there is not a single species of hardwood here ranking in commercial importance with the leading eastern hardwoods. Climatic conditions in many parts of California are favorable for the growth of a number of the valuable hardwoods, and the absence of these trees is due mostly to unfavorable factors of seed distribution.

UNIVERSITY AND EDUCATIONAL NEWS

The General Education Board has offered to give the Johns Hopkins University $200,000 on condition that a million dollars be raised for the removal of the university to its new site at Homewood.

Mr. N. W. Harris has promised to give Northwestern University $155,000 if the college will procure the remainder of a million dollars during the coming year.

The New York *Evening Post* states that Mrs. D. G. Richardson, who in the past has contributed liberally to the medical school of Tulane University, has recently given property valued at $55,000, and yielding an income of $3,000 for the endowment of the chair of botany. Professor R. S. Cocks fills the newly created chair.

The debt of Columbia University contracted in part payment of its new site and buildings has been funded, and the United States Trust Company has taken a mortgage of $3,000,000 on the blocks owned by the university on Fifth Avenue between forty-ninth and fifty-first streets. The university will pay off this debt in thirty annual installments.

Professor Irving Hardesty, the head of the department of anatomy at the University of California, has been appointed to the head of the department of anatomy in Tulane University, Louisiana.

Dr. George H. Ling, adjunct professor of mathematics at Columbia, has accepted the professorship of mathematics in the newly-established University of Saskatchewan.

Dr. Frank G. Speck, instructor in anthropology, has accepted the position of assistant professor of anthropology in the University of California.

Walter K. Van Haagen, assistant in chemistry at Lehigh University, has been elected associate professor of chemistry at the University of Georgia.

Professor J. A. Brown has resigned his position at Dartmouth College to accept the chair of physics at the Protestant College of Beirut, Syria.

Mr. Charles B. Gates, assistant in chemistry at the University of Wisconsin, has been chosen instructor in chemistry at the Michigan College of Mines.

Professor G. Elliot Smith, F.R.S., of the Government School of Medicine, Cairo, has been appointed to the chair of anatomy in the University of Manchester.

DISCUSSION AND CORRESPONDENCE

ON THE TEACHING OF THE ELEMENTS OF EMBRYOLOGY

In 1893 Professor A. Milnes Marshall wrote in the preface to his "Vertebrate Embryology":

> Great attention has of recent years been given to the study of embryology, and yet it is curiously difficult to find straightforward accounts of the development even of the commonest animals. . . . In works professing to deal with human embryology it is more common than not to find that the descriptions, and the figures given in illustration of them, are really taken, not from human embryos at all, but from rabbits, pigs, chickens or even dogfish.
>
> This latter practise is a most unfortunate one, and has been the cause of much confusion. The student is led to suppose that our knowledge is more complete than is really the case, while at the same time he finds the greatest difficulty in obtaining definite information on any particular point in which he is interested.

This very temperate statement needs to be repeated to-day with greater emphasis, for the attention given to the study of embryology has increased with the years; it is required from practically every student of medicine and of biology, and it is as difficult as ever, if not more so (for old accounts grow out of date), to find straightforward accounts of the development even of the commonest animals. Now, as then, our text-books leap from fish to man, back to *Amphioxus*, and forward again, with stops at intermediate stations, amphibians, reptiles and birds, in such a way as to

confuse the student seriously. His confusion is increased if he compares different books, for they are apt to select different illustrations from the unlimited body of facts; and statements are often contradictory. Moreover, it is frequently impossible to say when the description passes from one form to another, or indeed, what species of animal, or pale phantom of the imagination, is in the author's mind at all.

The distinction between fact and theory is a useful one, even in embryology; indeed, I know of no distinction so important for the student to master. But in the text-books of embryology there is a nebulous zone between peopled with morulæ, blastulæ, gastrulæ, germ-layers, etc., which dissolve and reappear in strange forms never the same. And the student is often uncertain whether he is on the sure ground of fact, in the fascinating field of theory or in the twilight zone between. Such uncertainty is demoralizing, because it limits his respect for exact facts and does not increase his capacity for sound generalization. The student who gains his conception of a developmental sequence by combining the morula of a mammal, the blastula of a starfish, the gastrula of *Amphioxus* and the germ-layers of a frog is as far removed from connected facts as from sound theory.

Such method of the text-book is of course ill-adapted to laboratory practise and there is usually a gap between. The student's laboratory practise is usually limited to an anatomical study of a few stages of one or a few forms, and if he turns to the text-book to bind his observations into a sequence, he finds brief superficial descriptions of disconnected stages of a great variety of forms, for the most part, of course, different from those he is studying in the laboratory. Neither in his laboratory practise nor in his text-book does the student obtain genuine understanding of the development of any single form. It would be just as reasonable to expect proper comprehension of the principles of comparative anatomy of vertebrates without knowledge of the anatomy of any definite species as to expect real understanding of the principles of comparative embryology from a student who does not know a single life history thoroughly.

These conditions are seriously aggravated by secondary considerations of the text-books, such as the alleged greater significance of certain aspects of the life history for various practical disciplines, which leads to unjust emphasis, and to the view that embryology is a field from which only facts of practical value are to be culled; I am far from denying the significance of the study of embryology for medicine, for instance, but I would maintain that much of its significance is lost by piecemeal selections. If the facts and principles are understood, the applications may be readily made at the proper time and place, but if they are not understood the applications are surely of doubtful value.

Theory changes so rapidly in embryology that text-books soon grow out of date; and tastes differ so widely that the selection of facts for a book fails to satisfy more than a limited number of teachers. Hence the constant procession of text-books of embryology. In this state of affairs there is bound to be a reaction, and it appears to me that this must take the form of a series of text-books dealing with the concrete development of single forms.

Probably no text-book of embryology has been so influential and of so long continued service as Foster and Balfour's "Elements of Embryology," of which the first edition was put forth in 1873, and the second edition (enlarged) in 1883, soon after Balfour's untimely death. Even now, although it has not been revised for twenty-six years, it is still in active service. The reason for this lies partly in the simplicity and clearness of the style, but largely in the fact that the greater part is a literal account of the development of a single form, the chick; it takes up the events of the development of each day, to the end of the sixth day at least, "as though the development were done by day labor," which is indeed the case, and the student obtains some idea of time-relations which are of the essence of embryonic development; he is made to see development as a continuous process marching steadily forward to a definite consummation;

and he controls the statements of the book by his observations in the laboratory; and where the latter are incomplete they can be supplemented by reference to the former.

The continued usefulness of this little book is an object lesson in embryological pedagogy by which the writer tried to profit in writing a new "Development of the Chick" which should bring the subject matter up to date, and serve as an introduction to embryology. On the whole it seems improbable that the chick will be displaced as the favorite subject for laboratory practise in embryology, because the material is of universal occurrence and available at all seasons of the year without great expense. Moreover, the technique is as simple as that of any other form, at least after the egg is laid; and the knowledge of its development, while yet incomplete, is certainly more considerable than that of any other animal with the possible exception of man himself.

Professor Metcalf's objections to the use of the chick for introducing students to the subject of embryology[1] do not appear to me to be well grounded. He complains that the embryo chick is "highly specialized" and "distorted from the general vertebrate type," and that "the space relations of the organs are distorted by secondary influences." For these reasons he prefers the frog, and wishes that there were an embryology of this form. I echo this wish and hope that Professor Metcalf will undertake to write one. I am afraid, however, that the inconsiderate agriculturalists who domesticated the hen and taught her to lay the year around have conferred on her an unfair advantage; and it appears to me better for the elementary student to study living hens' eggs than preserved frogs' eggs. This is indeed the main advantage that I see on the side of the chick. But I believe that the objections on account of "specialization" and "distortion" are more deeply rooted in tradition than in nature.

But whether the student uses the frog or the chick, or some other form, he needs a fairly complete and modern book of reference of the same form, if not to replace, at least to supplement, the comparative text-books. In this contention I think Professor Metcalf will agree. We need above all objectivity in the teaching of embryology; we must require some basis of exact facts to support generalizations, and keep the distinction between the two clear in the student's mind.

[1] Science, N. S., XXIX., May 7, 1909, pp. 738–739.

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GENERA WITHOUT SPECIES

In Science for February 26, 1909 (pp. 339, 340), Professor Cockerell discussed the "controversy" concerning "genera without species," pointing out the difficulty of dealing with such cases, since they are not distinctly provided for in the International Code of Zoological Nomenclature. Apparently each case should be dealt with solely on its merits. A few illustrations may help to make this point clear. In 1799 Lacépède proposed the genus *Picoides,* giving a short diagnosis of it, but omitting to refer to it any species. The diagnosis clearly indicates a woodpecker having only three toes. The only species of woodpecker at that time known with only three toes was the three-toed woodpecker of northern Europe, *Picus tridactylus* Linn. This species being clearly the basis of the diagnosis, it may be taken as the type of the genus *Picoides,* now, for a long time, current for the group containing this and other closely allied species.

In the same way, and at the same date, Lacépède proposed the name *Astur* for a genus of short-winged, long-legged hawks, giving for the genus a wholly inadequate diagnosis, without mentioning under it any species. In 1806 Froriep published a German translation ("Analytische Zoologie") of Duméril's "Zoologie analytique," adding to it, *passim,* much new matter, including the mention of examples under Duméril's genera, which, for the most part, were originally proposed by earlier authors, without, of course, the designation of types. As an example of *Astur* Froriep gave the species *Falco palumbarius* Linn., which thus may be taken as the type of *Astur.* But the genus should date