elementary algebra as the commutative law and the distributive law. While attention was called to these laws in what is commonly regarded as the most influential mathematical text-book ever written, *viz.*, the "Elements of Euclid," very little stress was laid on them before the nineteenth century. As evidence of this fact we may note that modern mathematical historians have as yet furnished no instance where a special name was given to either of these laws before 1814 when a French writer, F. J. Servois, gave them their present names.

Another fundamental law which is now commonly explained in our text-books on elementary algebra is the associate law. It is well known that this law plays a prominent rôle in the modern subject known as the theory of abstract groups and that no one has as yet given an instance where a special name was assigned to it before W. R. Hamilton introduced its present name, about thirty years after F. J. Servois had introduced the names of the two laws noted above. It is known that A. M. Legendre directed attention to this law in 1798 and proved its validity as regards the multiplication of positive integers, but no one seems to have thus far noted any instance of its earlier explicit use. Its implicit use is very old since it is involved in the rule that the volume of a rectangular parallelopiped is equal to the product of three concurrent edges.

The history of these fundamental laws relating to the entire domain of mathematics, from the most elementary subjects to the most advanced, exhibits the slowness with which mathematical concepts sometimes gained their present positions in the literature. In particular, the attitude of mind which accords to the theory of groups a somewhat prominent position in the mathematics of to-day can perhaps be best explained by noting the growing stress placed on the laws which underlie very ancient mathematical operations. At any rate such profound changes relating to scientific questions should be of general interest even if it can not be foreseen whether they will be permanent. It is also possible that wide publicity relating to the present stage of our knowledge along these lines may lead to additions thereto.

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## SOIL SCIENCE PUBLICATION IN RUSSIA

DR. A. YARILOV, editor of the Russian journals on soil science, "Bulletin Pochvoveda" and "Pochvovedenie" (Moscow, U. S. S. R., Vozdvizhenka 5, Gosplan) writes that beginning with the year 1928 the journals will publish papers in the original languages as submitted. He invites American colleagues to make use of these journals and in that way establish closer contact between soil science workers of the United States and Russia.

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## SCIENTIFIC BOOKS

*The Elements of General Zoology.* A Guide to the Study of Animal Biology, correlating Function and Structure with notes on practical exercises. By WILLIAM J. DAKIN, D.Sc., F. Z. S., professor of Zoology in the University of Liverpool. Oxford University Press, London: Humphrey Milford, 1927.

METHODS of teaching zoology are as numerous as the teachers but they group themselves naturally in three classes, those stressing structure, those emphasizing function and those magnifying habits and life histories. Professor Dakin's method is obviously the second as shown by his sub-title, and hence the morphologist, as well as the natural historian, has to make a very conscious effort to form a fair opinion of the real merits of the book. Were it entitled, "The Elements of Animal Physiology," its contents and purpose would be much better indicated. It is somewhat irritating to find animal physiology arrogating to itself the title of zoology. No one wishes to deny the vast importance of function, not merely as the concomitant but even as the "explanation" (in large part at any rate) of structure, but it is after all only a portion of the field of zoology. Some physiologists are poor zoologists because of a deficient knowledge of morphology, a complete ignorance of taxonomy, and a total indifference to habits and life histories. The real zoologist is the man who is interested in animals as living organisms whose structures, relationships, and natural history are vitally important—not the man who looks on them solely as machines.

Aside from this objection to Professor Dakin's title, the main criticism of his book has to do with omissions. Naturally any attempt to deal with the whole animal kingdom in one volume, even if only function is considered, necessitates omissions both numerous and important. The success of the writer must be judged in part by what he excludes, as well as by what he includes. Some of the omissions from the present volume are, to say the least, surprising. The most considerable perhaps is the complete omission of echinoderms—the phylum is mentioned on page 5 as one of "the most important phyla" in the animal kingdom (ten are given) but no further reference is made to it. The striking features of the skeleton, the unique method of excretion, the equally unique means of adhesion and locomotion and the surprising metamorphosis from extraordinary larval forms are all alike ignored. Another striking case is that of the cephalopods, whose unusual modes of locomotion, remarkable means of concealment when in retreat, and highly developed eyes, surely demand at least a reference. On page 298, the statement occurs: "The most complicated eye in the Mollusca is found in the scallop"—one wonders just what is meant by "complicated" and why the cephalopod eye is overlooked. Omission of many other extraordinary structures, functions and activities among invertebrates might be cited but lack of space forbids. Among the vertebrates we find no reference to the shell and skeleton of turtles, only a trivial allusion to the locomotion of snakes, no reference to the nest-building and egg-laying of birds, and no reference to animal voices, not even the singing of birds. It would of course, be foolish, and unfair to Professor Dakin, to extend indefinitely this list of omissions, but the point the reviewer wishes to emphasize is that too much is overlooked or ignored to justify calling this book "The Elements of General Zoology."

That there is much of value in the volume is beyond question. The text is clear, the illustrations and diagrams good and the marginal subtitles are helpful. There is a brief introduction of 8 pages, followed by Section I "An Introduction to the Protozoa." The 25 pages thus used form one of the most satisfactory chapters in the book. Just enough of classification is introduced to hold together the facts and the student who really masters this account will have a coherent idea of the Protozoa. Section II, "The Study of the Biology of the Multicellular Animals" occupies over 400 pages and suffers from the attempt to omit everything in the nature of a classification. It is not necessary to enumerate here all the chapters or to discuss their contents. The general arrangement is that of the usual text-book on physiology—nutrition, respiration, blood and its circulation, locomotion, nervous system and sense organs, excretion and reproduction. A chapter on the animal skeleton precedes that on locomotion, while another on the cell is intercalated between locomotion and the nervous system—just why at this point it is hard to see. Chapters on life histories, on the fresh-water pond as an animal community, on symbiosis, parasites, disease and bacteria and on the animal as a whole, make up the remainder of this section. A dozen of the chapters end in suggestions for "Practical Work," experimental studies and observations by the students themselves. The discussion of the animal as a whole leads to a brief account of some of the aspects of heredity and evolution, and the relation of biology as a study, to human life. The book ends with 35 pages of general instructions for laboratory work, a brief appendix, and a not very satisfactory index of four pages. The student who really masters the contents of Section II will have an admirable idea of animal physiology, but his ideas of structure will undoubtedly be more or less confused and he will know almost nothing of the animal kingdom.

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## SCIENTIFIC APPARATUS AND LABORATORY METHODS

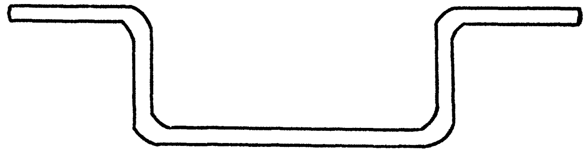
### A CONVENIENT DEVICE FOR PLANT SOLUTION-CULTURE WORK

The paraffin-impregnated corks commonly used as supports for the seedlings in plant solution-culture investigation present certain disadvantages which I have attempted to eliminate by substituting perforated paraffin discs supported on glass rods of appropriate design.

Two hundred cc. of hot water are measured into a 250 cc. Pyrex beaker which is placed on a hot-plate. To this is added ten grams of paraffin m.p. 52–56° C. When the latter is melted the beaker is removed from the hot-plate. When the paraffin disc has solidified by cooling, it is loosened with a thin-bladed knife and removed from the beaker. The diameter is lessened by paring off a millimeter or two from the circumference so that the disc fits loosely within the beaker in which the cultures are to be made.

The glass supports are made from 4 mm. rod. This is cut into 15 cm. lengths and marked off accurately at 2.5, 5.0, 10.0, and 12.5 cm. with a blue pencil. Right-angle bends are carefully made at these points using an iron block 2.5 cm. high as mold, and the small but hot flame of the micro-burner for heating. The complete support has this shape.

Four notches are cut in the paraffin disc so that it rests easily on the two supports hanging from the



edge within the beaker. When the discs and supports are properly made the former present a plane surface parallel with the surface of the culture solution which can be of any desired distance from the disc. Then the convenient number of holes is made in the paraffin disc through which the roots come in contact with the culture solution. These holes are made of any desired diameter by means of appro-