

Safety in Your Biology Laboratory

Scientific investigations are integrated throughout this textbook. Keep in mind at all times that working in a biology laboratory can involve some risks. *Therefore, become familiar with all facets of laboratory safety, especially for performing investigations safely.* To make the investigations and activities in *Inquiry into Biology* safe and enjoyable for you and others who share a common working environment:

- become familiar with and use the following safety rules and procedures,
- follow any special instructions from your teacher, and
- *always read* over the safety notes before beginning each lab activity. Your teacher will tell you about any additional safety rules that are in place at your school.

General Rules

1. Inform your teacher if you have any allergies, medical conditions, or physical problems (including a hearing impairment) that could affect your work in the laboratory.
2. Inform your teacher if you wear contact lenses. If possible, wear eyeglasses instead of contact lenses, but remember that eyeglasses are not a substitute for proper eye protection.
3. Read through all of the steps in the investigation before beginning. Be sure to read and understand the *Cautions* and safety symbols at the beginning of each Investigation or Launch Lab.
4. Listen carefully to any special instructions your teacher provides. Get your teacher's approval before beginning any investigation that you have designed yourself.
5. *Never* eat, drink, or taste any substances in the lab. *Never* pipette with your mouth. If you are asked to smell a substance, do not hold it directly under your nose. Keep the object at least 20 cm away, and waft the fumes toward your nostrils with your hand.

Safety Equipment and First Aid

6. When you are directed to do so, wear safety goggles and protective equipment in the laboratory. Be sure you understand all safety labels on materials and pieces of equipment. Familiarize yourself with the safety symbols used in this textbook, and with the WHMIS symbols found on the following page.
7. Know the location and proper use of the nearest fire extinguisher, fire blanket, fire alarm, first-aid kit, and eye-wash station (if available).
8. *Never* use water to fight an electrical equipment fire. Severe electrical shock may result. Use a carbon dioxide or dry chemical fire extinguisher. Report any damaged equipment or frayed cords to your teacher.

9. Cuts, scratches, or any other injuries in the laboratory should receive immediate medical attention, no matter how minor they seem. If any part of your body comes in contact with a potentially dangerous substance, wash the area immediately and thoroughly with water.
10. If you get any material in your eyes, do not touch them. Wash your eyes immediately and continuously for 15 minutes, and make sure your teacher is informed. If you wear contact lenses, take your lenses out immediately if you get material in your eyes. Failing to do so may result in material being trapped behind the contact lenses. Flush your eyes continuously with water for 15 minutes, as above.

Lab Precautions

11. Make sure your work area is clean, dry, and well-organized.
12. Wear heat-resistant safety gloves and any other safety equipment that your teacher or the Safety Precautions suggest, when heating any item. Be especially careful with a hot plate that may look as though it has cooled down. If you do receive a burn, apply cold water to the burned area immediately. Make sure your teacher is notified.
13. Make sure the work area, the area of the socket, and your hands are dry when touching electrical cords, plugs, sockets, or equipment such as hot plates and microscopes. Ensure the cords on your equipment are placed neatly where they will not be a tripping hazard. Turn OFF all electrical equipment before connecting to or disconnecting from a power supply. When unplugging electrical equipment, do not pull the cord—grasp the plug firmly at the socket and pull gently.
14. When using a scalpel or knife, cut away from yourself and others. Always keep the pointed end of any sharp objects directed away from yourself and others when carrying such objects.
15. When you are heating a test tube, always slant it so the mouth points away from you and others.

Safety for Animal Dissections

16. Ensure your work area is well ventilated.
17. Always wear appropriate protective equipment for your skin, clothing, and eyes. This will prevent preservatives from harming you in any way.
18. If your scalpel blade breaks, do not replace it yourself. Your teacher will do this for you.
19. Make sure you are familiar with the proper use of all dissecting equipment. Whenever possible, use a probe or your gloved fingers to explore a specimen. Scalpels are not appropriate for this. They can damage the structures you are examining.

Laboratory Clean-up

20. Wipe up all spills immediately, and always inform your teacher. Acid or base spills on clothing or skin should be diluted and rinsed with water. Small spills of acid solutions can be neutralized with sodium hydrogen carbonate (baking soda). Small spills of basic solutions can be neutralized with sodium hydrogen sulfate or citric acid.
21. Never use your hands to pick up broken glass. Use a broom and dustpan. Dispose of broken glass and solid substances in the proper containers, as directed by your teacher.
22. Dispose of all specimens, materials, chemicals, and other wastes as instructed by your teacher. Do not dispose of materials in a sink or drain unless directed to do so.
23. Clean equipment before putting it away, according to your teacher's instructions. Turn off the water and gas. Disconnect electrical devices. Wash your hands thoroughly after all laboratory investigations.

Working with Living Organisms









24. When in the field, be careful and observant at all times to avoid injury, such as tripping, being poked by branches, etc., or coming into contact with poisonous plants.
25. On a field trip, try not to disturb the area any more than is absolutely necessary. If you must move anything, do so carefully. If you are asked to remove plant material, do so gently. Take as little as possible.
26. In the classroom, remember to treat living organisms with respect. Make sure all living organisms receive humane treatment while they are in your care. If it is possible, return living organisms to their natural environment when your work is done.
NOTE: Some schools do not permit labs that involve bacteria. Your teacher will inform you of your school board's policy in this regard.
27. When working with micro-organisms, observe your results through the clear lid of the petri dish. Do not open the cover. Make sure that you do not touch your eyes, mouth, or any other part of your face during these investigations.
28. When handling live bacterial cultures, always wear gloves and eye protection. Be careful not to spill the cultures. Wash your hands thoroughly with soap immediately after handling any bacterial culture.
29. Carefully clean and disinfect your work area after handling bacterial cultures and other living organisms.
30. Follow your teacher's instructions about disposal of your swabs, petri dishes containing your cultures, and any other disposable materials used in the lab.

31. Your teacher will autoclave cultures before discarding them, if an autoclave is available. If an autoclave is not available, the culture surface should be sprayed with a 10% solution of chlorine bleach. (Your school may have other disposal techniques.)

Safety Symbols

	Disposal Alert This symbol appears when care must be taken to dispose of materials properly.
	Biological Hazard This symbol appears when there is danger involving bacteria, fungi, or protists.
	Thermal Safety This symbol appears as a reminder to be careful when handling hot objects.
	Sharp Object Safety This symbol appears when there is danger of cuts or punctures caused by the use of sharp objects.
	Fume Safety This symbol appears when chemicals or chemical reactions could cause dangerous fumes.
	Electrical Safety This symbol appears as a reminder to be careful when using electrical equipment.
	Skin Protection Safety This symbol appears when the use of caustic chemicals might irritate the skin or when contact with micro-organisms might transmit infection.
	Clothing Protection Safety A lab apron should be worn when this symbol appears.
	Fire Safety This symbol appears as a reminder to be careful around open flames.
	Eye Safety This symbol appears when there is danger to the eyes and safety glasses should be worn.
	Poison Safety This symbol appears when poisonous substances are used.
	Chemical Safety This symbol appears when chemicals could cause burns or are poisonous if absorbed through the skin.
	Animal Safety This symbol appears when live animals are studied and the safety of the animals and the students must be ensured.

WHMIS Symbols for Hazardous Materials

 Compressed Gas	 Flammable and Combustible Material
 Oxidizing Material	 Corrosive Material
 Poisonous and Infectious Material Causing Immediate and Serious Toxic Effects	 Poisonous and Infectious Material Causing Other Toxic Effects
 Biohazardous Infectious Material	 Dangerously Reactive Material

Safety in Your Online Activities

The Internet is like any other resource you use for research—you should confirm the source of the information and the credentials of those supplying it to make sure the information is credible before you use it in your work.

Unlike other resources, however, the Internet has some unique pitfalls you should be aware of, and practices you should follow.

- It's easy to waste a lot of time following links that "look interesting" long after you've found the information you need. Take advantage of the online links provided at www.albertabiology.ca to use your Internet research time efficiently. Develop your Internet discipline early: focus on what you need to know, find it, and log off.
- Online content is constantly changing. If you find some useful information once, there's no guarantee that it will be there when you go back to look for it. You may want to print it in order to have a permanent record. Always include the source and date of the information you're saving.

- When you copy or save something from the Internet, you could be saving more than information. Be aware that information you pick up could also include hidden, malicious software code (known as "worms" or "Trojans") that could damage your system or destroy data.
- It's easy to find your way into sites that are considered to be "off limits" by teachers and parents. Why are they judged this way? They are off-limits because they contain material that is disturbing, illegal, harmful, and/or was created by exploiting others. There are rules about what is acceptable in print and on the airwaves; they apply to Internet material as well. Also be aware that these site visits can come back to "haunt" you if you pick up "cookies" (electronic tags), that identify your computer as a target for more of the same.
- *Never, ever* give out personal information online. This includes your name, your age, your gender, your email address, street address, phone number, or your picture. Protect your privacy, even if it means not registering to use a site that looks helpful. Discuss ways to use the site while protecting your privacy with your teacher. There may be a way to access it through the school or the school library.
- Report any online content or activity that you suspect is illegal to your teacher. This can include online hate, harassment, cyberstalking, cyberbullying, or attempts to lure you into a face-to-face meeting with a stranger; dangerous activities concerning terrorism or illegal weapons; or physical threats. Discuss ways to deal with such material with your teacher; report it to the Internet Supervisor at your school, and find out what the school policy is for dealing with such material.

With your teacher and fellow students, discuss ways to apply critical thinking to online research and develop safe Internet practices.



Watch for the **BiologyFile** feature in the margins of many pages. **FYI** gives you instant facts and fascinating tidbits. **Try This** challenges you to test an idea. **Web Link** connects you to the McGraw-Hill Alberta Biology web site, where you can inquire further about a topic of interest.

The variety of **Investigations** presented may be directing you to conduct an inquiry to confirm results of experiments done by others, design a procedure to conduct your own investigation, or hone your skills in decision-making by gathering data and evaluating evidence in order to make decisions and solve practical problems. **Thought Labs** guide you in analyzing data or researching information to look for patterns, form opinions, and evaluate points of view.

Check out the back of the book for **Appendices** that detail basic scientific practices and procedures—from using measurement and microscopes to a quick review of related chemistry and tips for writing Diploma Exams.

SECTION 7.1
Structures of the Respiratory System

Section Outcomes

1. Identify the main structures of the respiratory system.
2. Describe the function of the respiratory system.
3. Explain the importance of the respiratory system.

Key Terms

respiratory system
trachea
bronchi
bronchioles
alveoli
diaphragm

Figure 7.1 Shows the main structures of the respiratory system. The trachea is the windpipe, and the bronchi are the main airways that branch out from the trachea.

Investigation 7.1 Identifying Blood Cells

Objectives

1. Identify the main structures of the respiratory system.
2. Describe the function of the respiratory system.

Procedure

1. Prepare a slide of blood cells for microscopic observation.

Analysis

1. Compare the appearance of the blood cells to the structures of the respiratory system.

Conclusion

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Real-world Applications

The **Connections** feature in each chapter spotlights a specific idea, technology, or issue that touches your life. Find out, for example, how Albertans are linked to a hippopotamus population in Ghana, making money (and energy) from manure, using traditional healing technologies, and reintroducing an endangered species to its traditional homeland among the Blackfeet Nation in the United States.

The **Career Focus** at the end of each unit features an interview with someone whose work in a particular field of biology may inspire your own career aspirations. You will also find a sampling of related careers that draw upon other fields within and beyond those of biology.

Connections • Social and Environmental Contexts

Traditional Healing in Modern Times

Traditional healing practices have been used for centuries to treat various ailments. In modern times, these practices are often combined with Western medicine to provide a more holistic approach to healthcare.

Example of a traditional medicine: The use of medicinal plants to treat various ailments.

Example of a traditional practice: The use of acupuncture to relieve pain.

Example of a traditional belief: The belief that the body has a natural healing ability.

Career Focus: Ask a Research Scientist

Dr. Salim Abdou has always been interested in science as a way to solve problems. Today, he is a research scientist at the University of Alberta, where he applies scientific knowledge to solve some of the most important problems facing our society today.

Other Careers Related to Science

Environmental Biologist: Studies the interactions between living organisms and their environment.

Marine Biologist: Studies the life of organisms in the ocean.

Plant Biologist: Studies the growth and development of plants.

Microbiologist: Studies the structure and function of microorganisms.

Go Further...

1. Research the career of your interest.

2. Interview a professional in that field.

3. Write a report on your findings.

4. Present your report to the class.

Assessing Your Learning

Use the following opportunities to pause and reflect on your learning.

Figure 18.8 The circulatory system consists of the pulmonary circuit and the systemic circuit. The pulmonary circuit carries deoxygenated blood from the right ventricle to the lungs, where it is oxygenated. The systemic circuit carries oxygenated blood from the left ventricle to the rest of the body.

Figure 18.9 The pulmonary circuit and the systemic circuit are interconnected. The pulmonary circuit carries deoxygenated blood from the right ventricle to the lungs, where it is oxygenated. The systemic circuit carries oxygenated blood from the left ventricle to the rest of the body.

Figure 18.10 The pulmonary circuit and the systemic circuit are interconnected. The pulmonary circuit carries deoxygenated blood from the right ventricle to the lungs, where it is oxygenated. The systemic circuit carries oxygenated blood from the left ventricle to the rest of the body.

- **Questions for Comprehension** (“Q questions”) check basic understanding of concepts.

Section 22 Summary

The circulatory system, the diaphragm and rib cage, and the respiratory system are all involved in the exchange of gases between the atmosphere and the body.

Section 22 Practice

1. Explain how the respiratory system can exchange O_2 and CO_2 between the atmosphere and the body.
2. Describe the role of the diaphragm in inhalation and exhalation.
3. Use the following diagram to explain the mechanism of breathing.

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- **The Section Summary lists** key points.
- **The Section Review** helps you gauge your understanding of essential knowledge and applications.

Sample Problems

Human Blood Types

Problem

If a man has type B blood and a woman has type B blood, what possible blood types could their children have? If a woman has type A blood and a man has type B blood, what possible blood types could their children have?

What is Required?

Possible blood types of children. Punnett squares for each cross.

What to Do

1. Determine the possible genotypes of the man and woman.

2. Determine the possible genotypes of the man and woman.

3. Determine the possible genotypes of the man and woman.

4. Determine the possible genotypes of the man and woman.

Practice Problems

1. A man has type B blood and a woman has type B blood. What possible blood types could their children have?
2. A woman has type A blood and a man has type B blood. What possible blood types could their children have?
3. A man has type B blood and a woman has type B blood. What possible blood types could their children have?
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9. A man has type B blood and a woman has type B blood. What possible blood types could their children have?
10. A woman has type A blood and a man has type B blood. What possible blood types could their children have?

- **Sample Problems** model techniques related to your study of genetics, and **Practice Problems** provide opportunities for you to develop and assess your ability to solve these problems.

Chapter 11

The nervous system plays a key role in maintaining homeostasis in the body. The function of the nervous system is to receive information from the environment and to coordinate the body's response to that information.

Chapter 11 Graphic Organizer

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- **The Chapter Summary and Chapter Review** broaden your focus and encourage you to apply your knowledge to different situations and contexts.

UNIT 7

Understanding Concepts

1. Explain the structure of the DNA double helix.
2. Describe the structure of the DNA double helix.
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- **The Unit Review** enables you to reflect on, consolidate, and apply your learning of the entire unit.

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Inquiring Further at *Inquiry into Biology Online*

In addition to the Unit Prequizzes and Web Links, *Inquiry into Biology Online* at www.albertabiology.ca highlights and reinforces key points from each chapter. The Electronic Study Partner aids and reinforces your understanding of key concepts and skills. Your web resource is also packed with study tips, strategies, research tools, and opportunities to extend your learning in many new directions

