

to incubation. Shaking eggs with the large ends up seems to be relatively less damaging to the embryo than shaking with the small end up. Jarred eggs develop a tremulous air sac, which in turn, is believed to cause the death of the embryo.

5. Optimal Conditions for Using Avian Eggs for Experimental Studies

Breeders should be healthy and free from any disease. They should be fed a diet adequately supplied with all nutrients eventually required for the normal development of the embryos. Layers should be in production for at least two months with well established high hatchability records. Eggs should be collected from the nests or cages at least 2-3 times daily or more frequently during extreme weather conditions. Soon after collection, the eggs should be transferred to a storage room maintained at 13°-16°C and 70-80% relative humidity. Eggs for experimental purposes should not be stored for more than 7 days. Under no circumstances, should the eggs held for varying durations of time and from different breeds and strains of birds, be utilized in the same experiment. Only clean eggs of uniform size and shape with good shell quality should be utilized in the experiment. Eggs retained longer than usual in the oviduct should not be utilized. A minimum handling of hatching eggs should be practiced.

Incubation should be carried out in an incubator housed in a well ventilated environment and equipped to maintain optimal conditions of temperature (37.5°-38°C), and relative humidity (70-80°). Preferably, the incubator should also be equipped with an automatic device for turning the eggs at least 6-8 times daily. The incubator should, at all times, be clean and free of any putrifying and decomposing material. A constant temperature should be maintained during the course of incubation.

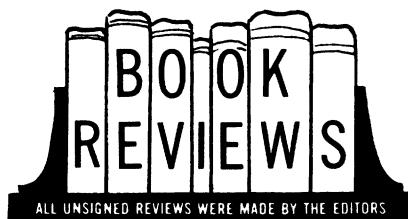
When using stored eggs, it is suggested that the eggs be held at room temperature (about 23°C) for about 12 hours after removing from the storage room; during which time, the blastodermal cells will gradually return to the metabolic level which must exist before they can participate in normal development.

The study of avian embryological development

and associated influences of environmental factors offer innumerable possibilities of experimentation in order to increase the basic understanding of developmental processes. The subject matter covered in this manuscript will not only add to knowledge about the material but also offers opportunity to beginning biologists and advanced students in biology for further experimentation in this area both inside and outside of the classroom.

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BIOCHEMISTRY AND BIOPHYSICS

GRAPHIC BIOCHEMISTRY, Thomas P. Bennett, Vol. 1, CHEMISTRY OF BIOLOGICAL MOLECULES: Vol. 2, METABOLISM

OF BIOLOGICAL MOLECULES, \$3.95 each, Macmillan Company, New York, 1968.

These are paperback un-books, attempting to provide subject matter in a unique format, supposedly to fill a gap in what the author believes to be the almost solely verbal treatment of the subject in textbooks and the strictly visual metabolic maps and similar aids now available. That this thesis may be specious is suggested by the many excellently illustrated books on biochemistry currently available, such as that by R. J. Light. The volumes are essen-

tially a series of odd shaped cards (two-and-three-quarters by four inches), printed eight to the page on perforated stock and capable of being removed *ad libitum*. The cards are printed on both sides and contain formulae and reactions of biochemical compounds, tables of pertinent data, and flow diagrams and schematics of biochemical processes and concepts. The student is enjoined to take pertinent cards to appropriate lectures and, instead of taking notes, simply jot down the applicable card numbers for study

later. To be effective, the professor is also requested to indicate to the student the card numbers that are pertinent to his presentation. An index which is provided to the cards becomes useless as soon as the cards are removed and reshuffled according to instructions.

The question is whether the gap exists that these two volumes are designed to fill and, if so, if the medium isn't far more cumbersome than the message. It is, however, an intriguing idea which some may find worthy of exploration.

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INTRODUCTION TO CHROMATOGRAPHY, Bobbitt, Schwarting, and Gritter, 160 pp., \$3.95, Reinhold Book Division, New York, 1968.

The title of this paperback book is correct. There are more compendious and also more weighty volumes on chromatography and there may be simpler ones. But this is a good introduction. It achieves its purpose by limiting its aims. After briefly outlining the field, the authors restrict themselves to three of its sectors: column chromatography, thin-layer chromatography, and gas-liquid chromatography. The presentation is direct and clear. The reader must have some acquaintance with general chemistry, but little that applies directly to chromatography itself is left unexplained. The emphasis is upon techniques and there is a minimum of theory. An abundance of data tables and of illustrations smooths the reader's path. The illustrations are nicely balanced between photographs and line drawings. A short bibliography and a list of suppliers precede the index.

In high school biology, paper chromatography has usually been employed and sometime, column chromatography. Except for an occasional sophisticated science fair project, thin-layer and gas chromatography are not in the high school repertoire. There is little to indicate any imminent change in this pattern. Nevertheless, this book may be of value to the high school biology teacher, not merely as a reference for aiding a rare explanatory student but, more importantly, as background for understanding some of the technology that lies behind so many reports of current research.

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FIELD BIOLOGY AND ECOLOGY

CONSERVATION YEARBOOKS: No. 1 (1965), *Quest for Quality*, \$1.00; No. 2 (1966), *The Population Challenge*, \$1.25; No. 3 (1967), *The Third Wave*, \$2.00; No. 4 (1968), *Man . . . An Endangered Species?*, \$1.50; No. 5 (1969), *It's Your*

World, \$2.00. U. S. Government Printing Office, Washington, D.C. 20402.

Government documents have not, historically, been the most exciting publications in the world; and the first report of the Secretary of the Interior was no exception. Secretary Ewing covered "Public Buildings, Patent Office, Agricultural Bureau, Pension Office, Public Lands, Mineral Lands, Route to the Pacific, and Indian Affairs" in fifteen unillustrated pages of unglowing declaration, published with no fanfare on December 3, 1849. In his wildest dreams Thomas Ewing could not have imagined what the "Home Department's" special reports to the American public would look like only a little over a century later!

The Conservation Yearbooks, published annually since 1965 by the Department of the Interior, are spectacular portrayals in color and black-and-white photographs, picture essays, and well written text of, generally, conservation problems facing the nation, and, specifically, the yearly endeavors of the Department's various bureaus such as Outdoor Recreation, National Park Service, Geological Survey, Land Management, Reclamation, Sport Fisheries and Wildlife, Commercial Fisheries, Water Resources Research, Indian Affairs. . .

From the biology teacher's standpoint, these 9x12 paperbacks should prove most valuable as students browse in classroom, library, or office; and perhaps they should be obtained at least for this purpose. The initial response will be to their esthetic quality—a poor man's Sierra Club series. But there is a newsworthy essence to the various departmental operation reports—Willamette River Basic clean-up (1968), completion of eleven Bureau of Reclamation dams (1966), reintroduction of masked bobwhites in Arizona (1969); a provocation in some of the special features—a community conservation checklist (1969), "A Rationed Tomorrow" (1966), "Road to the Future" (1965); and a literary flavor in some of the picture essays—"The Grassroots Conservation Story" (1969), "Man Was Here. . ." (1966)—which needs to be shared with students and teachers in the English Department.

If you obtain these yearbooks, don't file them with Ewing's report to gather dust. After you and your students have dog-eared them, leave them in your family doctor's waiting room, to spread the gospel.

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RACE AGAINST FAMINE, Melvin A. Bernarde, 97 pp., \$4.75, Macrae Smith Company, Philadelphia, 1968.

This book presents a clear, direct statement concerning the problem of population increase in relation to food

production. The growth of population is graphically presented in simple, easy-to-read charts and graphs in the chapter, "The Curves Tell the Story."

The Food and Agriculture Organization (FAO) has estimated that food supplies in underdeveloped countries will need to be increased by 80% by 1975 and almost 300% by the year 2000 if improved levels of nutrition are to be achieved.

The author explores the problems of protein deficiency as seen in so many places in the world, indicating its relationship to general malnutrition. Through the work of INCAP, a protein-rich food supplement of cottonseed flour and whole-cooked corn, with yeast, CaCO₃, and Vitamin A, and called Incaparina, is gaining acceptance in Central America. Other protein-rich food supplements, such as Laubina, FPC (fish protein concentrate), and soy products are discussed in terms of their use in meeting the needs of protein-starved populations.

Bernarde also discusses the possibility of greater use of the oceans as a food source and the attendant problems of refrigeration, transportation, and marketing in underdeveloped countries. Fish farming is acclaimed as a quick and effective method of increasing protein production. Improved agricultural methods, increased use of fertilizer, and use of improved seed show great promise and have already greatly increased yields in areas where they have received adequate testing. Getting people to try new foods, although better nutritionally, runs into difficulty because of customs, taboos, and just plain dislike for anything unfamiliar.

The book, although short (87 pages plus a good index), is well written, easily understood and well documented. It would be excellent for biology students and teachers concerned with problems of population explosion and insufficient food supply.

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NATIVE SHRUBS OF THE SAN FRANCISCO BAY REGION, Roxana S. Ferris, 82 pp., \$1.75, University of California Press, Berkeley, 1968.

DEEP-WATER FISHES OF CALIFORNIA, John E. Fitch and Robert J. Lavenberg, 155 pp., \$2.25, University of California Press, Berkeley, 1968.

These guides (No. 24 and No. 25 of the California Natural History Guides) like the others in the series, give the names of the organisms, with some information about each and line drawings and colored prints of many of them. Intended for field observations these small paperback books can be carried in a coat pocket.

High school and college teachers new to the area will find the guides an ex-