on the making of permanent microscopical preparations, and Dr. K. Belar on descriptive cytology.

The field of special microtechnique is somewhat unevenly broken up and developed under the headings of Protozoa by Dr. K. Belar, vital staining in plants by Professor E. Küster, permanent botanical preparations by Dr. H. Schneider, animal tissues and histochemical methods by Professor B. Romeis, cell pigments and lipoids by Dr. M. Schmidtmann and general and special methods in histochemistry by Professor G. Klein.

Methods in descriptive embryology, including collection, fixation, preservation and sectioning of embryos and the demonstration cavities and of vessels by injection and corrosion methods, are described by Professor E. Pernkopf. There is no treatment of the preparation of models from sections.

The final section deals with microscopical methods as applied to the skin, nervous system and sense organs of invertebrates and to several of the principal invertebrate phyla by Dr. J. v. Gelei.

The outstanding chapters in this comprehensive volume are those of Dr. Köhler on the theory and construction of the optical parts of the microscope, Dr. Peterfi's account of microdissection apparatus and Dr. Belar's discussion of the technique of cytology.

The second volume is assigned by title to "Allgemeine Physiologie." Possibly, since systematics are at present under the tabu of orthodox biology, the editor has conceded a place in the kindly shade of physiology [*sensu latu!*] to "Zoologische Musealtechnik" by Professor C. Zimmer and to "Botanische Museumskunde" by Professor J. Schiller, with "Herbarpflanzen" by Konservator Dörfler slipped in as an "Anhang," while the article by Professor P. Schulze on the collection of zoological material for investigation is permitted to devote all of two pages to vertebrates.

Continuing in the field of physiology, we find sections devoted to the maintenance and rearing of animals and plants, with chapters on fresh-water aquaria and terraria by Professor L. Müller, on sea-water aquaria by W. B. Sachs, on insects and insectaries by Professor A. Hase and on mammals by Professor H. Nachtsheim, while Professor E. Küster and Professor F. Oehlkers treat respectively the lower and higher plants.

The following section treats of photography, microphotography, cinematography, microcinematography and the technique of drawing. The last named, by Dr. K. Belar, is very helpful, though he omits mention of the exceedingly useful Wolff carbon pencils.

Methods in the study of heredity by Professor G. Just include the mathematical treatment of variation, a brief discussion of the analysis of individual characters and a very full account of methods in genetics in *Drosophila* and in man.

Developmental mechanics in plants is treated by Dr. A. T. Czaja and in animals by Dr. O. Mangold, including a most welcome account of the methods used in the study of external and internal factors, such as gradients, isolations, defects, combinations and transplantations, to which appendices on artificial parthenogenesis and cell stimulation are added.

A nearer approach to physiology is attained in the chapter on methods in aseptic operation by Professor H. F. O. Haberland, in the physiology of stimulation by Professor O. Koehler and of protoplasm by Professor J. Spek, on plant physiology by Professor E. G. Pringsheim, on electrometry by Dr. G. Ettisch, on the metabolism of cells and tissues by Dr. H. A. Krebs, on metabolism in plants by Dr. O. Arnbeck and on substance and energy changes in plants by Dr. J. Hirsch.

In face of the difficulties which arise from the dimensions of the fields covered, the inevitable omissions of desirable portions of the many fields and the obvious inequalities in the treatment of different subjects, the editor has succeeded admirably in producing a most useful encyclopedia of modern biological methods which every biologist will find exceedingly useful as a work of reference for methods in a wide range of biological investigations.

The current methods in German laboratories are to be found here with a moderate but by no means adequate account of those from other sources. There is a glossary of equivalent technical terms in German, English, French and Italian. The different subjects are extensively documented, but citations are largely drawn from German sources; for example, the closing chapter cites exclusively from such sources.

In these days of increasing specialization and of new developments a synthetic work such as this is both an aid to progress and a stimulus and a guide to endeavor.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN ELECTROMAGNETIC PUMP

DURING the course of some investigations in this laboratory, it became necessary to devise a pump which could be used to circulate sterile fluid in a system free from any rubber, metal, oil, grease or cement. To fulfil these requirements, a pump has

been constructed entirely of glass, in which the motion of the piston is actuated by electromagnetic forces.

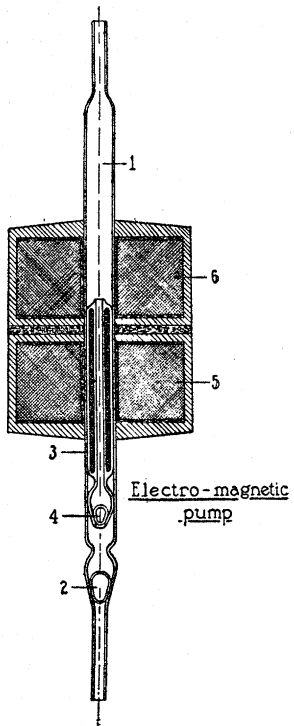

FIG. 1

The diagram shows the pump in cross section. The pump cylinder (1) is a glass tube which has a carefully ground valve (2) at its lower end. The piston (3) consists of two tubes with a soft iron core fused between them. The lower end of the piston has a valve (4) which is identically the same as the cylinder valve (2). Both valves close by gravity. The pump cylinder is surrounded by a lower solenoid (5) and an upper solenoid (6). Both solenoids are hooked up in separate circuits. By means of a three-pole, automatic, mercury switch actuated by a rocking device, the electric current flows through the solenoids periodically in such a way that they are switched on and off, one after the other, with an intermediate state in which both solenoids are magnetized for a short time. Thus, a magnetic field is created inside the solenoids. The center of this field travels up and down periodically.

The iron core inside of the piston is attracted into the center of the magnetic field. The piston moves up and down continually, like the plunger of any pump. The up-stroke of the piston opens the cylinder valve (2) and closes the piston valve (4), while the down-stroke closes the cylinder valve and opens the piston valve. By this means, any fluid can be circulated or transferred.

The pump has many practical applications, especially where it is necessary to maintain sterility. It can also be employed for blood, and for strong acids, alkalis or other dangerous fluids.

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A METHOD OF SECURING MARINE INVERTEBRATES

WHEN instructor in charge of Bryozoa in the course in marine invertebrates at the Marine Biological Laboratory at Woods Hole, Massachusetts, in 1918, Dr. C. L. Parmenter introduced the expedient of suspending microscope slides in racks from floats so as to be held below tide level and clear of the bottom near shore in the Eel Pond and outside in the harbor at the docks of the laboratory to become inoculated with Bryozoa colonies.

This method of securing young colonies of encrusting and stolonate Bryozoa, otherwise very difficult to study undisturbed or even to secure in any other way, has been continued and modified as occasion demanded by his successors in charge of this group. The writer, who is the present incumbent, learned of it from Professor D. B. Young when first succeeding to the group in 1926. During the past three summers the method has been used in securing young clean tunicate colonies and some solitary tunicates for class study. In addition young and very transparent Anomia individuals of varying sizes have been obtained in such condition that the heart-beat and other rhythmical activities may be very accurately observed and timed. Some study has been begun on the relation of these rhythms to varying temperatures and oxygen content of the sea water in finger-bowls in the laboratory. Some investigations have also been made on the early development of some of the encrusting Bryozoa so obtained. The transparent substratum is ideal for such studies. Material for class studies so obtained is more than satisfactory, but the uncertainty as to just what will turn up on the slides on a given day for study prevents its exclusive use as the basis for study of definite forms.

Among the animal species so obtained at different times and in some abundance were the following: Barentsia sp., Bowerbankia sp., *Bugula flabellata, B. turrita,* Schizoporella sp., Lepralia sp., Membranipora sp., Folliculina, Botryllus, Ciona, Hydroids, Microciona, Halicondria, Balanus sp. and Corophium, on the slides; and *Asterias forbesi* and *Arbacia punctulata* between them and inside the racks.

The following description applies to the racks now used and their methods of suspension.

Two pieces of wood 34.5 cm × 2.7 cm × 1.5 cm and two pieces 7 cm × 2.7 cm × 1.5 cm are fastened together to make a rectangular frame of 34.5 × 10 × 2.7 cm external and 31.5 × 7 × 2.7 cm internal dimensions. In the long sides of the rectangle so formed, in the interior face of each, and directly opposite each other, twenty saw-cuts are made to receive the glass micro-