AN organization, 'La société des amis de l'Université,' has been formed in Paris and adopted a constitution on December 11th. The object of the Society is to aid in the development of the University of Paris, by forming new chairs, assisting the laboratories, establishing scholarships, prizes, etc. It is proposed to issue a bulletin especially in the interests of the students.

DR. THOMAS EGLESTON, emeritus professor of mineralogy and metallurgy in Columbia University, has presented to the University his library and mineralogical collection. The former is especially rich in serials; the latter contains about 5,000 valuable specimens.

MR. CHARLES WHEELER, of Philadelphia, has given $5,000 to Harvard University in memory of his son, Stuart Wadsworth Wheeler, '98, who served in the Porto Rican campaign, and died in Boston a short time ago. The money will be invested, and the interest used as a loan fund in the Lawrence Scientific School.

PRESIDENT WARFIELD has announced a gift of $10,000 to Lafayette College. It is also reported that a gift of $50,000 has been made for the Chemical Laboratory.

IT is proposed to establish, as a memorial to Sir Robert Peel, a scholarship in the Technical School at Blackburn. Mr. Yerburgh has opened the fund with a donation of £1,000.

DR. JAMES LITTLE has been nominated regius professor of medicine in the University of Dublin in the place of Sir John Banks.

PROFESSOR RÖNTGEN, of Würzburg, has declined the call to Leipzig as the successor of Professor Wiedermann.

DISCUSSION AND CORRESPONDENCE.

THE ORIGIN OF MAMMALS.*

THE question under discussion is not new, but one of a series of similar nature and difficulty. The origin of birds, of reptiles, of amphibians and of fishes really precede it, and offer less difficulties in solution. The answer to each, in my opinion, belongs to the future, and how far it may profitably be sought in the present limited state of our knowledge is a fair question in itself.

Too often in the past a discussion on the origin of mammals has seemed a little like the long philosophico-theological controversies in the Middle Ages about the exact position of the soul in the human body. No conclusion was reached, because, for one reason, there were no facts in the case that could settle the question, while the methods of investigation were not adapted to insure a satisfactory answer. The present discussion is on a much higher plane, and the previous speakers have made an admirable presentation of their side of the case. I cannot, however, quite agree with them as to the value of the facts and theories they have presented, and shall consider the question from another point of view.

The mammals, as we know them to-day, are classed by themselves, yet contain such diverse groups that it may fairly be regarded an open question whether all have a common origin. The attempt to ascertain whence they came is likely to bring out indications that they may have had several sources of origin, and this, if so, may help to explain the great diversity among them.

It is, of course, evident that some of the most characteristic features of recent mammals, for example, the hairy covering, the circulatory system and the milk glands, cannot be used in a comparison with fossil forms. The osseous structure only is now available in the early mammals and other vertebrates, and in this alone points of resemblance must be found if different groups are connected genetically.

In considering the relations of reptiles to mammals so far as the fossil forms are concerned, which seems to be the main question before us to-day, I have only time to speak of the skull, and shall refer to some of its salient features already mentioned in this discussion, namely, the teeth, the squamosal bone, the quadrate, the occipital condyles, and with them the lower jaw. These, perhaps, may serve as crucial points in distinguishing the skull of a reptile from that of a mammal, even if they fail to indicate a near affinity between them.

* Remarks in the general discussion on the Origin of Mammals, at the International Congress of Zoology, Cambridge, England, August 25, 1898.

The different kinds of teeth seen in the reptiles regarded as mammalian in type I consider of comparatively small importance, for the reason that the same general forms of teeth are to be found, not merely in the reptiles supposed to be nearest to mammals, but also in other groups widely different. In the crocodiles, for example, the extinct genus *Notosuchus*, recently discovered in Patagonia, has all three kinds of teeth well distinguished. Again, some of the Dinosaurs, especially the genus *Triceratops*, have teeth with two rows, a supposed mammalian character. In some fishes, also (*Anarrhichas*), three kinds of teeth may be seen. It is more than probable, therefore, that the peculiar resemblance between the teeth of mammals and those of the lower vertebrates is merely one of parallel development, the adaptation being along similar lines, and in no sense an indication of genetic affinity.

The great development of the squamosal bone in Theriodonts is not seen in them alone, for somewhat similar proportions are found in other reptiles, for example, in the Plesiosaurs, where the squamosal is very large, and wrapped around the quadrate. In some of the Dinosaurs, also (*Torosaurus*), the squamosal has an enormous development, while the quadrate remains of very moderate size.

The quadrate bone, always present in birds, reptiles and other lower vertebrates, is well known as the suspensorium of the lower jaw, which meets it with a concave articular face. The quadrate, however, appears to be wanting in mammals, or at least has not yet been identified with certainty.

What represents the quadrate bone in mammals is a vexed question in itself, and some of the best anatomists in the past, Cuvier, Owen, Peters, Huxley and others, have endeavored to solve the problem. The tympanic bone, the incus and the malleus have each in turn been regarded as the remnant of the quadrate, but up to the present time the question has not been settled. It is not improbable that the quadrate may have coalesced with the squamosal.

The occipital condyles of mammals, as well known, are two in number, and separated from each other. This is not the case with any true reptile, although the contrary has been asserted. The nearest approach appears to be where there is a single bifid condyle, cordate in shape, with the two lobes meeting below, as in some reptiles and a few birds, but not separate as in mammals and amphibians.

Finally, in all known mammals, recent and extinct, the lower jaw is composed of a single piece, and has a convex condyle meeting the skull by a distinct articulation. All reptiles, even those supposed to be nearest the mammals, have the lower jaw composed of several pieces, and these show distinct sutures between them, a profound difference that must be explained away before an approach can be made between the two classes.

It may fairly be said that the separate elements of the lower jaw, if present, would naturally be looked for in the Mesozoic mammals, and this point I have long had in mind. I may safely say that I have seen nearly every species of Mesozoic mammals hitherto described, and have searched for evidence on this point without success. I have also sought for the separate elements in the young of recent forms, but without finding any indications of them.

Beside the crucial points I have mentioned in the skull, there are others of equal importance in the skeleton, which I must not take time to discuss, but will venture to allude to one of them in passing. I refer to the ankle joint, which, when present, is at the end of the tibia in mammals, but in reptiles between the first and second series of tarsals. When we really find an approach between these two classes the ankle joint will probably show evidence of it.

Having thus shown, as I believe, that we cannot, with our present knowledge, expect to find the origin of mammals among the known extinct reptiles, and that in attempting this we are probably off the true line of descent, it remains to indicate another direction in which the quest seems more promising.

Since 1876, when Huxley visited me at New Haven, and we discussed the probable origin of both birds and mammals, I have been greatly impressed by his suggestion that the mammals were derived from ancestors with two occipital condyles, and these were doubtless primitive

amphibians. I have since sought diligently for the ancestors of birds among the early reptiles, with, I trust, some measure of success, but this is a simple problem compared with the origin of mammals which we have before us to day.

In various interviews with Francis Balfour, in 1881, at the York meeting of the British Association, we discussed the same questions, and agreed that the solution could best be reached by the aid of embryology and paleontology combined. He offered to take up the young stages of recent forms, and I agreed to study the fossils for other evidence. His untimely death, which occurred soon after, prevented this promised investigation, and natural science still suffers from his loss. Had Balfour lived he might have given us to-day the solution of the great question before us, and the present discussion would have been unnecessary.

The birds, like the mammals, have developed certain characters higher than those of reptiles, and thus the two classes seem to approach each other. I doubt, however, if they are connected genetically, unless in a very remote way.

Reptiles, although much lower in rank than birds, resemble mammals in various ways, but this may be only an adaptive likeness. Both of these classes may be made up of complex groups only distantly related. Having both developed along similar lines, they exhibit various points of resemblance that may easily be mistaken for indications of real affinity.

In the amphibians, especially in the oldest forms, there are hints of a true relationship with both reptiles and mammals. It seems to me, therefore, that in some of the minute primitive forms, as old as the Devonian, if not still more ancient, we may yet find the key to the great mystery of the origin of mammals.

O. C. MARSH.

ZOOLOGICAL BIBLIOGRAPHY.

TO THE EDITOR OF SCIENCE: I am glad to see from Mr. Bather's letter in SCIENCE (No. 207) that the recommendations of the Committee on zoological and botanical publications are not what one would be justified in inferring from the printed abstract on which my remarks were founded. All zoologists are under obligations to Mr. Bather and his associates for their labors in the more arid, but not the less essential, branches of the subject. We hope to be still more grateful to them when their present task is completed, and, therefore, avail ourselves freely of the invitation to criticise the incomplete work in order that the completed structure may become more universally acceptable.

Nevertheless, I find even in his new presentation of the subject a lingering trace of the assumption that certain things are settled which do not appear to me to be determinate. What is the definition adopted by the committee of the phrases 'distributed privately' and 'published in the regular manner'? Upon this depends whether all that follows may be acceptable or not. How many is 'a few?' What is 'public' and what is 'private?' This sort of thing should not be left doubtful. The answers are by no means a matter of course.

When an author, to avoid two or three years' delay, pays for the prompt publication of his researches he does not, in my experience, lock up his copies in a safe and take his name out of the Naturalist's Directory. On the contrary, he at once distributes copies to the journals interested in his branch of science and to the experts in his special line, and sends a copy to Friedländer for the *Natura Novitates*, where it is advertised at a price. If he should omit the latter (a most improbable suggestion), and the paper is of interest, he will certainly be called on and glad to furnish copies to those desiring them. The author who does not desire publicity for his work, and has no known address, in my opinion is a myth. Why otherwise should he print at all?

I quite agree that the paper must be made available to those who wish to purchase it, but I do not for a moment admit that this must be solely through the Society in whose Proceedings it sees the light.

How about the highly genteel persons who publish in *éditions de luxe* of 100 copies? Such works are frequently far more inaccessible than those separata distributed by authors.

It seems to me that the committee would do well to state in the fullest detail their ideas of what constitutes publication and how this shall be registered.

My own opinion is that the sort of thing crit-