

TESTED STUDIES FOR LABORATORY TEACHING

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Edited by

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*We dedicate this volume to making laboratory biology
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Chapter

- 1 **Biology for the Visually or Orthopedically Impaired 1**
Dorothy Tombaugh and Roy Tombaugh
Key Words: *handicapped, visually impaired, orthopedically impaired*. Biology laboratories can be made accessible to visually or orthopedically impaired students by teachers who take the time to evaluate and overcome the limitations of the handicapped individual. We describe several procedures and devices which help the handicapped grasp the main concepts of biology experiments. An extensive bibliography is included.
- 2 **Techniques of Biological Close-Up Photography 19**
David T. Webb and Anne D. Webb
Key Words: *35 mm camera, macrophotography, biological photography*. This article reviews the basic operation of a 35 mm single-lens reflex camera and the use of diopter lenses, extension tubes, tele-converters, macro-lenses, and bellows to take close-up slides of biological subjects. It contains instructions on how to use copy stands and electronic flash units. It also contains exercises on the determination of the correct flash-to-subject distances for close and for distant subjects, and a comparison of automatic and manual operation of an electronic flash.
- 3 **Plant Tissue Culture Systems as Instructional Tools in the Biological Sciences 39**
William S. Rafail
Key Words: *plant tissue culture, callus culture, maize, carrot*. Plant tissue culture systems are useful as a means of instructing students in (1) the relationship between the genetic potential of all cells and the concept of differentiation and (2) the concept of the regulation of metabolic pathways. In each case students should consider the interaction between the internal cellular mechanisms and the external milieu. Techniques are presented for laboratory exercises in each of these areas using maize, a monocot, and carrot, a dicot.

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- 4 **Sea Urchin Development 53**
Carolyn M. Conway, Don Igelsrud, and Arthur F. Conway
 Key Words: *Lytechinus variegatus, sea urchins, development, embryology*. Basic developmental processes are easily studied in the laboratory by observation of living sea urchin gametes, zygotes, embryos, and larvae. Emphasis is placed on the study of *Lytechinus variegatus* which can be maintained at room temperature and has exceptionally clear eggs and embryos. Information is presented on animal availability and maintenance in the laboratory and on procedures required of instructors and students for the microscopic study of development.
- 5 **Organ Culture of Embryonic Chick Heart 91**
Ruthanne Batcheller Pitkin
 Key Words: *chick embryo, development, heart, organ culture*. This exercise exposes students to the embryonic development of the chick, heart structure and function, fine dissection, and organ culture. Students are asked to answer some questions on development using their own observations.
- 6 **Inhibition of Gland Development in Insects by a Naturally Occurring Antiallatotropin ("Anti-Hormone") 101**
Dorothy Feir
 Key Words: *insect, milkweed bug, antiallatotropin, corpora allata, juvenile hormone, precocene II, growth, development, anti-juvenile hormone*. Juvenile hormone is secreted by the corpora allata of insects. It functions (1) to cause a juvenile or immature stage to be produced during the molt cycle and (2) in the production of normal eggs in the adult female. Precocene 2 is 6,7-dimethoxy-2,2-dimethylchromene, and it was extracted from the common bedding plant, *Ageratum houstonianum*. When certain immature Hemiptera are exposed to precocene 2 they molt into precocious adults. As shown in this exercise, if adult females are exposed to precocene 2 they become sterile.
- 7 **Animal Behavior Experiments Using Arthropods 113**
Joseph R. Larsen and Danielle M. Meyer
 Key Words: *reflex, cerci, chemoreceptors, mechanoreceptors, taxis, kinesis, orthokinesis, ethology, hierarchy, insect, isopod, fly, cockroach, cricket*. These exercises allow the student to observe relatively simple animal behavior in various arthropods. Observations include chemoreception in flies, mechanoreception in cockroaches, aggression in crickets, taxis and kinesis in terrestrial

isopods, and courtship behavior in crickets and fruitflies. These exercises are designed for the introductory biology laboratory and can be accomplished in a three-hour period.

8 **The Basic Components of the Reproductive Strategy of the ‘Typical’ Vertebrate, as Illustrated by the Guppy, *Poecilia reticulata* (Peters) 133**

Bradley S. Bowden

Key Words: *guppy, Poecilia reticulata, courtship behavior, ovary, testis, embryo, sperm motility.* The guppy is used as a model to demonstrate the structural, functional, and behavioral components of reproduction that are characteristic of most vertebrates. Students can recognize and understand the significance of sexual dimorphism and courtship behavior, and can examine gonads, gametes, and developing embryos from freshly-killed specimens. Sperm structure and motility can be readily observed with a phase-contrast microscope. The student can easily observe and understand courtship behavior, and actual insemination of a female can be obtained by anesthetizing her in Finquel before placing her with a male. This part of the exercise can be supplemented with an available nine-minute film of courtship behavior in the guppy.

9 **Plant Fossils in the Laboratory 145**

Kristen P. Giebel

Key Words: *fossil, plant, coal-balls, compressions, impressions, petrifications, molds, casts, microexcavation.* The various types of plant fossils, the kinds of information contained in each, and their possible uses as aids in the study of such topics as evolution, plant structure, and energy sources are discussed. The techniques of coal-ball peeling (for thin sections of petrified material) and microexcavation (for compressions) are described in detail. Sources of fossils and methods of fossil collecting are explored.

10 **Hypothesis Testing in Ecology 157**

M. E. Nicotri

Key Words: *hypothesis, experimental design, marine intertidal zone, algae, limpet, barnacle, simulation, oil pollution.* This is a simulation exercise in which students are given a set of initial observations suggesting dramatic changes in a marine intertidal system over a period of seven years. Students then must propose and test hypotheses that explain these changes. To do this, they obtain general and experimental information from a large data

bank controlled by the instructor. The exercise uses (mostly) real data, based on the Torrey Canyon oil spill and subsequent clean-up with detergents. Skills stressed are experimental design, data evaluation, and analytical thought.

11 **Two Reliable and Inexpensive Lysozyme Assays for Teaching Enzymology and Microbiology 167**

John A. Snyder and Donald Fritsch

Key Words: *Lysozyme, Micrococcus lysodeikticus, enzyme, antibacterial, turbidimetric assay, diffusion.* Two assays for the antibacterial enzyme lysozyme can be used individually or together to demonstrate enzyme action. One, an intra-agar radial diffusion method, is easy to prepare but requires several hours to develop. The other, employing a spectrophotometer to measure the destruction of bacteria in a suspension of buffer, provides quantitative results within minutes using living cells. Both assays can be used to explore the effects upon enzyme action of pH, ionic composition, and temperature.

12 **Experiments with the Structure and Function of DNA 181**

Doris R. Helms

Key Words: *DNA, replication, transcription, translation, polytene chromosomes, chromatin, histones, acidic proteins.* Methods are described for the isolation of DNA from *E. coli* and from beef liver, and for the isolation and identification of histones and acidic proteins from eukaryotic chromatin. Procedures for examining the structure of *Drosophila* polytene chromosomes are also described. In addition, cardboard cut-out kits are described which facilitate the understanding of replication, transcription and translation.

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