Program Features

Frey's Inquiry Investigations™ Module *Human Biology and Health Issues* engages your students in active and meaningful learning. Each of the three units in the program focuses on a different theme and contains an exciting collection of classroom-tested activities that let students experience the wonders of science through direct, hands-on experience.

These standards-based units link to core science concepts, making them an excellent complement to your existing curriculum. Best of all, you won't need a strong background in science to use this program—the comprehensive Curriculum Guide that comes with the module provides teacher-friendly instructions on how to teach the activities.

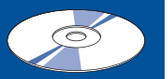
Each Unit includes

- Comprehensive investigation literature with planning and preparation tips, step-by-step instructions, expected outcomes, cross-curricular integration, and assessment strategies.
- A reproducible Student Guide for each unit with complete background information, step-by-step procedures, data tables, analysis questions, and options for open-ended student-designed investigations that challenge students to use their critical thinking skills. Also included are related websites and *Read More About It* sources for students to obtain additional information.
- A collection of safe and fun inquiry-based lab investigations with real-world applications.
- Enough high-quality science materials for a class of up to 40 students working in groups.
- A handy Storage Center to neatly store all materials.

The Curriculum Guide includes

- Comprehensive, unit-specific teacher and student guides.
- Materials lists, a comprehensive Glossary, Useful Equivalents, Symbols, and Equations, Science Safety, and How to Record, Analyze, and Report Data.
- Comprehensive Inquiry Investigation

Also included with the Inquiry Investigations™ Module *Human Biology and Health Issues* is the Curriculum Resource CD-ROM*, which includes…



Content Tutorials:

- Topic-related content featuring detailed illustrations that cover key human biology concepts.
- Hyper-linked glossary of key concepts and terms.

Assessment Monitoring:

- Test questions that can be accessed in either Practice or Test Mode; questions allow students to demonstrate content knowledge.
- Customized tests and worksheets with five question types (essay, multiple choice, concept map, matching, and labeling), as well as dynamic web-deliverable multi-media tutorials and presentations.

Correlation to National and State Science Standards:

- Key concepts correlated to the National Science Education Standards (NSES) and a link to the Frey Scientific website for selected State standards.

Teacher Resources:

- Image gallery containing printable illustrations and images relating to classification and ecology topic areas.
- Dynamic animations that reinforce key human biology concepts.
- Experimental results section that provides useful teacher tips for each activity as well as in-depth experimental data analysis. Where applicable, graphs, tables, and images are provided to enhance each activity.

Virtual Laboratory — Identifying Human Tissues

- Explore the object-based virtual lab environment. The virtual lab allows students to interactively perform every step of the lab activity by manipulating lab equipment on their virtual workbench.
- Use the electronic notebook to record and analyze results.

**System Requirements: Windows 2000 or higher, VISTA-compatible, Mac 9.2 or higher (including OSX), 128 MB RAM.*

The Curriculum Guide contains the following sections – Teacher Guide, Appendix, Student Resources, and a Curriculum Resource CD-ROM. Each section has the same general format, let's take a closer look –

A Closer Look at the Teacher Guide…

Science Concepts and Skills

- Overview of key concepts and skills presented in each lab

Science Standards

- A list of the National Science Education Standards covered in each lab

Materials

- Comprehensive list of the materials needed for each lab

Time Requirements

- Amount of time needed for preparation and activities

Pre-lab Preparation

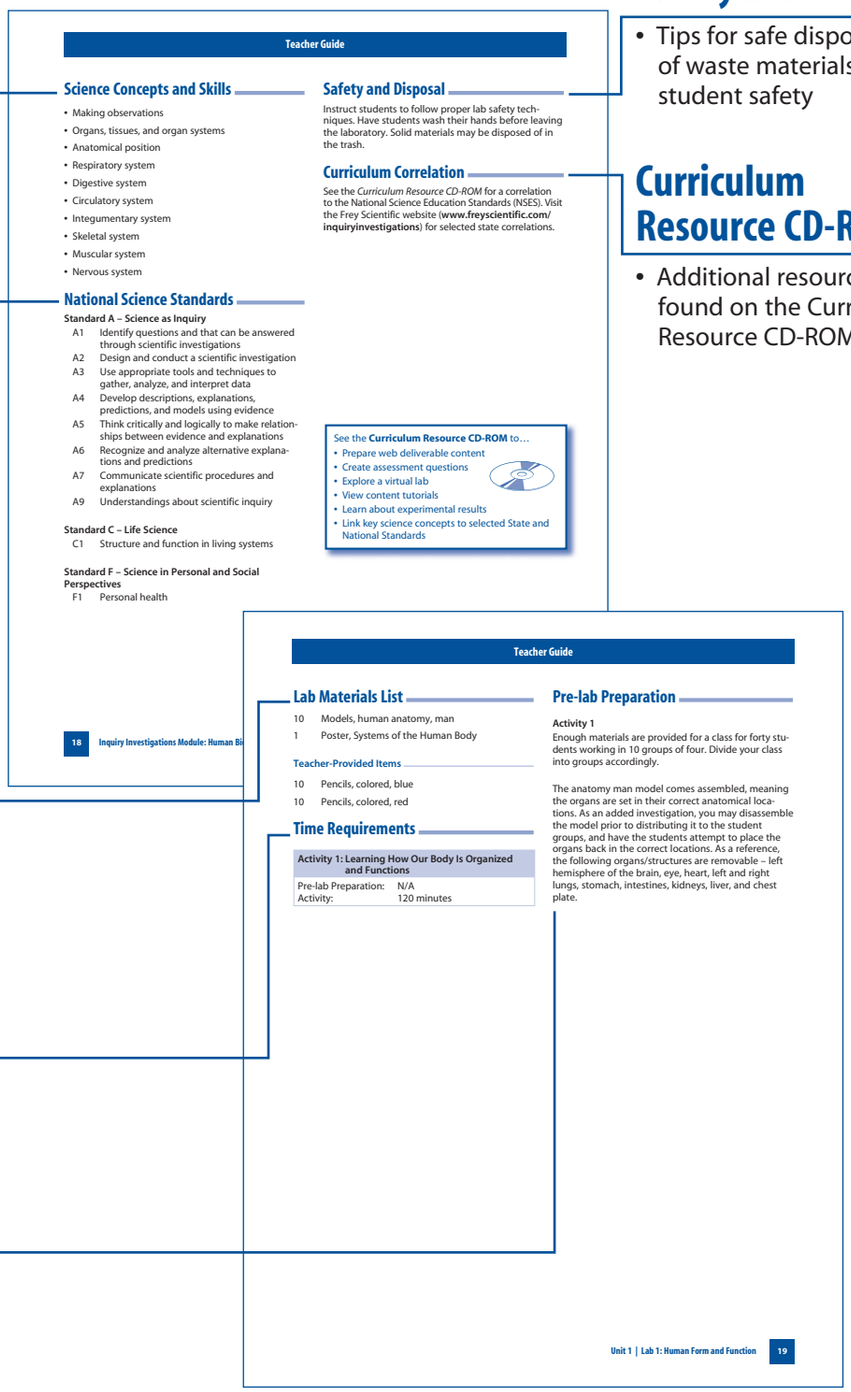
- Overview of any necessary pre-lab preparation

Safety and Disposal

- Tips for safe disposal of waste materials and student safety

Curriculum Resource CD-ROM

- Additional resources found on the Curriculum Resource CD-ROM



Teacher Guide

Science Concepts and Skills

- Making observations
- Organs, tissues, and organ systems
- Anatomical position
- Respiratory system
- Digestive system
- Circulatory system
- Integumentary system
- Skeletal system
- Muscular system
- Nervous system

National Science Standards

Standard A – Science as Inquiry

A1 Identify questions and that can be answered through scientific investigations
A2 Design and conduct a scientific investigation
A3 Use appropriate tools and techniques to gather, analyze, and interpret data
A4 Develop descriptions, explanations, predictions, and models using evidence
A5 Think critically and logically to make relationships between evidence and explanations
A6 Recognize and analyze alternative explanations and predictions
A7 Communicate scientific procedures and explanations
A9 Understandings about scientific inquiry

Standard C – Life Science

C1 Structure and function in living systems

Standard F – Science in Personal and Social Perspectives

F1 Personal health

Safety and Disposal

Instruct students to follow proper lab safety techniques. Have students wash their hands before leaving the laboratory. Solid materials may be disposed of in the trash.

Curriculum Correlation

See the *Curriculum Resource CD-ROM* for a correlation to the National Science Education Standards (NSES). Visit the Frey Scientific website (**www.freyscientific.com/inquiryinvestigations**) for selected state correlations.

See the **Curriculum Resource CD-ROM** to…

- Prepare web deliverable content
- Create assessment questions
- Explore a virtual lab
- View content tutorials
- Learn about experimental results
- Link key science concepts to selected State and National Standards

18 Inquiry Investigations Module: Human Bi

Teacher Guide

Lab Materials List

10 Models, human anatomy, man
1 Poster, Systems of the Human Body

Teacher-Provided Items

10 Pencils, colored, blue
10 Pencils, colored, red

Time Requirements

Activity 1: Learning How Our Body Is Organized and Functions	
Pre-lab Preparation:	N/A
Activity:	120 minutes

Pre-lab Preparation

Activity 1

Enough materials are provided for a class for forty students working in 10 groups of four. Divide your class into groups accordingly.

The anatomy man model comes assembled, meaning the organs are set in their correct anatomical locations. As an added investigation, you may disassemble the model prior to distributing it to the student groups, and have the students attempt to place the organs back in the correct locations. As a reference, the following organs/structures are removable – left hemisphere of the brain, eye, heart, left and right lungs, stomach, intestines, kidneys, liver, and chest plate.

Unit 1 | Lab 1: Human Form and Function 19

A Closer Look at the Teacher Guide…

Objective

- Specific student goals of the activity

What you need

- Specific materials used in each activity

Safety and Disposal

- Important safety information specifically related to each activity

What to do

- Teacher friendly step-by-step procedures for each activity

Recording Observations

- Sample student data for each activity

Questions

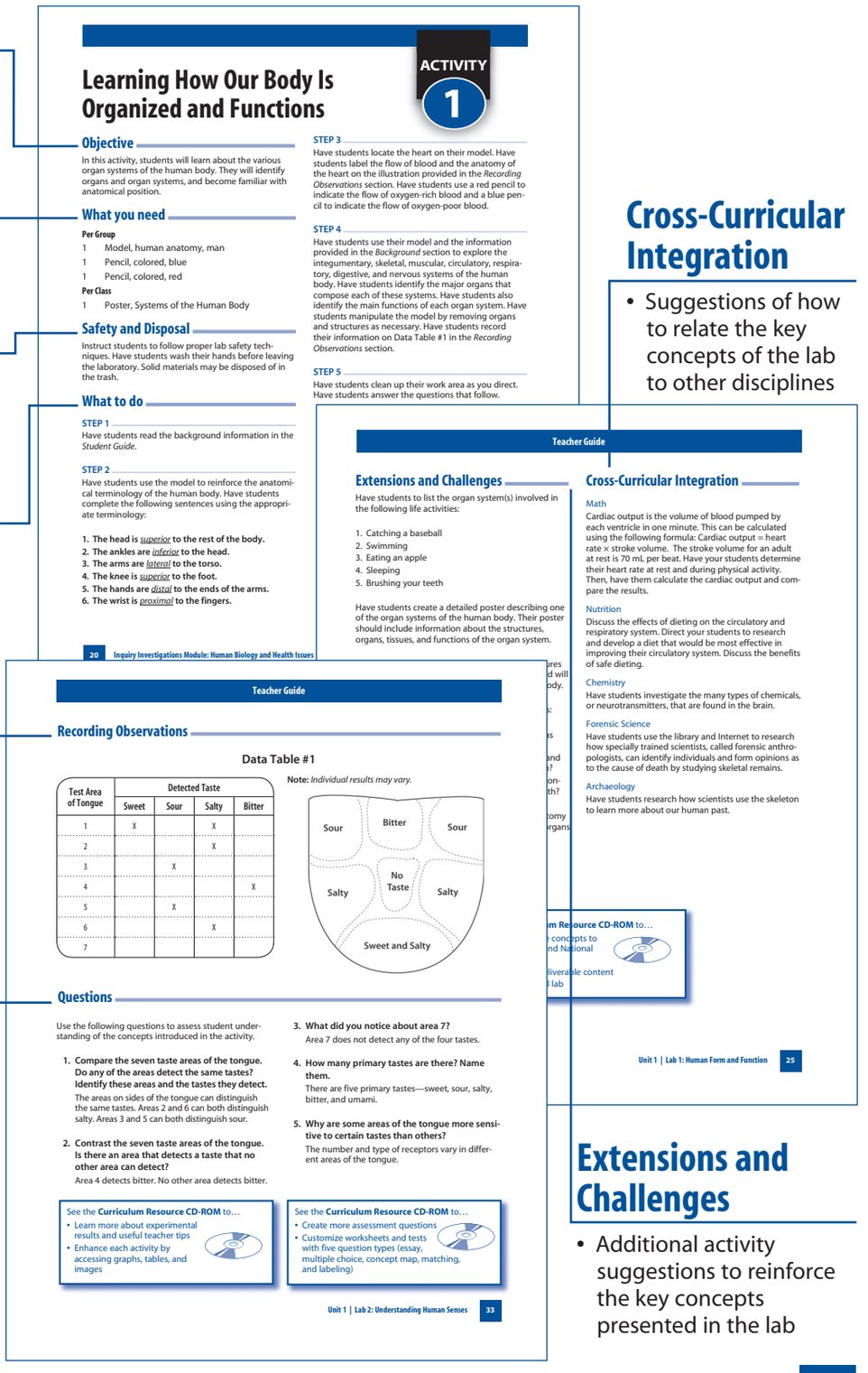
- Questions to assess student understanding of the activity

Cross-Curricular Integration

- Suggestions of how to relate the key concepts of the lab to other disciplines

Extensions and Challenges

- Additional activity suggestions to reinforce the key concepts presented in the lab



ACTIVITY 1

Learning How Our Body Is Organized and Functions

Objective

In this activity, students will learn about the various organ systems of the human body. They will identify organs and organ systems, and become familiar with anatomical position.

What you need

Per Group
1 Model, human anatomy, man
1 Pencil, colored, blue
1 Pencil, colored, red

Per Class
1 Poster, Systems of the Human Body

Safety and Disposal

Instruct students to follow proper lab safety techniques. Have students wash their hands before leaving the laboratory. Solid materials may be disposed of in the trash.

What to do

STEP 1
Have students read the background information in the *Student Guide*.

STEP 2
Have students use the model to reinforce the anatomical terminology of the human body. Have students complete the following sentences using the appropriate terminology:

1. **The head is *superior* to the rest of the body.**
2. **The ankles are *inferior* to the head.**
3. **The arms are *lateral* to the torso.**
4. **The knee is *superior* to the foot.**
5. **The hands are *distal* to the ends of the arms.**
6. **The wrist is *proximal* to the fingers.**

STEP 3
Have students locate the heart on their model. Have students label the flow of blood and the anatomy of the heart on the illustration provided in the *Recording Observations* section. Have students use a red pencil to indicate the flow of oxygen-rich blood and a blue pencil to indicate the flow of oxygen-poor blood.

STEP 4
Have students use their model and the information provided in the *Background* section to explore the integumentary, skeletal, muscular, circulatory, respiratory, digestive, and nervous systems of the human body. Have students identify the major organs that compose each of these systems. Have students also identify the main functions of each organ system. Have students manipulate the model by removing organs and structures as necessary. Have students record their information on Data Table #1 in the *Recording Observations* section.

STEP 5
Have students clean up their work area as you direct. Have students answer the questions that follow.

20 Inquiry Investigations Module: Human Biology and Health Issues

Teacher Guide

Extensions and Challenges

Have students to list the organ system(s) involved in the following life activities:

1. Catching a baseball
2. Swimming
3. Eating an apple
4. Sleeping
5. Brushing your teeth

Have students create a detailed poster describing one of the organ systems of the human body. Their poster should include information about the structures, organs, tissues, and functions of the organ system.

Cross-Curricular Integration

Math
Cardiac output is the volume of blood pumped by each ventricle in one minute. This can be calculated using the following formula: Cardiac output = heart rate × stroke volume. The stroke volume for an adult at rest is 70 mL per beat. Have your students determine their heart rate at rest and during physical activity. Then, have them calculate the cardiac output and compare the results.

Nutrition
Discuss the effects of dieting on the circulatory and respiratory system. Direct your students to research and develop a diet that would be most effective in improving their circulatory system. Discuss the benefits of safe dieting.

Chemistry
Have students investigate the many types of chemicals, or neurotransmitters, that are found in the brain.

Forensic Science
Have students use the library and Internet to research how specially trained scientists, called forensic anthropologists, can identify individuals and form opinions as to the cause of death by studying skeletal remains.

Archaeology
Have students research how scientists use the skeleton to learn more about our human past.

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Unit 1 | Lab 1: Human Form and Function 25

Teacher Guide

Recording Observations

Data Table #1

Test Area of Tongue	Detected Taste			
	Sweet	Sour	Salty	Bitter
1	X		X	
2			X	
3		X		
4				X
5		X		
6			X	
7				

Note: *Individual results may vary.*

Questions

Use the following questions to assess student understanding of the concepts introduced in the activity.

1. **Compare the seven taste areas of the tongue. Do any of the areas detect the same tastes? Identify these areas and the tastes they detect.**
   The areas on sides of the tongue can distinguish the same tastes. Areas 2 and 6 can both distinguish salty. Areas 3 and 5 can both distinguish sour.
2. **Contrast the seven taste areas of the tongue. Is there an area that detects a taste that no other area can detect?**
   Area 4 detects bitter. No other area detects bitter.
3. **What did you notice about area 7?**
   Area 7 does not detect any of the four tastes.
4. **How many primary tastes are there? Name them.**
   There are five primary tastes—sweet, sour, salty, bitter, and umami.
5. **Why are some areas of the tongue more sensitive to certain tastes than others?**
   The number and type of receptors vary in different areas of the tongue.

See the **Curriculum Resource CD-ROM** to…
- Learn more about experimental results and useful teacher tips
- Enhance each activity by accessing graphs, tables, and images

See the **Curriculum Resource CD-ROM** to…
- Create more assessment questions
- Customize worksheets and tests with five question types (essay, multiple choice, concept map, matching, and labeling)

Unit 1 | Lab 2: Understanding Human Senses 33

A Closer Look at the Appendix…

Laboratory Notebook

- Useful tips on how to record, organize, and understand data

The Laboratory Notebook: Recording, Analyzing, and Reporting Data

Data sets are unbiased information gathered through the scientific process that can lead to knowledge and understanding. To be useful, data must be recorded, organized, graphed, analyzed, and reported.

Recording Data

Science deals with verifiable observations. All scientists must keep clear and accurate records of their observations. It is critical that these notebook recordings are made at the time of observation.

Recording data can be done manually through the reading of an instrument, such as a thermometer, and writing down measurements in a lab notebook or data book. Some data measurement probes and instruments (temperature, balance, pH, dissolved oxygen to name a few) can sample and transmit data to a computer for storage in a data table.

At times, your investigation may require the use of a video or photo camera to record visual information. Try to include some dimensional reference (a ruler or other feature) in your shots to provide the correct perspective. Digital photo cameras and scanners allow an investigator to capture experimental results.

Organizing Data

Make sure data sets are presented in tables listed in correct relation to each other. Sometimes your investigations may call for the collection of very large data sets. One way to manage this pile of data is through a database—a large, complex list of facts and information. A database can be a card file or an electronic program that can both recall and merge data. FileMaker Pro (by FileMaker, Inc) or Excel (by Microsoft) are powerful database programs that combine database management and desktop-to-Web network publishing

reproducibility of a result. For example, if you measure a quantity several times and the values agree closely with one another, your measurement is precise. Accuracy describes how close a measured value is to the true or known value. The closer a measured value is to the true value, the more accurate it is. Let's investigate this further.

For example, examine the data sets below.

Procedure 1:	20.1
	20.1
	20.2
	20.0
Procedure 2:	24.5
	25.6
	26.1
	25.1

If the true value is 25.3, then data collected from procedure 2 is more accurate but less precise than the data collected from procedure 1. In this case the precision is poor but the accuracy is good. An ideal procedure is both accurate and precise.

Data Books

The best method of record-keeping is to record observations in a laboratory notebook or data book. Ideally, this should be a stiff-covered book, permanently bound, not loose-leaf, preferably with square grid pages.

Keep records in a diary form, recording the date first. If you make observations for two or more investigations on the same day, use numbers or abbreviations of the titles as subheadings.

Data may be recorded as words. In the laboratory, time is short. Make notes as brief as possible—but to the point. You may choose to sketch your observations. Drawings, digital images, and digital video are all useful data recording techniques.

Graphing Data

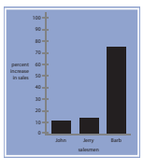
- Examples of ways to graphically present data

Graphing Data

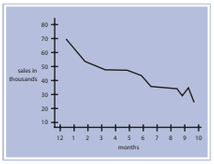
When you make a graph, the first step is to determine which kind to create. What you want to show and the kind of data you have will determine which graph type is most useful:

Circle graph – useful in showing parts or proportions of a whole.

Bar graph – useful for comparing quantities and changes over time.



Line graph – useful for comparing two sets of data or showing changes and trends over time.



Analyzing Data

When you analyze data you look for trends or patterns. You also look to see whether or not your data supports your reasoned guess—your hypothesis. If you have access to a computer, special analysis programs or spreadsheets (e.g., Microsoft Excel®) allow you to tabulate, manipulate (perform mathematical calculations), and graph your data.

Laboratory Reports

Discoveries become a part of science only if they are reported to others. In writing, scientists must express themselves clearly so that others can repeat their procedures exactly. Scientific reports usually follow the following form:

- **Title**
- **Introduction**: how the problem arose and a summary of past investigative work.
- **Materials and equipment**
- **Procedure**: complete and exact account of what was done in gathering the data.
- **Results**: data obtained from the procedure, often in the form of tables and graphs.
- **Discussion**: points out the relationship between the data and the purpose of the investigation.
- **Conclusion**: summary of the meaning of the results, often suggesting further work that might be done to clarify issues that the data may have uncovered.
- **References**: published scientific reports that have been specifically mentioned in the report.

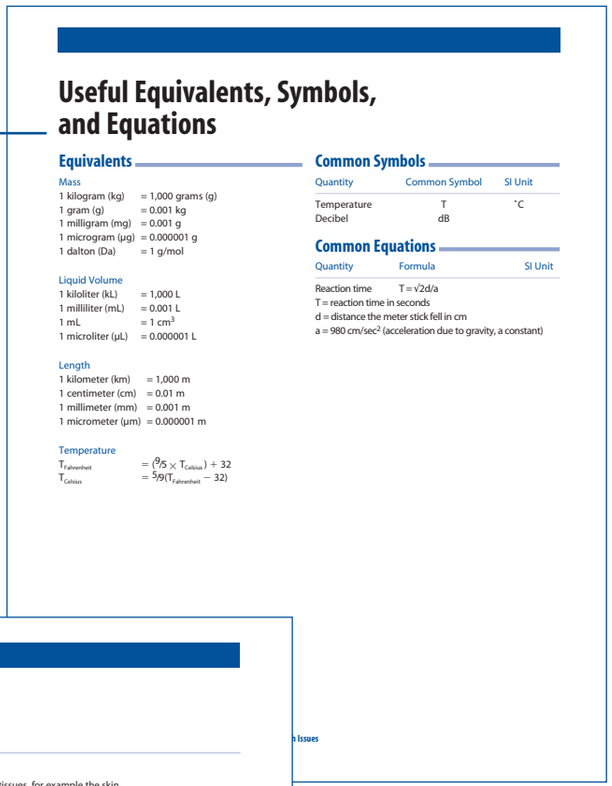
Laboratory Reports

- General outline for scientific reports

A Closer Look at the Appendix…

Useful Equivalents, Symbols, and Equations

- Quick reference guide of common conversions, symbols, and equations



Useful Equivalents, Symbols, and Equations

Equivalents

Mass

1 kilogram (kg)	= 1,000 grams (g)
1 gram (g)	= 0.001 kg
1 milligram (mg)	= 0.001 g
1 microgram (µg)	= 0.000001 g
1 dalton (Da)	= 1 g/mol

Liquid Volume

1 kiloliter (kL)	= 1,000 L
1 milliliter (mL)	= 0.001 L
1 mL	= 1 cm^3
1 microliter (µL)	= 0.000001 L

Length

1 kilometer (km)	= 1,000 m
1 centimeter (cm)	= 0.01 m
1 millimeter (mm)	= 0.001 m
1 micrometer (µm)	= 0.000001 m

Temperature

$T_{Fahrenheit} = (^9/_5 \times T_{Celsius}) + 32$

$T_{Celsius} = {}^5/_9(T_{Fahrenheit} - 32)$

Common Symbols

Quantity	Common Symbol	SI Unit
Temperature	T	˚C
Decibel	dB	

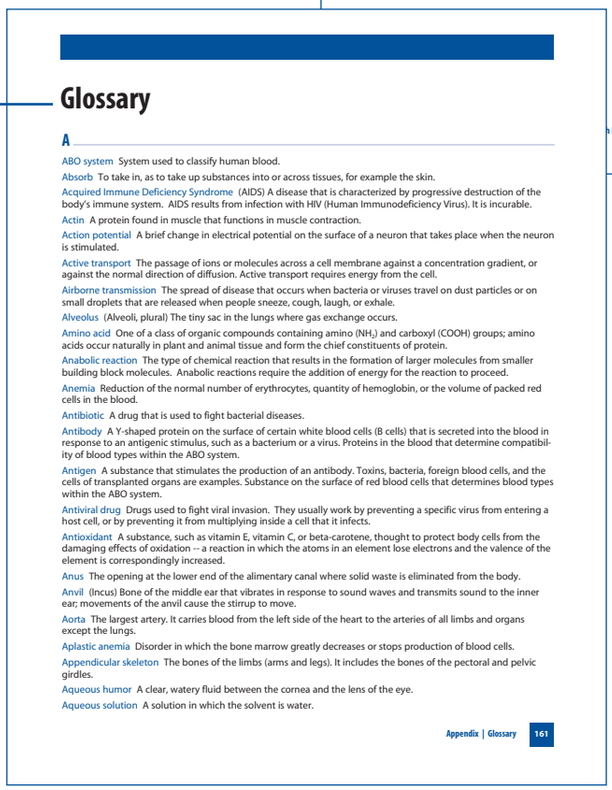
Common Equations

Quantity	Formula	SI Unit
Reaction time	$T = \sqrt{2d/a}$	

T = reaction time in seconds
d = distance the meter stick fell in cm
a = 980 cm/sec^2 (acceleration due to gravity, a constant)

Glossary

- Comprehensive glossary of key terms



Glossary

A

ABO system System used to classify human blood.

Absorb To take in, as to take up substances into or across tissues, for example the skin.

Acquired Immune Deficiency Syndrome (AIDS) A disease that is characterized by progressive destruction of the body's immune system. AIDS results from infection with HIV (Human Immunodeficiency Virus). It is incurable.

Actin A protein found in muscle that functions in muscle contraction.

Action potential A brief change in electrical potential on the surface of a neuron that takes place when the neuron is stimulated.

Active transport The passage of ions or molecules across a cell membrane against a concentration gradient, or against the normal direction of diffusion. Active transport requires energy from the cell.

Airborne transmission The spread of disease that occurs when bacteria or viruses travel on dust particles or on small droplets that are released when people sneeze, cough, laugh, or exhale.

Alveolus (Alveoli, plural) The tiny sac in the lungs where gas exchange occurs.

Amino acid One of a class of organic compounds containing amino (NH_2) and carboxyl (COOH) groups; amino acids occur naturally in plant and animal tissue and form the chief constituents of protein.

Anabolic reaction The type of chemical reaction that results in the formation of larger molecules from smaller building block molecules. Anabolic reactions require the addition of energy for the reaction to proceed.

Anemia Reduction of the normal number of erythrocytes, quantity of hemoglobin, or the volume of packed red cells in the blood.

Antibiotic A drug that is used to fight bacterial diseases.

Antibody A Y-shaped protein on the surface of certain white blood cells (B cells) that is secreted into the blood in response to an antigenic stimulus, such as a bacterium or a virus. Proteins in the blood that determine compatibility of blood types within the ABO system.

Antigen A substance that stimulates the production of an antibody. Toxins, bacteria, foreign blood cells, and the cells of transplanted organs are examples. Substance on the surface of red blood cells that determines blood types within the ABO system.

Antiviral drug Drugs used to fight viral invasion. They usually work by preventing a specific virus from entering a host cell, or by preventing it from multiplying inside a cell that it infects.

Antioxidant A substance, such as vitamin E, vitamin C, or beta-carotene, thought to protect body cells from the damaging effects of oxidation -- a reaction in which the atoms in an element lose electrons and the valence of the element is correspondingly increased.

Anus The opening at the lower end of the alimentary canal where solid waste is eliminated from the body.

Anvil (Incus) Bone of the middle ear that vibrates in response to sound waves and transmits sound to the inner ear; movements of the anvil cause the stirrup to move.

Aorta The largest artery. It carries blood from the left side of the heart to the arteries of all limbs and organs except the lungs.

Aplastic anemia Disorder in which the bone marrow greatly decreases or stops production of blood cells.

Appendicular skeleton The bones of the limbs (arms and legs). It includes the bones of the pectoral and pelvic girdles.

Aqueous humor A clear, watery fluid between the cornea and the lens of the eye.

Aqueous solution A solution in which the solvent is water.

Appendix | Glossary 161

A Closer Look at the Student Guide…

Objectives

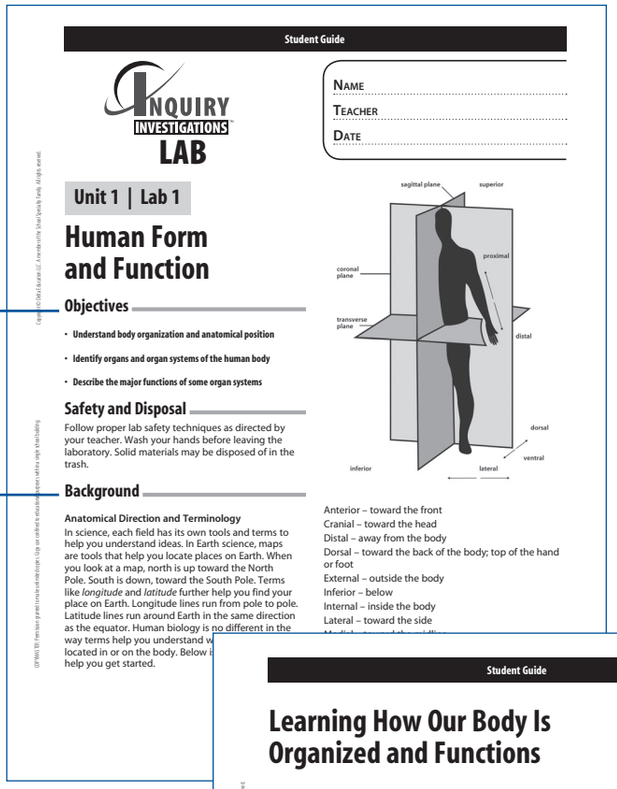
- Key concepts and student goals for the lab

Background

- Science information related to the lab topic

What to do

- Step-by-step procedures for each activity



Student Guide

INQUIRY INVESTIGATIONS™ LAB

NAME
TEACHER
DATE

Unit 1 | Lab 1

Human Form and Function

Objectives

- Understand body organization and anatomical position
- Identify organs and organ systems of the human body
- Describe the major functions of some organ systems

Safety and Disposal

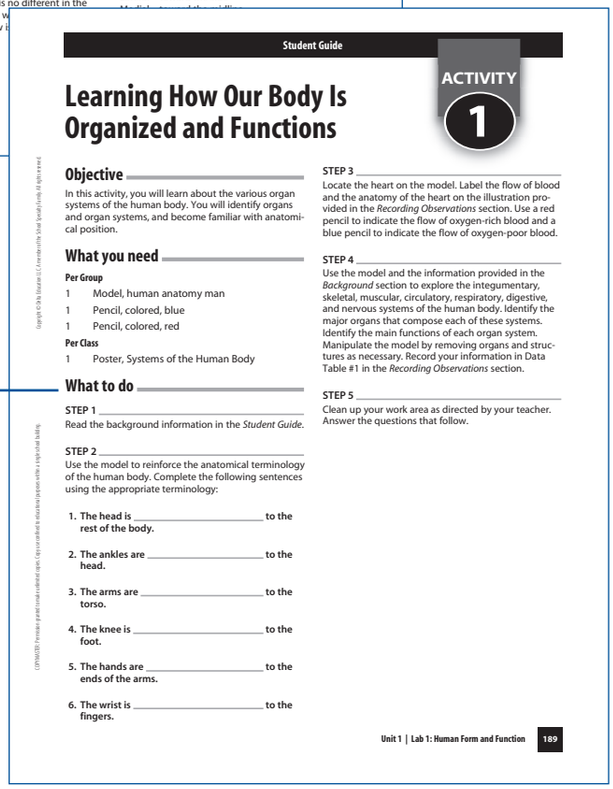
Follow proper lab safety techniques as directed by your teacher. Wash your hands before leaving the laboratory. Solid materials may be disposed of in the trash.

Background

Anatomical Direction and Terminology

In science, each field has its own tools and terms to help you understand ideas. In Earth science, maps are tools that help you locate places on Earth. When you look at a map, north is up toward the North Pole. South is down, toward the South Pole. Terms like *longitude* and *latitude* further help you find your place on Earth. Longitude lines run from pole to pole. Latitude lines run around Earth in the same direction as the equator. Human biology is no different in the way terms help you understand w
located in or on the body. Below i
help you get started.

Anterior – toward the front
Cranial – toward the head
Distal – away from the body
Dorsal – toward the back of the body; top of the hand or foot
External – outside the body
Inferior – below
Internal – inside the body
Lateral – toward the side



Student Guide

ACTIVITY 1

Learning How Our Body Is Organized and Functions

Objective

In this activity, you will learn about the various organ systems of the human body. You will identify organs and organ systems, and become familiar with anatomical position.

What you need

Per Group

1 Model, human anatomy man
1 Pencil, colored, blue
1 Pencil, colored, red

Per Class

1 Poster, Systems of the Human Body

What to do

STEP 1
Read the background information in the *Student Guide*.

STEP 2
Use the model to reinforce the anatomical terminology of the human body. Complete the following sentences using the appropriate terminology:

1. **The head is _____ to the rest of the body.**
2. **The ankles are _____ to the head.**
3. **The arms are _____ to the torso.**
4. **The knee is _____ to the foot.**
5. **The hands are _____ to the ends of the arms.**
6. **The wrist is _____ to the fingers.**

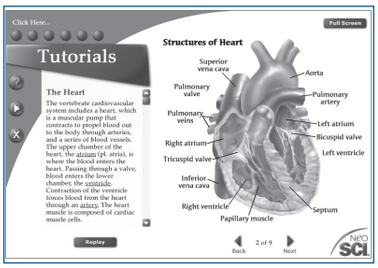
STEP 3
Locate the heart on the model. Label the flow of blood and the anatomy of the heart on the illustration provided in the *Recording Observations* section. Use a red pencil to indicate the flow of oxygen-rich blood and a blue pencil to indicate the flow of oxygen-poor blood.

STEP 4
Use the model and the information provided in the *Background* section to explore the integumentary, skeletal, muscular, circulatory, respiratory, digestive, and nervous systems of the human body. Identify the major organs that compose each of these systems. Identify the main functions of each organ system. Manipulate the model by removing organs and structures as necessary. Record your information in Data Table #1 in the *Recording Observations* section.

STEP 5
Clean up your work area as directed by your teacher. Answer the questions that follow.

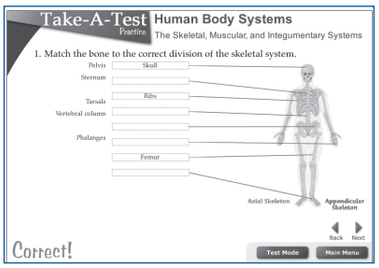
Unit 1 | Lab 1: Human Form and Function 189

A Closer Look at the Curriculum Resource CD-ROM*…



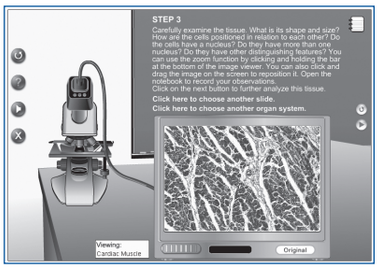
Content Tutorials

- Comprehensive tutorials offering self-paced, individualized lessons through illustrations and animations
- Hyper-linked glossary of key concepts and terms



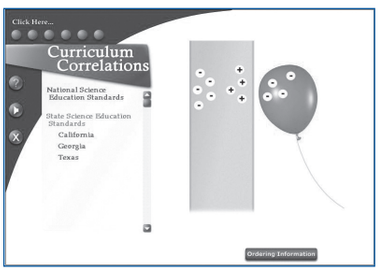
Assessment Monitoring

- Access test questions in either Practice or Test Mode to provide students with exam experience
- Create customized tests and worksheets with various question types, as well as dynamic multimedia tutorials and presentations—saving them on a disk or in web-ready format for easy Internet access



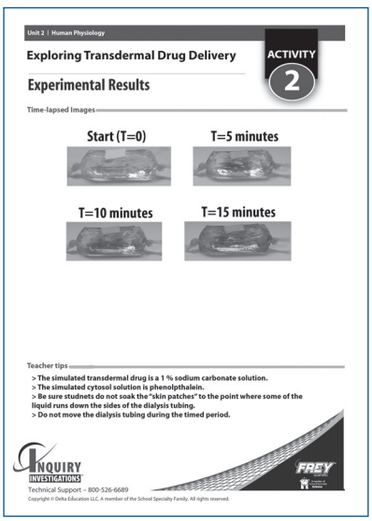
Virtual Laboratory

- Explore the object-based virtual lab environment. The virtual lab allows students to interactively perform every step of a lab activity by manipulating lab equipment on their virtual lab workbench.
- The electronic notebook allows students to record and analyze data.



Correlations to National and selected State Standards

- Key concepts correlated to the National Science Education Standards and 25 selected State standards linked to the Frey Scientific website (**www.freyscientific.com/inquiryinvestigations**)



Experimental Results

- Useful teacher tips for each activity, as well as in-depth experimental data analysis
- Graphs, tables, and images are provided to enhance each activity.

*CD-ROM System Requirements: Windows 2000 or higher, VISTA-compatible, Mac 9.2 or higher (including OSX), 128 MB RAM