stages in several species of the thecate amoebae have been noted, but it is in the genus Arcella that the more careful study was made. For that reason the comments will be restricted to the life cycle in Arcella—though many of the stages described for Centropyxis have been seen.

Beginning with the last paragraph on page 246 Cavallini describes the splitting of the parent shell (in some cultures) and the emergence therefrom of ". . . an oval mass, 174 μ long and 78 μ wide, full of spherical refractive bodies of different sizes. . . ." This phenomenon has never been observed by me[1]; although the spherical refractive bodies have been seen inside the shell and also in irregular masses of protoplasm protruding through the mouth of the shell. These refractive bodies have been isolated and amoebulae have been obtained from them.

It was found that growth and division of the amoebulae take place as described by Cavallini, the process being repeated so many times that I was forced to the tentative conclusion that I was dealing with a small amoeba which had nothing to do with Arcella. The process of shell formation has been observed in mass cultures and my observations agree essentially with Cavallini's; although she does not make it clear how the thecate form, which at first is nearly spherical, assumes the typical shape of the adult Arcella. This seems to be brought about, at least in part, by invagination.

There are two things in Cavallini's paper which should be specially pointed out: (1) My observations agree with hers regarding the lack of evidence for macro—and micro—gametes, yet my experiments have not been sufficiently controlled to preclude such a possibility and if hers were she has failed to give convincing evidence to that effect. (2) She says nothing concerning the cause of "sporulation." The season of the year in which her work was done is the same as that in which I found this phenomenon most marked, yet by changing the culture medium daily I have carried hundreds of Arcellae throughout the year without any evidence of "sporulation" or diminution in the rate of vegetative reproduction. On the other hand, these amoebulae have appeared in old cultures at practically all seasons of the year, but they occur much more commonly during the late autumn and winter months.

In concluding I wish to state that the evidence I have agrees more closely with Cavallini's account of the life-histories of these thecate amoebae than with that given by any other author.

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[1] This may be accounted for by the fact that *A. polypora* and *A. discoides* were used principally.

THE TROPICAL RESEARCH STATION OF THE NEW YORK ZOOLOGICAL SOCIETY

THE Tropical Research Station of the New York Zoological Society, located at Kartabo, British Guiana, will be open this summer for a limited number of men and women capable of carrying on independent biological research.

The station has been used by the University of Pittsburgh for the past two summers, courses in field zoology being offered by Dr. Alfred Emerson in 1924 and by Dr. S. H. Williams in 1925.

This year it will be sponsored by Mr. William Beebe, director of tropical research of the New York Zoological Society and founder of the station. The laboratory will be managed by Jay F. W. Pearson, a member of tropical research staff, assisted by Mrs. Pearson.

The party will leave New York about June 12 and will return September 12.

The expenses of each person will be approximately $750.00, including transportation, living expenses and incidentals after leaving New York. Stops will be made en route at the West Indian Islands of Grenada and Trinidad.

All communications and applications should be addressed to the undersigned at the department of zoology, University of Pittsburgh, Pittsburgh.

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SCIENTIFIC BOOKS

Taxidermy and Museum Exhibition. By JOHN ROWLEY; Preface by Frank M. Chapman. D. Appleton and Company, New York, 1925 (our copy received December 26). Octavo, pp. xvi + 331, 29 plates, 20 figs. in text. $7.50.

THIS book is the result of thirty-five years of continuous experience in devising and applying the technique of museum exhibition. As Dr. Chapman says in the preface, John Rowley has always held the highest ideals of the taxidermist's art and has fortunately been so situated that he has never been obliged to sacrifice them. The exhibits prepared by him in several different museums, notably those in the California Academy of Sciences building in Golden Gate Park, San Francisco, form an enviable record of achievement in this worthy line of endeavor.

Twenty-seven years ago Rowley wrote "The Art of Taxidermy," a book which registered the foremost accomplishments of that day. The author states in the forepart of the present book that the passage of a quarter of a century has seen the development of so many ideas and improvements in museum matters that but few of those described in the earlier volume are now being applied. The present book sets forth the

latest methods and formulae, so far as known to its author, and will therefore be welcomed far and wide among the very many museums of the country. It will be of immediate value to preparators and administrators, most especially in museums being newly established; and the numbers of these are increasing year by year. The museum is taking its place with the library as an agency of public instruction.

There are chapters in Rowley's book on the gathering of specimens for mounting, on tools and materials required, on formulae, on casting, modelling and making moulds, on the special treatment for fishes and reptiles, on the very important subject of accessories, including artificial plants and flowers in wax and celluloid, and finally on the proper assembling of groups and the construction of cases and backgrounds —all these subjects receive full attention upon the basis of exhaustive first-hand experience.

Rowley's book is written exclusively from the preparator's point of view, and it is the present reviewer's purpose now to call attention to certain features of it which bear on matters outside of that particular field. In giving various tanning or pickling formulae the author points out the danger in the use of salt brine, either alone or in combination with alum or acid, in that this solution changes the texture and certain colors of the hair of mammals. "Bright yellows are transformed to a dingy yellow and dark yellows are changed to purple and brown" (p. 115). This fact, of the use of brine pickle, has, as rightly stressed by Rowley, who cites instances, resulted in quantities of supposedly "scientific" material reaching museums proving practically worthless. And yet the preservation of pelts in brine, or the passage of them through salt solution in the tanning process, has been, and probably remains, a very general procedure in museums. Rowley's book will be vastly worth while, from a truly scientific standpoint, if it will have served to terminate this custom.

Another thing that Rowley rightly deplores is the exposure of mounted mammals and birds to daylight. An exhibit which is exposed to strong daylight "is a waste of time and money, if the exhibit is designed to be a permanent one. It is bound to fade in time and the whole thing is not worth while." Rowley argues for artificial lighting, whereby the fading or bleaching is reduced to a minimum; during non-exhibition hours the lights can be turned off, leaving the groups in absolute darkness. Rowley refers definitely to a series of very expensive groups installed in a prominent museum which, "after only eight years' exposure to top daylight, already show the bleaching effects of daylight" (p. 319).

The present reviewer would go farther and designate as a biological crime the placing upon continuous daylight exhibition type specimens, or *any* specimens of rare or vanishing species of animal. The custom of sending expeditions for "group material" for such purpose to territories where disappearing species are making their last stand for existence is to be condemned without reservation. The only justification for killing, then, is for the purpose of preserving scientific specimens under conditions insuring greatest permanence in texture and coloration—which is *not* under the usual exhibition conditions.

Rowley has much of marked value to say from his experience in regard to the construction of cases for artificial lighting, as well as also in regard to the construction of buildings for the specific purposes of exhibition. "The greatest trouble with museum buildings has been that the general plan has been left to an architect who knew nothing about the exhibition side of a museum and cared less. His sole idea was to erect a fine-looking building—one which would be a monument to himself. The result has been that, when completed, the structure has utterly failed as an exhibition museum" (p. 317).

Rowley has things to say of a pungent nature in regard to museum administration. For example: One "mistake that is quite common is for museum founders to try to combine art, history and science in one institution and under one head. . . . If started in this way, the sooner the charter is amended so as to eliminate one or the other, the better for the institution" (p. 323). "A museum which is built and owned entirely by a municipality is a purely political institution and as such will in all probability never expand and develop into a great institution. Both the heads and the employees owe their positions to political influence, and qualification in many instances is not considered. . . . The city authorities who furnish the money rarely know anything about the demands of a museum or how the funds should be spent" (p. 322). "The common mistake is to select a museum director from the ranks of scientific men. No greater error can be made" (p. 324). The head of a museum should be a "broad-minded business man of good personal appearance and 'mixing' qualities." His duties should be to "look after the large affairs of the institution, to meet and interest people, and get donations and bequests. . . ." "A director who has spent a term of years in an institution has been simply a time-server if the building has not grown or expanded during his administration."

Some of the above opinions in regard to museum administration are, it will be noted, strikingly similar to ideas that have been expressed elsewhere in regard to university administration. While the reviewer finds himself in sympathy with several of the above expressions by Mr. Rowley, he would point out one prin-

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.