interests of the station demand that it be represented. In such cases, the proper official should be sent as the station's representative and at its expense."

This was brought to the attention of the committee by the American Association of Economic Entomologists, but of course applies to all divisions of the experiment stations. The details of such arrangements are to be regarded as matters belonging to the administration and they are naturally left to the officers of each institution concerned. The association can not, of course, dictate to directors or boards of trustees; the above is, therefore, to be regarded only in the light of a recommendation showing the sentiment of the association.

F. L. WASHBURN,
President of the Am. Assoc. of Economic Entomologists

SCIENTIFIC BOOKS

Introduction to Psychology. By ROBERT M. YERKES. New York, Henry Holt & Co. 1911. Pp. xii + 427.

The Essentials of Psychology. By W. B. PILLSBURY. New York, The Macmillan Company. 1911. Pp. xi + 362.

An Introduction to Experimental Psychology. By CHARLES S. MYERS. Cambridge, University Press. 1911. Pp. vi + 156.

Elements of Physiological Psychology. By GEORGE TRUMBULL LADD and ROBERT SESSIONS WOODWORTH. (Thoroughly revised and rewritten.) New York, Charles Scribner's Sons. 1911. Pp. xix + 704.

The present year has been an unusually fruitful one in systematic works on psychology. Of the above-noted four text-books in English, three are by Americans. One is an elementary introduction to experimental research, another is a compendium of physiological psychology, and two are general outlines of psychology by writers long known for their special contributions, who have not hitherto given us surveys of the whole science.

The works of Yerkes and Pillsbury form an interesting contrast in standpoint. Professor Pillsbury, trained in a school which regards introspection as final arbiter, takes a remarkably objective attitude in his book. Psychology is treated as the science of behavior, and the structure and functions of the nervous system receive prominent attention. On the other hand, Professor Yerkes, whose investigations in animal psychology would suggest a predilection for objective criteria, proves to be an out-and-out introspectionist, and omits the customary discussion of the nervous system on the ground that it does not belong in a psychological text-book; nervous structure and animal behavior are merely "signs of consciousness."

Professor Yerkes's book is a capital introduction to scientific psychology. It outlines the fundamental facts, emphasizing the classic "descriptive" psychology, but at the same time seeking to familiarize students with the more important experimental and genetic work. Of its six parts, the first is introductory and discusses the scope and methods of the science; four deal with particular aspects of psychology; while the last part indicates some practical applications.

Part I. examines the relations of psychology to physical science. The data are shown to be substantially the same; but physics and chemistry treat the common material from the objective standpoint, while psychology views it subjectively. It is on the basis of this distinction that the author emphasizes introspection and subordinates behavior to consciousness throughout the work. This part contains an unusually interesting critique of scientific method, well worked out, though possibly too detailed for beginners. In place of the usual terms "observation" and "experiment," the distinction is more logically entitled "naturalistic" and "experimental" observation (p. 45).

Part II. is devoted to descriptive psychology. Professor Yerkes is a champion of the structural psychology, and believes that the first aim of the science is to discover the constitution of consciousness. His account of the

elementary sensations and feelings is well analyzed. He considers sensation and affection distinct classes, since the former possesses "a sort of local mark" which "affection lacks" (p. 147). In discussing the properties attributed by various authors to sensations and affections the writer is remarkably free from bias (pp. 104, 151). He advocates the word "mode" to indicate the fundamental sorts of sensation. Such distinctions as noise and tone are different modes within the same sense. Several tables are given of the senses and their modes (pp. 95–100), and here as elsewhere the tables are excellently presented. The synthetic discussion is good so far as it goes; but unfortunately it stops with perception and imagination. There is no adequate treatment of thought.

In Part IV. Professor Yerkes brings together a remarkable number of psychological generalizations and laws. This portion of the book deserves special study, in view of the claim in various quarters that psychology is not an exact science. The author is at his best here. He notes fifteen laws of sensibility (threshold, contrast, local sign, etc.), three laws of perception, and several laws relating to the affective life, attention and association. The collection and formulation of these laws is a valuable contribution to the science.

Part V. extends these laws to wider generalizations or "explanations" of mental phenomena. The author adopts the parallelistic view, which demands that psychology study psychical events by themselves, before attempting to correlate them with physical happenings. "The essence of the causal relation is uniformity of the order of events" (p. 328). It is found that sensation always precedes the after-image, disagreeable affections are "called up" by sensations, etc. (p. 334). On the very basis, therefore, on which we accept physical causation, these must stand as instances of psychical causation, and we can affirm that "certain mental conditions bring about the formation of an idea, an emotion, a judgment" (p. 336).

Parts II., IV. and V. belong together, and the interpolation of the genetic discussion (Part III.) is a break in continuity. However much the reader may sympathize with the author's desire to introduce genetic notions as early as possible, he will feel that the presentation of this topic should follow Part V. The phylogenetic account, although brief, is clear and thorough, as one would expect from a writer of Professor Yerkes's training and sympathies. Nevertheless, one misses the help which a discussion of behavior at this point would have afforded. This is left till Part V., where the relations of behavior and consciousness are considered in detail. The ontogenetic chapter is somewhat meager. The main stages of mental development from infancy to maturity are examined, but there is no attempt to trace the actual course of individual development. Part VI., on the control of mental life, supplements this chapter. The author points out the relation of psychology to education and eugenics, illustrating the effects of good and bad heredity by the striking contrast between Jonathan Edwards's descendants and the notorious Jukes family.

Failure to examine the thought processes is the only important omission. The cursory treatment of volition and other aspects of the motor life is in logical keeping with the author's purpose to subordinate behavior to consciousness. A novel distinction suggested between lightness and brightness (p. 122) is the only departure from accepted positions which introspection is likely to challenge. The volume shows careful preparation and abounds in good illustrative examples. Excellent judgment is used in the selection of material, and opposing standpoints are presented with remarkable fairness. There are innumerable citations and quotations, especially from recent writers. At the end of each chapter is a class exercise, usually related to the subject matter, which serves as an introduction to experimental methods. The clear style and skillful avoidance of technical expressions make the volume especially suitable for beginners.

Psychologists will welcome Professor Pillsbury's systematic attempt to treat human psychology in terms of behavior. It is unusual for a text-book on psychology to view human activity from an objective standpoint, and it is not easy to retain this point of view consistently.

The author defines psychology as "the science of human behavior" (p. 1). This limitation of the field is open to two objections: (1) it seems to exclude animal behavior from psychology, which is particularly undesirable in an objective discussion; and (2) it apparently discriminates against introspection. The latter criticism, however, is met by a broad use of the term "behavior"; Professor Pillsbury treats mental processes as antecedents of behavior, and includes the usual discussion of sensation, perception, memory, feeling and other phenomena of consciousness.

The structure and functions of the nervous system are thoroughly discussed in two chapters. The real nervous basis of consciousness is found in the synapses. According to this view, habit-formation probably involves a permanent lessening of tension at the synapse, rather than a modification within the neurone. The author seeks to mediate between functional and structural psychology. All psychological facts are reduced to three fundamental principles: "The first is that all mental qualities come originally from sensation. . . . The second principle is that the order in which mental processes of any sort enter consciousness and whether any process does or does not enter consciousness, depends upon the nature of the individual rather than upon the forces in the physical world. . . . The third and last of these principles is that experiences leave a disposition in the nervous system that tends to the reinstatement of that experience on suitable occasion" (p. 153). This provides three elementary facts—sensation, attention and retention—which may be regarded as either elements or processes.

Sensation, according to the author, stands in a specially close relation to the nervous system. "The development of the sense qualities depends upon and goes hand in hand with the development of the sensory endings. In the simplest organisms there is no differentiation of sensory organs, and consciousness probably shows no differences whatever" (pp. 62–63). The rise of the four skin senses is described first, then the higher senses, finally the kinesthetic, static and organic. The intricate topic of vision is exceedingly condensed, and the author scarcely does justice to the difficulties which have produced rival theories. We find here the parodoxical statement that "the retina is a part of the brain that in the course of development has come to the surface" (p. 86, cf. p. 132).

The chapters on feeling and emotions are very suggestive. The author makes feeling distinct from sensation: "Feelings are subjective, sensations objective" (p. 260). It is not clear how this can be reconciled with the earlier statement that "all mental qualities come originally from sensation" (p. 153). Nor does the position of these chapters furnish a clue; they follow instinct, which comes after perception, memory and reasoning, though the emotions are regarded as "intermediate between feelings and instincts and the higher intellectual operations" (p. 272).

After discussing sensation, attention and retention Professor Pillsbury proceeds to more complex phenomena. The chapter on perception contains a very full account of visual space perception and optical illusions. By some oversight tactual space is omitted. The chapter on memory and imagination contains a very helpful discussion of the laws of learning and the laws of retention and forgetting. On the neural side "learning is the result of producing changes in the synapses, retention depends on the persistence of the impression; forgetting, upon its disappearance" (p. 194). The author is strongly opposed to artificial memory systems, which in his opinion require more effort than they save.

The analysis of intellect and its growth needs amplification. Imagination is treated in about a page, while abstraction is given no independent examination whatever. The dis-

cussion of these processes scarcely affords an adequate basis for the reasoning process. On the other hand, the relation of reasoning to memory and imagination is shown in a particularly striking epigram: "The results of reasoning are new and are accepted as true; the results of memory are true, but not new; and the results of imagination are new, but not true" (p. 217). Professor Pillsbury regards belief as bearing "the same relation to reasoning that recognition does to memory" (*ibid.*).

The student will find the chapter on instinct especially helpful. "Instinct and reflex are to be distinguished in terms of the simplicity of the reflex and the complexity of instinct; by the fact that the reflex can be understood from the mechanical activity of the nervous structures, while the instinct can be referred to its purpose alone; and in the amount of consciousness that attaches to the instinct. . . . In instinct, ordinarily, all is conscious but the reason for the act" (pp. 254–255). The writer distinguishes between individualistic, racial and social instincts, with a suggestive discussion of each.

After the chapters on feeling and emotion the author passes to action and will. Recent work on the acquisition of skill is described; but interest is centered on the control of activity. The writer emphasizes the importance of developing a system of ideals in the individual in order properly to train his will. Work, fatigue and sleep are treated in a single chapter, with an account of the physical effects of fatigue and a curve illustrating depth of sleep.

The two concluding chapters give the broader aspects of the subject. Professor Pillsbury discusses the interrelations of mental functions, with some forcible criticisms of the faculty psychology. "Mind is not a collection of unrelated faculties and . . . it is not a single force or faculty" (p. 341). Experimental research alone can determine whether and how far the training of one function is transferred to another. The author defines three separate aspects of the self, as a continuous existence, as accumulated habits, and as unity of experience.

Dr. Myers's book is precisely what its name implies—an introduction to experimental psychology. It is intended for the beginner and sums up the most representative and interesting results. The presentation is clear and avoids mathematical discussions which are liable to perplex the novice. The whole topic of psychophysics is omitted, and there is no attempt to describe the technique of experimental research. This narrowing of the field is made up for by several features not usually introduced into an experimental text-book. In a number of cases the laboratory data are compared with results obtained from savage races; under the head of cutaneous sensations the author discusses certain pathological conditions which bear on the number of distinct dermal senses; and in describing mental tests stress is laid on the study of individual differences. Considerable of the data on mental tests, esthetics, etc., in this book are not found in the author's larger text-book. All this gives the beginner a wider perspective than if he were confined to the usual laboratory results.

The first chapter sums up the evidence for ascribing several distinct senses to the skin, and can not fail to impress the reader brought up to believe in the traditional five senses. Some of the more striking facts of color vision are discussed in Chapter II. The author alludes (p. 29) to the color terminology in Homer, as indicating a restricted color sense among the ancients. In the next chapter several forms of the Müller-Lyer illusion are illustrated. This and the succeeding topic of esthetics are perhaps treated at disproportionate length; but the chief purpose of the book is to interest the reader in experimental psychology, and one is justified in sacrificing symmetry to this more important aim. The well-known memory experiments are outlined in Chapter V., and the author points out the practical value of knowing how to memorize in the best way.

The last two chapters are devoted to individual tests, including visual acuity, sensory discrimination of various sorts, tests of mental and physical work and fatigue, and association tests. Dr. Myers describes in full the Binet tests, which have recently attracted such attention in this country, and concludes with an explanation of the methods used in correlating different sorts of tests. All his descriptions of tests are very clear, though in one table (p. 98) the value of the standard is inadvertently omitted.

A short bibliography is appended, which seems rather condensed and general for collateral reading. The text will certainly impress the reader with the value of the science, and stimulate him to take up work in the laboratory.

Those of us who were first introduced to physiological psychology through Ladd's "Elements," will be pleased to see that classic work revised and brought thoroughly up to date. Professor Woodworth, who is in close touch with recent neurological research, is associated with Professor Ladd as joint author. The edition in no way yields to the old as an accurate compendium of facts. The length remains about the same. To make way for the wealth of new material much of the old has been condensed. In its new form the book contains a mass of anatomical and physiological facts which every psychologist needs to know—facts which he would otherwise have to gather laboriously from many different sources. To give a single instance: the number of fibers in the dorsal and ventral spinal roots of the frog, and of fibers in the dorsal roots of man, are taken from separate magazine articles which the psychologist would not readily find (p. 75). Authorities are freely cited in footnotes. As in the old edition, the theory of mind and matter is given a prominent place; but the philosophical standpoint never biases the statements of anatomical or physiological fact.

The present work, like the earlier edition, is divided into three parts. The first part, about 300 pages, is devoted to anatomy and general physiology. The second part, slightly longer, embraces what is now known as experimental psychology. It contains an excellent compendium of results from the psychological laboratory, carefully selected and more suitably arranged than even the historic "Grundzüge." The third part, on the "nature of mind," has been considerably shortened. The subject index is unusually good, but the text itself is not easy to consult, for the chapters in each part and sections in each chapter are numbered separately, instead of continuously through the book. Placing the chapter number at the head of the page would have facilitated reference work considerably. Recent terms, such as distance receptor (p. 25) and archi-pallium (p. 31) are used so far as they have been sanctioned, and other new terms, not generally accepted, are mentioned in footnotes; thus, a list is given of the nervous tracts named according to their place of origin and termination (p. 89).

Part I. opens with a new chapter on the evolution of the nervous system from ameba up. The vertebrate and invertebrate types of brain are compared, and an interesting table of brain weight and body weight is copied from Warnecke (p. 34). Chapter II. contains a very explicit account of the development of nervous system and end organs in the human individual, followed by two chapters on grosser and finer nerve structures. The control of each hemisphere over the opposite side of the body is explained with special clearness in the complicated case of vision: "Since the rays of light cross within the eyeball, the right half of each retina receives light from the left side, and therefore the right half of the brain receives the impressions that come from the left side" (p. 92). Another new chapter describes the chemistry of the nervous system, which is seldom brought to the notice of psychologists. This is followed by a discussion of nervous conduction.

Chapter VII. treats of reflex and automatic functions. The authors regard *reflex* as a relative term. "The fatality and predictabil-

ity of reflex action have sometimes been overstated" (p. 173). They hold that the activity of the nervous system in its highest forms is "preeminently *automatic*. It is, therefore, highly probable that the reflex and the automatic forms of its functioning are most frequently, if not uniformly, combined in ever-varying proportions" (p. 149).

Taking up the end organs, a résumé of anatomical investigations indicates that the several cutaneous organs are by no means so definitely identified as psychologists often imagine. The human eye is wittily described in true advertising style as "'a wonderfully compact little instrument, capable of being focused on any distance from five inches upward, provided with the only original iris diaphragm, and having the special feature of a self-renewing plate, which automatically alters its sensitivity to suit the illumination, and also gives colored photographs. The camera can not, however, be guaranteed, as some specimens are defective, and even the best are liable to be injured by hard usage; none will be replaced, though some of the defects can be partially corrected'" (p. 196).

Two chapters are devoted to localization of functions in the cerebrum. At the present time, "the 'motor area' is definitely located; the 'visual area' is likewise; and the location of the areas for hearing and smell is only a little less definite" (p. 234). "It is probable that our ordinary movements of the eyes in looking at an object, *i. e.*, in directing the center of clear vision upon it, are reactions through the visual area, and not through the motor area" (p. 249). "Excitation of the temporal lobe, in animals, gives rise to movements of the ears. . . . These are, in appearance, 'listening' movements, and their occurrence indicates that the primary motor adjustment to sound occurs through the auditory area rather than through the motor area" (p. 250). The limitation of the speech functions to the Broca area does not seem justified (p. 259). Unusual emphasis is laid on differences in anatomical structure within the cortex: "The fact that a uniform structure exists over any considerable area of the cortex, giving place at its borders to areas of other structure, would seem plainly to indicate that within each area the elements have something in common in the manner of their functioning" (p. 273). The authors believe that we need, "on the physiological side, a more detailed knowledge of the structure of the cortex as a whole, and in its different parts; and, on the psychological side, a thorough analysis of such vague and gross so-called functions as 'speech,' or 'skilled movement,' or 'perception of objects,' or 'orientation in space,' into their elementary functional factors" (p. 264).

The concluding chapter of Part I. discusses the mechanism of the nervous system. Preference is given, as in Pillsbury's work, to the synapse or cell-boundary theory, which seems, "when worked out in detail, to be more capable of giving an expression in physico-chemical terms to most of the known peculiarities of central function than any other theory which has been put forward" (p. 290).

The quantitative results of psychophysics, in Part II., are compressed into a single chapter. The authors are inclined to minimize the importance of Fechner's law. "It is not so much . . . a law of absolute quantity of sensations as dependent on stimuli, but rather a law of our apprehension in consciousness of the relation of our own feelings" (pp. 375–6). "Granted that it is no longer considered as giving a measure of sensation; it may be retained as indicating the position of a sensation in the scale of intensities. . . . It seems better, then, to drop Fechner's logarithmic law, and abide by the more empirical expression of Weber" (p. 378).

Two chapters are devoted to sense perception, in which a middle ground is chosen between nativism and empiricism. Visual space perception is examined thoroughly, with considerable stress upon eye movements, though the motor theory is not accepted in its entirety. The survey is confined to space perception; but this limitation does not appear in the definition: "Perception is the result of an extremely complex activity of the psychical

subject, Mind; it involves a synthesis of a number of sense-data according to laws that are not deducible from the nature of the external objects, or of the physiological actions of the end-organs and central organs of sense" (p. 468).

On the affective side, the authors hold to an "almost infinite variety of, not only our complex feelings, emotions and sentiments, but also of those" simpler feelings which have hitherto resisted analysis. Pleasantness and unpleasantness are regarded as merely the "tone" of feeling (p. 515). The esthetic feelings are treated at considerable length, while the moral feelings are only briefly mentioned. The chapter on memory gives the classic results on learning and includes a reference to Freud's new method of psychoanalysis for bringing submerged complexes to the surface (p. 586). The behavior of animals in learning mazes, etc., is described, and curves of human learning and forgetting are reproduced. The mechanism of thought is the subject of the last chapter in this part.

Part III., as in the earlier edition, takes a frankly dualistic attitude. "The two existences, body and mind, may not be identified by the science which investigates their correlations. . . . They are, however, dependently connected. Each stands in causal relations to the other; although this dependence appears to be by no means complete" (p. 653).

One can scarcely overestimate the labor involved in reconstructing such a work as this, written before the neurone theory was formulated, or the evolution of the brain worked out. The revision has been thorough, however, and the "Elements" becomes once more a standard reference-book for the experimental psychologist.

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A Text-book of Physiological Chemistry. By OLOF HAMMARSTEN, Emeritus Professor of Medical and Physiological Chemistry in the University of Upsala. Translation from revised seventh German edition by JOHN A. MANDEL, Sc.D., Professor of Chemistry in the New York University and Bellevue Hospital Medical College. Sixth American edition. New York, John Wiley & Sons. 1911. 8vo. Pp. viii + 964. Cloth, $4.00 net.

No familiar text-book of physiological chemistry published in recent times presents the interrelations between chemistry and physiology, between organic structure and function, in the effective way that Professor Hammarsten has followed through many editions. To the organic chemist a presentation like that of Röhmann's "Biochemie" may appeal because of its distinctively chemical viewpoint; but to the biologist and physician who are interested above all in the activities of living organisms, the emphasis upon function rather than composition is more acceptable and inspiring.

While others have compiled in cyclopedic handbooks of considerable magnitude the individual chapters of biochemistry prepared by diverse eminent contributors, Professor Hammarsten has continued to retain that comprehensive grasp upon the literature of this subject which has enabled him to condense into a single volume the essential facts of the science. To say that most workers in this field still turn to Hammarsten's "Text-book" as the readiest exponent of both the permanent acquisitions and tentative ideas in chemical physiology, is to pay a just tribute to its author's useful contribution as an educator.

There are signs of the expansion of the details of the science beyond the grasp of one individual. For the first time, a chapter (Physical Chemistry in Biology, by Professor S. G. Hedin, of Upsala) has been prepared by a collaborator. It is a readable presentation of topics—such as osmotic pressure, colloids, catalysis, enzymes, ions and salt action, in their physicochemical bearings—which are not always offered to the untrained appetite in a palatable form.

Without referring in detail to a book of which the essential features must be familiar to many, the reviewer ventures the opinion that the excellent chapter on metabolism is