

# TESTED STUDIES FOR LABORATORY TEACHING

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Edited by

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Chapter

1 **Short Investigative Exercises Designed to Get Students to Think** 1

*Leonie K. Piternick*

**Key Words:** *educationally-disadvantaged students, reasoning skills, learning cycle, self-regulation, classification, enzyme, genetics, measurement.* These exercises are designed to develop reasoning skills in the context of teaching biology subject matter. Included are classification of organisms, enzyme action, elementary genetics, measuring with metric units, and proportional reasoning.

2 **Vascular Cannulation of the Rat** 13

*Jennifer Stewart*

**Key Words:** *rat, surgery, blood sampling, infusion, cannulation.* A method for surgically implanting a catheter into the right atrium of the rat is described. The catheter is made of either polyethylene or silastic tubing. It is inserted into the right heart through the jugular vein and exits from the body at the dorsal base of the neck. This laboratory exercise introduces the student to general surgical procedures and demonstrates a technique for intravenous infusion and blood sampling of conscious, freely-moving rats.

3 **Control of Surface Exudation by Slugs** 21

*Arthur W. Martin and Ingrith Deyrup-Olsen*

**Key Words:** *surface exudation, slug, neurotransmitter.* An *in vitro* preparation of the body wall of the terrestrial slug is described. This preparation can be used in studies of fluid exchange processes and their control by neurotropic substances. Activity of the muscles may be observed as well through recording of pressure changes indicated with the system's manometer.

4 **The Study of Development Using Red Algae** 31

*Susan D. Waaland*

**Key Words:** *development, phototropism, photosynthetic pigments, fluorescence microscopy, cell elongation, algae, Griffithsia.* Algae can be useful organisms for demonstrating developmental processes. The giant-celled marine red alga *Griffithsia pacifica*

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Kylin (Rhodophyta, Ceramiales) is particularly well suited for experiments on developmental patterns and their control. Its large cells (1.0 mm long and 0.2 mm wide) can be easily studied using a dissecting microscope. Single shoot cells can be excised with a razor blade; these cells will regenerate plants with 30 to 40 shoot cells in one week. The experiments described in this paper include studies on: 1. Development and its control at the cellular level, 2. Environmental control of photosynthetic pigment content, and 3. Cell enlargement, using fluorescent microscopy.

**5 An Evolutionary Approach to Teaching about Ferns in a Plant Kingdom Course 43**

*Marshall D. Sundberg*

*Key Words: evolution, classification, ferns, morphology, anatomy.*

This exercise presents an evolutionary approach to teaching about fern structure, based on the groundplan—divergence technique devised by Wagner. During a two-hour laboratory session each student research team carefully examines, describes, and sets up demonstrations of one fern. The descriptions include key morphological and anatomical characters which have proven to be useful in studies of fern evolution. After all research teams have completed setting up the demonstrations of their ferns, teams rotate to examine the demonstrations set up by their peers. At this time, summary data are collected for specimens which will be used to construct a classification. As an out-of-class assignment students are asked to complete the skeleton classification provided, based on their summary data. An additional 30-minutes to one-hour follow-up may be used to construct a class classification and to discuss some of the problems involved.

**6 The Use of Lectins (Agglutinins) to Study Cell Surfaces 53**

*Ingrith Deyrup-Olsen*

*Key Words: lectin, agglutinin, blood types, concanavalin A, erythrocyte, membrane, plasma membrane.* Lectins (agglutinins), proteins which react specifically with carbohydrates, may be used to analyze characteristics of cell surfaces. For example, red blood cells of different blood types are agglutinated by different lectins, such as those extracted from seeds of legumes (peas, beans, lentils, etc.) and animal tissues such as blood cells and albumin glands of snails and slugs. Experiments with lectins can focus students' observations on the cell surface, where so many of the events of physiology actually occur. Moreover, since the study of lectins is in a relatively early stage, students can carry out valid original experiments in this area.

- 7 **The Use of Aquatic Research Microecosystem in the Biology Teaching Laboratory 59**  
*C. Kenyon Wagner*  
 Key Words: *diversity, energy flow, microecosystem, pollution, succession.* Aquatic research microecosystems are small aquatic ecosystems enclosed in glass containers, which display behavior patterns similar to natural aquatic or terrestrial ecosystems. Problems in succession, energy flow, mineral cycles, and natural or unnatural disturbances can be studied using the microecosystem. Microecosystems consist of a community of organisms and a growth medium made from various materials used to sustain these organisms. The organisms are introduced into new growth medium by inoculating the medium with a sample of organisms from a natural system or from an old microecosystem.
- 8 **Energetics of an Aquatic Ecosystem 71**  
*William H. Leonard*  
 Key Words: *ecosystem dynamics, energy flow, trophic levels.* This is a laboratory activity on ecosystem energetics for university introductory biology. Students collect specified data on abiotic and biotic factors—either from a natural pond or a well-stocked laboratory aquarium. Students are then led via questioning into understanding of the concepts of consumers, producers, decomposers, biomes, trophic levels, food web, food pyramid, and entropy.
- 9 **Microsurgical Operations on the Giant Ciliate 91**  
*Stentor coeruleus*  
*Vance Tartar*  
 Key Words: *ciliate, Stentor coeruleus, morphogenesis, grafting, nuclear manipulation, regeneration, microsurgery.* Demonstrations live and on video tape prepare students from microsurgery on ciliates.

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