DOCUMENT RESUME

ED 138 451 SE 022 338

AUTHOR Herrick, Kathie G.
TITLE Community College Biology Lesson Catalogue.
INSTITUTION Illinois Univ., Urbana. Computer-Based Education Lab.
SPONS AGENCY National Science Foundation, Washington, D.C.
REPORT NO USNSF-C-723
PUB DATE Aug 76
NOTE 99p.; For related document, see ED 128 172; Not available in hard copy due to marginal legibility of Lesson Samples
AVAILABLE FROM PLATO Publications, Computer-Based Education Research Lab, 252 Engineering Research Lab, University of Illinois, Urbana, IL 61801 (no price quoted)

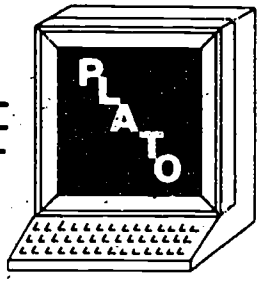
EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS *Biology; *Catalogs; *College Science; Community Colleges; *Computer Assisted Instruction; Higher Education; *Instructional Materials; Resource Guides; Science Education
IDENTIFIERS *PLATO; Programmed Logic for Automatic Teaching Operations

ABSTRACT

This catalog contains descriptions of the available biology lessons on PLATO IV, compiled to assist instructors in planning their curricula. Information is provided for 87 lessons in the following areas: experimental tools and techniques; chemical basis of life; cellular structure and function; bioenergetics - enzymes and cellular metabolism; reproduction and development; classical genetics and the nature of the gene and its action; evolution; population biology and ecology; plant anatomy, physiology, and pathology; taxonomy; human anatomy and physiology; animal behavior; and biology games. For each lesson, the following are provided: file name, authors, instructional objectives, description, student time, instructional strategy, special notes, and displays. All lessons are appropriate for use in the first semesters of college-level biology; most were written for non-major survey courses. The Appendix contains the Community College Biology Index and Multiple-Choice Quiz Construction. (CS)

Computer-based Education

Research Laboratory



University of Illinois

Urbana Illinois

COMMUNITY COLLEGE BIOLOGY

LESSON CATALOGUE

Bill Strutz

KATHIE G. HERRICK

AUGUST 1976

COMMUNITY COLLEGE BIOLOGY

LESSON CATALOGUE

by

Kathie G. Herrick

Computer-based Education Research Laboratory

University of Illinois

Urbana-Champaign

August 1976

This manuscript was prepared with partial support from the National Science Foundation (USNSF C-723) and the University of Illinois at Urbana-Champaign.

ACKNOWLEDGEMENTS

This catalogue is based on the original version by Mary S. Manteuffel, Biology Coordinator for the Community Colleges Project from August 1974 until August 1975. Without the example of her initial effort, the task of preparing this document would have been much more difficult.

For their assistance in the preparation of this catalogue, I wish to thank Rosanne Francis for providing descriptions of her lesson series; R. T. Gladin, photographer; and Roy Lipschutz, graphics specialist. I offer a very special thanks to Sheila Knisley and Sibyl Pellum, typists, for their fine work and, most of all, their patience.

TABLE OF CONTENTS

* (M) indicates that a microfiche is required.

3. Cellular Structure and Function (continued)

c1. Surface Area/Volume in Living Systems
(by R. Arsenty)

d1. Cell Growth
(by R. Francis, S. Kaplan, and D. Burke)

4. Bioenergetics: Enzymes and Cellular Metabolism

a1. Enzyme Experiments
(by R. Baillie and G. Hyatt)

b1. Essentials of Photosynthesis
(by R. Arsenty)

b2. Photosynthesis
(by. J. Noell and A. Haney)

b3. Experiments in Photosynthesis
(by J. Noell)

b4. Mother Nature's Own Green Machine (Requirements for Photosynthesis)
(by A. Hernandez, K. Herrick, and J. Sweany)

c1. ATP, Anaerobic, Aerobic Respiration, and Electron Transport Chain
(by R. Arsenty)

c2. Measuring the Level of Life
(by R. Arsenty)

c3. Respiration and Enzymes
(by J. Silvius and G. May)

c4. Experiments in Respiration
(by J. Silvius)

5. Reproduction and Development

a1. Mitotic Cell Division
(by J. Lendway)

a2. Mitosis
(by L. Porch)

b1. Meiosis
(by R. Arsenty)

b2. Meiosis
(by L. Porch)

c1. Embryology
(by C. Matz)

d1. Plant Life Cycles (M)
(by A. Haney and G. May)

Hormonal Control of the Menstrual Cycle (see 11c1)
(by L. Porch, M. Manteuffel, and S. Boggs)

6. Classical Genetics and the Nature of the Gene and Its Action

a1. DNA and Protein Synthesis
(by P. Tenczar and R. Baillie)

a2. DNA, RNA and Protein Synthesis
(by R. Arsenty)

b1. Vocabulary Drills for Genetics--Part I
(by J. Lendway)

b2. Vocabulary Drills for Genetics--Part II
(by J. Lendway)

c1. Elementary Probability and Mendel's Laws
(by R. Baillie and G. Hyatt)

c2. Genetics and Heredity
(by R. Baillie, G. Hyatt, and J. Noell)

d1. Drosophila Genetics
(by J. Denault, G. Hyatt, and D. Eades)

d2. Gene Mapping in Diploid Organisms
(by K. Frank)

d3. Plant Genetics Problems
(by J. Noell)

e1. Blood Typing
(by L. Porch and M. Yamada)

7. Evolution

a1. Genetic Drift
(by G. Hyatt)

a2. Population Genetics (Demonstration of Inbreeding)
(by M. Grossman and D. Walter)

a3. Population Genetics (Hardy-Weinberg Principle)
(by M. Grossman, D. Walter, and D. Chirolas)

a4. Population Genetics (Quantitative Genetics)
(by M. Grossman, D. Walter, and D. Chirolas)

b1. Natural Selection
(by G. Hyatt)

b2. Natural Selection Model
(by G. Hyatt)

c1. Comparative Serology
(by G. Hyatt)

d1. Induced Mutations Experiment Using Aspergillus
(by J. Noell)

Plant Life Cycles--An Evolutionary Approach (see 5d1)
(by A. Haney and G. May)

8. Population Biology and Ecology

a1. Biogeochemical Cycles
(by R. Baillie and G. Hyatt)

b1. Energy Relationships in Biological Systems
(by R. Baillie and G. Hyatt)

c1. Predator-Prey Relationships
(by R. Baillie and G. Hyatt)

d1. Buffalo--Animal Population Experiment
(by C. Burson and T. Gordon)

d2. Population Dynamics
(by S. Boggs)

d3. Populations Laboratory Using E. coli
(by J. Noell)

d4. Stationary Phase of Cell Growth
(by R. Francis, S. Kaplan and D. Burke)

d5. Lag Phase of Cell Growth
(by R. Francis, S. Kaplan and D. Burke)

d6. Death Phase of Cell Growth
(by R. Francis, S. Kaplan and D. Burke)

Life in a Microcosm (see 1c2)
(by A. Haney and G. May)

9. Plant Anatomy, Physiology, and Pathology

a1. Seed Germination
(by S. Wolniak)

a2. Plant Growth
(by M. Manteuffel and J. Noell)

a3. Plant Responses and Apical Dominance
(by M. Manteuffel and J. Noell)

a4. Flowering and Photoperiod
(by J. Noell)

a5. Fruiting and Leaf Senescence
(by J. Noell)

a6. Enzyme-Hormone Interactions
(by J. Noell)

b1. Organization of the Higher Plant (M)
(by A. Haney and G. May)

c1. Plant Pathology (M)
(by J. Silvius)

Water Relations Laboratory (see 3b3)
(by J. Silvius)

INTRODUCTION

This catalogue was initially compiled to assist instructors participating in the NSF Community College Biology PLATO Project in identifying courseware appropriate for their classes. During the two-year field test, the curriculum has doubled to include over eighty lessons. Hence, the need for a complete reference document is even more important.

Each lesson description contains the following information:

File Name: Designation in "bioindex" (the on-line lesson index of biology lessons)
Lesson title

Authors: Lesson designers, programmers and editors

Instructional Objective: General statement of anticipated student behavior(s) as a result of the lesson

Description: Index availability within the lesson

Outline of contents including special branching activities and an indication of where in the lesson questions are encountered

Student Time: Most times were derived from an on-line accounting system and/or lesson summary tables. However, these values are highly dependent on a number of variables, among which is how the lesson is used (e.g., first exposure or review).

Instructional Strategy: Four major categories are used to characterize our courseware; lessons generally contain aspects of more than one type.

Practice: Lessons which assume student has received instruction off-line prior to the session. These lessons are suitable review exercises.

Tutorial: Instructional presentation followed by direct questions on content--or practice.

Simulation/Model: A real situation is duplicated on-line via PLATO's graphic capabilities. Simulation is used to describe lessons in which each step of a process is controlled by the student; part of this process may include designating parameters and observing the results. Model is used to describe lessons which involve only manipulation of parameters to alter a graphic display.

Inquiry: Instruction followed by questions and feedback, which guide the student towards a conclusion.

Instructional Strategy (cont.): Two additional categories which are represented less frequently are:

Game: Student learns in a competitive setting, playing either against PLATO or a real opponent.

Exam: Test items presented with immediate feedback.

Special Notes: Contains usage suggestions including background required; special indication of dependence on ancillary materials (e.g., handout, microfiche)

Displays: Sequential displays are included to better demonstrate PLATO's interactive capabilities.

All of the lessons contained in the catalogue are appropriate in whole or in part for use in the first semesters of college-level biology. Most were written for non-major survey courses. The majority of the lessons were developed at three institutions by five contributing agencies. The authors are listed below according to their affiliation when they wrote their lessons.

Chicago City Colleges: Kennedy-King (K), Malcolm X College (MX), Wright College (W), Mayfair College (M)

UICC: University of Illinois Chicago Circle

UIUC: University of Illinois Urbana-Champaign

CCC

Faye Bomer (K)
James Cooper (M)
Alicia Hernandez (K)
Eddie Ingersol (K)
Jerry Lendway (W)
Charles Matz (MX)
Lee Porch (K)
Joan Sweany (MX)
*Mitsuru Yamada (MX)

UICC

John Denault
David Eades
*Gary Hyatt
Joan Mehney
Bette Virdrine

UIUC

Biology 100-101

Richard Arsenty
Stephen Boggs

Botany 100

*Alan Haney
Mary Manteuffel
Gary May
John Noell
John Silvius
Stephen Wolniak

NSF-CERL

Robert Baillie
Stephen Boggs
Kathie Herrick
Gary Hyatt
Mary Manteuffel
Paul Tenczar

* Single contact for lessons authored by these group members; still affiliated with their respective institutions.

MISCELLANEOUS

UIUC Microbiology Department

Daniel Burke
Rosanne Francis
Samuel Kaplan

UIUC Education Department

Craig Burson
T. Gordon

UIUC Dairy Science

Michael Grossman
David Walter

U.S. Army Research Institute, Arlington, VA

B. Knerr
Peggy McClintock
Martha Moore

CERL

Darlene Chirolas

LESSON DESCRIPTIONS

File Name: bioindex-1a1 ecs: 7334
Tools Used in Biology -- Log Scales, Metric System, and Chi-Square Analysis

Authors: R. Baillie and G. Hyatt

Instructional Objective: To manipulate log scales, the metric system, and chi-square analysis for biological problems.

Description: Index (accessible through TERM*-index)

1) Graphing with semilog and log-log scales
   a. Why use log scales?
   b. Linear scales vs. log scales
   c. Graphing bacterial growth on semilog graph
2) The Metric System
   a. Length -- meters
      1. What is the length of the line in cm.?
      2. Conversion between metric units -- problems
   b. Volume -- liters
   c. Weight -- grams
   d. Sample Problems
3) Chi-Square Distribution
   a. Introduction to χ^2
   b. Enter values in a χ^2 table to perform a χ^2 analysis on your data

Student Time: 50 minutes

Instructional Strategy: Tutorial

Special Notes: This lesson covers some basic tools used in biology that are often confusing to the student. It can be used as a lecture-lab supplement or as a review for students who require additional assistance in one or more of these topics.

* While holding the SHIFT key down, press the TERM ANS key, then type in the word "index".

File Name: bioindex-1a2 ecs: 3100
Review of Logs and Exponents

Authors: R. Francis with S. Kaplan and D. Burke

Instructional Objectives: To learn about exponents and logarithms in order to

1) understand what a logarithm is
2) find the logarithm of a number
3) read a semilog graph
4) follow the transformation of

$$N_n = N_0 2^n \text{ into } \frac{\log_{10}\left[\frac{N_n}{N_0}\right]}{.301} = n$$

Description: No index

1) Option to take the pretest--if passed, go to item #10 of this lesson
2) If option not accepted or pretest failed, do the following items
3) Definition of exponent, base
4) Define multiplication = addition of exponent
5) Definition of logarithm = fractional exponent
6) Reading a log table
7) Drill on finding logs
8) Logs of numbers greater than 10
9) Special cases: e.g., log of 1, $\log_n N$, etc.
10) Rearranging $N_n = N_0 2^n$ into $\frac{\log_{10}\left[\frac{N_n}{N_0}\right]}{.301} = n$

Student Time: 15 minutes plus 20 - 25 minutes for log review

Instructional Strategy: Tutorial

Special Notes: This is the second in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

File Name: bioindex-1a3 ecs: 3041
Exponential Growth Formulas

Authors: R. Francis with S. Kaplan and D. Burke

Instructional Objectives: To compute growth rate and generation time and gain a qualitative feeling for typical values.
To read and describe the relationship of semilog graphs to linear graphs.
To define the meaning of slope on semilog and linear graphs.

Description: No index

1) Semilog graph: relationship to linear graphs, reading the graph
2) Relationship of $N_n = N_0 2^n$ and $\frac{\log_{10}\left[\frac{N_n}{N_0}\right]}{.301} = n$
to the semilog and linear graphs of exponential growth
3) Solving the equation $\frac{\log_{10}\left[\frac{N_n}{N_0}\right]}{.301} = n$ for generation time, growth rate, doubling time, and practice with computation
4) Plotting of growth curves for student-supplied generation times and growth rate constants
5) Matching tests on symbols, definitions, and formulas
6) Meaning of slope on semilog and linear graphs

Student Time: 25 -65 minutes

Instructional Strategy: Tutorial

Special Notes: This is the third in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

File Name: bioindex-1a4 ecs: 3682
Graphing Exponential Cell Growth Data

Authors: R. Francis with S. Kaplan and D. Burke

Instructional Objectives: To plot data, draw a growth curve and compute the growth rate.
To deduce growth rate from cell population curves.
To gain an intuitive feel for typical food spoilage problems.

Description: No index

1) Student option to work growth rate problems with computer aid. If declined, go to item #2
   a. Student chooses graphing limits
   b. Plots his own or supplied data
   c. Draws best straight line approximation
   d. Computes growth rate (based on formula in 1a3)
2) Given graph of cell population vs. time, student determines cell growth rate vs. time
*3) Student works two computer-supplied problems to find how long typical foods will remain fresh under varying temperatures
Student may work as many additional problems as he wishes given five organisms and five temperatures.

Student Time: 15 - 30 minutes for the graphing
20 - 30 minutes for the remaining items

Instructional Strategy: Practice/Inquiry

Special Notes: This is the fourth in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

* Temporarily unavailable (8/76)

File Name: bioindex-1b1 ecs: 1897
A Tool: The Spectrophotometer

Author: G. May

Instructional Objectives: To explain the principle of spectrophotometer operation.
To interpret data obtained from a spectrophotometer.

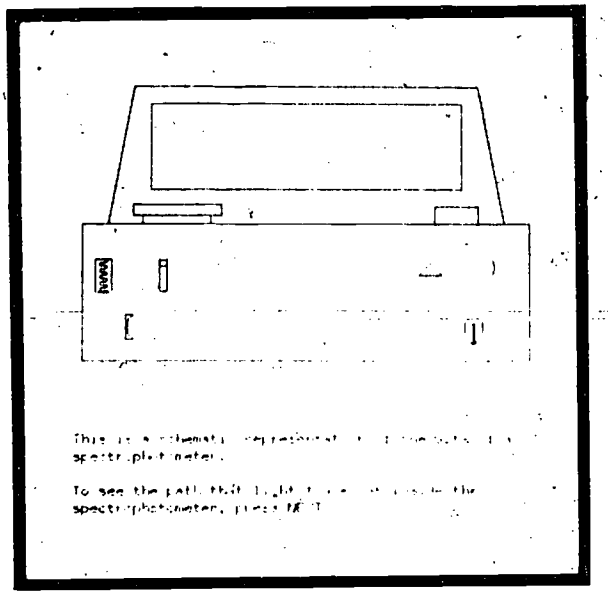
Description: No index initially accessible; areas designated can be reviewed through index seen at end by pressing BACK

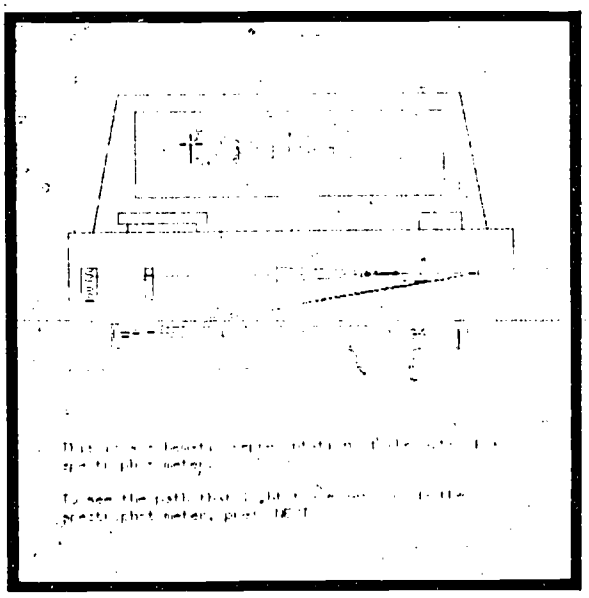
1) Color, light, absorbance, and transmittance -- illustrative examples and six questions
2) The spectrophotometer -- diagram, explanation of components
3) The blank and the standard curve -- example, six questions

Student Time: 25 minutes

Instructional Strategy: Tutorial

Special Notes: Good topic coverage, requires no introduction.





File Name: bioindex-1c1 ecs: 2983
Experimental Technique

Authors: A. Haney and G. May

Instructional Objectives: To learn the process of scientific inquiry.
To analyze the steps in the process.
To manipulate conversions between English and metric measure.

Description: Index (accessible through TERM-index)

1) Scientific inquiry
   a. Definition of science
   b. Flow chart
   c. Example
2) Setting up an experiment
   a. Choosing an hypothesis
   b. Using controls
3) Observing an experiment--5 steps to follow
4) Drawing proper conclusions--2 examples of hypotheses with experimental designs and results
5) Conversions and extrapolation
   a. Metric conversion tables
   b. Sample problems

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: Good comprehensive coverage of subject area. There is a sequel lab (bioindex- 1c2) for practice in applying these principles.

File Name: bioindex-1c2 ecs: 4284
Life in a Microcosm

Authors: A. Haney and G. May

Instructional Objectives: To evaluate hypotheses and experimental designs for their potential to yield a sound conclusion. To interpret results of research accurately taking above into consideration.

Description: Choose area for research:

1) Competition between plants
   a. Choose hypothesis (3)
   b. Choose experimental design--2 for each hypothesis
   c. Make conclusion--(3)
   d. PLATO scores 1-10
2) Effects of light on plant growth
   a. Choose hypothesis (3)
   b. Choose experimental design (2)
   c. Make conclusion (3)
   d. PLATO scores 1-10

Student Time: minimum 20 minutes
depends on number of experiments conducted

Instructional Strategy: Practice/Inquiry

Special Notes: Designed as a lab replacement.
Very flexible for a variety of experimental combinations.
PLATO evaluates and scores procedure (0-10 for each experiment). Minimum score of 20 must be obtained before lesson is completed.

File Name: bioindex-1d1 ecs: 1909
Serial Dilutions

Author: B. Virdrine

Instructional Objective: To calculate concentrations and dilution factors.

Description: Index (accessible through TERM-index)

values for each problem selected randomly from pool

1) Introductory Problem Set--step-by-step explanation
2) Problem Set 1 (a serial dilution)--9 questions
3) Problem Set 2 (calculating concentrations, I)--minimum 2 questions: no. of colonies ÷ dilution factor
4) Problem Set 3 (calculating concentrations, II)--minimum 2 questions
5) Problem Set 4 (calculating the dilution factor)--minimum 2 questions: colony count ÷ concentration

Evaluation at the end of each unit.
Can redo each set with different values.

Student Time: 25 minutes

Instructional Strategy: Practice

Special Note: Students must be familiar with the SUPER-script key.

File Name: bioindex-2a1 ecs: 7078
A Few Material Facts for Biology Students

Authors: E. Ingersol and CCC programmers

Instructional Objectives: To recognize the chemical symbols for elements encountered in biology.
To know the components of atoms.
To understand the meaning of chemical formulas.

Description: Index (accessible through DATA)

1) Elements--symbols--atoms
   a. Definition; derivation of symbols
   b. Symbol→element; 10 questions
   c. Element→symbol; 10 questions
2) Particles that make up atoms
   a. Definitions and masses
   b. A hydrogen atom; an oxygen atom
   c. Identifying parts; 5 questions
3) The making of atoms
   a. Composition of nucleus and electron shell for atoms of first 10 elements in periodic table
   b. Designating a neutral atom (9)
4) The atom factory
   a. Identifying parts and location in atom--7 questions
   b. Determining numbers of particles from amu--8 questions
5) Compounds--formulas--molecules
   a. Examples
   b. Designate number of atoms for compounds containing two elements (6 compounds)
   c. Designate number of atoms for compounds containing three elements (6 compounds)
6) Atoms combine into molecules; gaining, losing, and sharing electrons
7) Data on this lesson

Student Time: 55 minutes

Instructional Strategy: Tutorial

Special Notes: Orientation lesson for the biology student who has had little or no background in chemistry.

File Name: bioindex-2b1 ecs: 2915
Experiments in Radiobiology: Scaler Experiment and Carbon-14 Dating

Author: R. Arsenty

Instructional Objective: To learn the technique of C-14 dating.

Description: Index (accessible through TERM-index)

1) Introduction to Scaler experiment; explanation of apparatus; advantages and disadvantages of simulation
2) Scaler experiment
   a. Determine background count (CPM)
   b. Determine P32 activity (CPM)
   c. Material absorbtion determination
   d. Activity vs. distance determination
   e. Continue carbon-14 dating using scalers for this; see handout
4) Carbon-14 dating experiment
   a. Request unknown sample--4 choices; background information, statement of problem
   b. Place one gram of unknown into chamber
   c. Run experiment for 48 hours
   d. Repeat for next unknown
   e. Continue answer 12 questions; 3 multiple-choice questions/ unknown (how many CPM; what is sample age; is sample from period anticipated?)

Student Time: 45 minutes

Instructional Strategy: Simulation

Special Notes: Discussion of isotopes, half-life, and accuracy of C-14 dating is included in a handout. There is also a graph relating counts per minute and age of sample and tables for recording data.

File Name: bioindex-3a1 ecs: 6159
The Ultrastructural Concept of the Cell

Authors: J. Cooper, G. Hyatt, City Colleges of Chicago Programmers

Instructional Objectives: To recognize the organelles of the "typical" plant or animal cell.
To explain functions of cell organelles and their contributions to the working of the whole cell.

Description: Index (accessible through DATA)

Introduction: history, objectives
1) Nucleus, nuclear membrane and nucleolus (4 questions).
2) Cell membrane (2)
3) Cell wall (3)
4) Endoplasmic reticulum (3)
5) Golgi apparatus (2)
6) Mitochondrion (3)
7) Centriole (3)
8) Chloroplast (3)
9) Test (30)

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: Microfiche displays are interchangeable with diagrams throughout lesson.

File Name: bioindex-3b1
Diffusion and Osmosis

ecs: 3189

Author: S. Boggs

Instructional Objectives: To know the principles of molecular movement.
To apply these principles to biological systems.

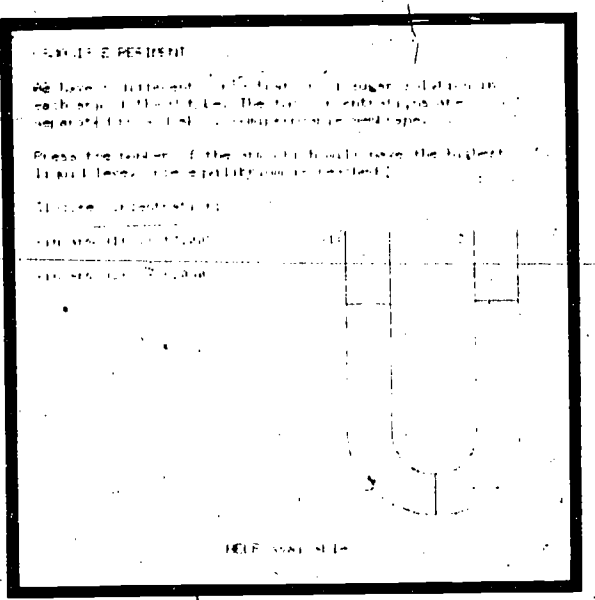
Description: Index (*-ed areas accessible through TERM-index)

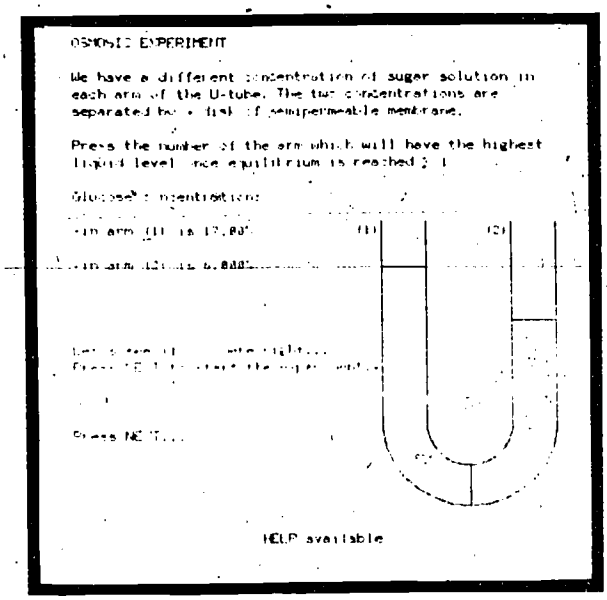
1) *Molecular motion
   *a. Diffusion--definition, animation
   *b. Brownian
   c. Summary
2) Osmosis
   *a. Semipermeable membrane--diagram, animation
   b. Osmosis demonstration--five questions (HELP from questions accesses * index)
   *c. Osmosis experiments--U tube, red blood cells

Student Time: 30 minutes

Instructional Strategy: Tutorial/Inquiry

Special Notes: This lesson is often used as a lab replacement.
The animations and experiments are particularly helpful in visualizing the concepts presented.





File Name: bioindex-3b2 ecs: 1611
Introduction to Water Relations

Author: J. Silvius

Instructional Objective: To discuss the factors that influence the direction of water movement across membranes.

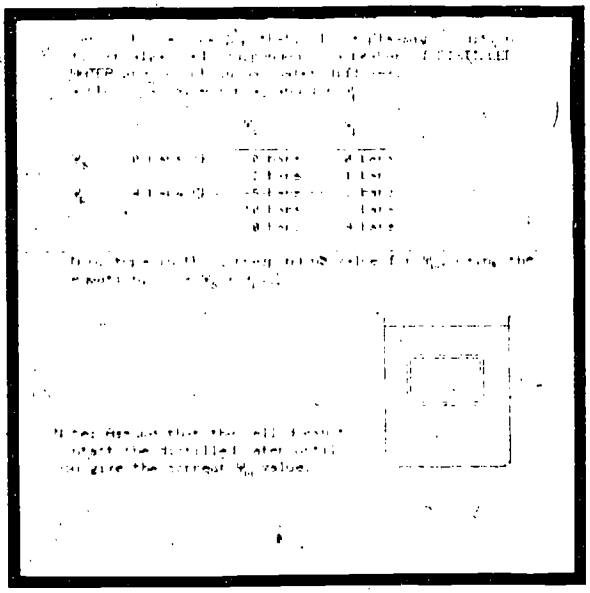
Description: No index

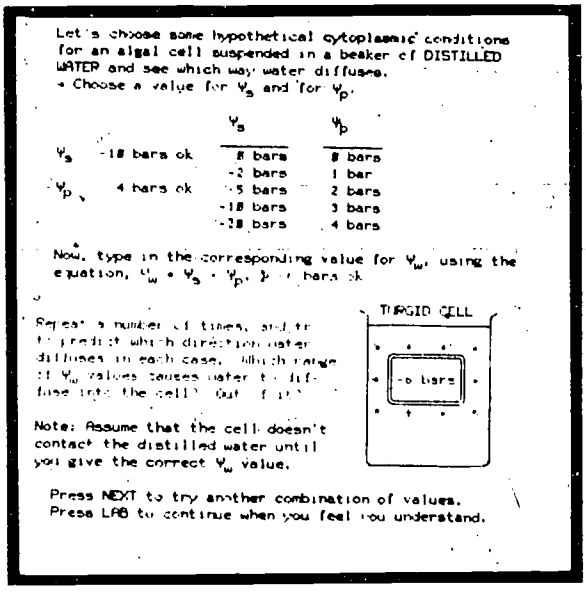
1) Introduction
   a. Role of water in living systems
   b. Properties of water
2) Factors affecting diffusion tendencies demonstrated with osmometer in animated squence
   a. Solute
   b. Pressure
   c. Colloids
3) Mathematical expression of components
4) Choose hypothetical values of solute for algal cell, observe concentration and pressure effect--two summary questions

Student Time: 15 minutes

Instructional Strategy: Tutorial

Special Notes: Designed as laboratory replacement.





File Name: bioindex-3b3 ecs: 4111
Water Relations Laboratory

Author: J. Silvius

Instructional Objectives: To learn a method for determining water potential of living cells.
To describe the conditions which affect transpiration by manipulating a potometer.

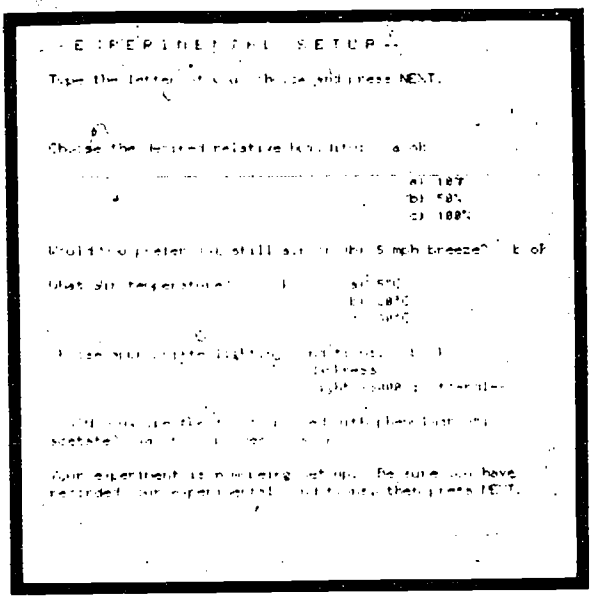
Description: Index (accessible through TERM-index)

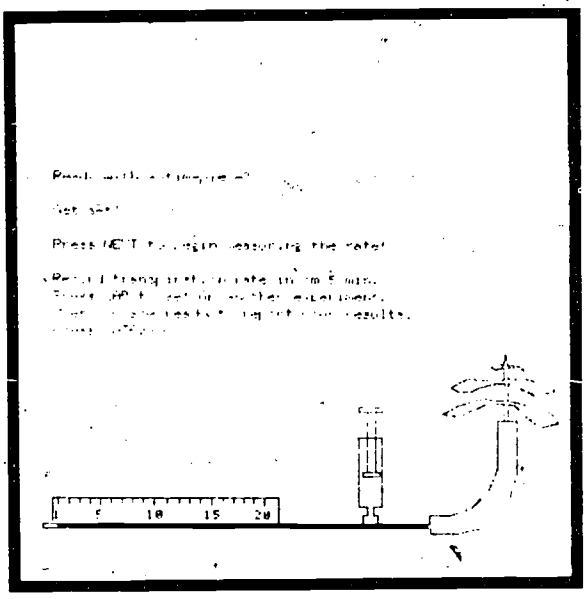
1) Estimation of water potential (Ψw) of potato tuber cells
   a. Background--technique
      Use cores of potato tubers, expose cells to solution with known solute potential (Ψs), determine initial and final weight
   b. Experiment--to determine actual Ψw of potato tuber cells, calculate Ψw for one solution, get data for five more solutions, graph % change in weight vs. water potential (bars), answer questions
2) Transpiration and water movement
   c. Background--definition
   d. Experiment--choose conditions: relative humidity, wind velocity, air temperature, light intensity, phenylmercuric acetate
      Includes three questions.

Student Time: 40 minutes

Instructional Strategy: Simulation

Special Notes: Designed as lab replacement, sequel to bioindex-3b2.





File Name: bioindex-3c1 ecs: 2411
Surface Area/Volume in Living Systems

Author: R. Arsenty

Instructional Objectives: To discuss the relationship between survace area and volume.
To describe the consequences of this relationship in living organisms.
To describe ways to maintain a high SA/V ratio.

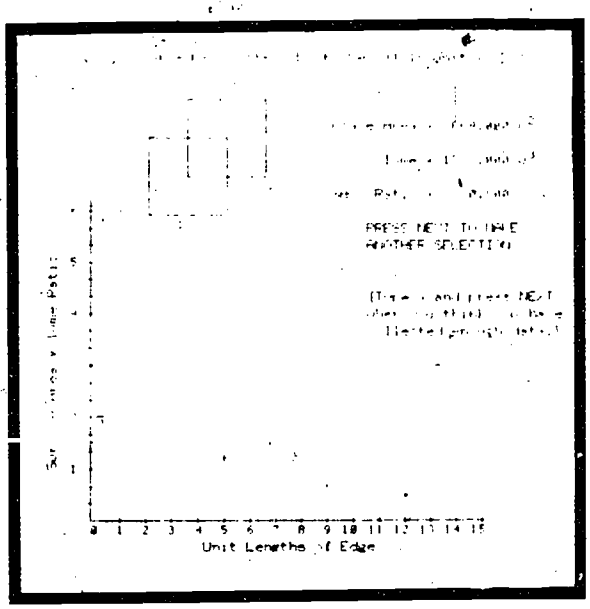
Description: Index (accessible through TERM-index)

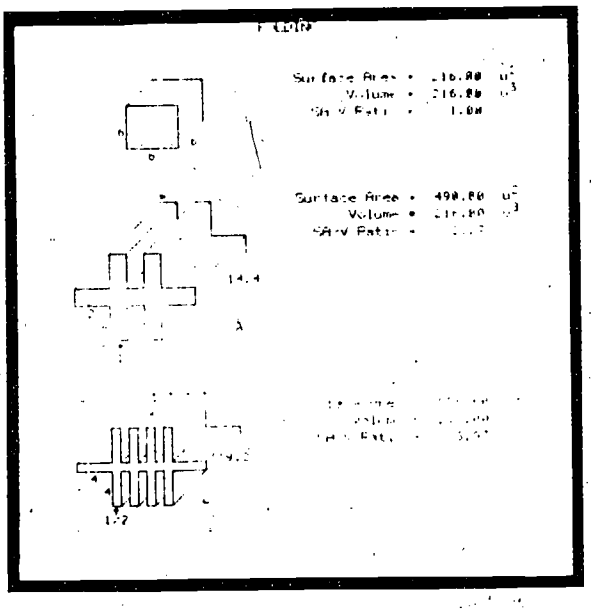
1) Problem of surface area and volume relationships
   a. Student chooses lengths of cube edge
   b. Program calculates surface area, volume and ratio (SA/V)
   c. Program plots edge length vs. SA/V ratio
   d. Repeat for radii of sphere
   e. 4 questions based on conclusions drawn from graphs
2) Demonstrations--solving the problem of SA/V
   a. Flattening, folding, dividing parameters calculated
   b. 3 questions

Student Time: 15-20 minutes

Instructional Strategy: Inquiry

Special Notes: There is a handout written to accompany this lesson. Without the handout, an introduction and summary are in order. Specific examples (as the mitochondrion and chloroplast) are not mentioned.





File Name: bioindex-3d1 ecs: 3181
Cell Growth

Authors: R. Francis with S. Kaplan and D. Burke

Instructional Objective: To describe elementary concepts and terminology associated with exponential growth.

Description: No index

1) Mother/daughter cells
2) Doubling time
3) Analysis of formula $N_n = N_0 2^n$
4) Plotting exponential growth on linear coordinates

Student Time: 15 - 35 minutes

Instructional Strategy: Tutorial

Special Notes: This is the first in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

TERM-index accesses index for remainder of series.

1. Exponential or log phase
2. Graphing growth (bioindex-1a3, 1a4)
3. Exponents and logs (bioindex-1a2)
4. Semilog graph (bioindex-1a3)
5. Slope (bioindex-1a3)
6. Plotting own data (bioindex-1a3, 1a4)
7. Food problem (bioindex-1a4)
8. Stationary phase (bioindex-8d4)
9. Toxicity
10. Linear
11. Lag phase (bioindex-8d5)
12. Death phase (bioindex-8d6)

File Name: bioindex-4a1 ecs: 4744
Enzyme Experiments

Authors: R. Baillie and G. Hyatt

Instructional Objective: To explain how and why environmental factors affect enzyme reaction rates.

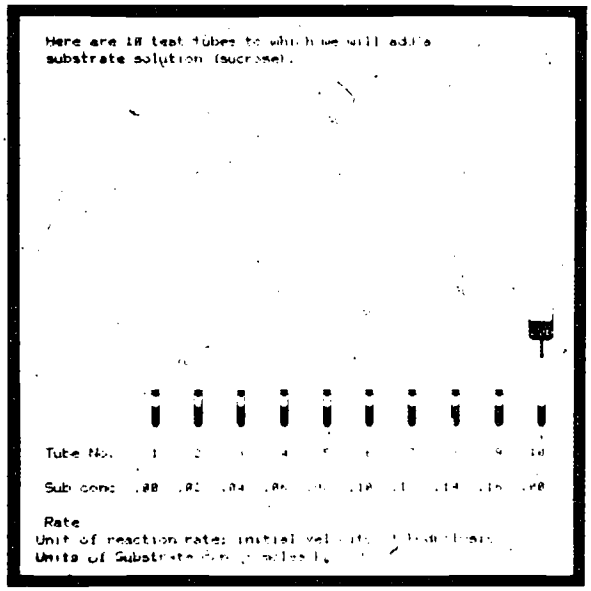
Description: Index (accessible through TERM-index)

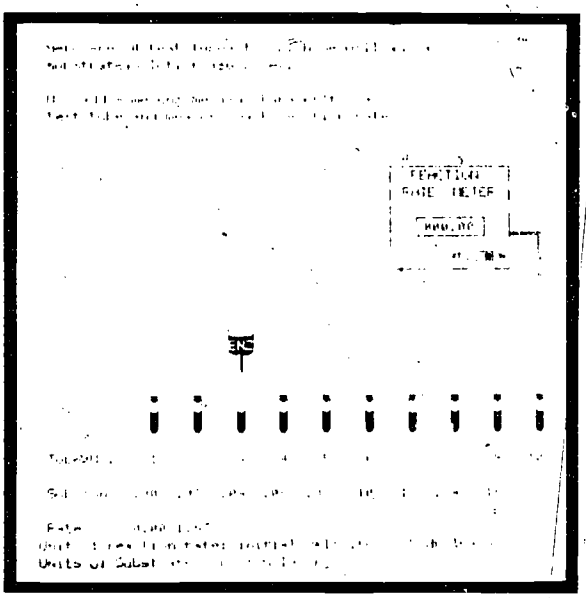
1) Introduction--lesson objectives, role of enzymes, how they work, animation
2) Experiments chosen by the student
   a. Student varies pH, temperature, enzyme concentration or substrate concentration
   b. A specific substrate or enzyme is chosen
   c. Experiment run and reaction rates are observed
   d. Data and graph are presented with questions
3) Nine review questions

Student Time: 30 minutes

Instructional Strategy: Simulation/Tutorial

Special Notes: This lesson allows for a variety of experimental conditions even if the student repeats an experiment; a small amount of randomized "experimental error" is built into the observed values of the reaction rates. Familiarity with enzyme structure is assumed.





File Name: bioindex-4b1 ecs: 1500
Essentials of Photosynthesis

Author: R. Arsenty

Instructional Objective: To summarize the basic steps of the photosynthetic process and its relationship to respiration.

Description: No index

1) Introduction
2) The light reaction--the Z-scheme (refer to handout steps 1 - 6)
3) The dark reaction
4) Interrelationship of photosynthesis and respiration

Student Time: 15 - 20 minutes

Instructional Strategy: Tutorial

Special Notes: A brief lesson concentrating on the Z-scheme with animation. The discussion of each step is included on a handout written by the author. Definitely requires prior preparation of student. Since this lesson contains few questions, it is a prime candidate for use in conjunction with an on-line quiz lesson (see appendix).

File Name: bioindex-4b2 ecs: 4289
Photosynthesis

Authors: A. Haney and J. Noell

Instructional Objectives: To describe the relationship of leaf structure and function.
To explain the principles of chromatography.
To identify the fate of raw materials in photosynthesis.
To explain varying photosynthetic efficiencies of plants.

Description: Index (accessible through TERM-index)

1) Introduction
   a. Requirements for photosynthesis--student must supply
   b. Definition
   c. History--one question
   d. Leaf structure--diagrammed
2) Pigments and chromatography
   a. Pigments involved and how
   b. Description of chromatography and time lapse scenario
3) The photosynthetic process, animated Z-scheme
4) The Calvin cycle
5) Photorespiration (by J. Silvius)--diagrams and graphs

Student Time: 40 minutes

Instructional Strategy: Tutorial

Special Notes: Good overview of entire subject. Calvin cycle treated very briefly. Appropriate for review or lecture-lab supplement. Designed as introduction for bioindex-4b3. Usage followed by a quiz on content is recommended. See appendix for on-line quiz construction.

File Name: bioindex-4b3 ecs: 2288
Experiments in Photosynthesis

Author: J. Noell

Instructional Objectives: To identify by various experimental procedures environmental factors which affect photosynthesis.
To interpret data obtained from simulated experiments.

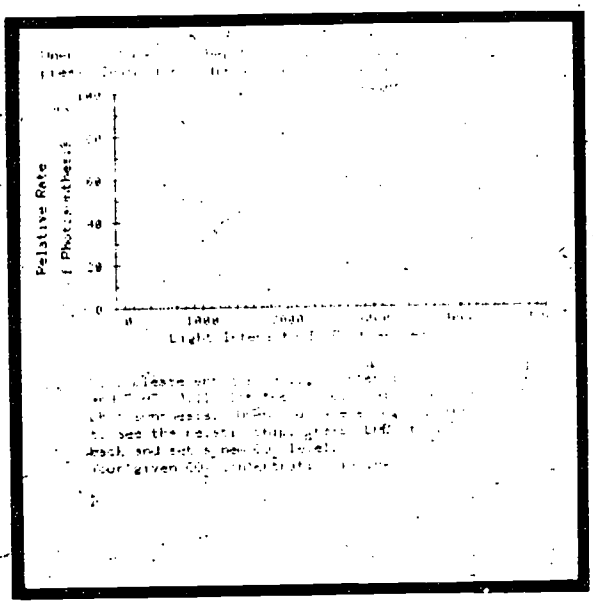
Description: Index (accessible through TERM-index)

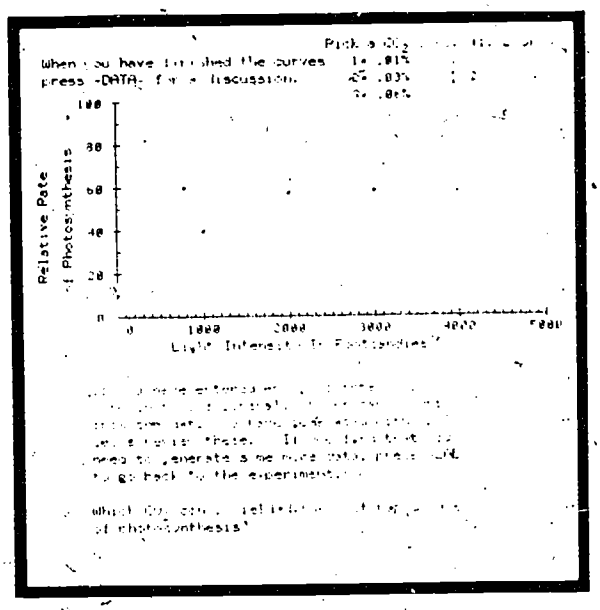
1) Light quality and plant growth--select color, PLATO describes plant condition
2) Dye reduction and photosynthesis--select wavelengths, PLATO reveals color and amount of dye reduction; graph of action spectrum
3) CO_2 and light saturation of photosynthesis--choose CO_2 concentration, enter light intensities, see graphical relationship, includes two questions

Student Time: 20 minutes

Instructional Strategy: Inquiry

Special Notes: Designed as a lab replacement. Meant for use in conjunction with bioindex-4b2. Assumes familiarity with spectrophotometer.





File Name: bioindex-4b4 ecs: 8333
Mother Nature's Own Green Machine (Requirements for Photosynthesis)

Authors: A. Hernandez with K. Herrick, J. Sweany, and Biology Review Board

Instructional Objectives: To understand the dependence of all life on plants.
To know the role of pigments in photosynthesis.
To describe the relationship of leaf structure to photosynthetic function.
To identify the fate of raw materials in photosynthesis.

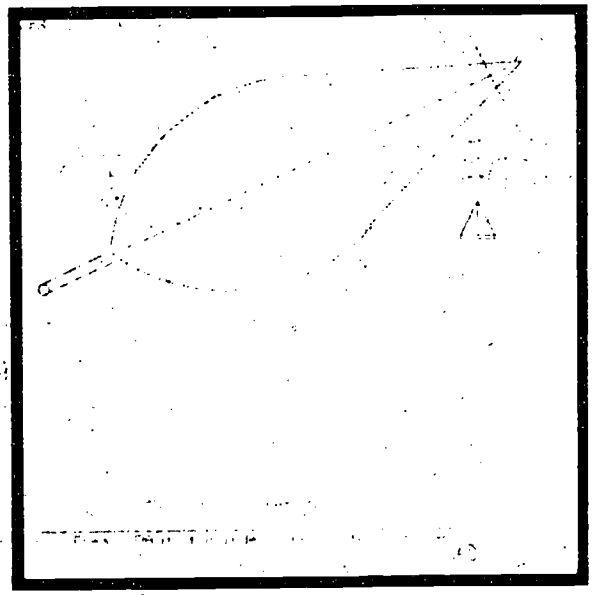
Description: Index (accessible through DATA)

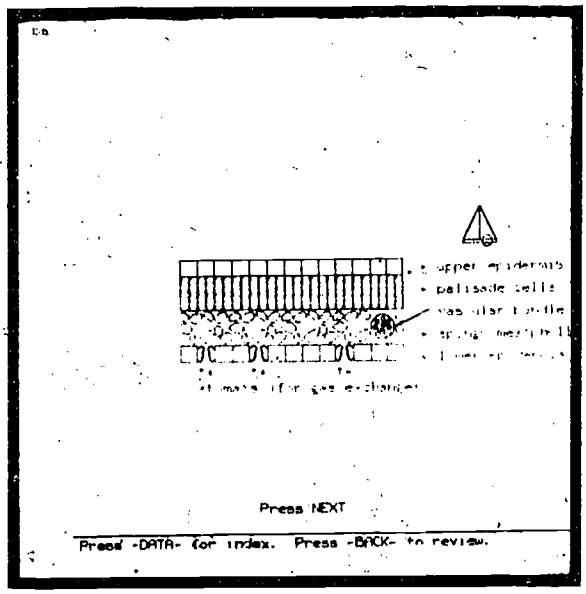
1) Introduction--energy relationship between animals, plants, and the sun; the relationship of energy release and storage; raw materials and end products; includes 13 questions
2) Light and pigments--the visible spectrum, pigment definition, absorption, and action spectra for all photosynthetic pigments; chlorophylls and carotenoids; HELP1 accesses background on properties of light; includes 13 questions
3) The green leaf and chloroplasts--leaf specializations for obtaining raw materials needed for photosynthesis; chloroplast structure: stroma, grana, thylakoids, photosystem, pigments, and their involvement in the light and dark reactions; HELP1 accesses more details on chloroplasts; includes 8 questions
4) And a little about the process--the raw materials and end products involved in each phase (light and dark); the balanced equation; includes 8 questions

Student Time: 60 minutes

Instructional Strategy: Tutorial/Inquiry

Special Notes: Comprehensive topic coverage, highly interactive





File Name: bioindex-4c1 ecs: 5200
ATP, Anaerobic and Aerobic Respiration and Electron Transport Chain

Author: R. Arsenty

Instructional Objectives: To explain how energy for biological processes is obtained.
To calculate energy yield in ATPs per glucose during respiration.

Description: Index (accessible through TERM-index)

1) ATP
   a. Importance--efficiency
   b. Structure
   c. Animated reaction ATP → ADP + energy + P_1
2) Anaerobic Respiration (glycolysis and fermentation); animation and summary; explanation of steps appear on a handout
3) Aerobic Respiration (Krebs cycle); animation; explanation on accompanying handout
4) Electron Transport Chain
   a. 4 introductory questions
   b. Animation using 10 2H* from Krebs, includes 4 questions
   c. 8 questions on energy production
   d. Summary of energy production

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: For instructional purposes, the lesson must be accompanied by the handout. For review, students could record off-line a description of events without the handout. Background and summary are required, e.g., localization of the process within the cell, discussion of electron-carriers themselves, and elaboration on the role of enzymes. Enzyme involvement is illustrated very effectively in the animation.

This lesson assumes 3 ATPs are produced for each hydrogen pair removed in the Krebs cycle. It does not account for the fact that only 2 ATPs are obtained from the pair carried by $FADH_2$; this accounts for the discrepancy in 38 ATPs and 36 ATPs accepted. Initially, origin of 32 ATPs is only apparent; but an additional 6 ATPs are accounted for at the end (4 from NADH in glycolysis, 2 from GTP in Krebs) of the lesson.

File Name: bioindex-4c2 ecs: 2921
Measuring the Level of Life

Author: R. Arsenty

Instructional Objective: To calculate ATP from volume of O_2 consumption by respirating peas.

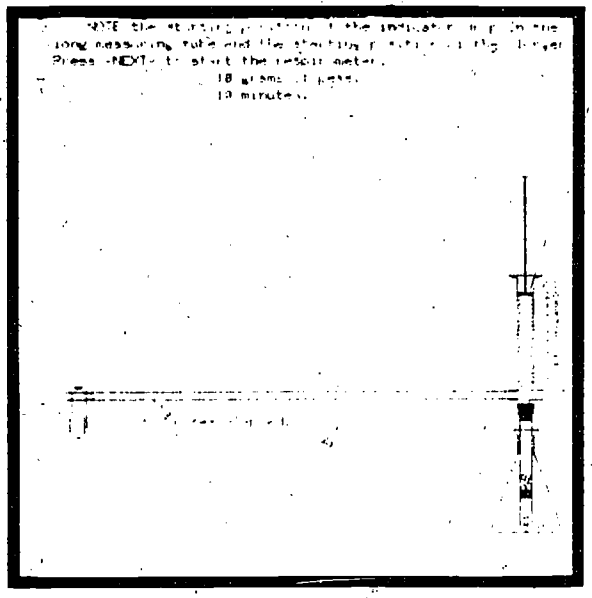
Description: No index

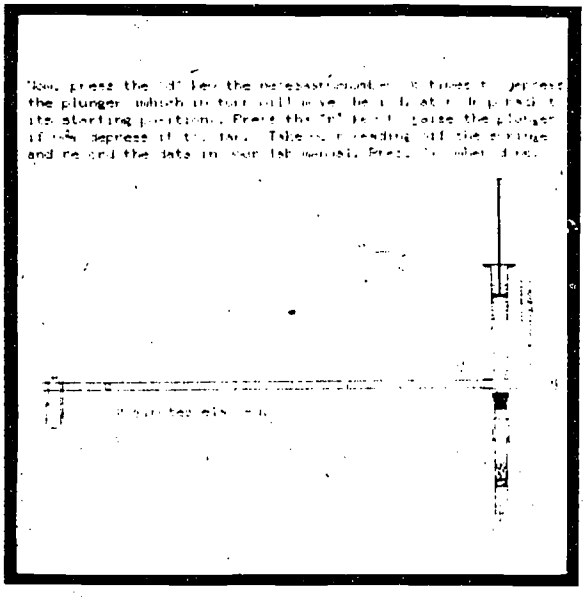
1) Review of the respiration process
2) Respirometer experiment
   a. Assemble parts for experiment
   b. Running the experiment
   c. Data collection
   d. Practice example for calculation of ATP production from data
   e. HELP sequence on scientific notation available via TERM-notation

Student Time: 30 minutes

Instructional Strategy: Simulation

Special Notes: This lesson was designed as a lab replacement.





File Name: bioindex-4c3 ecs: 2087
Respiration and Enzymes

Authors: J. Silvius and G. May

Instructional Objectives: To describe the general scheme of glycolysis, Krebs cycle, and electron transport.
To understand the relationship of glycolysis to aerobic respiration.

Description: No index

1) Introduction
   a. ATP--the energy molecule
   b. Energy-requiring cell processes
2) Process of energy transfer to ATP reserves--respiration in twelve steps
   a. Glycolysis--diagram using C-skeleton for intermediates with description of events; question
   b. Additional requirements for aerobic respiration; question
   c. Krebs cycle--diagram, explanation; question
   d. Electron Transport Chain--effect of O_2 absence, CN poisoning, advantages of aerobic respiration; question

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: Designed as background for bioindex-4c4.

The lesson derives 36 ATPs but not in the conventional manner: it does not include the 2 ATPs obtained from GTPs in the Krebs cycle nor does it account for the fact that only 2 ATPs are obtained from $NADH_2$ produced in glycolysis. Instead, it assumes 3 ATPs are produced for each $NADH_2$ and $FADH_2$ produced in glycolysis and the Krebs cycle.

File Name: bioindex-4c4 ecs: 3207
Experiments in Respiration

Authors: J. Silvius and G. May

Instructional Objectives: To explain dependence of mitochondrial activity and enzyme activity on temperature.
To design an experiment to determine optimum temperature for activity.

Description: Introduction: Temperature in Life Processes
Index (accessible through TERM-index)

1) Experiment I: Effect of temperature on amylase activity
   a. Techniques for measuring reaction rate
   b. Experiment
   c. Analysis of results--graphs, two questions
2) Experiment II: Effect of temperature on respiration in isolated plant mitochondria
   a. Procedure
   b. Experiment
   c. Results, calculations, graphs
   d. A competitive inhibitor--malonic acid
   e. A non-competitive inhibitor--cyanide

Student Time: 30 minutes

Instructional Strategy: Simulation/Inquiry

Special Notes: Assumes familiarity with enzyme structure and nature of action, in addition to knowledge of standard curves and spectrophotometer.

File Name: bioindex-5a1 ecs: 3263
Mitotic Cell Division

Author: J. Lendway

Instructional Objective: To identify the important occurrences in each phase of mitotic cell division.

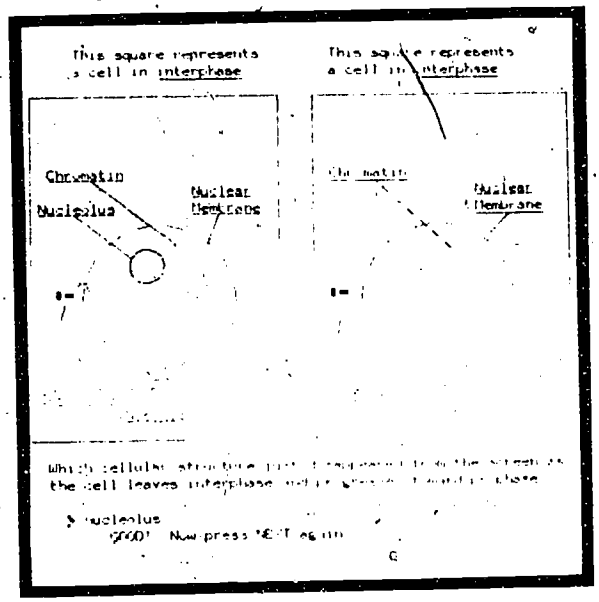
Description: No index

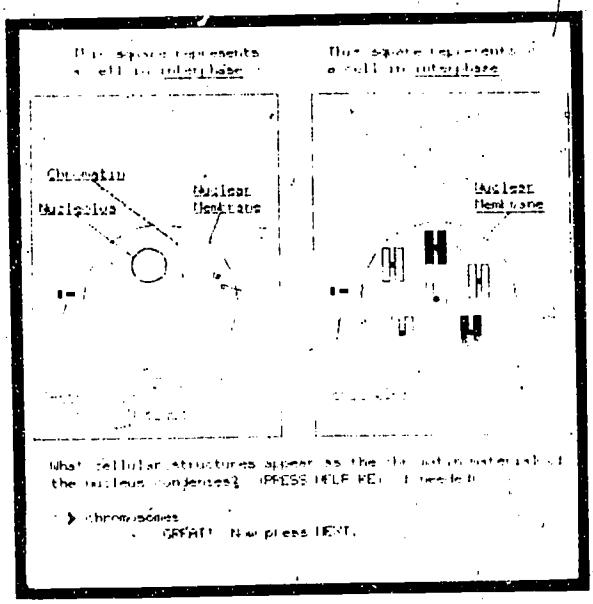
1) Overview
   a. Cytokinesis
   b. Karyokinesis
   c. Questions
2) Outline of mitotic phases, what is accomplished in each and questions
3) Animation of the mitotic phases with discussion and questions accompanying each phase

Student Time: 35 - 45 minutes

Instructional Strategy: Tutorial

Special Notes: This lesson is intended to be a thorough coverage of the subject and requires much student interaction.





File Name: bioindex-5a2
Mitosis

ecs: 5883

Author: L. Porch
revised by City Colleges of Chicago programmers

Instructional Objective: To explain the process of mitotic cell division.

Description: Index (accessible through DATA)

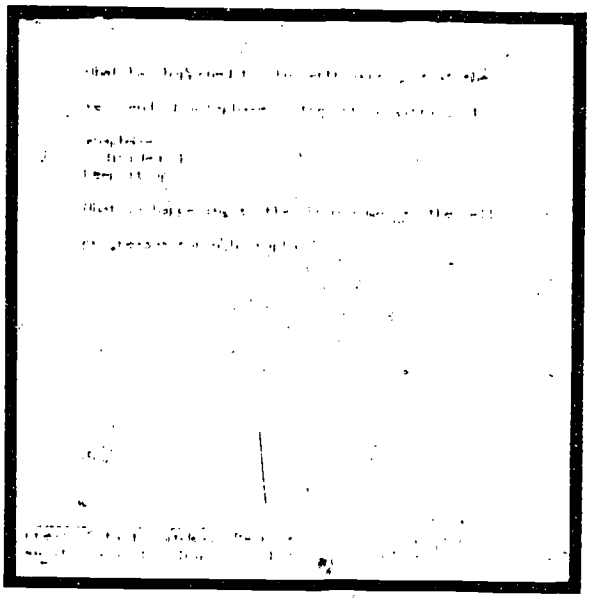
Branch--DATA1 for diagram, LAB1 for description

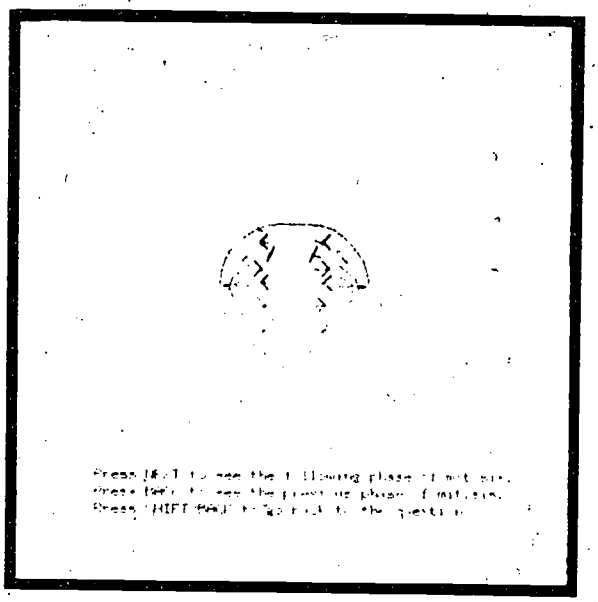
1) Introduction--role of mitosis, two questions
2) Interphase--three questions about process
3) Prophase--six questions
4) Metaphase--three questions
5) Anaphase--two questions
6) Quiz--ten questions
7) Data--graphs of student performance in each of the above sections

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: Especially adapted for emphasizing sequential nature of process. Optional branch sequences accommodate a wide variety of learning styles, e.g., the student who learns with visual models can complete this lesson relying mainly on those sequences. Comprehensive evaluation at end of each unit.





File Name: bioindex-5b1
Meiosis

ecs: 3688

Authors: R. Arsenty
revised by M. Manteuffel and S. Boggs

Instructional Objective: To identify when, where, why, and how meiosis occurs.

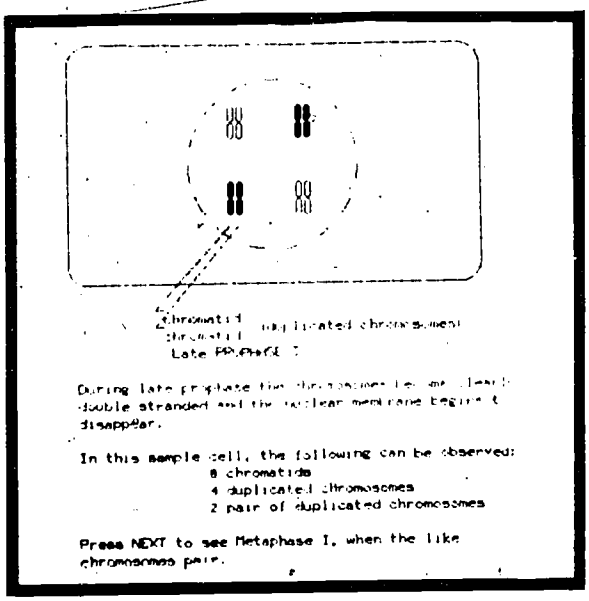
Description: Index (accessible through TERM-index)

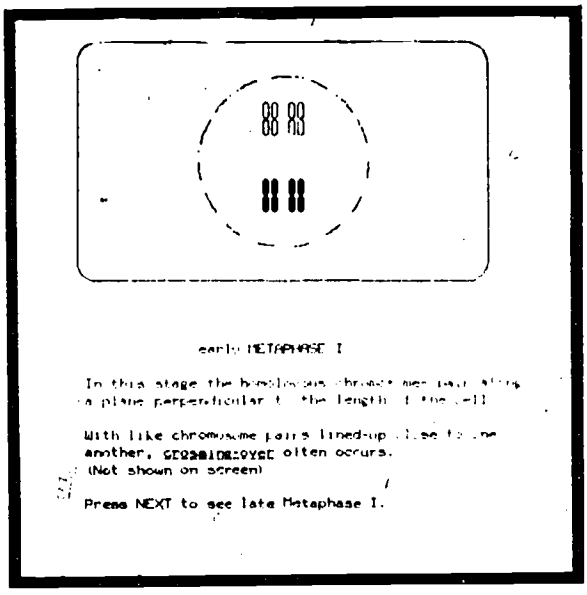
1) Introduction
   a. Overview
   b. Lesson objectives
   c. Table of comparison of mitosis and meiosis--questions
   Definitions accessible at end of Introduction via HELP.
2) Meiosis I--labelled diagrams, animation and discussion of phases, one question
3) Meiosis II--animation and discussion of phases
4) Fertilization--animation and discussion
5) Seven review questions--definitions accessible via HELP before quiz

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: This lesson was designed to utilize animations for emphasizing the continuity of the meiotic process. Presentation of lesson is such that the student is not dependent on knowledge of terminology. However, animations are accompanied by detailed descriptions. Comprehensive topic coverage.





File Name: bioindex-5b2 ecs: 7561
Meiosis

Author: L. Porch, revised by Chicago City Colleges Programmers

Instructional Objectives: To know the differences between mitosis and meiosis.
To describe the process of meiosis using the terms homologous chromosomes, haploid, diploid, chromatids, synapsis, gamete.
To know the events of each phase of meiosis.

Description: Index (accessible through DATA)

1) Introduction: role of meiosis in living organisms, homologous pairs of chromosomes, distinguishing meiosis and mitosis, reviewing mitotic phases; includes 13 questions
2) Phases of Meiosis I: description of events; DATA1 diagram comparing early stages of meiosis and mitosis, also all stages of meiosis; 9 questions based on discussion and analysis of diagrams
3) Phases of Meiosis II: description; DATA1 for diagrams; 9 questions
4) Quiz--9 questions

Student Time: 60 minutes

Instructional Strategy: Tutorial

Special Notes: Ability to view sequential diagrams of the phases helps student grasp process.

File Name: bioindex-5c1 ecs: 4188
Embryonic Development in Animals

Authors: C. Matz, M. Yamada, S. Boggs, and J. Sweany

Instructional Objectives: To describe development from the fertilized egg to formation of the three germ layers.
To identify the major adult derivations of these three germ layers.

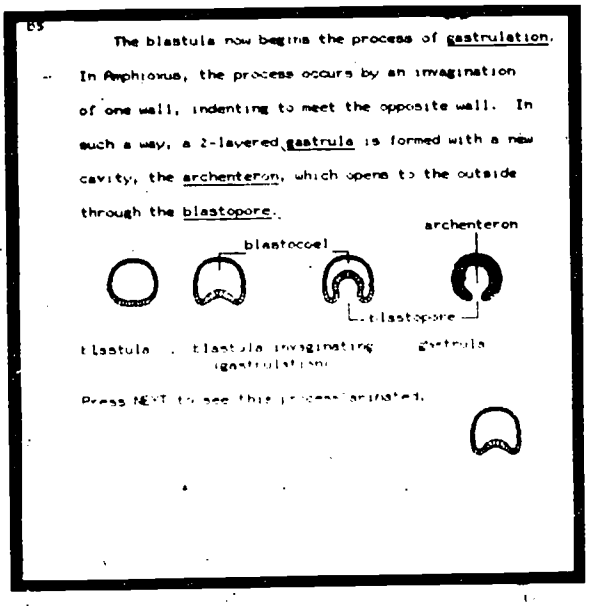
Description: Index (accessible through DATA)

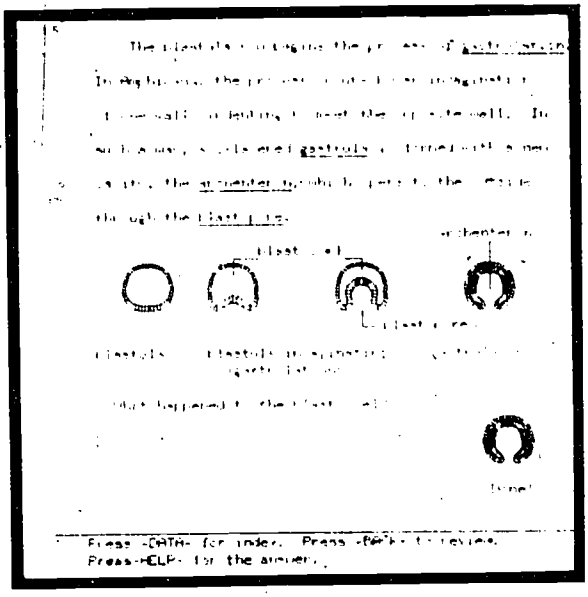
1) Introduction, five objectives, three pretest items
2) Embryonic development in Amphioxus
   a. Cleavage
   b. Blastulation
   c. Gastrulation--includes animated sequence
   d. Formation of mesoderm
   e. Notochord formation, neural groove and tube--eight questions, diagrams
3) Posttest--twenty questions
4) Data on student performance

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: Comprehensive coverage for elementary presentation. Excellent supplement. Animation of gastrulation very helpful for envisioning process.





File Name: bioindex-5d1 ecs: 7339
Plant Life Cycles

Authors: A. Haney and G. May

Instructional Objectives: To construct a diagram of a generalized plant life cycle given the components.
To discuss the relationship between gametophyte and sporophyte generations.
To know how this relationship differs throughout the plant kingdom with special emphasis on evolutionary significance.

Description: Index (accessible through TERM-index)

1) Introduction
   a. Alternation of generations--two forms, two processes
   b. Evolutionary requirements
   c. Meiosis
2) Algae--importance. representative slides (diatoms, Volvox, Ulothrix, Oedogonium, Spirogyra), a diagram of simplified algal life cycle
3) Bryophytes--representative slides (Mnium, Polytrichum, Marchantia), life cycle diagram, slides of moss life cycle stages
4) Ferns--representative slides (Christmas fern, walking fern, maidenhair fern), fern life cycle including description
5) Gymnosperms--representative slides (Gingko biloba, bald cypress, Douglas fir, white pine), slides of Austrian pine life, schematic diagram of pine life cycle
6) Angiosperms--distinctive features, modifications, fruits (discussion includes slides), schematic diagram of life cycle stages
7) Summary and overview--five questions, advantages and disadvantages of haploidy and diploidy

Student Time: 90 minutes

Instructional Strategy: Tutorial

Special Notes: Designed as lab replacement. This is an evolutionary presentation of the topic. Microfiche required.

File Name: bioindex-6a1 ecs: 4825
DNA and Protein Synthesis

Authors: P. Tenczar and R. Baillie

Instructional Objectives: To discuss the process of protein synthesis.
To order the protein assembly mechanism given three amino acids and corresponding mRNA codes.

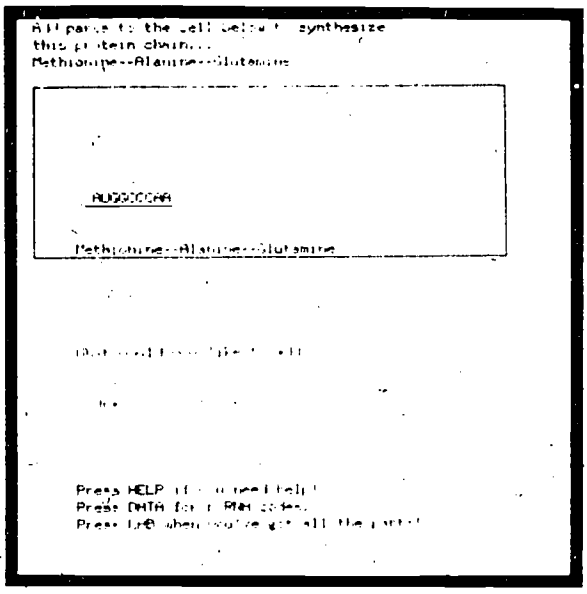
Description: Index (accessible through TERM-index)

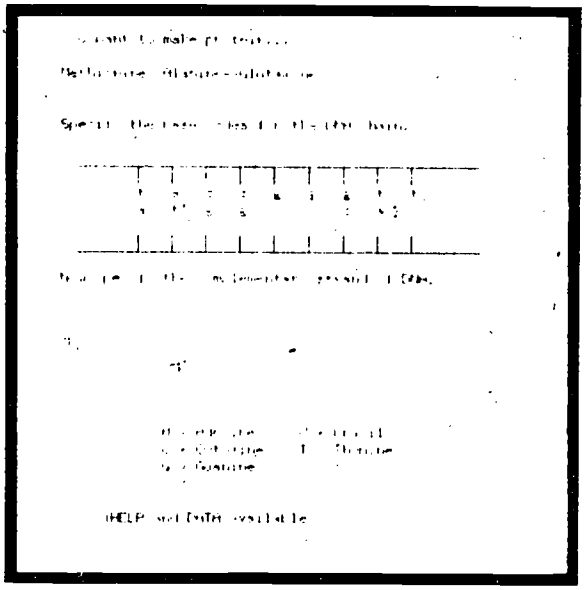
1) Summary and introduction to DNA, RNA, the genetic code and and protein synthesis. Concludes with step-by-step explanation accompanying an animation of the process.
2) Student-directed protein assembly; given three amino acids and corresponding mRNA codes, determine the DNA and tRNA codes. If everything is designated correctly, the student sees an animation and explanation of the process. BACK enables student to change designations.

Student Time: 40 minutes

Instructional Strategy: Simulation/Practice

Special Notes: In assembling the protein the student must not only designate correct nitrogenous base pairs but must also specify the needed parts (i.e., DNA, ribosome, etc.). Knowledge of cell ultrastructure is assumed.





File Name: bioindex-6a2 ecs: 5204
DNA, RNA, and Protein Synthesis

Author: R. Arsenty

Instructional Objectives: To distinguish the structure and function of DNA and RNA.
To pair nitrogenous bases in DNA, mRNA and tRNA.

Description: No index

1) Discussion of DNA and RNA
2) Occurrences during cell division--DNA replication animation
3) Occurrences between cell division
4) Supply correct base codes for DNA, mRNA, tRNA given amino acids and corresponding mRNAs
5) Assemble components in "model" cell

Student Time: 15 - 30 minutes (depends upon number of proteins assembled)

Instructional Strategy: Simulation/Practice

Special Notes: Participation in the assembly animation facilitates comprehension of the concept. Lesson only tests ability to manipulate base pairs.

File Name: bioindex-6b1 ecs: 4717
Vocabulary Drills for Genetics (Part I)

Authors: J. Lendway and J. Sweany

Instructional Objective: To define common terms used in the study of genetics.

Description: Index (choice of lists) (accessible through BACK1)
Format same as bioindex-6b2.

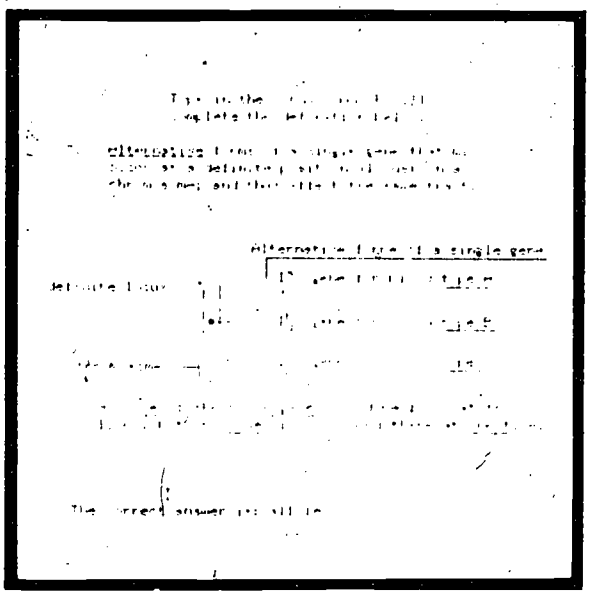
Lists:

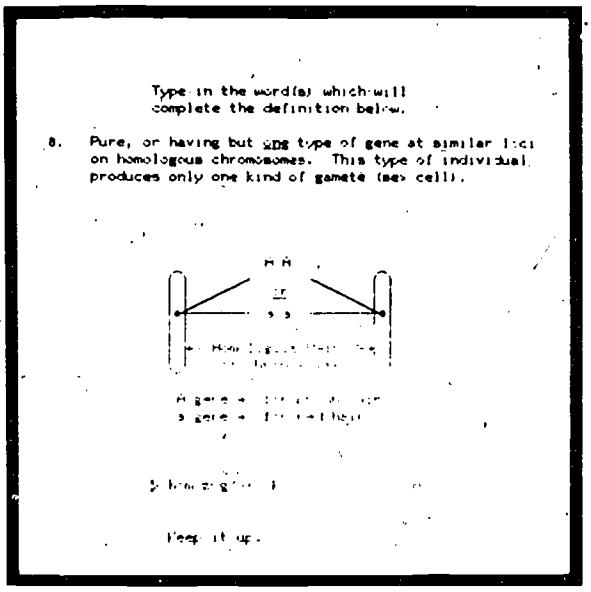
a	b	c	d
hybrids	gamete	dominance	dihybrid cross
homologous chromosomes	phenotype	Punnett square	crossing-over
heterozygous	fertilization	probability	linkage
gene	zygote	recessive	recombinants
locus	law of segregation	monohybrid cross	autosomes
character	genotype	F_2	carrier
homozygous	genome	test cross	sex chromosome
genetics	meiosis	F_1	law of independent assortment
allele	diploid number	genetic probabilities	lack of dominance (codominance)
chromosome	haploid number	P	sex linkage

Student Time: 50 minutes

Instructional Strategy: Practice

Special Notes: Format enables flexibility in usage. The terms included in each category can often be identified with a common theme.





File Name: bioindex-6b2 ecs: 4197
Vocabulary Drill for Genetics (Part II)

Authors: J. Lendway and J. Sweany

Instructional Objective: To define frequently used genetic terms.

Description: Index (choice of lists) (accessible through BACK1)

1) See list of words contained in category
2) Complete or incomplete definitions appear sequentially; definitions often include descriptive diagrams
3) Student supplies term or completes definition HELP available; must complete all without HELP to continue
4) BACK accesses summary of terms with definitions that are completed
5) LAB enables student to repeat lists, but this also negates option to see completed summary

Lists:

a	b	c	d
sex-influenced traits	genetic interaction	hybridization	hemophilia
sex-limited traits	polygenetic inheritance	deletion	Duchenne's muscular dystrophy
chromosome mapping	Barr body	duplication	Huntington's chorea
backcross	expressivity	hybrid vigor	sickle cell anemia
trisomy	multiple alleles	mutation	Down's syndrome
pedigree	epistatic gene	inversion	Tay Sach's disease
non-disjunction	polyploid	germinal mutation	Turner's syndrome
karyotype	complementary genes	translocation	Klinefelter's syndrome
reciprocal cross	epistasis	somatic mutation	outbreeding
cross-over unit	penetrance	lethal gene	inbreeding

Student Time: 50 minutes

Instructional Strategy: Practice

Special Notes: Format enables flexibility in usage. The terms included in each category are often related in some way.

File Name: bioindex-6c1 ecs: 5989
Elementary Probability and Mendel's Laws

Authors: R. Baillie and G. Hyatt

Instructional Objectives: To define probability.
To demonstrate Mendel's laws.
To manipulate probability problems and genetic crosses.

Description: Index (accessible through TERM-index)
Introduction

Part A. Probability--includes working definition, simulations
1. Coin tossing experiment
2. Dice throwing experiment
3. Calculating probabilities
4. Summary of probabilities

Part B. Heredity and genetics--perform crosses, analyze results with Punnett square
*5. Monohybrid crosses
*6. Dihybrid crosses
7. Heredity of human blood types (BACK from this section accesses 6e1)
*8. Summary of heredity and genetics

*also bioindex-6c2

Student Time: 40 - 50 minutes

Instructional Strategy: Tutorial

Special Notes: There is a handout to accompany this lesson.
Requires brief introduction and summary without handout; lesson is useful as laboratory replacement.

File Name: bioindex-6c2 ecs: 2499
Genetics and Heredity

Authors: R. Baillie and G. Hyatt (edited for Introductory Botany by J. Noell)

Instructional Objective: To identify important principles of genetics concentrating on plants.

Description: Index (accessible only at the conclusion of a section)

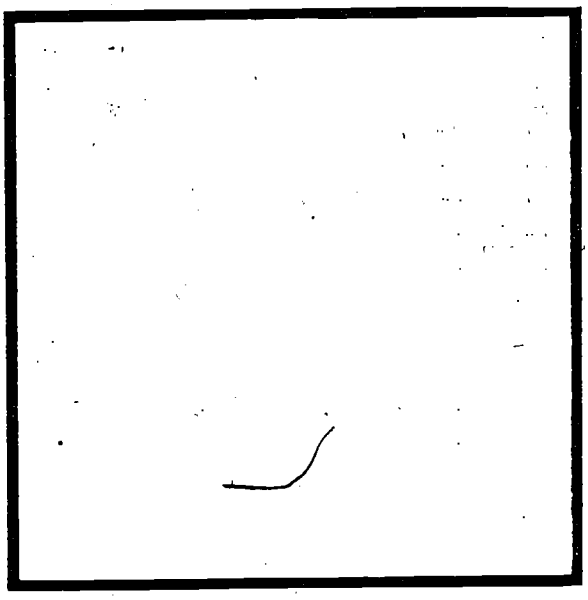
1) Monohybrid crosses--accounting for Mendel's laws
   a. Mendel's laws, sample cross F_1 and F_2 generations
   b. Terminology
   c. Punnett square--monohybrid crossing problem for the student to solve
2) Dihybrid crosses
   a. Deriving the phenotypic ratios of a dihybrid cross
   b. Sample dihybrid cross
   c. Student sets up crosses (can be done 0 - many times)
3) Summary of heredity

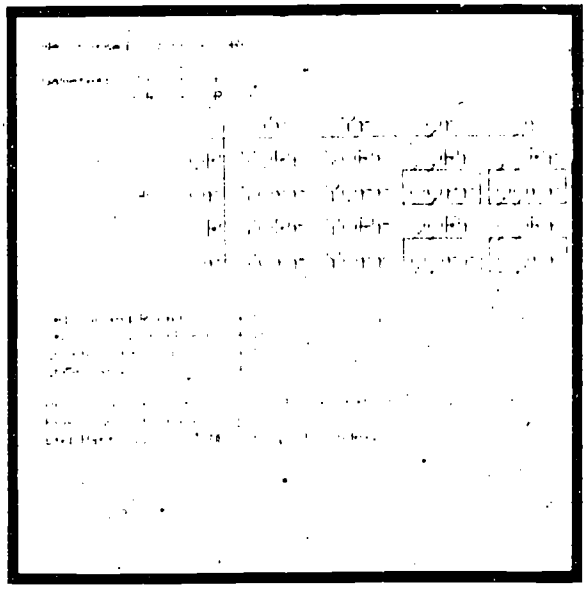
(same as 5, 6, 8 in bioindex-6c1)

Student Time: 35 minutes

Instructional Strategy: Tutorial

Special Notes: Very clear, concise lesson, good presentation of topic. Appropriate for use in conjunction with genetics vocabulary drills (6b1).





File Name: bioindex-6d1 ecs: 6201
Drosophila Genetics

Authors: J. Denault, G. Hyatt, P. Tenczar, D. Eades

Instructional Objective: To deduce patterns of inheritance through genetic crosses with Drosophila.

Description: Choice of crosses

1) Monohybrid cross
2) Dihybrid cross I
3) Dihybrid cross II
4) Sex-linked cross
5) Mystery cross (one of the first four types of crosses)
6) Chi-square statistical analysis (same as bioindex-1a1)

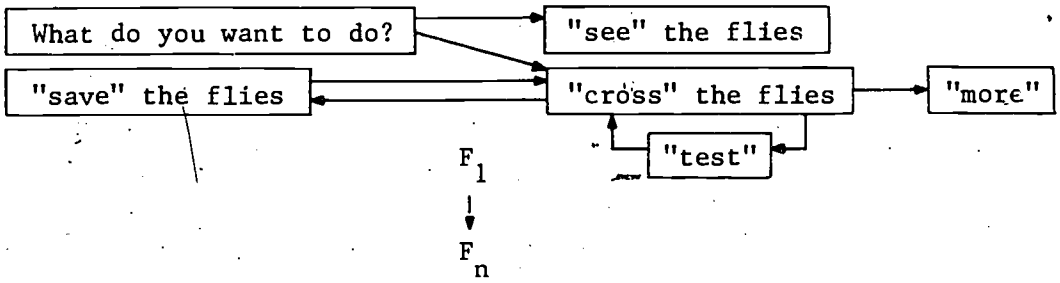
At start of each unit the student is asked "What do you want to do" Simulation allows six activities.

"cross" -- mate two flies
"more" -- get more flies from same cross
"save" -- save flies by their number (1 - 18)
"see" -- examine up to four flies
"test" -- perform a chi-square test
"mutant"-- see types of flies

Student Time: 45 minutes (depends on the number of problems attempted)

Instructional Strategy: Simulation

Special Notes: There is a laboratory manual available for this lesson. The manual consists of introductory and background material in addition to defined problems. This lesson requires such supplemental information whether by lecture or by handout. Some instruction in how to flowchart the activities would facilitate lesson usage.



Lesson assumes familiarity with principles of Mendelian genetics.

File Name: bioindex-6d2 ecs: 6594
Gene Mapping in Diploid Organisms

Author: K. Frank

Instructional Objectives: To explain the process of crossing-over.
To calculate gene distances and order from crossover frequencies.

Description: Table of Contents (only accessible at end of each section)

1) Introduction--includes comparison of linkage and independent assortment
2) Demonstration of the direct relationship between gene distance and the frequency of cross-over--twenty trials
3) Mapping two genes on a chromosome with sample problems
4) Mapping three genes on a chromosome
5) Procedure for determining the order of genes on a chromosome
6) Determination of the coefficient of coincidence and interference
7) Modifiers which affect cross-over frequency
8) Practice problems

Student Time: 60 - 90 minutes

Instructional Strategy: Tutorial

Special Notes: Very clear, concise presentation. First three sections particularly appropriate for introductory biology courses. Remaining parts are more advanced.

File Name: bioindex-6d3 ecs: 2129
Plant Genetics Problems

Authors: J. Noell, G. May, A. Haney, and J. Silvius

Instructional Objective: To determine genetic composition of parents from progeny when one or two traits are involved.

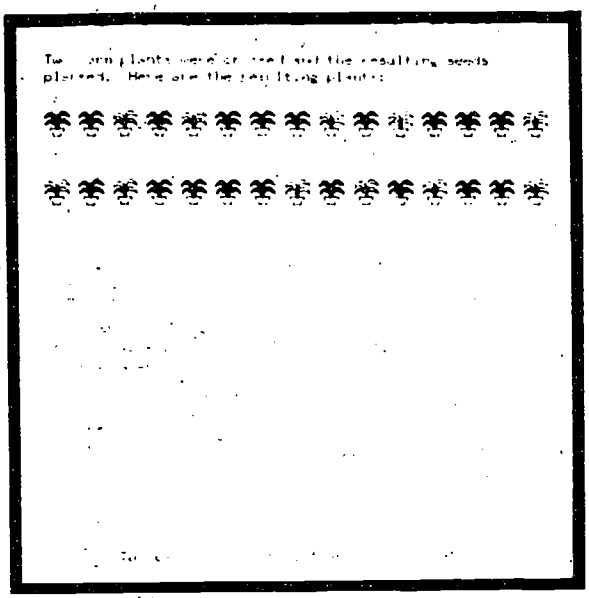
Description: No index (TERM-begin allows return to start of lesson anytime)

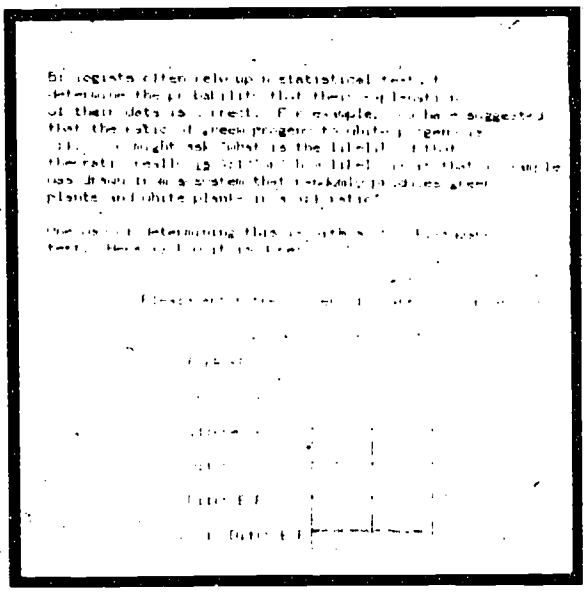
1) Albino-normal corn plant problem--designate parental genotype from progeny
   a. Data collection from monohybrid cross
   b. Chi-square analysis of data
2) Dihybrid corn kernel problem--HELP sequence for designating parental genotypes
3) Eight questions

Student Time: 20 minutes

Instructional Strategy: Inquiry

Special Notes: This lesson assumes familiarity with basic genetics and terminology and requires much student interaction. Good sequel to bioindex-6c2. Lesson designed as laboratory replacement.





File Name: bioindex-6e1 ecs: 3084
Blood Typing

Authors: L. Porch and M. Yamada

Instructional Objective: To list steps in laboratory determination of blood types.

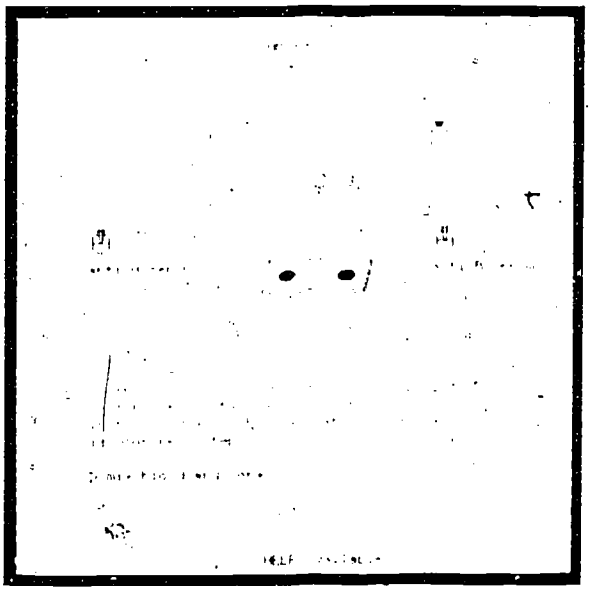
Description: Index (accessible through TERM-index)

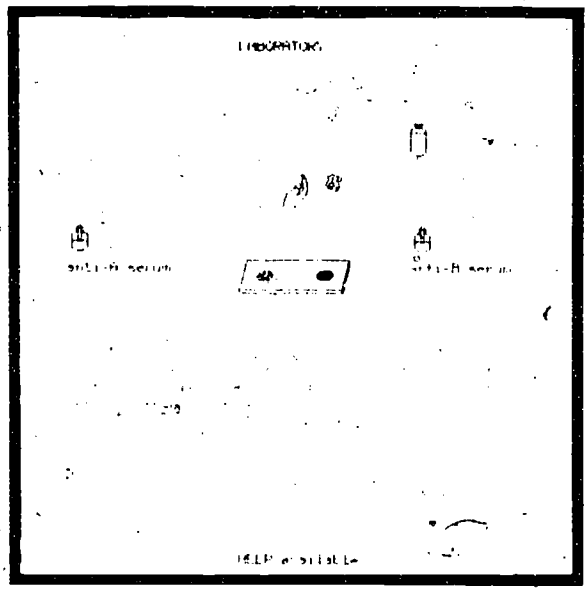
1) Introduction
   a. Objective
   b. Discussion of transfusions, antigens, antibodies, transfusion relationships, blood proteins
2) Going to the storeroom (student requests needed equipment for experiment on blood determination)
3) Going to the laboratory (student performs experiment using a patient PLATO provides and the equipment from the storeroom); must go the storeroom first
4) Summary of blood types--must find a blood type to see review questions, can repeat with new blood samples
5) Four review questions

Student Time: 30 minutes

Instructional Strategy: Simulation

Special Notes: An excellent preparatory activity prior to an actual laboratory experience or especially enriching when lab experience is not possible. HELP is always available.





File Name: bioindex-7a1 ecs: 2879
Genetic Drift

Authors: G. Hyatt and J. Denault

Instructional Objective: To deduce the effect of genetic drift by observing changes in gene frequency.

Description: Index (accessible through TERM-index)

1) Genetic Drift
   a. Brief review of natural selection
   b. Explanation of experiment
   c. Experiment—population size (number of progeny) = 50
      i. PLATO randomly selects 10 parents for next generation. Program tabulates frequency of genotypes in population along with genotypes of parent selected for next generation. Student must run at least 2 trials; it is recommended that a trial consist of 15 - 20 generations. Single question based on data.
      ii. Student designates number of parents for each trial; PLATO randomly selects frequency data as above. Lesson completed after 5 trials; 4 problems to solve with data.
2) Random Drift
   a. Student selects number of progeny (2 - 1000) and number of parents (2 - 100)
   b. Same data tabulated

Student Time: 40 minutes (variable)

Instructional Strategy: Model

Special Notes: Student is expected to plot data (frequency vs. generation) off-line. Knowledge of the Hardy-Weinberg principle and equation is assumed. A workbook is designed to accompany the first part of the lesson, which contains a brief introduction, graphs for plotting the data, and a restatement of the 4 problems introduced in the lesson. The second part is too flexible for the introductory student without explicit definition of problems to be solved using the data.

File Name: bioindex-7a2 ecs: 4505
Population Genetics (Demonstration of Inbreeding)

Authors: M. Grossman and D. Walter

Instructional Objective: To deduce how the degree of inbreeding affects the loss of heterozygosity.

Description: Table of Contents (accessible through shift-HELP)

1) Regular inbreeding system
   a. Choose inbreeding method--choice of eight including selfing, brother-sister mating, etc.; also may study differences between two breeding methods
   b. Designate number of generations to be used
   c. Enter initial level of inbreeding ($0 \leq N \leq 1$)
   d. Level of inbreeding in previous generation where applicable
   *e. Program generates graph of inbreeding coefficient vs. generations
2) Irregular inbreeding system
   a. Enter individual inbreeding--create by mating existing members or specifying individuals from outside the breeding pattern
   b. Assign coefficient of inbreeding for starting generation
   c. Specify coefficient of relation
3) Lesson--Hardy-Weinberg--bioindex-7a3
4) Lesson--Quantitative Genetics--bioindex-7a4

*There are many options available from graphical displays, e.g., one may alter parameters, replot, clear, etc.

Student Time: Variable, 10 minutes - ???

Instructional Strategy: Model

Special Notes: Most of this lesson is somewhat advanced for the introductory student. However, the regular inbreeding simulation could be used on an introductory level. To manipulate the parameters effectively, the student should know Wright's inbreeding coefficient, inbreeding methods and systems. Also to facilitate use of the simulation, the activities could be flowcharted by the instructor.

File Name: bioindex-7a3 ecs: 6627
Population Genetics (Hardy-Weinberg Principle)

Authors: M. Grossman, D. Walter, D. Chirolas

Instructional Objective: To deduce the effects of mutation, migration, selection and drift on gene frequency.

Description: Table of Contents (accessible through shift-HELP)

1) Calculator
2) Mutation simulation
3) Migration simulation
4) Selection simulation
5) General graphical simulation
   a. Choose axes
   b. Specify limits for plotting
6) Sex-linkage simulation
   a. Specify initial value of q for males and females
   b. Simulation assumes ten generations of breeding
7) Simulation of genetic drift in small populations--effect of random mating in a small population
   a. Choose size of population
   b. Select initial values of q
8) Simulation of two locus effects--simulates successive generations of random breeding large enough to avoid drift
   a. Specify gene frequency of populations or allow random generated frequencies
   b. Choose coefficient for probability of cross-over
9) Jumpouts to bioindex-7a2 and bioindex-7a4

Specify:
a. limits for the generations used in simulation
b. initial values of q
c. frequency of A_2 allele for a single locus A with 2 alleles A_1 and A_2

Student Time: Variable, minimum of ten minutes depending on number of simulations

Instructional Strategy: Model

Special Notes: Assumes familiarity with Hardy-Weinberg principle and assumptions thereof. Preparation for the lesson should include a discussion of the mathematical representation $p^2 + 2pq + q^2$ and the meaning of these values. A handout is available. Parts of this lesson are adaptable to introductory courses.

File Name: bioindex-7a4 ecs: 2570
Population Genetics (Quantitative Genetics)

Authors: M. Grossman and D. Walter

Instructional Objective: To deduce the effects of various selection methods and intensities on representative traits from agricultural production.

Description: Table of Contents (accessible through shift-HELP)

1) Simulation of selection effects on various traits and selection methods
   a. Choose trait--e.g., milk yield (kg) in dairy cattle, egg production (number) in chickens, or swine litter size (number of pigs)
   b. Designate selection for males and females--single method or independent selection methods
   c. Choose selection system--mass or individual, family selection, progeny testing, etc.
   d. Indicate genetic relationship--where applicable
   e. Choose family size
   f. Choose selection intensities--small and large populations
   g. Number of generations
   h. Program generates graph of improvement vs. generations
2) Jumpout to Hardy-Weinberg lesson, bioindex-7a2
3) Jumpout to Inbreeding lesson, bioindex-7a3

Student Time: Variable, 10 minutes - ???

Instructional Strategy: Model

Special Notes: Can be used very effectively to obtain data on the success of various selection procedures. Requires explanation of parameters in order to successfully manipulate these values to obtain meaningful data.

File Name: bioindex-7b1 ecs: 4828
Natural Selection

Author: G. Hyatt

Instructional Objectives: To know that natural selection must exist in free-living populations.
To understand that in absence of mutation, selection and other variables, gene frequencies are in equilibrium.

Description: No index (BACK activated throughout most of the lesson)

1) Introduction and conclusions based on sample dog population that:
   a. Species overproduce and not all progeny survive
   b. Individuals vary
2) Natural selection in terms of reproduction and survival
3) Hardy-Weinberg Equation
   a. Derivation from Punnett square of parental gametes
   b. Discussion of gene frequencies
   c. Assumptions
   d. Determining p and q in absence of mutation, selection, etc.; data of observed phenotypes for "taster and non-tasters"; questions
4) Effect of natural selection on gene frequencies (p and q); background information on industrial melanism; moth catching experiment (see bioindex-7b2)

Student Time: 50 minutes

Instructional Strategy: Tutorial/Inquiry

Special Notes: A handout is designed to accompany this lesson. However, besides a brief introduction, it only contains tables and graphs for recording data.

File Name: bioindex-7b2 ecs: 5641
Natural Selection Model

Author: G. Hyatt

Instructional Objective: To deduce the effects of natural selection by observing survival values of moth populations.

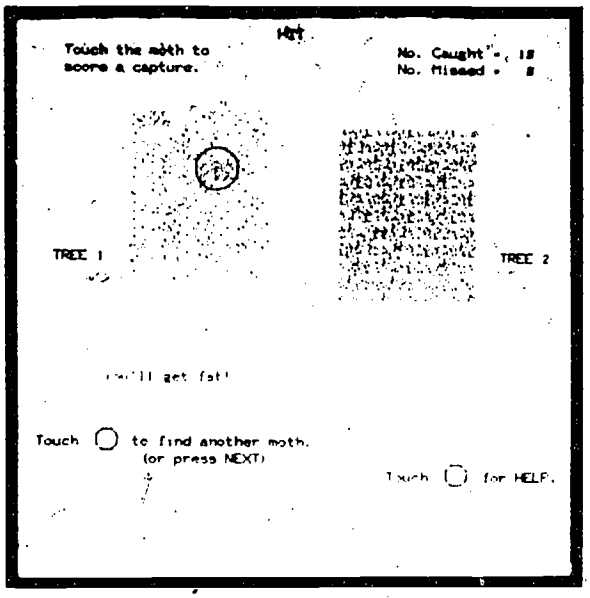
Description: No index

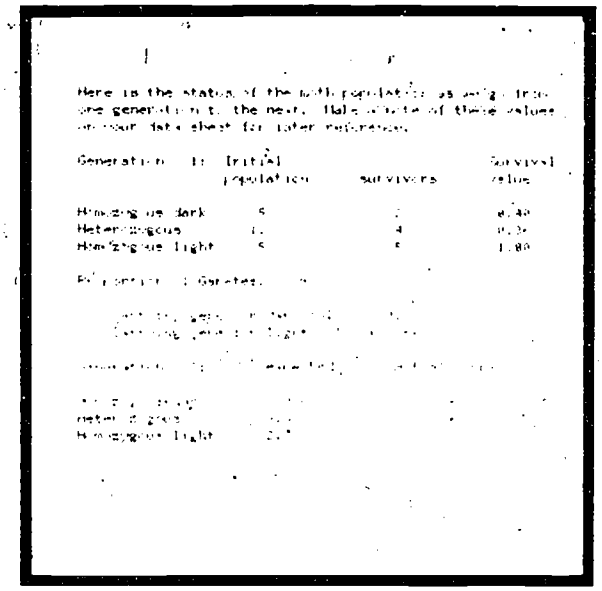
1) Introduction--identification of trees and moths
2) Moth catching (student must choose to catch 10, 20, or 40)
   a. 1850--starting population: homozygous dark (50%), homozygous light (50%); expected and actual genotype frequencies and survival value tabulated for each generation; repeat for three generations
   b. 1950 (100 generations later)--same starting population as above with greater proportion of dark trees
   c. 2 questions based on data
   d. Wright adaptive landscape

Student Time: 30 - 40 minutes

Instructional Strategy: Simulation/Inquiry

Special Notes: This lesson does not access the background information on industrial melanism presented in 7b1. A lab manual containing graphs and tables for data and a flowchart of activities is available. If this lesson is used independent of 7b1 and/or the manual, an introduction and description of ways to use the data is required. The lesson may be used with a touch panel.





File Name: bioindex-7c1 ecs: 3450
Comparative Serology as Evidence for Evolution

Author: G. Hyatt

Instructional Objective: To describe how the precipitin test can reveal relationships between organisms.

Description: No index

1) Introduction
2) The precipitin test and homology
3) The mammal experiment
   a. Student finds degree of relationship of different mammals by requesting precipitin tests
   b. Summary
4) The insect experiment
   a. Student finds degree of relationship of different insects
   b. Summary
5) Review options

Student Time: 30 - 45 minutes

Instructional Strategy: Inquiry

Special Notes: Without the lab manual designed to accompany this lesson, a brief introduction including definition of terminology and problem description is required.

File Name: bioindex-7d1 ecs: 3483
Induced Mutations Experiment using Aspergillus

Author: J. Noell

Instructional Objectives: To describe a method to determine mutation frequencies.
To calculate mutation rate.

Description: No index

1) Introduction
2) Life cycle of Aspergillus
3) Experiment
   a. Tools of the experiment
   b. Questions to answer during the experiment
   c. Induced mutation flowchart
   d. Induced mutation experiment
   e. Calculations a - f

Student Time: 20 - 40 minutes

Instructional Strategy: Simulation

Special Notes: This lesson was designed as a lab replacement and requires summary remarks about the significance of the results.

File Name: bioindex-8a1 ecs: 3568
Biogeochemical Cycles

Authors: R. Baillie and G. Hyatt

Instructional Objective: To generate the four most important biogeochemical cycles.

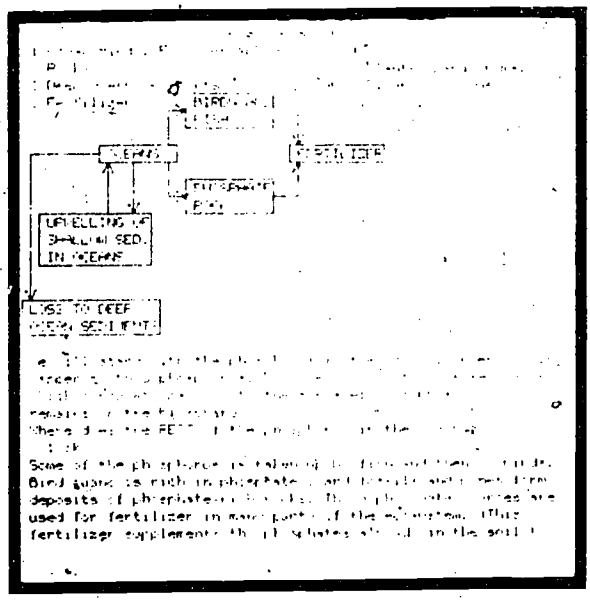
Description: Index (accessible through TERM-index)

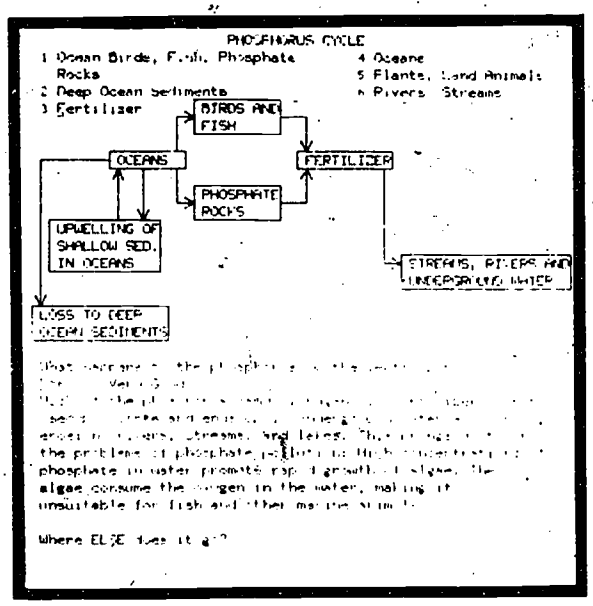
1) Introduction
2) Oxygen cycle
3) Carbon cycle
4) Nitrogen cycle
5) Phosphorous cycle

Student Time: 20 minutes

Instructional Strategy: Inquiry

Special Notes: For each cycle a list of the important parts of the cycle is provided. The student is required to give the sequence for each cycle (by answering questions of the nature "Where does it go from here?"); in doing so, the entire cycle is diagrammed. Many clues are provided in feedback statements. An introduction and summary are recommended. Lesson traces elements within compounds--not just pure molecular forms.





File Name: bioindex-8b1 ecs: 6552
Energy Relationships in Biological Systems

Authors: R. Baillie and G. Hyatt

Instructional Objectives: To know the basic laws of thermodynamics and how they apply to energy flow in biological systems.
To measure efficiency of food chains.

Description: Index (accessible through TERM-index)

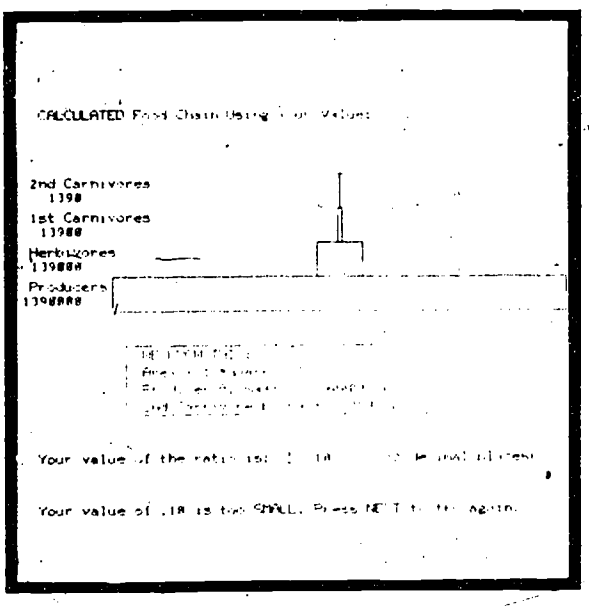
Part A. First and second laws of thermodynamics
1) Definitions and examples of energy and work; examples of conversion of energy
2) The first law of thermodynamics (the law of conservation of energy)
3) Illustrations of the first law: pulleys and weights, the pendulum
4) The second law of thermodynamics: heat flow and equilibrium
5) The second law: gas molecules, entropy, and randomness

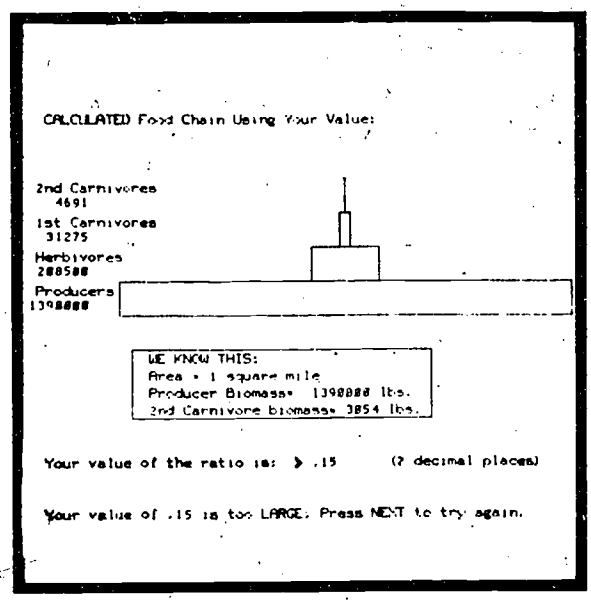
Part B. Energy in biological systems
6) Energy and biomass pyramids
7) Summary of a simple food chain
8) Finding the efficiency of a food chain
9) Finding the producer biomass
10) Other models of food chains: green plants; plants and herbivores; one predator, two prey

Student Time: 40 minutes

Instructional Strategy: Inquiry

Special Notes: Brief treatment of all the factors one must consider concerning this topic.





File Name: bioindex-8c1 ecs: 6112
Predator-Prey Relationships

Authors: R. Baillie and G. Hyatt

Instructional Objective: To learn basic principles of predator-prey relationships from models of such systems.

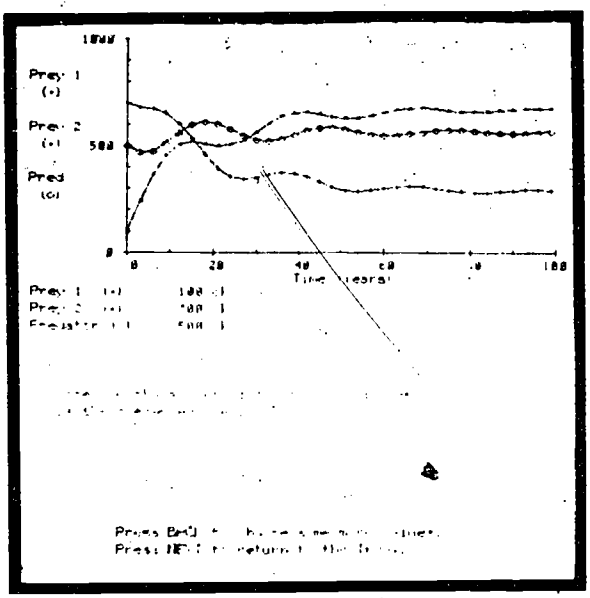
Description: Index (accessible through TERM-index)

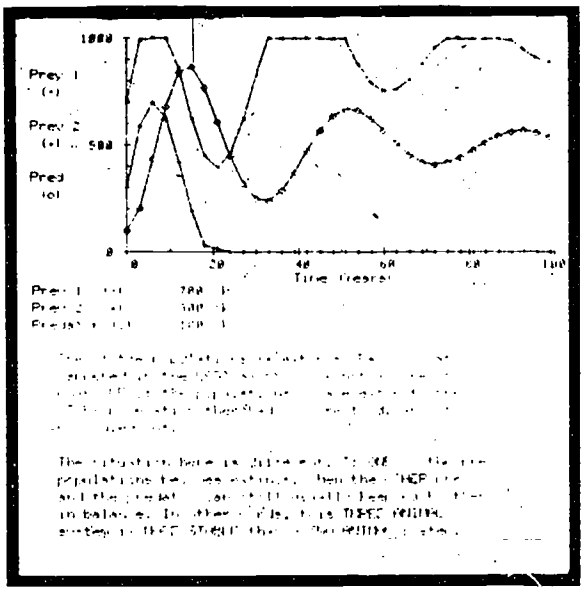
1) Competitive exclusion principle--graphic representation
2) Exponential growth--growth in unlimited environment, graph
3) Logistic growth--growth in finite environment, LAB for experimentation with variables
4) Predator-prey interaction: one predator, one prey--graphs; 4 questions
5) Mutual predation--graph with independent experiment
6) One predator, two prey--graph with independent experiment
7) Prey density experiment--grub-catching concept (number caught depends on number available); LAB accesses graph

Student Time: 30 minutes (variable)

Instructional Strategy: Inquiry

Special Notes: Lesson is fairly self-sufficient. Illustrates the dependence of population stability upon complexity.





File Name: bioindex-8d1 ecs: 3093
Buffalo--Animal Population Experiment

Authors: C. Burson and T. Gordon

Instructional Objective: To manage animal populations by altering a variety of parameters in a model.

Description: No index

Introduction--includes interpretation of population graphs

1) Initialize herd population
   a. Select total herd population or
   b. Select individual population of adults, yearlings, and calves
2) Select harvesting policies
3) Summary of herd population and harvesting policies
4) Experiment: graph and data (total population vs. year)
   LAB--alters mortality and birth rates
   s --severe winter

Student Time: 25 - 45 minutes (depending on how many experiments the student wishes to conduct)

Instructional Strategy: Model

Special Notes: This lesson has a lab manual to accompany it. In addition to a reiteration of that which is on-line, it includes a description of several problems. An orientation lecture could provide such guidance in the absence of a handout. The flexibility of the simulation enables much freedom for the instructor.

File Name: bioindex-8d2 ecs: 4012
Population Dynamics

Author: S. Boggs

Instructional Objective: To describe the parameters of human population growth and how they affect changes in the population.

Description: No index

1) Introduction--enumeration of parameters
2) Projections of population growth--six options with parameters that can be altered
   for U.S.
      a. overall population in the future
      b. female population in the future
      c. male population in the future
      d. changes in the profile
   general
      e. population growth at some rate
      f. compare two growth rates

HELP accesses additional instructional information as:
   a. meaning of the parameters
   b. what parameters to change
   c. what the graphs show
   d. meanings of some terms
   e. how the projection works

Student Time: 15 - 30 minutes

Instructional Strategy: Model

Special Notes: A handout designed by the author defines several problems for the student that can be answered using this lesson. This information could be supplied in a supplemental lecture.

File Name: bioindex-8d3 ecs: 1500
Populations Laboratory Using E. Coli

Author: J. Noell

Instructional Objectives: To describe how populations grow.
To identify factors affecting the growth of bacterial populations.

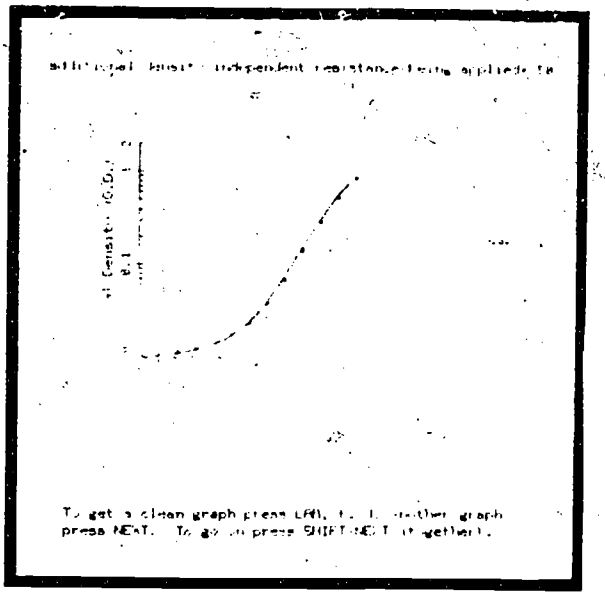
Description: No index

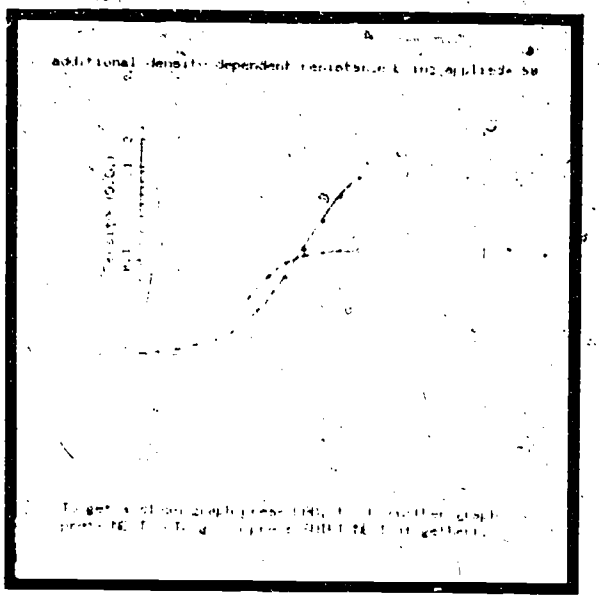
1) Introduction
2) Population growth discussion with graphs--semilog and linear
3) Environmental resistance--density-dependent and density-independent
4) Experiment--student sets parameters (resistance type and severity), can repeat with different parameters and compare values on same graph
5) Three questions

Student Time: 15 - 25 minutes

Instructional Strategy: Tutorial/Model

Special Notes: Designed as lab replacement





File Name: bioindex-8d4 ecs: 2670
Stationary Phase of Cell Growth

Authors: R. Francis with S. Kaplan and D. Burke

Instructional Objectives: To explain the growth curve in stationary phase and the relationship of the growth curve to viable cell count, total cell count, and cell mass.
To differentiate between graphs of stationary phase caused by toxic products and nutrient exhaustion.
To describe the effects of lysis and linear growth on cell growth curves.

Description: No index

1) Stationary phase
   a. What it is
   b. What causes it
   c. Definition and problems with viable and total cell count and cell mass
2) Graphs of cells in stationary phase caused by toxic products and nutrient exhaustion
3) Define lysis
4) Define linear growth--an animated comparison of linear and logarithmic growth

Student Time: 10 - 20 minutes

Instructional Strategy: Tutorial

Special Notes: This is the fifth in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

File Name: bioindex-8d5 ecs: 2333
Lag Phase of Cell Growth

Authors: R. Francis with S. Kaplan and D. Burke

Instructional Objective: To explain the growth curve in lag phase.

Description: No index

1) Characteristics and causes of lag phase
2) Shift-up and shift-down
3) Lag phase graphs

Student Time: 15 - 40 minutes

Instructional Strategy: Tutorial/Inquiry

Special Notes: This is the seventh in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

File Name: bioindex-8d6 ecs: 3548
Death Phase of Cell Growth

Authors: R. Francis with S. Kaplan and D. Burke

Instructional Objective: To explain growth curve in death phase.

Description: No index

1) Conditions that cause death phase
2) Explanation of the formula $N_n = N_0 e^{-kt}$
3) Death rate constant and some typical values
4) A practical exercise determining canning times for cooked foods

Student Time: 15 - 25 minutes

Instructional Strategy: Tutorial

Special Notes: This is the sixth in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

File Name: bioindex-9a1 ecs: 3970
Introduction to Seed Germination

Author: S. Wolniak

Instructional Objectives: To describe the processes of seed germination and seed dormancy.
To define optimum conditions for seed germination.

Description: No index

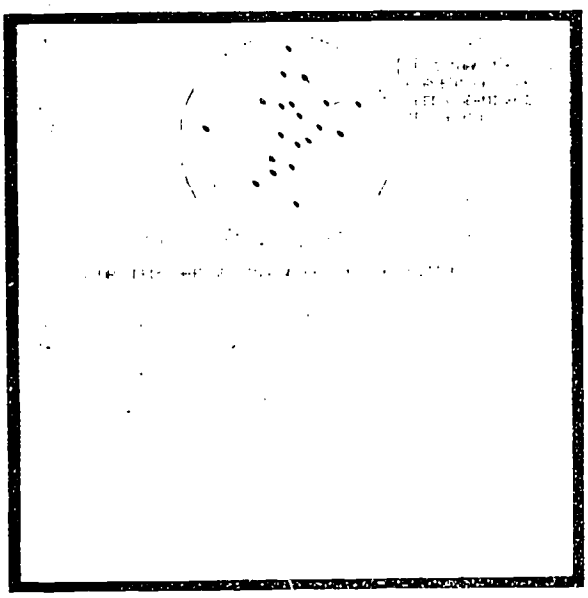
1) Introduction--HELP index
   a. Parts of a seed
   b. Fertilization
   c. First seed
   d. Anaerobic respiration
2) Factors which control seed germination: water (imbibition), oxygen, temperature
3) Dormancy in seeds: seed viability, historical background, storage, mechanisms
4) Experiment with lettuce seed germination; experimental variables include: photoperiod, hormones, color of light

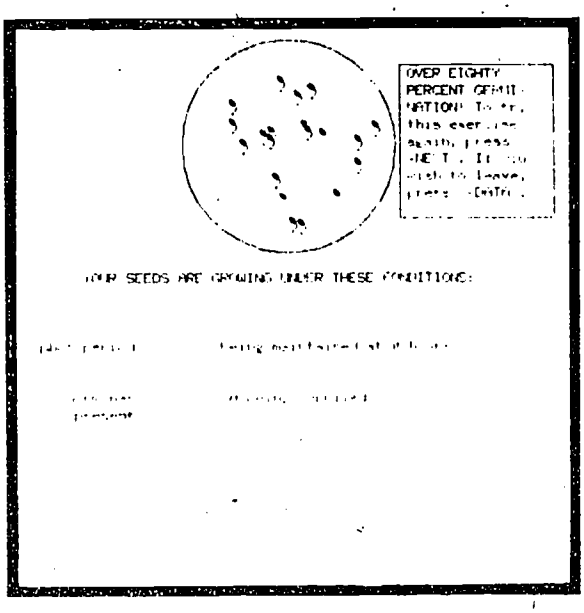
Note: Student must attain high percentage of seed germination in order to leave lesson.

Student Time: 30 - 40 minutes

Instructional Strategy: Tutorial

Special Notes: An understanding of the respiration process and familiarity with plant hormones are recommended. Designed as lab replacement. Summary required and/or on-line quiz follow-up (see appendix).





File Name: bioindex-9a2 ecs; 2212
Plant Growth

Authors: M. Manteuffel and J. Noell

Instructional Objectives: To explain the stages of sigmoid growth curve.
To evaluate results of student growth experiments with corn, beans, and peas.

Description: Index (accessible through TERM-index)

1) Growth curves
   a. The sigmoid growth curve and its phases
   b. Determinant and indeterminant growth
*2) Observations on growth and development of corn and beans
*3) Growth of peas in light

*These sections are ones in which the student uses data from plants grown at home.

Student Time: 20 - 30 minutes

Instructional Strategy: Tutorial

Special Notes: This lesson is part of a series of growth and development lessons. It is self-explanatory and can be used independent of supplemental information.

File Name: bioindex-9a3 ecs: 3945
Plant Responses and Apical Dominance

Authors: J. Noell and M. Manteuffel

Instructional Objectives: To explain the mechanisms of plant responses to light and gravity.
To describe hormonal control of apical dominance.

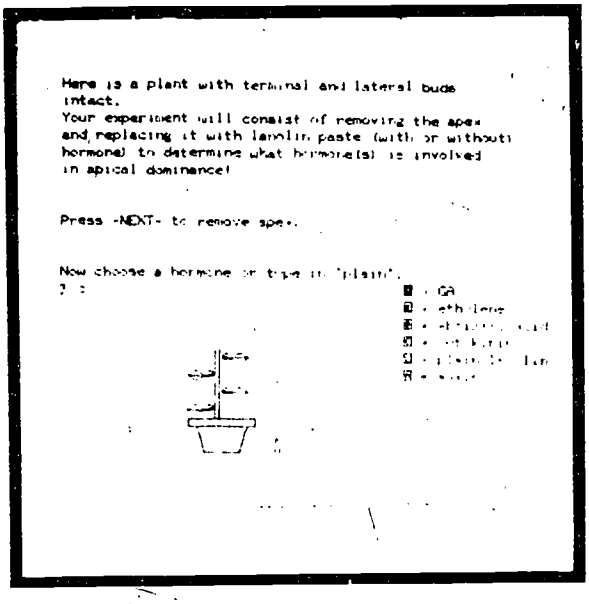
Description: Index (*-accessible through TERM-index)

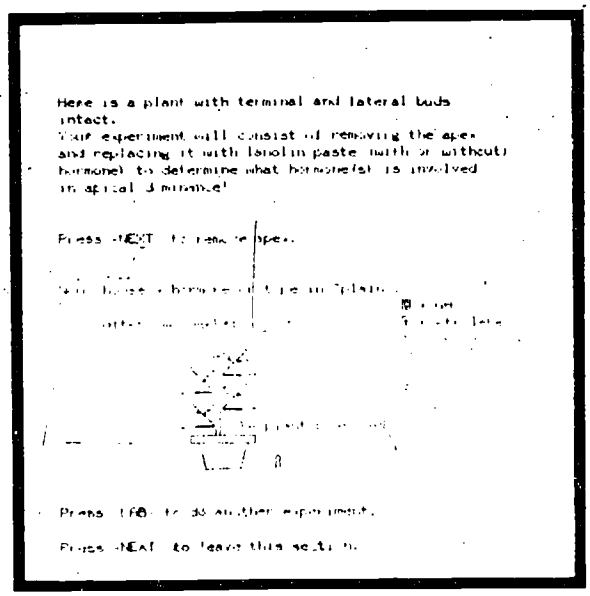
A. Plant responses
*1. Phototropism: coleoptile experiment, questions, mechanism, action spectrum, review
*2. Geotropism: mechanism, experiment, questions
*B. Apical dominance
1. Introduction
2. Experiment--apex of plant removed and student replaces it with lanolin paste (with or without hormone) to determine what hormone(s) is (are) involved in apical dominance.
3. Questions

Student Time: 30 - 40 minutes

Instructional Strategy: Simulation/Tutorial

Special Notes: This lesson is part of a series of growth and development lessons. Familiarity with plant hormones is recommended for lesson. Designed as lab replacement.





File Name: bioindex-9a4 ecs: 2921
Flowering and Photoperiod

Author: J. Noell

Instructional Objective: To explain the mechanism of flowering in response to light.

Description: No index

1) Introduction
2) Structure of the flower
3) Alternation of generations--the angiosperm life cycle
4) Photoperiod--graph: hours daylight vs. months (Champaign-Urbana, Winnepeg, Miami)
   a. Short-day, long-day, and day-neutral plants
   b. The discovery of photoperiodism
   c. The mechanism--phytochrome red and phytochrome far red
   d. Questions on photoperiodism
   e. Experiment--determination of photoperiod

Student Time: 30 - 45 minutes

Instructional Strategy: Inquiry

Special Notes: Designed as a lab replacement. Part of the series of growth and development lessons.

File Name: bioindex-9a5 ECS: 1768
Fruiting and Leaf Senescence

Authors: J. Noell and A. Haney

Instructional Objectives: To describe fruit formation, growth and maturation.
To deduce physiology of leaf abscission from hormone experiments.

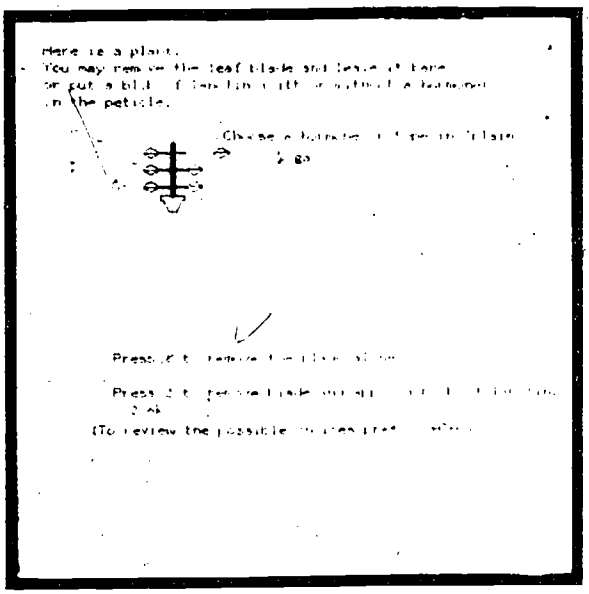
Description: Index (accessible through TERM-index)

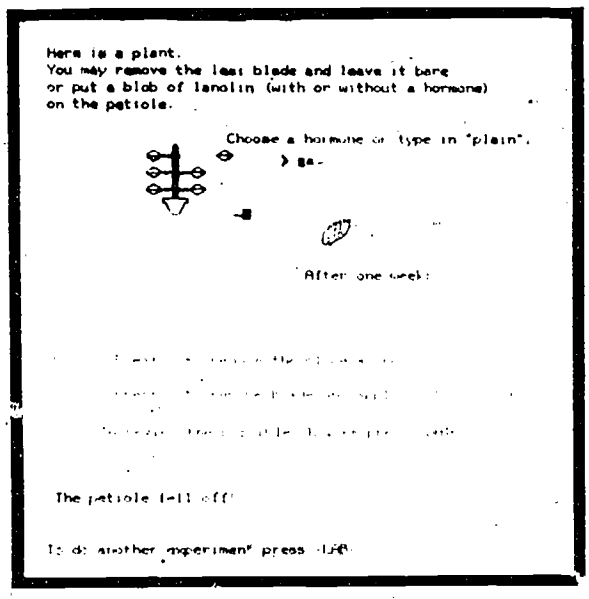
1) Fruiting
   a. Review of fruit formation
   b. Fruit growth--measurement and graphing of tomato growth
   c. The fruit ripening process
2) Leaf senescence
   a. Discussion of leaf abscission
   b. Experiment with leaves and hormones

Student Time: 15 - 20 minutes

Instructional Strategy: Inquiry

Special Notes: This lesson is part of a series of lessons on growth and development. A familiarity with plant hormones and the angiosperm life cycle is recommended. This lesson designed as a lab replacement. Summary and/or quiz follow-up recommended (see appendix).





File Name: bioindex-9a6 ecs: 2442
Enzyme-Hormone Interactions

Author: J. Noell

Instructional Objectives: To understand the relationship of enzymes and hormones.
To determine the effect of IAA and GA on the growth form of Alaska and Dwarf peas.
To find the specific activity of IAA oxidase.

Description: No index

1) Introduction--control of hormones with enzymes; observe growth without hormone application
2) Hormones and growth form; student directs experiment with IAA, GA and water to determine effects on growth of Alaska and Dwarf varieties of peas; 3 questions
3) Determination of specific activity of IAA oxidase in Alaska and Dwarf roots and shoots to explain above observations
   a. Assay for IAA oxidase; choose one of six treatments to analyze (Dwarf treated with IAA, GA, or water; Alaska treated with IAA, GA, or water); experimental procedure, read spectrophotometer (root and/or shoot), DATA to interpret reading--standard curve for IAA (optical density vs. IAA concentration)
   b. Assay for total protein; choose one of six treatments to analyze; experimental procedure, read spectrophotometer (root and/or shoot), DATA to interpret reading--standard curve for protein (optical density vs. protein)

Student Time: 20 - 40 minutes

Instructional Strategy: Inquiry

Special Notes: This lesson is designed as a lab replacement. Introductory material on plant hormones is recommended prior to student use. Included in the growth and development series. Knowledge of spectrophotometer assumed.

File Name: bioindex-9b1 ecs: 4312
Organization of the Higher Plant

Authors: A. Haney and G. May

Instructional Objective: To explain how each plant organ is specialized for its particular function.

Description: Index (accessible through TERM-index)

1) Cytology quiz--match organelles with functions
2) Organs: leaf, stem, root
   a. Leaf--variations in leaf forms, tissues, specializations, cross-section lilac (Syringa)
   b. Stem--function and specialization
      herbaceous--monocot (Zea mays) and dicots (Helianthus, Medicago)
   c. Root--function and specialization
      monocot (Smilax)
      dicot (Ranunculus)
      branch roots
      meristem (Allium)
3) Organization of higher plant
   a. Apical meristems--longitudinal cross-sections of Coleus and Elodea
   b. Hickory bud growth
   c. Phyllotaxy

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: Comprehensive presentation, designed as laboratory replacement. Lesson requires microfiche. On-line quiz follow-up recommended (see appendix).

File Name: bioindex-9c1 ecs: 3029
Plant Pathology: An Introduction to Disease and Koch's Postulates

Authors: J. Silvius and G. May

Instructional Objectives: To formulate a procedure for identifying the pathogen causing a disease.
To calculate the dilution factor for making soil cultures.

Description: Index (accessible only at beginning of lesson)

1) Introduction to Plant Pathology
   a. Purpose
   b. Terminology
   c. Three questions
   d. Examples (six slides) of diseases of plant parts
2) Identifying the cause
   a. Procedure for determining what pathogen caused disease
   b. Student must evaluate postulates--Koch's
3) Culturing soil microbes
   a. Preparation of a culture dish containing colonies growing in distinct regions
   b. Determination of number of spores and bacterial cells present in a sample of soil

Student Time: 40 minutes

Instructional Strategy: Inquiry/Tutorial

Special Notes: Designed as lab replacement. Microfiche required for introduction (part 1).

File Name: bioindex-10a1 ecs: 3541
Use of Taxonomic Keys

Author: J. Mehney

Instructional Objectives: To construct a dichotomous key.
To use a key to identify invertebrates.

Description: Index (available only at beginning of lesson)

1) Part I--Key construction
   a. Discussion of keys with example
   b. Dichotomy--discussion and practice problem
2) Part II--Key use
   a. Illustration using invertebrate key
   b. Sixteen questions (student must tell what class a certain invertebrate is in)

Student Time: 20 minutes

Instructional Strategy: Tutorial

Special Notes: Feedback is fairly extensive even if student is not familiar with the physical characteristics of organisms to be keyed: (1) rotifer, (2) hydra, (3) jellyfish, (4) earthworm, (5) nightcrawler, (6) clam, (7) lobster, (8) oyster, (9) planaria, (10) aphid, (11) butterfly, (12) leech, (13) bloodsucker, (14) spider, (15) snail, (16) vinegar eel.

File Name: bioindex-10b1 ecs: 2220
Plant Taxonomy

Author: A. Haney

Instructional Objectives: To recognize plant characteristics commonly used in vegetative keys.
To learn to use a taxonomic key.

Description: No index

1) Why should I study taxonomy? Includes discussion of use of common names
2) Features emphasized in vegetative key (slides)
   a. Leaves: form, parts, arrangement, types, four questions
   b. Twigs: buds, scars
3) Example of key use from Botany 100 manual

Student sent outside to key five labelled trees: two required, choose remaining three.

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: Designed as laboratory replacement; microfiche required.

File Name: bioindex-10b2 ecs: 2240
Tree Identification Quiz

Author: A. Haney

Instructional Objective: To successfully key out five trees.

Description: Index

1) Cercis canadensis (Red bud)
2) Pseudotsuga menziesii (Douglas fir)
3) Pinus strobus (White pine)
4) Gleditsia triacanthos (Honey locust)
5) Taxodium distichum (Bald cypress)
6) Fagus sp. (Beech)
7) Liriodendron tulipifera (Tulip poplar)
8) Acer saccharum (Sugar maple)
9) Platanus occidentalis (Sycamore)
10) Taxus sp. (Yew)

Trees are presented by number only. The student chooses tree number (five minimum) and records his/her identification. If identification is correct, she/he sees slide of tree. If not, student receives hints as to where she or he might have made a mistake in key.

Student Time: 15 minutes

Instructional Strategy: Exam

Special Notes: Designed as lab replacement. Requires microfiche. Sequel to bioindex-10b1. The key used is contained in the Botany 100 laboratory manual by A. W. Haney, et al.

count and cell mass

2) Graphs of cells in stationary phase caused by toxic products and nutrient exhaustion
3) Define lysis
4) Define linear growth--an animated comparison of linear and logarithmic growth

Student Time: 10 - 20 minutes

Instructional Strategy: Tutorial

Special Notes: This is the fifth in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

Special Notes: This is the seventh in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

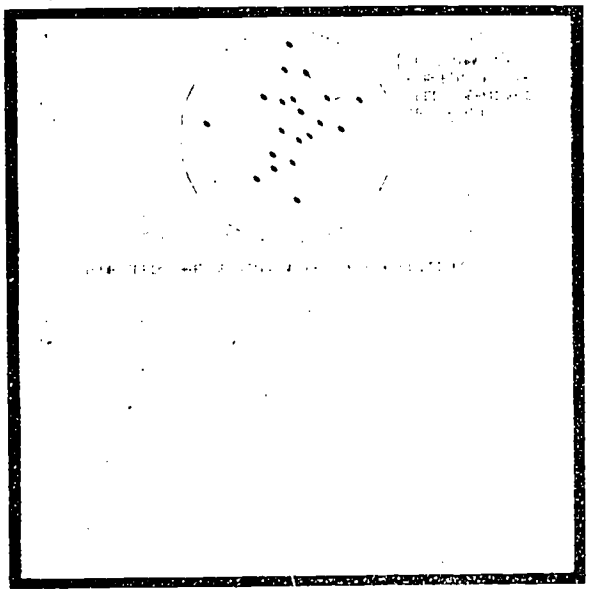
Special Notes: This is the sixth in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

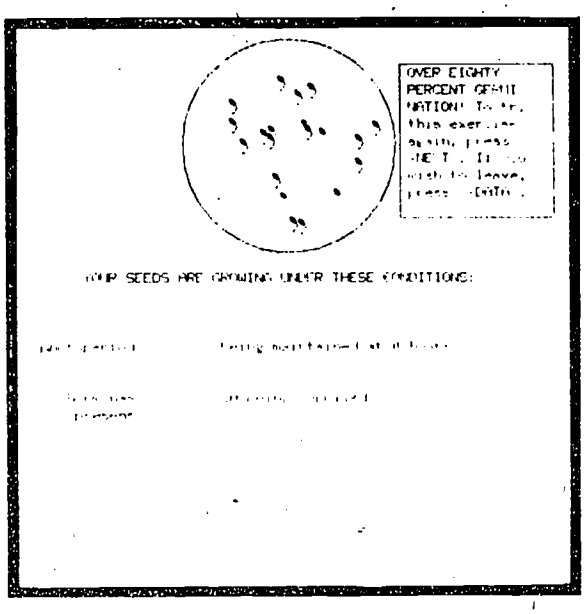
Note: Students must obtain high percentage of [illegible] in order to leave lesson.

Student Time: 30 - 40 minutes

Instructional Strategy: Tutorial

Special Notes: An understanding of the respiration process and familiarity with plant hormones are recommended. Designed as lab replacement. Summary required and/or on-line quiz follow-up (see appendix).





Student Time: 20 - 30 minutes

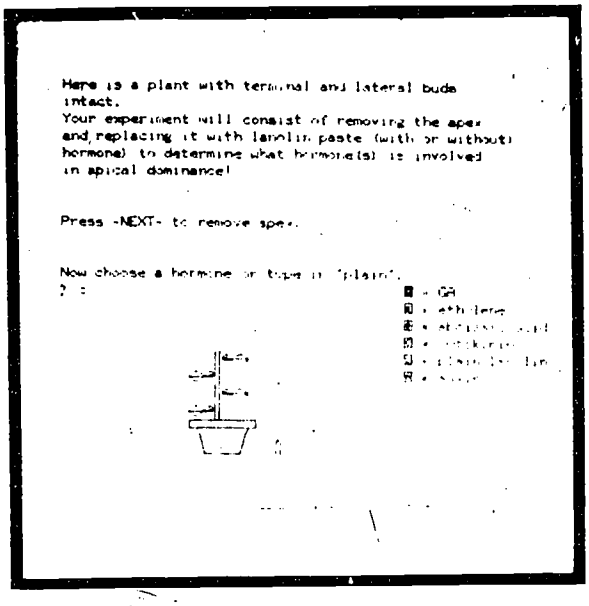
Instructional Strategy: Tutorial

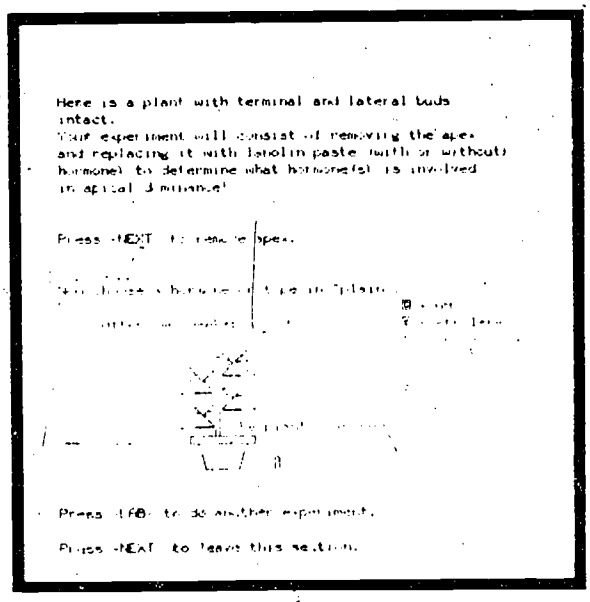
Special Notes: This lesson is part of a series of growth and development lessons. It is self-explanatory and can be used independent of supplemental information.

Student Time: 30 - 40 minutes

Instructional Strategy: Simulation/Tutorial

Special Notes: This lesson is part of a series of growth and development lessons. Familiarity with plant hormones is recommended for lesson. Designed as lab replacement.





Student Time: 30 - 45 minutes

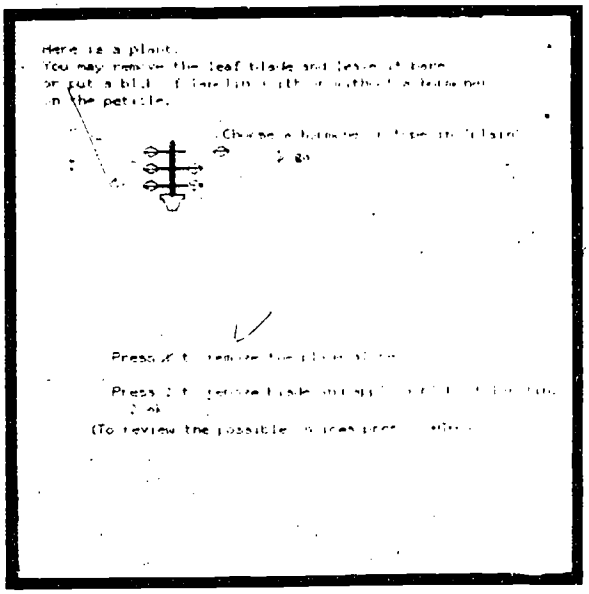
Instructional Strategy: Inquiry

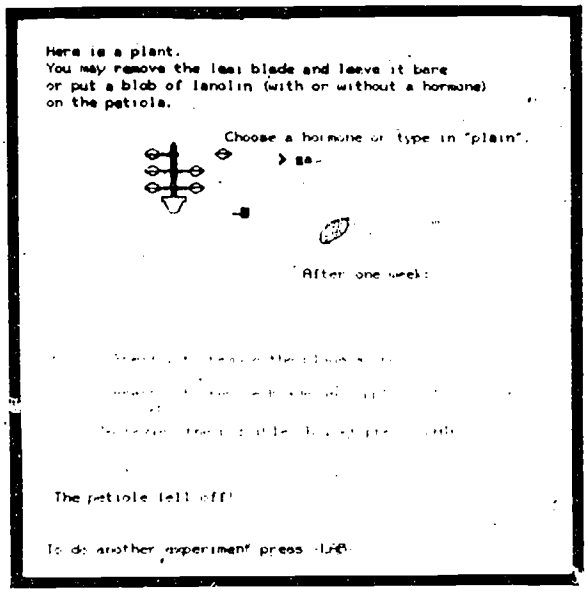
Special Notes: Designed as a lab replacement. Part of the series of growth and development lessons.

Student Time: 15 - 20 minutes

Instructional Strategy: Inquiry

Special Notes: This lesson is part of a series of lessons on growth and development. A familiarity with plant hormones and the angiosperm life cycle is recommended. This lesson designed as a lab replacement. Summary and/or quiz follow-up recommended (see appendix).





interpret reading--standard curve for IAA (optical density vs. IAA concentration)

b. Assay for total protein; choose one of six treatments to analyze; experimental procedure, read spectrophotometer (root and/or shoot), DATA to interpret reading--standard curve for protein (optical density vs. protein)

Student Time: 20 - 40 minutes

Instructional Strategy: Inquiry

Special Notes: This lesson is designed as a lab replacement. Introductory material on plant hormones is recommended prior to student use. Included in the growth and development series. Knowledge of spectrophotometer assumed.

meristem (Allium)

3) Organization of higher plant
   a. Apical meristems--longitudinal cross-sections of Coleus and Elodea
   b. Hickory bud growth
   c. Phyllotaxy

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: Comprehensive presentation, designed as laboratory replacement. Lesson requires microfiche. On-line quiz follow-up recommended (see appendix).

a. [illegible]
growing in distinct regions
b. Determination of number of spores and bacterial cells present in a sample of soil

Student Time: 40 minutes

Instructional Strategy: Inquiry/Tutorial

Special Notes: Designed as lab replacement. Microfiche required for introduction (part 1).

Instructional Strategy: Tutorial

Special Notes: Feedback is fairly extensive even if student is not familiar with the physical characteristics of organisms to be keyed: (1) rotifer, (2) hydra, (3) jellyfish, (4) earthworm, (5) nightcrawler, (6) clam, (7) lobster, (8) oyster, (9) planaria, (10) aphid, (11) butterfly, (12) leech, (13) bloodsucker, (14) spider, (15) snail, (16) vinegar eel.

Student Time: 45 minutes

Instructional Strategy: Tutorial

Special Notes: Designed as laboratory replacement; microfiche required.

number (five minimum) and records his/her identification. If identification is correct, she/he sees slide of tree. If not, student receives hints as to where she or he might have made a mistake in key.

Student Time: 15 minutes

Instructional Strategy: Exam

Special Notes: Designed as lab replacement. Requires microfiche. Sequel to bioindex-10b1. The key used is contained in the Botany 100 laboratory manual by A. W. Haney, et al.

b. How the homeostatic mechanism of water regulation operates

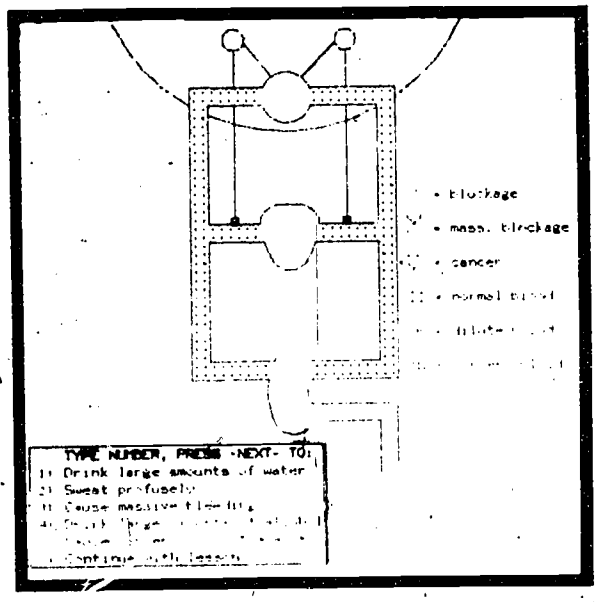
2) Simulated experiment on water balance using the model--student induces changes in water balance

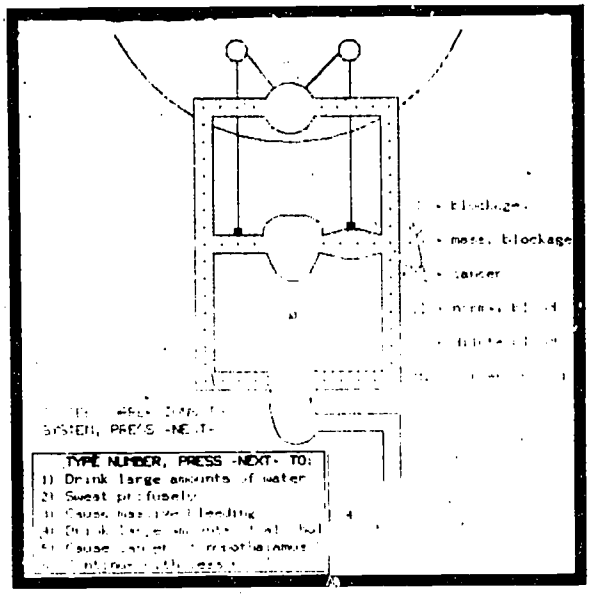
3) Ten questions based on information collected from the experiment

Student Time: 30 minutes

Instructional Strategy: Simulation

Special Notes: There is a handout available for this lesson. This simulation enables the student to visualize a feedback mechanism. Some background information on the hypothalamus, anti-diuretic hormone, stretch receptors in the circulatory system and kidney function might be helpful in preparation for this lesson.





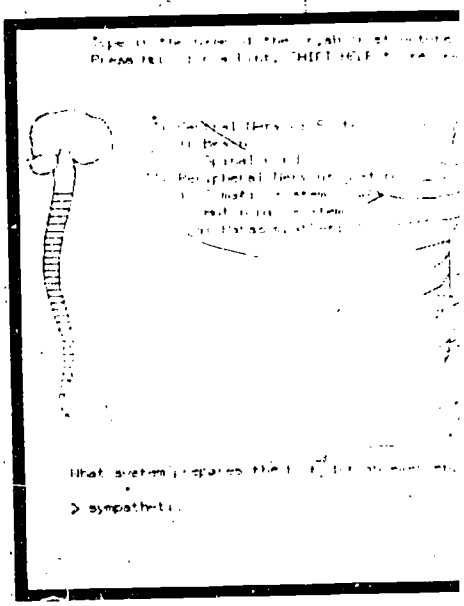
systems), outp

3) General organi
   Descriptions o
   autonomic nerv
   sympathetic)--
   DATA--Table of
   Brain Bigboard
   parasympatheti
   stimulation
4) Assembling the
5) Summary

Student Time: 60 - 70 minutes

Instructional Strategy: Tuto

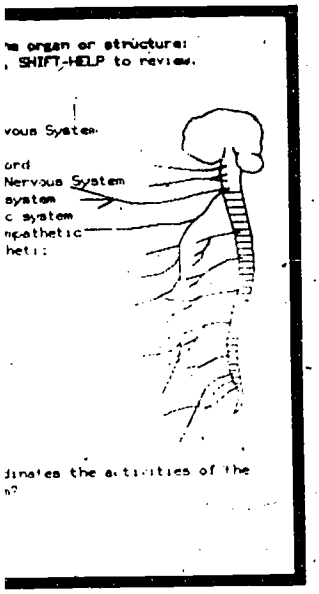
Special Notes: Use in conjun
recommended.



nervous system,
athetic and para-

m
mpathetic and
gan and type of

l function (11b3)



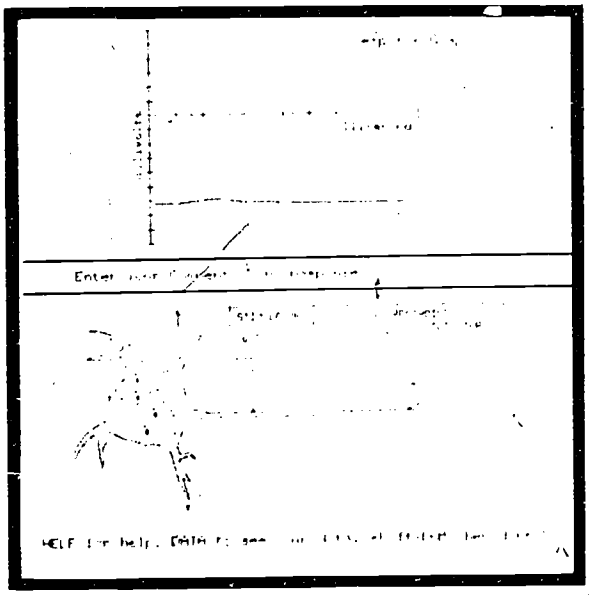
a. Student given a particular neuron must determine its threshold stimulus by applying pulses of electric current
b. Response graph given
c. Data recorded for each trial
d. Student concludes what threshold stimulus is

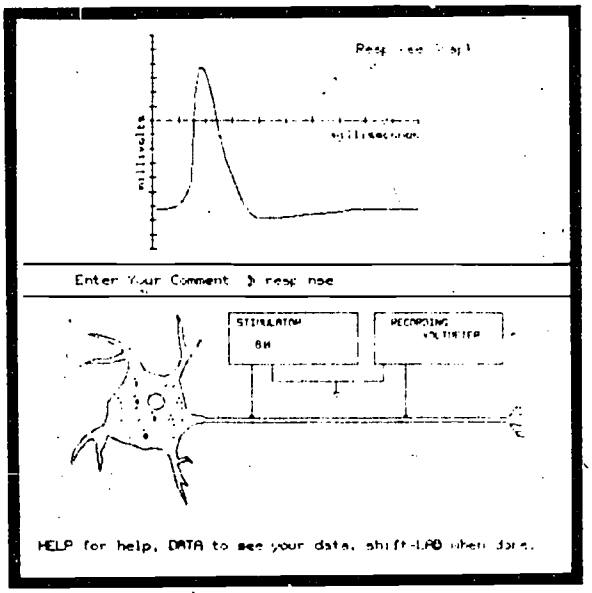
4) The synapse -- discussion of synaptic transmission with animation and a discussion of the effects of poisons on neurotransmission
5) Integration, includes a discussion of the reflex arc

Student Time: 30 - 45 minutes

Instructional Strategy: Tutorial/Inquiry

Special Notes: Comprehensive introductory treatment of subject



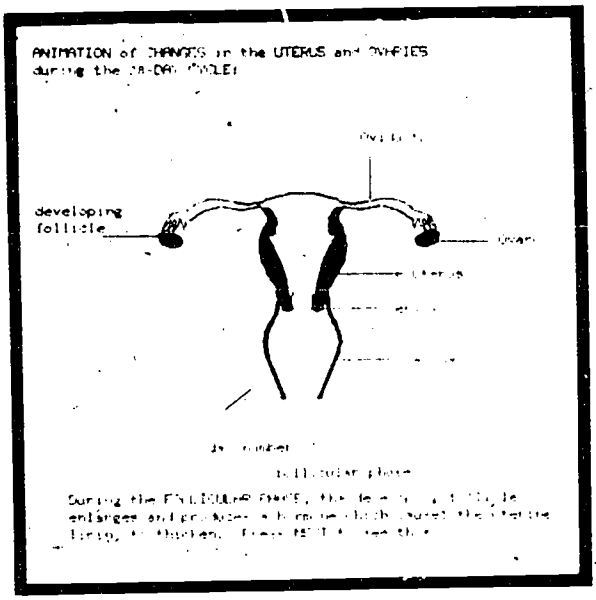


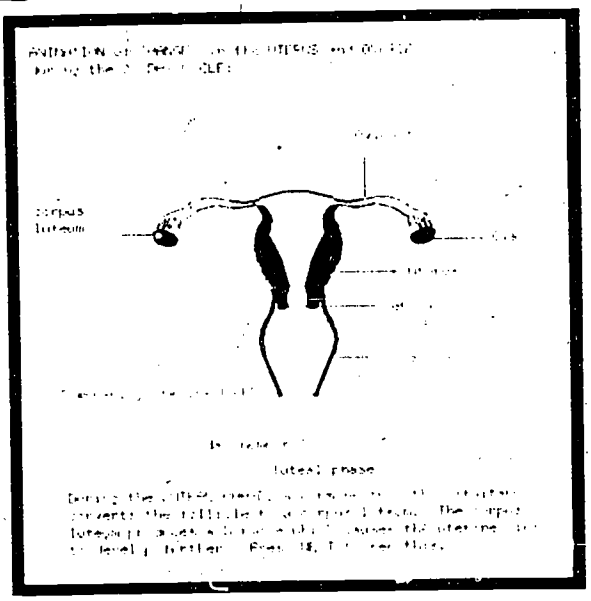
1) Anatomical features of the female reproductive system -- discussion and questions, diagram
2) Changes in the ovaries and uterus during the 28-day cycle -- animation and questions
3) Hormonal changes during the 28-day cycle -- discussion and questions, table
4) Review questions

Student Time: 60 - 90 minutes

Instructional Strategy: Tutorial

Special Notes: Thorough subject treatment, extensive interaction





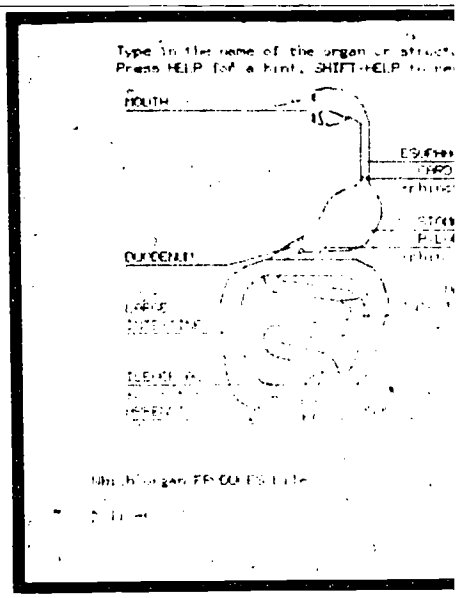
Discussi(

3) Process of d:
substrates (l
4) Given functi(
5) Five disorde:

Student Time: 60 - 90 minut(

Instructional Strategy: Tut(

Special Notes: Excellent in



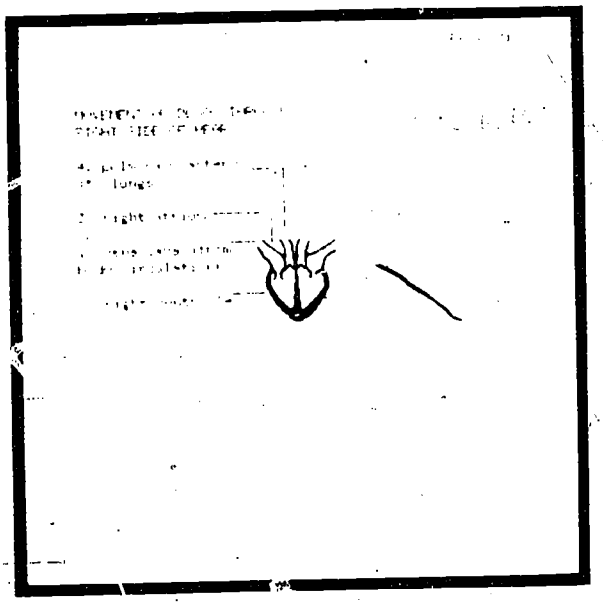
systole - diastole

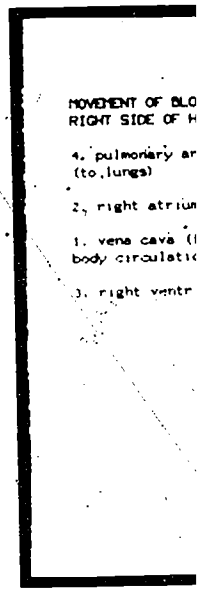
3) The cycle in detail -- atrial and ven schematic representation, summary of beat
4) Examination -- ten questions
5) Student performance data

Student Time: 70 minutes

Instructional Strategy: Tutorial

Special Notes: This lesson is designed so that the s questions with presentation of each r





4) Stretch and pressoreceptors, includes seven questions
5) Miscellaneous factors, includes five questions
   a. Emotions
   b. Temperature
   c. Hormones
6) Test -- thirteen questions
7) Student performance data

Student Time: 60 minutes

~~Instructional Strategy: Tutorial~~

Special Notes: High degree of student interaction. Good subject area coverage. Familiarity with autonomic nervous system as treated in 11b2 would further facilitate understanding.

b.
c.
d.
2) Ana
a.
b.
c.
3) Pos
4) Dat

Student Time: 45-

Instructional Strat

Special Notes: An
11

culatory system with summary
irculatory system

t -- includes questions, diagrams, animation

hrough the heart and associated vessels
four questions

---

appears in this lesson is also used in

a. Lungs
b. Pleura and pleural cavity
c. Discussion includes four questions

3) Pressure and muscle action
   a. Path of the gases
   b. Ribcage, intercostal muscles, and the diaphragm - animated
   c. Includes seven questions
4) The process of inspiration
   a. Pressure-volume changes
   b. Includes six questions
5) The process of expiration
   a. Muscular changes
   b. Pressure-volume changes
   c. Summary of expiration
   d. Includes eight questions
6) Examination -- seven questions
7) Performance data

Student Time: 50 minutes

Instructional Strategy: Tutorial/Inquiry

Special Notes: This lesson design is particularly effective because
frequency that students encounter questions. Assumes
with principles of diffusion and osmosis, pressure/vo
relationships.

APPENDIX

File Name: bioindex
Community College Biology Index

ecs: 3923

Author: S. Boggs

Instructional Objective: not applicable

Description: An on-line index for use in conjunction with hard-copy catalogue. Accesses all lessons described in the catalog. Index numbers correspond to catalog numbers.

Student Time: not applicable

Instructional Strategy: not applicable

Special Notes: Lessons included in this index are appropriate in whole or in part for the first two to three semesters of college biology survey courses.

File Name: mcquiz ecs: variable
Multiple-Choice Quiz Construction

Author: J. Kraatz

Instructional Objective: not applicable

Description:

1) HELP
   a. Explanation and display of sample item
   b. Description of options
2) NEXT to go to test setup; allows up to 50 students and 50 questions
   a. NEXT to add, delete or see items; type question and 5 choices
   b. BACK to see test as a student (no data)
   c. DATA to see summary data
      i. Students' scores and times
      ii. Item data (each student's response, items missed, item analysis)
   d. LAB to set up test parameters
      i. Title
      ii. Time
      iii. Penalty for guessing
      iv. Show answers on review
      v. Allow students to repeat quiz
      vi. Allow students to review
   e. HELP to delete students
   f. HELP1 to destroy everything
   g. DATA1 to see the test AND collect data
   h. STOP1 to quit

Student Time: variable

Instructional Strategy: Exam

Special Notes: Extra lesson space must be requested and set up by site personnel (to -use- "mcquiz"); especially recommended for use in conjunction with lessons that are not very interactive.