SCIENTIFIC BOOKS

A Guide to the Constellations. By SAMUEL G. BARTON and WILLIAM H. BARTON, JR. vii + 74 pages. McGraw-Hill Book Company, London and New York, 1928.

THIS book is to be highly recommended to all who wish to become acquainted with the constellations. It will also be very useful to those with some knowledge of the stars, if they wish to do naked-eye observing or to learn more about astronomy. Although it is not intended to be a text-book, and treats each topic only briefly, still the text does contain much accurate astronomical information as well as the essential facts about the various astronomical bodies. All astronomical terms are clearly and simply defined, so that even the beginner will have no trouble in understanding the meanings. Furthermore, the definitions are well arranged, and the book contains such a complete index that it should prove to be a very satisfactory reference book for many purposes.

The main part of the book consists of seventeen excellent charts, accompanied by copious notes on each constellation. Twelve of the charts, which represent the sky for latitude 40° at intervals of two hours, are printed in white on a blue background, and thus resemble the sky more than does any chart printed in black. By means of the dates on the charts and the explanations, it should be a simple matter for any one to find the right chart to use at the time he wishes to observe. An interesting feature of these white and blue charts is that they show only those stars which give us as much light as stars overhead having a magnitude of 4.5. By thus taking into consideration the effect of atmospheric absorption, more stars can be put on the charts without crowding; and also the stars are shown as they actually are seen, fewer being visible near the horizon than in the zenith.

Probably many who use this book will become interested enough in astronomy to continue their reading and observations. For this reason, it is an excellent idea to have given at the end of the book some information about the societies for amateur observers, as well as a bibliography of books and magazines.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

BIOCHEMICAL EXPERIMENTS PRACTICAL FOR ELEMENTARY BIOLOGY CLASSES

LABORATORY work in introductory biology courses usually places chief emphasis upon a morphological study of type-forms. There is a growing tendency, however, to introduce work concerning the physiology of the structures studied. If the laboratory treatment of physiological concepts is to be adequate it should include experiments on the chemical composition and physical structure of protoplasm, osmosis, the rôle of enzymes and similar topics underlying the activities of organisms.

Such experiments are thought of as requiring the equipment of a physiology laboratory and are considered impractical for large elementary classes. Courses in introductory biology are frequently taught in laboratories unsuitable for such work, since they lack a sufficient supply of sinks, Bunsen burners, racks for reagent bottles, test-tube set-ups and similar items. The cost of installing and maintaining such equipment is prohibitive, especially since it would be used only in certain portions of an elementary biology course, much of which is devoted to other types of work. Furthermore, biochemical experiments as usually performed require a certain amount of experience in laboratory technique, hence, in large classes of inexperienced students there would be much general confusion and high breakage costs.

Many biochemical experiments, however, can be performed by large numbers of students inexperienced in laboratory procedure by a method that does not require the usual apparatus. The only supplies needed are ordinary microscope slides, alcohol lamps and 25 cc dropping-bottles for the reagents. With the pipettes of the dropping-bottles one or two drops of the various reagents are placed near one end of a slide together with a small amount of the necessary organic material. Holding the slide by the opposite end, the substances are easily heated in the alcohol flame. If the slide is held in a level position the materials remain at one end and do not overflow the edges. This method replaces the usual one of pouring into test-tubes several cubic centimeters of substances from regular reagent bottles and heating in the flame of a Bunsen burner. The biochemical reactions usually demonstrated in that way are shown with equal clarity on the ends of slides. Color changes are observed by placing the slides on a sheet of white paper. As the experiments are performed the various slides can be kept side by side for comparison with each other and with the controls. Microscopic examination is possible at any time concerning the effects of the reaction upon cell structures, which relates the experiment to living things in a way not so effective if the work is performed with commercially prepared substances. The technique is so simple that no experience is necessary for every student to perform successfully his own experiments, a fact having pedagogic values not attained if such experiments are performed by the instructor

with the regular test-tube set-up as class demonstrations only.

The dropping-bottles can be kept in small trays, supplying one tray for every five or six desks. Since materials are measured in drops, a 25 cc bottle provides for several hundred experiments. Refilling is seldom required and only small amounts of reagents are used. Slides are in every way preferable to test-tubes with reference to such points as initial cost, breakage and space for storage. Washing slides does not require the brushes and racks necessary for cleaning test-tubes.

For example, the determination of the presence of organic components in organisms is handled in the following manner. The reagents supplied in dropping-bottles are iodine solution for the starch test, Benedict's solution for the reducing-sugar test, nitric acid solution for the xanthoproteic test and tap-water. Suggested organisms and tissues to be tested are potato, apple, banana, beet, bean, onion, carrot and pieces of meat. The student may obtain from himself hair, pieces of finger nail, scrapings of cells from the inner surface of the cheek and blood from a finger. White of egg and milk can be supplied in dropping-bottles. In the case of each material a very small amount is placed near the end of each of several slides. If the substance is solid a drop or two of tap-water is added and the material is broken up with a toothpick. One or two drops of the various testing reagents are added to each of the slides, respectively. If heating is required this is done by holding it in the alcohol flame. Thus a number of organisms can be tested for the presence of starch, reducing-sugars and proteins. Lipin tests are not very practical with this slide technique. The Sudan III test can be used with milk, although the color reaction is so faint when viewed through the microscope as to be almost meaningless to the student.

The action of enzymes can also be satisfactorily studied in this manner. Several drops of saliva are placed on the ends of each of three slides, *a*, *b* and *c*. The saliva of slide *a* is boiled. Several drops of starch solution are added to each slide. Slide *b* is gently warmed without overheating, while slide *c* is kept at room temperature or is cooled. Starch solution without saliva is placed on slide *d* as a control. At two-minute intervals a droplet is transferred by means of a toothpick from each of the four slides to small drops of iodine solution placed on a separate slide. In this way it is ascertained how long starch remains in each of the four preparations. When a slide shows a negative starch test it is given the Benedict's test for reducing-sugars. The experiment not only proves the digestive action of ptyalin through the use of chemical tests, but it illustrates the heat-destruction of enzymes at high temperatures, and shows the effects of various temperatures upon the speed of the reaction. To show the action of diastase similar experiments can be performed with starch solution by using a crushed sprouting barley seed. To show the action of sucrase an extract of crushed yeast-cells can be used with cane-sugar solution.

Hydrolysis by the catalytic action of HCl may also be illustrated. The student makes four slide preparations of scraped potato. Testing one with iodine solution he determines that a large amount of starch is present. Testing the second with Benedict's solution he ascertains that there is present only a small amount of reducing-sugars. To the third and fourth preparations he adds a drop of 1 per cent HCl solution and heats; he then neutralizes with a drop of 1 per cent NaOH solution. By applying the starch test to slide three and the Benedict test to slide four he secures evidence that the starch has been hydrolyzed to relatively large amounts of reducing-sugars. In a similar manner the sugar of beets may be tested before and after hydrolysis.

The same technique permits certain experiments concerning the physical structure of protoplasm. The reversibility of the sol and gel condition of proteins can be demonstrated by placing a small portion of a 2 per cent. gelatin solution, which is in a jellied condition, upon the end of a slide and repeatedly heating and cooling it. The irreversibility of coagulation can be demonstrated by applying the same treatment to milk or egg-white. Surface tension experiments can be performed with oil and water drops placed on slides that are scrupulously clean in contrast to those that have a greasy film. The contrasting structures of oil-in-water and water-in-oil emulsions can be studied under the microscope and while the preparation is under actual microscopic observation a drop of $CaCl_2$ solution may be added to the oil-in-water emulsion and the student can observe its disruption.

The practical advantages of this technique lie in its simplicity as to supplies required and ease of manipulation. It has been used with success in the freshman biology course at Washington Square College, New York University, by large classes of students inexperienced in laboratory procedure. Its theoretical advantage lies in the fact that it makes available to elementary classes a considerable variety of experiments illustrating the physicochemical activities of protoplasm. One reason that this most important phase of biology is not generally included in introductory courses is the impracticability of giving elementary students laboratory work in this field. The above simple experiments, cited as examples, constitute laboratory work on such topics as organic components of protoplasm, hydrolysis, catalysts, enzymes, tempera-

ture effects on organic processes, the contrasting action of acids and bases, gelation, coagulation, surface-tension and the structure of emulsions. This technique, therefore, makes possible in an introductory course of general biology the inclusion of experiments on biochemical subjects heretofore regarded as too difficult or impractical, and these subjects are the very ones most essential to any consideration of organisms as physicochemical mechanisms.

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MARKING LIVING FISHES FOR EXPERIMENTAL PURPOSES

IN experimental investigations with fishes it is frequently desirable to be able to distinguish individuals. When more than a half dozen are used at a time this becomes somewhat of a problem. Large fishes may be "tagged" by the methods in use in the Bureau of Fisheries, but these methods are inapplicable to small fishes, such as *Fundulus,* which are commonly used for experimental purposes. Clipping or punching the fins leaves an opening for infection and interferes with the normal movements of the fish. For experiments of brief duration, stains such as mercurochrome may be used, but these wash off in a very few days.

Using *Fundulus parvipinnis,* I tried marking with a fine hypodermic needle and india ink. Excellent results were obtained when the needle was inserted under a scale from behind, holding the syringe nearly parallel to the fish's body. The introduction of the needle must be carefully made; as soon as the point "takes hold," a delicate pressure is applied to the plunger and the needle withdrawn immediately. The needle should penetrate the scale pocket but must not break through the dermis. A little practice is all that is needed to rapidly mark large numbers of fishes without injuring them. When properly done the result is a round black spot from one to two millimeters in diameter which remains intensely black for several weeks and only begins to disappear after forty to sixty days. The mark seems to be absolutely permanent on specimens preserved in formalin.

In this laboratory over three hundred fishes have been thus marked and kept under various environmental conditions for periods ranging from two weeks to several months without showing the slightest harmful effect of the marking. Any part of the fish may be marked, but I have found the sides and venter most suitable, avoiding the head and the lateral line.

A number of other inks and stains were tried, but none of them proved satisfactory, some not holding their color and others causing a harmful local irritation. With a good grade of india ink, however, it was remarkable that not even a slight swelling or distortion of the scales was apparent and not a single case of infection was seen.

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SPECIAL ARTICLES

ASSOCIATION OF THE CAUSATIVE AGENT OF A CHICKEN TUMOR WITH A PROTEIN FRACTION OF THE TUMOR FILTRATE

SINCE 1911 when Rous reported on the transplantability of a chicken sarcoma a number of other fowl tumors have been transplanted and studied. The outstanding features of these sarcomata are that they can be transferred to no other species of fowls; that all, with the exception of two, differ from each other in their histology and general biological behavior on transplantation; and that the tumors in transmission from fowl to fowl retain all their finer characteristics and can be passed from fowl to fowl by filtrates and desiccates as well as by grafts of living tumor cells. While the filtrable agents obtained from the tumors have been generally referred to as viruses, their extreme specificity and the multiplicity of tumor types which are faithfully transmitted in each case by the agent seem to separate them from the virus class of disease producing agents as generally defined at the present time.

In our recent studies we have endeavored to determine more precisely the nature of the tumor-inducing agents, which possess the power to stimulate cells not only to grow but to undergo differentiation in specific ways. The present report deals with the results of the fractionation of the proteins contained in the extracts of Chicken Tumor 1 of the Rockefeller Institute series.

In the first tests differential precipitation was accomplished by dialyzing out the salts by means of the ingenious apparatus devised by Dr. J. J. Bronfenbrenner. After concentrating the Berkefeld filtrate of the tumor in Alumdun thimbles lined with soluble cotton membranes, the salt content of the concentrate was reduced by electrodialysis. In the very short time of three to seven minutes, a clear, mucoid material precipitated out, for the most part about the positive pole and in the bottom of the thimble. This precipitate injected into chickens proved active in the production of tumors; while the remaining fluid, though still containing considerable protein, proved inactive. Moreover the tumor agent may be precipitated in a highly active form by electrodialysis from