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PRESENT STATE OF OUR KNOWLEDGE OF THE ANATOMY OF THE PRIMATES*

BY

F. WOOD JONES, F.R.S., F.R.C.S., F.R.A.C.S.

Sir William Collins Professor of Human and Comparative Anatomy, Royal College of Surgeons of England

In making any attempt to review the present position of primate anatomy it is essential that some consideration be paid to the historical background of the subject, for in no other way is it possible to appreciate the factors that have created this position or to indicate how unsatisfactory the present position actually is. A digression may be permitted in order to pave the way for what must be said concerning the phases of investigation into the comparative anatomy of the primates. Were we, following the modern fashion of testing public opinion by means of a questionnaire, to ask a generally informed set of people, "What British scientific man was the great authority on the method of formation of coral islands and reefs?" the answer would probably be, "Charles Darwin." For was not Charles Darwin the propounder of the much acclaimed theory of subsidence that apparently explained so well the development and structure of coral reefs and atolls? It is quite certain that of all those who gave this answer with considerable confidence very few indeed would be acquainted with the fact that when Darwin elaborated his erroneous theory of coral-island evolution he had never seen a coral structure of any kind, even from the deck of a passing ship. Nevertheless, the publication of *Coral Reefs* in 1842 produced the very general impression that there was little or nothing that remained to be investigated regarding coral formations, since Darwin, with his painstaking researches during the voyage of the *Beagle*, had exhausted the possibilities of the subject.

Even if there might not be complete unanimity regarding the answer to the coral-island question in our imagined questionnaire, there would be general agreement regarding the second question, "Which British zoologist was the great authority on the relationship existing between men and monkeys?" The answer would inevitably be, "Charles Darwin." For was it not Charles Darwin who made it clear to the whole world that an intimate comparison of the anatomical features of man and apes guaranteed the confident assertion that man had been "evolved from an ape-like progenitor"? But most of those who gave this answer would do so entirely unaware that Darwin had no first-hand knowledge whatever of the anatomy of monkeys, apes, or men, that he was unacquainted with or ignored much readily accessible current literature on the subject, and that such information as he possessed at second hand consisted largely of ill-assorted

and ill-assimilated odds and ends culled, often enough, from the writings of the anecdotal period of natural history. This is the conclusion regarding Darwin's competence to adjudicate on the relationship existing between man and apes to which any impartial reader of his works must come.

The Malar Bone

Any comparative anatomist who reads the *Descent of Man* with an open mind can only dismiss the whole thesis as one lacking any factual basis in primate anatomy. It is remarkable that those who make confident appeal to the works of Darwin must in many cases be so unfamiliar with the actual text that such strange things as his assertions regarding the malar (jugal) bones of monkeys and man have never intruded themselves upon their notice. Of this bone Darwin writes: "... the malar bone, which in some of the quadrupeds, and other mammals, consists of two portions. This is the condition in the two-months-old human foetus: and thus it sometimes remains, through arrested development, in man when adult, more especially in the lower prognathous races" (*Descent of Man*, 1st ed., vol. 1, p. 124). For this piece of anatomical information Darwin gives a reference to the work of Canestrini; but it is obvious to any anatomist that the account, erroneous as in any case it is, actually relates not to the malar bone at all but to the old question of the condition of the premaxilla and maxilla typical of monkeys on the one hand and of man on the other.

It is obvious that so little was Darwin acquainted with the cranial characters of the primates that he translated the whole story into the morphology of the malar bone and thereby created an anatomical absurdity with which those who so freely quote his authority appear to be wholly unacquainted. It can hardly be claimed that Darwin wrote "malar" for "premaxilla" by a mere slip of the pen, for the statement is repeated in a footnote added to the same page and again upon the page following.

On the whole the malar bone suffered considerable injustice at the hands of the Darwinians, for Thomas Henry Huxley also took unwarranted liberties with it. Huxley, who had postulated that "with the increase of our knowledge of fossil forms" the distinctions between the Perissodactyla and Artiodactyla would disappear (*Anatomy of the Vertebrated Animals*, 1871, p. 292), described the post-orbital bar of the horse in the following terms: "The orbit is bounded behind by the united post-orbital processes of the frontal and the jugal" (*op. cit.*, p. 297). This description of the horse's jugal is completely at variance

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with the facts, for the jugal does not articulate with the frontal but with the temporal. But since it is an accurate account of the bone as it is present in the cow it renders a belief that in evolution the perissodactyl and artiodactyl phyla "pass one into the other" (*The Classification of Animals*, 1869, p. 102) more readily acceptable.

Our knowledge of the morphology of the malar bone in the primates and the ungulates cannot be said to have been in any way clarified by the immediate propagandists of Darwinian evolution.

Supracondyloid Foramen

Again, it usually escapes the notice of those who appeal to Darwin's own statements that he asserts that the supracondyloid foramen is present "in the quadrumana and some other orders of mammals," and that in man "there is generally a trace of this passage, and it is sometimes fairly well developed (*op. cit.*, p. 28). This account would naturally lead the reader to suppose that in man there was generally a small foramen and sometimes a large one, and that this condition was derived from the fully developed form present in the apes. The human anatomist must realize how unwarranted such a statement is when made about the occasional presence of a supracondyloid spur in man. The comparative anatomist can only feel that by this statement Darwin smoothed away one of the anatomical facts most fatal to any belief in an evolutionary progress along the assumed line of the groups constituting the Order Primates.

As a matter of fact, no monkey or ape of the catarrhine series (with which man shows most anatomical affinity) has ever been known to develop a supracondyloid or entepitrochlear foramen: and the position is complicated by the fact that, although absent in the Catarrhini, the presence of the foramen is typical of the Platyrrhini. Of the two humeral foramina, termed by him the supracondyloid and intercondyloid, Darwin had but little real conception and no first-hand knowledge, and since in a footnote he made direct reference to the work of St. George Mivart he naturally drew upon himself the very just criticism of this authority on comparative anatomy. But this and the many other criticisms made by Mivart fell for the most part on deaf ears.

If then it must be admitted that Darwin made no contribution to our knowledge of primate anatomy and that he had in fact assimilated very little of the knowledge that was current at the time, it might be supposed that those zoologists who so strongly supported his claims had supplied the anatomical details so conspicuously lacking in his own work.

Huxley's Contribution

In 1863, four years after the appearance of the *Origin of Species*, Thomas Henry Huxley published *Man's Place in Nature*, a book that received great acclaim from Haeckel and others and which paved the way for the *Descent of Man* eight years later. Some review of Huxley's contribution to the knowledge of primate anatomy is therefore essential. *Man's Place in Nature* is divided into three parts, between which there is but little continuity.

Part I is entitled "The Natural History of the Man-like Apes." It occupies 56 pages, quotes over 30 authorities, mostly of the anecdotal type, on the history, habits, and appearance of the anthropoid apes. It is a mere compilation and contains no original observations.

Part II deals with "The Relations of Man to the Lower Animals." It occupies 55 pages, and may be said to prove what Darwin also proved—that man is an animal. But it cannot be claimed that in the 1860s this thesis stood in any need of proof. It is astonishing that Huxley should stress the fact

that both man and the dog were developed from an ovum as though it was a crucial point in testing the truth of Darwin's hypothesis. The second section of the book introduced and reiterated what Haeckel termed "Huxley's Pithecometra thesis." This dictum maintains that, no matter what structural feature is examined, the difference between man and the gorilla is less than that between the gorilla and the "lower primates." The Pithecometra thesis was destined to become a perfect anodyne for all those who lacked sufficient knowledge of primate anatomy to detect its fallacies.

Judged by the state of embryological knowledge at the time, Huxley's account of human development can only be described as out of date. His statement that "it is very long before the body of the young human being can be readily discriminated from that of the young puppy" can only be matched with Haeckel's claim for the late appearance of distinctive human characters in the human embryo. Haeckel's pronouncement occurs in his *Anthropogenie oder Entwicklungsgeschichte des Menschen* and is as follows: "At length in the fourth and fifth month these [distinguishing human] characters make their appearance, and during the four last months of the embryonic life of the human being, from the sixth to the ninth month of pregnancy, the human embryo is readily distinguished."

Such references as there are in this part of the book to the actual structure of man and apes deal mostly with the skeleton and are mainly metric and not descriptive.

Following Part II of the book are 6 pages, irrelevant in their content, dealing with Huxley's argument with Richard Owen concerning the hippocampus minor.

Part III is entitled "On Some Fossil Remains of Man." It occupies only 40 pages and deals mainly with the Engis and Neanderthal crania. After an examination of these crania the book ends in what appears, following the previous note of high assurance, as somewhat of an anticlimax: "In conclusion, I may say, that the fossil remains of Man hitherto discovered, do not seem to me to take us appreciably nearer to that lower pithecod form, by the modification of which he has, probably, become what he is."

It cannot be claimed that *Man's Place in Nature* made any real contribution to the subject of primate anatomy, and Huxley is not to be ranked as a primate anatomist. Nor, as is commonly assumed, can he be regarded as the authority who supplied the facts of anatomy necessary for the full acceptance of the Darwinian hypothesis. Out of a total of some 170 papers published in his lifetime Huxley wrote only two dealing with primate structure. The only contribution he made before writing *Man's Place in Nature* concerned the brain of Ateles.

Anatomists Contemporary with Darwin

It is naturally absurd to pass judgment upon any work unless that work has been regarded in proper perspective in relation to the background of knowledge existing at the time of its appearance. If we are to provide the background against which the anatomical knowledge of the primates that went to the making of the *Descent of Man* and *Man's Place in Nature* is to be judged we must not forget the work of Robert Bentley Todd. From 1835 to 1859 Todd issued the five volumes of his great *Cyclopaedia of Anatomy and Physiology*, and Huxley himself was a contributor to this work. Here there were available Vrolik's contribution on the anatomy of the quadrumana and Allen Thomson's account of the ovum. Vrolik gave a perfectly accurate account of the maxilla and premaxilla in the primates, and he drew attention to the fact that the entepitrochlear foramen of the humerus was present only in the platyrrhine monkeys. It seems an extraordinary thing that Darwin apparently ignored this important work so readily available to all students of human and comparative anatomy.

The fact that Darwin was only very imperfectly acquainted with primate anatomy, even at second hand, and

that Huxley's contributions added but little to fill in the gaps in Darwin's knowledge, is all the more remarkable when it is remembered that in 1863 Richard Owen was 59 years old, that St. George Jackson Mivart was 36, and that the one was a master of the comparative anatomy of the vertebrates and the other a leading authority on the anatomy of the mammals and especially of the primates. But Owen had the misfortune to challenge Huxley's knowledge of primate anatomy on a point upon which his own knowledge was deficient. Owen, though the supreme authority on comparative anatomy, was defeated in a particularly stupid argument, and thereafter his weight as a critic of the ape origin of man thesis declined.

Mivart's book *Man and Apes* fell dead in 1873, two years after the publication of the *Descent of Man*. It fell dead not because the facts of primate anatomy so cogently brought forward by Mivart were proved incorrect but because they were ignored. They were ignored because a belief had been created that Darwin and Huxley had said the last word on the structural affinities between man and the rest of the primates. Unfortunately this belief persisted after the euphoria of nineteenth century scientific thought had, for many sciences, passed away. With some it seems to persist even to-day, and as a consequence the whole subject of comparative primate anatomy has failed to receive that re-examination that is so long overdue and that has already been carried out in so many other branches of science. Not until the complete anatomy of a wide series of members of the primates is recorded shall we be in a position to determine the interrelations of the different groups and to place the subject of man's place among the primates on a perfectly sound basis.

It is safe to prophesy that, as knowledge of the anatomy of the primates increases, the complexities of the problem will increase, and much work will have to be accomplished before ultimate clarity is achieved. It is satisfactory that the period of dogmatism is passing, but it will not be until anatomists regain their lost faith in the importance of morphological studies that the new era in our knowledge of primate anatomy dawns.

CARCINOMA OF THE BREAST AND ITS TREATMENT*

BY

Sir CECIL WAKELEY, K.B.E., C.B., D.Sc., F.R.C.S.
F.R.S.Ed., F.A.C.S., F.R.A.C.S.

*Senior Surgeon, King's College Hospital; Surgeon to the
Royal Masonic Hospital; Consulting Surgeon to the
Royal Navy*

It may be thought that carcinoma of the breast is a common and hackneyed subject and one of little interest to the medical practitioner, yet it must be acknowledged that breast cancer is one of the main killing diseases in women. There can be no doubt that the incidence of this disease is steadily rising, and it behoves the medical profession to instruct and advise the public about the importance of its early diagnosis and treatment. Every year some 7,500 women die of cancer of the breast, this situation being the commonest site for cancer in women, accounting for 20% of female cancer deaths.

All clinicians will agree that the breast is a very favourable site for malignant disease, and that in early cases operative treatment gives excellent results. Even in cases

in which no treatment whatever is given the patient may be expected to live for three years; this is a fact that the medical profession does not realize.

The two common factors for causing patients to seek medical advice are pain and the presence of a lump. Only the second of these is present in early cases; this in itself is the main factor in the poor results which are obtained in the treatment of this condition.

Spread of Mammary Cancer

Cancer of the breast begins in the acini or ducts and at first is a very limited condition; soon, however, there is spread of cancer cells up and down the ducts and then through the duct wall. From here the extension is via the lymphatics of the breast, and, lastly, via the blood stream. There can be little doubt that the condition of the stroma of the breast together with its lymphatic and blood connexions plays an important part in the spread of the disease. In girls and young women the vascularity of the breast is very pronounced, and if cancer develops the prognosis is hopeless. It is also very bad in cases of cancer developing during pregnancy and lactation; while in women over 80 the condition of the breast and its stroma is so fibrotic that the disease may last many years without any real extension. I have watched a woman aged 88 with a carcinoma of the breast for 15 years; she has refused every kind of treatment that has been advocated.

To understand the lymphatic spread of mammary cancer it is important that a true conception of the connexions of the lymphatic vessels should be forthcoming.

The Lymphatics of the Breast

Our knowledge of the lymphatic drainage of the breast has increased during the last 40 years. As a student I often watched the late Sir Watson Cheyne perform a radical excision of the breast, divide the clavicle, and remove the supraclavicular glands. These patients rarely survived six months but died of general metastases and recurrence in the supraclavicular regions. It was thought and taught at that time (1909) that the lymphatics of the breast passed under and over the clavicle to the supraclavicular glands. It was also taught that the lymphatics of the axilla passed upwards into the supraclavicular glands. These ideas of lymphatic spread have been greatly modified during the last 20 years as the pathology of mammary cancer has been placed on a more sound foundation.

I believe, but not every surgeon will agree with me, that there is no lymphatic connexion between the breast and the supraclavicular glands except via the upper intercostal spaces and the internal mammary glands. In my opinion there is no connexion between the axilla and the supraclavicular glands. On this belief hangs the modern conception of radical mastectomy. The conservation of the clavicular head of the pectoralis major muscle implies that no lymphatic vessels pass from the breast to the supraclavicular glands in front of or behind the clavicle.

Involvement of the supraclavicular glands therefore means that intrathoracic extension of the disease has taken place and the condition is therefore inoperable.

Although the lymphatics of the breast are numerous, there are very definite pathways which determine the spread of the disease. The lymphatics from the upper and outer quadrant drain into the axillary glands. Those from the lower and outer quadrant drain for the most part into the axilla, but a few may drain to the lymphatics of the abdominal wall to the umbilicus and so via the ligamentum teres to the liver. The lymphatics of the inner quadrants of the breast drain via the intercostal spaces into the

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