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Title of Study: A SYLLABUS FOR A COURSE IN PRACTICAL BIOLOGY FOR SECONDARY SCHOOLS

Pages in Study: 49 Candidate for Degree of Master of Science

Major Field: Natural Science

Scope of Study: Any attempt to change the rigid curriculum of academic biology for secondary schools is at most rather controversial. This report involves the compilation of a syllabus in practical biology for secondary schools and is designed to be as much non-technical as feasable and yet present the true concepts of the field of biology to the student. It is planned primarily for those students who will make their high school biology a terminal course. The course, as planned, will in no way, however, hinder the student who plans to further his education in college. Non-technical portions of various biology textbooks were used in compiling the syllabus and are referred to throughout the report.

Findings and Conclusions: Most of the textbooks written for biology in the secondary schools are designed in a technical manner and intended primarily for students who plan to further their education in college courses in biology. The use of any one of these text-books for a practical course in biology is really not feasable. By using portions of several books, biology can be practical to the non-college student.

ADVISER'S APPROVAL James H. Zant

A SYLLABUS FOR A COURSE IN PRACTICAL BIOLOGY FOR SECONDARY SCHOOLS

By

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A SYLLABUS FOR A COURSE IN

PRACTICAL BIOLOGY FOR SECONDARY SCHOOLS

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PREFACE

The primary objective of this report is to compile a general and broad outline for a course in biology for students who will not attend college or for those who will make their high school biology a terminal course.

The criterion for the selection of the various units and chapters has been the question: Is the material meaningful, and is it related to needs and interests of students as they meet their everyday problems.

Another main approach to the problem has been to present the subject in simple language, that which will be understood by the pupil. The subject matter is as much non-technical as can be feasable and yet present the true content of the field of biology to the student. The results of this report will not, of course, handicap the gifted student, and it will make learning possible for those of lesser ability.

In the development of the biology course around the practical aspects of daily living, it is essential that the teacher:

1. Use live materials
2. Use familiar organisms - local flora and fauna
3. Avoid emphasis on technical terms
4. Use varied methods, techniques, and content
5. Use seasonal materials

The suggested course of study is arranged in eight units with various chapters in each unit. Four books were used in compiling the course of study. The references for each chapter are numbered in

alphabetical order (eg. 1, 373-380, ie. book #1, pages 373-380), and are listed below.

1. Baker, Arthur C., and Lewis H. Mills, Dynamic Biology Today. New York: Rand McNally & Company, 1952.

2. Fitzpatrick, Frederick L., and Thomas D. Bain. Living Things. New York: Henry Holt and Company, 1953.

3. Moon, Truman J., Paul B. Mann, and James H. Otto. Modern Biology. New York: Henry Holt and Company, 1951.

4. Smith, Ella Thea. Exploring Biology. New York: Harcourt, Brace and Company, 1954.

With the above objectives in mind, I submit the following outline for a rather non-technical course in general high school biology.

I wish to express my sincere appreciation and gratitude to Dr. James H. Zant, Professor of Mathematics and Director of the Supplementary Training Program for High School Science Teachers, for his valuable assistance in checking this report, and for his counseling as adviser.

UNIT I

BIOLOGY, YOU, AND EVERYDAY LIVING

I. Purpose

A. What is biology, anyway? It is a science, or branch of learning, dealing with many facts. These facts are used to solve problems, and who does not have problems? Biology is the science of all living things. The student studies botany or plant life, zoology or animal life, and human biology or how his own body works. Biology will help him to have fun while in school, but, even more important, it will help him solve many personal problems after he finishes school.

The purpose of this unit is to give the student a brief introduction into the science of biology, how it is related to his everyday life, and how it can help him to solve some of the problems related to life.

B. Unit objectives

1. To lead pupils to understand how biology can train for outdoor work
2. To lead pupils to understand how biology can help train for certain indoor work
3. To help the pupil find a hobby in living things
4. To help the pupil to become more aware of the world of plants and animals around him

5. To lead the pupil to understand and apply the scientific method

II. Suggested content

A. Chapter 1. Biology Helps One Find a Place in the World. 2, 1-11; 3, 1-78.

1. Biology and outdoor work

a. Nurseryman

b. Florist

c. Orchardist

d. Landscape gardener

e. Forestry

2. Biology and indoor work

a. Food industry

b. Manufacture and research in drugs and medicines

c. Assistants to doctors, dentists, and opticians

d. Nursing profession

B. Chapter 2. Fun With Biology. 2, 8-10.

1. Hobbies for fun through biology

a. Biological collections

(1) Insects

(2) Leaves

(3) Flowers

(4) Fossils

(5) Shells

b. Wildlife study

(1) Nature study clubs

(2) Individual study

2. Hobbies for gain through biology

a. Vegetable gardens

b. Animal raising, ie. rabbits, chickens, etc.

C. Chapter 3. How To Be a Scientist. 1, 4-12; 2, 11-15.

1. Use of scientific method

2. Performing experiments

III. Suggested Student Activities

A. Have each member of the class examine the fingers of his or her right hand. Place the hand, palm down, on a flat surface. Count the thumb as the first finger. Each student should decide whether: (a) the second and fourth fingers are about the same length; (b) the second is longer than the fourth; (c) the fourth is longer than the second. Record the results on the blackboard. Now, have each student look at his or her left hand. Record the results on the blackboard. Do the results agree with those which you found for the right hand? What do you think these figures show?

B. Suppose someone asks you this question: "Will bean seeds sprout in the dark?" Form one or more hypotheses based on what you already know. Test these by experiment. Use controls to be sure the seeds will sprout under normal conditions.

C. Discuss some real problem of the group or a member of the class. Refer to the "Steps in the Scientific Method." See what facts you know about the problem. Form one or more hypotheses in the light of these facts. Now consider what other facts you need to test the hypotheses. See if you can get these facts and arrive at a sound conclusion.

UNIT II

THE WORLD IN WHICH YOU LIVE

I. Purpose

A. Any organism, large or small, must secure food if it continues to live. It must have oxygen. It must survive against it's enemies and be able to adapt to its environment or protect itself against it. These problems are solved in different ways by different types of organisms. These different kinds of organisms have different ways of living, but all of them are fitted in their own way to satisfy the same fundamental needs. Each organism must adapt itself not only to the environment, but also to other organisms in the environment. The purpose of this unit is to help understand and appreciate the living world about us and to better understand the great struggle that living things are engaged in for their existence.

B. Unit objectives

1. To lead the pupil to appreciate the structure and function of living organisms.
2. To help pupils to understand how different organisms adjust themselves to their environment.
3. To help students to understand the barriers to life.
4. To help students to understand how plants and animals are alike and how each is named.

II. Suggested content

A. Chapter 4. Characteristics of Living Things. 1, 45-50; 2, 21-23; 4, 4-20.

1. The cell
2. Protoplasm
3. Tissues
4. Organs
5. Organisms

B. Chapter 5. What Living Things Can Do. 2, 26-30; 3, 24-35.

1. Movement
2. Obtain food
3. Digestion
4. Uses energy and grows
5. Uses oxygen
6. Gets rid of waste
7. Is sensitive
8. Respiration
9. Reproduces

C. Chapter 6. Similarities and Differences of Plants and Animals. 1, 73-108; 2, 30-37; 3, 78-87.

1. Protoplasm
2. Cells
3. Organs
4. Organisms
5. Chlorophyll - plants only
6. Locomotion - animals only

D. Chapter 7. How We Name Living Things. 2, 33-37; 3, 72-78.

1. Kingdoms
2. Phylum
3. Class
4. Order
5. Family
6. Genus
7. Species

E. Chapter 8. Plants and Animals Living Together. 1, 445-467; 2, 37-41; 3, 72-78.

1. Communities
2. Dependence upon each other for food
   a. Plants
   b. Plant eaters
   c. Flesh eaters
   d. Parasites
   e. Saprophytes
3. Balance of Nature

F. Chapter 9. Why Do Living Things Need Water? 2, 49-53.

1. Water in organism
2. Water in soil

G. Chapter 10. Why Plants Need Sunlight - Photosyntheses. 1, 243-248; 3, 156-170.

1. Needed raw materials
2. Products produced
3. By-products or waste products

III. Suggested Student Activities

A. Learn to use a microscope. The names of its parts should be learned. Look through the eyepiece and adjust the mirror to

get a good light. Learn to open and close the diaphragm. What effect does this have on the light?

B. Peel off an outer layer of an onion. Between the inner layers you will find a very thin membrane. Put this on a glass slide. Add a drop of water and a cover glass. Look at your specimen under the microscope. What do the cells look like?

C. Here's how you can make a pond culture. Get a quart jar and go to the edge of a pond or stream if one is nearby. Fill the jar about half-full of water. Now add some of the decayed matter you find on the bottom in shallow water. Add a few growing plants such as the "pond scums" you will find on the surface. Examine drops of your culture under the microscope. Describe what you see.

D. Weigh a potato. Cut it into small pieces. Dry out the small pieces in an oven or on a radiator. Weigh them again when thoroughly dry. How much weight has been lost? What does this weight loss represent?

E. Using a microscope or a microprojector, look at the cross-section of a leaf. Locate the pores or openings through which gases enter or leave the leaf. Locate a vein through which liquids move in the leaf. Identify the cells which make the foods.

F. Change the position of a potted plant on a window shelf from day to day. See whether the leaves keep turned to the light.

UNIT III

PLANTS IN THE WORLD

I. Purpose

A. A name identifies a given object or thing so that, in speaking or writing, it will not be confused with other things. Without names we could express very few thoughts and even our thinking would be greatly hindered. A name, however, can do more than merely identify a given object or thing. It can tell us something about the thing named. In biology the name usually shows relationship. In order that the name may perform such a function, organisms which are related to, or are like one another are classed in one group.

The object of this unit is to show how the plants in the world are classed, their characteristics, and their economic importance.

B. Unit objectives

1. To show why scientific classification of plants is necessary.
2. To acquaint pupils with the common phyla of plants and general characteristics of each.
3. To show the similarities and differences existing among plants of all degrees of development.
4. To show how plants are given their names.

II. Suggested content

A. Chapter 11. Non-Seed Bearing Plants. 1, 84-101; 2, 65-81; 3, 88-100; 4, 50-66.

1. The Algae

a. One-celled

(1) Terrestial

(2) Aquatic

b. Many-celled - seedweeds

c. Economic importance

(1) Food

(2) Gelatin

(3) Contamination of drinking water

(4) Contamination of swimming pools

2. The bacteria

a. Characteristics

(1) Lack Chlorophyll

(2) Size

(3) Reproduction

b. Types

(1) Rod-shaped

(2) Ball-shaped

(3) Spiral-shaped

c. Destribution of bacteria

d. Economic importance

(1) Bacteria and their relation to nitrogen in the soil

(2) Bacteria and their relation to decay

(3) Diseases caused by bacteria

3. The fungi

    a. Yeasts

        (1) Characteristics

            (a) Food getting

            (b) Reproduction

        (2) Economic importance

            (a) Bread making

            (b) Beaverages

            (c) Crop damage

            (d) Ringworm

            (e) Athletes' foot

    b. Molds

        (1) Characteristics

            (a) Reproduction

            (b) Moisture needs

            (c) Food needs

        (2) Economic importance

            (a) Damage to crops

            (b) Destruction of food

            (c) Destruction of clothing

            (d) Food industry

            (e) Medicines

4. Mosses and ferns

    a. Characteristics of mosses

        (1) Contains chlorophyll

        (2) Reproduces

b. Economic importance of mosses

(1) Food

(2) Covers for small animals

c. Characteristics of ferns

(1) Structure (true roots)

(2) Reproduction - alternation of generation

d. Economic importance of ferns

(1) Food

(2) Cover for small animals

(3) Coal

B. Chapter 12. Seed Plants. 1, 101-107; 2, 87-94; 3, 179-193.

1. General characteristics of seed plants

a. Roots

(1) Structure

(2) Function

b. Stems

(1) Structure

(a) Monocots

(b) Dicots

(2) Function

c. Leaves

(1) Structure

(2) Function

d. Flowers

(1) Structure

(2) Function

C. Chapter 13. Crop Plants Provide Food. 1, 178-202; 2, 94-98.

1. Description

a. Forage

(1) Grass

(2) Clover

(3) Alfalfa

b. Cereal grains

(1) Wheat

(2) Corn

(3) Rice

2. Vegetables and fruits

a. Tomatoes - history of

b. Beans

c. Peas

d. Citrus fruit

e. Apples

f. Peaches

g. Pears

h. Grapes

i. Nuts

D. Chapter 14. Industrial Plant Uses. 1, 202-205; 2, 102-111; 3, 208-219.

1. Paper

2. Plywood

3. Cloth

4. Rubber

5. Oils

6. Plastics

7. Sugar

8. Alcohol

9. Drugs

   a. Quinine

   b. Ergot

   c. Opium

   d. Cocaine

   e. Strychnine

III. Suggested Student Activities

A. Get a pond culture which contains some algae. The pond scums which float on the surface in shallow water are made up of algae. One-celled algae are also common in pond water. Examine samples of the culture with a microscope or a microprojector. Report on what you see, or make drawings if you wish.

B. Break off a small piece of bark that is covered with algae. Scrape off a little of the green mass. Put it on a microscope slide. Add a drop of water and put on a cover glass. Now look at the specimen with a microscope. Describe what you see, or make a drawing.

C. Algae are simple plants, but some of them grow to great size. Look up the kelps in a botany book or in an encyclopedia. Report on them to the class, telling as much as you can find.

D. Mix nutrient agar and water according to the directions on the package. Pour this mixture into several Petri dishes and let it set. It will form a medium on which bacteria will grow.

Put a little dust on one agar surface, and a little material scraped from the side of a tooth on the other. Cover both samples and keep them in a warm, dimly-lighted place. Look at them each day for several days. See whether colonies of bacteria have developed.

E. With a microscope or projector, look at a cross-section of a corn stem. Compare it with the cross-section of a bean stem or any woody stem. In what ways are the stems alike? Different?

F. Plant some bean or corn seeds in a tray containing moist soil. Cover the seeds to a depth of about an inch. Put the tray in a warm spot on a window shelf. After the young plants have sprouted, remove them from the soil and study their parts.

G. Collect and exhibit samples of papers and cloth made from plant products.

H. Get soilless gardening set from a supply house. Follow the directions that come with the set. Make a soilless garden on a window ledge. You can use an acquarium or large battery jar to hold the liquid.

I. This is a demonstration to show that green plants contain more than one kind of colored material. Your teacher will help with the demonstration. Heat some alcohol in a water bath. Put spinach leaves in the hot alcohol. The alcohol will absorb colored materials from the leaves. Soon the Alcohol will become dark green. At this point, put out your fire. Let the alcohol cool. Now pour 50 cc of the green

alcohol in a large test tube or a tall bottle. Add 10 cc of water. Add 60 cc of benzol. Stir this mixture with a glass rod. When the liquid comes to rest again it is in two layers. One layer is green. This layer contains chlorophyll. What color is the other layer?

UNIT IV

ANIMALS IN THE WORLD

I. Purpose

A. There are many animals in your environment. Some are useful. Others are pests, or are of little importance. Man's problem is to make the best use of the useful animals, and to control the pests.

Many of the invertebrate animals are useful because they're parts of food chains. But some of the small animals cause diseases. The worm parasites are important because they affect the welfare of man, other animals, and plants. From oysters and clams we get food, pearls, and shell products. Crayfish, lobsters, crabs, and shrimp are also important sources of food. Some types of insects are useful, but many species are pests.

The animals with backbones (vertebrates) include the fish, amphibians, reptiles, birds, and mammals. Fish taken from oceans, lakes, and rivers are still a valuable factor in our food supply. They are also a source of oils and fertilizers. Most amphibians are useful, and so are many reptiles. But a few reptiles are pests.

Most birds are useful because they eat either weed seeds, insect pests, or rodent pests. Such mammals as house rats and house mice are pests, but many other mammals are useful

fur-bearers, or sources of food, leather, and other products. The purpose of this unit is to help the pupil to understand the way in which animals are classed, their environments, and their economic importances.

B. Unit objectives

1. To help the students to understand and appreciate the vast numbers of animals in the world.
2. To acquaint pupils with the various classes of animals
3. To acquaint pupils with the differences of the animal classes
4. To show the economic importances of various animals

C. Chapter 15. Simple Animals. 1, 109-118; 2, 120-124; 3, 253-273; 4, 73-80.

1. One-celled animals
   a. Amoeba
      (1) Structure
      (2) Reproduction
      (3) Locomotion
      (4) Economic importance
   b. Paramecium
      (1) Structure
      (2) Reproduction
      (3) Locomotion
      (4) Economic importance
2. Sponges and corals
   a. Hydra
      (1) Structure

(2) Habitat

(3) Economic importance

b. Corals

(1) Structure

(2) Habitat

(3) Economic importance

(a) Jewelry

(b) Reefs

D. Chapter 16. Animals Without Backbones. 1, 118-138; 2, 127-144; 3, 268-324; 4, 80-93.

1. Worms

a. Flatworms

(1) Parasites (tapeworms)

(2) Non-parasitic

(a) Habitat

(b) Economic importance

b. Roundworms

(1) Trichina

(2) Hookworms

c. Segmented worms

(1) Earthworm

(a) Body structure

(b) Economic importance

[1] Food chain

[2] Benefits to soil

(2) Leeches

(a) Habitat

(b) Economic importance

2. Oysters and clams

a. Body structure

b. Economic importance

(1) Food

(2) Pearls

(a) Natural

(b) Cultured

(3) Mother-of-pearl

(4) Oyster shells

3. Joint-legged animals

a. Crayfish and relatives

(1) Structure

(2) Habitat

(3) Economic importance

(a) Food

(b) Crop damage

(c) Dam damage

b. Spiders and their relatives

4. Insects, general characteristics of the phylum

a. Grasshopper

(1) Structure

(a) Legs

(b) Eyes - simple and compound

(c) Wings

(d) Body segments

(2) Life cycle

(a) Egg

(b) Nymph

(c) Adult

(3) Economic importance

(4) Control

b. Moths

(1) Life cycle

(a) Egg

(b) Larvae

(c) Cocoon

(d) Adult

(2) Economic importance

c. Mosquitoes

(1) Life cycle

(2) Economic importance

(3) Control

d. Boll weevil

B. Chapter 17. Animals With Backbones. 1, 131-158; 2, 151-159; 3, 335-410; 4, 157-176.

1. Aquatic

a. Fish

(1) General body structure

(2) Respiration

(3) Importance

(a) Food

(b) Oils

(c) Fertilizers

2. Amphibians

   a. Characteristics

      (1) Body covered by a thin, flexible, usually moist skin, without scales, fur or feathers

      (2) Feet, if present, often webbed

      (3) Toes soft and lacking claws

      (4) Immature, or larval forms, vegetarian; adults usually carnivorous

      (5) Heart three-chambered in adults; circulation well developed

      (6) Eggs directly fertilized as laid

      (7) Development in stages called a metamorphosis

   b. Examples

      (1) Salamanders and newts

      (2) Frogs

      (3) Tree frogs

      (4) Toads

   c. Reproduction

   d. Economic importance

3. Birds

   a. Characteristics

      (1) Body covered with feathers

      (2) Forelimbs (arms) developed as wings, solely for locomotion and never for prehension

      (3) Mouth provided with a horny, toothless beak

      (4) Body supported on two limbs only (like man)

   b. Adaptations for flight

c. Food habits

d. Economic importance

(1) Food

(2) Destruction

e. Reproduction

4. Reptiles

a. Characteristics

(1) The body is usually covered with scales

(2) The skin is dry, not moist and slimy

(3) The feet, if present, are provided with claws

(4) Eggs are internally fertilized and, if laid, have a protective shell. Certain species retain the eggs within the body and bring forth the young alive

(5) They have no metamorphosis

(6) Gills are not present as in the fish and amphibian, both young and adult reptiles breathing with lungs

b. Examples

(1) Snakes

(a) Poisonous

(b) Nonpoisonous

(2) Lizards

(3) Turtles

(4) Crocodilians (including alligators and crocodiles)

c. Reproduction

5. Mammals

a. Examples

(1) Cows

(2) Horses

(3) Dogs

(4) Cats

(5) Sheep

(6) Man

b. Characteristics

(1) Air breathers

(2) Possess backbone

(3) Warm-blooded

(4) Four chambered heart

(5) Hair

(6) Teeth in bony sockets

(7) Reproduction

(a) Live bearers

(b) Egg layers

c. Classes of mammals

(1) Gnawing (rodents)

(a) Adaptation for gnawing

(b) Economic importance

[1] Fur bearers

[2] Description

(c) Control

(2) Flesh eaters (carnivores)

(a) Dogs

(b) Wolves

(c) Coyotes

(d) Leopards

(e) Seals

(f) Walruses

(g) Bears

(h) Mink

(i) Weasels

(j) Foxes

(k) Skunks

(3) Marine

(a) Example - whale

(b) Economic importance

1 Oil

2 Glycerin

3 Whale bone

(4) Man

F. Chapter 18. Domestic Animals. 2, 167-171.

1. What are domestic animals

2. History of animal domestication

G. Chapter 19. Fur Bearers. 2, 171-174.

1. Wild

2. Fur farms

III. Suggested Student Activities

A. With a lens, examine some living or preserved specimens of Hydra. Locate the parts.

B. Examine some preserved or living specimens of planarians, tapeworms, and roundworms. Try to find out in what ways they are different. For one thing, notice that only the roundworms

have complete digestive canals.

C. Examine shells of clams, oysters, and snails. Locate the mother-of-pearl layer, and study its relation to the rest of the shell. If possible, examine products from mollusks, such as cracked shell (bird food), pearl buttons, and pearl inlay work (mostly on furniture or ornamental boxes).

D. Examine a living or preserved grasshopper. Locate the structures. Remember that there are many different species of grasshoppers.

E. Put a little meat in a dish on a window shelf. In a day or two certain flies may lay eggs on the meat. Put the meat and eggs in a large jar. Cover the jar carefully with cheesecloth. Now you can watch the development of fly larvae, pupae, and adults.

F. With the aid of your teacher, examine a fresh fish. Locate the fins, gills, and the larger internal organs.

G. Save some wing and leg bones of a chicken. Cut them in two with a saw. Study their hollow structure. If you have a bird skeleton at hand, study the way in which bones are joined together. The result is strength and light weight.

H. Observe the skeleton of any mammal. Note especially the structure of the backbone, and the bones which are in the front and hind limbs.

UNIT V

YOUR BODY AND HOW IT WORKS

I. Purpose

A. The body is one's most valuable possession. It has a very complex structure with each organ working with other organs to make up the complete organism called a human body. The purpose behind this unit is to give the students a general knowledge of his own body and the various complex structures and processes which are found in the body.

B. Unit objectives

1. To acquaint students with the general regions of the body
2. To lead pupils to a better understanding of how the various systems of the body function
3. To lead the pupils to appreciate the body, what good health really is, and what is required to maintain it.

II. Suggested content

A. Chapter 20. General Body Structure. 2, 184-185; 3, 426-435.

1. Body regions

a. Organs within the head and neck

(1) Brain

(2) Top of spinal cord

(3) Special senses represented

(a) Sight - eye

(b) Hearing - ear

(c) Smell - nose

(d) Taste - tongue

(4) Glands

b. Trunk and contents

(1) Chest cavity

(a) Heart

(b) Lungs

(2) Abdomen

(a) Stomach

(b) Intestines

(c) Liver

(d) Pancreas

(e) Kidneys

(f) Bladder

c. Limbs

(1) Arms and regions

(a) Upper arm

(b) Forearm

(c) Wrist

(d) Hand

(2) Legs and regions

(a) Thigh

(b) Shin

(c) Ankle

(d) Foot

B. Chapter 21. Body Framework. 1, 384-390; 2, 189-194; 3, 435-444.

1. Purposes

   a. Support

   b. Protection for internal organs

   c. Forms attachment for muscles

2. Structure

   a. Skull

   b. Backbone - vertebrae

   c. Ribs and breast bone

   d. Shoulders and arms

      (1) Collar bone

      (2) Shoulder blade

      (3) Upper arm

      (4) Forearm

      (5) Wrist

      (6) Hand

   e. Hips and legs

      (1) Pelvis

      (2) Thigh

      (3) Kneecap

      (4) Shin

      (5) Foot

C. Chapter 22. Muscles of the Body. 1, 390-393; 2, 194-200; 3, 435-444.

1. Muscle composition

2. Types of muscles

   a. Voluntary

   b. Involuntary

(1) Characteristics

(2) Composition

c. Heart

(1) Composition

(2) Control

D. Chapter 23. Digestion and Absorption in the Body. 1, 254-266; 3, 459-474; 4, 195-212.

1. What is digestion

2. Organs of digestion and digestive process

a. Digestion in mouth

(1) Teeth

(2) Tongue

(3) Salivary glands

b. Digestion in stomach

(1) Enzymes

(2) Storage

c. Digestion in small intestine

(1) Enzymes

(2) Storage and absorption

3. Absorption

a. Small intestine

b. Large intestine

E. Chapter 24. Circulation in the Body. 1, 353-376; 2, 228-232; 3, 485-499; 4, 187-190.

1. Blood

a. Composition

(1) Plasma

(2) Red cells

(a) Number

(b) Size

(c) Structure

(d) Function

(3) White cells

(a) Number

(b) Size

(c) Structure

(d) Function

b. Pressure

2. The heart

a. Structure

(1) Size

(2) Regions

(a) Right auricle

(b) Right ventricle

(c) Left auricle

(d) Left ventricle

(e) Valves

(f) Veins

(g) Arteries

b. Function

3. Arteries

a. Structure

b. Function

4. Veins

a. Structure

b. Function

F. Chapter 25. Respiration. 1, 376-384; 2, 232-236; 3, 474-484; 4, 183-186.

1. Structures involves

a. Trachea

b. Bronchial tubes

c. Lungs

(1) Air sacs

(2) Blood vessels

2. Control

a. Inhalation

b. Exhalation

c. Artificial respiration

3. Transpiration and exchange of Oxygen and Carbon Dioxide

a. Blood

b. Body cells

G. Chapter 26. Elimination. 1, 329-334; 2, 2360239; 3, 508-514;

1. Lungs

2. Kidneys

a. Structure

b. Function

3. Skin

4. Intestines

H. Chapter 27. The Brain and Nervous Responses. 1, 510-524; 2, 245-256; 3, 514-525; 4, 236-267.

1. Nerve cells
    a. Structure
        (1) Cell
        (2) Dendrites
        (3) Axon
    b. Function
        (1) Receives stimuli
        (2) Sends messages
2. Spinal cord and brain
    a. Function of cord
    b. Struction of cord
    c. Divisions of brain
        (1) Medulla
            (a) Structure
            (b) Position
            (c) Function
        (2) Cerebellum
            (a) Position
            (b) Function
        (3) Cerebrum
            (a) Position
            (b) Function
                1 Memory
                2 Intelligence
                3 Habits

I. Chapter 28. Chemical Messengers. 1, 529-533; 2, 256-263; 3, 514-525; 4, 236-267.

1. Ductless glands
    a. Structure
    b. Function
2. Thyroid
    a. Location
    b. Hormone produced
    c. Affect on body
    d. Medical control
3. Adrenal
    a. Location
    b. Hormone produced
    c. Affect on body
    d. Medical control
4. Pancreas
    a. Location
    b. Hormone produced
    c. Affect on body
    d. Medical control
    e. Diabetes and control

III. Suggested Student Activities

A. Examine a chart of the human body. Find and study the regions and structures.

B. After reading directions in the Red Cross First Aid Textbook practice: (a) splinting and bandaging a "broken arm"; and (b) bandaging a "sprained ankle."

C. Get an animal joint from your butcher. Examine it to see how the bones are held together. Do you find any cartilage? Any tendons? What is bone marrow?

D. Get a complete voluntary muscle from your butcher, or remove one from the leg of a preserved frog. Note the presence of blood vessels and nerves. Observe the continuous sheath of connective tissue, and the tendons at the ends of the muscle.

E. If you have microscope slides and a microscope, examine cells of: (a) voluntary muscle; (b) involuntary muscle; and (c) heart muscle. Note how they differ as to shape, stripes, and number of nuclei.

F. Prepare three small dishes of: (a) sugar solution; (b) salt solution; and (c) vinegar. Dip the end of a toothpick in the sugar solution, and touch your tongue with the sugar solution in several different places. Do you taste the sugar on all parts of your tongue? Repeat with salt solution and vinegar. What do you learn from the results?

G. Examine a chart of the human digestive system, and locate the main structures, including related glands. If you have a microscope and prepared slides, examine sections of: (a) the stomach wall; and (b) the intestine wall. Locate glands and blood vessels.

H. Put pieces of several foods in test tubes one-fourth full of water. Use cooked egg white, meat, bacon, cheese, bread, potatoes, crackers, or any other foods you have at hand. Add three or four drops of iodine solution to each test tube. Shake the contents. If starch (a carbohydrate commonly found in foods) is present, a bluish-black color appears. Which foods contain a large amount of starch?

I. Put pieces of several foods in test tubes one-fourth full of

water. Use the same kinds of foods as in experiment H. Add a pipette full of Fehling's solution A to each tube and heat to boiling. Add a pipette full of Fehling's solution B and heat again. If the food tested contains sugar, a coppery brown color will appear. Which foods contain large amounts of sugar?

J. Put a piece of bread or cracker in a test tube one-fourth full of water and another piece in a test tube one-fourth full of saliva. Allow each to stand a half-hour. Test each for sugar as in experiment I. Is sugar present in both tubes? What did the saliva do?

K. Place a small drop of blood on a glass slide. Dilute it with a drop of salt water. Cover with a cover glass. Examine under a microscope. Study the red blood cells. Can you find any white blood cells?

L. Dissect a lamb or pork heart. Locate the two auricles and the two ventricles. Observe the location and form of the heart valves.

M. After you have been sitting down for about 20 minutes, find your pulse and take your pulse rate. Then stand up and sit down again a half-dozen times. Take your pulse rate again. How do you account for the difference?

N. You may have microscope slides showing cross-sections of arteries and veins. Examine them through a microscope. How do they differ? How is the difference related to the work they do?

O. After referring to the Red-Cross First Aid Textbook, show

the class how to apply artificial respiration.

P. Examine and dissect a beef, pork, or sheep kidney. Locate the artery that brings blood to the kidney, and the vein that carries blood away. Find the duct that carries urine to the bladder.

Q. Examine models or charts of the eye and ear. Learn to recognize the parts. Study how these parts work together so that you can see and hear.

R. Have a member of the class roll up his left sleeve. Blindfold him, and put a pencil in his right hand. Now take another pencil and touch him lightly on the forearm. Have him try to touch the same spot on his forearm. Try different spots up and down the arm, and on both sides. Are nerve endings of touch evenly distributed through the skin?

S. Get a calf, pig, or sheep brain from a butcher. Locate the cerebrum, cerebellum, and medulla. Cut into the cerebrum with a razor blade. Where is the gray matter? The white matter? See if you can find the internal cavities.

T. Sit in a dimly lighted part of a room with your back to the windows for two or three minutes. Look at your eyes in a mirror. Note the size of the pupils. Now go to a window and look out at the light for two or three minutes. Note the size of your pupils again. This change in the size of the pupils is the result of a reflex act. It is an automatic response over which you have no control.

UNIT VI

HEALTH AND BODY WELFARE

I. Purpose

A. Good health is necessary for our social and economic well being. Certain basic facts must be known by one if he is to have a healthy body. The purpose of this unit is to give the student a basic understanding of the underlying principles of good health.

B. Unit Objectives

1. To lead the student to know the causes of many of our common diseases

2. To acquaint the student with various methods of disease control

3. To help the student to understand what is needed to have a healthy body

II. Suggested contents

A. Chapter 29. Disease and Germs. 1, 280-319; 2, 266-273.

1. Bacteria

a. Diphtheria

b. Scarlet fever

c. Tetanus

d. Typhoid fever

2. Protozoan disease - malaria

3. Spread of disease

a. Contact

b. Food and drink

c. Lice

d. Mosquitoes

4. Protection against disease

a. Skin

b. Immunity

(1) Active

(2) Passive

c. History of immunity of some diseases

(1) Smallpox

(2) Typhoid

(3) Tetanus

B. Chapter 30. Diseases Not Caused by Germs. 1, 234-239; 3, 295-305.

1. Heart

2. High blood pressure and hardened arteries

3. Cancer

a. Danger signs

(1) Changes in the color or size of moles and warts, from which cancerous growths may develop

(2) The development of any unusual lump of tissue

(3) Unusual bleeding from any opening of the body

(4) Sores which do not heal up as they should

(5) Continued indigestion which does not yield to treatment

(6) Sudden loss of weight which is not due to diet or increased exercise

b. Cures

C. Chapter 31. Public Health. 1, 334-352; 2, 285-289.

1. Control of epidemics

2. Sewage and garbage

3. Safe water supply

4. Pure food and drug laws

5. Safe milk supplies

6. Drugs used in disease

a. Sulfa

b. Penicillin

c. Streptomycin

d. Chloromycetin

e. Aureomycin

D. Chapter 32. Body Nutrients. 1, 224-243; 3, 444-459; 4, 195-212.

1. Basic seven

a. Minerals

b. Vitamins

III. Suggested Student Activities

A. With the aid of your teacher, make several agar surfaces for the growth of bacteria. Use Petri dishes and nutrient agar.

B. Put scrapings from your teeth on two or three agar surfaces. Put a little dust from the floor on two or three other agar surfaces. Cover these preparations. Keep them in a warm place for several days. Note the bacterial colonies which develop.

C. Put scrapings from your teeth and dust on different agar surfaces. Then flood the surfaces with iodine solution or 70% alcohol. Pour off any surplus iodine. Cover the agar surfaces, and keep them in a warm place for several days. What are your results?

D. Visit a garden or a field. See if you can find some plants that are being attacked by diseases. Many plant diseases are caused by molds, rusts, mildews, and bacteria.

E. Carry out one or more field trips to study (a) your local water supply, including the source of the water, how it is tested, and how it is cleaned and purified; and (b) the methods used in getting rid of garbage and sewage in your community.

F. From your local Board of Health, find out what policies are followed in quarantining. Try to relate these policies to the ways in which germs get into your body.

G. Plant six young sunflower plant seeds in flower pots. Wait until they are about six inches tall. Then paint an area on each stem several times with a solution that is about one-fifth ammonia and four-fifths water. See if you can cause tumorous growths to form.

UNIT VII

REPRODUCTION

I. Purpose

A. All living things must reproduce to assure the continuation of the race. Reproduction is complicated and hard to explain even in the simplest of animals. Many concepts and theories are involved in explaining the process of reproduction. The purpose of this unit is to lead the student to an understanding of the basic concepts and realities of reproduction.

B. Unit objectives

1. To show that all living things are produced by living parent or parents

2. To acquaint pupils with the main events in cell division

3. To help pupils to become familiar with the formation of the germ cell in animals and with the process of fertilization

4. To help pupils to better understand the factors of inheritance

II. Suggested content

A. Chapter 33. Reproduction. 1, 542-585; 2, 319-326; 3, 607-652; 4. 361-389.

1. Types of reproduction

a. Fission

b. Budding

c. Vegetative

d. Fertilization

2. Sexual reproduction of animals

a. Formation of germ cells

b. Fertilization

3. Reproduction in plants

a. Stamen

b. Pistil

c. Pollination

4. Growth of embryo

a. Protection

b. Incubation

c. Maternity

B. Chapter 34. Inheritance and Individual Characteristics. 1, 585-602; 2, 332-344; 3, 607-652; 4, 406-443.

1. Individual variations

a. Slow change through variations

b. Acquired characteristics

c. Mutations

d. Cross breeding

2. Inherited traits - Mendel's law

a. Dominant characteristics

b. Recessive characteristics

c. Blending

d. Mutants

III. Suggested Student Activities

A. Fill a culture bowl with sugar water. Add some yeast, and

let it stand in a warm place for 48 hours. Now examine drops of the culture through a microscope. You will see the yeast cells budding. This is one way in which yeast cells reproduce.

B. With the aid of a microscope, examine slides which show Paramecium dividing. The one-celled animal divides to produce two new animals.

C. Plant some bulbs, geranium slips, pieces of potato, and green willow shoots in moist, sandy soil. Keep them watered, and in a warm place. See if complete plants develop from these plant parts.

D. Examine several microscope slides which show early development of a starfish or sea urchin. You will need a microscope or a projector. Starfish and sea urchin eggs divide equally during early stages. Find 2-cell, 4-cell, 8-cell, and 16-cell stages. See if you can find out how the three germ layers are formed.

E. Examine a flower. Identify its structures. Locate the pollen. Cut an ovary in two and examine the contents of the ovary.

F. Plant some bean and corn seeds in moist, sandy soil. Study them in various stages of sprouting. Find out what structures give rise to the roots and stems. Find out how the seed leaves of beans and corn differ.

G. Weigh and measure the height of each of the members of your class. Have your teacher help you make a chart with curves showing the variations in height and weight.

H. Count the members of your class who have: (a) brown eyes; and (b) blue eyes. Do not count "in-between" colors such as

hazel. What type appears to be dominant? Explain why two brown-eyed parents might have a blue-eyed child.

I. Prepare an exhibit which shows variation in some species of plant or animal.

UNIT VIII

CONSERVATION

I. Purpose

A. People are entirely dependent upon nature for all the things they enjoy. To save all the material resources it would be necessary to stop using them. If the present modern way of life is to continue, then the natural resources must be used, but they must be used wisely. To do this, these resources must be used so as to bring the greatest benefits to the greatest number of people for the longest period of time. The purpose of this unit is to point out the need for conservation.

B. Unit objectives

1. To show that the nature of the soil determines the nature of the plants
2. To cause students to become conservation conscious
3. To learn the important methods of soil conservation
4. To develop an appreciation of the beauty of nature
5. To help pupils understand some of the major factors which have been responsible for the depletion of the natural resources
6. To give pupils a working knowledge of some of the principles involved in the conservation, restoration, and management of natural resources

7. To direct pupils in their efforts to attack conservation problems which exist in their own community

II. Suggested content

A. Chapter 35. Soil Conservation. 1, 742-747; 2, 354-359; 3, 670-683; 4, 518-528.

1. Composition of the soil

a. Decomposed rock

b. Plant nutrients

c. Two sources of organic matter

(1) Organic matter as related to soil fertility

(2) Organic matter as related to water holding capacity of the soil

d. Soil bacteria

e. The nitrogen cycle

2. Types of erosion

a. Wind

b. Water

3. Preventing soil erosion

a. Cover crops

b. Terracing

c. Strip cropping

d. Planting trees and shrubs

e. Controlling gullies

4. Maintaining soil fertility

a. Crop rotation

b. Green manure crops

c. Legume plants

d. Commercial fertilizers

e. Livestock, vs. grain farming

B. Chapter 36. Conservation Through Insect Pest Control. 1, 740; 3, 687.

1. Methods of controlling insects which attack crops

a. Using poison

b. Rotating crops

c. Knowledge of the life history of insects

d. Encouraging enemies

2. Pests that affect domestic animals

a. Lice

b. Mites

c. Flies

d. Fleas

e. Ticks

f. Method of control

g. Economic loss

C. Chapter 37. Conservation of the Forest Resources. 1, 738-740; 2, 363-367; 3, 685-690; 4, 528-532.

1. Principle uses of wood

2. Compare the annual production of timber with the demand for timber products

3. Principal factors which have been responsible for the depletion of forest resources

a. Forest fires

b. Man

c. Insects

d. Fungus

e. Waste

4. Forest conservation as related to soil conservation, water conservation, conservation of minerals, and wild life management

D. Chapter 38. Wild Life Management. 1, 730-737; 2, 374-379; 3, 691-696; 4, 532-538.

1. Three essentials for the production of all wild life
2. Value of wild life to man
3. Destruction of habitat causes depletion of wild life
4. Methods of improvement of the general habitat
5. Need for conservation of wild life

III. Suggested Student Activities

A. Plan and carry out a field trip to study erosion, and ways that are used or can be used to check erosion. You may also be able to visit an abandoned farm or a farm that has been later restored.

B. Make a study of soil conservation in your community. Try to find out the following things: (a) what types of erosion are common; (b) what measures are used to check erosion; (c) what row crops and what soil-building and cover crops are grown; (d) what kinds of crop rotations are being used; (e) what fertilizers are commonly used.

C. Study the water supply problem of your community. Try to find out the following things: (a) why the present source of water is used; (b) what measures are taken to clean and purify the water; (c) what plans are made for the future.

D. Examine specimens or charts of: (a) insects which are pests of crop plants; and (b) insects which serve to control such pests in fields and gardens.

E. Arrange a field trip to observe: (a) the extent to which cover is provided for wildlife; (b) the native plants which provide food for wildlife.

F. Visit streams in your community. Find out whether they are polluted, and if so, what causes the pollution. Learn what fish are present in the streams, and whether the fish population has changed in recent times.

VITA

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Master of Science

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