professor say that a young teacher should not get married, because the profession does not offer a living for two. Is this the price a man must pay for learning? Is it worth while? Does it lead to scholarship?

The assistant professor with a family can not, on $1,500 a year, get the necessary literature and books, he can not attend meetings at a distance, or travel and gather knowledge and inspiration from others of his kind. Does this lead to scholarship? Is it an inspiration for a university fellow to teach at $1,000 a year in a secondary school? Does this indicate that the market is not overstocked?

I raise a question as to whether "it is the professor that needs endowment" if we are to produce scholars. One reason there are not more scholars in America is because the entering inducements are not sufficient. Men prepare for the teaching profession and then turn aside for more remunerative work. In the zoological laboratory at Columbia University last year there were five students about ready to come up for the Ph.D. degree. Of these, three signified their intention of abandoning their plans of following the teaching profession. It is the young men who abandon the call of scholarship. They are the ones who need encouragement. It is the getting of more men into the profession that will produce scholars as well as helping those already in it. From the many will come the few real scholars that the nation can produce and these will be the result of heredity as well as of training.

It has been claimed that the greatest intellects in America are among the business men. This may be partly true. If the inducements of the teaching profession had been greater some of these men would, doubtless, be leading scholars to-day.

Dr. Patten's hopes of a promising man are that he will settle down on $1,500 a year, forgetting that he has a family to provide for, that he needs literature, travel and association with others. I can not forget seeing a university instructor spending his vacation wheeling a wheelbarrow. This is not going to produce scholars. It produces assistant professors without enthusiasm or inspiration. The teaching profession is bad enough. Why make it worse?

The idea that "no one should have the title of professor until it was fully earned" is good. But he should be supported while he is attempting to earn it. If this were done more generously than at present more men would make the attempt. Poverty does not offer a smooth road to learning.

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SCIENTIFIC BOOKS

Human Embryology—Keibel and Mall. Written by C. R. BARDEEN, Wisconsin; H. M. EVANS, Baltimore; W. FELIX, Zurich; C. GROSSER, Prague; F. KEIBEL, Freiburg, i. Br.; F. T. LEWIS, Boston; W. H. LEWIS, Baltimore; J. P. MCMURRICH, Toronto; F. P. MALL, Baltimore; C. S. MINOT, Boston; F. PINKUS, Berlin; F. R. SABIN, Baltimore; G. L. STREETER, Michigan; J. TANDLER, Vienna; E. ZUCKERKANDL, Vienna. Edited by FRANZ KEIBEL and FRANKLIN P. MALL. In two volumes. Volume I. 550 pp., with 423 illustrations. Philadelphia and London, J. B. Lippincott Company. 1910.

The publication of this work is worthy of very special notice, for it may well be said to mark an epoch of accomplishment in the study of human embryology, while on the other hand it furnishes exceptionally numerous suggestions of many problems yet to be solved, with the most promising lines of attack.

In the introduction, Professor Keibel brings out vividly, after an excellent historical review, the conditions which led up to the inauguration of the modern study of human embryology by Wm. His. It is fortunate that the great volume of these studies which have been accumulated under this inspiration should now be so fully reviewed and made available by the cooperation of these students of his. The plan of His for an extended exposition of human embryology is thus finally accomplished under the leadership of Keibel and Mall on two sides of the Atlantic.

Examination of the first volume gives quite a different conception of the field of human embryology from that obtained from other older text-books on the subject; for instance, Minot's very successful and constructive text-book of twenty years ago. It was evident then that, though much valuable work had already been done in various lines, it was still of a scattered character and unorganized. The effect, as a whole, was inconclusive. There were very few topics which had been studied with thoroughness or on sufficient human material.

In the new book we find that a considerable mass of fresh facts and accurate information have been accumulated, from intensive and systematic studies of a far more complete series of embryos, by more effective methods. Though much remains to be done in every department of investigation, it is now clear that the study of human embryos has become organized. Extensive collections are accessible. There is a systematic effort to obtain more complete records in every chapter of the history. The comparative and experimental method is not less used, but has become more an aid to interpretation; while the results secured from the study of human material itself now overshadow all else.

Another striking feature of the new book is the fact that it is the product of a cooperation between so many active American anatomists with well-known Germans; and that it is published, at the same time, in two languages. This is not only a recognition of the extent of His's influence, and of the general wide growth of a cooperative spirit in scientific anatomical research, which has become very marked in this science; it is also a substantial appreciation from abroad of the effective work which has been done in embryology among our anatomists in recent years. Almost every chapter of the book enforces this fact, and the use of illustrations and references to contributions from Americans published in the *American Journal of Anatomy* is frequent. Nine of the fifteen editors are Americans and, of these, five are pupils of Dr. Mall, whose initiative and stimulating example have encouraged much of the activity in embryological investigations of this character in this country.

Keibel writes the more general chapters in the first part (90 pages), including the historical introduction, the account of the germ-cells, fertilization, segmentation, young human ova, germ-layers and gastrulation, and a general summary of the development of the embryo. The rather restricted space given to these topics, which are treated so extensively in Hertwig's "Handbook of Comparative Embryology," is an illustration of the limitation of the scope of the new work to the results of the study of human material. Much of the greatest interest connected with these topics is here necessarily omitted, but there is a decided advantage in exhibiting the actual status of our knowledge. All through these chapters Keibel's fine critical judgment is evident. One receives the true impression that the writer has thorough personal familiarity with the facts. Nowhere is a nice judicial decision in such demand as in discussions about young human ova, hence we are especially glad to find this chapter by Keibel, whose treatment is masterful and illuminating. The tables are new and the details of comparison of young stages are satisfactory. The reader has an opportunity to secure a necessary amount of detail often lacking, confused or pointless in other accounts. The obstetrician will find much of interest here. Keibel's discussion of germ-layers is especially well put. The summary and résumé of the general history of the embryo based on the His and Keibel-Elze Nommentafeln of human embryos is excellent, the little critical accounts of each important embryo being well worth while.

Grosser's long chapter (90 pages) on menstruation, implantation, placentation, membranes, etc., is based on extensive personal investigations. This account is almost a monographic treatment of these subjects. The obstetrician will find a mine of discoveries in this chapter and the two following ones. The trophoblast, chorion, villi, decidua,

placenta, menstruation, ovulation, age of embryos and other related topics are given proper attention, and put in the most modern light. An excellent basis is laid by precise description for further work in the histological or pathological study of membranes and uterine conditions, and a better idea is now possible of the physiological environment of early embryos, especially from the new young human embryos described in detail.

In his chapters (60 pages), Mall advocates a new and improved method of measuring embryos, which may also be applied to the adult. His analysis of our knowledge of the age of embryos, growth rate, etc., is original, and results in new curves and tables of development. He thus furnishes us a standard, the result of a wide experience with all known data. His chapter on pathological embryos is novel and an advance in view point. It represents the essentials of his very extensive publications on this subject. The types of abnormalities, percentage of abortions, and the association of the pathology of the membranes with these are discussed. This leads up to an analysis of the bearing which experimental studies, mechanical and chemical, leading to the production of definite monstrosities in other forms, probably have on the origin of abnormalities in human embryos. Medical students and pathologists will turn to these chapters freely, and general embryologists will find here interesting significance in their work.

The second half of the first volume is devoted to the first chapters of the development of special systems of organs, which will be continued in the second volume. An examination makes it plain that these chapters were not written for beginners, though the treatment is direct and clear enough for any one. Even this first volume is sufficient to show that there is now ample material for satisfactory courses in mammalian embryology of advanced character, specially adapted to medical students.

It is evident that the time has come for our anatomical departments to insist that students beginning anatomy should have already obtained, during their two years of pre-medical college work now generally required, sufficiently thorough courses in elementary vertebrate embryology, to permit of properly introducing them to the later stages, in man and mammals, which have so much significance for their work in human anatomy.

The fifty pages by Pinkus, devoted to the integument, proves to be a consideration of many interesting aspects of the growth of the skin structures often not insisted upon. For in the treatment of pigmentation, glycogen, fat, glands, hair and hair tracts, and of the friction ridges and metamerism, we have emphasized the value of more general studies like those of Galton, Wilder, Sherrington, Bolk and Harrison. The special circulation, lymph supply, and nerve supply of the skin are largely left for the writers who shall describe these systems.

Bardeen's section (150 pages) on the skeleton and connective tissues may be characterized as encyclopædic in the inclusion of so great a mass of data. It is a storehouse of information, the variety of which has made the task of collecting and arranging very difficult. The author has exhibited much energy and skill in handling the material, to which he has contributed considerable of value. Mall's views are accepted as the most reasonable for the origin of the reticulum and fibrillæ of this tissue. Some of the most welcome sections on the skeleton are those on joints, and on variation and abnormalities in development. The origin and changes of form of vertebræ are illustrated by Bardeen's models, a set of which should be found in every anatomical laboratory. The treatment of the development of special regions of the skeleton, of ossification centers, of the length and curvature of the spine, is accompanied by valuable figures and diagrams. The skeleton of the limbs is taken up with similar fulness and contains further contributions from the author, many figures new to text-books, and useful tables. The skull is studied in forty pages with a proper reference to comparative embryology where also much has been done, and such important complicated regions as the

orbit, temporal and nasal regions, and the visceral arch derivatives are considered separately. The author publishes, for the first time, two new views of the skull of a twenty-millimeter embryo which combine numerous interesting relations. It is a pity that the details of these figures are not better shown in the half-tones. Anatomical illustrations are being steadily improved, and this is shown in many figures in this edition; but far more care is yet required in both the printing and selection of suitable paper, before the standard of German editions can be approached. The chapter closes with an extended account of the ossification of the individual bones of the skull.

The development of the muscular system is described by W. H. Lewis in about seventy pages. We find this an excellent account, well planned and comprehensive, while at the same time concise and logical. The influence of a participation on the part of the writer in embryological studies of an experimental nature is quite evident and gives a modern point of view.

The chapter is well illustrated, many of the figures being original, and some published here first. It is possible to obtain from them and the text a good idea of the origin and development of the various muscle groups. The author's contributions to the development of the muscles of trunk and limbs, and more recently of the head, tongue and larynx, are outlined here with figures from his new models. Futamura's striking series of pictures representing the stages of spreading of the facial musculature forms an interesting feature.

Only twenty-four pages are allotted to the last section, including the septum transversum diaphragm, and the cœlom, but the subject is brought up to-date by Mall with the aid of new investigations in addition to his previous extensive studies and the conditions found in a number of recently described young human ova. Broman's work is also incorporated to advantage.

One praiseworthy feature is the extensive bibliography at the end of each chapter.

Though the printing of the illustrations and the general make-up of the German edition is decidedly superior to the English, the American publishers have, on the whole, succeeded in making the volume a creditable one. The second volume, now in press, will be anticipated with much interest.

H. McE. Knower

Cincinnati, Ohio,
February 18, 1911

Special Articles

The Origin of Nine Wing Mutations in Drosophila[1]

In the following preliminary report I wish to put on record some of the principal wing mutations that have appeared in cultures of the fruit fly, *Drosophila ampelophila*. In another communication I shall describe five mutations in eye color that have been found in the same cultures, and their modes of inheritance. The theoretical questions involved must be deferred until the complete data can be published. These mutations have appeared in such rapid succession that my time has been almost entirely consumed in producing pure strains of the new forms, which can be utilized later for a thorough study of the inheritance of the new types. I wish here merely to call attention to the fact that while most of the new types breed true from the start, others do not; and also to the fact that while certain of the mutations are sex-limited other mutations involving the same organs do not show this form of inheritance. It may appear that we have here an opportunity to learn something further of these different modes of inheritance appearing in the same animal. One fact especially will impress itself on any one who follows the history of these new types, viz., the "segregation" of the characters, and in most cases the absence of intergrades.

Beaded Wings.—In May, 1910, a number of flies, pupæ, larvæ and eggs of *Drosophila* were subjected to radium rays. One fly was pro-

[1] The main facts in this paper were given before the American Society of Zoologists, December 29, 1910.