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ABSTRACT

Included is a set of five teacher-prepared Learning Activity Packages (LAPs) for individualized instruction in topics in biology. The units cover the topics of genetic continuity, methods of investigation, cell biology, genetics, and animal physiology. Each unit contains a rationale for the material; a list of behavioral objectives for the unit; a list of resources including texts (specifying reading assignments) and visual materials; activities, including laboratories when appropriate; a depth study; and a self-evaluation test. For other documents in this series, see SE 016 427. (JR)

LEARNING ACTIVITY PACKAGE

GENETIC CONTINUITY

Ninety Six High School
Ninety Six

RATIONALE

In LAP 18 we learned that sexual reproduction results from the combination of two types of cells, or from each parent. This results in greater variety than asexual reproduction and offers a greater chance of species survival. But how do all the variations arise? What makes organisms different? We will discover in this LAP several aspects which have influence on our every day life. What are the chances that two people will have children which have their characteristics? Many questions will be answered and even more should arise.

In our last LAP we will study the influence that the genetic make up of organisms have on their survival and how genes can change over a period of time.

Behavioral Objectives:

Section I Mendel's Investigations

After referring to the rescources:

1. You will be able to successfully culture fruit flies in the prescribed method. (Lab)
2. You will be able to list the stages in the life cycle of fruit flies and give the approximate time spent in each stage.
3. You will be able to etherize, and sex correctly at least 30 fruit flies.
4. You will make a predition to the following hypothesis after completing a cross between a long wing fruit fly and a vestigual wing fruit fly. You will base your prediction upon data obtained from your cross. If a wild winged fruit fly is crossed with a vestigual wing fruit fly then the offspring have _____.
5. You will be able to discuss the experiments done by Gregor Mendel in his work with the genetics of garden peas. Your discussion will include the following aspects.
   (a) the methods used by Mendel which made his work successful
   (b) a description of the types crossed and the results.
6. Based upon the rules of probability you will be able to give the probability of two or more events occuring at the same time if given the probability of each event or the following information
   (1) the number of alternatives
   (2) that each alternative has equal chance of occuring
   Example: Given the probability in fractional terms of the following assume each event has equal chance of occuring.
   (a) the chances of having two girls in a row
   (b) the probability of rolling two (1's) on a pair of dice.

8. You will demonstrate your understanding of Mendelian genetics by correctly diagraming a corss between any combination of the following:

   Pure dominate Pure recessive Monohybrid Dihybrid

   In your diagram you will include the following in this order.

   (a) the genotype of p

   (b) all possible gametes of each parent

   (c) all possible different combinations of gametes in the offspring

   (d) the genotypic and phenotypic ratios of the different offspring.

9. You will be able to use the following words in a discussion concerning genetics.

   (a) homozygous (b) geterozygous (c) allele (d) linked genes

   (e) gene mutation (f) multiple alleles

Resources

Readings

1. Biology Silver, Burdett pp. 549-560
2. Life its forms and changes pp. 424-432
3. Patterns of Life, Schwartz, Troost (a) pp. 366-378

Visuals

20. "Drosophilia Life Cycle" Bioreview sheet
21. "The gene concept" Rhoden Taped lesson with visual package.

Lab

1. "A Monohybrid Cross with Drosophila" Patterns of Life pp. 407-410

Activities

I. Individual games

II. Group pannel discussion

III. Class the teacher will announce the work to be completed

Lab Mendelian monohybrid cross in Drosophila" BSCS green pp. 636-641

Self-Evaluation

Questions 1 and 2 are bases upon the following information:

I. Adult

II. Egg

III. Pupa

IV. Larva

1. The correct order of stages in the life cycle of fruit flies is

   (a) I,II,III,IV

   (b) II,III,IV,I

   (c) I,II,IV,III

   (d) IV,I,III,II

2. The stage in which the fly spends the largest percentage of time before becoming an adult is

   (a) II (b) IV

   (c) III (d) all are the same in length

3. If RR (red) and rr (white) are crossed and the offspring are all pink then we could say that this was an example of:

   (a) sex-linkage (b) dominance, recessive

   (c) incomplete dominance (d) crossing over

4. The evidence seems to support the evidence that sex is determined by

   (a) one gene (b) two genes

   (c) a pair of chromosomes (d) several pair of chromosomes

5. The chromosomes that result in a male offspring are

   (a) xx (b) yy

   (c) xy (d) xxy

TAKE THE PROGRESS TEST

Section II Post Mendelian Genetics

Behavioral Objectives:

10. You will demonstrate your understanding of sex-linkage and the use of pedigree charts by correctly completing a chart involving a sex-linked trait, given a description of the trait and a key to the symbols used in the chart. (See Self-Evaluation of example)

11. You will be able to identify from a given description of a cross whether the trait being followed demonstrates dominance, recessive or incomplete dominance.

12. You will demonstrate your understanding of the chromosome theory by applying the theory in choosing the best prediction based upon the chromosome theory.

13. After completing the laboratories and referring tc the resources you will be able to draw conclusions based upon the evidence presented concerning the influence that environment has as compaired to heredity in determining the characterisitcs possessed by an organism. (3) (4a)

14. You will be able to give a brief description of the genetic influence upon the following human traits (2)

    (a) sex (b) blood type

    (c) phenylketonuria (d) skin color

    (c) intellligence

Resources

Readings

1. Biology Silver. Burdett pp. 561-573
2. High School Biology pp. 641-458
3. Life its forms and changes pp. 450-453
4. Patterns of Life, Schwartz (a) pp. 444-446 (b) pp. 449-467

Resources (cont')

5. Human Heredity, Roastand ch. II, VI, VIII, IX

6. Parenthood and Heredity, Reed - ch. 18, 28

Visuals

20. "Prosophilia Genetics" Bioreview sheet.

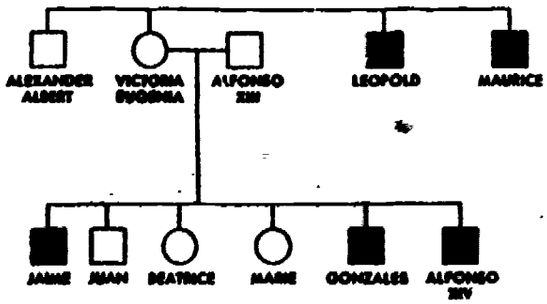
Laboratory

1. "Seedling Phenotypes" High School Biology pp. 651-652.

2. "Human Inheritance" High School Biology pp. 656-658

Self-Evaluation II

Questions 1 and 2 are based upon the following pedigree which shows the incidence of hemophilia, a sex-linked trait, in the Spanish royal family. Circles denote females, squares denote males, and shaded figures denote persons who had hemophilia.



1. If x^h represents the gene causing hemophilia and x its normal allele, the genotype of Victoria Eugenia is:

   (a) XX (b) XX^h (c) $X^h X^h$ (d) XY

2. What is the probability that Juan is carrying a gene for hemophilia?

   (a) 0% (b) 25% (c) 50% (d) 100%

3. In a cross between the following, fruit flies BB (black leg) and bb (red leg) the phenotypic ratio would be:

   (a) 3 black to 1 red (b) all black

   (c) all red (d) 3 red to 1 black

4. In a cross between Bb and Bb the probability that the offspring will be bb will is:

   (a) 1/10 (b) 1/5 (c) 5/10 (d) 1/4

5. Which of the following factors did not help Mendel in his work with the genetics of garden peas?

   (a) the use of only tall peas (b) using only one trait at a time

   (c) keeping accurate records of the results of each cross

   (d) using many crosses of the same king

6. What is the probability that a family will have five boys in a row?

   (a) 1/100 (b) 1/32 (c) 1/36 (d) 1/4

7. Diagram the following cross indicating all prescribed aspects. Show the f_1 generation

Self-Evaluation (cont')

(note genotypic of F_1 not necessary in dihybrid cross)

L - long

l- short

G- green

g- yellow

P_1 Ll, Gg xLl, Gg

A C I T I V I T I E S

1. Individual - choosing a easily identifiable trait construct a pedigree chart for your family as far back as you can find evidence.

2. group

3. class

Depth Study:

A suggested area of study would be to isolate a predicular heriditary disease and research the resources for data. After your literature search you will have a conference with the teacher for further investigative techniques.

SELF EVALUATION KEY

Section I

1. C
2. C
3. B
4. D
5. A
6. B
7.

P_1 Ll,Gg x Ll, Gg

gametes

♀ \ ♂	LG	Lg	lG	lg
LG	LL, GG	LL,Gg	Ll,GG	Ll,Gg
Lg	LL,gG	LL,gg	Ll,Gg	Ll,gg
lG	lL,GG	lL,Gg	ll,GG	ll,Gg
lg	Ll,Gg	lL,gg	ll,Gg	ll,gg

F_1 Phenotypic ratio 9:3:3:1

9- long, green

3- short,gre en

3- long, yellow

1- short, yellow

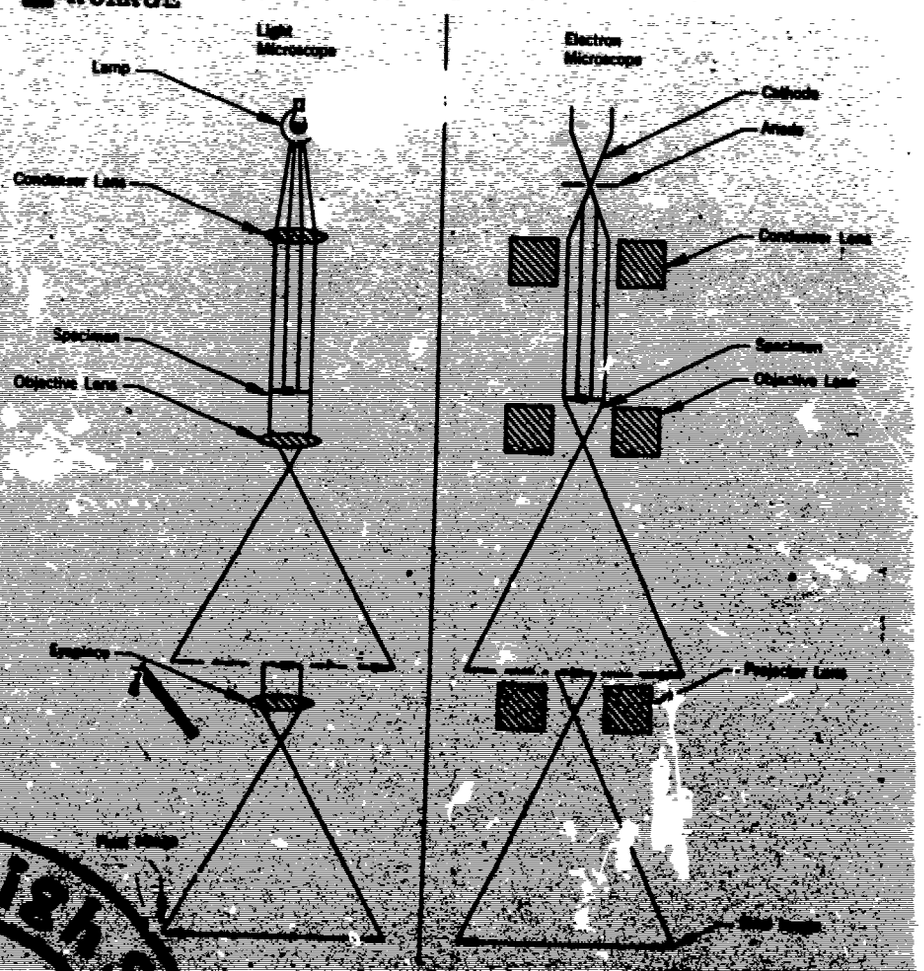
Section II

1. B
2. A
3. C
4. C
5. C

10

LEARNING ACTIVITY PACKAGE

METHODS OF INVESTIGATION



REVIEWED BY

JAR

Rationale

Science can be divided into two areas, scientific content and the procedure of science. As Roger Bacon said "experimental science has one great prerogative ... that it investigates its conclusions by experience".

The collection of scientific facts is only one aspect of science. The method of investigating (the way in which a scientist forms hypotheses, experiments, and makes predictions and generalizations) is far more important.

In this LAP we will become familiar with the content, the tools of science, and the procedure of science. The understanding of these areas are basic to any study of science. You will be using what you learn through out the study of biology.

Section I "Scientific Method"

Behavioral Objectives - After consulting the following references, you will:

1. Identify a given statement as being deductive or inductive.

2. Identify the following from a given written statement:

   a. observations

   b. problem

   c. hypothesis

   d. prediction

   e. experiment

   f. variables

   g. control objects

   h. experimental objects

Resources

I. Readings and Problems

<u>Biological Science - Molecules to Man</u>, pp. 7-11 "A Sample Problem"

II. Audio-Visuals

Cassette - "Scientific Method" Rhoden Cat#(39) I.

Cassette and Filmstrip - "Great Ideas in Biology" - Experiment

Self-Evaluation I

1. A scientist observed that when he injected 40 female leopard frogs with pituitary hormone that 38 of them gained weight. He concluded that female leopard frogs gain weight when injected with pituitary hormone.

___ The reasoning used by the scientist would be:

a. inductive

b. deductive

c. both

d. neither

2. It was observed that salmon have the ability to return to the exact spot where they were born to spawn(1). A scientist wanted to know how they are able to do this. He thought that they might do so(2) solely on the basis of visual stimuli(3). If this were true, then covering their eyes would prevent them from finding their spawning(4) ground. To test this idea the scientist covered the eyes of 30 Oneorhyncus kisulch salmon and released them upstream(5) from the spawning ground. The next day he re released 30 Oneorhyncus kisulch in the same spot as the others,(6) but this group did not have their eyes covered. After three days, he counted 10 salmon which had their eyes covered and 25 without the cover. He concluded that sight is the sole factor in the homing ability of fish.

___ A. In the above statement the number that identifies the hypothesis is

a) 1 b) 2 c) 3 d) none of these

___ B. The experimental group is

a) 4 b) 5 c) 6 d) none of these

DEPTH STUDY

Compare the experimental procedure of Redi with that of Spallanzani in their experiments on spontaneous generation. Be sure to include an evaluation of procedures, (use of control, variables, hypothesis, and validity of conclusion). Your comparison should be no longer than four pages. When it is complete, it should be handed in to your instructor.

Section II Reporting Data

Behavioral Objectives - After consulting the following references, you will:

4. Identify the type of errors in a given statement after playing at least one round of each of the sections of the game Inquest.

5. Design and carry out an experiment to solve a given problem using correct experimental procedure.

Resources

I. Reading and Problems

1. Biological Science - Molecules to Man, pp. 14-17.
2. High School Biology pp. 5-7.

II. Games

Inquest - may be played with more than one person.

Self-Evaluation II

1. Identify the type of error in the following statements.

A. Boviere measures the relative humidity of the air (4)
at 8 a.m. and 12 noon each for 10 days. He got
averages of 80 ± 2% at 8 a.m., 74 ± 3% at 12 noon.
When asked what was the average relative humidity
at 10 a.m. those days, Boviere reports that it was
77 ± 2%.

B. Tomkson reported, "The tiny amoeba-like creature (4)
that we suspect may have been our first hint of
life on Venus, had two nuclei which joined together
just before the creature disintegrated".

Depth Study Section II

In the past, we have found that the tap water had a high degree of acidity (about 5.5). Normally, pure water has a pH of 7. Take this problem and form your hypothesis, prediction, and design an experiment to solve the problem. You will not necessarily carry out the experiment, but you should describe your probable procedure.

Section III Analysis of Data

Behavioral Objectives - After consulting the references, you will:

6. Given an appropriate measuring instrument, measure the mass, volume, and/or length of a substance in metric units.
7. Identify a given description of a sampling technique as being biased or unbiased.
8. Calculate the mean, median, and mode from a given sample of data.
9. Given a set of data, construct a line graph. (Be sure to use a scale that distributes the data over the entire graph.)
10. Identify the following from a given line graph:
    a. mode
    b. mean
    c. median
    d. range
11. Identify a given scale as arithmetic or logarithmic.
12. Interpolate and/or extrapolate a given valve from a graph.
13. Determine if a given graph substantiates a given list of conclusions.

Resources

I. Reading and Problems

___ 1. The Study of Biology, Baker, Allen. pp. 66-89.

___ 2. Interpreting Biological Data, F. S. #1553

___ 3. Biological Science, Interacting of experiments & ideas. pp. 57-69

Self-Evaluation III

1. A psychologist wanted to determine whether there was a dietary cause in mental retardation. He selected 1000 men from a mental hospital and compared their diet with 1000 men of the same age from a nearby community.

   Determine if the statement is biased or unbiased.

2.

14	13
23	18
17	18
20	20
21	20
22	17
20	19
	20

A. Calculate the mean.

Mean _____

B. Calculate the mode.

Mode _____

C. Calculate the median.

Median _____

3. Construct a line graph from the following data. A student measured the growth of coleoptiles as greater concentrations of indolacetic acid were added.

Concentration of Indolacetic Acid	Height of Coleoptile in mm.
0	5
.005N	100
.010N	150
.015N	175
.020N	200
.025N	210
.030N	208
.035N	185
.040N	170
.045N	120

Self-Evaluation III (cont')

4. From the graph drawn in #3, determine if the following conclusions are substantiated by the graph.

   A. The increase in height of the coleoptile increases in direct proportion to the concentration of indolacetic acid.

   B. If a company wanted to grow bean coleoptiles for use in their soup, they would produce a larger coleoptile if they used .025N indolacetic acid than they would if they used .1N indolacetic acid.

Advance Study

Laboratory 3-4 Investigating variations within a species.

<u>Biological Science - Molecules to Man</u>, pp. 70-71. Answer discussion questions to be turned in.

See your teacher about taking the Progress Test

Section IV Laboratory Equipment

Behavioral Objectives

After consulting the resources, you will:

15. Conduct all laboratories as prescribed in "lab procedure" handout unless otherwise specified by instructor.

16. Write up all experiments in the manner prescribed on "handout - 'Laboratory Notebook'" unless otherwise directed by the instructor.

Resources

I. Readings & Problems

___ 1. Handout "Lab Procedure"

___ 2. Handout "Lab Notebook"

Self-Test -- See Teacher.

Section V Laboratory Equipment

Behavioral Objectives

After consulting the resources, you will:

17. Name orally or in writing any equipment pictured on handout - "Lab Equipment".
18. Demonstrate the proper procedure when performing the following:
    a. heating glassware
    b. using a burner
    c. carrying a microscope
    d. mounting and examining a specimen with a microscope
    e. inserting glass tubing through a stopper
    f. using chemicals

Resources

I. Reading and Problems

___ 1. Handout "Lab Equipment"

___ 2. Filmstrip - "Safety in the Biology Lab"

___ 3. Handout "The Compound Microscope"

Self-test -- See Teacher.

See your teacher about LAP Test

Answers to Self-Evaluations

Section I

1. Inductive (A)

2.A. c

B. b

C. - He could have eliminated such variables as differences in time the two groups were released.

- Also he should have released them downstream since that was the usual way they migrated.

- His conclusions were a hasty generalization. He tested only one type of fish, not all fish.

- You may have found other errors. To check to see if your other answers are correct, consult the teacher.

Section II

1. A. unwarranted interpolation

B. not reproducible observation

Section III

1. biased

2. (a) 19.4

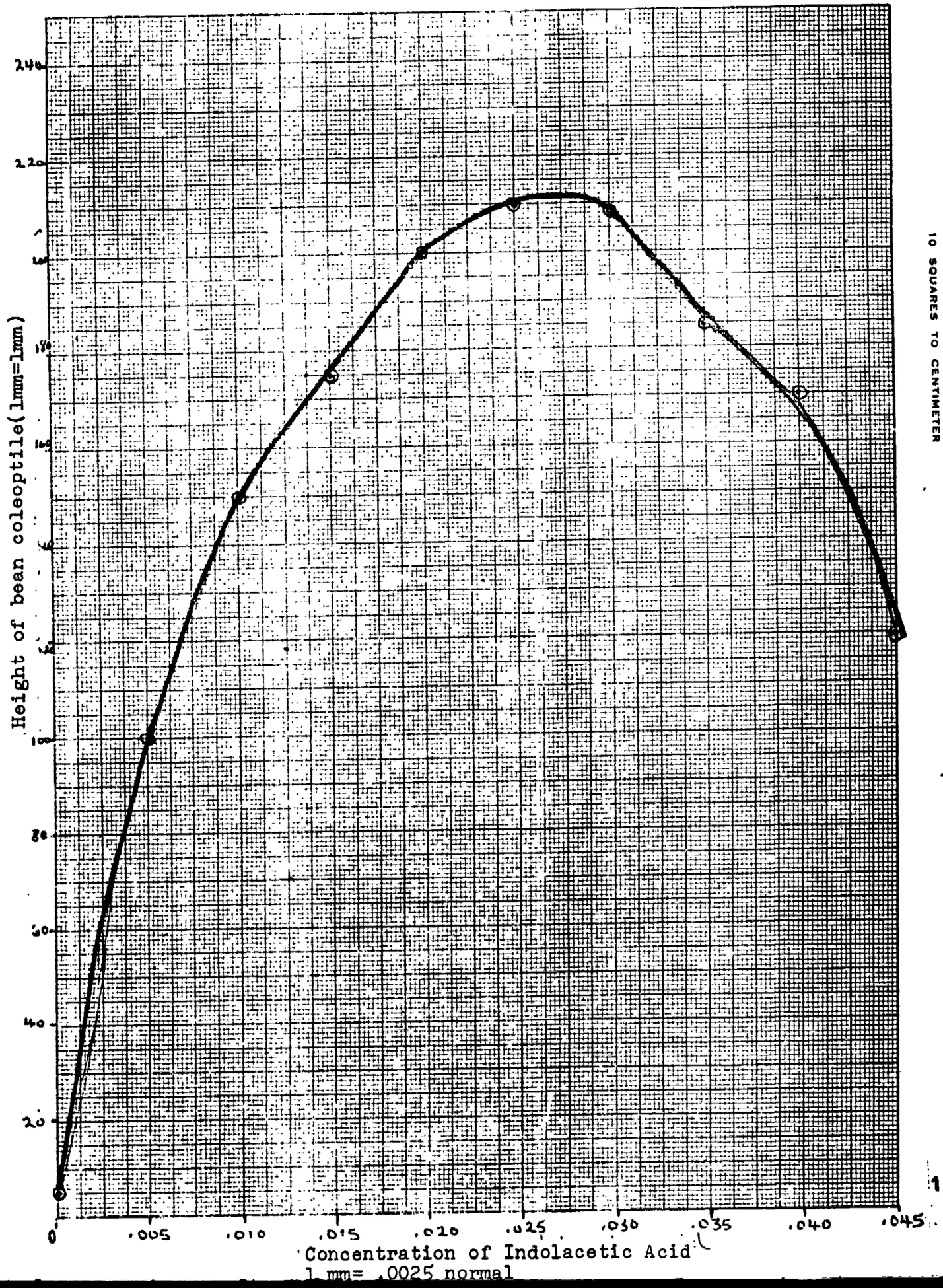
(b) 20

(c) 20

3. see graph on next page

4. (a) not substantiated

(b) not substantiated



10 SQUARES TO CENTIMETER

LEARNING ACTIVITY PACKAGE

CELL BIOLOGY

Rationale

The cell is the structure upon which all familiar life forms are built. All life functions are controlled within the cell. Therefore, it is of utmost importance that we understand this unit of life. We will begin by examining a few of the more important structures in some detail. We will then study the dynamic functions of the cell and its products. We will concentrate on the metabolic process (respiration and the associated energy exchanges). This LAP will help us to understand many of the processes of life which are repeated on all levels and branches of biology.

Section I. Celluar structure

After consulting the resources you will be able:

1. To demonstrate your ability to use a light microscope by correctly preparing a wet mount of an onion skin and focusin on at least 400 power.

2. To apply your knowledge of the cell theory by identifying statements which support the theory.

3. To name the cell orgenelle responsible for a given abnormal cellular activity, leased upon your knowledge of cell orgenelle functions.

4. To describe how the surface to volume ratio of a cell effects the activity.

5. To explain why procaryotic cells are found in fewer species than eucaryotic cells.

Resources

I. Readings and problems:

Biological Science, molecules to man pp. 21-24, 274-279

High School Biology, (green version) pp. 378-384

The Study of Biology, Baker, Allen pp. 95-110

Cell Ultrastructure Jenson, Park pp. 1-38

Biology Kimball pp. 118-132

Handout- "Generalized Plant Cell"

Handout- "Animal Cell"

II. Visuals

Transparency

"The Animal Cell"

"The Plant Cell"

III. Laboratory

(B.S.C.S. blue) INvestigation 11-2 "Relationship between Diffusion and Cell Size" pp. 265

Depth Study- Construct a detailed model of a cell organelle. You may use any material available but the size should be large enough for class demonstration and small enough for easy handling.

Self-Evaluation

1. Identify the following statements which support the cell theory:

____ The autolydic enzymes are produced within the cells of the caudal fin.

____ Certain bacteria contain many nuclsi within one cell membrane.

____ Red blood cells contain no nuclei

2. Two cells were examined to determine which one was the most active in metabolism. Cell A had a surface to volume ratio of 1.5/2.8. Cell B had a surface to volume ratio of .08/1.2. Which one most likely would have functioned at a higher netabolic rat ? (4)

_____

3. When cynide is added to a cell the rate of respiration drastically drops. What orgenelle whould be examined for the cause of this reaction? (3)

_____

4. The first cell to evolve were most likely

a. eucargotic

b. procaryotic

c. mulinuclate

d. multicelluar

Section II. Transport through membranes

After consulting the resources you will:

6. Identify the movement as osmosis, diffusion, or active transport, given the concentration of a specified substance on both sides of a membrane and the direction of the movement of that substance.

7. Predict the cause of the different permeability of membranes to substances based upon the structure of a unit membrane

8. Based upon your knowledge of the plasma membrane construct an experiment that would demonstrate the effect of osmotic pressure on living cells and predict the results.

9. Describe the functions of membranes in the endoplasmic reticulum and mitochondrian.

10. Graph the rate of osmosis in a osmometer as time indicated by the rise in water level over a given period.

11. Form a hypothesis for the curve obtained in the preceding experiment.

Resources:

I. Readings and Problems

Biology Kimbell pp. 146-153

High School Biology pp. 386-392

Scientific American "How things get into cells"

Cell ultrastructure vol. 3 pp. 835

II. Visuals

filmstrip

(a) "osmosis"

(b) "Pumps in the living Cell"
Demonstrational Osomosis

III. Laboratory

"Does the membrane regulate the passage of substances through it" B.S.C.S. Blue version P. 156

Depth Study

"Differential Permeability of cell membranes"

See the instructor for more specific directions

Self-Evaluation

1. A student measured the number of sodium ions on both sides of a plasma membrane at the beginning of an experiment, and found them to be equal. After thirty minutes he again calculated the number of sodium ions and found that 1/3 of the ions outside had moved inside the cell. What type of movement had probably occured.

   a. active transport

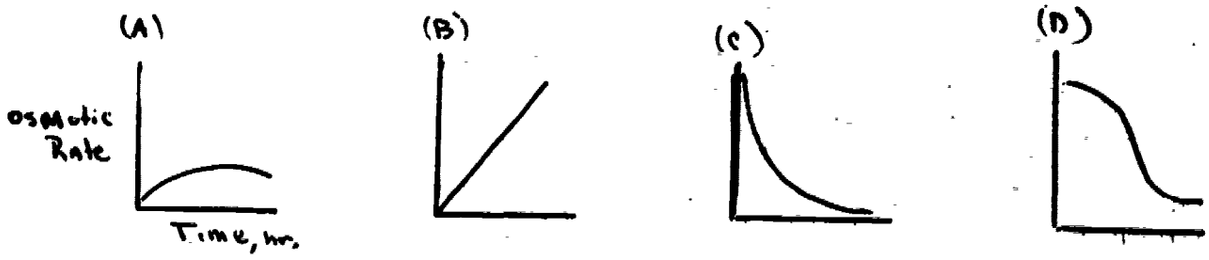
   b. osmosis

   c. diffusion

   d. none of the above

2. It has been found that most lipid soluable soluable molecules pass through the cell membrane at a higher rate than non lipid soluable substances. What structural characteristic of the membrane might cause this effect?

3. Which of the following best dexcribes the curve formed when the rate of osmosis in a osmometer is graphed.



4. Describe the functions of the membranes found inside the mitochondrion.

TAKE THE PROGRESS TEST

Section III Cellular Metabolism

12. Name and identify the structural formulas of each of the basic units of the three classes of compounds (proteins, fats, lipides) involved in the metabolic reactions of living organisms.

13. Distinguish between dehydration synthesis and hydrolysis in terms of the chemical reactions involved.

14. Describe the structure of enzymes and list factors which effect their activity.

1t. Compare competitive inhibition and non competitive inhibition.

16. Demonstrate your understanding of the use of variables by describing the procedure you would use to test effects of sucrose concentration on yeast growth, after completing the lab "a study of variables."

Resources:

Biology Kimball pp. 100-112

Cells and Energy Goldsby, "Enzymes" pp. 37-45

Introduction to Cell Physiology Howland pp. 42-59

Modern Biology, otto. Towle pp. 42-47

Biological Science- interaction of experiments and ideas pp. 37-40

II. Visuals

Filmstrips

"Biochemistry of Enzyme Action"

III. Laboratory

"A study of variables" B.S.C.S. (black version)

pp. 21-24

"Making a Enzyme Preparation" B.S.C.S. (black version)

pp. 40-43

Depth Study

Investigation "3" B.S.C.S. (black version) pp. 29-30

Self-Test

To which of the three classes of organic compounds commanly used in metabolism does the following belong.

1.

```
  H H H  HH  H
  | | |  | |  /
H-C-C-C-C-C-C-=O
  | | | | |
 OHOHOHOH  OH!
```

_____

2. In dehydration synthesis

   a. water is removed

   b. water is added

   c. hydrogen is used as a catalyst

   d. water is used to break the chemical bond between monomers.

_____

3. In the enzyme system $A \xrightarrow[E_1]{} B \xrightarrow[E_2]{} C \xrightarrow[E_3]{} D$. Product D was found to combine with enzyme # 1 and inhibit the production of B. This type of inhibition is called_____?

4. Many of the factors that effect enzyme activity can be related to (choose the best answer)

   a. their chemical structure

   b. lipid soluability

   c. their atomic weight

   d. ionic bonding of the protein

Section IV. Cellular respiration

17. Name an example of ATP utilization.

18. Construct and lable a diagram of the major steps in glycolysis (from glucose to acetaldehyde) Be sure to include in each step all products and/or reactions added.
(use handout "Cellular Respiration" as a guide)

19. Conduct and label a diagram of the steps involved in the Krebs cycle including all materials added and/or produced.
(use handout above as a guide)

20. Describe the reactions which occur as the hydrogen and electrons removed from the compounds during respiration are transferred along the electron transport system.

21. Compare abobic and anaerobic respiration in terms of products formed and effeciency.

22. State the number of ATP molecules formed when a given compound (found in the respiratory reactions) is respired completely.

23. Describe how the energy contained in fats, carbohydrates, and proteins are converted into more usuable forms of cellular energy from your knowledge of the process of respiration.

Resources

I. Readings and Problems

High School Biology pp. 413-419

Biology, an introduction to life pp. 251-267

Modern Biology otto, Towle pp. 98-103

Cells and Energy Goldsby pp. 46-57

Introduction to cell physiology pp. 83-99, 112-120,

Animal physiology Larimar pp. 50-52

Scientific American "Energy Transformations in the Cell" vol. 2 p. 549

"Interaction of experiments and ideas" pp. 47-48

Handout- "Mitochrondria"

Reprint- "How Cells Transform Energy"

II. Visuals

filmstrip - "Sugar Metabolims"

Transparencies

"Energy Release In Living Things" 10 transparencies

III. Laboratory

Investigating "Measuring the rates of respiration" B.S.C.S. (black version) pp. 49-54

Depth Study

Pattern of Inquiry 4 "The respiratory ratios" B.S.C.S.

To be turned for credit

or

"Wine" Scientific American vol 5 p. 1676. Write a brief summary and be prepared to report the reading to the class.

Self-Evaluation

1. Fill in the blanks with the appropriate compound oxaloacetic acid and acetyl coenzyme A_____ → _____

   diphasphoglyceric acid_____ pyruvic acid

   2_____

2. The net amount of ATP produced during aerobic respiration of one molecule of glucose is_____

3. What is the total number of molecules of ATP formed when one molecule of pyruvic acid is areobically repired to CO_2 and H_2O._____?

4. When hydrogens are removed from citric acid they are accepted by what compound?_____

5. What is the function of oxygen in the respiratory reactions?

   _____

6. List the product formed when the electrons removed from the cytochromes are combined with oxygen.

TAKE LAP TEST

LEARNING ACTIVITY PACKAGE

RATIONALE

We learned in the preceding LAP that the "Cell Theory" includes a statement that all cells come from pre-existing cells. But how? A complete study of the processes involved in cell reproduction would be too lengthy and complex for us to investigate in any depth. Therefore, we will be primarily concerned with the general aspects of individual and population genetics. We will use such organism as Drosophila and fungi to study the principles of inheritance. We will also investigate some of the characteristics which are hereditary in man.

This LAP should give us the genetic background for a better understanding of animal and plant functions, which will be our next LAP.

SECTION I - Historical Aspects

Behavioral Objectives:

After consulting the resources and completing the activities and labs, you will be able to:

1. List and describe the four aspects involved in a definition of "genetic continuity". (2A)
2. Outline the general steps taken by a scientist in attempting to solve a problem. (2A)
3. Follow the instructions as given in lab block except where the teacher instructs otherwise. (2A)
4. Distinguish between the theories of biogenesis and spontaneous generation. (2B), (1), (3), (4)
5. Describe the conditions under which one could claim to have "proved" an hypothesis. (2A)
6. Compare the procedures used by John Needham to those used by Spallanzani with respect to variables and controlled conditions used as a basis for their conclusions. (2C), (1), (3), (4)
7. Describe the modification in procedure made by Pasteur that was an improvement over the procedure used by Spallanzani. (3), (4), (2C), (1)

RESOURCES

Reading and Problems:

1. B.S.C.S. Blue Version pp. 87-97
2. "Genetic Continuity" Lab Block - (a) pp. 1-4
   (b) p. 6
   (c) p. 8, 11-19
3. Biology, introduction to Life (14.1) pp. 14-20
4. B.S.C.S Yellow Version pp. 22-37

Visuals:

Laboratory:

(As described on lab schedule)

SELF-EVALUATION I

1. List and briefly describe the four aspects involved in "Genetic Continuity."

2. Based upon your understanding of Pasteur's experiment concerning Spontaneous Generation, write the hypothesis upon which he was working.

3. List the variables involved in Needham's experiment that were controlled in the ones performed by Spallanzani.

4. Briefly describe the theory of Spontaneous Generation.

SECTION II - Sexual Reproduction

Behavioral Objectives

After consulting the resources, you will be able to:

8. Identify the five major phases in mitosis, given a description of the events occuring or an illustration of the phases. (1), (2B), (20), (4A)

9. Describe the differences between mitosis in plant cells as opposed to mitosis in animal cells. (22), (4A), (2B), (20)

10. Diagram and describe the major phases involved in the complete meiotic division of a male and/or female cell with a specified number of chromosomes. (20), (4A)(6)

11. Specify the distinction between mitosis and meiosis in terms of processes and chromosome characteristics of the cells produced. (4A), (2B), (20)

12. Demonstrate your understanding of Mendelian inheritance and the principle of probability by correctly diagraming a cross between any combination of the following: pure breeding, monohybrid, dihybrid. And be able to explain the diagram in terms of the laws of segregation and independent assortment. The cross should be carried through the F_2 generation. Also be able to evaluate prediction based upon such crosses. (2A), (4B)

13. Write the genotype, given the phenotype, the dominant trait and whether or not it is heterozygous or homozygous (2A), (4B)

14. Describe the way in which a blending of traits (partial or incomplete dominance) differs from a true dominance/recessive situation and be able to evaluate predictions based upon such a cross. (4B), (2A)

15. Give the phenotypic and/or genotypic ratios of a cross between any of the following: pure/pure, pure/hybrid, hybrid/hybrid. The cross may involve one or two traits. (2A), (4b)

16. Determine the number of different combinations of chromosomes possible in the gametes of an organism with a specific number of chromosomes. (2a), (4b)

17. Determine from the phenotypic ratio of the F_1, whether or not two traits are linked. (2c),(4c)

18. Based upon your understanding of the gene theory (chromosome theory), you will determine whether given statements are

    (1) logical interpretations of given data
    (2) predicted based upon the gene theory

Behavioral Objectives (cont'):

(3) false
(4) made with insufficient information

19. Choose statements which are logical interpretations or predictions of the events in sex-linkage. (2c), (4c)

20. After performing the laboratory #23 and #24, calculate the mutation rate of bacteria given the value of the following: M, LN2, and N. (3b)

21. Describe how most mutagens produce produce their effect. (3b), (2d)

22. Give the correct sequence of events in the following:

(1) the life cycle of Sordaria
(2) mitosis of onion root tip cells (lab block)

23. Describe at least three changes which can occur to a chromosome as a whole or part to cause mutations. (3b), (2d)

TAKE PROGRESS TEST

RESOURCES II

Reading and Problems:

1. Silver Burdett - pp. 38-41
2. Blue Version ~~B.S.C.S~~ - (a) 382-398
   (b) 267-272
   (c) 409-427
   (d) 431-438
3. Genetic Continuity - (a) 21-22, 28-29, 51
   (b) 130-136
4. The Study of Biology, Allen, Baker
   (a) pp. 471-478, 482-491
   (b) 495-521
   (c) 525-531
5. The Gene Concept, Barish - a good general text for most objectives.
6. The Study of Biology Allen Baker Sec. Ed. pages 482-490

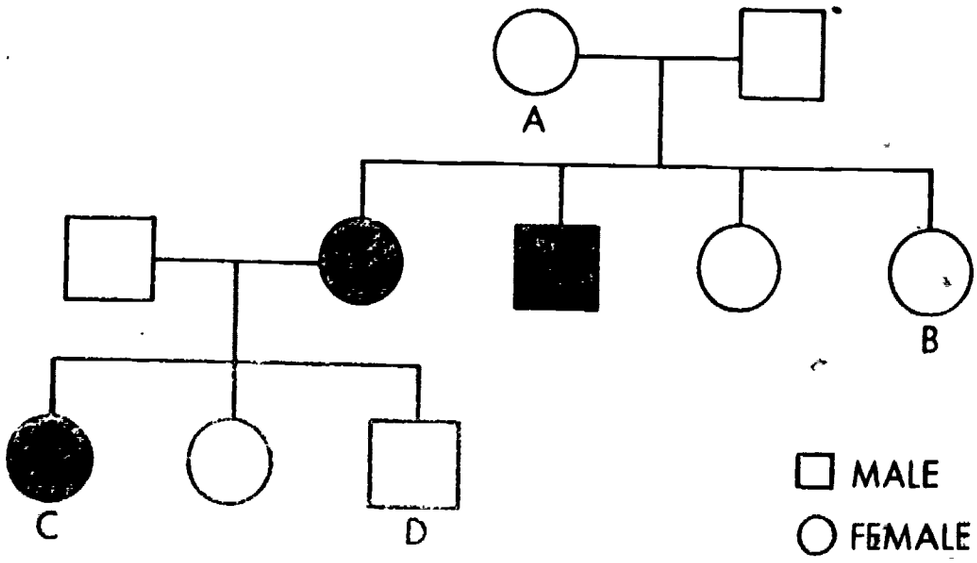
Visuals:

20. "Maturation of Gametes" - fs
21. "Neurospora Experiment" - fs
22. "Mitosis" - film loop
23. "Drosophila Technique" - film loop
24. "Working with Microorganism" - film loop
25. "Drosophila Mutants" - Carolina Tips No. 13
26. "Exercises with Drosophila" - Handout
27. "Animal Meiosis" - Handout
28. "Drosophila Genetics - Sex-Linkage" - Handout
29. "Drosophila Life Cycle" - Handout
30. "Neurospora Life Cycle" - Handout

Self-Evaluation II

QUESTIONS 1 - 4 relate to the following information and KEY:

Persons exhibiting albinism are represented by the black figures below:



KEY:

(A) heterozygous
(B) homozygous dominant
(C) homozygous recessive
(D) insufficient evidence

1. What is the probable genotype of A?

2. What is the probable genotype of B?

3. What is the probable genotype of C?

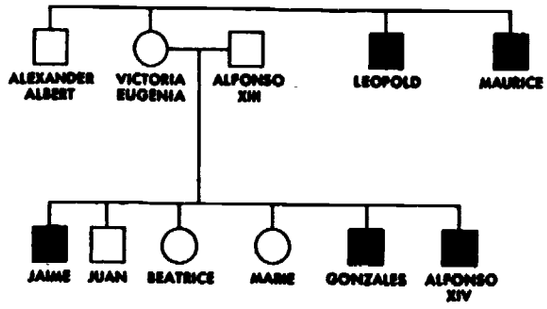
4. If D marries a woman with a heterozygous genotype, what is the probability that any of their children will exhibit albinism?

   (A) 0% (none)
   (B) 25%
   (C) 50%
   (D) 100%

5. The greatest danger of large doses of high energy radiation to human populations is
   (A) mutation in body cells.
   (B) mutation in reproductive cells.
   (C) damage to the skin and radiation sickness.
   (D) damage to the nervous system and an increase in cancer rate.

Questions 6 and 7 are based upon the following:

Information: The following pedigree shows the incidence of hemophilia, a sex-linked trait, in the Spanish royal family. Circle denotes female, squares are males, and shaded figures denote persons who had hemophilia.



6. If X^h represents the gene causing hemophilia and X is a normal athlete, the genotype of Victoria Eugenia is

   (a) XX

   (b) XX^h

   (c) X^hX^h

   (d) XY

7. What is the probability that Juan is carrying a gene for hemophilia?

   (a) 0%

   (b) 25%

   (c) 50%

   (d) 100%

SECTION III - Human and Population Genetics

Behavioral Objectives:

After consulting the resources, you will be able to:

24. Calculate the frequency in a population of a specific gene given the following information:

    (1) which gene is dominant or recessive
    (2) the frequency of a specific geneotype (1)

25. Calculate the frequency of a specific geneotype in a population given the frequency of a particular gene and using the formula : (1)

$$p^2 + 2pq + q^2 = 1 \text{ or } p + q = 1$$

26. Demonstrate your knowledge of the Hardy-Weinburg Principle by predicting the frequency of a particular gene in a specific generation given the frequency in the parent generation. (1)
    Example: What will be the frequency of the gene for baldness in the F_3 generation if the frequency in the parent generation is .16 and the Hardy-Weinburg assumptions hold true?

27. Describe the condition under which genetic equilibrium would be maintained. (2)

28. Demonstrate your understanding of the interaction of heredity and environment by identifying factors which are largely controlled by heredity and those which are more under the influence of environment.

RESOURCES III

Reading and Problems:

1. B.S.C.S Blue Version - pp. 438-447.
2. The Study of Biology, Allen, Baker - pp. 702-703
3. B.S.C.S. Blue Version - pp. 378-381
4. "Genetic Continuity" - Lab Block pp. 111-136
5. "The Genetic Basis of Evolution" Scientific American, reprint of Jan., 1950

Visuals:

20. Human Blood Antigens and Antibodies" Carolina Tips/- No. 14 (relates blood type and frequency in varies populations)

SELF-EVALUATION III

1. The gene pool for a population contains .25B alleles for a particular trait. Assuming the conditions of a model population, the proportion of b alleles in the next generation would be

   (a) .25
   (b) .50
   (c) .36
   (d) .75

2. The geneotype GG in a particular population was found to occur with the frequency of .64%. What would the frequency of the recessive homozygous be?

   (a) .36
   (b) .04
   (c) .16
   (d) .8

3. The geneotype AA in a certain population was found to occur .36%. What would be the frequency of the heterozygous geneotype Aa?

   (a) .64
   (b) .16
   (c) .8
   (d) .48

QUESTIONS 4-6 are based upon the following information:

Forty-nine percent of a population is homozygous for sickle-cell anemia. Assume that the gene for anemia is recessive to the gene for normal blood.

4. What is the percentage of normal blood individuals?

   (a) .51%
   (b) .9%
   (c) .3%
   (d) .21%

5. What is the percent of individuals heterozygous for blood condition?

   (a) 6%
   (b) 7%
   (c) 21%
   (d) 42%

6. The frequency of the recessive alleles would be

   (a) .49
   (b) .7
   (c) .51
   (d) .21

QUESTIONS 7 - 10 are based on the following:

In a community it was observed that 25% of the individuals have blue eyes.

7. When choice of mate is random regarding eye color the probability expressed as a percentage of both a husband and wife having blue eyes is
   (A) 12.5%
   (B) 6.2%
   (C) 50%
   (D) 75%

8. The frequency of the gene for blue eyes in this community is
   (A) 0.5.
   (B) 0.75.
   (C) 1.0.
   (D) 0.125.

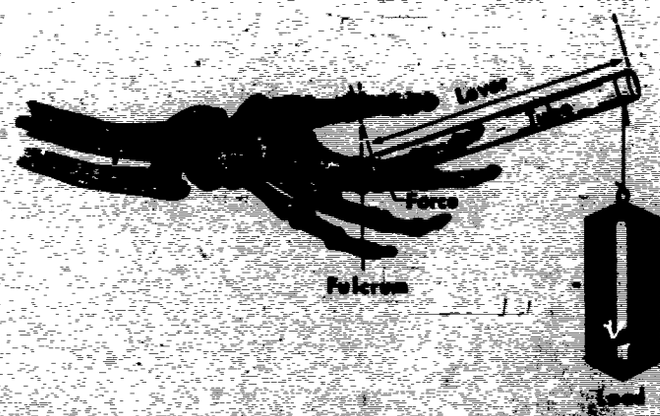
9. The frequency of the gene for brown eyes in this community is
   (A) 1.0.
   (B) 0.75.
   (C) 0.5.
   (D) 0.125.

10. What is the probability of both a husband and wife having brown eyes when the choice of mates is random regarding eye color?
   (A) 18%
   (B) 56.2%
   (C) 33.3%
   (D) 79.6%

11. Point mutations or small changes in the DNA of an organism are very significant in the evolution of a species because
   (A) the traits caused by these mutations are often inferior to those of the previous generation.
   (B) these mutations ordinarily kill an organism and thus eliminate undesirable individuals.
   (C) the mutation often has a rather minor effect but an accumulation of minor changes may result in a new species.
   (D) these mutations most often affect specific traits.

LEARNING ACTIVITY PACKAGE

ANIMAL PHYSIOLOGY



Ninety Six High School
Ninety Six, S.C.

BIOLOGY II

LAP NUMBER 33

WRITTEN BY B. Hooden

VIEWED BY

RATIONALE

The relationship between structure and function is important as a biological concept. In the previous Laps we have been building upon the major concepts of biology, from the cell to cellular and organismic reproduction. In this Lap we will select several types of organs and discover the way in which their structure is related to their function.

Section I

Homeostatic Regulation and Animal Tissue

BEHAVIORAL OBJECTIVES

1. From a description of a system in equilibrium, you will indicate whether it is static equilibrium or steady state. (1-A) (2-A) (5)

2. You will demonstrate your knowledge of homeostatic systems by describing the regulation of the following in man.

   (a) breathing rate

   (b) regulation of body temperature

   (c) regulation of blood sugar

   (3-A) (3-B) (1-A) (2-B) (2-C) (4)

3. You will identify a given written statement or illustration describing as positive or negative feedback. (1-A) (2-A)

4. You will be able to identify from a drawing, microscope slide or 2 x 2 slide the indicated tissue as being:

   (1) Epithelial

   (2) connective tissue

   (3) muscular tissue

   (4) nervous tissue

   (5) reproductive tissue

   given a description of the structure or general area being shown. (1-B)

5. You will give at least two specific areas in man where a given tissue is found. (1-B)

RESOURCES

Readings and Problems

(1) The Study of Biology - Allen, Baker

(a) pp. 458-468

(b) pp. 363-668

(2) Homeostatosis

(a) pp. 12-21

(b) pp. 22-33 - breath

(c) pp. 58-67 - respiratory

(3) Biology - Molecules to Man

(a) pp. 496-497

(b) pp. 562-568

(4) "The Human Body - Chemical Balance"

Life Reprint #57

(5) Elements of Biology - Weisz - pp. 281-286

Laboratory:

Self Test I

1. At a crucial moment in a championship basketball game, the star forward snatches the ball, races bull court, and goes up for two points to win the game. The physiological activities occurring in his body during this burst of effort include the following:

   (a) the CO_2 concentration of the blood rises sharply

   (b) breathing rate increases

   (c) muscular activity increases CO_2 production

   (d) an increased concentration of O_2 is available to the muscle cells

   (e) the respiratory center in the medulla increases its rate of impulses to the muscles of breathing

   Select from the following the correct sequence of these physiological activities occuring in the basketball player's body during his race down the court.

   (a) B, D, A, E, C

   (b) C, B, D, E, A

   (c) C, A, E, B, D

   (d) E, B, D, C, A

   (e) A, E, C, D, B

2. A thermostat that regulates the room temperature would be an example of

   (a) static equilibrium

   (b) steady state

   (c) positive feedback

   (d) negative feedback

3. Beside each structure you will list the type of tissue of which it is composed.

   (a) leg bone _____ (d) hair _____

   (b) brain _____ (e) sperm _____

   (c) skin _____ (f) heart _____

Section II

Digestive, Circulatory and Excretory Systems

BEHAVIORAL OBJECTIVES

6. You will trace the pathway taken by ingested food in each of the following animals: (1) amoeba (2) hydra (3) earthworm (4) bird (5) man. You will identify the anatomical structures through which food passes in correct order and give a brief description of the physical and chemical digestive processes which occur in each area. (3-A)

7. Based upon your understanding of the experiments in resource (1-A), you will be able to describe,

   (a) what factors initiate gastric secretion in hungry animals?

   (b) whether the swallowing reflex is controlled entirely by nerves? (1-A)

8. After completing laboratory II-A you will be able to compare digestion in paramecium, daphnia, earthworm and minnows in the following respects:

   (1) intracellurar or extracelluar digestion

   (2) general arrangements of digestive organs

   (3) how the digestive process is adapted to the type of food eaten. (3-A) (II-A)

9. Given one or more of the following enzymes you will be able to give (a) the substate upon which it acts ~~(b) the~~ products that result from the breakdown (c) the anatomical area of a vertebrate in which the reaction usually takes place (d) the PH range necessary for such reaction (if any). (3-A) (2) (4)

cellulase	lipase
pepsin	trypsin
pepsinogen	pancreatic protease
pancreatic amylase	

10. After completing laboratory II B you will be able to describe the function of the villi and microville in the intestine of vertebrates. (1-B) (3-A) (2) (4)

11. You will be able to describe the flow of blood through the mammalian and amphibian heart and lungs naming the vessels and chambers through which the blood flows. Also include the vessels which carry blood into and away from the heart. (4-C) (6-A)

12. You will be able to differentiate between excretion and secretion.

Behavioral Objectives con't

13. You will be able to list the three basic forms in which nitrogenous waste are excreted from animals and be able to describe how the method is adapted to specific habitats - Example: What would be the problems encountered if birds excreted ammonia? (1-C)

14. Given a diagram or other representation of the kidney you will be able to locate the following areas and describe the part they play in the excretion process. (4-B) (1-C)

cortex medullary region renal pelvis	gross anatomy
Bowman's capsule glomerulus	microscopic

15. Based upon your understanding of the functioning of the nephron, you will be able to choose the best prediction of a given hypothesis. Example - If the blood pressure of a man is increased then rate of urine formation will

(a) increase

(b) decrease

(c) not be effected

RESOURCES

Readings and Problems

1. The Study of Biology - Allen, Baker

   (a) pp. 369-378
   (b) pp. 380-382
   (c) pp. 397-404

2. "The Human Body - Food to Fuel" - Life Reprint #34

3. Biology - Silver, Burdett

   (a) pp. 363-378

4. Biological Science (Blue version)

   (a) pp. 523-536
   (b) pp. 546-552
   (c) pp. 4800488

5. "The Heart" - Scientific American - May 1957

6. High School Biology (Green version)

   (a) 496-498

Visuals

1. Micro Slides

   (a) Kidney - median, Sag. Sec.
   (b) Small Intestine, Mammal C.S.
   (c) Intestine, large C.S.

Activities

1. Answer the following questions to be turned in on page 404-408 - The Study of Biology - Allen, Baker - #2, 4, 5, 6, 7, 10

Laboratory Handout

"33-II"

Depth Study

Laboratory "In Vitro Technique" deals with absorption of glucose in a living intestine.

Self Evaluation Test II

1. Arrange the following parts of the human alimentary canal in the order in which food passes through them: stomach, rectum, large intestine, mouth, anus, small intestine.

2. Which of the following reactions represent digestion?

   (a) glycerol + fatty acid $\longrightarrow$ fat
   (b) protein $\longrightarrow$ amino acids
   (c) monosaccharide $\longrightarrow$ polysaccharide
   (d) disaccharide $\longrightarrow$ 2 monosaccharides

3. Which one of the following important substances in human digestion is not an enzyme?

   (a) pepsin
   (b) bile
   (c) amylase
   (d) lipase
   (e) trypsin

4. Arrange the following structures in the correct sequence in which blood passes through them, beginning with the left ventricle.

   (a) right atrium
   (b) tricuspid valve
   (c) aorta
   (d) leg capillaries
   (e) leg arteries
   (f) pulmonary artery
   (g) left atrium
   (h) leg veins
   (i) left ventricle
   (j) lung capillaries

5. Which one of the following substances would <u>not</u> normally be present in urine?

   (a) urea
   (b) red blood cells
   (c) uric acid
   (d) salts
   (e) water

Section III

Movement and Coordination

BEHAVIORAL OBJECTIVES

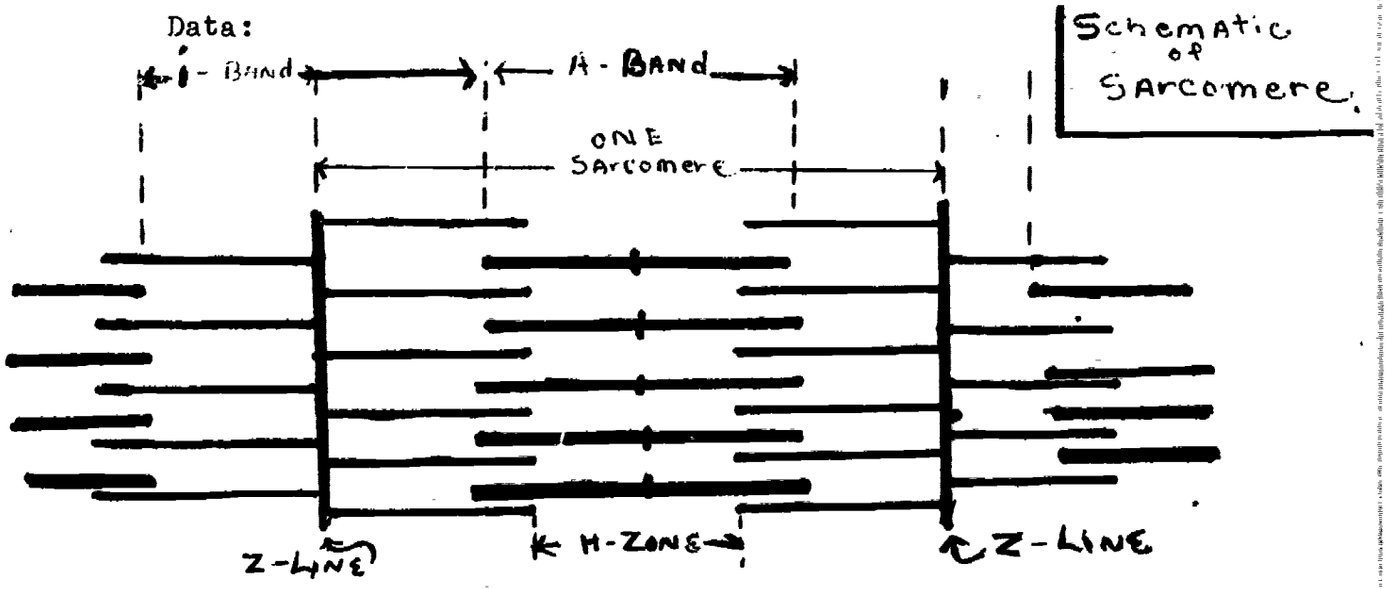
16. You will be able to describe the way in which a cell becomes polarized. (1-A) (4)

17. Based upon your understanding of "The Biochemical Approach" to the study of muscular contraction, you will be able to explain how the muscle is able to contract even though the body cannot supply it with sufficient oxygen. Also be able to explain the role played by creatine phosphate in the energy pathways. (1-A)

18. You will be able to list at least two factors responsible for muscle fatigue. (1-A)

19. Based upon your understanding of the "sliding filament" hypothesis, you will be able to choose the correct prediction from a given set of data and hypothesis. (1-A) Example:

Data:



Hypotheses - If the muscle contracted then,

(a) the distance between each sarcomere would become less

(b) the H zone would disappear

(c) the actin would be changed to myosin

(d) the sarcomere would become longer

(answer b)

20. Be able to describe the "all or nothing response" as it applies to muscular contraction and to nerve impulse. (1-A) (1-B)

L-W 21. Demonstrate your ability to perceive the relationship between the "chemical transmitter" hypothesis and the following observations: (1-B)

(1) Light and electron micrographs of the synapse show that there is no direct connection between the end brush of one neuron and the dendrite of the next.
(2) The synapse slows down the transmission of the nerve impulse.
(3) Transmission across a synapse is always one-way.
(4) Successive transmissions across a synapse brings about fatigue of the synapse area itself.
(5) Stimulation of some nerves actually seem to inhibit the nerves which lead away from them at the synapse.

L-III 22. Identify the function of the "sodium pump" in maintaining the potential in a nerve. (1-B)

C-11 23. Given the major structures of the nervous system of man, do each of the following: (5) (3) (2-B) (4)

(1) Classify each structure as a part of the central, autonomic, or peripheral nervous system.

(2) Describe nerve cells as motor (efferent), sensory (afferent), or associative (connective) nerve cells.

(3) Identify axons, dendrites, cell body, neurilemma, and mylin on a neuron.

(4) Describe the general functions of the medulla, cerebrum, and cerebellum.

24. You will be able to distinguish between reflex action and conditioned reflexes in terms of: (2-B) (4)

(1) neural pathways involved

(2) examples of each

RESOURCES

Readings

1. The Study of Biology - Allen, Baker

   (a) pp. 410-421

   (b) pp. 423-448

2. Biological Science (Blue version)

   (a) pp. 612-625
   (b) pp. 588-601

3. Biology - Silver, Burdett - pp. 477-485

4. Biology - "Introduction to Life" - pp. 439-446

5. "The Human Body - Circuits of the Senses" - Life Reprint #35

Laboratories

1. "Muscular Contraction" (Blue version)- pp. 617-618

2. Lab Handout "33-III"

Self Test

1. Explain the "sliding filament" hypothesis of muscle contraction.

2. Explain the function of each of the following portions of the human brain (a) cerebrum (b) cerebellum (c) medulla

3. Discuss what is meant by the following terms in relation to the passage of a nerve impulse along an axon:

   a) threshold

   (b) all-or-nothing