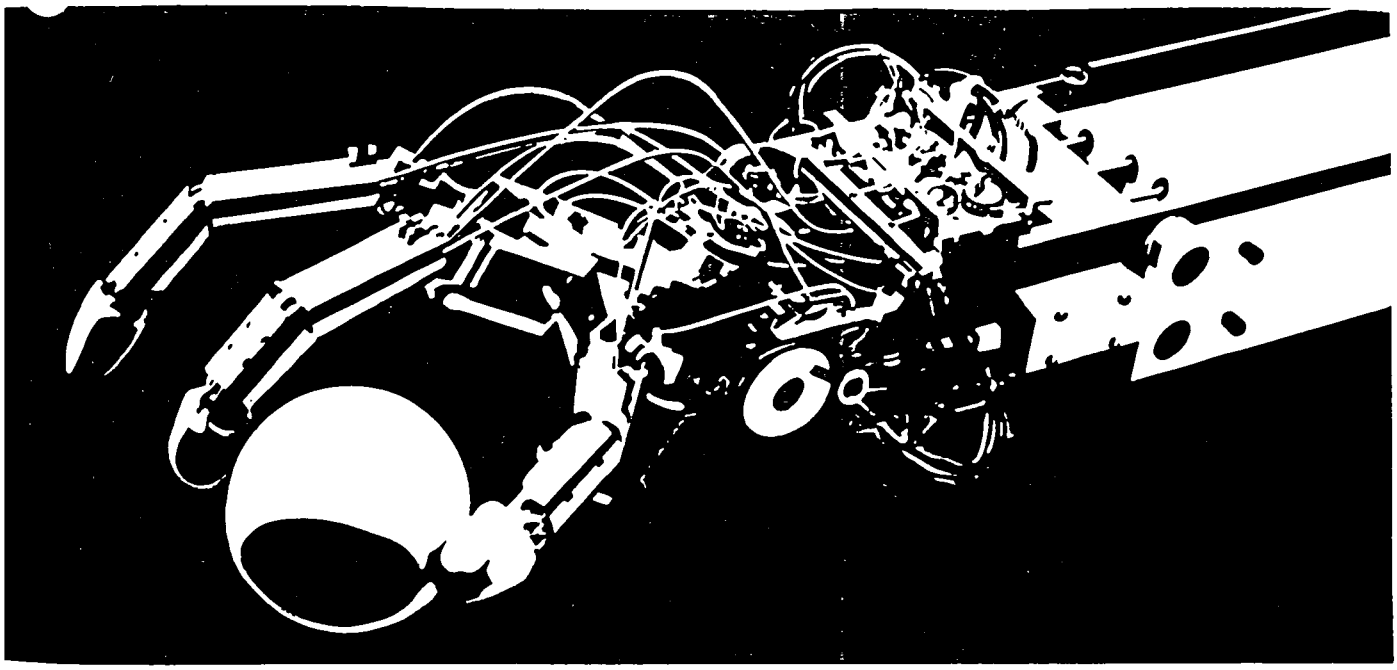
HEALTH OCCUPATIONS EDUCATION
TECHNOLOGY EDUCATION

BIOTECHNOLOGY

LEARNING ACTIVITY BRIEFS



The University of the State of New York
The State Education Department
Division of Occupational Education Programs
Albany, New York 12234

TABLE OF CONTENTS

PAGE

INTRODUCTION..... 1

ERGONOMICS APPLIED TO AIDS FOR THE HANDICAPPED AND ELDERLY..... 3

SOIL POLLUTION: IDENTIFICATION AND RECLAMATION..... 7

HUMAN PHYSIOLOGICAL MONITORING..... 11

IMPACTS OF RESIDENTIAL USE MAINTENANCE CHEMICAL AGENTS ON THE ENVIRONMENT..... 14

MATERIALS SELECTION APPLIED TO BIOTECHNOLOGY..... 17

SIMULATING HANDICAPPING CONDITIONS..... 21

EFFECTS OF CHEMICALS ON ANIMAL TISSUE BEFORE AND AFTER TISSUE TREATMENT..... 25

PLANT TISSUE CULTURE..... 28

MUNICIPAL WASTE: PREVENTION, PROCESSING, TOXICITY..... 32

MICROBES AND THE ENVIRONMENT..... 35

APPENDIX..... 38

HEALTH/TECHNOLOGY CONNECTIONS

OVERVIEW

Among the most rapidly growing occupational clusters are those relating to health occupations. Careers in this field transcend mere custodial care, and include such diverse areas as bio-engineering, development of adaptive devices for the handicapped, and the use of new materials that are compatible with human anatomy. A symbiotic relationship exists between health occupations and technology.

In an attempt to provide students with an opportunity to explore promising technical careers in the health field, a symposium for health occupations and technology teachers was held during the summer of 1987. After hearing presentations on applications/health-related technology, the 36 participants developed a series of learning activity briefs based on the presentations, which relate to the Health Occupations and Technology Education curricula.

THE LEARNING ACTIVITY BRIEF

Both the Health Occupations and Technology Education programs are designed to be taught through experience-based learning. Learning activity briefs are hands-on activities which may be used to convey student competencies in both programs' syllabi.

Each brief provides a framework for the teacher to use in developing more detailed lesson plans. The components of the brief include the following:

Number of 40-minute periods: These are suggested times and may vary. They may not represent the actual number of minutes of student contact time necessary to complete the activity. For example, this could include parts of a period that might be devoted to several concurrent activities.

SYLLABUS CONNECTIONS: The activity has been designed to match a particular module or modules of both the Health Occupations Core and Introduction to Technology Syllabi. The brief should be used to implement student performance objectives. It is conceivable that all performance objectives within a module might not be addressed by a particular activity. In that event, additional strategies should be chosen by the teacher to convey the remaining objectives.

GOAL: This identifies what the student should learn from the activity.

OVERVIEW: This sets the stage for the activity and provides a rationale for doing it.

MATERIALS: These include consumable supplies, tools and equipment students will use to accomplish the activity.

DISCUSSION TOPICS: This section provides key items which might provoke discussion and/or lead to some exploration of terminology and concepts.

ACTION PLAN: This suggests a number of possible procedures for the activity. Included are ideas for both students and teachers. The Action Plan might be further developed into lesson plans.

GOING BEYOND: This section provides opportunities to link the individual activity to other subjects and life experiences. Included are suggested additional activities that could be viewed as extensions of the brief (e.g. field trips, and use of outside consultants).

RESOURCES: References, human resources, software, etc.

It is hoped that the connections that have been generated by this project are only a beginning. It is apparent that Technology teachers and Health Occupations teachers have mutual interests. These two professional groups have a great deal to offer one another. The participants in this symposium are resources who stand ready to assist their colleagues in both disciplines who may wish to implement the learning activity brief.

LEARNING ACTIVITY BRIEF

Ergonomics Applied to Aids for the Handicapped and Elderly

Number of 40-minute periods: 5 to 10

Clagett Boehner (T)
Dolores Fioritta (H)
Henry Harms (T)
Dolores Pieters (H)

SYLLABUS CONNECTIONS:

7/8 TE	T-5	-	How Technology Affects People and the Environment
HOE CORE	Mod	-	Maintaining and Promoting a Safe Environment

GOAL:

To recognize that the elderly and individuals with handicapping conditions have special needs. In order for those individuals to have a safe, comfortable environment aids can be developed.

OVERVIEW:

The lives of the elderly and people with handicaps can be improved by well-designed products. Special aids or devices can help them maximize and/or maintain their potential.

Ergonomics is the process of matching technology to human needs and characteristics. Ergonomic principles should be applied to the design of devices for the elderly and people with handicapping conditions.

MATERIALS:

- motor aids: wheelchairs - manual, motorized
- walkers: full, unilateral
- crutches
- canes, including a quad cane
- orthopedic devices
- prostheses
- aids for hearing and visual impairment
- waterbased paint
- screw drivers
- wood screws
- 1/4 inch graph paper
- wood block with predrilled pilot holes

DISCUSSION TOPICS:

1. Aging often reduces mobility and flexibility. The elderly may find it more difficult to hold their bodies erect; joints become stiff and bones become brittle. Because aging decreases strength, elderly people may find it harder to grip things. Higher work surfaces and seats can cut down on the need to bend.

2. There are many handicapping conditions. Examples include hearing and visually impaired, intellectually impaired, and physically impaired. The design of aids for disabled people require careful study. Some examples follow: built up handles on eating utensils and woodworking tools can improve an individual's grip; aids for walking on level ground or stairs; devices for people who cannot walk; luggage and grocery carts; special seating that makes it easier to get up; remote control of appliances; braille overlays for microwave ovens; light sensor controlled faucets.

ACTION PLAN:

1. Involve students in simulations of a handicapping condition such as use of a wheelchair or restricting the use of an extremity by tying one limb to oneself.

2. Visit an elderly or a handicapped individual to realize their ongoing problems and list these as an out-of-school assignment. Identify commercial devices which may alleviate these difficulties.

3. Take a field trip to a Cerebral Palsy Center for the Disabled, Developmental Center, Association for Retarded Citizens, Senior Citizens Center, etc.

4. Have students measure, record, and average the sizes of classmates in areas such as total height, sitting height, and distances from elbow to floor. Discuss how this information can be used to help design products.

5. Show the videotape "Miraculous Machines" by National Geographic. This film depicts the use of robotics to assist the handicapped.

6. Show the videotape "Feedback," which is a segment of Search for Solutions available from Phillips Petroleum. Phillips provides a master tape and allows you to make your own copy.

7. Have the students identify everyday situations where ergonomics is important to the elderly and/or handicapped.

ACTION PLAN, continued

8. Demonstrate basic ergonomic principles by having students use chairs of varying heights to work at a bench top or desk. Have students explain their observations and feelings.

9. Find out how the power of a screwdriver is affected by the area of contact between the hand and handle. This can be done by the following activity:

Part I

- Coat screwdriver handle with paint.
- Grip the screwdriver.
- Place your hand flat on graph paper to transfer paint.
- Wash your hand and the screwdriver handle.
- Calculate contact area by counting the number of 1/4 inch squares covered by paint.
- Repeat for a variety of screwdrivers and record results.

Part II

- Test each screwdriver by driving a screw as far as you can with one complete turn into the predrilled block.
- Measure the distance from the screwhead to the top of the wood, and subtract this from the total length to determine how deep you were able to drive the screw. Record the results.
- Compare these results with the hand to handle contact results. What relationships can you see? Can you use this information to design an improved screwdriver handle? How can you use this approach to help design a device for an elderly or handicapped person?

GOING BEYOND:

- Have an elderly or handicapped person describe difficulties they have in doing things at home or work. Ask students to select one problem and sketch possible solutions; have students share their ideas with the person to get his/her suggestions and feelings about the proposed solutions. If possible, allow students to model their ideas and have the elderly or handicapped person provide feedback.

- Identify obstacles in a building which prohibit use by the handicapped.

- Design and illustrate solutions to problems such as posting signs to identify the best access route, modifying water faucet handles, and adding an elevator or ramp.

GOING BEYOND, continued

- Demonstrate devices such as a braille typewriter, TTY, voice synthesizer, and programmable robot.

- Ask students to determine the measurements needed to design a kitchen or bathroom for a person in a wheelchair.

RESOURCES:

Health Occupations Education Core Curriculum

Introduction to Technology Curriculum

Craft, Design and Technology for G C S E (Peter Toft), Heinemann Educational Books, Ltd., 22 Bedford Square, London WC1B 3HH

"Miraculous Machine" by National Geographic, National Geographic Society, 17th and M Street, NW, Washington, DC 20036

"Feedback" from Search for Solutions by Phillips Petroleum

LEARNING ACTIVITY BRIEF

Soil Pollution: Identification and Reclamation

Number of 40-minute periods: 20

Joan Boorman (T)
David Kelsey (T)
Dorothy Lloyd (H)
Charlotte Wickliffe (H)

SYLLABUS CONNECTIONS:

7/8 TE	T-5	-	How Technology Affects People and the Environment
HOE CORE	Mod	-	Maintaining and Promoting a Safe Environment

GOAL:

To understand that soil pollution is a problem and that there are technological means to remediate this condition.

OVERVIEW:

Soil pollution is all around us. The American scene is marred by visible garbage and threatened by buried radioactive, toxic, and other life-threatening wastes.

Through these activities, students will gain an understanding of healthy versus polluted soil, sources of soil pollution, soil remediation techniques, and potential land redevelopment and preservation possibilities.

MATERIALS:

- "Biochemistry of Soil": Soil evaluation kit #66595 ($35.95) available from Science Kit and Boreal Laboratories, 777 East Park Dr., Tonawanda, NY 14150 (1-800-828-7777)
- "pH 700": Soil pH meter #64407 ($15.95) from Science Kit and Boreal Laboratories
- test tubes and "nutrient broth" (see Science Kit and Boreal Laboratories)
- Five - 1'x3'x3' plywood boxes that represent model landfills with a variety of simulated soil pollution problems (teacher made)

MATERIALS, continued

- grid paper with scale that allows students to plot locations of pollution within simulated landfill
- Geiger counter
- chips of brick to simulate radioactive waste
- food coloring to simulate pcb's
- vinegar to simulate acid
- cooking oil to simulate oil and fats
- discarded toy wheels to simulate trash
- simple teacher-made device that allows students to pour water through soil samples and collect results (food coloring ti simulate pcb's, oil to simulate fats or oil pollution, vinegar (pH) signals acid pollution, Geiger counter to simulate radiation pollution)
- "The Technology of Trash" VHS videotape (free loan) available from Modern Talking Picture Service, 5000 Park Street North, St. Petersburg, FL 33709
- "Toxic Turmoil: The Silicon Valley Story" VHS videotape (free loan) available from Modern Talking Picture Service

DISCUSSION TOPICS:

1. Common soil pollutants and their sources

Pollutants:	heavy metals, radioactive wastes, carcinogens, pesticides, pcb's, acids, sludge, bacteria, trash/litter, fats and oils
Sources:	human beings, animals, other living things, production systems, construction systems, service systems, and transportation systems

2. Characteristics of normal, healthy soil

Physical:	appearance, odor, texture
Chemical:	pH, presence of nitrogen, phosphorus, and potassium in small amounts
Biological:	bacteria, protozoa, fungi and yeast, nematodes, and higher organisms

DISCUSSION TOPICS, continued

3. Soil remediation methods: containment, incineration, bio-processing, chemical treatment, and recycling

4. Development and preservation of soil (natural resource): reforestation, redevelopment, environmental planning, and soil conservation techniques

ACTION PLAN:

1. Visit a landfill to explore common waste disposal practices.

2. Discuss the common soil pollutants and their sources. Show the video "Toxic Turmoil: The Silicon Valley Story."

3. Have the students take a walking field trip to collect litter.

4. Have the students analyze litter to identify categories and likely sources.

5. Have the students bring in soil samples from home for analysis (one sample from an area where things are growing well, one from an area where things are growing poorly). Students will analyze and compare samples for different characteristics.

6. Discuss the characteristics of polluted and non-polluted soil.

7. Discuss soil remediation techniques, including bio-processing.

8. Have the students create a bacteria culture to simulate bio-processing.

9. Have the students isolate and quantify bacteria in their culture

10. Working in teams, have students locate and analyze pollutants in teacher prepared model landfills.

11. Have the students develop a plan for landfill remediation.

12. Discuss soil conservation and land redevelopment.

13. Develop a plan for future soil conservation and land redevelopment. Show the video tape, "The Technology of Trash."

ACTION PLAN, continued

14. Using plans, reconfigure land and simulate re-development through the use of cardboard models.

GOING BEYOND:

- invite a speaker from the Department of Environmental Conservation.
- discuss careers in waste management or related fields such as microbiology.
- organize community action projects.
- disucss other impacts of soil pollution.
- look for alternatives to landfills.

RESOURCES:

Brandles, Louis Grant. Science Can be Fun. J. Weston Welch, 1979.

Chemical Education for Public Understanding Project. University of California at Berkeley, 1986.

Coolidge, Bonita. "Our School Gave Acid Rain A Hearing." The Science Teacher. 54:3-30, March, 1987.

U.S. Environmental Protection Agency. Hazardous Waste Site Remediation. (free publication).

Epstein, Samuel S., M.D., Lester O. Brown, and Carl Pope. Hazardous Waste in America. San Francisco, 1982.

"Storing up Trouble," National Geographic Magazine, Vol. 167 (March 1985), pp. 318-33.

Otto, James H., Towle, Albert, Otto, W. David. Laboratory Investigations in Biology. New York: Holt, Rinehart and Winston, 1981.

Walker, Charles A., Leroy C. Gould, and Edward S. Woodhouse (eds.). Too Hot to Handle. New Haven, 1983.

LEARNING ACTIVITY BRIEF

Human Physiological Monitoring

Number of 40-minute periods: 5

John Gagliardo (T)
Robert Gottlieb (H)
Gary Shelhamer (T)
Joan Wilbur (H)

SYLLABUS CONNECTIONS:

7/8 TE T-8 - Controlling Technological Systems

HOE CORE Mod - Overview of the Human Body

GOAL:

To understand the necessity for and the methodology of monitoring human physiological systems with the latest technological devices.

OVERVIEW:

Human well-being necessitates that our physiological systems operate at optimum efficiency at all times. Monitoring these systems indicates their functioning or dysfunctioning. In most cases, monitoring devices will provide information as to whether treatment is needed. In other instances, the monitoring device will correct dysfunction.

Through activities involving the monitoring of temperature, pulse, respiration, and blood pressure, the student will learn the relationship between the technological aspects of monitoring and physiological responses.

MATERIALS:

- Materials and instruments for physiological monitoring: mechanical/electronic thermometer, watch/electronic pulsemeter, sphygmomanometer/stethoscope/electronic blood pressure machine, spirometer

DISCUSSION TOPICS:

1. General body systems - Review general body systems as they relate to cardiovascular and respiratory functions.

2. Cardiovascular monitoring - Use monitoring devices to measure pulse rate, blood pressure, and electrical heart function. These procedures can be used to diagnose irregularities of heart function and abnormal pressures within the circulatory system.

3. Temperature monitoring - Methods of monitoring temperature to indicate disease states or other physiological activities.

4. Respiratory status monitoring - Observation of respiratory effort, timing of respiratory rate, and measure of respiratory volume by use of a spirometer.

ACTION PLAN:

1. Review the cardiac system. Discuss the concept of the heart as a pump.

2. As an example, measure the heart's pumping action by taking the pulse rate.

3. Define systolic and diastolic blood pressure.

4. Measure the pressure within the blood vessels by taking arterial blood pressure.

5. Relate elevated blood pressure (hypertension) to cardiovascular dysfunction which, if unchecked, can lead to failure of numerous body systems or organs.

6. Discuss the various methods of taking body temperature. Have students take their own temperature. Compare and interpret findings.

7. Observe the normal respiratory rate at rest and after exercise (e.g., running in place).

8. Demonstrate the use of an incentive spirometer with observation of chest expansion due to increased air volume.

GOING BEYOND:

- Invite an Emergency Medical Technician to demonstrate the use of an electrocardiogram at rest and with exercise, and interpret the results.

- Show a demand pacemaker implantation videotape.

- Discuss diabetes and the need for insulin. Show a videotape on the use of an insulin infusion pump.

- Utilize computer software to detect electrical signals generated during a muscle contraction.

- Discuss the use of an electroencephalogram (EEG) as relates to electrical brain wave impulses and disease conditions.

RESOURCES:

Body Log Inc. - 34 Maple Avenue, Armonk, N.Y. 10504
"Standard E.M.G. sensor"
"Cardio Exercise package"

Preview Catalog, Cambridge Development Laboratory Inc., P.O. Box 605, Newton Lower Falls, MA 02162

Science Kit and Boreal Laboratories Catalog, Tonawanda, NY 14150

Med-Tech Inc. - manufacturer of insulin infusion pumps

Smith, Kline and French - filmstrip on sounds heard when taking blood pressure and pulse, 1500 Spring Garden Street, P.O. Box 7929, Philadelphia, PA 19101

Sunburst Communications, 39 Washington Avenue, Pleasantville, NY 10570 - "The Human Pump"

American Heart Association and American Lung Association filmstrip on heart blood vessels and lungs; speakers on monitoring devices

LEARNING ACTIVITY BRIEF

Impacts of Residential use Maintenance Chemical Agents on the Environment

Number of 40-minute periods:
10

Tom Barrowman (T)
Mariana Fodor (H)
James Mooney (T)
Jane Ryan (H)

SYLLABUS CONNECTIONS:

7/8 TE	T-5	-	How Technology Affects People and the Environment
	T-9	-	Technology and Society: Now and in the Future
HOE CORE	Mod	-	Personal Health and Wellness
	Mod	-	Maintaining and Promoting a Safe Environment

GOAL:

To understand the impact of everyday use of maintenance chemical agents on the living organisms in the environment.

OVERVIEW:

Chemicals are used daily in residential environments. Most of these substances or agents have a lethal capability depending on concentration levels, modes of application, and duration of exposure. Some of these agents break down into different components at different times. Through experimentation with living organisms exposed to household maintenance agents, the students will observe the effects of these agents on the living organism. (Some effects are beneficial: e.g., plants fare better when washed with a mild detergent solution.)

MATERIALS:

- Living organisms: sproutable beans, daphnia in water, live brine shrimp, five-day-old seedlings (any type). Optional: fleas, lice, roaches
- Maintenance Chemical Agents: bleaching laundry detergent, aerosol pesticide (anti-roach, rodent, etc.), ammonia, strong detergent. Optional: lye, waxes, solvents, paints, glue, table salt, boric acid, pediculocides.
- Tools & Equipment: jars and/or containers
  test tubes and stands
  netting or mesh
  water
  light source (natural or artificial)

DISCUSSION TOPICS:

1. Agent/Object - The action of a common household agent can have a damaging effect on a living object.

2. Circumstances of exposure to the agent - Methods of application and the concentration of the agent will affect the results. Duration of exposure is another factor. Application: topical versus inhalation or ingestion by the living organism.

3. Synergistic - Combination of two ordinary substances can yield an unexpected result: two seemingly harmless agents may be toxic when combined (e.g., ammonia and household cleaner--poisonous gas).

ACTION PLAN: Each class or group will perform a different experiment by adding a given agent to a living organism and recording observations.

1. Select an agent - living organism.

2. Develop a system of observation and recording data.

3. Select and prepare concentrations of agents.

4. Decide mode of application of agent.

5. Obtain appropriate materials to contain the experiment.

6. Prepare the living organism; maintain a "control" per experiment. For example, take a 5 day old seedling and spray it with a specific concentration of clorine bleach such as 25%, 50%, 75%, or 100%.

ACTION PLAN, continued

7. Observe at determined intervals for reactions.

8. Record findings.

9. Discuss findings in relation to human exposure to the household agents.

GOING BEYOND:

- Discuss the impact of similar agent on recreational sites.

- Discuss the impact of similar agents on school sites.

- Discuss the Union Carbide incident in Bhopal, India.

- Dicuss the Carbon Dioxide "Kill-off" in Cameroon - National Geographic, Sept. 1987.

- Discuss living organisms that thrive on some of these agents -- often in excessive amounts.

- Invite a toxicologist to address the class.

- Contact the local Poison Control Center for additional information and/or speakers.

- Contact NASA Public Information Service for management of these substances in space.

- Discuss the "greenhouse effect"; present an assessment of the enlarging hole in the atmospheric ozone layer.

RESOURCES:

Carolina Biological Scientific Supply Co. Main office and Laboratory, Burlington, NC 27215, 800-334-5551

Local pet store (for brine shrimp)

Biology teachers

OSHA Regulations

Science Kit and Boreal Laboratories P.O. Box 2726, Santa Fe Springs, CA 90670-4490, 800-828-7777

National Geographic Index

LEARNING ACTIVITY BRIEF

Material Selection Applied to Biotechnology

Number of 40-minute periods: 5 - 8

Neil Dugan (T)
Carolyn Kozubal (H)
Eleanor Miter (H)
John Riley (T)

SYLLABUS CONNECTION:

7/8 TE	T-1	-	Getting to Know Technology
	T-2	-	Resources Needed for Technology
	T-6	-	Choosing Appropriate Resources for Technological Systems
HOE CORE	Mod	-	Introduction to Health Occupations
	Mod	-	Overview of the Human Body

GOAL:

To understand how and why specific materials are used in the manufacturing of prosthetic devices.

OVERVIEW:

All materials, whether natural or synthetic, have specific chemical and mechanical properties. Some materials are better suited for use in the human body than others. Selection is based on usage and location in the body.

Students will compare materials by testing for various physical and chemical properties. The environment in which they exist has an effect on these materials.

MATERIALS:

- variety of metals: e.g., copper, brass, stainless steel, iron
- plastics: e.g., polyethylene, plexiglass
- fabrics: e.g., cotton, nylon, rayon, dacron
- animal skin
- mechanical fasteners: nails, screws, hinges
- metal plates and wires
- normal saline (1 tablespoon table salt to 1 quart of tap water)
- testing equipment: plastic trays, measuring equipment, fish scale
- lab equipment as needed: e.g., hammer, weights, vices
- prosthetic devices from medical doctors and/or medical supply companies

DISCUSSION TOPICS:

1. Properties - Characteristics which determine the strength, durability, and flexibility of a given material under specific conditions.

2. Materials - Substances can be human-made or natural. They resources can exist in solid, liquid, or gaseous states. Shaping of materials adds to their inherent strength.

3. Testing - Methods to determine the properties, both physical and chemical, which exist in different materials. Tests for tensile, compression, and shear strengths and chemical incompatibility can be performed.

4. Prothesis - A device used to replace a diseased, missing, or damaged body part.

5. Environment - State in which a material exists.

6. Aerobic - An environment with oxygen.

7. Anaerobic - An environment without oxygen.

ACTION PLAN:

1. Have students research history of different prosthetic devices including:

   a) orthopedic eg. joints, plates, pins
   b) cardiovascular eg. veins, valves, arteries, heart
   c) simple surgical procedures eg. hernia
   d) prosthetic eye and lens replacement
   e) dentures, plates, fillings, caps

ACTION PLAN, continued

2. List the various materials used for prosthetic devices.

3. Classify the materials as natural or synthetic.

4. Show properties of materials by demonstrating elasticity, ductility, flexibility, hardness, and chemical stability.

5. Discuss how heat and pressure in the environment affects material.

6. Students will perform tests on a variety of prepared materials to determine strengths and stability (shear test, tensile strength tests, compression tests, chemical tests in saline solution, tests for hardness).

7. Student should record measurement and may develop their own measurement systems.

8. Discuss the needs of specific properties for specific anatomical replacements by showing examples of prosthetics -- both new and used products.

9. Discuss the biotechnical careers made available due to the advent of prosthetic devices (material engineers, lab technicians).

GOING BEYOND:

- Invite an orthopedic surgeon, a cardiovascular surgeon, dentist and/or ophthalmologist to speak to the class.

- Invite a materials engineer, with latest testing devices, to give the class a demonstration.

- Invite a medical equipment salesperson to address the class.

- Show films such as "History of Plastic Surgery."

- Give library assignments.

- Learn about protective coatings research being done at the SUNY Buffalo Surface Science Center.

RESOURCES:

American Heart Association

Medical equipment companies

Patient pamphlets from doctors

Anatomy and physiology textbooks

RESOURCES, continued

Technical schools

SUNY Buffalo, Surface Science Center

Trainex

School nurse

Ferris, Skelly and Dorig. Basic Standards and Functions. Delmar Publishers, Albany, 1981.

Hacker and Barden. Technology in Your World. Delmar Publishers, Albany, 1987.

Todd, McCrory, Todd. Understanding and Using Technology. Davis Publications, Inc., Worcester, MA., 1985.

Working with Orthopedic Patients. Nursing '84 Books, Springhouse Corp., Springhouse, PA.

1985 Book of ASTM Standards. American Society for Testing and Materials.

The World of the Future: Robots: Science & Medicine into the 21st Century. Usborne Publishing, Ltd., 20 Garrick Street, London, WC2E 9BJ.

Concept Media, P.O. Box 19542, Irving, CA 92712. (800-253-7078).

Trainex Corp., P.O. Box 116, Garden Grove, CA 92642. (800-854-2485).

Film from Public Broadcasting Station: "A Normal Face." NOVA - WGBH Boston, Box 322, Boston, MA 92134.

LEARNING ACTIVITY BRIEF

Simulating Handicapping Conditions

Number of 40-minute periods: 6 to 10

Doug Beard (T)
Anne Bishop (H)
Alice Cowles (H)
Wally Yelverton (T)

SYLLABUS CONNECTIONS:

7/8 TE	-	T-2	-	Resources Needed for Technology
		T-3	-	How People Use Technology to Solve Problems
		T-4	-	Systems and Subsystems
		T-5	-	How Technology Affects People and the Environment
		T-8	-	Controlling Technological Systems
		T-10	-	Using Sytems to Solve Problems
HOE CORE	-	Mod	-	Leadership and Communication
		Mod	-	Personal Health and Wellness
		Mod	-	Overview of the Human Body

GOAL:

The student will develop awareness of physically handicapping conditions and the impact upon individuals with handicapping conditions and society.

OVERVIEW:

Individuals with handicapping conditions are integrated throughout our society in varying degrees. Societal perceptions of these individuals are often misunderstood and distorted.

Through activities involving simulation of handicapping conditions, problem solving, research, and other methods, students will develop an awareness and appreciation of the challenges facing people with physical handicaps.

MATERIALS:

- Use Safety Considerations for Handicapped Simulation

SIGHT: goggles, tape, glasses for tunnel vision, distortion (blurred vision), half vision, blindfold, eye patch, cane (walking stick), walker

HEARING: ear plugs (cotton), ear phones (walkman) buzzing & external sounds to mask outside (room) sounds

MATERIALS, continued

LIMBS: splints on fingers, restrictive devices such as straps and gloves, taping fingers together to limit or restrict movement, web thumb & index finger, crutches*, wheelchair*, sling, and bandages
*Proper safety procedures need to be followed
SPEECH: Prohibit speaking or use muffled speech
TOUCH: Gloves, mittens (multiple layers)

OTHER MATERIALS:

- Typical Technology Education general lab, health office, science room, other common school areas, Health Occupations laboratory.

- Robotics - to approximate human sensing and movement (Radio Shack Armatron and other toys; Veterans Administration - Bionic Arm)

DISCUSSION TOPICS:

1. Define handicap, handicapping conditions, and other related terms.

2. Identify causes of physical handicaps: birth defects, accidents, war, disease processes such as cancer, arthritis, metabolic disorders.

3. Discuss types of physical handicaps.

4. List the rights of handicapped persons: education, employment, access.

5. Identify famous handicapped persons (e.g., F.D.R., Stevie Wonder, Ray Charles, Helen Keller, Ted Kennedy Jr.).

6. Discuss special events for handicapped persons: skiing, Special Olympics.

7. List support groups: Lions, Kiwanis, Muscular Dystrophy Association, March of Dimes, United Cerebral Palsy, Veterans Administration, Goodwill Industries, Association for Blind, etc.

ACTION PLAN:

1. Have students describe the handicapping condition of a person they know or a public figure.

2. List as many types of physical handicaps as possible.

3. Have a presentation/demonstration on handicapping conditions by a professional in the field.

4. Have a handicapped person visit the classroom.

5. Have students research selected topics:

   a. Rights of handicapped people
   b. Causes of handicapping conditions
   c. Effects of handicapping conditions on other body systems
   d. Transportation systems/mobility
   e. Support groups
   f. Famous people
   g. Inspection of school for building modification for handicapped. Report positive and negative findings

6. Have the students simulate various physically handicapping conditions using the resources provided by the instructor (e.g., wheelchair, tie thumb & forefinger together, goggles for tunnel or half vision, gloves for touch). Problem solving techniques could be identified here.

7. Ask students to attempt normal daily activities while simulating a handicapping condition (e.g., eating while blind folded; drinking from a fountain while in a wheelchair; going from point A to point B while blind; transfering from wheelchair to other surface; putting a jacket on with one arm; opening anything with one hand; eating without use of a thumb; communicating with a deaf person; determining hot and cold with heavy mittens on).

8. After experiencing the handicapping condition noted in # 7, have the students record their feelings and list various ideas that may help improve/correct the handicapping condition. (Brainstorming may be used at this point.)

9. Using the formal problem-solving method, have the students devise/simulate device(s) to help improve/correct handicapping conditions.

GOING BEYOND:

- Visit a rehabilitation center, Cerebral Palsy Center for the Disabled, Association for Retarded Citizens, or regional Developmental Center.

- Invite an occupational therapist to give a presentation.

- Give a presentation about prostheses.

- Demonstrate voice controlled devices.

- Use robotics to simulate human sensing and movement.

- Discuss complications of the handicapped.

RESOURCES:

Nursing textbooks

Occupational Health and Safety - P.O. Box 7573, Waco, TX 76714-7573

Health Professionals

Hacker and Barden. Technology in Your World. Delmar Publishers, Inc., Albany, 1987.

LEARNING ACTIVITY BRIEF

Effects of Chemicals on Animal Tissue Before and After Tissue Treatment

Number of 40-minute periods: 4

Judy Conlin (H)
Janet Cook (H)
Bob Jones (T)
Charlotte Shuck (H)

SYLLABUS CONNECTIONS:

7/8 TE	T-5	- How Technology Affects People and the Environment
HOE CORE	Mod	- Personal Health and Wellness

GOAL:

To observe the effects chemicals have on untreated animal tissue and to understand the implications relating to human injury and disease.

OVERVIEW:

In the course of living, people come in contact with many potentially dangerous chemicals designed for household and/or industrial use.

Personal health and wellness often depend upon the integrity of human tissue. When tissue becomes damaged, various disease processes are set in motion. Certain agents, when applied to tissue, can prevent, minimize, or treat such damage.

Through activities and experiments, students can observe actual effects of various chemicals on tissue samples. Thus, disease processes/injury treatments are demonstrated.

MATERIALS:

- various animal tissues: muscle, epithelial, mucous membranes, serous membranes
- heat tempered glass containers with labels
- chemicals: e.g., hydrochloric acid NaCl solution - 0.9% gasoline alcohol (grain) ammonia

MATERIALS, continued

- gastric juices
- oxalic acid
- battery acid
- solvents: acetone, turpentine
- detergents - germicidal solutions
  finishes and paints

TREATMENT:

- zinc oxide
- cream, milk
- liquid antacid
- lanolin
- water
- commercial cream for diaper rash
- soda bicarbonate
- industrial hand protectant

DISCUSSION TOPICS:

1. Defense mechanisms - skin, mucous, and serous membranes are protective barriers.

2. Disease/injury - various diseases/injuries occur due to chemical alterations of the protective barriers.

3. Prevention/treatment - various chemicals can enhance the protective barriers and/or reduce or reverse the diseased state.

ACTION PLAN:

1. Introduce notion of hazards in commonly used chemicals . discuss natural defenses.

2. As an example, expose various animal tissue in the lab setting to hazardous chemicals, protective chemical, and treatment type chemical.

3. Perform periodic examinations of samples and documentation of observations.

4. Relate tissue damage to human disease/injury.

5. Relate positive results to safe use and prevention of disease/injury.

GOING BEYOND:

- Discuss chemical poisoning/poison control center.
- Discuss the regulations of the Occupational Safety and Health Act.
- Invite a guest speaker from industry or medicine.
- Have students design a similar experiment for a science/ technology fair.
- Discuss use of tissue for medical devices.

RESOURCES:

HOE Core Resource Guide

OSHA manuals

Pharmaceutical companies

American Red Cross First Aid Manual

Guest speaker: nurse, patient with tissue damage

LEARNING ACTIVITY BRIEF

Plant Tissue Culture

Number of 40-minute periods:
4, plus observation time as the process develops

Frank Darzano (T)
Marshall S. Hahn (T)

SYLLABUS CONNECTIONS:

7/8 TE	T-7	-	How Resources are Processed by Technological Systems
	T-5	-	How Technology Affects People and the Environment
HOE CORE	Mod	-	Microbes and the Environment

GOAL:

To understand and practice the appropriate techniques for asepsis, sterilization, and disinfection.

To understand the reasons for the techniques and the advantages of plant tissue culture over traditional methods of propagating plants.

OVERVIEW:

During the 1970s and 1980s there has been increasing commercial application of plant tissue culture. Agricultural and horticultural research establishments are making considerable use of the technique. It has become an important aspect of the new biotechnology age.

Through activity involving plant tissue culture with potatoes, the students will learn about the regeneration of whole plants from isolated cells or pieces of tissue grown on a nutrient media under controlled conditions, without contamination by micro-organisms.

MATERIALS:

- Containers: e.g., sterile bottles or jars
- Murashigo and Skoog media - (this media should have no plant hormones or sucrose, and normally comes without agar)
- Sucrose
- Shooting potato tubers
- Agar
- Sharp scalpels
- Methylated spirits
- Beakers to hold alcohol
- Sterile cotton swabs
- Sterile petri dishes
- Sterile water
- 10% Domestos solution
- Forceps
- Labels

DISCUSSION TOPICS:

1. Isolated plant parts: root shoot, leaf primordia, or embryo of many plants.

2. Nutrient medium: This is a sterile medium, solid or solution, containing the substances essential for growth and development of a healthy plant. It comes from a plant part unable to photosynthesize or draw nutrients from a seed food store. It must contain a source of carbon (usually sugar), inorganic mineral salts, vitamins, and growth regulators.

3. Aseptic techniques: Basic sterile techniques, to prepare for media, equipment, and the handling of plant material, are essential for success in plant tissue culture.

4. Controlled conditions: Most important is a temperature in the range of 23 - 28 degrees C(25 degrees C is the optimum) and 12-14 hour days. The level of light intensity may be comparatively low, as the plants are supplied with a ready source of carbohydrates from the sucrose in the nutrient medium.

5. Transfer of learning: The experiences in this activity are directly transferable to activities performed by doctors, dentists, nurses, therapists, morticians, veterinarians, medical technicians, scientists, botanists, arborists, and other professionals who make similar preparations and grow cultures under controlled sterile conditions.

DISCUSSION TOPICS, continued

6. Safety: Adequate safety precautions must be taken to ensure that tools are not heated beyond the sterilization temperature and the temper is not burned from the blade. Otherwise the blade will dull quickly and other metals will loose their strength and durability.

ACTION PLAN:

1. Lecture on or discuss the introduction to plant tissue cultures.

2. Demonstrate the basic stages in plant tissue culture:
   a. Preparation of stock plants
   b. Initiation
   c. Multiplication
   d. Rooting
   e. Weaning

3. Demonstrate the procedure for making a potato plant tissue culture:
   a. Aseptic techniques
   b. Preparation and use of media
   c. Subculturing
   d. Weaning

4. Have the students make a potato plant tissue culture.

5. Observe plant development over time and perform weaning activity as needed.

GOING BEYOND:

- Have students change the conditions used in their plant tissue cultures (e.g., no aseptic techniques, changes in sucrose concentrations) and observe effects on plants grown.

- Design a growth cabinet to meet certain criteria of cost, temperature control, and light conditions. Use electronic devices for these applications of control.

- Experiment with the intensity of light: Results will be reliable only if all plants have been cloned from the same parent plant.

- Compare conventional propagation techniques and tissue culture, with regard to cost and time.

- Calculate the number of plants that could be propagated from three generations of clones.

- Organize in a field trip to a local nursery where plant propagation takes place.

RESOURCES:

Boodley, James W. The Commercial Greenhouse. Delmar Publishers, Albany, 1981.

Dodd, John H. and Lorin W. Roberts. Plant Tissue Culture, Cambridge U. Press, New York, 1982.

MacDonald, P. Plant Cell and Tissue Culture: A Laboratory Manual. Sprenger-Verlag, New York, 1982.

Mantel, S.H. and H. Smith. Plant Biotechnology, Cambridge U. Press, New York, 1983.

Plant Study Kit, Science Kit and Boreal Laboratories 1987-88 Catalog, Tonawanda, New York 14150.

LEARNING ACTIVITY BRIEF

Municipal Waste: Prevention, Processing, Toxicity

Number of 40-minute periods: 5 - 10

Michael Doyle (T)
Betty Low (H)
Neal Swernofsky (T)

SYLLABUS CONNECTIONS:

7/8 TE	T-5	-	How Technology Affects People and the Environment
	T-8	-	Controlling Technological Systems
	T-10	-	Using Systems to Solve Problems
HOE CORE	Mod	-	Personal Health and Wellness
	Mod	-	Microbes and the Environment
	Mod	-	Maintaining and Promoting a Safe Environment

GOAL:

To understand the impact of municipal waste on the environment and the use of microbes to control waste and waste by-products.

OVERVIEW:

As the population increases, the impact of waste on the environment threatens all living species. This activity demonstrates the effects of toxic waste levels on living organisms and the various technological solutions to this environmental problem. The student will be introduced to techniques for preventing and processing waste, both toxic and nontoxic.

MATERIALS:

- materials for simulating toxic waste that would result in a leachate
- processing materials for producing safe or acceptable environmental levels: e.g., activated charcoal, diatenacious earth
- organic waste products: e.g., coffee grounds, soap, motor oil
- materials for isolation unit: e.g., running water, soap
- containment areas
- sterilization equipment
- chemicals

DISCUSSION TOPICS:

1. Bioassay - The quantitative determination of the relationship between a toxic agent's effect and concentration.

2. Leachate - The liquid resulting from a percolation process.

3. Isolation technique - Procedures used by people to prevent the spread of communicable diseases or hazardous materials by protecting themselves and others. Procedures include proper gowning and use of gloves when handling contaminated waste, both organic and nonorganic.

4. Processing - The combining of resources to achieve a desired result.

5. Toxicity - Relating to the degree of poisons in a living organism.

6. Incineration - the process of burning to ashes.

ACTION PLAN:

1. Develop a prototype that will produce a toxic leachate (e.g., model landfill).

2. Use bioassay on obtained leachate (could be sent to lab).

3. Relate the results of #2 to drinking water contamination.

4. Demonstrate the impact on plants, animals, and humans.

5. Use methods to treat contaminated materials (sterilization, isolation, incineration, microbiology) or prevent materials from becoming contaminated.

6. Organize field trips to a sewage plant, water works, hospital, and/or landfill.

GOING BEYOND:

- Spread of disease

- Habitat destruction

- Extinction of various species

- Disruption of food chain

- Economics

RESOURCES:

Pharmacy text

Microbiology text

Bodasch and Chesebro. The Health Care Worker. Brady Communications Company, Inc., Bowie 1985

Health Occupational Education Core - Resource Guide

LEARNING ACTIVITY BRIEF

Microbes and the Environment

Number of 40-minute periods: 5

Frank Darzano (T)
Michael Doyle (T)
Betty Low (H)

SYLLABUS CONNECTIONS:

7/8 TE	T-5	-	How Technology Affects People and the Environment
HOE CORE	Mod	-	Microbes and the Environment

GOAL:

To understand that pathogenic microorganisms have positive and negative impacts on people and the environment.

OVERVIEW:

Microbes are all around us. These microscopic organisms can be harnessed to benefit living species; they can also cause undesirable effects such as illness.

Through activity involving fermentation processes, students will learn how microorganisms reproduce. This growth will be related to the growth and disease producing organisms. Aseptic techniques that inhibit pathogenic organisms will be demonstrated.

MATERIALS:

- materials for bioprocessing: bread-making, yogurt, etc.
- lab equipment: glass slides and required stain, microscopes, culture curates
- running water and soap
- vaccine materials

DISCUSSION TOPICS:

1. Bioprocessing - A method of using microorganisms to manipulate biological materials. This process can be used to control the physical environment (e.g., eating sludge), create new materials (e.g., fermentation, cheese production), or provide for human, plant, and animal needs (e.g., drugs, vaccines, pesticides).

2. Disease - Pathogenic organisms can cause dysfunction of living organisms. Natural defenses, vaccines, antibiotics, and special therapeutic methods may be used to help the living organism to inhibit or prevent the effects of the pathogenic organisms.

3. Aseptic technique - Aseptic technique is used by people to kill disease producing microorganisms and thus prevent spread of infection by protecting themselves and others. Procedures include proper hand-washing and disinfection.

ACTION PLAN:

1. Introduce notion of multiplication of microorganisms. (Discuss concept of Exponential growth.)

2. As an example, make cheese, bread, and yogurt (fermentation).

3. Take periodic specimens to identify growth of microorganisms. Inspect each under microscope.

4. Relate fermentation process (desirable) to multiplication of microorganisms in disease (undesirable).

5. Relate growth of microorganisms in bread to growth of disease producing organisms in living species. Display slides of vaccine material.

6. Discuss need for aseptic technique to prevent spread of disease producing organisms (e.g., pasteurization, disinfection, chlorination, hand-washing).

7. Take a field trip to a medical lab.

GOING BEYOND:

- Discuss germ warfare - the potential exists for governments to commit vast resources to research applied to development of microbes as weapons of war. Organisms harmful to the human body might be unleashed in great quantity and reap death and destruction within a targeted population.

- Visit a pasteurization plant or cheese factory.

- Take cultures from specimens and send to the medical lab for analysis.

- Invite a lab technician in to address classes.

APPENDIX

Health/Technology Technical Updates

GOAL:

To stay abreast of new Biotechnological developments as they happen.

OVERVIEW:

Biotechnological developments, events, discoveries, and inventions influence the present and future of progress and career opportunities. Review of valid, creditable, and current literature will keep students and teachers up to date on biotechnical developments.

RESOURCES:

National Geographic Index (e.g. Bio-Med Technical Equipment-June 1986 issue). National Geographic Society, Washington DC 20038.

Fortune Magazine weekly section on Technology, Science & Health. Time Life Building, Rockefeller Center, New York, NY 10020-1393.

Insight Magazine weekly sections on Science briefings - Health, Legal and Legislative briefings, 3600 New York Avenue, NE, Washington, DC 20002.

Breakthroughs, Weekly Newsletter, Boardroom Reports, $49/yr. Contains latest inventions, purpose & applications; by whom, where, when available, 330 W 42nd Street, New York, NY 10036.

Mayo Clinic Health Newsletters by Mayo clinic updates on equipment, techniques, procedures. Rochester, Minn. 555905.

Healthwise Newsletter - Biweekly update on Equipment Pharmaceuticals, Treatments, Surgeries. P.O. Box 1786 Indianapolis, IN. 46206.

T.H.E. Journal, Technoligical Horizons in Education, 2626 South Pullman Santa Ana, CA 92705.