indicated. The present contribution treats of more than four hundred western species from the standpoint of their field appearance and behavior.

"Birds of the Pacific States" is a compact volume (one and one-eighth by five and three-eighths by seven and five-eighths inches) substantially bound in green buckram, and hence suited for actual field use. The style is terse, an element of the contract which produced a volume useful from Vancouver Island to San Diego and from the Pacific Ocean to the Great Basin. The appearance, voice and movements of the bird, its habitat preference and the ways in which it may be differentiated from other species of similar appearance constitute the principal parts of the text of the species chapters. The plumage, geographic range and nesting habits are set forth briefly, following the paragraphs dealing with identification. The *species* is (with one or two exceptions) the unit of consideration; subspecies are listed with their respective ranges but without reference to their characters. The book follows the "new" or revised classification and sequence which will be used in the forthcoming Fourth Edition of the American Ornithologists' Union check-list and which American bird students will soon be forced to learn.

The illustrations merit special mention. All are by Allan Brooks and all are *new*. There are ten plates in color, showing in all forty-seven species. In several instances both males and females are figured. The plates are not quite right in this impression; either the etching or inking is slightly in error, giving too much red in several figures, a fault which can be corrected in future printings. The black-and-white illustrations are from pen-and-ink sketches, a medium seldom used heretofore by Brooks, but one which he has handled exceedingly well. Differences in color are indicated by different types of line treatment so that the student obtains a very good idea of the distribution of color masses on the bird. Here again some of the figures are of groups of two or three species or exhibit differences in plumage due to sex or season so that, in all, upwards of 60 per cent. of the species are shown either in color or line. The reviewer is of the impression that, in general, black and white illustrations are better than color for the beginning student, although the novice will probably believe the contrary to be true. The element of conservation in identification is involved here, an item which also is stressed by our author.

Among the thousands of items of record in the volume under discussion a few—a very few—catch the eye as errors or omissions. The iris of the barn owl is dark, not yellow (p. 161), the pileated woodpecker resides in the Coast Ranges from Lake and Mendocino counties northward as well as in the Sierra Nevada (p. 193), the breeding range of the robin scarcely includes the Sierran foothills (p. 259) but begins with the yellow pine forest; it also nests at various places in the Coast Ranges and locally in the lowlands of California. The ecologic preferences of certain species are even more restricted than indicated. The Bell sparrow (p. 326) is a bird of the greasewood (*Adenostoma*) chaparral, the rufous-crowned sparrow (p. 327) chiefly of the "old-man" sage (*Adenostoma californica*). It would have been helpful to indicate (for the beginner) the meaning of the few abbreviations used, and dimensions for nests and eggs would have aided in field identification of accessories.

This volume is built upon the principle that the habits of birds are, in general, so stable that we can predict their behavior and can use behavior as a means of field identification. This point, although well known to critical teachers of ornithology, has not found adequate expression heretofore in field manuals. The habits of birds are specific characters no less than the details of skeletal structure, soft parts and feather architecture. Mr. Hoffmann has written his book largely upon this basis and has produced a "comparative field ornithology" or a "manual of comparative behavior of birds" which we can rank with our manuals of comparative anatomy.

The quality of the present volume rests, among other things, upon the author's energetic field work; during his seven years of residence on the Pacific coast he has succeeded in observing alive upwards of 95 per cent. of the species described. First-hand impressions, written on the spot, and, with many species, tested by repeated contact, are the firm foundation on which this outstanding manual is constructed.

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Textbook of Comparative Physiology. By CHARLES GARNER ROGERS. McGraw-Hill Co., N. Y., 1927.

ROGERS' book on comparative physiology of animals is the most comprehensive discussion in this neglected field that has yet appeared in a single volume in the English language. Emphasis in recent years on the teaching of physiology under pressure for direct training in subject-matter for immediate practical application in the arts of medicine and of agriculture has led to the extreme development of human and mammalian physiology to the exclusion of that degree of comparative training which we accept without question as necessary for cytology and for anatomy.

There are twenty-nine chapters on the subjects of properties of protoplasm, the cell, general phenomena of life, organ systems, the transport system, the blood as an oxygen carrier, catalytic actions of animals, and the more conventional topics on secretion, nutrition of animals, circulatory mechanisms, physiology

of the heart, etc. The chapter on the nervous system has eighty odd pages of an exceptionally able discussion of the origin and development of the nervous system as a coordinating mechanism. It is illustrated by examples drawn from a great variety of nervous organizations from the neuromuscular apparatus of the protozoa and the nerve net of the coelenterates to the neurone and the synaptic systems of a wide range of invertebrate and vertebrate nervous systems. The segmental nature of the nervous system is presented by discussion of the functional behavior of a well-chosen series of invertebrates in which the chain ganglia are still distinct.

There are able discussions of several topics peculiar to comparative physiology, for example, the functions of the swim bladder as a static organ. However, the important problem of animal luminescence seems to be wholly neglected.

At the close of the volume are references to selected literature of value to the investigator in the field.

This volume should have a distinct influence in rescuing the subject of physiology from the restrictive dominance of the arts and to that extent should give back to practical medicine and to agriculture correspondingly broader training in the basic physiological sciences.

C. W. GREENE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE COLLODION METHOD AND SERIAL SECTIONS

THE collodion (celloidin) method is admitted to give better effects than can be secured by the use of paraffin on a number of tissues, while for certain material, *e.g.*, grasshopper eggs, it is the only known means of securing satisfactory results. Nevertheless, there is a general reluctance to use collodion due chiefly to the belief that it is difficult to preserve the serial order of the sections by this method. In reality, mounting in serial order is very easily accomplished and, while the collodion method is slightly slower than the paraffin method, with some simplification of details it is easier, in many respects, to handle. This article contains little that is new, but the various points are so scattered through scientific papers that it seems desirable to make the whole procedure available.

Preliminary steps. The first part of the process is the same as for the paraffin method. Dehydration must be completed by the use of absolute alcohol since "clearing" oil is not used. The principle involved in clearing, however, is employed, *e.g.*, the tissue is saturated with a solution which is miscible with the infiltrating substance, namely, a mixture of equal parts of absolute alcohol and ether.

Infiltration and embedding. The usual method of accomplishing these processes by two distinct steps is largely responsible for the prevalent idea that the collodion method is necessarily cumbersome. However, they may be combined in a very simple way by using a shell-vial or a similar vessel of suitable size as a container. It is desirable that the container should not have a neck in order to facilitate the later removal of the hardened mass.

Tri-nitro-cellulose under some of its trade names (collodion, celloidin, parlodion, etc.) is dissolved in equal parts of absolute alcohol and ether and used as the infiltrating medium. The solution, which ordinarily should be fairly thin, readily penetrates without heat tissues which are already saturated with the solvents. The time required varies widely. Usually the container is kept tightly closed for several days or in some cases even weeks or months. The cover is then slightly loosened to permit a very gradual evaporation of the solvents with a corresponding concentration of the collodion in the tissue. When the solution has become fairly viscous the tissue is oriented as desired. After the mass becomes firm it should be loosened about the edge so that it will contract away from the vial. When it has become sufficiently solid it can be removed easily. Evaporation should occupy several days; if sufficient time is not given the mass will not be of uniform density.

Hardening and blocking. The mass is trimmed, leaving about 1 mm. of collodion about the tissue and a flat base for mounting. It is then returned to the vial together with a piece of cotton saturated with chloroform for further hardening. The block may be stored in 70 per cent. or 80 per cent. alcohol indefinitely, but it should be hard enough for sectioning before it is placed in the alcohol. The necessity for again dehydrating, however, is obviated if the block containing the tissue is mounted on a proper support before placing in alcohol. The simplest procedure is to take the block directly from the chloroform vapor, stand the base for a moment in alcohol and ether to soften it, then transfer quickly to a fiberoid block, the top side of which has just received two or three drops of thick collodion. After not more than ten minutes' exposure to the air, in order that the collodion may set, the whole is placed either in chloroform vapor for further hardening, or, if the mount is small, directly in 70 per cent. alcohol, where it should remain for several hours before sectioning in order that the entire mount may become very firm.

Cutting and mounting of sections. Collodion sections are cut with the knife placed at the least possible angle to the direction of movement. The