the teaching functions of the priest are shared by a non-priestly class, and thus the secular educator comes into existence. Mr. Spencer quotes, in support of this theory of development, extracts from the records of peoples, past and present, in various parts of the world. The evidence adduced goes to show "how teaching was in the beginning exclusively concerned with religious doctrines and rites, and how there eventually began to rise a teaching which, in some measure detached from the religious institutions, at the same time entered upon other subjects than the religious." In some cases, the normal genesis of teachers from priests was interfered with, but that does not alter the general fact of such development. The differentiation of the teaching class from the priestly class is even now incomplete, for a large number of the private schools in our own kingdom are carried on by clergymen. Finally, as in other professions, segregation and consolidation into unions and associations have followed upon differentiation.

M. Berthelot, the renowned chemist, lately appointed French Minister for Foreign Affairs, was a close friend of Renan. A few incidents referring to that friendship, and what Renan might have thought of the appointment, are given in the *Contemporary* by Mr. Albert D. Vandam. The same review contains the first instalment of an article on "Physics and Sociology," by Mr. W. H. Mallock. The character of the article is sufficiently indicated by the following headings of the sections. (1) On the application to social phenomena of the methods and principles derived from physical science; (2) on the crucial difference between the subject-matter of physical science and that of social science, which render the method of study proper to the first inadequate when applied to the second; (3) on the deliberate rejection by contemporary sociologists of the methods by which, in social science, the methods of physical science must be supplemented; (4) on the nearness with which contemporary sociologists have approached the methods of study, which they have nevertheless missed or rejected. The *Contemporary* also contains articles on the Secondary Education Report, by Prof. J. Massie; Mr. Balfour's philosophic writings, by Mr. Norman Hapgood; and a reply, by Prof. A. A. Bevan, to an article in which Prof. Sayce dealt with Biblical criticism from an archaeological point of view.

The first number of the English series of the *Popular Science Monthly* contains a large amount of readable matter on scientific topics. Accompanying a description, by Mr. H. P. Fitzgerald Marriott, of the Palaeolithic skeletons discovered near Mentone in 1892 and 1894, are three good illustrations reproduced from photographs of the remains. Prof. Sully contributes an interesting paper entitled "Studies of Childhood," and there are also popular articles on consumption, the saltiness of the sea, and other subjects. We notice a letter entitled "Are Animals Left-handed?" by Mr. D. S. Jordan. Several observers have stated that parrots grasp and hold food with the left claw, but Mr. Jordan concludes from his observations that "the appearance of left-footedness is due entirely to the fact that those who offer the finger or food to parrots do so as a rule with the right hand. Repetition of this process makes the parrot more or less left-footed in time."

Lieut. E. Baden Powell describes his "Air-Car, or Man-