ciple that he believes holds with the natural history museum precisely to the same extent that it does with the college; namely, that to fulfil its function in highest degree the teaching in both the museum and the college must be backed up by the soundest sort of scientific achievement. And very rarely in the museum are those concerned solely with exhibition gifted with the scientific mold of thought. There can be no really successful exhibition museum, nor teaching university, unless it include among its workers, if not at its head, men with scientific instincts, men who are at least as proficient as investigators as they, or others on the staff, are as exhibitors or teachers. The public museum, rightly conducted (that is, for purposes of instruction rather than primarily for amusement) ranks as an agency for general education along with the school and college. At core, in both, there must be the scientific spirit, the spirit that seeks for truth to the farthest detail, and expounds the truth accurately.

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SPECIAL ARTICLES

ARE DROMATHERIUM AND MICROCONODON MAMMALS?

DROMATHERIUM and *Microconodon* from the Triassic of North Carolina have long been cited as the oldest known mammal jaws and as such they are mentioned in practically all text-books of historical geology. Although briefly described by Emmons as early as 1857,[1] the only detailed study of these unique remains has been that of Osborn.[2] Since 1887 our knowledge of the mammal-like reptiles has been very greatly increased and one or two writers have tentatively questioned the correctness of referring the two American genera to the true mammals. Through the kindness and cooperation of Dr. G. H. Chadwick, professor of geology in Williams College, and of Dr. Witmer Stone, director of the Museum of the Academy of Natural Sciences in Philadelphia, the writer has recently had an opportunity to examine the originals under very favorable conditions and with the best modern optical aids with a view to determining, if possible, the true zoological position of *Dromatherium* and *Microconodon*. The present brief note is a preliminary statement of results; a more detailed paper with new figures will follow elsewhere.

The following are the most valuable criteria for distinguishing between the isolated lower jaws of mammals and of reptiles:

(1) In reptiles the lower jaw is compound and the articular and quadrate intervene between the dentary and squamosal. In mammals the lower jaw is simple and the dentary articulates with the squamosal.

(2) In reptiles[3] the cheek teeth have but one root. In mammals[4] most or all of the cheek teeth have two or more roots.

(3) Certain molar patterns are known only among reptiles and others, even more distinctive, are known only among mammals.

Of these criteria the first is diagnostic and the others, while usually of more practical value, are empirical. Applying them to the problem in hand:

(1) The single bone preserved in each case is not larger relative to the dentition than is the dentary of many cynodonts. In the latter reptiles the other elements of the jaw are much reduced and lie loosely against the inside of the dentary, whence they are often lost during or before burial. Both *Dromatherium* and *Microconodon* appear to be exposed on the outer side only, but even if this were not true it is doubtful whether the former simple or compound nature of these jaws could be positively asserted. Both fragments are unfortunately broken posteriorly, but there is reason to believe that this break was very close to the original posterior margin. In neither case is there any evidence of an articular condyle on the dentary. In *Dromatherium,* at least, it is very unlikely that such ever existed for there is no thickening such as is necessary for the support of this condyle in the mammals and the dentary seems to end posteriorly as a thin flat blade of bone, as does that of the cynodont reptiles. In *Microconodon* there is a thickening which might have supported a condyle, but there is no evidence that it did so, and it is hardly more marked than a similar feature in some reptiles.

(2) In the cheek teeth of *Microconodon* there is a single, undivided root and the same is very probably true of *Dromatherium,* although here observed with a little less certainty. In both, however, an incipient root division is seen in a median longitudinal constriction of the roots of the posterior teeth. Such a constriction is very common among cynodonts and may even occur in a somewhat less marked form in some theromorphs of quite indirect mammalian relationships. All undoubted Mesozoic mammals, including some as old as *Dromatherium* and *Microconodon,* have clearly and completely divided premolar and molar roots.

[1] "American Geology," etc., p. 93.

[2] Proc. Acad. Nat. Sc. Phila., 1886, p. 359. Proc. Am. Phil. Soc., xxiv, 1887, p. 109.

[3] With very rare exceptions which could not possibly confuse the issue.

[4] With the exception of some highly specialized and degenerate forms which, again, can not obscure the issue in the present case.

(3) In *Dromatherium* the molar pattern is variable, the first two molars consisting essentially of a single high cusp with very minor anterior and posterior accessory cusps, asymmetrically placed, and the succeeding molars consisting essentially of a high anterior cusp with a single posterior accessory cusp of varying size. The variability and asymmetry are quite unlike the most nearly similar mammals (the triconodonts) and the pattern of the posterior molars is entirely unlike anything known among mammals but very closely similar in ground plan to that of a number of mammal-like reptiles, such as *Cynosuchus* and *Glochinodon*. The molar pattern of *Microconodon* is more mammalian in aspect and, except for its asymmetry, somewhat resembles that of the most primitive triconodonts. There are cynodonts, however, such as *Ictidopsis*, which resemble the triconodonts more closely than does *Microconodon* and there are other cynodonts, such as the well-known *Cynognathus*, the molar pattern of which is much closer to that of *Microconodon* than is that of any known mammal.

In conclusion, on the basis of the present material it is not possible to settle the systematic position of *Dromatherium* and *Microconodon* beyond all doubt. It is possible, however, to say that many of the characters which they exhibit resemble the cynodonts much more than they do any known mammals, that none of the characters which they exhibit resemble any known mammals more than they do the cynodonts, and that none of the characters which they exhibit involve any difficulty in their reference to the Cynodontia. It is, therefore, not justified by our present knowledge to consider *Dromatherium* and *Microconodon* as mammals and they should, at least until further material is forthcoming, be referred to the Reptilia. In the latter class they certainly must be placed in the group Cynodontia, under which each of them must probably be considered the type of a distinct family in view of the great differences between them in tooth pattern and jaw form. This does not, of course, deprive these forms of interest with regard to the origin of mammals and they were probably quite near the ancestry of the latter, although probably not more so than any of the other known small cynodonts. That they were not directly ancestral to any known mammals is certain.

Through the cooperation of Professors Chadwick, Brinsmade and McElfresh, of Williams College, an interesting new point of technique was developed which may be of use to some other students of small and obscure forms. In studying *Dromatherium*, the better preserved but more obscure specimen of the two, great difficulty was experienced in observing the boundary between the black teeth and equally black matrix (coal). After experimenting with various ray filters and color screens, it was found that by using the unmodified light from a small laboratory mercury arc in quartz very remarkable results were obtained. This light, rich in ultra-violet, set up a bluish fluorescence in the teeth which, while faint, was sufficient to distinguish them quite clearly from the unmodified black of the coal. Care must, of course, be taken to shield the eyes from the direct radiation of the arc, but the lenses of the compound binocular microscope through which, in this case, the specimen is viewed remove the harmful rays.

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VIABILITY OF DESICCATED OR GLYCERINATED CELLS OF A CHICKEN SARCOMA

IT is a matter of general knowledge that some microorganisms are resistant to drying and to the action of glycerin, and the revival of desiccated lower forms of animal life is not a rare phenomenon in experimental biology. It has not been suspected that the cells of as high an animal as the chicken are resistant to these processes.

In recent experiments I was able to show that the cells of the Rous chicken sarcoma No. 1 withstand the processes of desiccation and of glycerination. I am indebted to Dr. James B. Murphy, of the Rockefeller Institute for Medical Research, New York, for a quantity of the desiccated tissue of the chicken sarcoma. Some of my experiments were carried out with this desiccate, while others were based on new tumor material obtained in this laboratory by injecting the desiccate into chickens. The desiccate sent to me by Dr. Murphy was prepared October 8, 1925, and was used in my experiments four months later (the early part of February, 1926). Material prepared in this laboratory was dried in the desiccator over calcium chloride in a partial vacuum, and was kept in sealed glass tubes for two to six weeks before it was used.

A small portion of the dried and pulverized material, proved to be capable of producing sarcoma by injecting into chickens, was ground up into a viscous suspension in a mortar with the addition of an adequate quantity of sterile physiological salt solution. This suspension was examined microscopically with the addition of an appropriate amount of trypan blue dissolved in normal salt solution. It showed a large number of cells with the morphological appearance of living cells. The nuclei of these cells were very slightly bluish, and were not deep blue as in the case of dead cells, the nuclear permeability of dead cells to certain dyes being a well-known fact. Stained smears made of this suspension also showed numerous live-looking cells with well-stained nuclei and cyto-