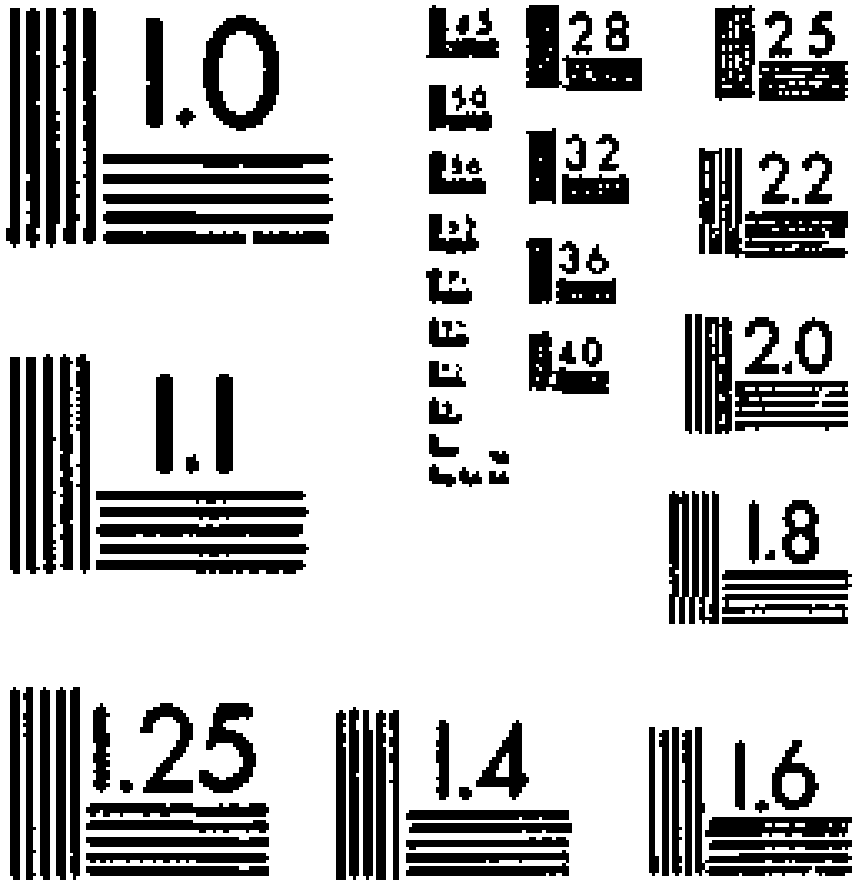

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STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No 2)

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DOCUMENT RESUME

ED 238 522 PS 013 625

TITLE	Decisions about Science. Teacher's Guide. Fair Play: Developing Self-Concept and Decision-Making Skills in the Middle School.
INSTITUTION	Florida State Univ., Tallahassee.
SPONS AGENCY	Women's Educational Equity Act Program (ED), Washington, DC.
PUB DATE	83
NOTE	154p.; For student guide to this unit, see PS 013 626. For related documents, see PS 013 616-627.
AVAILABLE FROM	Education Development Center, Women's Educational Equity Act Publishing Center, 55 Chapel St., Newton, MA 02160.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Academic Achievement; *Decision Making Skills; Environment; Genetics; Instructional Materials; Junior High Schools; Middle Schools; Resource Materials; *Science Education; Secondary School Science; *Self Concept; *Sex Differences; Sex Fairness; Sex Stereotypes; Student Attitudes; Teaching Guides; Teaching Methods; Units of Study
IDENTIFIERS	PF Project

ABSTRACT

This unit, one of six which comprise the Fair Play program, examines male and female characteristics and behaviors in relation to genetics and environment. The Fair Play program is a series of student and teacher materials the purpose of which is to help students expand their female or male self-concepts, increase their decision-making skills, and improve their academic achievement by changing their stereotypic attitudes toward particular content areas. This teaching guide includes a brief description of the total program, an overview of the content of this unit, recommendations for instructional approaches, descriptions of program materials, a bibliography of print and audiovisual resources, and tips for small-group management. The bulk of this guide consists of the student guide which contains 17 lessons organized into four parts: (1) female and male attitudes toward science; (2) role of chromosomes and genes in human development; (3) relationship between humans and their environment; and (4) environmental decisions related to technology, lifestyle, and society. Detailed annotations are provided to aid the teacher in planning and presenting each lesson. The final section provides a unit performance test with answer key. (DC)

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Fair Play: Developing Self-Concept
and Decision-Making Skills
in the Middle School

Decisions about Science

Teacher's Guide

Byron G. Massialas
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Florida State University

Women's Educational Equity Act Program
U.S. Department of Education
T. H. Bell, Secretary

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The activity which is the subject of this report was produced under a grant from the U S Department of Education, under the auspices of the Women's Educational Equity Act. Opinions expressed herein do not necessarily reflect the position or policy of the Department, and no official endorsement should be inferred.

Printed and distributed by WEEA Publishing Center, 1983
Education Development Center, Inc., 55 Chapel Street
Newton, Massachusetts 02160

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Acknowledgments

We wish to acknowledge the assistance of the many people who helped develop and field-test the unit. We are grateful for the cooperation of local school personnel facilitated through support of Fairview Middle School Administrators Nick Nims and Mary Markin, Leon County School Administrators Acquilina Howell and Josie Speed, and Florida State University Developmental Research School Director Edward Vertuno.

We especially appreciate thorough content review by Citizens' Review Committee Members Evelyn B. Martin, Donna Franks, Nancy Bakler, M. L. Bachman, and Jean Morani.

We wish to thank the following field-test teachers and consultants.

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Contents

Preface

Cultural beliefs and attitudes about what it means to be female or male influence all of us. Recently, beliefs about what females can and should do have been changing. Beliefs about male roles are changing too. Students need an opportunity to examine themselves in a new light—and make decisions about their lives.

This program, Fair Play: Developing Self-Concept and Decision-Making Skills in the Middle School, has two main purposes: to expand each student's female or male self-concept, and to increase each student's decision-making capabilities. Because of the recent emphasis on teaching basic skills in the schools, a third focus of the program is to improve students' academic abilities and skills. Specifically, the program goals are as follows:

- To help students expand their self-concept in relation to their female or male identity, including their role behavior, personality traits, and occupational aspirations and expectations
- To increase students' self-confidence and participation in making decisions
- To increase students' academic achievement by helping students change stereotypic attitudes toward particular content areas and alerting them to the relationship between subject matter and occupational opportunity

Program units are a series of five student texts and six teacher's guides designed to supplement components of the present curriculum. In each of these units, students have the opportunity to discover information that can enable them to expand their female or male self-concepts. Students are encouraged to examine stereotypes about what girls or boys "are like" and what girls or boys "should do." Students then have the opportunity to make personal and group decisions based on the knowledge they have gained.

The units, which focus on specific skills, are as follows:

- Decisions and You—a 12-lesson prerequisite decision-making unit in which students learn personal and group decision-making skills (student text and teacher's guide)

- Decisions about Roles—a 20-lesson social studies unit in which students find out how roles change over time and how people can choose and define their roles (student text and teacher's guide)

- Decisions about Language—a 20-lesson language arts unit in which students compare and analyze female and male language (student text and teacher's guide)

- Decisions about Mathematics—an 18-lesson math unit in which students learn how to collect and interpret quantitative data while examining economic and career-related issues about females and males (student text and teacher's guide)

- Decisions about Science—a 17-lesson science unit in which students examine female and male characteristics and behaviors in relation to genetics and environment (student text and teacher's guide)

- Decisions about Physical Activity—a 29-lesson physical education unit in which students participate in a physical fitness program designed to improve students' fitness skills and attitudes toward physical activity (teacher's guide)

The teacher's guide for each unit contains not only the student materials but also detailed annotations to aid the teacher in planning and presenting each lesson.

Introduction

The purpose of this unit, Decisions about Science, is to provide students with information about the forces that have shaped them, and to provide students with opportunities to make choices about the parts of their lives over which they have some control.

Students in middle school are at a critical point in their development as females and males. They are becoming more aware of what it means to be a female or male in our society. But they often feel no choice in defining their roles. Once students become aware of the forces that have shaped them, including heredity, the natural environment, and the social environment, they can perceive the environmental variables over which they have some control. Furthermore, they can feel a greater sense of efficacy in shaping their own environment in a way that does not limit their fulfillment as females and males.

The 17 lessons in this unit, which take between four and five weeks to complete, are grouped into four parts. Part I, Do You Like Science?, introduces students to issues of female and male attitudes about science. These issues encompass attitudinal differences toward science and other areas of activity.

Part II, Learning about Your Genes, presents students with information regarding the role of chromosomes and genes in human development.

Part III, Learning about Your Environment, provides students with information about parts of the environment, including the natural versus human-made environment, and the social environment.

Here the students examine the effects of the environment on humans, the effects of humans on the environment, and the controllable aspects of the environment.

Part IV, Using Science to Make Decisions, gives students the opportunity to make environmental decisions that seem conducive to increased physical and mental fulfillment.

TEACHING THE UNIT

To implement these lessons, you will need an appropriate number of copies of the student text, a teacher's guide (which includes the Unit Performance Test), and an Implementation Handbook.

The unit is designed so that teachers can use it in one of three ways. First, the lessons can be used sequentially, on a daily basis, which will require four to five weeks. Second, the lessons can be interspersed in the regular curriculum program over a longer period of time. Third, individual lessons or series of lessons can be used in conjunction with particular topics at appropriate points. The way the lessons are used should be based on the needs of students, other curricular priorities, and classroom time constraints.

Because the unit is structured according to a decision-making model, it is strongly suggested that the lessons used be sequenced to allow student involvement in all four decision phases. Otherwise, the decision-making impact of the unit will be lost. A sample sequence for a class not using the entire unit might be two lessons from Part I, five lessons from Parts II and III, and one or two lessons from Part IV. In this way, students will have completed lessons from each part. The lessons chosen should work smoothly together, be appropriate for the particular level and age of the students, and relate to the present curriculum.

As a guide to using the lessons with different levels of students, three possible approaches to the lesson are outlined under Teaching Suggestions in the Teacher Overview for each lesson. Level 1 is the minimal course; activities at this level can often be oral instead of written, and the approach should allow relatively more time for reinforcement. Level 2 is the regular course. And Level 3 is the enriched course; the approach at this level often includes additional activities on the assumption that students can more quickly master the skills in the minimal and/or regular course and proceed to expand their skills in other activities.

In general, Level 1 refers to sixth-grade students, Level 2 to seventh-grade students, and Level 3 to eighth-grade students. However, the ability and motivation of childreh vary greatly from region to region and from school to school. Care should be taken to choose a level that seems appropriate for your particular classroom. In many cases during field testing, for example, sixth-grade students easily worked through Level 2 activities. Activities, then, should be scheduled and presented in the way that seems best for your class.

Since the emphasis of these materials is on the affective as well as the cognitive thinking process, it is essential that you the teacher create a climate of acceptance in which the students feel free to express a variety of viewpoints. In many instances, questions have no right or wrong answers. Eliciting from the students their honest, thoughtful answers to these questions is necessary for the unit to be a success.

You are encouraged to make a special effort to ensure that a large proportion of both female and male students participate in the activities, discussion, and decision making.

Many of the activities can be done by students individually. Sometimes the text indicates that an activity should be done with partners or in small groups. In general, activities should be done in the way that seems most appropriate for your students and classroom organization. If activities are done in small groups, you should circulate among the groups to help those who may have difficulty. (See page xvi for tips on small-group management.)

MATERIALS

Student Materials

In each lesson, students participate in a variety of activities, including reading the text and answering questions (with or without partners), and participating in class discussions, small-group activities, and role playing.

The evaluation exercise at the end of many lessons is called a Flight Check. Flight Checks may be used as small quizzes for grading purposes, as tests if the evaluation activities for several lessons are accumulated, or as self-evaluation activities for students' information only. Lessons in the first or last part of the unit do not have a Flight Check, since the main objective of these lessons is either exploration or personal and group decision making.

Teacher's Guide

The teacher's guide contains the student text and annotated material for your use and convenience. Each lesson is preceded by a Teacher Overview that indicates the lesson's duration, purpose, student objectives, teaching suggestions, vocabulary, evaluation activity, and background information. Some lessons may need more time than that specified, depending on their level of difficulty,

students' level of involvement, and use of optional activities. In the teacher's guide, the answers to student questions are included within each lesson.

Unit Performance Test

In order to determine students' level of readiness before beginning the unit, you will need to administer the unit pretest (Unit Performance Test). At the completion of the unit, you should readminister the test to determine how much students have progressed and in what areas they need additional assistance. The pretest/posttest, as well as the answers, is included in the back of the teacher's guide.

Implementation Handbook

The Implementation Handbook is designed to assist the school—its faculty, students, and administrators, as well as students' parents—in carrying out the basic goals of the Fair Play program.

For your convenience, the handbook is designed as a reference. Sections addressed to both teachers and administrators involved in the program include Program Goals, Description of Units, and Program Evaluation. A section entitled Administering the Program specifically addresses administrative concerns, while the section Teaching the Program contains material particularly useful for teachers.

You will probably make the most use of the handbook while you are planning implementation of the program. But keep it handy throughout, for use in clarifying particular aspects of the program.

RESOURCES

The following print resources were used in developing this unit and may be useful sources for teachers desiring further information. The audiovisual materials listed in this section may be used at appropriate points in the unit to heighten student interest and reinforce learning.

Print Materials

Klein, David, and Klein, Marymae. Your Self and Others. Evanston, Ill.: McDougal, Littell, and Company, 1975.

Kreinberg, Nancy. I'm Madly in Love with Electricity. Berkeley, Calif.: University of California, 1977.

Women in Science and Technology. Iowa City, Iowa: ACT Publications, 1976.

Audiovisual Materials

Listings

Nonprint Resources in Women's Educational Equity. Princeton, N.J.: Educational Testing Service, 1978. 243 pages. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Stock number 017-080-01836-5.

Positive Images: A Guide to Nonsexist Films for Young People. Produced by Linda Artel and Susan Wingraf, 1976. 176 pages. Available from Booklegger Press, 555 29th Street, San Francisco, Calif. 94131.

Women and Work—New Options: A Guide to Nonprint Media. Produced by Linda Artel, 1979. 76 pages. Available from the Women's Educational Equity Communications Network, operated by the Far West Laboratory for Educational Research and Development, 1855 Folsom Street, San Francisco, Calif. 94103.

Films

The Aphid-Eaters—Eve's Research Project. 15-minute color film (1976) showing a 12-year-old girl developing the curiosity and research skills necessary for scientific work. Rental $25, sale $220. Available from Barr Films, P.O. Box 5667, Pasadena, Calif. 91107.

But What Can a Girl Do—A Series. Film showing eight interviews with American working women. Available from Westinghouse Learning Corp., 100 Park Avenue, New York, N.Y. 10017.

I'm Going to Be . . . an Engineer. 15-minute color film (1977) designed to inform and interest both girls and boys, blacks and whites, in engineering. Rental $17, sale $205. Available from Universal Education, 100 Universal Plaza, Universal City, Calif. 91608.

Jobs in the City: Women at Work. Produced by Douglas MacDonald. 11-minute color film (1972) showing women in a wide variety of nontraditional and traditional jobs. Sale $165, rental—inquire. Available from Centron Educational Films, Lawrence, Kans. 66044.

The Math-Science Connection. 18-minute color film, 16mm (1980) documenting high-interest programs that encourage females to prepare for math and science careers. Sale $115, rental (3 days) $. Videotape cassette (color, 3/4"); sale $32, rental (3 days) $5. Available from WEEA Publishing Center, Education Development Center, 55 Chapel Street, Newton, Mass. 02160.

Other Women, Other Work. Produced by Joan Churchill and Janie Kennedy. 20-minute color film (1973) showing women working in stereotypically male occupations. Available from Extension Media Center, 2223 Shattuck Avenue, Berkeley, Calif. 94720.

Planner-Geographer. 13-minute color film (1974) about a woman planner-geographer who works for an environmental agency. Rental $25, sale $220. Available from Paramount Communications, 5451 Marathon Street, Hollywood, Calif. 90038.

Remarkable American Women Who Influenced Our Lives (Seldom Told Stories). "Women Who Pioneered in Science" and "Women Who Pioneered in Medicine," each a 10-minute color filmstrip with cassette. Available from Eye Gate House, Inc., 146-01 Archer Avenue, Jamaica, N.Y. 11435.

Sandra, Zella, Dee and Claire. 19-minute color film or videotape cassette (1978) presenting in-depth portraits of four women scientists: an astronomer, a veterinarian, a laser physicist, and an industrial engineer. Rental (3 days) of 16mm film $8, videotape cassette (color, 3/4") $5; sale of film $120, videotape cassette $32. Available from WEEA Publishing Center, Education Development Center, 55 Chapel Street, Newton, Mass. 02160.

TIPS ON SMALL-GROUP MANAGEMENT

Although getting students to work in small groups can be frustrating for you and sometimes unproductive, it can also be rewarding, both socially and academically, for your students. Here are some suggestions to help you and the students have successful experiences with small-group work.

Advance Preparation

Make sure you know exactly what you want students to accomplish in their groups, and make sure you have enough materials for each group.

Organizing Students into Groups

In general, assign students to groups instead of allowing them to choose their own. This way, you will avoid the prospect of cliques working together all of the time, some students being left out, or all of the high achievers or low achievers being in one group. You can assign students in one of two ways: (a) randomly group them, having them count off or having them choose cards marked with numbers or symbols for each group; or (b) arrange the groups so that they are balanced for race, sex, skill level, and compatibility.

When you randomly group students or balance the groups, explain to the students why they are doing small-group work: you want them to learn how to work with one another, respect one another, and learn from one another; you want them to get to know everyone else in the class; and you want them to work seriously on the problem at hand. Emphasize that working in groups is an extremely important life skill. Be sure to let students know that you do not expect them to be perfect at group work at the beginning. It takes practice and certain skills. It's serious business!

Make sure the students know exactly where each group is to work. Put three to five students in each group. The groups should be small enough so that everyone can easily participate.

Guidelines for What Happens in the Group

Be firm and explicit about what you expect from the students. Establish rules for group work and make sure everyone understands the rules. Have the students help you in establishing these limits for effective group work. Emphasize that everyone is expected to contribute to the group and to listen respectfully to every other group member's ideas.

Be sure to tell students specifically what you expect them to produce from their work in the group.

You can assign a group leader, tell the group to choose one, or simply allow a leader to emerge within each group. You may choose each of these strategies at different times. It is often helpful to have a group recorder.

Set a time limit for the work. If you expect the students to accomplish several things, break up the task into small tasks and time segments. You might say: "I want each group to list at least three reasons why so few women work as physicists. You have five minutes to complete this assignment. When you have agreed on three reasons, I will give you the second part of your assignment. Okay, your five minutes begin now." Then circulate among the groups. Help groups if they need it and be ready to hand them (or verbally explain) the next part of their assignment when they are ready. As much as possible, keep to your time limits. Sometimes you will need to extend the limit if you have underestimated the difficulty of the assignment or students' degree of interest in it. When you allow more time, set another specific limit.

Circulate among the groups, and interact with them. If a group is having problems, try to help by providing hints, asking questions, or giving feedback about how the group members are working together.

Provide students with instruction in ways to cooperate, come to agreement, generate ideas, solve conflicts, assume responsibility, and respond to one another. Discuss and have students practice the following productive group behaviors: (a) giving ideas and information; (b) encouraging other group members to share by asking them for information, ideas, opinions, or feelings; (c) actively listening; (d) clarifying and making connections; and (e) checking to see if the group agrees on an idea.

Collect the results, or have the students share with the class the results of their group work. Be sure to have a procedure for students to follow in cleaning up and in returning any materials used.

Evaluation

To emphasize the importance of group work, you can assign grades based on students' efforts to work together and the excellence of their product. Group cooperation and responsibility to the group can be rewarded by assigning to all students in the group the same grade. Provide frequent opportunities for group members to evaluate how they have worked together. In addition, provide students with feedback about how you think they have worked together.

To you, the student:

Who are you? What has shaped you into who you are?

In this unit, you will study some factors that have greatly affected what you look like, what you do, and what you value. The better you understand the factors that shape you, the more control you can have over what you become.

At the end of this unit, you will have the chance to make decisions about your life today and in the future.

Do You Like Science? Part I

TEACHER OVERVIEW FOR LESSON 1

Duration: One class period

Purpose: To help students explore their attitudes about science

Student Objective:

- To indicate attitudes about science and about females and males in relation to science

Teaching Suggestion:

All levels: All activities

Vocabulary: Genes, natural environment, social environment

Evaluation Activity: None

Background:

Many people have misconceptions about the abilities of women and men in relation to scientific study. In Part I of this unit, students are introduced to some questions about science and about female and male differences. In Part II, students study information related to these questions. In Part III, students are asked to use the information to make decisions about their own lives.

Note: Briefly explain to students this organizational plan of the unit.

In this lesson, students should respond to the true-false questions according to their present attitudes. Compile the results, and then discuss each question in an exploratory manner. Try to give enough information to arouse the students' interest in these issues, without attempting to change their attitudes. Debate is desirable at this point, but conclusions should not be made.

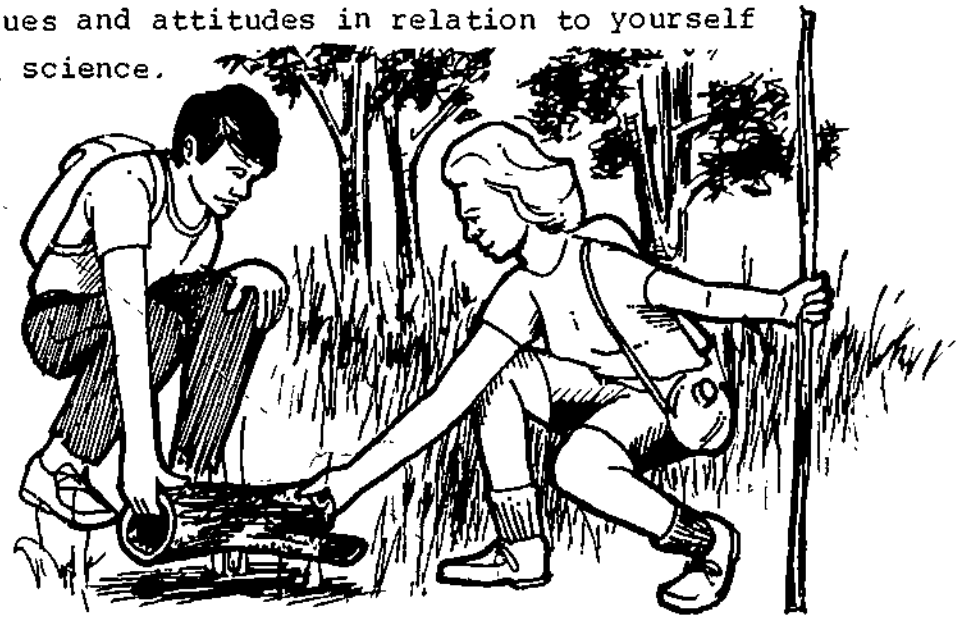
Lesson 1: Science and You

Activity A: Your feelings about science

In this unit you are first going to look at your attitudes and beliefs about science and yourself.

Later, you will find out how you have formed your attitudes. You will study the factors that have helped shape you. These factors are your genes, your natural environment, and your social environment. (You will find out what these words mean later in the unit.)

Finally, you will make decisions about your values and attitudes in relation to yourself and science.



Read the statements below. Write T next to a statement if you think it is true. Write F if you think a statement is false. This test will not affect your grade. Your answers should be what you believe—not what you think your teacher or other people might believe.

A-1 False

A-2 False

A-3 False for most middle school students, true for many high school students (in high school, girls are more likely to perceive science as a male subject area)

A-4 False

A-5 True

A-6 Personal opinion

A-7 False

A-8 True

A-9 False

A-10 False

A-11 False

A-12 False (both heredity and environment affect people's feelings about themselves)

A-13 True

A-1 Boys are naturally better at science than girls are.

A-2 Girls are too emotional to make good scientists.

A-3 Boys usually get better grades in science than girls do.

A-4 Men make better scientists than women do.

A-5 Most scientists are men.

A-6 Science is interesting.

A-7 Science doesn't affect our everyday lives.

A-8 Knowledge of science can help people make better decisions about their lives.

A-9 Scientists are usually geniuses.

A-10 Only a few jobs are related to science.

A-11 Heredity (the traits people get from their parents) is the main thing that determines people's feelings about themselves.

A-12 Environment (people's surroundings) is the main thing that determines people's feelings about themselves.

A-13 People's feelings about themselves affect the decisions that they make.

Activity B: Class wrap-up

B-1 What were your answers for A-1 through A-5? What do the results show about the attitudes of the class? Where do you think these attitudes come from?

B-2 What were your answers to A-6 through A-10? What do the results show about the attitudes of the class? Where do you think these attitudes come from?

B-3 What were your answers for A-11 through A-13? What are you going to find out in this unit? Which of these factors interest you? Why?

Suggestions for Activity B. Compile results of the test. Report the results to the class before you discuss them. Compare girls' answers with boys' answers. Are there differences?

B-1 Some students probably marked A-1 through A-4 as true. Attitudes that stereotype males as natural scientists and females as more emotional, less scientific creatures come from society, including parents, teachers, and friends; science textbooks; and television programs. As a result of such attitudes, girls have been discouraged from taking advanced science courses and pursuing science careers. But there have been enough outstanding female scientists to show that women are as capable as men in these fields. Recently, because society's views of appropriate female-male behavior are undergoing change, more women are beginning to see science and technology careers as desirable options.

B-2 Students, especially girls, may regard science as having nothing to do with their lives. In reality, science (in the form of technology) has drastically affected everyone's lives. Television, fast foods, automobiles, airplanes, sewing machines, dishwashers, satellites, and the information we obtain from them—all are the results of scientific research. The number of jobs related to use of scientific research is constantly increasing. Students, especially girls, may think that to be a scientist, one must be a genius. In the next few lessons, students will find out more about what it takes to be a scientist.

B-3 In this unit, students will find out how heredity and environment have shaped them. They will also find out how they can influence or control certain parts of their environment.

TEACHER OVERVIEW FOR LESSON 2

Duration: One class period

Purpose: To help students recognize the scope of science-related activities

Student Objectives:

- To identify a variety of activities and occupations as being related to a field of science or technology
- To express interest in a science-related activity

Teaching Suggestions

All levels: All activities (activities may be written or done orally)

Vocabulary: Science, technology, biologist, television technician, geologist, environmental scientist, medical technologist

Evaluation Activity: None

Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- Scientific and technological activities may involve research and experimentation or application of skills and ideas to problem situations.
- Many occupations and many levels of occupation (from skilled labor to postdoctorate research) are related to science or technology.

Lesson 2: How Is Science Used?

Activity A: What is science about?

What do you think scientists do at work? Here is a list of some types of work scientists do.

- Find out how alcohol affects the body
- Discover ways to prevent diseases like polio and measles
- Try to decide when earthquakes are likely to occur
- Find ways to make water safe to drink
- Grow new types of corn that taste better and don't get attacked by harmful insects
- Find better ways to use the sun to heat and cool houses
- Discover how to make a gasoline engine

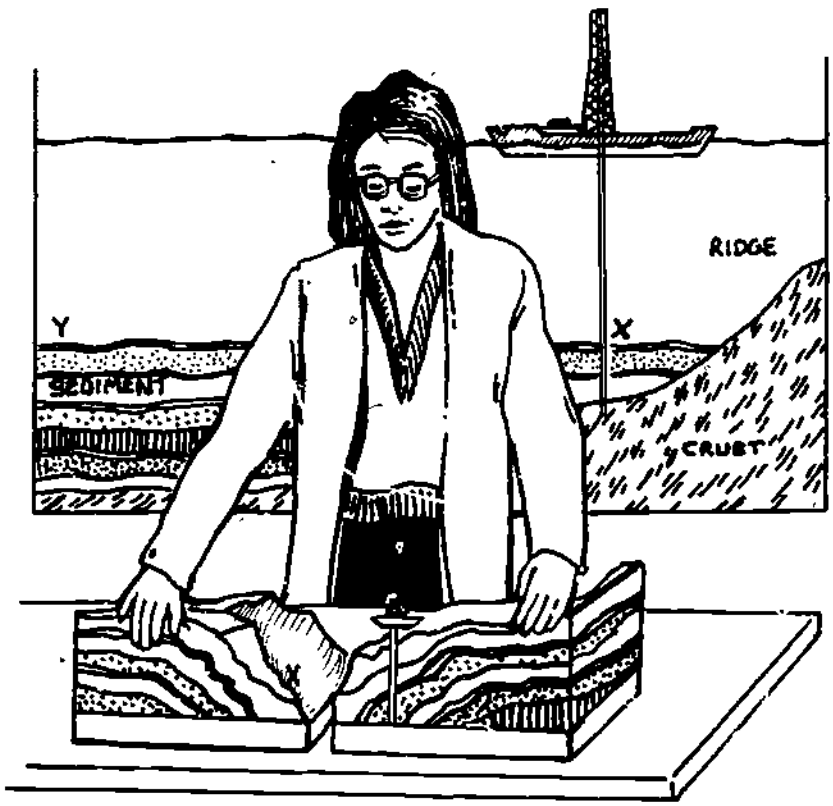
Some of the activities listed above were done in the past. Scientists are still working on others. Imagine yourself as a scientist. Which <u>one</u> of the above activities sounds the most interesting to you as a project? Why?

Activity B:
What are jobs like in science and technology?

Science is a way of trying to understand our universe better. We ask questions about our world. Then we try to answer the questions. We read, observe, and experiment. We then try to find answers that fit the information we have gathered.

The use of scientific information for human needs is called technology. For example, if you study electricity, you are a scientist. But if you use your knowledge of electricity to make a television set, you are a technician or technologist. As you can see, science and technology have a lot in common.

Look at the pictures in B-1 through B-5. Under each picture is a quote from a person who works in an area of science or technology. Read each quote. Then try to match the job described in the quote with one of the jobs listed below each picture. If you have trouble with a word, look up the definition.



"I work for an oil company. We are exploring the ground beneath the Gulf of Mexico to find oil. Many of the wells we drill never produce any oil. These wells are expensive to build. For this reason, we use tests to increase the chances of finding a good oil field.

"I work for a private company, but I still feel as though I'm working to help people. After all, everyone is hurt by lack of oil."

B-1 What person does this kind of work? B-1 e

a. biologist
b. chemist
c. physicist
d. laboratory technician
e. geologist
f. engineer

"I work on a team. In general, we try to find cures for different forms of flu. We have already had some luck in making vaccines for a few kinds of flu. But there are still many more cures we haven't discovered yet.

"We test drugs on mice that have a flu virus. In this way we find out whether the drug cures the disease without harming the mice. Then we decide whether the drug will work for people as well. Many tests will be done before the drug becomes a medicine for people."

B-2 a

B-2 What person does this kind of work?

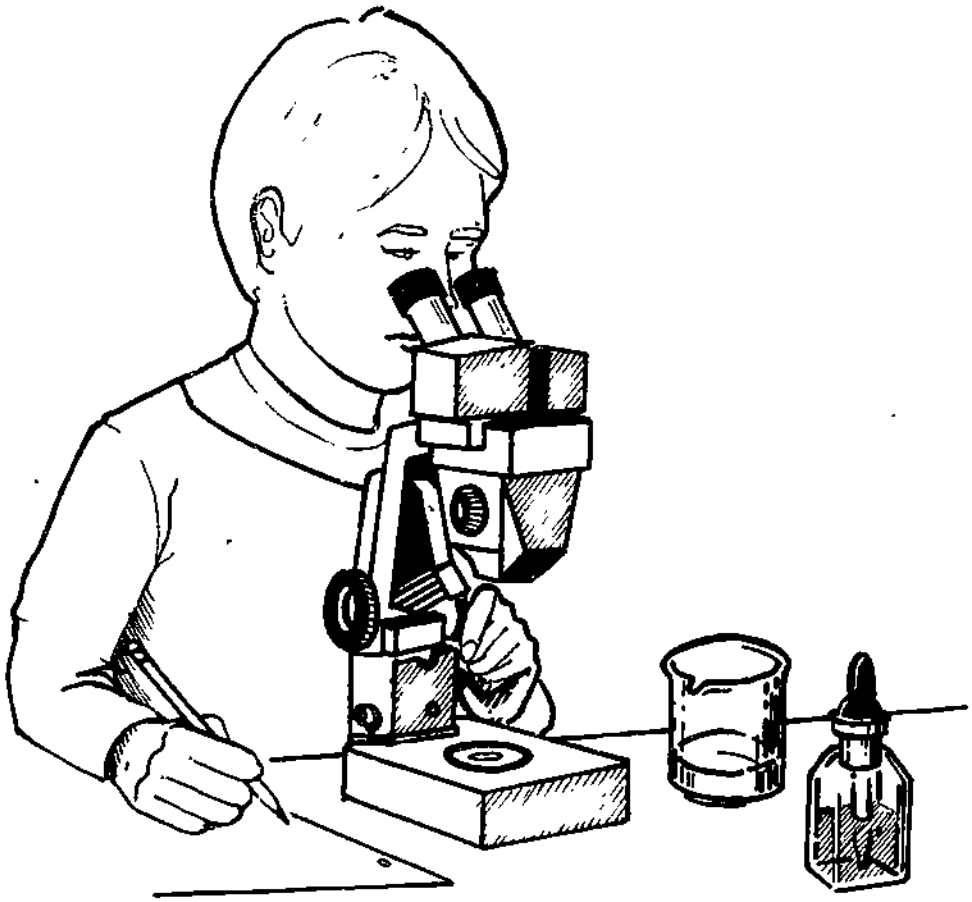
a. biologist
b. physicist
c. geologist
d. engineer
e. oceanographer
f. nurse

"I work with cities and towns that are growing rapidly. I help them plan when and where to build shopping centers and roads. This way, the city's growth won't harm the water supply or create flooding problems.

"I mainly study problems with the water supply. But other scientists work with the towns, too. They decide what the new plans could do to wildlife, air, and traffic flow."

B-3 What person does this kind of work? B-3 b

a. biologist
b. environmental scientist
c. laboratory technician
d. physicist
e. chemist
f. astronomer



"I work in a hospital. Each day I do many tests on samples of people's blood and urine. Some things I test for are amount of sugar in the blood, amount of blood in urine, and number of white blood cells. I record the information and give it to the doctor. The doctor uses it to help determine what is wrong with the patient."

B-4 f

B-4 What person does this kind of work?

a. nurse

b. physicist

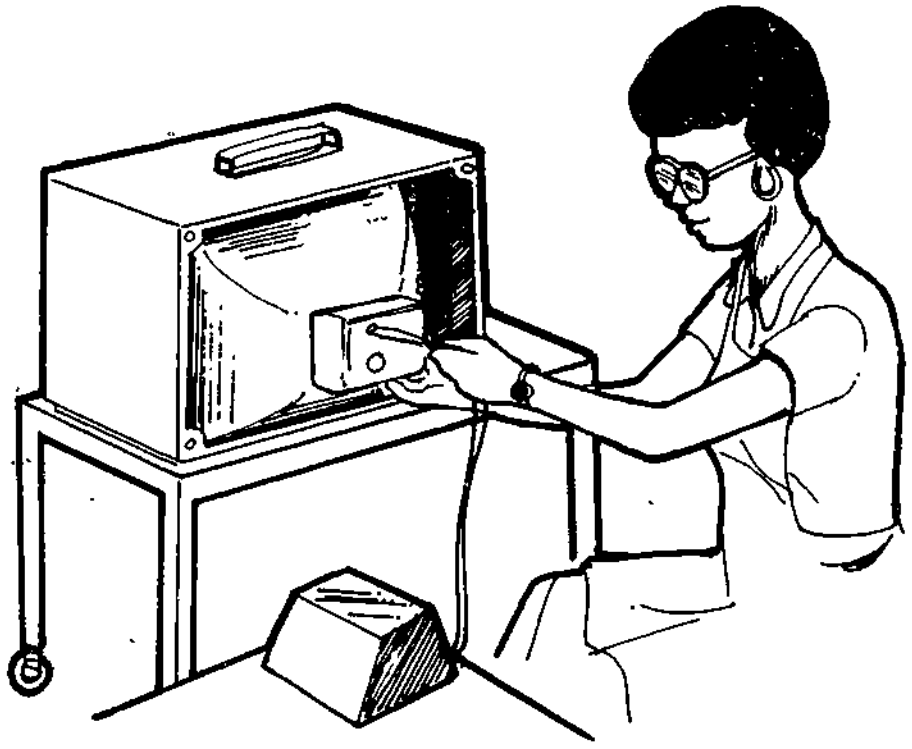
c. physician

d. environmental scientist

e. geologist

f. medical technologist

30



"Most people don't know how to repair their television sets, so they depend on us. In school we studied electricity as one part of our training.

"If I didn't understand electricity, I could still fix some things that go wrong with television sets. But since I do understand electricity, I can fix more difficult problems. I'm glad I learned a lot about electricity. This way, I can do a better job for my customers."

B-5 What person does this kind of work? B-5 b

a. physicist
b. television technician
c. television reporter
d. chemist
e. medical technologist
f. engineer

3i

B-6 Rank-order B-1 through B-5, according to your own opinion, from most interesting job to least interesting job.

Activity C: Class wrap-up

C-1 In Activity A, you chose the scientific activity which sounded the most interesting to you. Why did you choose that activity? How many other people in your class chose the same activity? Why did they choose their activities?

C-2 Discuss your answers for Activity B. Tell which jobs you chose as most interesting and least interesting and why. Give at least one reason that you think you would like or dislike the job.

C-3 Was there a difference in the way boys and girls in your class answered C-1 and C-2? Many females seem not to want to be scientists and technologists. Why do you think this happens? What can be done to change this situation?

C-4 Do you think it is important for everyone to study science? Why or why not?

C-3 Often, females regard science as a subject area and career area for males. In the past, very few women chose science or technology careers. Although the number is increasing, many girls still do not identify with science. Before girls can take advantage of increased career opportunities in science, their attitudes as well as the attitudes of others who influence them must change.

C-4 Science is a highly practical field of study since it relates directly to technology. Jobs in technology are plentiful. Point out to students that most of the jobs in Activity A are technological (application) jobs.

TEACHER OVERVIEW FOR LESSON 3

Duration: One or more class periods

Purpose: To help students recognize ways that science affects their lives

Student Objectives:

- To think about science-related problems that may affect one's life
- To state what kinds of scientific information or expertise may be required to solve a given problem

Teaching Suggestions:

All levels: All activities

Vocabulary: No new words

Evaluation Activity: None

Special Preparation: You will need to provide research material that relates to the topic chosen for the class discussion.

Background:

The following is the main point of the lesson. Make sure to emphasize it as often as appropriate.

- Scientists are involved in solving many human problems, including improving the quality of life, feeding the human population, and finding cures for diseases.

Lesson 3: Does Science Affect Your Life?

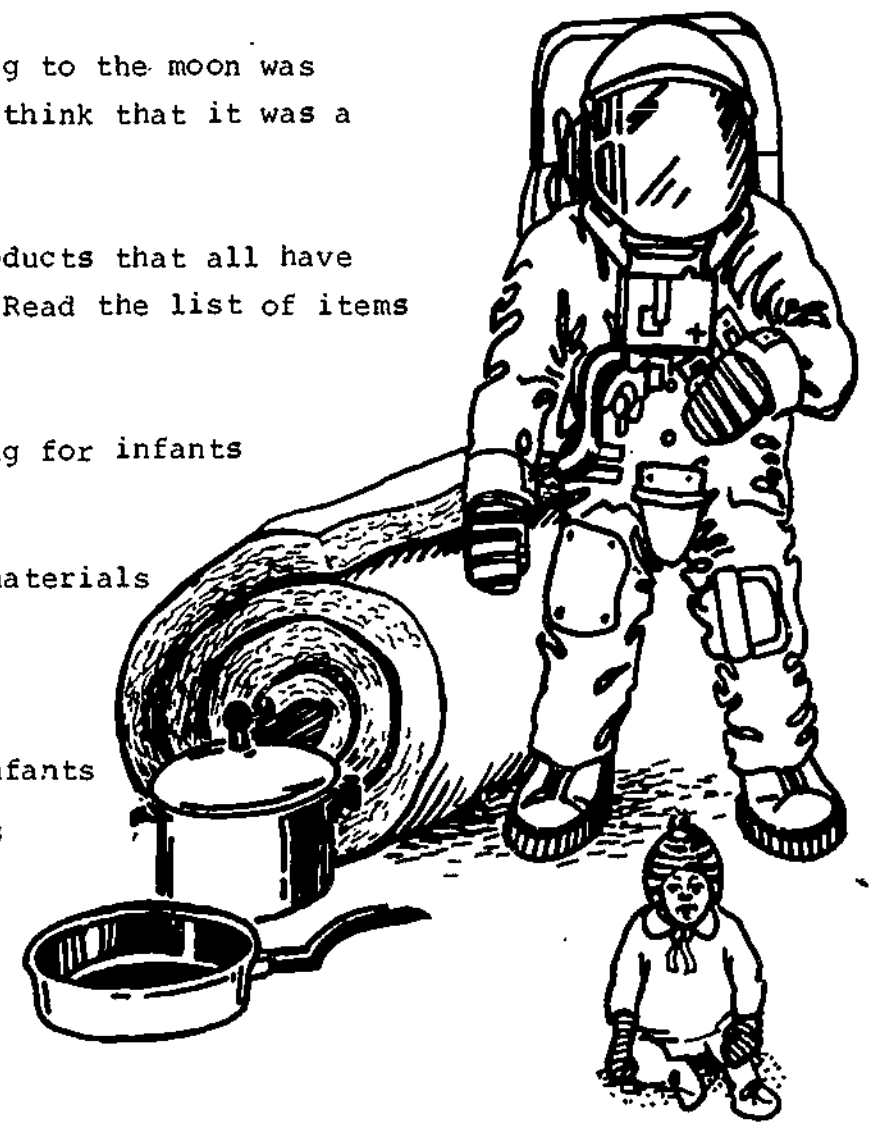
Activity A: Humans visit the moon

Many people remember July 20, 1969, as the first time human beings visited the moon.

Do you think that going to the moon was important? Or do you think that it was a waste of money?

Below is a list of products that all have something in common. Read the list of items carefully.

- fireproof clothing for infants
- girdles
- home-insulation materials
- pots and pans
- heart monitors
- pacemakers for infants
- radio transistors
- ball bearings



What do these products have in common? They were all invented or improved upon as a result of space research—like the trip to the moon.

In fact, since 1968, over 63,000 products have been developed as a result of space research.

Do you think your life is easier because of science? Has your life become worse in some ways because of science? To think about these questions, do Activity B.

Activity B: Does science help solve problems?

Jobs in science can be exciting! People in these jobs are trying to solve all kinds of problems. Some of these problems are very important to people.

B-1 Sample answers: What causes mental illness? Is cancer inherited? How long does it take to travel from earth to the nearest galaxy? Is the behavior of some animals a good device to use in predicting earthquakes? Can bridges be designed to withstand earthquakes? What chemical reactions in the brain are responsible for memory? What can be done to increase the yield from each acre of farmland? Can vitamins be used to cure or prevent certain illnesses?

B-1 Write down two inventions or cures that you would like to see occur in your lifetime. Would you like to work on a scientific team that tries to make the invention or cure you listed?

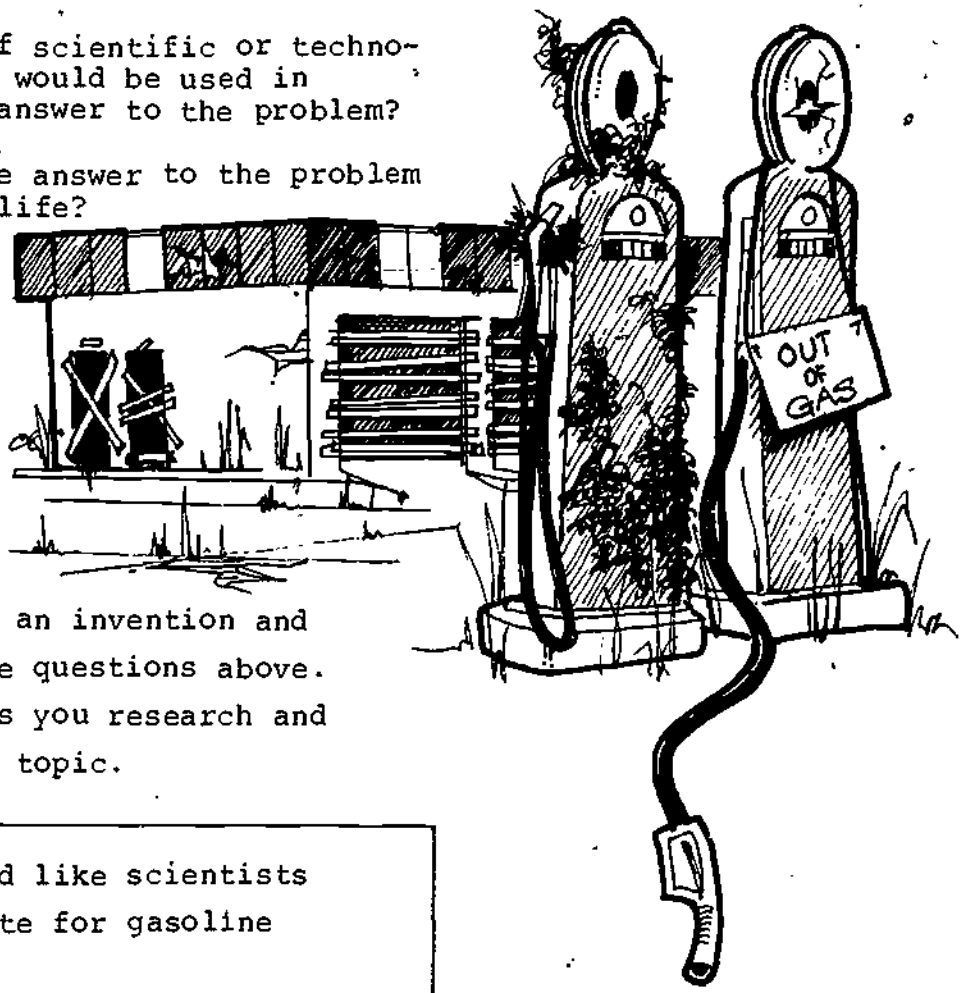
B-2 As a class, make a list of as many important cures or inventions as possible. From the list, choose three you think you know the most about or are the most interested in. From the choices, your teacher will choose one problem. The class will discuss this problem in the next assignment.

B-3 Before the class discussion begins, you may need to do some library research about the topic chosen. As you do your research, think about the following questions:

a. What kinds of information would scientists need to know to solve the problem?

b. What kinds of scientific or technological jobs would be used in finding the answer to the problem?

c. How might the answer to the problem affect your life?



Here is an example of an invention and several answers to the questions above. This might help you as you research and think about the class topic.

Invention: I would like scientists to find a substitute for gasoline to make cars run.

a. Kinds of information needed:

1. What resources—other than gasoline—can produce power?

2. Can those other resources provide power to cars as well as gasoline can?

3. Can we make new forms of energy to run cars?

b. Kinds of jobs needed to find the answer:

1. geologist
2. physicist
3. chemist
4. engineer
5. biologist
6. mechanic

c. How the solution might affect my life:

1. Twenty years from now, gasoline will be much harder to buy. But with the new power resources, I might be able to drive as much as I like.
2. If no new power resources are developed within the next 20 years, I might have to limit my driving greatly.

Activity C (discussion): Science and your life

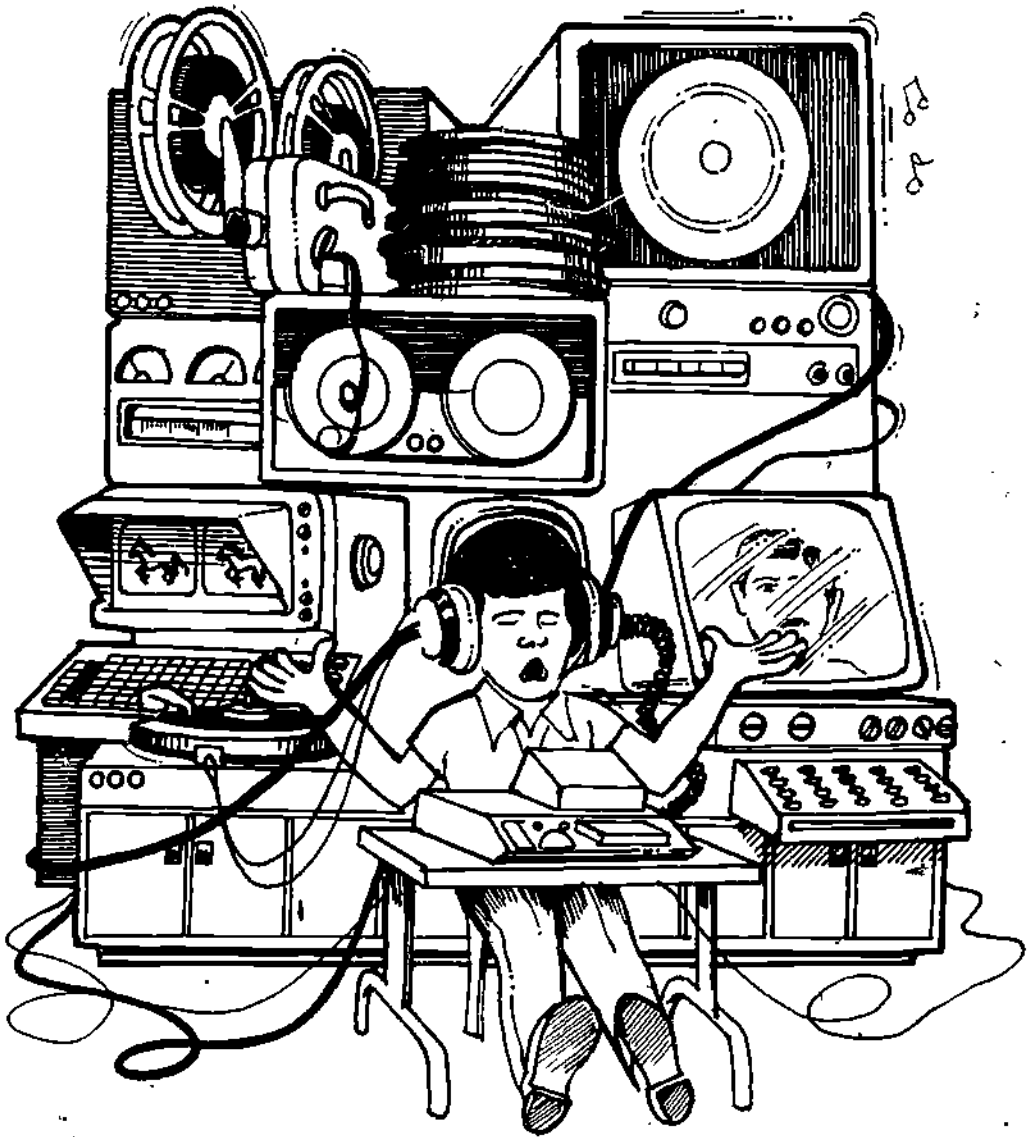
C-1 Use the questions listed in B-3 for the cure or invention you have chosen. Think of as many ideas as you can to answer the questions.

C-2 What are some ways science and technology have affected your life? Which inventions of technology have had a negative (bad) effect? A positive (good) effect?

C-1 Variety of answers

C-2 To encourage discussion, ask the class to recall the way they began their day. Raise questions such as: Was it warm or cold? How was the temperature regulated? What products or inventions did you use as you were dressing? What did you have for breakfast? How was it prepared? How did you get to school?

The benefits we have gained from scientific research are responsible for our high standard of living. But questions should be raised about whether some discoveries are "good" or "bad" (atomic energy, for example). Emphasize here that science itself is neither good nor bad. Rather, the applications of scientific knowledge may be deemed good or bad according to the values held by society. Sometimes, technology causes problems such as air pollution, water pollution, carcinogens, and so on.



Activity D:
Technology and more technology.

Do one or both of the following.

D-1 Make a collage of things created by technology that affect your life.

D-2 Make a list of things created by technology that you think affect people's lives in a negative way. Present your list to the class.

TEACHER OVERVIEW FOR LESSON 4

Duration: One class period

Purpose: To think about whether females or males are more likely to choose science as a career and why

Student Objectives:

- To read various statements made by scientists and technologists about working in science
- To hypothesize which activities may predispose a person to like or do well in science
- To hypothesize why only a small percentage of scientists are women

Teaching Suggestions:

All levels: All activities

Vocabulary: No new words

Evaluation Activity: None

Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- Scientists and technologists have widely varying personalities and characteristics, reflecting the variety of scientific and technological fields.
- Females display fear of, or lack of interest in, science for several reasons:
  (1) Many females perceive science as a male subject or career area because they accept stereotypes about appropriate and inappropriate fields of study and activities for females and males.
  (2) Many females have been raised to be less active, less inquisitive, and less aware of mechanics than boys. For this reason, many boys are more comfortable than girls are with activities requiring initiative, visual-spatial skills, exploration, and mechanical skills.
- People with a negative attitude toward science greatly limit their career options, since an increasing number of jobs in science and technology are becoming available. Students, especially girls, should have an opportunity to rethink their attitudes toward science.

Lesson 4: Who Is Likely to Become a Scientist?

Activity A: What makes a scientist?

Form a group with three or four of your classmates. Choose a group recorder to write your group's answers.

What do you think it takes to be a scientist or technologist? Do you have to be a genius?

Here's what some scientists have said about themselves. Read each statement aloud in your group.


When I was younger, I enjoyed taking things apart—I wanted to know how they worked.
If you can see things a little differently from everyone else, you can bring new ideas to science.
Wanting to make the world a better place gives me ideas for new research.
To be a scientist, you must be stubborn—but you don't have to be a genius!
I like working with numbers. Solving a problem by mathematics is more like doing puzzles than like hard work.
You have to be interested in your environment and want to know why things happen.

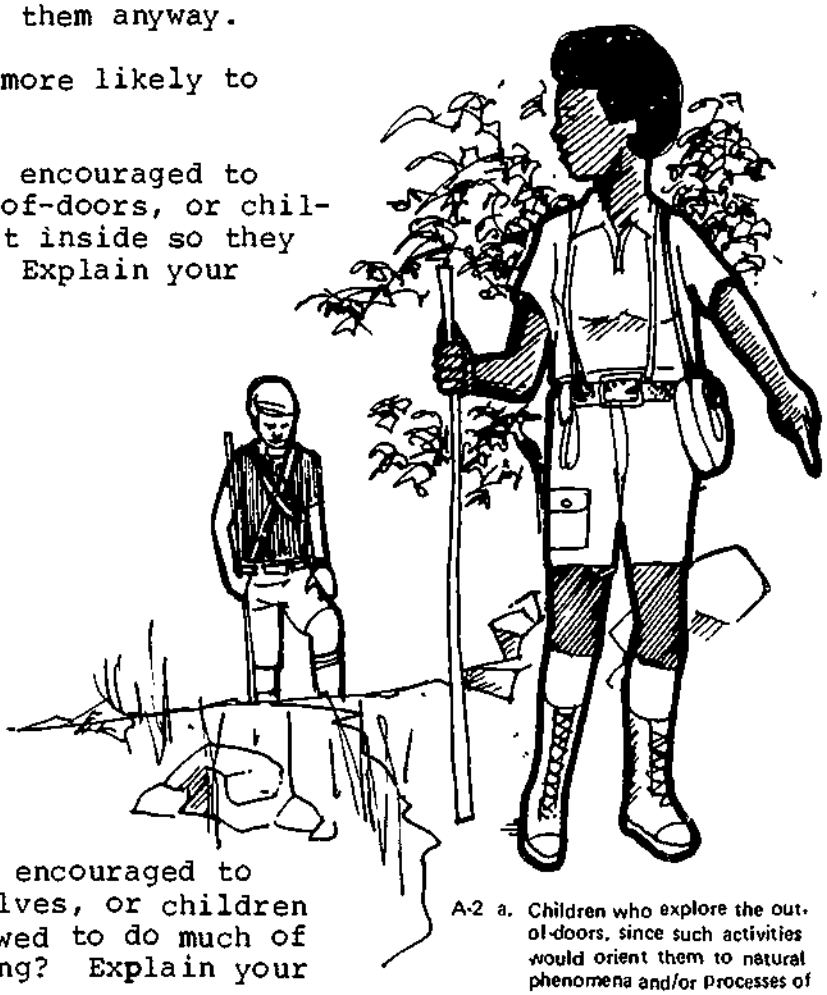
41

A-1 List characteristics that different scientists and technologists might have. Use the quotes on pages 23 and 24. It is doubtful that any one scientist has all of the characteristics described in the quotes, but list them anyway.

A-1 Sense of adventure, desire to help humanity, ability to cooperate, curiosity, ability to see things from a new angle, stubbornness, quantitative skills, interest in surroundings

A-2 Who do you think is more likely to become a scientist?

a. Children who are encouraged to explore the out-of-doors, or children who are kept inside so they won't get hurt? Explain your answer.



b. Children who are encouraged to think for themselves, or children who are not allowed to do much of their own thinking? Explain your answer.

c. Students who are encouraged to take math courses, or students who are encouraged to take English courses? Explain your answer.

d. Children who are encouraged to take things apart and put things together, or children who are discouraged from taking things apart? Explain your answer.

A-2 a. Children who explore the out-of-doors, since such activities would orient them to natural phenomena and/or processes of nature

b. Children who think for themselves, since an independent thinker can be more creative in approaching problems

c. Students who take math courses, since math provides skills needed in many areas of science

d. Children who take things apart and put things together, since such activity would help people develop a feeling for mechanics, or the way moving objects relate to one another

A-3 For each choice in questions a through d in A-2, who are more likely to do the activity: girls or boys?

A-3 Boys

A-4 a. 9%, 91%

b. compute: scientists: engineers

A-5 Women have been discouraged by society from going into science careers. This situation limits women's job options and their fulfillment as creators and inventors.

A-4 Look at the following chart.

TOTAL WOMEN AND MEN IN SCIENCE LABOR FORCE (BY PERCENT)

	Women	Men
Physical sciences	9%	91%
Mathematics sciences	16%	84%
Computer sciences	17%	83%
Environmental sciences	4%	96%
Engineers	.5%	99.5%
Life sciences	13%	87%

Source: Mary Jo Boehm Strauss, "Wanted: More Women in Science," *The American Biology Teacher*, Vol. 40, No. 3: March 1978, p. 183.

a. What percentage of physical scientists are women? What percentage are men?

b. Which field has the largest percentage of women? Which field has the smallest percentage of women?

A-5 Why do you think more men than women choose science as a profession? Is this situation good? Why or why not?

B-2 People often think scientists are geniuses and are interested only in abstractions, not in people. Scientific and technological fields are so diverse that it is impossible to identify a "scientific personality."

B-3 Attitudes are learned from the social environment. Therefore, attitudes can be unlearned and relearned given a different social environment or given increased awareness of the effects of the present social environment.

B-4 Girls have as much science potential as boys. Girls' and boys' differences in attitude are primarily due to the environments in which they were raised, not their genes.

B-5 Arbitrary determinations of appropriate activities for females and males often limit people's career and role options unnecessarily. A far greater number of roles and careers have been considered appropriate for males than for females. As a result, many women get trapped in traditionally female jobs, which in many cases are lower paying than traditionally male jobs.

B-6 Greatly increase, technology is constantly growing. Ironically, undesirable results of present technology—such as air pollution caused by automobile exhaust—must be corrected by new technology. This fact is important because both women and men who are planning careers need to be as knowledgeable as possible about future availability of various kinds of jobs.

Activity B: Class wrap-up

B-1 Discuss your answers to A-1 through A-5.

B-2 What false ideas do you think people have about scientists?

B-3 Where do you think girls' and boys' attitudes about science come from?

B-4 What are some other differences in male and female attitudes and activities? How can you explain these differences?

B-5 Do you think boys and girls should be raised to act in different ways? Why or why not?

B-6 In 20 years, do you think the number of careers in science will greatly increase or greatly decrease? Explain. Why should this fact be important to both women and men?

TEACHER OVERVIEW FOR LESSON 5

Duration: One class period

Purpose: To prepare students for a study of genetics by introducing them to learned and unlearned behaviors

Student Objectives:

- To distinguish between examples of learned and unlearned behaviors
- To relate unlearned behavior to a person's genetic inheritance

Teaching Suggestions:

All levels: All activities

Vocabulary: Genes, genetic characteristics, learned behavior, unlearned behavior

Evaluation Activity: Activity E (for general information about the use of evaluation activities, see page xii)

Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

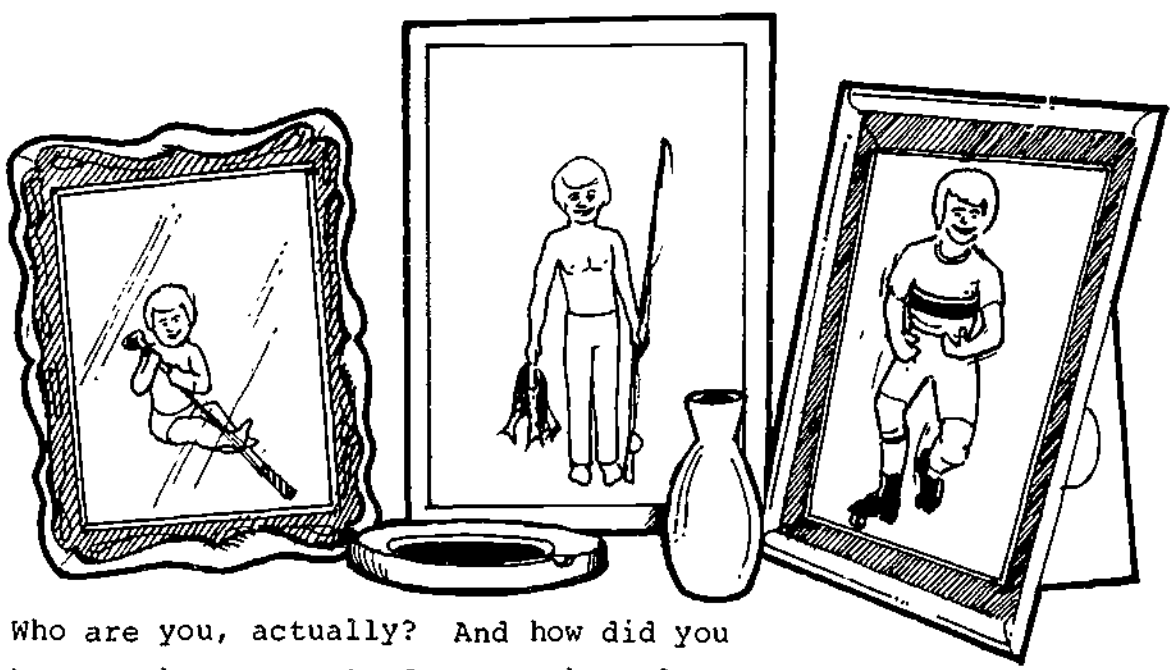
- People's physical characteristics are due primarily to genes, although environment may also affect a person's appearance.
- People's behaviors are both learned and unlearned. Unlearned behaviors are passed genetically from parents to children.

Lesson 5: What Is Heredity?

Activity A: Learned and unlearned behaviors

Why are there more men scientists than women scientists? Are men born with abilities that cause them to be better scientists than women?

In the first four lessons of this unit, you found that you have developed attitudes—attitudes about science and attitudes about who you are and what you do.

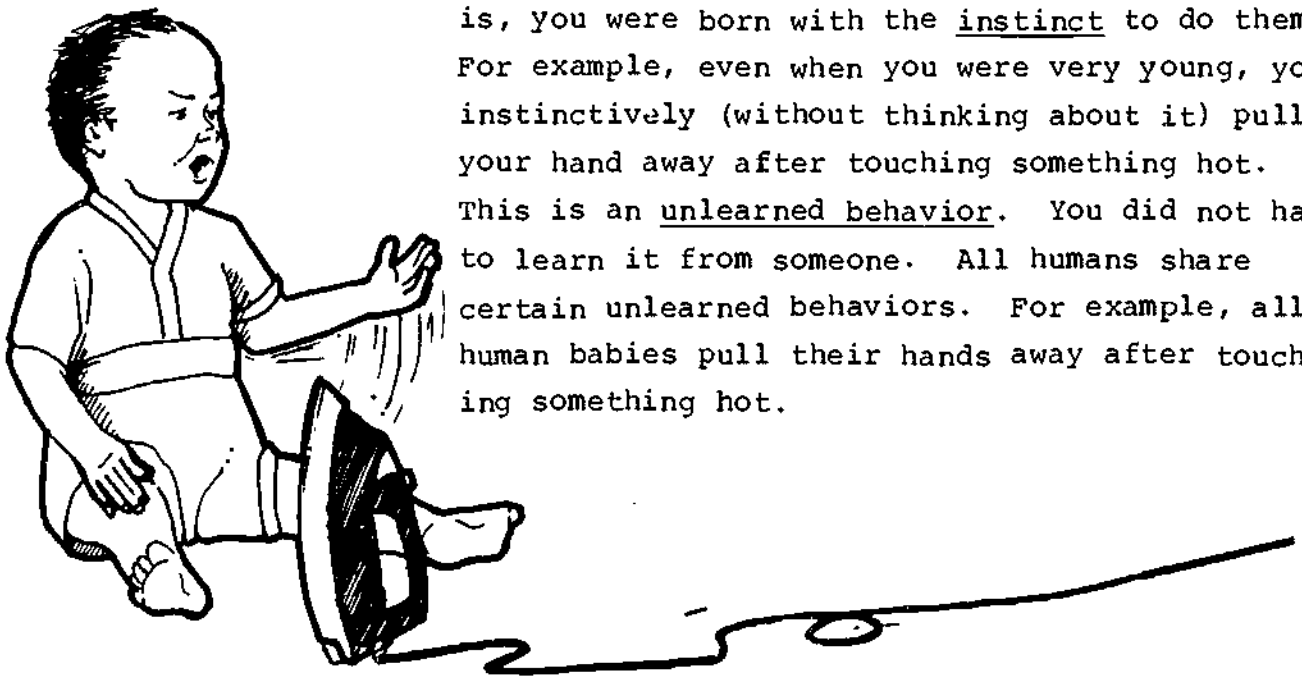


Who are you, actually? And how did you become who you are? Can you change? Do you want to change in any way?

In the next few lessons, you'll discover some things about yourself that you can't change. These are genetic characteristics—traits you get from your parents. You received half your genetic characteristics from your father and half from your mother.

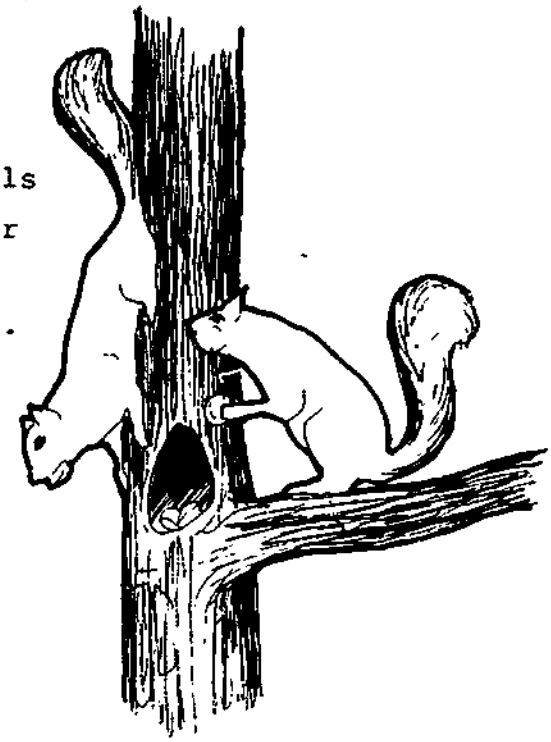
Is your behavior a result of your genes? Think about your behavior (actions). You have learned much of your behavior from either your parents or other people. For example, you have learned how to count, how to speak English, and how to tie your shoes. You were not born with the knowledge to do these things. These things are learned behaviors.

Other behaviors, though, are unlearned. That is, you were born with the instinct to do them. For example, even when you were very young, you instinctively (without thinking about it) pulled your hand away after touching something hot. This is an unlearned behavior. You did not have to learn it from someone. All humans share certain unlearned behaviors. For example, all human babies pull their hands away after touching something hot.



These unlearned behaviors come from your genes. The genes you have came from your mother and your father. You will learn more about genes in Lesson 7.

Much animal behavior is unlearned, that is, instinctive, behavior. For example:



- Squirrels bury nuts in the fall for the long winter ahead. Some squirrels are born in the spring and have never seen other squirrels burying nuts. But they still bury nuts in the fall.
- Spiders spin webs without learning how to do this.
- Scientists have taken baby birds and raised them in soundproof rooms. The songs of these birds were almost the same as the songs of the birds raised in the forests.
- Sea turtles never see their parents. They hatch from eggs buried in the sand and head right for the ocean.
- If an earthworm is dug up, it will try to dig back down under the soil.

Do you think most human behavior is learned or unlearned? How do you think you would act if you had been left alone by your parents when you were a baby--and no other humans were around? There are a few cases in which this has happened. Children were shut away by their parents from other humans from the time they were born. Later on, when they were free, they lacked many human characteristics. They had no language, ran on all fours, and were fearful of other humans.

Here is a list of animal behaviors—including human behaviors. For each behavior, try to decide if it is learned or unlearned. If you think all animals of that type would behave the same way without training, then the behavior is probably unlearned.

A-1 Unlearned
A-2 Unlearned
A-3 Unlearned
A-4 Learned
A-5 Learned
A-6 Unlearned
A-7 Learned
A-8 Unlearned
A-9 Learned
A-10 Unlearned
A-11 Learned
A-12 Learned

A-1 A bee stings you when you step on it.

A-2 A female fish lays eggs.

A-3 A rattlesnake wiggles its tail when something moves nearby.

A-4 A dog rolls over and sits up to beg for a treat.

A-5 A racehorse shoots out of the starting gate and runs as fast as it can to the finish line.

A-6 You probably cried when you were born.

A-7 You can read this page.

A-8 The first time you touched a hot stove, you quickly jerked your hand away.

A-9 You refused to touch a hot stove after the first time you touched it.

A-10 Your eyes blink when someone else moves quickly toward your face.

A-11 You try to dress the way your friends dress.

A-12 A 6-month-old baby of deaf parents cries without making any noise.

Activity B (discussion): Thinking about human behavior

B-1 Check your answers to A-1 through A-12. What is the main difference between learned and unlearned behaviors?

B-2 Discuss whether you think most human behavior is learned or unlearned.

B-3 Do you think most of the behaviors that help a person become a scientist are learned or unlearned?

B-1 Unlearned behaviors are due to a person's genetic inheritance. Humans all exhibit the same unlearned behaviors. Learned behaviors are not due to genetic factors but instead to environmental factors. Learned behaviors can be changed, but unlearned behaviors cannot be changed.

B-2 The potential to learn is inherited, but many behaviors are due to environmental factors and therefore are learned behaviors. However, geneticists are discovering more and more about genetic components of behavior.

B-3 Many of the behaviors that cause a person to choose to become a scientist are learned from one's culture. However, intelligence—which is a genetic factor—must also be present in a person who becomes a scientist.

Activity C: Physical traits and functions of your body

You found out earlier that your genes are passed from your parents to you. Your genes are responsible for your unlearned behaviors. Your genes are also responsible for some of your other characteristics.

C-1 Do you think each of the following characteristics is genetic (inherited) or environmental (a result of some other factor, pertaining to a person's surroundings)?

a. Denise has brown eyes.

b. Your stomach and small intestine digest your food.

c. Carlos' voice is changing. It is getting much lower.

d. Sandra's hair was dark brown last month. This month it is blonde.

e. Mr. Gomez can no longer walk very well, and can't speak very clearly. Recently he had a stroke and a part of his brain was damaged.

f. When Robert was born, his body was not able to make a certain chemical. As a result, his brain was damaged and he is retarded.

Activity C: Try to rouse students' interest and encourage discussion. Tell students not to worry about being right or wrong. In this activity, thinking and hypothesizing are much more important than trying to be right or wrong. The interaction of genes and the environment is complex and even scientists don't yet have answers for many related questions.

C-1 a. Genetic

b. Genetic: all people inherit the ability to digest food, unless a mutation occurs

c. Genetic

d. Environmental (dyeing the hair)

e. Either environmental stress or genetic factors (for example, tendency to have high blood pressure) or both

f. Genetic (unless genetic aberration was due to a harmful environment during fetal development)

Discuss this question with one other person.

C-2 Both: environment (lack of food or neglect) can keep a person from growing.

C-2 Josephine is 5 feet 7 inches tall. Is her height a result of her heredity, her environment, or both? Be prepared to share your answer with the class.

You have looked at the difference between unlearned and learned behaviors. You have also seen the difference between behaviors affected by heredity and those affected by environment. In the next lesson, you will learn where inherited traits come from. You will see why you are similar to—but not exactly like—your parents. Later in the unit, you will look more closely at how your environment (surroundings) affects your traits.

Activity D: Class wrap-up

Discuss your answers to Activity C.

Activity E: Flight check

Did you understand this lesson? To find out, answer the following questions without looking back at the lesson. Then, your teacher will help you check your answers.

E-1 Give three examples of unlearned behavior.

E-2 Where do unlearned behaviors come from?

TEACHER OVERVIEW FOR LESSON 6

Duration: One or more class periods

Purpose: To help students understand the basic principles of human genetics

Student Objectives:

- To state how chromosomes from the egg and sperm combine in the first human cell
- To state the function of chromosomes in determining heredity

Teaching Suggestions:

Level 1: Activity A, orally; Activities B and C

Levels 2 and 3: All activities

(If you feel students would not respond well to working with clay in Activity A, have them draw the chromosomes. However, research shows that most middle school students learn better when they can manipulate objects.)

Vocabulary: Heredity, hereditary traits, genetics, fertilized, fertilized egg, chromosome, nucleus, fertilization

Evaluation Activity: Activity C (for general information about the use of evaluation activities, see page xii)

Special Preparation: You will need to provide students with scissors and two colors of clay for Activity A. Each student will need enough clay to make three sets of chromosomes several centimeters long.

Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

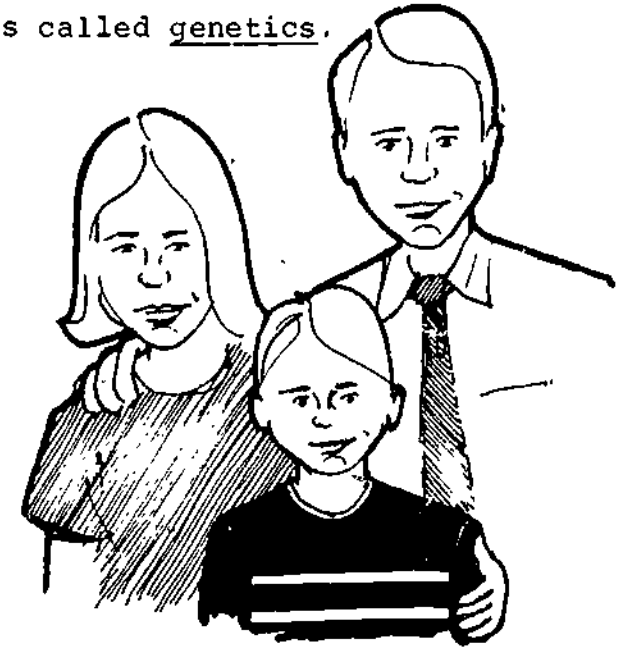
- Human beings are formed from 23 pairs of chromosomes.
- For each pair, a person receives one chromosome from the father and one from the mother.

Lesson 6:

How Do You Inherit Traits?

Activity A:
The sperm and the egg get it together

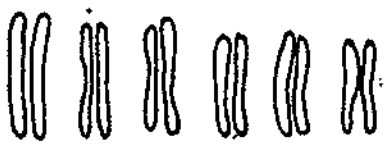
Has anyone ever told you that you look like one of your parents? You may or may not look like your parents. But you <u>are</u> like them in many ways. You found out in the last lesson that your body was formed from two sets of information. One set came from your mother and one set from your father. That information from your two biological parents is your <u>heredity</u>. Biological traits, or characteristics you get from your parents, are called <u>hereditary traits</u>. The study of how those traits are carried from parents to children is called <u>genetics</u>.



You probably know that you started out as one cell. It was made when a sperm from your father and an egg from your mother came together (fertilized). That first "you" cell had all of the hereditary information that caused you to grow up into who you are.

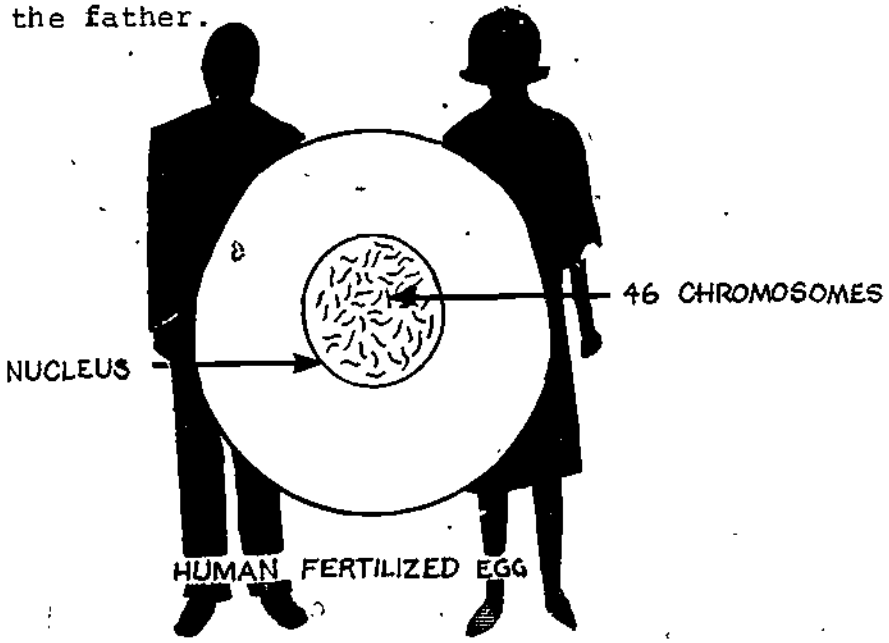
The first "you" cell was very small. It was smaller than a dot on this page. The cell (fertilized egg) that grew and divided was the start of the millions of cells that make up your body. All of the hereditary information was inside that first cell. It is hard to imagine that millions of bits of information about your traits are able to fit inside one cell. The bits of information are very, very, small. You would need a powerful microscope to see them.

The bits of information, or chemical code words, are carried on small, noodlelike structures called chromosomes. The first "you" cell had 46 chromosomes. You (the fertilized egg) received 23 chromosomes from your mother and 23 chromosomes from your father.



EXAMPLES OF CHROMOSOMES

In a cell, the chromosomes aren't lined up. They are scattered inside the nucleus (the center part) of each cell. You can't look at a cell and tell which chromosomes were from a person's mother and which were from the father.

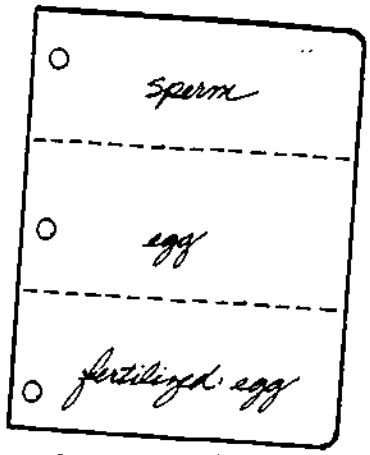


To understand chromosomes better, do the following activity.

A-1 Gather the following materials:

- two colors of clay—enough to make three snakelike shapes several centimeters long
- one piece of notebook paper
- scissors

A-2 Put the labels sperm, egg, and fertilized egg on the sheet of paper. Then cut the paper into the three labeled parts.



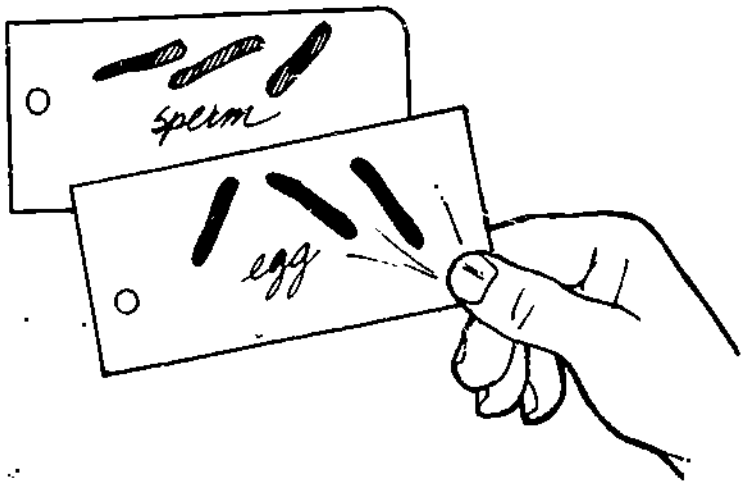
A-3 You already know that there are 23 chromosomes in each sperm and 23 chromosomes in each egg. The sperm and the egg unite to form a fertilized egg. This fertilized egg has 23 pairs of chromosomes (46 in all) inside. Because it would take a long time to make 46 clay chromosomes, you are going to make a simpler model. You will make just three pairs of chromosomes.

First make three chromosomes of one color clay and put them on the paper labeled sperm.

Next make three chromosomes of another color clay and put them on the paper labeled egg.

A-4 Now take the sperm paper with its three chromosomes and the egg paper with its three chromosomes and move them together. You are now showing fertilization—when the sperm and egg come together inside a female.

You will have to pick up the sperm and egg papers with their clay chromosomes when you move the sperm and egg together. Result:



A-5 Now take the fertilized egg paper and put it over the egg and sperm papers and their chromosomes. The result is a model fertilized egg cell.

A-6 Answer the following questions about what you just did.

a. How many chromosomes were in the model sperm cell you made?

b. How many chromosomes were in the model egg cell?

c. How many chromosomes were in the model fertilized egg cell?

d. How many chromosomes are in a real human sperm cell?

e. How many chromosomes are in a real human egg cell?

f. How many chromosomes are in a real human fertilized egg cell?

A-6 a. 3
b. 3
c. 6
d. 23
e. 23
f. 46

A-7 Now take another look at the chromosomes in the fertilized egg cell. Match them in pairs. In each pair there should be one chromosome from the father and one from the mother.

A-7 a. 3

b. 23

a. How many pairs of chromosomes are in your model fertilized egg cell?

b. How many pairs of chromosomes are in a real human fertilized egg cell?

Important note: Keep one pair of chromosomes to use in the next activity. Put the rest of the clay back with the correct color.

57

Activity B: Class wrap-up

B-1 Discuss your answers to A-6 and A-7.

B-2 What carries the genetic information what determines your traits?

B-3 Can you change your genetic characteristics?

B-2 Chromosomes

B-3 No

Activity C: Flight check

Did you understand this lesson? To find out, answer the following questions without looking back at the lesson. Then, your teacher will help you check your answers.

C-1 When you were born, your first "you" cell had how many pairs of chromosomes?

C-2 Explain where one pair of chromosomes came from.

C-1 23

C-2 One chromosome in each pair came from the father, and the other from the mother

TEACHER OVERVIEW FOR LESSON 7

Duration: Three or more class periods

Purpose: To familiarize students with the function and characteristics of genes

Student Objective:

- To identify traits resulting from given combinations of dominant and recessive genes

Teaching Suggestions:

Level 1: Activity A, orally; Activity B; Activity C, optional; Activity D; Activity E (except E-3)

Level 2: Activity A, orally; all other activities

Level 3: All activities

Vocabulary: Gene, dominant, recessive, widow's peak, tongue rolling, hitchhiker's thumb, PTC, unique

Evaluation Activity: Activity E (for general information about the use of evaluation activities, see page xii)

Special Preparation: For Activity B, you will need to provide each student with two colored plastic chips, two clear plastic chips, and two small paper bags. If you cannot get chips, you can use folded clear and colored contact paper. Obtain PTC testing paper for Activity C.*

Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- The gene is the basic unit of hereditary information.
- Most characteristics are determined by several pairs of genes.
- Some human characteristics are determined by dominance within a single pair of genes.
- Dominant genes mask the expression of recessive genes for that trait.
- Recessive genes must occur in pairs in order for the trait to be expressed.

*If your Science Department cannot obtain it for you, PTC paper can be ordered directly from: Carolina Biological Co. Burlington, NC 27215

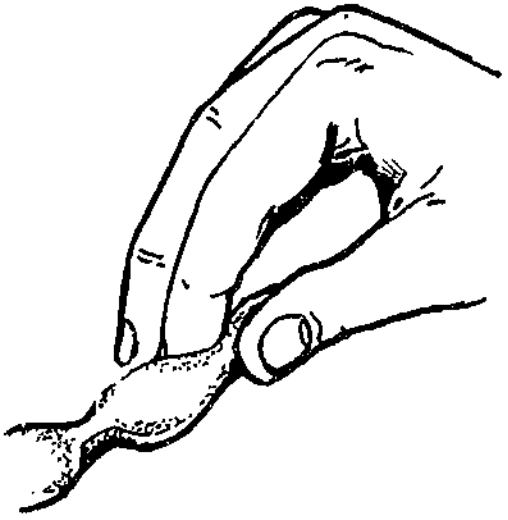
Lesson 7: Your Genes Are Showing

Activity A: Introduction to genes

In this lesson, you are going to learn more about genes.

Genes are carried on chromosomes. Think of each chromosome as a pearl necklace. A gene is one of the pearls. In other words, a chromosome is a string of genes. Each gene is one piece of hereditary information.

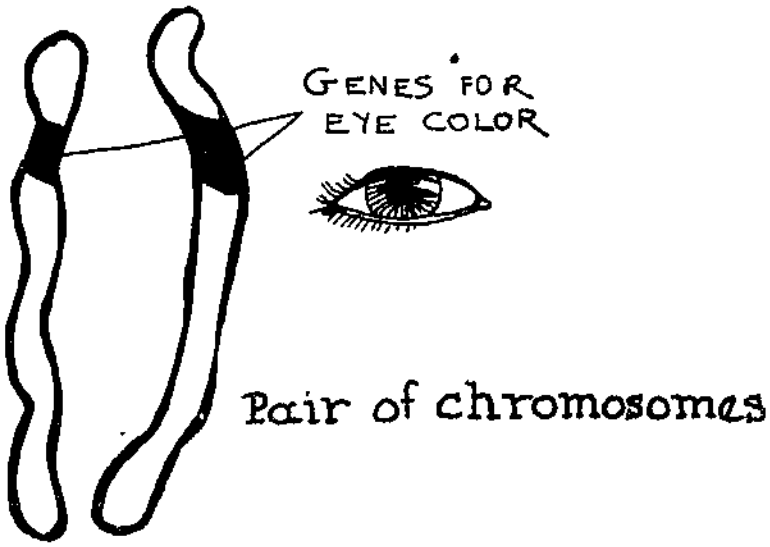
A-1 To understand genes better, get the pair of chromosomes you saved from Lesson 6. Make three pinches along one chromosome. Make three pinches at the same places along the other chromosome.



A-2 You have made four genes on each chromosome, or four pairs of genes

A-2 Now imagine that each clay section between the pinched areas is a gene. How many genes have you made on each chromosome? How many pairs of genes are there? On real chromosomes in the cells of your body, there are many genes on each chromosome. Remember where the genes came from—half of them came from your mother and half of them came from your father.

Do you remember that chromosomes come in pairs? Well, so do genes. If one chromosome in a pair has a gene for eye color, the other chromosome also has a gene for eye color. Both of these genes are in the same position on the chromosomes (see illustration, below).

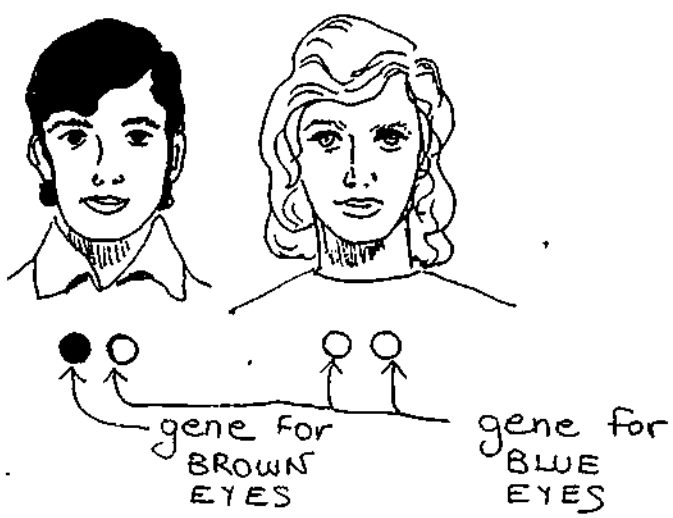


This means that you have at least two genes for each piece of hereditary information, including eye color. (Some of the genes on the sex chromosomes do not fit this pattern. But we'll discuss those later, in Lesson 9.)

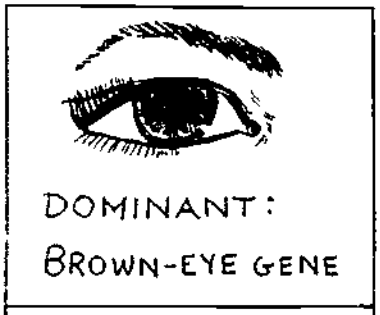
Do you suppose all of the genes for eye color are the same? Of course not, because not everyone has the same color eyes. There must be more than one kind of gene for eye color—and for other traits as well.

In each person's case, there are two possibilities:

- the two genes for eye color are the same
- the two genes for eye color are different



If both genes are for brown eyes, the person will have brown eyes. If both genes are for blue eyes, the person will have blue eyes. But what if there is one brown-eye gene and one blue-eye gene? The person will have brown eyes!



This is because one gene for a trait can "hide" a different gene for the same trait. For example, a brown-eye gene will hide a blue-eye gene. So it is possible for a brown-eyed person to have either <u>two brown-eye genes</u> or <u>only one brown-eye gene</u>. Because of this fact, we call the brown-eye gene <u>dominant</u> and the blue-eye gene <u>recessive</u>.

A-3 Write the eye color a person would have with each of the following pairs of genes:

a. brown and brown

b. blue and blue

c. brown and blue

A-3 a. Brown

b Blue

c Brown

Activity B: Getting freckles

Note Make sure to discuss with students the answers for Activity B after students have completed the activity.

Do this activity with a partner.

Let's look at another trait that is easy to see on some people—getting freckles after being in the sun.

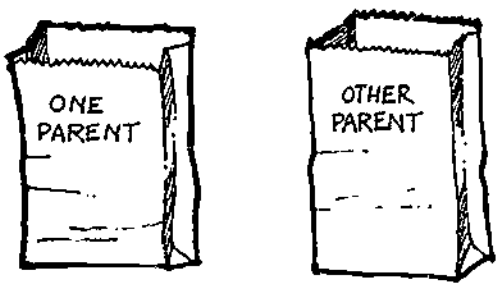
The gene for freckles is dominant. In other words, if you inherit one gene for freckles and one gene for normal tanning (no freckles), you will get freckles when you have been in the sun.

To understand better how you inherit dominant and recessive genes, do the following activity.

B-1 Gather these materials:

- two paper bags
- two pieces of colored plastic chips
- two pieces of clear plastic chips

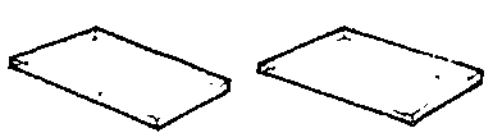
B-2 Label the bags as follows:



B-3 Put the two colored chips into one bag. Put the two clear chips into the other bag. The clear chip stands for a gene that causes normal tanning (no freckles). The colored chip stands for a gene that causes freckles. It masks—or is dominant over—the gene for no freckles (the clear chip).

You now have one parent with two genes for freckles

and the other parent with two genes for normal tanning (no freckles).



Remember, for each pair of chromosomes, you inherit one chromosome from your father and one from your mother. Also remember that genes are what make up chromosomes. Each chip represents a gene on a chromosome.

B-4 Now pull a chip (gene) out of each parent bag. Record the colors of the two chips you drew out of the bags.

B-5 Stack the two chips together. Hold the stacks up to the light. What color do you see? If you see color, that means the dominant gene is masking, or covering, the recessive gene.

B-6 Put the chips back in their bags. Shake each bag and draw one chip from each bag. Each chip represents the gene in a sperm or an egg. Record the colors of the chips you pulled out.

B-7 No, each bag has only clear or only colored chips

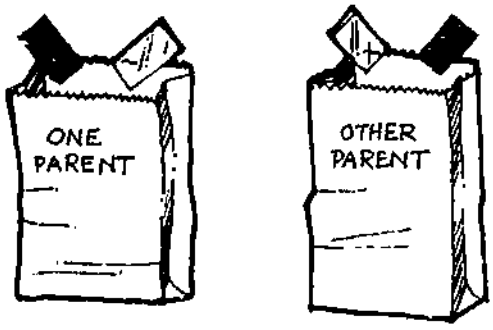
B-7 Can you get any other color combination by drawing one chip from each bag? Why or why not?

B-8 The children will have freckles

B-8 Think about what you drew out of the two bags. What will any offspring (children) from these two parents look like? Will they have freckles or not?

B-9 Now let's look at another possibility. What happens when two freckle-faced people like the offspring in your experiment have children? Both parents have one gene for freckles and one for normal tanning.

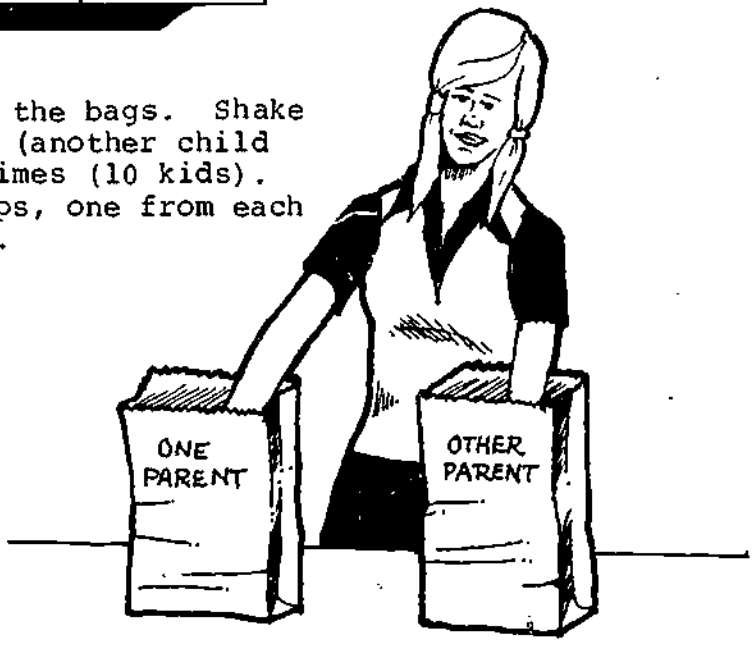
Put the chips back into the bags. This time, put a clear chip and a colored chip into each bag.



B-10 Draw one chip of information (one gene) from each bag. Record your results like this:

	Chips drawn	Looks like
First time		
Second time		
Third time		

Put the chips back into the bags. Shake the bags and draw again (another child is born!). Repeat 10 times (10 kids). Each drawing of two chips, one from each bag, represents a child.



If you drew out two colored chips, you would record:

	Chips drawn	Looks like
First time	■ ■	FRECKLES
Second time		
Third time		

B-11 How many combinations did you get? What were they?

B.11 Two colored—freckles.
one colored, one clear—freckles.
two clear—no freckles

B-12 a. Dominant-dominant

b. Dominant-recessive

c. Recessive-recessive

B-13 The dominant gene

B-14 Two recessive genes

B-12 Each pair of chromosomes has many pairs of genes on it. There is at least one pair of genes for each trait. If there is just one pair of genes for a trait, what three combinations are possible?

a. dominant-dominant

b.

c.

B-13 If a person has one dominant gene for a trait and one recessive gene, which gene will show?

B-14 What combination of genes will result in the recessive gene showing?

Activity C: Are you made up of all dominant genes?

Do this activity with a partner.

Most inherited human characteristics come from more than one set of genes. Some traits come from just one pair of genes. A trait that comes from just one pair of genes is easier to study.

Now, you're going to find out if you have certain inherited characteristics. You'll also find out if your classmates have those characteristics.

You may have trouble seeing whether you have any of the characteristics. If so, use a mirror or have your partner check for the characteristic.

Mark dominant or recessive according to the information given. Mark your results the way Carletha did in the following example.

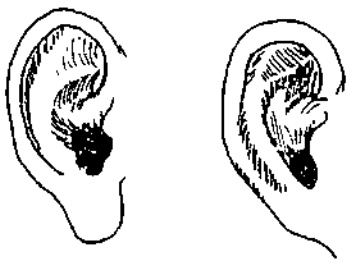
Example

Carletha checked her ear lobes. She decided that hers were not attached—the lobes were hanging free. Her partner agreed. This is the way she filled in her chart.

		ME		
	dominant or recessive	yes	no	possible gene combination
attached ear lobes	recessive		X	FF, Ff

Notice that Carletha used FF and Ff for the possible gene combinations she has. The FF stands for two dominant genes. The Ff stands for one dominant gene and one recessive gene.

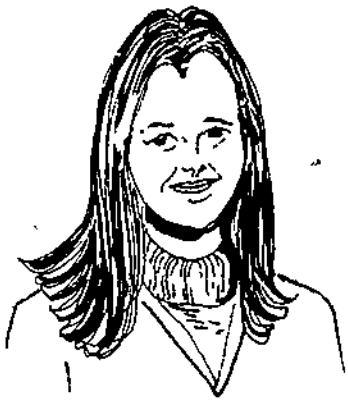
Remember, to have a dominant trait, you need only one dominant gene. To have a recessive trait, you must have two recessive genes. Don't forget to use the letters listed at the bottom of each description as you mark your results.



Attached ear lobes Most people have ear lobes that hang free. In some people, the ear lobes are attached directly to the side of the head, with no lobe hanging free. This characteristic results from two recessive genes. As you look for this characteristic, don't worry about the size of the lobes. Look only at whether they are attached.

F = dominant gene for free-hanging ear lobes

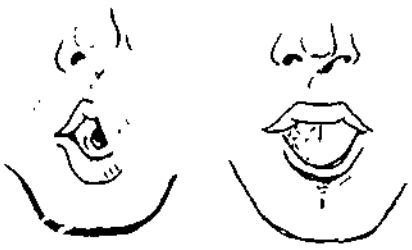
f = recessive gene for attached ear lobes



Widow's peak Some people have hairlines that drop down at the center of their forehead into a definite point. This is called a widow's peak. It results from a dominant gene. See if you have a widow's peak (dominant) or a continuous hairline (recessive).

W = dominant gene for widow's peak

w = recessive gene for continuous hairline



Tongue rolling Try to roll your tongue into a U-shape when it is extended from your mouth. This trait is called tongue rolling. It is caused by a dominant gene. People who do not have this trait can only make a slightly downward curve of the tongue when it is extended from the mouth.

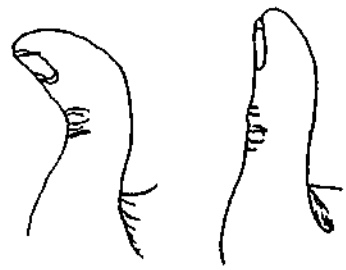
T = dominant gene for tongue rolling

t = recessive gene for not being able to roll your tongue

Hitchhiker's thumb Bend the joint of your thumb closest to the tip back as far as possible. Some people can bend it backward to almost a 45-degree angle. This trait is called a hitchhiker's thumb. It is determined by two recessive genes.

S = dominant gene for straight thumb

s = recessive gene for hitchhiker's thumb



PTC tasting Some people can taste a chemical called PTC (phenylthiocarbamide). Others cannot taste it at all. This chemical is completely harmless. The ability to taste it comes from a dominant gene. Nontasters have two recessive genes.

Your teacher will give you some paper soaked with this chemical. Place a piece of the paper on your tongue and chew it. If you can taste nothing more than paper, you are a nontaster. If you are a PTC taster, there will be no question at all in your mind!

P = dominant gene for tasting PTC

p = recessive gene for not tasting PTC

C-1 Now, check yourself and your partner for each trait just listed. Record your results on a chart like the one below.

Trait	Dominant or Recessive?	Me		Possible Gene Combination
		Yes	No	
Attached ear lobes				
Widow's peak				
Tongue rolling				
Hitchhiker's thumb				
PTC tasting				

C-2 Do you have all dominant or all recessive characteristics, or do you have some of each? What about your partner?

C-3 For each characteristic described, find out how many students in the class have it.

Important note: Just because a trait is dominant, it doesn't mean that more people have the trait.

Now, fill in a chart like the following for your class as a whole, noting the total number of students who have or don't have each trait.

Trait	Yes	No
Attached ear lobes		
Widow's peak		
Tongue rolling		
Hitchhiker's thumb		
PTC tasting		

C-4 Some people have at least one dominant gene for tongue rolling. People who are not tongue rollers have two recessive genes for not being able to roll the tongue.

C-5 No

C-4 Some people in your class are tongue rollers and some people aren't. Why?

C-5 Can people change their genetic characteristics?

Activity D:
How unique are you?

With so many people on the earth, do you think another person can be born with the same genes as you were born with? Unless you have an identical twin, there is no one else on earth like you. This means that you are unique.

D-1 Try an experiment. Your teacher will ask a student to read his or her characteristics (from Activity C) one at a time. Listen as the person reads the first characteristic. Raise your hand if you have the same characteristic. Keep your hand up.

D-2 The person will then read the second characteristic. Only the people who already have their hands up can respond. If they have this second characteristic, they can keep their hands up. If not, they must put their hands down. The person will continue to read her or his characteristics until all hands are down.

D-3 Your teacher will then ask other students to read their characteristics to the class. Follow the same steps as you did for the first reader.

D-4 Fill in a chart like the one below. Show how many characteristics each person had to read before all hands went down. How many characteristics did you have to look at to see that the person is unique?

Name of Reader	Number of Characteristics

D-5 Thousands

D-5 How many genes make up one human being?

D-6 How do you feel about being unique? Is it important to you to be unique? In what ways do you want to be like other people?

Activity E: Flight check

Did you understand this lesson? To find out, answer the following questions without looking back at the lesson. Then, your teacher will help you check your answers.

E-1 What are two possible eye-color genes? For each one, write whether it is a dominant or recessive gene.

E-2 Where are genes found?

E-3 On a pair of chromosomes, how many genes for tongue rolling are there?

E-4 Where did your genes come from?

E-5 Is there anyone else in your class exactly like you? Is there anyone in the world exactly like you? Why or why not?

E-1 Blue (recessive)

Brown (dominant)

E-2 On chromosomes

E-3 Two

E-4 Your parents

E-5 No, everyone (except for identical twins) has a different combination of genes

TEACHER OVERVIEW FOR LESSON 8

Duration: Two or more class periods

Purpose: To illustrate that each person is genetically unique unless he or she has an identical twin

Student Objective:

- To diagram a family pedigree for one hereditary characteristic

Teaching Suggestions:

Levels 1 and 2: No activities (skip this lesson)

Level 3: All activities

Vocabulary: Family pedigree

Evaluation Activity: None

Background:

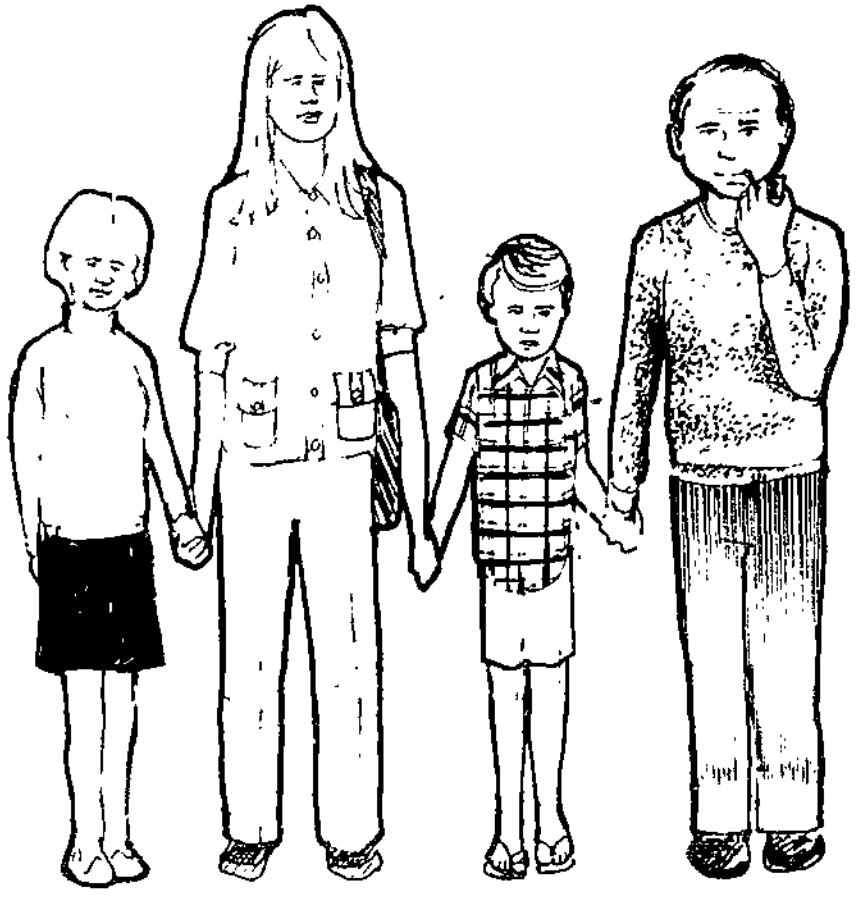
The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- A person expressing a dominant trait received a dominant gene from at least one parent.
- A person expressing a recessive trait received two recessive genes, one from each parent.
- A parent expressing a recessive trait has only a recessive gene to contribute to her or his children.
- A parent expressing a dominant trait may contribute a dominant gene or a recessive gene to her or his children.

Lesson 8: Your Family and You

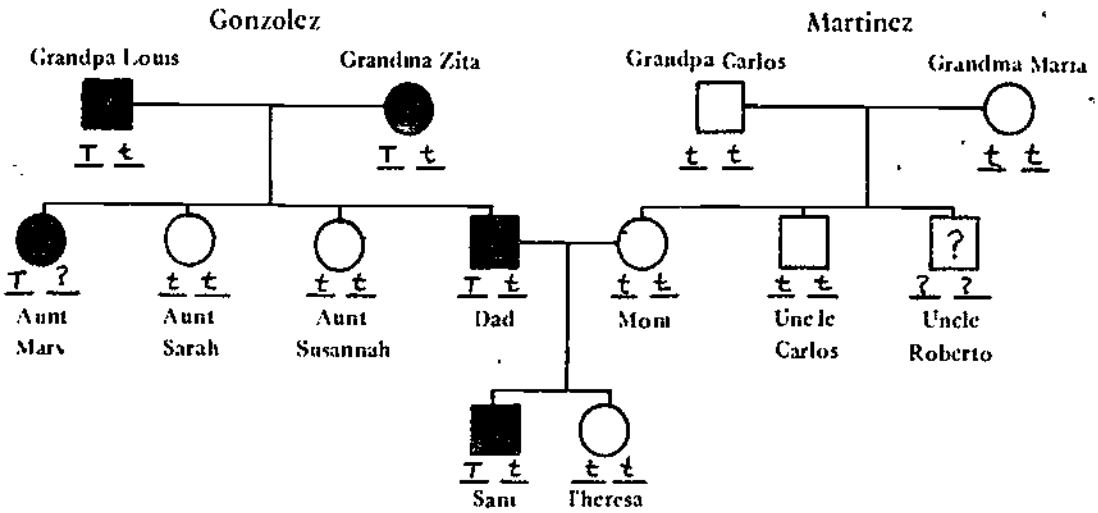
Activity A:
Reading a family pedigree

A family pedigree (genetic history) can be used to see which members of a family have a certain trait. Then a person can predict whether future children in the family will have the trait or not.



Here is a family pedigree for the Gonzolez-Martinez family. The trait being studied is tongue rolling. The letters under the name of each person in the family represent that person's trait.

KEY:
- ○ female without trait
- ● female with trait
- □ male without trait
- ■ male with trait
- T = dominant gene for tongue rolling
- t = recessive gene for tongue rolling



You may have noticed that there is a question mark (?) in the square for Uncle Roberto. That means the person who put together the pedigree chart couldn't check the trait for Uncle Roberto. It could be that he lives in another town, or is dead. Maybe he simply didn't want to try to roll his tongue. It is common to have some question marks on a pedigree chart.

Study the Gonzolez-Martinez family pedigree to answer the following questions.

A-1 Can Grandpa Louis roll his tongue? How do you know?

A-2 Can Uncle Roberto roll his tongue? How do you know?

A-3 Aunt Mary's gene type is T ?. Why couldn't the second gene be filled in with a T or a t?

A-4 If Sam (T t) has a child when he grows up, could his child be unable to roll her or his tongue? Explain.

A-1 Yes. he has a dominant gene for tongue rolling

A-2 No, his parents had no gene for tongue rolling

A-3 Aunt Mary could have either two dominant genes or only one dominant gene for the trait to show. If the trait shows, you know only that she has at least one dominant gene.

A-4 Yes, he can pass his recessive gene to his children

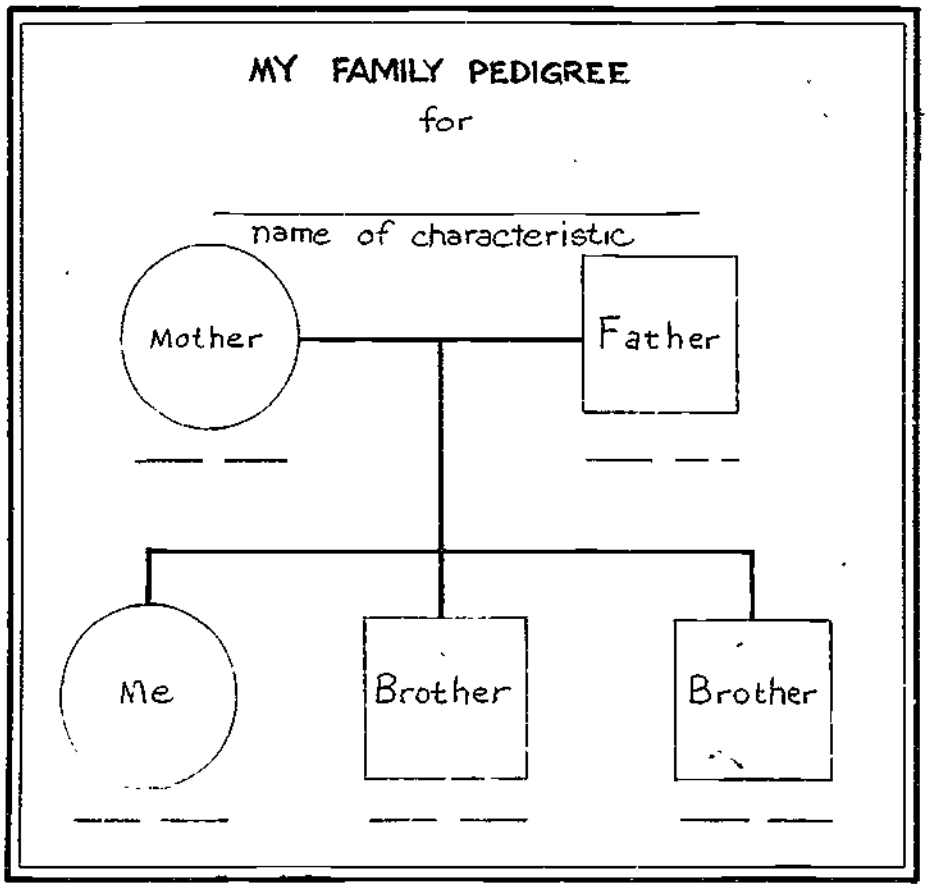
Activity B: Making your own family pedigree

In this activity, you will check your family for one of the traits you learned about in Lesson 7.

B-1 First, fill in the following chart by checking your family for the traits listed in Lesson 7.

Family Member	Traits									
	Attached ear lobe		Widow's peak		Tongue rolling		Hitchhiker's thumb		PTC tasting	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No

B-2 Choose a characteristic that was not the same for everyone in your family. Begin to put together a pedigree chart for your family. Draw a circle for each female member and a square for each male member. If you are a girl and you have two brothers, your chart might look like the one below.



If possible, find out whether your grandparents, aunts, and uncles show the trait, in addition to noting whether members of your immediate family show the trait. Make sure you don't include step-parents—you are tracing genes through birth from one generation to the next.

B-3 Color in each square or circle if the person shows the characteristic.

B-4 On the lines under each square or circle, write a capital letter if the person shows the dominant characteristic. Write two small letters if the person shows the recessive characteristic. Use the letters in Lesson 7. Remember, you can't tell by looking at a person if she or he has two dominant genes or only one. This is because it takes only one dominant gene to show the trait.

B-5 Do any children show two recessive genes? From where did they get them?

B-5 One from each parent

B-6 Yes

B-6 Can a parent have a recessive gene without showing that characteristic?

B-7 As often as you can, try to predict which people in your family pedigree have a capital-letter-small-letter combination. Write it beneath the square or circle. Don't just guess. There should be a good reason for placing a small letter (recessive gene) next to a capital letter (dominant gene). If not, don't do it. (You may need help from your teacher for this question.)

B-8 Predict whether someone might have a dominant-dominant combination. (You may need help from your teacher for this question.) If you know the traits for your grandparents, you can fill in or predict more parts of your chart.

B-9 From where do you get your genetic characteristics?

B-9 From Your Parents

TEACHER OVERVIEW FOR LESSON 9

Duration: Two or more class periods

Purpose: To show that some hereditary traits are related to the sex of a person

Student Objectives:

- To state the differences between the sex (X, Y) chromosomes
- To identify sex-linked traits and how they are passed from parents to children

Teaching Suggestions:

Levels 1 and 2: Activity A; Activity D, orally or written; Activity E (E-2); Activity F

Level 3: All activities

Vocabulary: Sex chromosomes, X chromosome, Y chromosome, sex-linked traits, color blindness, hemophilia, carrier

Evaluation Activity: Activity G (for general information about the use of evaluation activities, see page xii)

Background:

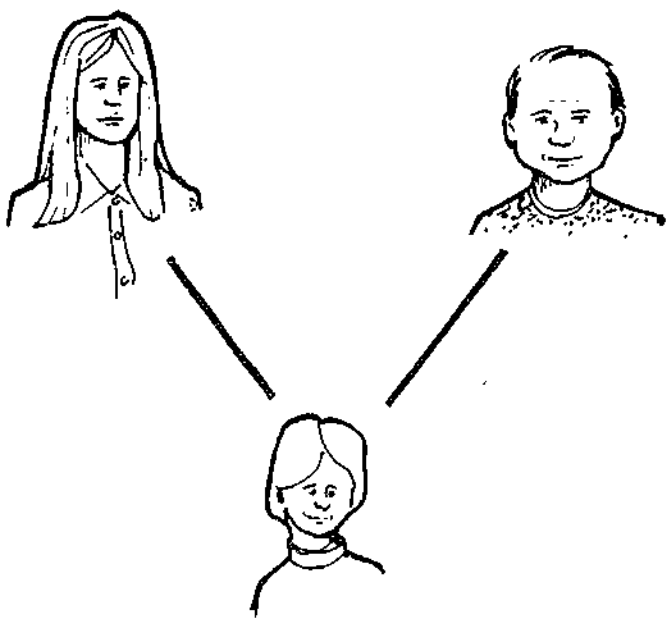
The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- Sex-linked traits are those for which genes are found only on the upper end of the X chromosome and not at all on the Y chromosome.
- Sex-linked traits are recessive and show up more frequently in males than females, because it takes only one gene to express the trait in males.
- There are no sex-linked genes for intelligence.

Lesson 9: Traits in Girls and Boys

Activity A: Genetic differences between girls and boys

Both girls and boys get half of their genes from their father and half from their mother. Remember, you received 23 chromosomes (made up of genes) from your father. You also received 23 chromosomes from your mother.



As a result, boys and girls have an equal chance for receiving most genetic characteristics. But there are some genetic characteristics that only girls or only boys have.

Look at the list of traits below. Write F next to the trait if you think the trait is inherited mainly by females. Write M if you think the trait is inherited mainly by males. Write B if you think both sexes inherit the trait equally.

Suggestion for Activity A. As you go over the answers with students, point out that intelligence and the ability to express emotions are not inherited mainly by females or mainly by males.

A-1 M
A-2 F
A-3 M
A-4 B
A-5 B
A-6 M
A-7 F
A-8 F
A-9 B

A-1 Development of a beard

A-2 Development of a soprano voice

A-3 Voice that becomes much lower at puberty

A-4 Intelligence to become a scientist

A-5 Ability to smile

A-6 Color blindness

A-7 Body height of less than 5 feet 5 inches

A-8 Ability to give birth

A-9 Ability to cry

Activity B:
Sex chromosomes

How did you become either a girl or a boy?

Two of your chromosomes (one pair) are called your sex chromosomes. These chromosomes determine whether you are female or male.

Sex chromosomes come in two different shapes. The large one is called the X chromosome. The small, slightly curved one with a bend in it is called the Y chromosome. A combination of two X chromosomes in a pair produces a girl. A combination of one X chromosome and one Y chromosome produces a boy.

XX = female

XY = male

Females have two X chromosomes. Males have an X and a Y chromosome. If you are a girl, you got an X chromosome from each parent. If you are a boy, you got an X chromosome from your mother and a Y chromosome from your father.

B-1 XX

B-2 XY

B-3 No

B-4 If the student is a boy, the father gave a Y chromosome. If the student is a girl, the father gave an X chromosome.

B-1 Which two sex chromosomes does your mother have?

B-2 Which two sex chromosomes does your father have?

B-3 Could your mother have given you a Y chromosome?

B-4 Did your father give you an X chromosome or a Y chromosome? How do you know?

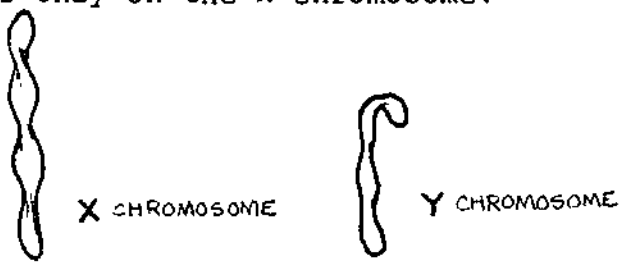
Genes that determine sex characteristics are carried on the X and Y chromosomes. The X and Y chromosomes cause male and female sex glands to develop. These glands begin to produce hormones that cause girls and boys to develop differently.

Some of these differences are as follows:

- At birth, girls' average weight is about 5 percent less than boys'
- Girls are an average of 10 percent shorter than boys by age 20
- Boys experience a growth increase from age 13 to age 15½
- Girls experience a growth increase from age 11 to age 13½
- Adult women require less food per pound than men to produce the same amount of energy

Scientists are still studying sex differences that may exist in the human brain. However, intelligence does not depend on whether someone is female or male. In general, females and males are more alike than different. One sex is not better than the other.

Look at the picture of the X and Y chromosomes, below. The top of the X chromosome has genes that do not appear on the Y chromosome. Some traits are controlled by genes at the top of the X chromosome. These are called sex-linked traits; the genes controlling such traits appear only on the X chromosome.



One example of a sex-linked trait is color blindness. A person who has this trait cannot tell the difference between red and green.

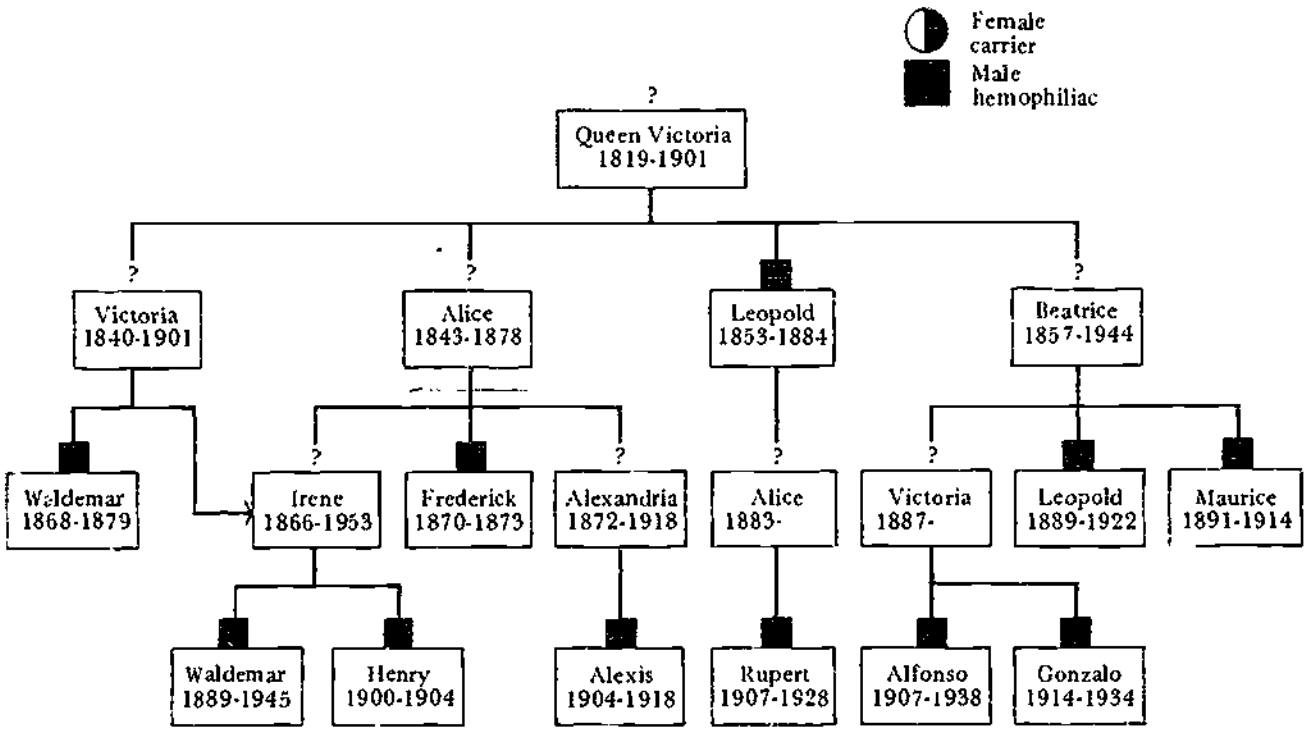
Hemophilia is another sex-linked trait. A person who has hemophilia has a blood condition that causes delayed clotting of the blood. With hemophilia, the person can lose a lot of blood from even minor injuries.

Sex-linked traits are recessive and show up more frequently in males than in females. This is because males must have only one of these recessive genes for the trait to show up, whereas females must have two of these recessive genes for the trait to show up.

For example, a man who has only one recessive gene for the sex-linked trait of hemophilia will have hemophilia. This is because the Y chromosome in the male does not have a corresponding gene, either for hemophilia (delayed clotting) or for normally clotting blood. (Remember, the Y chromosome in the male does not have a gene for a sex-linked trait such as hemophilia. Only the X chromosome--males having one, females having two--has this kind of gene.) As a result, the presence of the single recessive gene, on the man's X chromosome, determines that the trait of hemophilia will show up. Females, in contrast, must have two recessive genes, one on each X chromosome, for a sex-linked trait such as hemophilia to show up.

On the following page is a family pedigree (genetic history) for the sex-linked trait of hemophilia. The people listed in the pedigree chart are all descendants of Queen Victoria of England (although not all people related to the Queen are included in the chart).

A woman who has one dominant gene for normally clotting blood and one recessive gene for the sex-linked trait of hemophilia is called a carrier; she is carrying a gene for the trait of hemophilia. But the hemophilia doesn't show up in her. This is because she also has the dominant gene to mask the recessive characteristic. The recessive gene for hemophilia can then be passed on to the woman's offspring.



B-5 Try to answer the following questions about the Queen Victoria family pedigree for hemophilia.

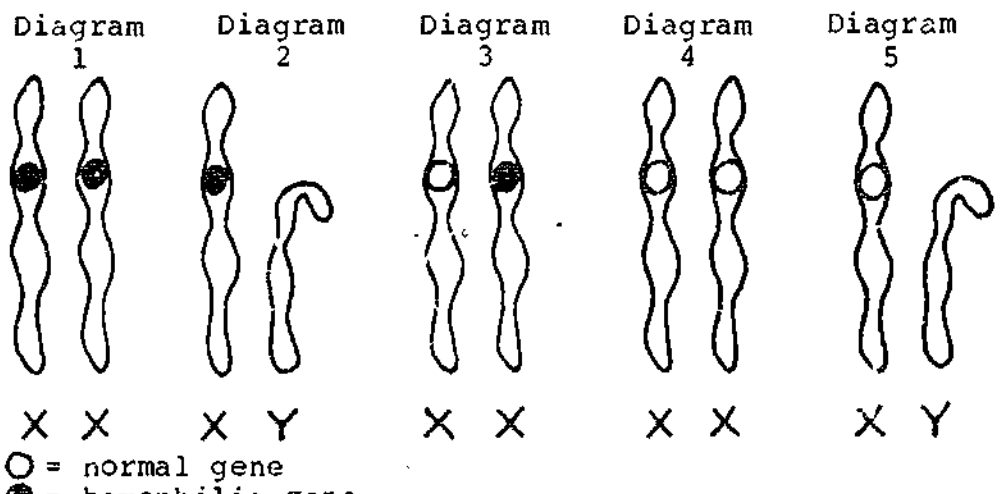
a. Was Queen Victoria a carrier of hemophilia? How do you know?

b. Queen Victoria's son, four grandsons, and six great-grandsons had hemophilia. How many of the Queen's female descendants had hemophilia?

B-5 a. Yes, one of her offspring had hemophilia

b. None

Use the following diagrams to answer questions c through f.



c Diagram 2

d Diagram 3

e. 2, 3, 5, 7, 9, 10, 11

f No, no female offspring had hemophilia

c. Which diagram best describes person number 8 in the pedigree chart?

d. Which diagram is correct for Queen Victoria?

e. Pick out at least one other person (by number) in the pedigree chart who had the same chromosome and gene combination as Queen Victoria.

f. Did anyone in the pedigree chart have the chromosome and gene combination of diagram 1? How do you know?

As you can see, a recessive sex-linked trait is inherited much more often by males than females. So far, no one has found a sex-linked trait that would help a person be a better scientist.

B-6 Have you learned about any genetic traits that would make males better scientists than females?

Activity C: Class wrap-up

C-1 See answers for Activity A.

C-2 No, the male determines the sex of the child, since only the male carries a Y chromosome. The female contributes an X chromosome to children of either sex.

C-3 The X chromosome

C-4 XX for a girl, XY for a boy

C-5 No, everyone's genes are a combination of both Parents' genes

C-6 No. the environment has also played an important role in shaping people's attitudes, emotions, abilities, and activities

C-1 Go back to A-1 through A-9. Which characteristics are inherited differently by females and males?

C-2 A king wanted to have a son to follow him on the throne. The king and the queen had only girls, so the king decided to divorce the queen. Was it her fault that she didn't give birth to a son?

C-3 A sex-linked trait is carried on which chromosome?

C-4 Describe the pair of sex chromosomes for a girl and for a boy.

C-5 Can you be genetically exactly like your father or exactly like your mother? Why or why not?

C-6 Do genes determine completely who you are?

Activity D:
Judging by appearance

Do this activity with a partner or by yourself.

So far, you have found out that genes have a lot to do with a person's physical appearance. People often judge others by their appearance. Is this healthy or fair?

D-1 Most television ads show youth, beauty, and sexiness. Certain clothing styles, certain hair styles, and skin color are other variables one can observe in ads.

D-1 Certain kinds of physical appearances are used to sell things on television and in magazines. For example, most people in detergent ads are young women. Most people in ads about fast-food restaurants are young. Look at the advertisements in a few magazines. Make a chart like the one below to show your findings. Your description of appearances can include the characteristics listed in Activity A.

Ad Product	Appearance

D-2 Color of eyes, color of hair (unless dyed), height, sex, and so on. In general, these traits cannot be changed.

D-2 Describe your own appearance. What parts of your own appearance are caused by your genes? Can you change these parts?

D-3 Can tell color of eyes, color of hair (unless dyed), height, gender, and so on.

Cannot necessarily tell personality, feelings, attitudes, skills, and abilities.

D-3 What are some things you can tell about a person by looking at her or his appearance? What are some things you can't tell by looking at appearance?

D-4 Cannot tell much about a person's feelings or abilities by looking at any of these variables. Tallness, shortness, fatness, thinness, youth, or old age may be indicators of physical abilities. However, people can compensate for these physical characteristics in many ways. Therefore, it is unsafe to make generalizations about a person based on his or her appearance alone.

D-4 Can you know a person's feelings and abilities by looking at the following?

a. Whether they are female or male

b. Whether they are black or white

c. Whether they are tall or short

d. Whether the are fat or thin

e. Whether they are attractive or unattractive

f. Whether they are young or old

D-5 Give examples of how people in each of the categories in D-4 have been discriminated against in our society.

Activity E: Male and female appearance

Your teacher will ask volunteers to form a panel to discuss the following questions.

E-1 What genetic differences between males and females did you find out about in this lesson? Does intelligence depend on whether someone is female or male?

E-2 Should females and males have different jobs? Should females and males participate in different activities?

Activity F: Physical appearance in your school

How important is physical activity in your school? To find out, take a survey. Ask some students the following questions. Make sure to record their answers.

F-1 How do you decide what clothes you will wear or how you will style your hair?

F-2 What kinds of appearances do people make fun of in your school?

F-3 Describe the appearance that seems to be required for a student (boy or girl) to be popular in your school.

D-5 a. Because females are often shorter or less muscular than males, people often wrongly assume females are emotionally and physically weaker than males. In reality, females live longer than males and suffer far fewer heart attacks.

b Black people have been discriminated against in many ways.

c. Tall people are often assumed to be better leaders than short people.

d. Fat people are often thought to be less competent than thin people.

e Attractive people are often treated better than unattractive people. (Have students think about the way they treat each other.)

f. Older people are often forced to retire at a certain age. They are often thought to be less competent than younger people.

E-2 Students should recognize that females and males have comparable intellectual potential, and similar physical potential. Women have proven that they can handle almost all of the jobs traditionally held by males.

Activity G: Flight check

Did you understand this lesson? To find out, answer the following questions without looking back at the lesson. Then, your teacher will help you check your answers.

G-1 Who gives a boy his single X chromosome?

G-2 If a boy is color-blind, which parent gave him that trait?

G-3 In general, do you think there are more color-blind girls or color-blind boys? Why?

G-4 If a girl is color-blind, who gave her that trait?

G-1 His mother

G-2 His mother

G-3 More color-blind boys, they have an X chromosome, on which color blindness is carried, and a Y chromosome, which has no gene either for or against color blindness, thus allowing the one recessive gene to show On the other hand, girls must have two recessive genes (one on each of their X chromosomes) for the characteristic to show

G-4 Her father and mother

TEACHER OVERVIEW FOR LESSON 10

Duration: Two or more class periods

Purpose: To help students understand the concept of environment and its relationship to themselves

Student Objectives:

- To identify parts of the environment
- To differentiate between the natural environment and the human-made environment
- To state feelings about various aspects of the environment

Teaching Suggestions:

Level 1: A-3 and B-1, orally; Activities C, D, E

Levels 2 and 3: Activity A or C; Activities B, D, E

Vocabulary: Environment, natural, human-made

Evaluation Activity: Activity E (for general information about the use of evaluation activities, see page xii)

Special Preparations: You will need to make preparations for a field trip for Activity A or C or both.

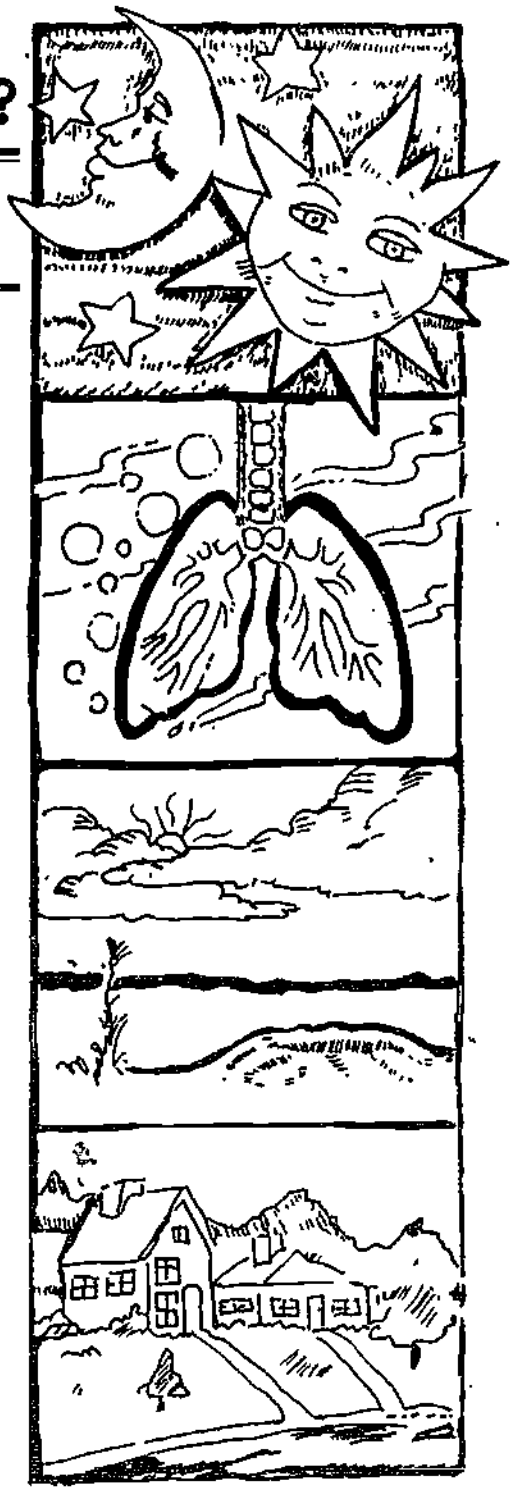
Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- Parts of the environment are natural.
- Parts of the environment have been made by humans.
- The natural and human-made environments affect people physically and emotionally.

Studies show that females often do not identify with male generic words. As a result, the term human-made has been used in place of the male generic man-made.

Lesson 10: What Is Environment?



Activity A:
What is your environment?

Who you are is partly determined by heredity. Remember, heredity means that certain characteristics are passed by genes from your parents to you. These genes have a lot to do with what you look like. Your genes also have something to do with how you act.

But there is another factor that determines who you are and how you act. It is called environment. Your environment is everything around you.

Think about your surroundings for a minute. What is around you? Is it dark or light? Is it warm or cold? What is going into your lungs: air or water? Are there other people around, or are you alone? Where do you live: in a hole in the prairie or in a house?

These are only some of the parts of your environment.

How does your environment affect you?

In general, there are two parts of the environment. One part is the natural environment. The other part is the human-made environment.

Your natural environment is all of nature—the air you breathe, the water you drink, the heat or cold, the sun or rain, the grass and plants. You know about your natural environment through what you touch, taste, smell, see, and hear.

A-1 Sample answers. Plants, air, water, earth, mountains, ocean, grass, animals, sun, weather

A-1/ Either:

Think of the outside world. To do this, think of things you see on the way to school, or try to remember vacations you and your family have had. Then list at least five things in the natural environment.

Or:

Go on a field trip outdoors with your class. As you walk, observe the natural environment around you. Try to see new things or try to look at familiar things closely. Then list at least five things in the natural environment.

96

A-2 Now, look at the emotions below. Think of parts of your natural environment that make you have each feeling. Your answers can include things you touch, taste, smell, see, or hear.

A-2 Variety of answers

a.	peaceful	g.	trapped
b.	sad	h.	amazed
c.	angry	i.	nervous
d.	secure	j.	beautiful
e.	powerful	k.	free
f.	mysterious	l.	enthusiastic

Humans often use things from the natural environment to make new things. These things are part of the human-made environment. For example, humans use trees to make paper. Humans use heat and sand to make glass.

A-3 Think of at least five parts of your environment that have been created by humans.

A-3 Sample answers television, homes, clothing, air conditioners, heaters, automobiles, smog, nuclear plants, dams, buildings

A-4 How do you feel about the natural environment? To find out, read the following phrases. For each one, complete the sentence with something that shows your <u>own</u> feelings or ideas about the environment.

a. People who wear fur coats . . .

b. The ocean . . .

c. Mining companies . . .

d. People who smoke cigarettes . . .

e. Automobiles . . .

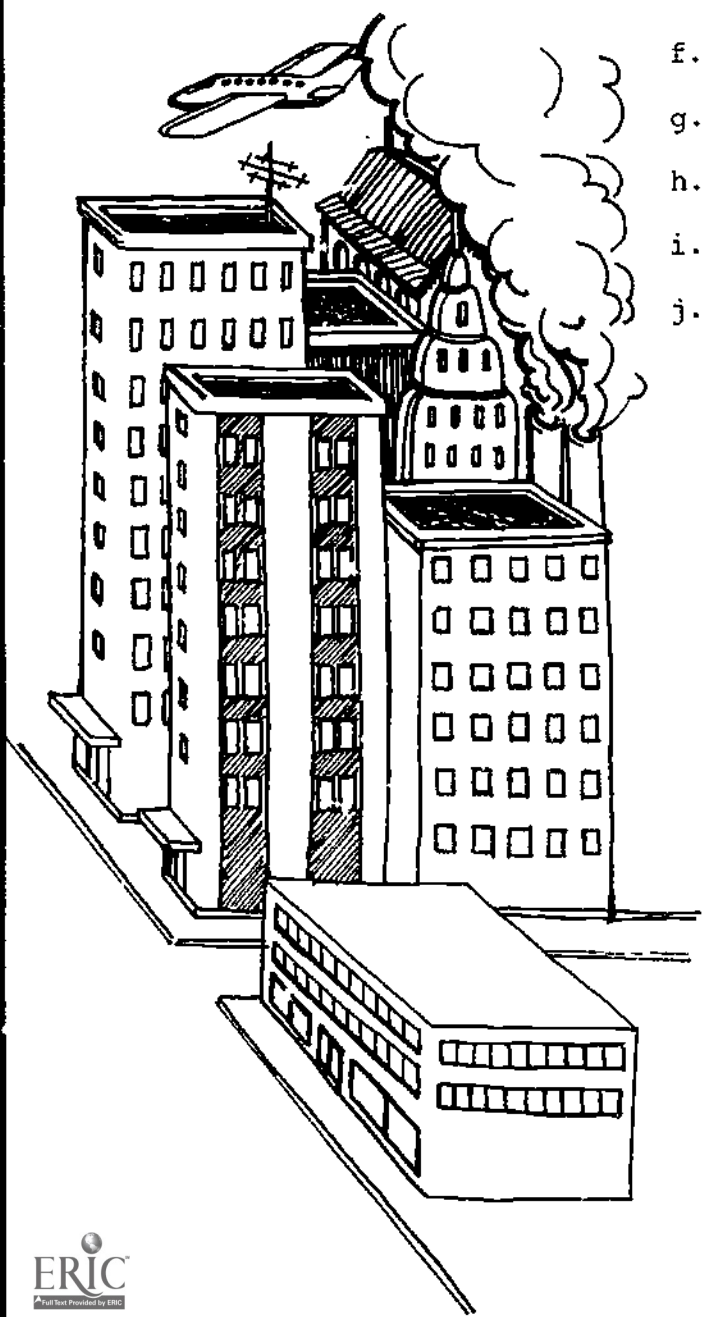
f. Whales and seals . . .

g. The logging industry . . .

h. Redwood trees . . .

i. Cities . . .

j. Mountain climbing . . .



Activity B:
Exploring your classroom environment

What kind of environment do you have in your classrooms?

B-1 Take a survey of the environment in three of your classrooms. Use a chart like the one below.

Classroom Environmental Survey			
	Acceptable	Fair	Unacceptable
General Appearance			
1st Period			
3rd Period			
6th Period			
Comments:			
Noise Level			
1st Period			
3rd Period			
6th Period			
Comments:			
Temperature			
1st Period			
3rd Period			
6th Period			
Comments:			
Light			
1st Period			
3rd Period			
6th Period			
Comments:			
Easy to Learn In			
1st Period			
3rd Period			
6th Period			
Comments:			

Use the following terms and definitions as you rate your classroom:

acceptable:	pleasant or enjoyable
fair:	a few problems but still okay
unacceptable:	unpleasant or unenjoyable

B-2 After you fill in the chart, write at least two general statements about your classroom environment.

B-3 Write any changes you would suggest.

B-4 Prepare to report your survey and conclusions (general statements) to the class.

Activity C:
A field trip outdoors

Take a walk in some interesting outside area. Discuss or write as many observations as you can about the environment. Your observations should include:

C-1 Which parts are natural.

C-2 Which parts are human-made.

C-3 Some information about each part of the natural environment that you observe (temperature, weather, colors, textures, quantity, size, smells)

Activity D: Class wrap-up

D-1 Discuss your answers and observations for Activities A, B, and C.

D-2 Which parts of your human-made environment would you rather get along without?

D-3 What decisions can you make about your natural environment? Your human-made environment?

D-3 Natural environment: Can decide which parts to explore or visit, how to protect oneself from the natural environment, when to eat, and so on

Human-made environment: Can decide what clothes to wear, which television shows to watch, what food to eat, when to use the car, and so on

Activity E: Flight check

Did you understand this lesson? To find out, answer the following questions without looking back at the lesson. Then, your teacher will help you check your answers.

E-1 What are three parts of your natural environment?

E-2 What are three human-made parts of your environment?

E-1 Variety of answers

E-2 Variety of answers

Duration: Three or more class periods, plus additional time over a period of two or three weeks

Purpose: To help students become aware of how humans change the natural environment

Student Objectives:

- To identify ways in which humans change the environment
- To test the effects of household products on plants

Teaching Suggestions:

Level 1: Activity A, orally; Activity C, D or E

Levels 2 and 3: Activities A and B; Activity C, D or E; Activity F

Vocabulary: Pollute

Evaluation Activity: Activity F (for general information about the use of evaluation activities, see page xii)

Special Preparations: For Activity A, if collages rather than lists are made, you will need to provide magazines for students to cut up, poster paper, scissors, and glue. For Activity D, you will need to make appropriate materials available to students (see D-2). For Activity E, you will need to make preparations for a field trip.

Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- People affect the environment in many complex ways, some of which help them and some of which harm them.
- People have no control over certain aspects of their natural environment.

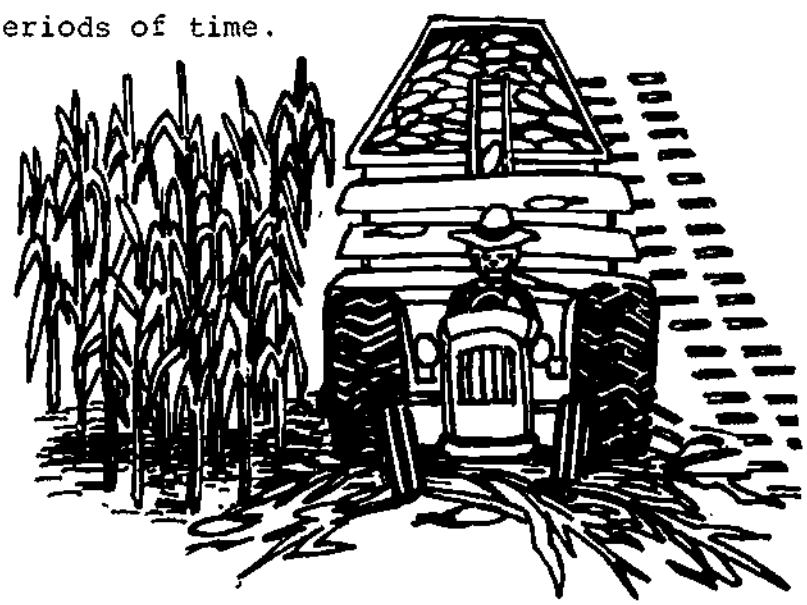
The term Native American is used in this lesson instead of Indian, since the latter term reinforces myths and stereotypes about this nation's first inhabitants. Students need to be presented with accurate information about Native Americans and encouraged to view them from a humane perspective.

Lesson 11: Do Humans Change Their Environment?

Activity A:
Learning to control our environment

Like all animals, we humans need food and water in our environment to stay alive. In fact, humans can survive without water and food for only a few days. Many other animals can survive much longer without food or water. In this sense, humans are not as well adapted to the eath's environment as some other animals are.

We have learned some ways to control our environment. We have learned to grow food instead of only gather or hunt it. And we have learned how to store food for long periods of time.



Like other animals, humans need to be protected from the weather. For example, dogs' fur coats allow them to live in many kinds of weather. We humans have learned to wear clothing to protect ourselves. We have also learned how to build houses and other buildings with air conditioners and furnaces. All of these things help protect us.

Form a small group to complete A-1 through A-5. Have your group recorder write your group's answers.

A-1 Make either a list or a collage of human-made things in your environment that you think you must have to survive.

A-2 List at least three parts of the natural environment over which humans have <u>little or no control</u>.

A-3 List at least three parts of the natural environment over which humans have <u>some control</u>. For each part, explain what humans have created or done to control it.

A-4 List one genetic factor over which humans have control.

A-1 People need clothing, shelter, and food to survive. When discussing students' answers, point out that values help determine what people think they must have to "survive." Some students may feel they could not survive without their make-up, stereo, or car. Actual survival could probably be achieved without any of these!

A-2 Sample answers: the weather, the placement of mountains, our path around the sun, some viruses

A-3 Sample answers. The temperature, the effect of the weather (we can take shelter, protect our skin from the sun's rays, use an umbrella, try to predict the weather); placement of trees; choice of crops, locomotion through use of coal, iron, oil, and so on; control of disease; use of cures of disease

A-4 We have methods for increasing the chance of having a son instead of a daughter (depending on the age of the sperm when the egg is released); we can surgically correct or control many genetic defects; people can dye their hair.

A-5 In your group, discuss this question: Do we depend on our environment more or less than did the Native Americans who first lived in this country? Think about tools, clothing, shelter, and food. Have your group recorder write your group's answers.

A.5 We are just as dependent on our environment in the sense that all of our technology comes from materials and substances in the natural environment. Due to technological advances and more specialization and exchange, we can often control more aspects of the environment, such as agriculture, transportation, communication, and disease.

Activity B (discussion): How much control do we have?

B-1 Discuss your answers to A-1 through A-5.

B-2 How much control do humans really have over their environment? Explain your answer. Think of ways that control can hurt the environment.

B-2 We have learned how to manipulate (control) more aspects of the environment, although our "control" has resulted in oil spills, threat of extinction by nuclear warfare, and disease and genetic aberration due to insecticides and other kinds of pollutants.

Activity C:
Interviewing a Native American

Either:

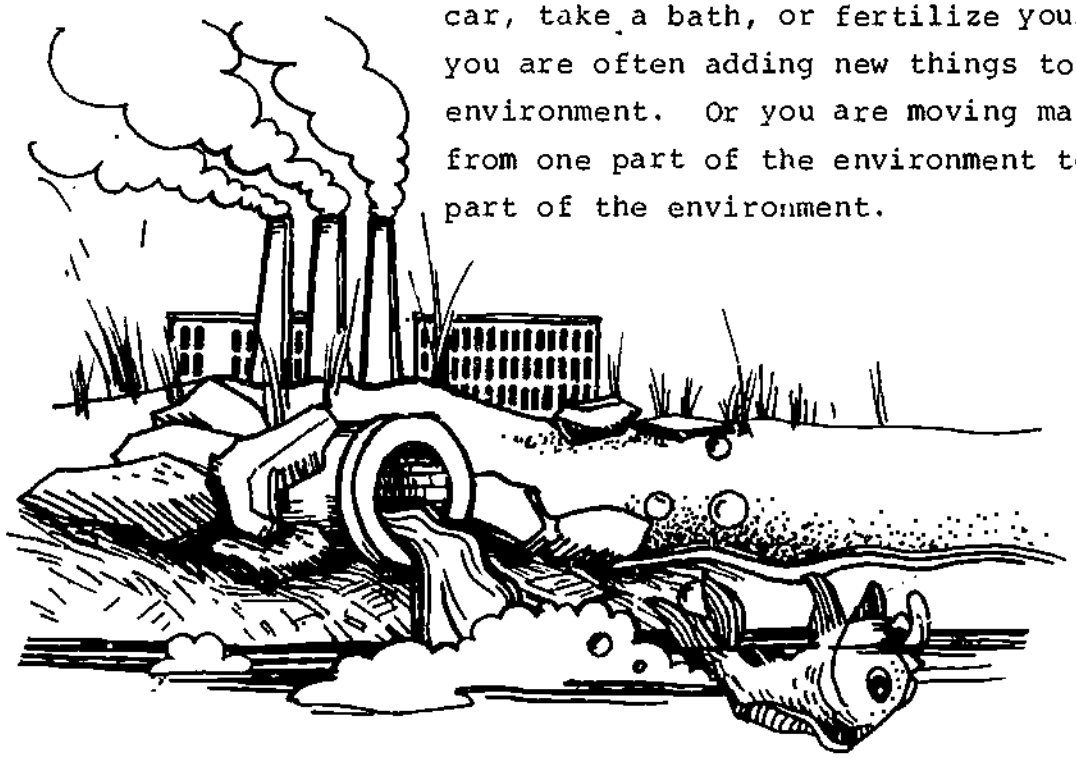
Interview a Native American to see if she or he agrees with how we use and control our environment.

Or:

Read about Native Americans to see what they think about their relationship with the natural environment.

Activity D:
How do humans affect the environment?

Think about the materials that people add to the water, soil, or air. When you wash a car, take a bath, or fertilize your garden, you are often adding new things to the environment. Or you are moving materials from one part of the environment to another part of the environment.



All of these substances—soap, chemicals, wastes—go into a sewer or septic tank. Many cities have sewage treatment plants that treat the water. But most of the substances you add cannot be removed. Sewers ultimately empty into rivers, lakes, or oceans, which are the sources of our water supply.

Some chemicals get into water through the soil—chemicals such as those used in many fertilizers and weed killers. Do you think these chemicals affect us?

When human-made materials hurt the natural environment, we say that the environment is polluted.

In this activity, you are going to study pollution. To do this, you will test the effects of common household products on living things.

D-1 First, as a class, discuss the things that may be good for plants and those that may be bad for plants.

D-2 Form small groups. In your group, plan your experiment together. Your experiment can last from one to three weeks. Make sure that each person in the group has a task to do.

Choose one of the suggestions below for your experiment.

- What effect do different liquids have on your plants?
- What effect does light, lack of light, or colored light have on your plants?
- What effect do different temperatures have on your plants?

Choose from the following experimental materials (or think of your own):

- Plants: radish seeds or other seeds that grow quickly
- Foodstuffs: milk, coffee, orange juice, sugar, water
- Other liquids: detergents, salt water, liquid fertilizer
- Soils: sandy, organic, clay, vermiculite
- Container in which to plant the seeds: baby-food jars, egg cartons, different-colored light bulbs
- Measuring devices: rulers, scales, the five senses

D-3 Experiment in as many ways as you want to find out how changing the environment will affect your plants. To do this:

a. Plant the seeds in three or four containers.

b. Make one container the control plant. Feed and water it the same way each day.

c. For each of the other plants, add a different liquid to each container (or put each container in a different light, or different temperature). Make these the experimental plants.

D-4 Keep a daily log like the one shown below. Make one log for your control plant. Make the other log for your experimental plants.

Day	Observation for Control Group	Observation for Experimental Group
1		
2		
3		
4		
5		
6		

Observe facts such as the following:

- When (if) you water your plants
- Where your plants are located (light or dark)
- When the seeds sprout
- What differences you can observe and measure in the plants from day to day

D-5 Two or three weeks later, make an oral or written report answering the following:

a. What conditions seem to be good for your plants?

b. What conditions seem to hurt your plants?

c. Which environmental factors helped your plants survive?

Activity E: Field trip

Go on a field trip with your class. Observe all the ways that people have altered (changed) the environment. Are there any negative results?

Activity F: Flight check

Did you understand this lesson? To find out, answer the following questions without looking back at the lesson. Then, your teacher will help you check your answers.

F-1 Name three ways humans control their environment.

F-2 Name three parts of the environment that humans cannot control.

F-3 Give two examples of how environmental control can backfire (cause harm).

F-1 Sample answers: air conditioners, clothing, weather prediction, growing certain crops

F-2 Sample answers: the outside temperature, tornados, hurricanes, some viruses

F-3 Sample answers, technology to manipulate environment can cause many kinds of pollution (air, water, noise) as well as physical and environmental strain on humans, who live at a faster and faster pace.

TEACHER OVERVIEW FOR LESSON 12

Duration: Two or more class periods

Purpose: To introduce the concept of social environment and its effects on people

Student Objectives:

- To state the definition of social environment
- To identify aspects of the school's social environment
- To respond to parts of the school environment by stating personal feelings

Teaching Suggestions:

Level 1: Activity A, orally; all other activities

Levels 2 and 3: All activities

Vocabulary: Social environment, social animal

Evaluation Activity: Activity F (for general information about the use of evaluation activities, see page xii)

Special Preparations: During Activity C, carefully observe each group (don't let students know what you are doing). Record the following:

- Who is the leader: male or female?
- Who is the recorder: male or female?
- How is the leader chosen (who influences the actions and decisions of the group the most)?

In Activity D, report the results to the students.

Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- A person's social environment affects his or her attitudes and values.
- Awareness of the effects of the social environment can enable a person to make choices about the variables in the social environment.

Lesson 12: What Is Society?

Activity A: What is your social environment?

So far, you have learned about your natural environment, which is the world around you. It includes the air you breathe, the food you eat, the heat or cold, the sun or rain.

But there is another part of your environment. It is called the social environment. Your social environment is made up of the people around you—and what they say and do.

A general definition of social environment is all of the effects that human beings have on other human beings. In other words, you behave (act) in certain ways because of the people around you. Also, other people behave in certain ways because of you.

The main way humans affect (change) other humans is through communication. Because we humans can communicate and because we live in groups, we are called social animals.

The kinds of groups that humans form include families, churches, friends, schools, cities, and countries.

How do you feel about your social environment? How does your social environment affect you? To find out, answer the following questions. You may do these with a partner or by yourself.

A-1 Of what groups are you a member?

A-2 List all of the places you can think of where you communicate with other people.

A-3 What methods do humans use to communicate with each other?

A-4 Who are the main people who affect your feelings and actions?

A-5 Who are the main people you affect?

A-1 Sample answers: family, school, church, friends, clubs, sports teams

A-2 Sample answers: in class, during lunch, at home, on the phone, at school dances

A-3 Sample answers: spoken language (human voice, telephone, radio); written language (newspapers, magazines, letters, textbooks); visual communication (movement of human body, pictures, photographs, sculptures, television, movies); electronic communication (codes, satellites, underwater and underground cable, as well as telephone, radio, television, and movies)

A-4 and A-5 Sample answers: friends, parents and family, teachers, pastor

Activity B: Interviewing each other about your school's social environment

Your teacher will ask volunteers to take turns being interviewed by the class. Ask the volunteers any questions you want to about your school's social environment. Your questions might include:

B-1 What things in your school's social environment make you feel good? Bad?

B-2 What choices does your school let students make?

B-3 In your opinion, which parts of your school's environment need to be changed?

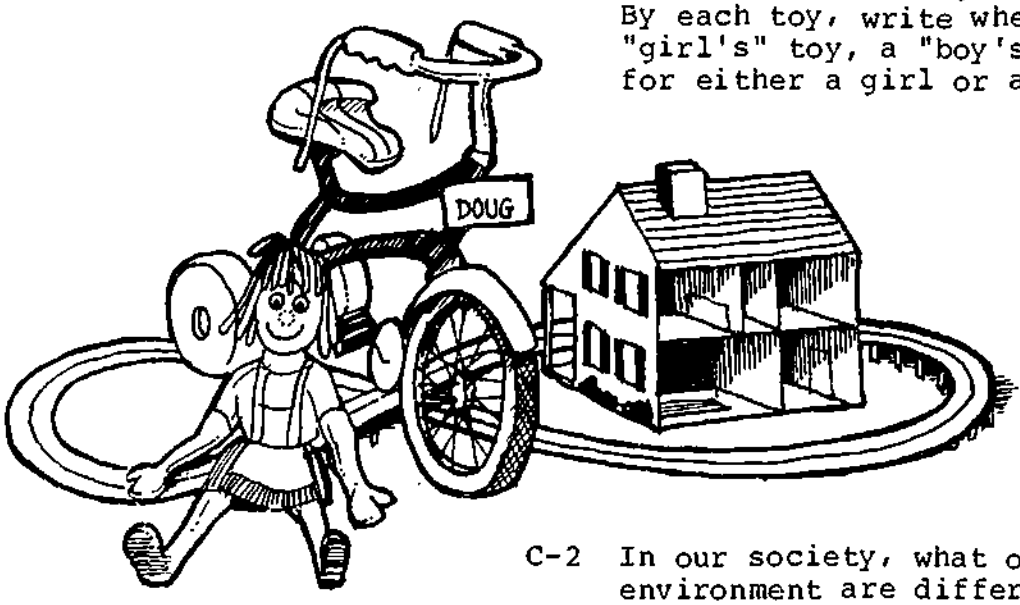
Activity B. Variables may include other people's attitudes, textbooks, magazines, teachers, principal, amount of time to talk between classes, arrangement of classes, number of students in classes, seating arrangements, social functions

Activity C:
Females and Males in the environment

Form a group with three or four other students. Choose a group recorder.

Is the social environment for males different from that for females? If so, what effect does this have on you as a female or male? To find out, answer the following questions.

C-1 Make a list of the main toys you played with between the ages of four and eight. By each toy, write whether it was a "girl's" toy, a "boy's" toy, or a toy for either a girl or a boy.



C-2 In our society, what other parts of the environment are different for girls and boys? (Think of clothing, outdoor activities or indoor activities, and so on.)

C-3 Remember, your social environment is made up of what the people around you do and say. Do people treat girls differently from the way they treat boys? How? Do people say different things to girls from what they say to boys? Give examples.

C-1 Variety of answers. this question is designed to cause students to recognize differential socialization of females and males.

C-2 Girls wear different clothing. Often, at least in the past, girls' clothing has inhibited free movement. Women, for example, often wear high heels, which are undoubtedly more difficult to walk in than men's shoes. Girls and boys usually play with different toys and participate in different activities.

C-3 People often treat females as if they are more sensitive, emotional, or weak than males. Females are often judged according to their appearance, whereas males are judged according to their ideas. Girls are often expected to be more sensitive to people's feelings than boys are. Boys and men are often expected to be leaders and to be strong physically and emotionally. Girls and women are often expected to be followers and to be passive and weak. Males are expected to make more important decisions (finances, politics, law) than females are.

Activity D:
Class wrap-up

D-1 What is your social environment?

D-2 Discuss your answers to B-1 through B-3.

D-3 Do you think girls and boys should be raised by their parents in different ways? Why or why not?

D-4 How can people's natural and social environment affect their attitudes toward science?

D-5 Do you think people's attitudes about what boys and girls should say and do are changing? How? Why?

D-6 So far, you have found out about three forces that have shaped you into who you are. These forces are genetics, natural environment, and social environment. Which of these most influenced who took leadership roles in the groups? Which of these can you change in some way? Why is this good to know?

D-1 The people around you and all communications that take place

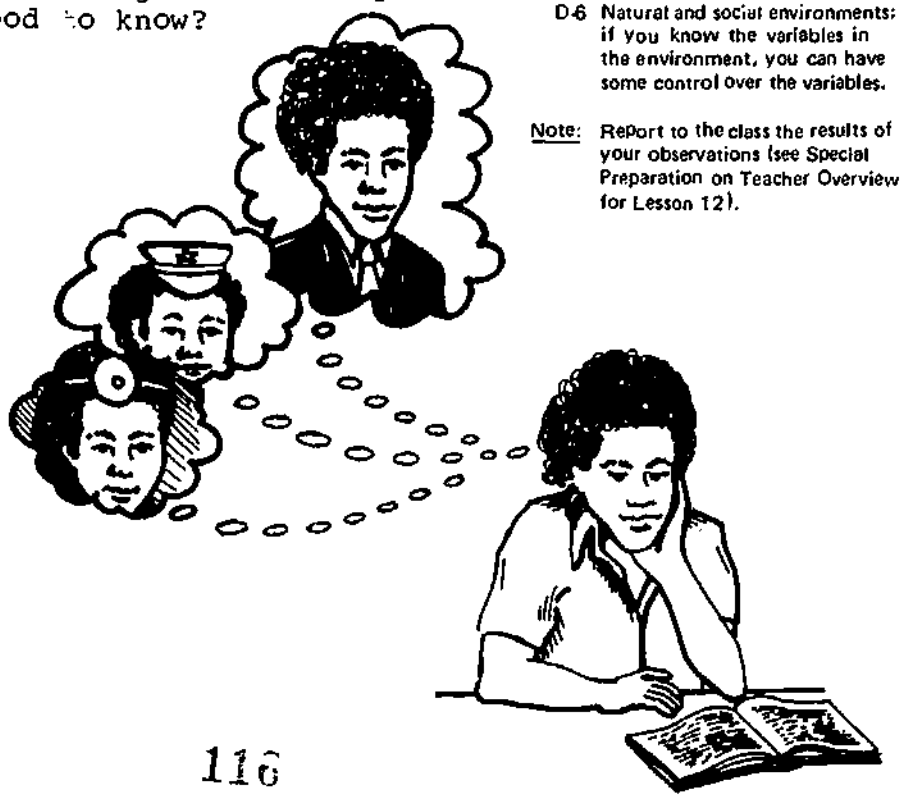
D-3 Variety of answers. Parents who raise boys and girls differently are in many ways needlessly limiting the children's self-concepts and potential choices. It makes more sense to raise children with sensitivity to individual needs.

D-4 See answer to C-3. Because of different opportunities and expectations, males feel more comfortable or identify with activities involving aggressiveness, initiative, independence, visual-spatial skills, and teamwork. All of these skills and characteristics are necessary to some degree in science classes and careers.

D-5 Slowly, our society is affirming the right of equal treatment and opportunity for everyone—females and males.

D-6 Natural and social environments: if you know the variables in the environment, you can have some control over the variables.

Note: Report to the class the results of your observations (see Special Preparation on Teacher Overview for Lesson 12).



Activity E:
Your friends and their activities

Interview one male friend and one female friend. Find out some characteristics of their social environment. Use this information to predict what future job each person will probably have and why.

Activity F:
Flight check

Did you understand this lesson? To find out, answer the following questions without looking back at the lesson. Then, your teacher will help you check your answers.

F-1 The people around you and all communications that take place

F-2 Because they live in groups and can communicate

F-3 Variety of answers

F-1 What is your social environment?

F-2 Why are humans called <u>social animals</u>?

F-3 What are some ways the social environment affects the way people feel and act?

TEACHER OVERVIEW FOR LESSON 13

Duration: Two or more class periods

Purpose: To help students see how and where learning takes place

Student Objectives:

- To give examples of learned behavior that helps people survive
- To identify rewards and punishments and explain how they relate to learning
- To identify examples of behavior learned from one's family, friends, and culture

Teaching Suggestions:

Level 1: Activities A and B, orally; Activities C, D, E

Levels 2 and 3: All activities

Vocabulary: Reward, punishment, culture

Evaluation Activity: Activity E (for general information about the use of evaluation activities, see page xii)

Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- A reward is a pleasurable experience that reinforces a behavior in such a way that there is a desire to repeat it.
- A punishment is an unpleasurable experience that reinforces a behavior in such a way that there is a desire to avoid it.
- Behavior is learned from various socialization agents such as family, school, friends, and church.

Lesson 13: Learning from Your Social Environment

Activity A: Learning and survival

You may remember that your very survival depends on your natural environment. You cannot survive without food, water, and air to breathe. Can you survive without a social environment?

What if you had to learn everything by yourself? Pretend for a minute that there are no books, no television, no parents around to teach you, no schools. To find out how high a mountain is, you have to climb it, or figure out a way to measure it. To find out what is on the ocean floor, you have to dive down to it. To find out what food is good for you, you have to try different foods. Now do you think you could survive without learning from other humans?

Make a list of the kinds of things you have learned that you could not survive without knowing.

Activity A sample answers.
how to eat, what to eat, how to talk, how to dress

Activity B: How people learn

One of the main ways humans learn is through reward and punishment. Society rewards people for behavior the society values. Society punishes people for behavior the society does not like. Rewards are usually pleasurable, whereas punishments are usually unpleasurable.

Your social environment is full of rewards and punishments. You learn to do things that get rewards. And you learn to stop doing things that you think will result in punishment.

Following are some short stories about situations in your society. Try to decide what makes the person behave (act) in the way shown. Is it a reward or a punishment?

B-1 A small child wants to put her hand into a light socket. All of a sudden she remembers the last time she did that—it hurt! So she pulls her hand away.

a. Is punishment or reward at work here?

b. What is the punishment or reward?

c. Has the child learned something? Explain.

B-1 a. Punishment.

b. Shock.

c. Yes – that the socket can cause a shock.

B-2 A small boy has just run into the street. There were no cars, but his father still scolds him.

a. Is punishment or reward at work here?

b. What is the punishment or reward?

B-3 Dawn is trying to win a touchdown for her team.

a. Will Dawn be rewarded or punished?

b. What reward or punishment will Dawn get if she makes the touchdown?

c. Does she know whether she will get a reward or punishment? How?

B-4 Frank is sitting behind Beth in class. He tugs at her hair.

a. Will Frank be punished or rewarded?

b. What will his punishment or reward be?

B-5 Jim is trying very hard to earn a scholarship in music.

a. Will Jim be rewarded or punished is he gets the scholarship?

b. What will the reward or punishment be?

B-6 Jerry is robbing a bank.

a. Will Jerry be punished or rewarded?

b. What will the punishment or reward be?

B-7 What are your favorite rewards?

B-2 a. Punishment

b. Scolding

B-3 a. Rewarded

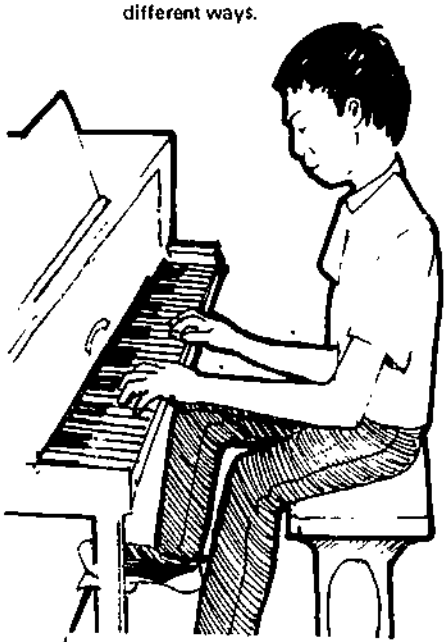
b. Applause, affection from teammates

c. She knows she will be rewarded if she makes a touchdown. She knows based on observation of others and personal experienc

B-4 a. It depends on Frank's perception of the situation. If he wants attention from the girl, he will probably be rewarded. If the teacher reprimands him in some way, he may or may not consider himself punished.

b. Attention (reward); reprimand (punishment)

Note: Explain to students that different people often perceive and respond to the same situation in different ways.



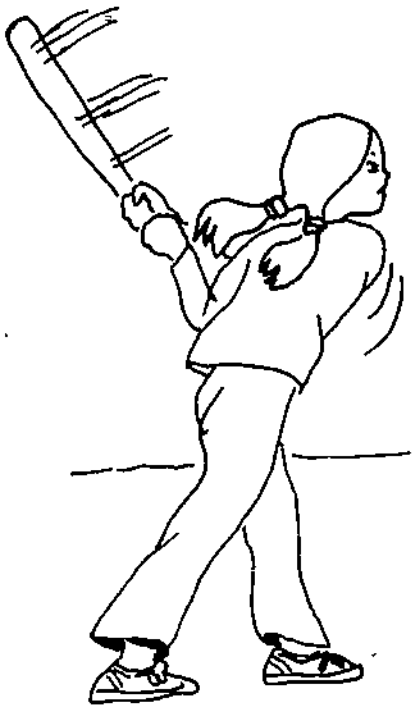
B-5 a. Rewarded

b. Scholarship money, respect or admiration from peers and family

B-6 a. If he does not get caught, he will be rewarded with money (he may also be punished with a guilty conscience). If he gets caught, he will probably be punished (imprisoned).

b. Money (reward), imprisonment (punishment)

B-7 Variety of answers



Activity C:
Where people learn

You may know by now that not everyone learns the same things. Different people learn different behaviors, values, and beliefs. For example, one person may learn how to fish. Another person may learn how to play baseball. One person may learn to value having a job outside the home. Another person may learn to value working at home.

Why do different people learn different things? The main reason is that they grow up in different social environments. They have different homes, schools, friends, and churches.

People also live in different cultures. A culture is all of the attitudes, values, skills, and behaviors learned by a group of people.

Sometimes you are aware of learning taking place. For example, as you sit in a classroom, you probably realize that you are in a learning environment.

But you are learning all kinds of other things—in all kinds of places. Think about your friends. What do you learn from them? Do you learn to behave in certain ways because of their attitudes?

C-1 Take a close look at the people you usually hang around with at school. Write a description of at least three of these people, explaining their personalities. You do not have to name the people.

C-2 Do you act differently around these people from the way you act at home? In what ways?

C-3 Do these people ever influence you to do things you usually wouldn't do?

C-4 Make a chart of the feelings you have during one school day with your friends. Include on the chart how these feelings affect you in your school work, in your communication with your teacher, and in your view of your surroundings at that time.

Let's explore some differences in what people learn.

C-5 Make a list of things you have learned from your family. Be as specific as you can. Think about what to eat, how to act, what boys should do, what girls should do, and what activities are important.

C-6 Think about these questions about people's cultures:

a. What language do people in France speak? Is this behavior learned or unlearned? How do you know?

b. As an American, which of the following foods do you like best: fish eyes, dog meat, or steak? Is this behavior learned or unlearned? How do you know?

c. In some Oriental cultures, people show anger by smiling. How do most Americans show anger? Are these behaviors learned or unlearned?

C-6 a. French: learned, because different cultures speak different languages

b. Steak: learned, because different foods are preferred in different cultures

c. Frowning: learned, since people's behaviors vary from culture to culture

Activity D: Class wrap-up

D-1 Discuss your answers for Activities A and B.

D-2 Below are some examples of differences in cultural behavior. For each one, try to guess the behavior.

a. In the United States, it is 2½ to 3 feet. In Latin America, it is 1½ to 2 feet.

b. It is shown to people in Japan by bowing. In the United States, it is shown by not using the first name.

c. Most people in other parts of the world who are your age do not know how to use this object. You probably use it every day.

d. You probably know it word for word, but most people in the Orient have never heard of it.

D-2 a. Distance between people engaged in social interaction

b. Respect

c. Variety of answers (for example, telephone)

d. Variety of answers (for example, The Lord's Prayer)

D-3 Go back to A-1 through A-5 in Lesson 1. Are these attitudes about females and males learned or unlearned?

D-4 How is society in the United States different from society in other countries?

D-5 Is it important to question society's values? Why or why not? Do society's values change from time to time?

D-3 Learned

D-4 Our society seems to value individual freedom, equality, convenience, speed, youth, aggressiveness, material goods, diversity, democracy. Other values held by various societies could include passivity, tribal customs, art, socialism, old age, and authenticity.

D-5 Yes; insight and change can arise from independent, creative thought. Values are based on the needs of a society, and a society's needs are constantly changing and being defined differently. As a result, a society's values are constantly changing.

Activity E: Flight check

Did you understand this lesson? To find out, answer the following questions without looking back at the lesson. Then, your teacher will help you check your answers.

E-1 What are two things that cause you to learn?

E-2 Where are some places people learn things?

E-3 Why do different people learn different things?

E-4 What is one behavior that you have learned that helps you survive?

E-1 Reward and punishment

E-2 Home, school, church, interactions with friends

E-3 Because different people grow up in different societies and cultures

E-4 Sample answers. how to eat, what to eat, how to talk, how to dress

TEACHER OVERVIEW FOR LESSON 14

Duration: One class period

Purpose: To help students recognize sources of learning female and male behavior

Student Objectives:

- To link learned attitudes about female or male behavior with environmental sources
- To make conclusions about female or male behavior learned from television and from science textbooks

Teaching Suggestions:

All levels: All activities

Vocabulary: No new words

Evaluation Activity: None

Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- Attitudes about "appropriate" female and male behavior are learned through a variety of socializing agents such as the family, the school, peers, and the media.
- Attitudes can be changed through change in the socialization agents.

Lesson 14: Learning about Female and Male Behavior

Activity A: Learning attitudes

How much does your social environment affect who you are and what you do?

Form a group with three or four other students. Look at the list of attitudes below. These attitudes are about what males should do and what females should do.

For each attitude, decide:

a. From which parts of the environment the attitude is learned (television, parents, school, friends, textbooks, and so on). Be specific—that is, give examples.

b. Whether the attitude helps people or hurts them in becoming what they want to be.

c. How someone could change the attitude.

A-1 Boys make better scientists than girls do.

A-2 Girls are more emotional than boys.

A-3 Science and math are mainly for boys.

A-4 Girls should be less aggressive (forceful) than boys.

A-1 a. Learned from texts that show only boys in science, television programs, advertisements showing stereotypic females and males, parents, friends

b. Limits girls' potential

c. By recognizing the stereotypic quality of this information and choosing to ignore the stereotype

A-2 For a and c, see A-1

b. Limits girls' self-concepts, activities, and opportunities for leadership and power; limits boys' expression of feelings

A-3 For a and c, see A-1

b. Limits women's access to many prestigious or lucrative careers

A-4 For a and c, see A-1

b. Limits women's potential for fulfillment in positions of leadership and power

A-5 For a and c, see A-1

b Limits girls' activities and aspirations, encourages false bravado in boys

A-6 For a and c, see A-1

b Limits women's access to the variety of activities participated in by men, limits women's access to material goods; subjects men to stress as breadwinners

A-7 For a and c, see A-1

b. Limits women's potential for fulfillment in positions of leadership and power

A-8 For a and c, see A-1

b. Relegates women to positions of service and nonleadership, thus limiting access to prestige and power; limits women's access to material goods, since secretarial work is not usually high paying; limits role options of males

A-5 Boys are tougher than girls.

A-6 Men should work outside the home. Women should work inside the home.

A-7 Men are better leaders than women.

A-8 Girls, not boys, should be secretaries.

Have your group recorder write your group's answers. Be prepared to report your answers to the class.

Activity B (discussion): Thinking about attitudes

B-1 Discuss each group's answers to A-1 through A-8.

B-2 How can people change their attitudes?

B-3 Are people rewarded or punished for these attitudes?

B-4 When should people change their attitudes?

B-5 In our culture, are some people's attitudes toward females and males changing? What parts of the environment have caused this change?

B-2 Through understanding the variables at work in their environment, articulating their values, and acting in accordance with their individual potential rather than in accordance with stereotypes

B-3 A combination: girls, for example, are often rewarded by their families, peers, and other people if they act in accordance with expectations of appropriate behavior (passivity, politeness, nonaggressiveness, efforts to be attractive or "sexy," efforts to please others rather than themselves). However, often they are punished eventually in the form of low pay, lack of power or prestige, lack of preparedness for careers, lack of decision-making opportunities, and so on.

B-4 When they see that such attitudes limit growth and self-fulfillment

B-5 Yes; we now have some control over family size. As a result, many women have chosen to move out of the home into the labor force, and many are insisting on equal treatment. The women's movement has had a tremendous effect on women's definitions of themselves.

Activity C:
Female and male behavior on television

What do you learn from television about what it means to be female or male?

To answer this question, think of the shows you usually watch, or notice the ones you watch this evening. Write a report on what you learn from television about female and male behavior. As you write your report, think about these questions:

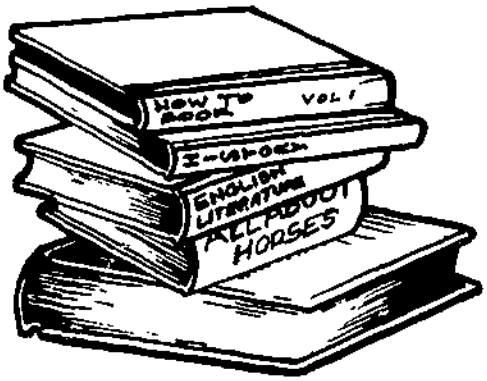
- What are the females and males saying or doing in each program?
- What are the females and males doing in different commercials?
- Who are the main characters in the shows you watch?
- Who makes the decisions in each program or commercial: males or females?
- Who is active in each program or commercial? Who is passive (not active)?

Activity D:
Looking at your textbook

Activity D. Help students divide the pages in their science textbook among themselves. Then help them total their answers into a class tally.

Do this activity together as a class or by yourself.

You learn some attitudes about being female or male from your textbook.



Look carefully through at least 20 pages of your science textbook. Make a chart like the following one. Fill it in by completing D-1 through D-5, below, and then answer D-6 through D-9 on the next page.

	Females	Males
Number in pictures		
Number active		
Number of scientists		

D-1 Count the number of females in pictures and the number of males in pictures.

D-2 Count the number of active females (those who are doing something—not just watching).

D-3 Count the number of active males.

D-4 Count the number of male scientists who are mentioned.

D-5 Count the number of female scientists who are mentioned.

D-6 Look at the results. Are there more female or more male scientists? Does your science book probably cause mainly boys, mainly girls, or both to be interested in science?

D-7 What attitude about females and males are you probably learning from your textbooks?

D-8 If a book has mainly pictures of boys doing something, who is more likely to enjoy that book: girls or boys?

D-9 Now present your report to the class.

TEACHER OVERVIEW FOR LESSON 15

Duration: Two or more class periods

Purpose: To involve students in decisions about their physical environment

Student Objectives:

- To suggest solutions for a given list of problems and think of advantages and disadvantages of each solution
- To design a plan of action for improving a particular environment

Teaching Suggestions:

All levels: All activities

(It is important that students do this lesson, since it provides an opportunity for students to make personal and/or group decisions using the information learned in the unit.)

Vocabulary: No new words

Evaluation Activity: None

Special Preparations: For Activity C, you may have to secure special permission from various school personnel in order to take action on changes suggested. It is suggested that the principal's approval be secured before students do the activity.

Background:

The following is the main point of the lesson. Make sure to emphasize it as often as appropriate.

- Technological products, which are designed to improve our quality of life, sometimes have undesirable side effects.

This lesson and Lessons 16 and 17 are very important, since students have a chance to use the information learned so far in order to make decisions about their physical and social environments.

Lesson 15: Decisions about Technology

Activity A: A review

In this unit, you have found out about some forces that have shaped you into who you are. These forces include:

- your genes
- your natural environment
- your social environment

A-1 Write a description of yourself. In this description, include:

a. Three of your characteristics resulting from your genes

b. Behavior that helps you survive in your natural environment

c. Three of your attitudes resulting from your social environment

A-2 Which can you or others change: your genes, your natural environment, or your social environment? Give an example of how you could change at least one characteristic, behavior, or attitude.

Activity B:
Thinking about change

By now, you should know that you cannot change your genetic traits. But you can make changes in your natural and social environments. You may not be able to make changes by yourself. But as a member of a group, you can help change take place.

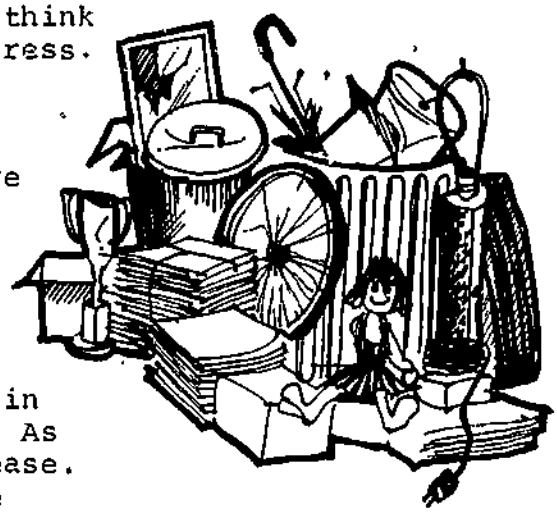
Do you see things in your environment that you would like changed?

In this activity, you will look at some problems humans have today. Each problem is described as it occurs in the United States.* These problems are often caused by some aspect of technology.

* Descriptions adapted from World Wildlife Fund, 910 Seventeenth Street, N.W., Washington, D.C. 20006.

- Too many people

  Today in the United States, there are more than 200 million people. Many of them want to move to the cities and build more highways, more shopping centers, and more houses. Many people think that growth is the only kind of progress.



- Too much trash

  Today in the United States, there are 1,000 pounds of trash per year for every person. Much of this trash is burned, which causes pollution.

- Polluted air

  Today in the United States, the air in the cities is often foul and brown. As a result, more people have lung disease. Cars and factories cause much of the pollution.

- Too much garbage

  Today in the United States, there are 100 pounds of wasted food per person every year—enough to feed millions of the world's starving people.

- Too much sewage

  Today in the United States, there are 200 gallons of sewage per person every day. Much of it ends up in rivers and is often untreated. As a result, many creatures in the rivers die.

- Too much noise

  Today in the United States, we create more noise each year—including car noise, electronic noise, aircraft noise, and human noise.

Form a group with several other students.

B-1 Choose three of the problems. Decide what factors have caused each problem.

B-2 Think of two possible solutions for each problem.

B-3 For each solution, write some advantages and disadvantages.

B-4 Report your solutions, with their advantages and disadvantages, to the class.

Activity C: Changing your school environment

Do C-1 through C-4 by yourself or in a group.

C-1 Design what you think is a perfect learning (school) environment. Draw a plan of it on paper. Write down the characteristics that you can't show on your drawing.

C-2 Pretend you are from another country. You have been asked to study your school. Your job is to find out if the school has a perfect learning environment. First, decide on a plan for studying your school environment.

C-3 Now, put your plan into action. Write down everything you observe about the environment in your school.

C-4 Make a list of the things that you think need to be changed and explain why.

C-5 Explain how you and other students can go about changing what you have listed.

C-6 As a class, decide on one part of the school environment that needs to be changed.

C-7 State your goal and decide what actions to take to reach your goal. Some suggested actions are:

- signing petitions
- talking with other teachers, students, and administrators
- forming a committee to study students' attitudes toward the school and to make recommendations to the student council and/or school administrators

C-8 Make a timeline (schedule) for reaching your goal.

C-9 Follow through with the actions your class chose.

TEACHER OVERVIEW FOR LESSON 16

Duration: Two or more class periods

Purpose: To give students an opportunity to consider alternative lifestyles and develop a plan to convince others to adopt different behaviors

Student Objectives:

- To select a lifestyle and state opinions about why it should be adopted
- To design a plan of action to bring about the changes suggested

Teaching Suggestions:

All levels: All activities

(It is important that students do this lesson, since it provides an opportunity for students to make personal and/or group decisions using the information learned in the unit.)

Vocabulary: No new words

Evaluation Activity: None

Background:

The following is the main point of the lesson. Make sure to emphasize it as often as appropriate.

- People need to adapt their lifestyles to environmental, social, and economic realities.

Lesson 16: Decisions about Lifestyle

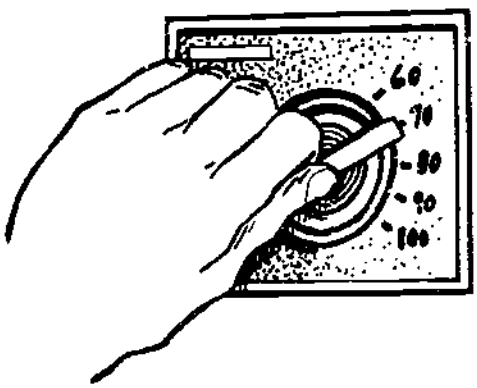
Activity A:
Convincing others to change

Sometimes we want a part of our society to change. But first, people have to be convinced that the change will be good.

Form a group with several other students. Your group's job is to convince people that they need to form some new habits or lifestyles.

A-1 As a group, choose one of the different actions listed below or think of your own.

A-2 Design a plan to convince the rest of the class members that they need to change. Think of how you could make the idea so popular that everyone would want to do it. You can make up television ads, radio ads, newspaper articles, or statements of people who have tried it. Prepare a five- or ten-minute report and present it to the class.



Natural Environment

a. Bathe and wash clothes only once a week. Water is valuable—use it like money!

b. Travel only in car pools, by public transportation, or on bicycles. Oil must be conserved!

c. Use no prepackaged or prepared foods (cake mixes, frozen pizza, artificial toppings, and so on). They're not good for you!

d. Cut down your family's electrical use by 500 kw per month.

Social Environment

e. Give the males and females you know the same opportunities and the same treatment.

f. Prepare for careers in math or science. They're fun and available!

g. Convince girls and boys to share expenses on dates.

Activity B:
Changing your community

As a class, choose the lifestyle that seems the most necessary. Decide how to convince people in the community to make changes. You may want to write ads about the problem and send them to the newspaper or a local radio station. Or, you may decide to attend a city council meeting to talk about the problem. Petitions are also helpful in making changes in your city.

Follow through with the actions you chose.

Duration: One or more class periods

Purpose: To give students an opportunity to assess the impact of the unit and explore means of changing attitudes and behaviors

Student Objectives:

- To identify which of their own characteristics are the result of their genes, natural environment, or social environment
- To state the impact of the unit on their feelings about their capabilities as females or males

Teaching Suggestions

All levels: All activities

(It is important that students do this lesson, since it provides an opportunity for students to make personal and/or group decisions using the information learned in the unit.)

Vocabulary: No new words

Evaluation Activity: None

Background:

The following are the main points of the lesson. Make sure to emphasize them as often as appropriate.

- Many behaviors and characteristics of people (including attitudes about appropriate female and male behavior) are learned from the social environment.
- People can change their attitudes and learned behaviors.

Lesson 17: Decisions about Society

Activity A (discussion): Judging by appearance

A-1 Do this part of the activity by yourself. For each role below, write a short description of how you think a person in that role would look.

a. doctor

b. gas station attendant

c. student council representative

d. principal

A-2 Now, as a class, take turns reading your descriptions. Which descriptions were about females? Which descriptions were about males? Does our society judge people according to their female or male appearance? If so, how?

A-2 Yes: females are often judged according to their attractiveness and males according to their toughness. Because females are usually shorter and less muscular than males, they have often been stereotyped as weaker than males and less capable of emotional strength and rationality.

A-3 Is it fairer to judge people as members of groups or as individuals? Why?

A-3 As individuals

Activity B:
Deciding how to treat people

Think about the way you treat other people in your school.

B-1 Make your own private list of people you think you are judging only by appearance.

B-2 Think of a plan to get to know each person better. Then try out your plan.

B-3 Write what new things you found out about each person.

B-4 Think about whether you want to add to your list of friends to include other people. Write one thing you might learn from three or four of the people you listed in B-1.

Activity C:
A personal evaluation

In this unit, you have learned about the forces that shaped you into who you are. Write a paragraph that answers the following questions:

C-1 What characteristics of yours are the result of your genes?

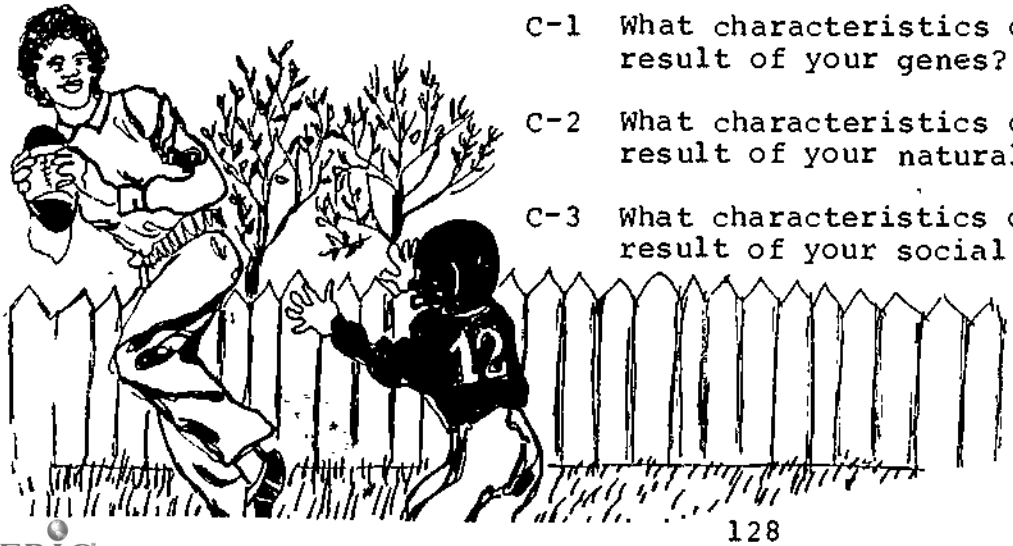
C-2 What characteristics of yours are the result of your natural environment?

C-3 What characteristics of yours are the result of your social environment?

C-1 Sample answers: height, color of eyes, color of skin, tendency to be thin or fat

C-2 Sample answers clothing for protection, biological changes resulting from pollution (lung damage or genetic damage)

C-3 Sample answers. the types of clothes you wear, the types of food you eat, attitudes, all communication activities



If you are aware of your natural and social environments, you are able to make some changes.

C-4 Have parts of your social environment limited your feelings about what you can do as a female or male? If so, which parts?

C-5 As a result of this unit, have you changed your feelings about what you can do as a female or male? If so, how?

C-6 What jobs would you consider in your future? Is your list limited to only traditionally female or male jobs? Or does your list include both types of jobs?

C-7 Do you think science is only for males?

C-8 Do you think any of your attitudes limit you as a girl or boy? If so, make a plan of action for changing the attitude(s). Then follow through with the plan.

C-9 Go back to Lesson 1 and answer A-1 through A-13 again. Have you changed your ideas since you began this unit? If so, how?

Activity D: Planning your future

Activity D Have boys do D-2.

D-1 (Do this only if you are a girl.) How can you become more involved or interested in science? Some suggestions are:

- Try to change your attitude toward the equipment in your science class. You can learn to enjoy it.
- Try to be active—move around and participate eagerly in experiments.
- Be willing to make mistakes.
- Stop acting like "a girl who is not supposed to like these activities." This is behavior that you have learned, and it is keeping you from enjoying science!
- Ask your teacher for encouragement. Decide on a plan of action and follow it through.

D-2 Think of how you would raise children. Develop a plan that would keep the children from feeling limited as males or females.

Present your plan to the class.

Name _____

DECISIONS ABOUT SCIENCE
UNIT PERFORMANCE TEST

Section I: Multiple Choice

Lesson 5

1. Put an X by all the behaviors below that are unlearned (genetic).

   _____ a. A female fish lays eggs.

   _____ b. You cried when you were born.

   _____ c. You try to dress the way your friends dress.

   _____ d. A rattlesnake wriggles its tail when something moves nearby.

   _____ e. A racehorse shoots out of the starting gate and runs as fast as it can to the finish line.

2. Put an X by all the characteristics below that are unlearned (genetic).

   _____ a. When Terry was born, he was color-blind.

   _____ b. Richard's voice is much lower than it used to be.

   _____ c. Ms. Berkshire, who smoked all her life, developed lung cancer.

   _____ d. Jill has green eyes.

Lesson 6

_____ 3. How many chromosomes does the first cell of a human being have?

   a. 23
   b. 100
   c. 46
   d. 50

_____ 4. How many chromosomes are passed on by one parent?

   a. 23
   b. 100
   c. 46
   d. 50

Lessons 7 and 8

_____ 5. A chromosome is best described as

a. an egg
b. a sperm
c. a set of genes
d. a behavior

_____ 6. For every one of your genetic characteristics, you have at least

a. two genes
b. three genes
c. four genes
d. five genes

_____ 7. A family pedigree is

a. a genetic history of a family
b. the family name
c. the number of females and males in a family

_____ 8. Rufus has a brown-eye gene and a blue-eye gene for eye color. What color are his eyes? (Note: The gene for brown eyes is dominant. The gene for blue eyes is recessive.)

a. blue
b. brown
c. either blue or brown

Directions: Use the information in the fo.lowing chart to answer questions 9-11.

Characteristics	Mother	Father	Child
Ear lobes	A	F	A

A = attached ear lobes (a recessive characteristic)
F = free-hanging ear lobes (a dominant characteristic)

____ 9. What genes determine the father's ear lobes?

a. Father has a recessive gene and a dominant gene.
b. Father has a pair of dominant genes.
c. Father has a pair of recessive genes.

____10. What genes determine the mother's ear lobes?

a. Mother has a recessive gene and dominant gene.
b. Mother has a pair of dominant genes.
c. Mother has a pair of recessive genes.

____11. What genes determine the child's ear lobes?

a. The child has a recessive gene and a dominant gene.
b. The child has a pair of dominant genes.
c. The child has a pair of recessive genes.

Lesson 9

____12. The Johnstons have a baby girl. Which combination of sex chromosomes does the baby have?

a. XX
b. XY
c. YY
d. none of the above

____13. A child has a combination of XX sex chromosomes. Which parent(s) did those chromosomes come from?

a. both X chromosomes from the mother
b. both X chromosomes from the father
c. one X chromosome from the mother and one from the father

____14. Which trait or traits are inherited mainly by males?

a. color blindness
b. ability to smile
c. intelligence to become a scientist
d. ability to cry
e. development of a beard

_____15. Andrea is married and has two children. Her daughter has normal vision. Her son is color blind. Which of the following statements explains how the trait was passed on?

a. Andrea's husband is color blind.
b. Andrea's husband is a carrier of color blindness.
c. Andrea is a carrier of color blindness.

_____16. Roger has hemophilia. Will Roger pass on the trait of hemophilia to his son?

a. yes
b. no
c. maybe

Lesson 10

17. Read the list below. Put an X by the objects that are made by people.

_____ a. paper
_____ b. soil
_____ c. coal
_____ d. plastic
_____ e. wild animal life
_____ f. gasoline
_____ g. paper clip

_____18. Your environment is

a. your genes
b. your surroundings
c. your feelings
d. your values

19. List three parts of your natural environment.

a.

b.

c.

20. List three parts of your human-made environment.

a.

b.

c.

Lesson 11

Directions: The following are changes people make in their environment. Give at least one positive and one negative effect resulting from each.

21. An oil refinery (factory)

Positive: _____

_____

Negative: _____

_____

22. Construction of a freeway

Positive: _____

_____

Negative: _____

_____

Lesson 12

_____23. Social environment can best be described as

a. nature
b. communication with people
c. the indoors
d. dating

_____24. Your social environment

a. does not affect the way you feel and act
b. greatly affects the way you feel and act
c. only slightly affects the way you feel and act

Lessons 13 and 14

_____25. People learn social behavior from

a. genes
b. natural environment
c. punishments and rewards
d. heredity

_____26. Cultural behavior is

a. learned
b. unlearned
c. genetic
d. hereditary

151

27. A child throws a paper cup on the street. Her older brother sees her and scolds her. Which of the following statements is true about this situation?

a. The child is being rewarded.
b. The punishment is throwing a cup on the street.
c. The punishment is scolding.
d. Scolding is an unlearned behavior.

___ 28. Most differences in female and male attitudes are probably

a. natural
b. learned from the social environment
c. hereditary
d. unchangeable

Lesson 15

____29. All players on the middle school soccer team are boys. This is a result of

a. genes
b. natural environment
c. social environment

_____30. During the winter, people in Colorado wear warm clothes. This is a result of

a. genes
b. natural environment
c. social environment

_____31. Some people in this school have black hair and others have blond hair. This is a result of

a. genes
b. natural environment
c. social environment

Section II: Attitude Inventory

Directions: For the items that follow, decide how much you agree or disagree with each statement. Mark your answer according to the code below. There are no right or wrong answers.

a = strongly agree
b = agree
c = no opinion
d = disagree
e = strongly disagree

____ 1. Studying science is just as appropriate for women as for men.

____ 2. Girls can do just as well as boys in science.

____ 3. It's hard to believe a female could be a genius in science.

____ 4. Girls who enjoy studying science are a bit odd.

____ 5. I am sure that I can learn science.

____ 6. I think I could handle more difficult science courses.

____ 7. I have a lot of self-confidence when it comes to science.

____ 8. I'm not good at science.

____ 9. I am not the type to do well in science.

____ 10. I will need science for my future work.

____ 11. I will use science in many ways when I am an adult.

____ 12. Taking science is a waste of time.

DECISIONS ABOUT SCIENCE
ANSWER KEY TO UNIT PERFORMANCE TEST

Section I

1. a, b, d
2. a, b, d
3. c
4. a
5. c
6. a
7. a
8. b
9. a
10. c
11. c
12. a
13. c
14. a, e
15. c
16. b
17. a, d, f, g
18. b
19. variety of answers
20. variety of answers
21. variety of answers
22. variety of answers
23. b
24. b
25. c
26. a
27. c
28. b
29. c
30. b
31. a

Section II

To compute an "Attitudes toward Females in Science" score:

For items 1 and 2: a = 4, b = 3, c = 2 d = 1, e = 0

For items 3 and 4: a = 0, b = 1, c = 2, d = 3, 3 = 4

To compute a "Confidence in Science" score:

For items 5, 6, 7, 10, and 11: a = 4, b = 3, c = 2, d = 1, e = 0

For items 8, 9, and 12: a = 0, b = 1, c = 2, d = 3, e = 4