Thus far the work undertaken by this new survey has been cooperative, especially with geologists associated with universities. The first work to be published will be a very comprehensive bibliography of the geology of California, prepared by Dr. Solon Shedd, of Stanford University. This is now in the hands of the state printer.

By giving some financial assistance to certain worthy research workers, the geological survey of the Division of Mines has been able to foster a number of extensive field investigations this summer. The Weaverville quadrangle in northern California is being completed by Dr. N. E. A. Hinds, while in southern California Dr. C. D. Hulin has been mapping the Searles Lake quadrangle, a work which supplements his bulletin on the geology and ore-deposits of the Randsburg quadrangle. The results of the work of these geologists (both members of the faculty of the University of California) will be issued as separate bulletins covering in detail the problems of their respective areas.

The Division of Mines is making it financially possible for eight graduate students to carry on the necessary field work for their advanced degrees, with the result that several important areas in the state are being mapped. These are as follows: Elizabeth Lake quadrangle, by Edward C. Simpson; Sebastopol and Duncans Mills quadrangles, by F. S. Johnson; two areas in San Bernardino County, one by John C. Hazzard and the other by Dion Gardner, and a portion of northeastern Madera County by Homer D. Erwin, all of the University of California. The geology of the southern and western part of Mono County is being mapped by Evans B. Mayo, formerly of Stanford, but now of Cornell. A large part of the San Jacinto quadrangle has just been finished by Donald Fraser, of Columbia University. Underground mining geology in Grass Valley is being carried on by Robert L. Loofbourow, of Stanford University, working under the direction of the U. S. Geological Survey in cooperation with the Division of Mines. Mr. George Green, of Stanford University, is just beginning a study of the underground geology of the coast tunnels of the Hetch Hetchy aqueduct. In addition to these special studies, Mr. Charles V. Averill, district mining engineer of the Division of Mines in northern California, is making a study of the geology of the mines of the Shasta quadrangle, correlating his work with that secured from the Southern Pacific Company. Besides these projects there are many other new plans under consideration, such as cooperation with the U. S. Geological Survey in the publication of many data already in manuscript form.

The work of the new survey is, therefore, well under way. Cataloguing of data is well in hand, the bibliography is completed and the state map is in preparation. Altogether twelve field men, together with several assistants, are contributing new data to the geology of California.

Enthusiasm for the undertaking has been met on all sides, and cooperation of all sorts has been more than cordial. We now hope that the State of California will favor the continuance of the geological study and will encourage the building up of a strong geological survey by granting in the future liberal appropriations for the work.

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SCIENTIFIC BOOKS

A History of Experimental Psychology. By EDWIN G. BORING. New York; The Century Company, 1929, pp. xvi, 699.

IT is extraordinary that there should have appeared within a single year two such important histories of psychology as Gardner Murphy's "Historical Introduction to Modern Psychology" and the present work.

In contrast with most earlier treatments of this subject, both these books are the productions of men who are intimately in touch with the enterprises of present-day psychology. As a consequence, they supply a background which the active investigator can hardly afford to neglect. And the expert in another science who would cultivate a serious acquaintance with psychology could adopt no more profitable means than that of reading either or both of these historical works.

Although the present review is of Professor Boring's book, it is not entirely outside that purpose to make a distinction between it and the Murphy history. If one is interested in obtaining information in regard to the development of some special topic of modern psychology, Dr. Murphy's book will probably offer prompter service. If, on the other hand, one is interested in the present science of psychology as the outcome of a large and intricate adventure of the human mind, then one would better turn to Boring.

Histories of psychology have been in the habit of starting out with a discussion of ancient conceptions of soul or mind. When treated in detail this is an elaborate subject and one which, unfortunately, bears no obvious relation to modern psychological research. Histories which begin with such minor issues have seldom given understanding treatment to the impor-

tant sources of present psychology. They have thus tended to make the past seem meaningless and the present trivial. Professor Boring has adopted a more fruitful procedure. Since he is interested in the history of a *science* of psychology rather than in all attempts to deal with the mind, he finds his significant starting point in the emergence of scientific modes of thought and in the development of controlled observation as a basis for such thought. Although he is clearly conscious of a continuously important relationship between philosophy and science, he believes that the essential qualities of science depend upon a clearly defined distinction between the two.

> It seems probable . . . that the cleft between philosophy and science is caused by a more fundamental human individual difference than are any of the clefts between the different sciences, and that science split off from philosophy, in this personal way, largely because of the rise of the experimental method. In the first chapter of this book we have said little of the great Aristotle and more of the lesser Aristarchus, who measured the distances to the sun and the moon, and of the lesser Eratosthenes, who measured the size of the earth. These two men were experimentalists, and the contrast of the experimental with the rationalistic method shows clearly in the simple beginnings of the former. Both philosopher and scientist require imagination, but the imagination of the scientist is limited by the scope of the experiment. . . .

Perhaps nothing illustrates better the general outlook and emphasis of Professor Boring's book than the composition of his first chapter. "The Beginnings of the Scientific Attitude," "Greek Philosophy and Greek Science," "The Emergence of Observation as a Method in Science," "Early Physics and Biology," "The Rise of Modern Science," "The Development of Biological Science": these are the real sources of the present science of psychology, and it is with them that this history begins. As a result one feels from the first why and how psychology, as we now know it, came to be. In the case of most of the earlier histories of psychology nothing of the kind was true. Their authors, weighted down by antiquarian interests, have plodded a laborious, chronological trail from the forerunners of Aristotle to some convenient modern stopping point.

Scientific psychology, though not without relationship to speculation about the mind, is nevertheless the child of experimental physiology, which was in turn the child of experimental physics. As Boring says, there may be some question as to whether biological and then psychological inquiry ought to have followed the pattern laid down by physics. But he recognizes that he is writing history, and he wisely turns aside from such issues of *ought*.

> The actual fact is that science was what physics and astronomy were. Scientific physiology developed because physics had provided a method for it, and physiology was scientific because it held to this method. Later we shall see that physiology gave birth to experimental psychology, at first called "physiological psychology," in much the same way that physical science gave birth to physiology.

Working in this frame of mind, Boring devotes the first long section of his history to those developments within the physiology of the first half of the nineteenth century which proved especially influential upon experimental psychology. This period is taken to be peculiarly important because it is just prior to the emergence of the independent science of experimental psychology and also because many of the accomplishments of the physiology of those years were as much psychological as physiological. Throughout the volume Boring is always striving to bring out the larger movements and more significant ideas. In his treatment of this physiological psychology of the early nineteenth century he begins with the Bell-Magendie law and then turns to the velocity of the nervous impulse. Regarding the first, he tells us that:

> There is little danger of overestimating the importance of these discoveries for the physiology of the nervous system. Up to this time, the nerves had been supposed to transmit promiscuously "the powers of motion and sensation." Bell's work established the fundamental dichotomy of function which has remained the implicit assumption of almost all research upon the nervous system for a century.

Similarly, Boring notes how revolutionary was the discovery that the nervous impulse is not instantaneous. The slowness of this transmission constituted an invitation for the mechanical analysis of behavior. Like Bell's discovery, it suggested that study of human action is possible in a way that it could not be if action were the instantaneous outcome of an indivisible neural flash.

Included in the discussion of early physiological psychology are chapters on the personal equation and on hypnotism. Although the first of those topics had its origin in astronomy rather than in physiology, it had a great deal to do with the rise of the classic reaction time experiments, which soon became closely related to the problem of the speed of neural processes. Hypnotism did not come into importance in the physiological laboratory, nor has it ever received much attention from orthodox scientific investigators. Most of what we now know of the subject was, however, determined by medical men and it is presumably for this reason that the topic is treated at this

point. It is interesting to note that hypnotism is one of the foundation stones of present-day psychology which has hardly any structure erected upon it. Boring is certainly justified in describing hypnotism as an important scientific chapter of the early nineteenth century, but its importance as a forerunner of experimental psychology is a matter yet to be determined.

Although it is Boring's strong contention that the facts and problems of psychology grew up within science—especially within physiology—he clearly recognizes that experimental psychology was not split off as an independent subject until what was psychological in science at large came into contact with a philosophical psychology which since antiquity had existed as a field of speculative activity. The second section of the present history is devoted, therefore, to "The Preparation for Experimental Psychology within Philosophical Psychology." In content this topic is more like what has conventionally gone under the name of history of psychology. But from the viewpoint of a present-day psychologist, Boring handles philosophy with a peculiarly happy capacity for selection. After a brief treatment of Aristotle, he goes at once to Descartes. Then follow in turn: Leibnitz, Locke, Berkeley, Hume, Hartley, the Mills, Bain, Spencer, Herbart and Lotze. The important contributions of these men are set forth with remarkable clarity and quite fully enough for the purpose of the present book. The treatment of the development of association theory in England is much the best brief account that has come to the reviewer's notice.

There are some 670 pages of text in Boring's history and Fechner makes his major entrance on page 265. This gives an idea of the relative space given to the history of psychology after it became experimental. The story of the founding of experimental psychology is told as follows: after a chapter on Fechner there is one on Helmholtz which emphasizes his theories of perception as well as his contributions to the more restricted aspects of vision and audition; then Wundt with the Leipzig Laboratory, followed by a chapter on those three non-Wundtians Brentano, Stumpf and G. E. Müller; the period immediately subsequent to "the founding" is represented by the work of a German group made up of Ebbinghaus, Külpe and Titchener (even though the last lived his professional life in America) and a number of others such as Mach, Avenarius, Lipps, Ziehen, Münsterberg, Kraeplin and Meumann, each of whom for one reason or another lay outside of the main experimental current; a chapter on the act psychology establishes the historical origin and importance of the distinction between content and act and also prepares the way for the understanding of the functional movement later to arise in America and of the *Gestalt* psychology which is still causing excitement in both Germany and America; British psychology is regarded as important for the systematic writings of Ward, Stout and McDougall, for the contributions of Darwin, Romanes and Lloyd Morgan to animal psychology, and for the fundamental operations of Galton in the field of individual differences; and finally there is a chapter on the American pioneers, James, Hall, Ladd, Scripture, Baldwin and Cattell. All this is a long and difficult piece of writing which it is hard to characterize except in general terms. Perhaps the task could have been better done, but it is the reviewer's belief that no living man could have done it so clearly and almost simply and yet so expertly. Professor Titchener had the knowledge required for this task, but even had he undertaken it, he probably would not have done as well, because, while he was capable of superb exposition at the elementary level, he was hideously difficult when he aimed to be scholarly. But Boring has exemplified a scholarship that is definitely of Titchenerian order coupled with a directness that his master was able to employ only when he could be dogmatic.

There is much talk of personalities in this account of the early days of experimental psychology, but, as Boring points out, those days were made by personalities. The objective study of reaction times would never have been undertaken simply because some one in Wundt's laboratory thought it was a good idea. It should be of the first importance for psychologists to realize that this idea happened in the head of an American youth whose dynamic character is reflected in the fact that he was Wundt's self-nominated assistant. The introspective method would never have gathered around itself a school in America if Titchener had sought to be a congenial colleague of his American contemporaries.

When a historian comes into current events, he is peculiarly exposed to challenge, and it is Boring's treatment of the movements of American psychology which is most likely to arouse arguments. Functional psychology, experimental animal psychology and mental tests are subjects that all of us have known and fought over since the infancies of our professional lives. But before any questions of personal bias are raised, it should certainly be said that Boring has attacked these difficult contemporary and local questions with every effort to be fair. He has read Dewey and Angell on the general standpoint of functionalism and he has read them sympathetically. It is doubtful whether any careful student will be disposed to disagree with his statement of the aims and claims of these men. Nor is he wrong in pointing out that Angell's students more or less naturally drifted into

applied psychology and animal psychology. As compared with his treatment of the factual discoveries of such a group as Külpe's, his treatment of the achievements of those American experimentalists who have been motivated by a dynamic view-point is, however, very incomplete. The reviewer has the feeling that the pioneer studies of Bryan and Harter and of Book on the acquisition of skill were of substantial importance even for the development of a generalized human mind. Stratton's classic experiment on inverted vision reflected very definitely the theoretic framework of American thought. Thorndike's studies of transfer and fatigue were other influential products of the experimental operation of that larger dynamic view-point which has pervaded America and determined the nature of a large part of the investigation done here. The reviewer has similar feelings in regard to Boring's treatment of animal psychology and the mental test movement. There is an attempt to characterize these subjects, but they are, after all, treated rather as offshoots from experimental psychology than as vital ingredients. Boring recognizes in a word that animal psychology has developed into a more general approach to mind than that afforded by the study of the human subject alone, but he has not paid tribute to the large part that investigations of animal behavior have had in shaping current notions of behavior. He recognizes that mental tests are an important offshoot from experimental psychology, but he gives little stress to the really epoch-making discoveries brought about by this device. The reviewer would hazard the prediction that the discovery of the almost invariably positive correlation of intellectual capacities will sooner or later be regarded as more important even for experimental science than the number of layers which somebody can discern in consciousness. It is not to be concluded from Boring's failure to treat in any detail the development of our knowledge of skill, intelligence and work that he regards these topics as trivial. The explanation seems to lie rather in the fact that he has purposely restricted the meaning of "experimental psychology" to what Wundt meant by that expression—"that is to say, the psychology of the generalized, human, normal, adult mind as revealed in the psychological laboratory." Like Titchener before him, Boring seems to feel that experimental psychology of this type must be kept clear of issues that arise out of application or out of investigations of animal behavior which the original Wundtian theory has always found it so difficult to place. But why should one want to confine oneself to the history of what is left of the Wundtian theory? That is a difficult question. It is especially difficult when one considers that the majority of the present work is an adequate history of "scientific psychology" in a much broader sense. It is only in his treatment of American psychology of the fairly recent past that Boring's interest shows its restriction.

Perhaps the reviewer attaches altogether too much importance to the fundamental, scientific contributions made by those who, in this country, have been dominated by a dynamic and functional point of view. It was not his wish, however, as he laid down this history that Boring had said a word less about occurrences within and close to the Wundtian tradition of experimental psychology. He only wished that the author had gone under the *schools* of functionalism and behaviorism and under the more superficial characters of the movements of application and animal study in order to bring out, as he surely would have brought out, discoveries of fact and the development of theory which have already shown their importance for psychology in its largest and most general sense.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A MODIFICATION IN LANTERN SLIDE PROJECTION TECHNIQUE

IN the teaching of the usual courses in physiology, difficulty is experienced in the presentation of visual material. The usual method, and perhaps the simplest, is to draw the diagrams upon the blackboard during the lecture. This takes too much of the time from a short and busy lecture hour, time better occupied otherwise. Large charts mounted on cardboard are useful but have the disadvantage of being expensive, hard to keep clean, difficult to make and bulky for storage. It is often difficult to make them large enough to be easily seen by a large class.

Moving picture films are becoming cheaper and more accessible but are still expensive, and the exact diagrams and drawings of the individual lecturer are rather difficult to prepare in this way, taking a good deal of time and labor. Alterations are not easy, and still projection is hard on film.

Lantern slides still seem to be the best medium for charts and diagrams. However, the ordinary slide prepared by photography does not pass as much light as is often required when daylight illumination of the room is desired. Darkening a room for lantern slide projection is usually a strong hint to the class to take a nap. The process of preparing