

Life Is a Gift



A Manitoba Grade 11 Biology Resource for
Organ Donation and Transplantation



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This resource is also available on the Manitoba Education and Transplant
Manitoba websites at
<www.edu.gov.mb.ca/k12/cur/science/index.html> and
<www.transplantmanitoba.ca>.

Acknowledgements

Life Is a Gift: A Manitoba Grade 11 Biology Resource for Organ Donation and Transplantation is intended to provide a unique context and focus to students in achieving the learning outcomes in the Manitoba Grade 11 Biology curriculum at a time when the need for organ donor awareness is becoming an area of importance in public health. It provides an opportunity for teachers and students alike to examine in detail the issues surrounding organ donation and transplantation and make connections to the improvement of the health and well-being of the people of Manitoba.

Some topics in this document may be potentially sensitive to some students and their parents/families and/or communities. This sensitivity may be based on personal, family, religious, and/or cultural values and experiences.

The Transplant Manitoba—Gift of Life Program and Manitoba Education gratefully acknowledge the contributions of the following individuals in the development of *Life Is a Gift: A Manitoba Grade 11 Biology Resource for Organ Donation and Transplantation*.

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September 2010

To: Teachers

It is with great pride that I announce the publication of *Life Is a Gift: A Manitoba Grade 11 Biology Resource for Organ Donation and Transplantation* to support the teaching and learning experiences of your students. This is an important and timely resource that serves to contextualize your teaching approaches to human biology at a time when the need for transplantable organs and donor awareness are on the increase. Through making direct connections to Manitoba biology curriculum, *Life Is a Gift* explores organ donation, transplantation and the importance of maintaining the health of critical body systems. The development of this teacher resource constitutes the fruits of a long-standing and successful collaboration between Transplant Manitoba and Manitoba Education.

As your students have reached advanced study in the sciences, perhaps considering a career in the health sciences, they are at the same time firming up their personal decision making about adopting lifestyle choices that can contribute to an active, healthy future. Though great progress is being made in areas such as early detection of organ failure and the implementation of prevention strategies, there is still an expectation that many Canadians will come to know someone who needs a new organ through transplant in order to save a life. Education in science and increased understanding of the issues surrounding donation and transplantation can be keys to appreciating more fully the impact that a single donor can have on the lives of individuals.

Manitobans often engage in inspiring acts of giving the gift of an organ to a patient, and we believe that a sound science education in this area contributes to wider understanding of the complexities of this medical field. Our partnership with Transplant Manitoba demonstrates a commitment to relevant, high-impact science education here in Manitoba. My hope is that this new resource will improve students' awareness of the particular needs in our healthcare system, invite consideration to becoming a donor, and increase their technical knowledge in applying biological science to vital human needs.

Sincerely,

Nancy Allan



In the late 1990s, Transplant Manitoba partnered with Manitoba Education to undertake development and production of its first resource kit for Senior 3 Biology teachers and students in Manitoba. *Organ and Tissue Donation: A Fact of Life* was delivered to all schools throughout the system in 2001.

Today, we are just as eager to present you with this completely revised learning resource kit, *Life Is a Gift: A Manitoba Grade 11 Biology Resource for Organ Donation and Transplantation*.

This important and timely work has happened through the dedication and hard work of one of our own Manitoba biology teachers—Tara Shepherd of John Taylor Collegiate in Winnipeg. To say Tara was a tireless worker would be an understatement given the time and commitment she made to this project. Tara also organized a contest with students at her school to help us provide a name for this valuable resource. A Grade 11 student from John Taylor—Garrett Armstrong—penned the new name for the document and was rewarded for his creative efforts with a special gift!

I would also like to acknowledge, with special thanks, science consultant John Murray from Manitoba Education for believing in the value of this work and the ongoing support required to make this project a success.

As with many organizations involved in health care, we rely on the financial support of many organizations to help us take our projects from just another great idea to a professionally finished product. In that spirit of cooperation, the printing costs of this document have been generously sponsored by Hoffmann-La Roche.

I know that you will find *Life Is a Gift* a useful resource for incorporating current issues and the science surrounding organ donation with Manitoba's Grade 11 Biology curriculum. May it be a stimulating and rewarding addition to learning and teaching.

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Introduction

THE ISSUES SURROUNDING ORGAN AND TISSUE DONATION AND TRANSPLANTATION ARE NOT UNIQUE TO the science education system in Manitoba, but they do constitute a notably humanistic orientation to the biology curriculum. Engaging the learner in this area will require sensitivity and sound judgment on the part of teachers, and will strongly reflect local experiences and cause embedded personal convictions to surface. Nevertheless, biology teachers have already spent many years incorporating aspects of organ donation into their regular instruction. Some do so precisely because of the prospect that they—or their students—will be directly touched in some manner by the people and processes involved. There can be a variety of reasons for contextually addressing biology curriculum strands through such a complementary and relevant lens as this one. It is the hope of those who have been involved in the development of *Life Is a Gift: A Manitoba Grade 11 Biology Resource for Organ Donation and Transplantation* that fruitful and lasting connections are made between the curriculum and the remarkable human achievements that come about through continued health care research and practices.

This resource follows the Manitoba Grade 11 Biology curriculum in a sequence that provides teachers with the opportunity to insert organ donation/transplantation aspects into key sections of their overall course. Each of the six units of the biology course—Wellness and Homeostasis, Digestion and Nutrition, Transportation and Respiration, Excretion and Waste Management, Protection and Control, and Wellness and Homeostatic Changes—are represented by student learning activities that are field tested and correlated to both the skills and content learning outcomes. In addition, teachers are provided connections that support alternative and differentiated instructional practices as recommended by the *Senior Years Science Teachers' Handbook: A Resource for Teachers* published by Manitoba Education. We hope that you and your students have ample opportunity to explore the fascinating technological advancements and complex ethical issues that make organ donation and transplantation an ideal context in which to examine human biological systems.

Specific Learning Outcomes



Activities can be used in the progression shown or as stand-alone lessons. It is not necessary to use all the lessons or materials provided.

Note: Learning outcome connections listed in lessons are the closest match between the lesson content and the curriculum, but other connections can also be made as indicated in this chart.

Life Is a Gift—Correlation to Manitoba Grade 11 Biology Curriculum

	Lessons in <i>Life Is a Gift</i>	Organs and Tissues Available for Transplant	Liver Transplant	Giving the Breath of Life	Operation Heart Transplant	Kidney Dilemma	Organ Transplant Rejection	Organ Donation in Relation to Society
Unit 1: Wellness and Homeostasis	B11-1-03 Recognize how individual wellness choices affect others.	✓	✓		✓			
	B11-1-06 Identify life processes that individual cells, as well as complex organisms, need to manage.						✓	
	B11-1-07 Explain how cell membranes regulate movement of materials into and out of cells and recognize the importance of this regulation in managing life processes and maintaining homeostasis.						✓	
Unit 2: Digestion and Nutrition	B11-2-01 Identify major structures and functions of the human digestive system from a diagram, model, or specimen.	✓	✓					
	B11-2-07 Describe the homeostatic role of the liver with respect to the regulation of nutrient levels in the blood and nutrient storage.		✓					
	B11-2-011 Investigate and describe conditions/disorders that affect the digestive process.		✓					
	B11-2-12 Use the decision-making process to investigate an issue related to digestion and nutrition.		✓	✓				

	Lessons in <i>Life Is a Gift</i>	Organs and Tissues Available for Transplant	Liver Transplant	Giving the Breath of Life	Operation Heart Transplant	Kidney Dilemma	Organ Transplant Rejection	Organ Donation in Relation to Society
Unit 3: Transportation and Respiration	B11-3-01 Design and execute an experiment to investigate an aspect of the transportation or respiratory system.			✓				
	B11-3-02 Compare the characteristics of blood components in terms of appearance, origin, numbers, relative size, and function in the body.						✓	
	B11-3-03 Compare and contrast the characteristics of different blood groups.			✓				
	B11-3-04 Predict the physiological consequences of blood transfusions involving different blood groups.	✓		✓				
	B11-3-05 Describe the blood donation process and investigate related issues.	✓		✓				
	B11-3-08 Describe the cardiac cycle.					✓		
	B11-3-14 Identify major structures and functions of the human respiratory system from a diagram, model, or specimen.	✓		✓		✓		✓
	B11-3-15 Describe how breathing is controlled to help maintain homeostasis in the human body.				✓			
	B11-3-16 Investigate and describe conditions/disorders associated with transportation and/or respiration in the human body.				✓			

	Lessons in Life Is a Gift	Organs and Tissues Available for Transplant	Liver Transplant	Giving the Breath of Life	Operation Heart Transplant	Kidney Dilemma	Organ Transplant Rejection	Organ Donation in Relation to Society
Unit 4: Excretion and Waste Management	B11-4-02 Describe the roles of the major excretory structures in eliminating wastes and helping the body maintain homeostasis.					✓		
	B11-4-04 Identify structures of the human urinary system from a diagram, model, or specimen, and describe the function of each.	✓				✓		✓
	B11-4-05 Explain the processes of filtration, reabsorption, and secretion in the nephron.					✓		
	B11-4-07 Describe what types of information can be gained through urinalysis.	✓						✓
	B11-4-08 Investigate and describe issues related to kidney failure and treatment options available.	✓	✓				✓	
Unit 5: Protection and Control	B11-5-01 Describe the body's defence mechanisms for protection from foreign agents. Include: non-specific and specific defences		✓				✓	
	B11-5-02 Describe the body's response to allergens, vaccines, viruses/bacteria. Include: inflammatory response and immune response	✓		✓			✓	✓
	B11-5-04 Investigate issues related to the immune system and the protection of public health.	✓	✓	✓			✓	✓
	B11-6-03 Recognize the difficulties faced in defining "death" and identify some of the different definitions in use today.		✓			✓		✓
Unit 6: Wellness and Homeostatic Changes	B11-6-04 Identify and analyze social issues related to the process of dying.							✓
	B11-6-05 Describe how technology has allowed us to control our wellness, and describe the ethical dilemmas that use of technology can create.	✓			✓			✓

Lessons in Life Is a Gift		Organs and Tissues Available for Transplant	Liver Transplant	Giving the Breath of Life	Operation Heart Transplant	Kidney Dilemma	Organ Transplant Rejection	Organ Donation in Relation to Society	
Cluster 0 Biology: Skills and Attitudes	Demonstrating Understanding	B11-0-U1 Use appropriate strategies and skills to develop an understanding of biological concepts.	✓		✓	✓			
		B11-0-U2 Demonstrate an in-depth understanding of biological concepts.	✓	✓	✓	✓	✓	✓	
	Personal Perspectives/ Reflection	B11-0-P1 Demonstrate confidence in their ability to carry out investigations.			✓			✓	
		B11-0-P2 Demonstrate a willingness to reflect on personal wellness.			✓				
		B11-0-P3 Appreciate the impact of personal lifestyle choices on general health and make decisions that support a healthy lifestyle.			✓		✓		
Scientific Inquiry	B11-0-P4 Demonstrate an understanding of, and respect for, a diversity of cultural perspectives and approaches to maintaining health and treating illness.	✓		✓				✓	
	B11-0-S1 State a testable hypothesis or prediction based on background knowledge or on observed events.			✓					
	B11-0-S2 Plan an experiment to answer a specific scientific question. Include: materials, independent, dependent and controlled variables, methods, and safety considerations			✓	✓				
	B11-0-S5 Demonstrate sensitivity toward, and respect for, living and non-living tissues, specimens, and organisms utilized for biological research.			✓				✓	

Cluster 0 Biology: Skills and Attitudes		Lessons in <i>Life Is a Gift</i>	Organs and Tissues Available for Transplant	Liver Transplant	Giving the Breath of Life	Operation Heart Transplant	Kidney Dilemma	Organ Transplant Rejection	Organ Donation in Relation to Society
Scientific Inquiry (continued)	B11-0-S6 Make detailed observations and/or collect data; organize and display this information using an appropriate format. Include: biological drawings							✓	
	B11-0-S7 Evaluate the relevance, reliability, and adequacy of data and data collection methods. Include: discrepancies in data and sources of error	✓							
Decision Making	B11-0-S8 Analyze data and/or observations in order to identify patterns or draw conclusions.	✓						✓	
	B11-0-D1 Identify and explore a current issue.	✓	✓	✓			✓	✓	✓
	B11-0-D2 Evaluate implications of possible alternatives or positions related to an issue.	✓	✓	✓			✓		✓
	B11-0-D3 Recognize that decisions reflect values and consider personal values and those of others when making a decision.	✓	✓	✓			✓		✓
	B11-0-D4 Recommend an alternative or identify a position, and provide justification.			✓				✓	
	B11-0-D5 Propose a course of action related to an issue.				✓				
	B11-0-D6 Evaluate the process used by self or others to arrive at a decision.				✓				

Biology: Skills and Attitudes		Lessons in Life Is a Gift	Organs and Tissues Available for Transplant	Liver Transplant	Giving the Breath of Life	Operation Heart Transplant	Kidney Dilemma	Organ Transplant Rejection	Organ Donation in Relation to Society
Information Management and Communication	B11-0-11 Synthesize information obtained from a variety of sources. Include: print and electronic sources, resource people, personal observations	✓	✓				✓		✓
	B11-0-12 Evaluate the quality of sources of information, as well as the information itself.						✓		✓
	B11-0-13 Quote from or refer to sources as required, and reference sources according to accepted practice.						✓		
	B11-0-14 Communicate information in a variety of forms appropriate to the audience, purpose, and context.						✓		✓
Group Work	B11-0-G1 Collaborate with others to achieve group goals and responsibilities.	✓			✓		✓	✓	✓
	B11-0-G2 Elicit, clarify, and respond to questions, ideas, and diverse points of view in discussions.	✓			✓		✓		✓
	B11-0-G3 Evaluate individual and group processes used.				✓		✓		
Working in Science	B11-0-W1 Demonstrate a continuing, increasingly informed interest in biology and biology-related careers and issues.	✓						✓	✓
	B11-0-W2 Appreciate the contributions of scientists, including Canadians, to the field of human biology.	✓							✓



Connections to Curriculum

- ✓ Personal Perspectives/ Reflection
- ✓ Decision Making
- ✓ Working in Science
- ✓ B11-1-03 Recognize how individual wellness choices affect others.

Senior Years Science Teachers' Handbook

Chapter 9: Tapping into Prior Knowledge

- ✓ 9.20 Anticipation Guide and 9.26 (Attachment 9.3)

Unit 1

Wellness and Homeostasis

Organs and Tissues Available for Transplant Lesson Plan

Objectives

Students will

- reflect on personal views of organ donation and transplantation
- identify which organs are transplantable
- appreciate the process of transplantation and its importance in society
- recognize how personal life choices may help others

Materials

- small pieces of scrap paper (one per student)
- copies of Who Donates Organs and Tissues for Transplant? Anticipation Guide (BLM 1.1) (one per student)
- copies of Organs and Tissues Available for Transplant (BLM 1.2) (one per student)
- computer, Internet, projector access (for multimedia presentation)
- the Transplant Manitoba Gift of Life multimedia presentation available online at <www.transplantmanitoba.ca>.

Anticipatory Set

1. Explain the connection between personal choices and organ transplantation in society. Depending on the life experiences and composition of the class, perhaps ask students if they have any personal/family experience with organ transplantation.
2. Distribute a small piece of scrap paper to each student. Ask students to write down one question/comment they have about the process or idea of organ transplantation. Pass the papers forward for the teacher to read aloud to the class. Questions do not have to be answered or discussed—hearing questions from classmates may provoke thought in students.

(continued)

Lesson

1. Hand out Who Donates Organs and Tissues for Transplant? Anticipation Guide (BLM 1.1) to students. Read statements aloud with the class and instruct students to briefly summarize their thoughts on the statements on the line provided.
2. Lead students through the Transplant Manitoba Gift of Life multimedia presentation. Provide ample opportunities for pause, reflective discussion, or commentary.
3. Revisit the anticipation guide with students to reflect on whether or not their ideas have changed. Ask students to fill in the remaining spaces on the anticipation guide.

Assessment/Closure

1. Distribute the Organ and Tissues Available for Transplant (BLM 1.2) on page 15 that illustrates which organs/tissues are transplantable. In groups, individually, or as a take-home assignment, students identify the body parts based on the descriptors provided.

Who Donates Organs and Tissues for Transplant? Anticipation Guide

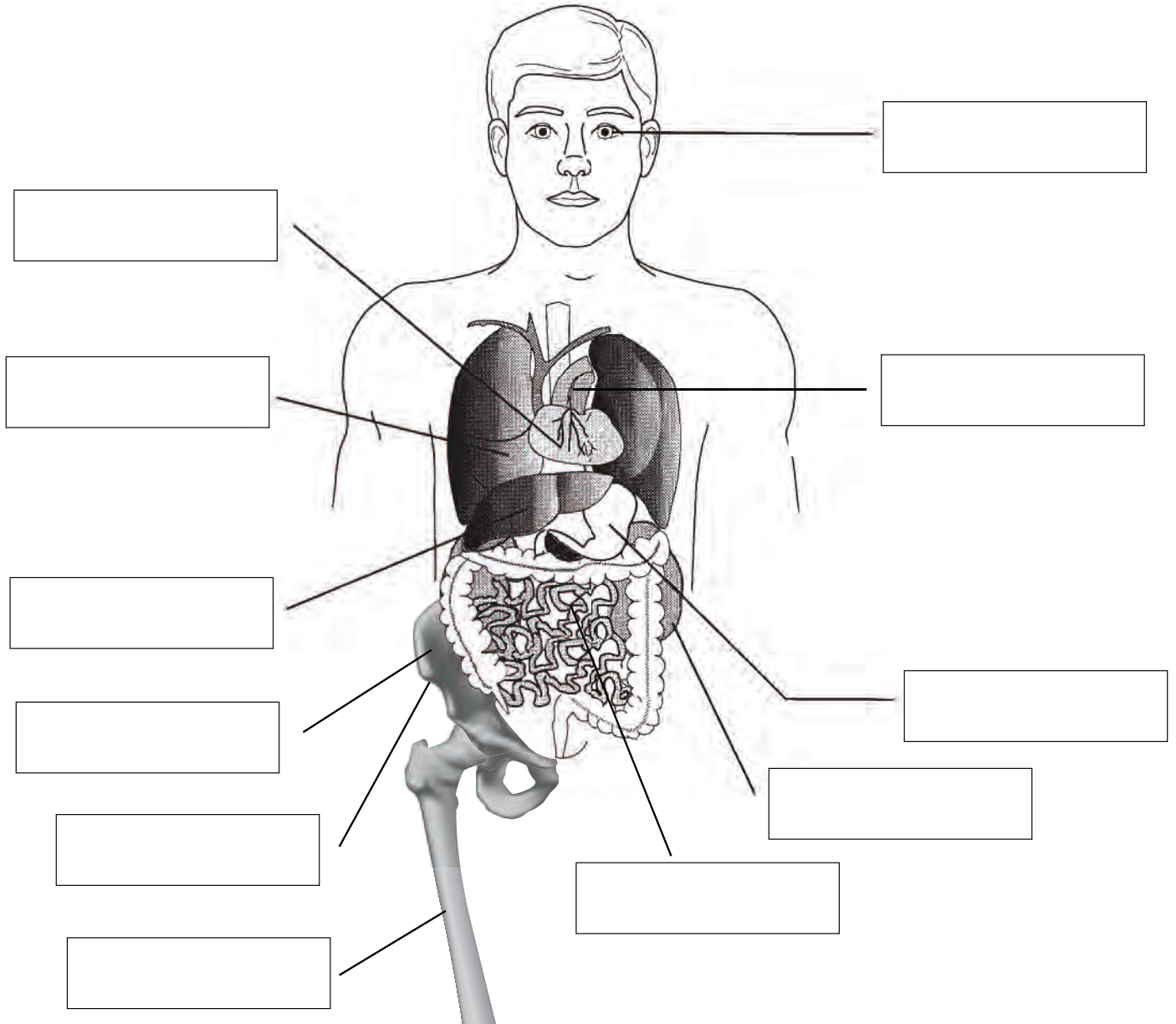
Consider the following statements. Do you agree or disagree with each? Record your initial reactions based on your first impressions of the topic. Revisit the statements at the end of the lesson and note any changes.

Statement	Reaction
<p>People over the age of 65 can no longer donate organs for transplant use.</p>	<p>Initial: _____ After: _____ Reason for change: _____</p>
<p>If you decide to donate organs/tissues for transplant, all you have to do is sign an organ donor card.</p>	<p>Initial: _____ After: _____ Reason for change: _____</p>
<p>Most cultures and religious traditions do not support the use of organs/tissues for transplant purposes.</p>	<p>Initial: _____ After: _____ Reason for change: _____</p>
<p>Organs and tissues used for transplant purposes come only from the recently deceased and with an otherwise clean bill of health.</p>	<p>Initial: _____ After: _____ Reason for change: _____</p>
<p>Although most people would agree to do so, donations of a lobe of a lung or kidney between living, related individuals is not permitted.</p>	<p>Initial: _____ After: _____ Reason for change: _____</p>

Name: _____

Organs and Tissues Available for Transplant

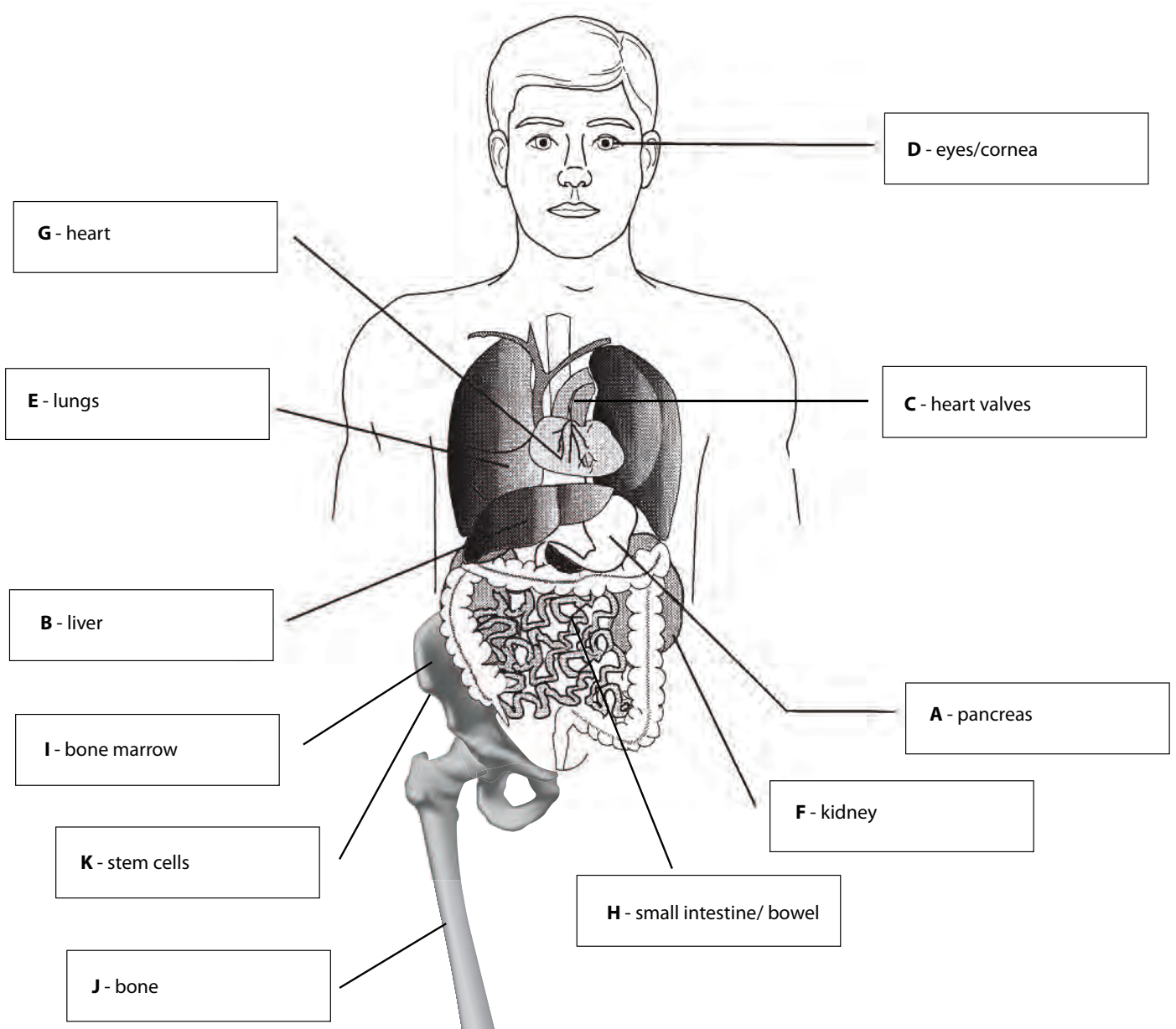
Place the letter corresponding to each statement on the following page beside the correct organ/tissue on the diagram below. Once completed, record the name of the organ/tissue in the space provided.



- A** 1966—The first transplant of this organ took place. The recipient was a 28-year-old who suffered from hyperglycemia, and 2005 was the year that the cells from this organ were transplanted from a **living donor** in Kyoto, Japan. The cells began producing insulin within minutes of the transplant.
- B** This organ had the highest number of patients on a waiting list in 2006.
- C** This tissue type may be replaced with synthetic structures or structures from animals (e.g., pigs).
- D** There is an over 90 percent success rate in transplants involving this structure.
- E** Either one **or** two of these organs may be transplanted, **and** donations come from mostly deceased (non-living) donors rather than living donors.
- F** This organ had the highest number of transplants performed in Canada in 2008.
- G** During this transplant procedure, a bypass machine is used to pump blood to the rest of the body.
- H** This is the largest of all structures to be fully transplanted (cm³).
- I** Patients with abnormal red blood cell production or specific forms of cancer (such as leukemia) may require a transplant of this tissue.
- J** 1668—The first documented *xenotransplant* (transplants between humans and other animals) took place. Doctors used portions of a dog's skull and grafted it onto a human's cranium.
- K** Transplant of "liquid" tissues (not solid, such as the liver) is done in an effort to replace unhealthy cells with healthy cells.

Organs and Tissues Available for Transplant

Place the letter corresponding to each statement on the following page beside the correct organ/tissue on the diagram below. Once completed, record the name of the organ/tissue in the space provided.



- A** 1966—The first transplant of this organ took place. The recipient was a 28-year-old who suffered from hyperglycemia, and 2005 was the year that the cells from this organ were transplanted from a **living donor** in Kyoto, Japan. The cells began producing insulin within minutes of the transplant.
- B** This organ had the highest number of patients on a waiting list in 2006.
- C** This tissue type may be replaced with synthetic structures or structures from animals (e.g., pigs).
- D** There is an over 90 percent success rate in transplants involving this structure.
- E** Either one **or** two of these organs may be transplanted, **and** donations come from mostly deceased (non-living) donors rather than living donors.
- F** This organ had the highest number of transplants performed in Canada in 2008.
- G** During this transplant procedure, a bypass machine is used to pump blood to the rest of the body.
- H** This is the largest of all structures to be fully transplanted (cm³).
- I** Patients with abnormal red blood cell production or specific forms of cancer (such as leukemia) may require a transplant of this tissue.
- J** 1668—The first documented *xenotransplant* (transplants between humans and other animals) took place. Doctors used portions of a dog's skull and grafted it onto a human's cranium.
- K** Transplant of "liquid" tissues (not solid, such as the liver) is done in an effort to replace unhealthy cells with healthy cells.



Connections to Curriculum

- ✓ Demonstrate Understanding
- ✓ Decision Making
- ✓ Group Work
- ✓ Information Management
- ✓ B11-2-07 Describe the homeostatic role of the liver with respect to the regulation of nutrient levels in the blood and nutrient storage.
- ✓ B11-2-12 Use the decision-making process to investigate an issue related to digestion and nutrition.

Senior Years Science Teachers' Handbook

- Chapter 12: Reading Scientific Information
- ✓ 12.9 During Reading Strategies
 - ✓ 12.12 Collaborative Reading
 - ✓ 12.14 Reciprocal Teaching
 - ✓ 12.22 Question-Answer Relationships (QAR)

Unit 2

Digestion and Nutrition

Liver Transplant Lesson Plan

Objectives

Students will

- review functions of the liver
- organize information from a written source
- evaluate situations where an organ transplant is necessary and make decisions as to who will receive the organ

Materials

- Liver Transplant: Prereading Questions (BLM 2.1) (one per student)
- Wanted: Liver: Case Study of the Necessity for Liver Allocation (BLM 2.2) (one per student)
- Liver Transplant: Post-reading Analysis (BLM 2.3) (one per student)

Note: This case study is recommended as reinforcement to SLO B11-2-07, while at the same time making information applicable to a real world setting of organ transplantation.

Anticipatory Set

1. Hand out the Liver Transplant: Prereading Questions (BLM 2.1) and ask students to review the functions of the liver and label the diagram provided.

Lesson

1. Hand out Wanted: Liver: Case Study of the Necessity for Liver Allocation (BLM 2.2) to the class. Read the studies aloud one at a time, or have students read the case studies aloud, one paragraph at a time.
2. Ask students to organize the information from the case study by filling out the Liver Transplant: A Post-reading Analysis form (BLM 2.3).
3. Have students reflect on the information provided by answering the discussion questions, individually at first.

(continued)

Assessment/Closure

1. To facilitate group discussion, divide class into groups (after written answers have been completed in class or at home) and assign each group a question to discuss. Each group comes to a group consensus, records their response on chart paper, and presents it to class.
2. To aid discussion, have six groups in the class, two groups per discussion question. When presenting group answers, have both groups present answers at the same time, and ask the class to describe discrepancies in the answers provided.

Liver Transplant: Prereading Questions

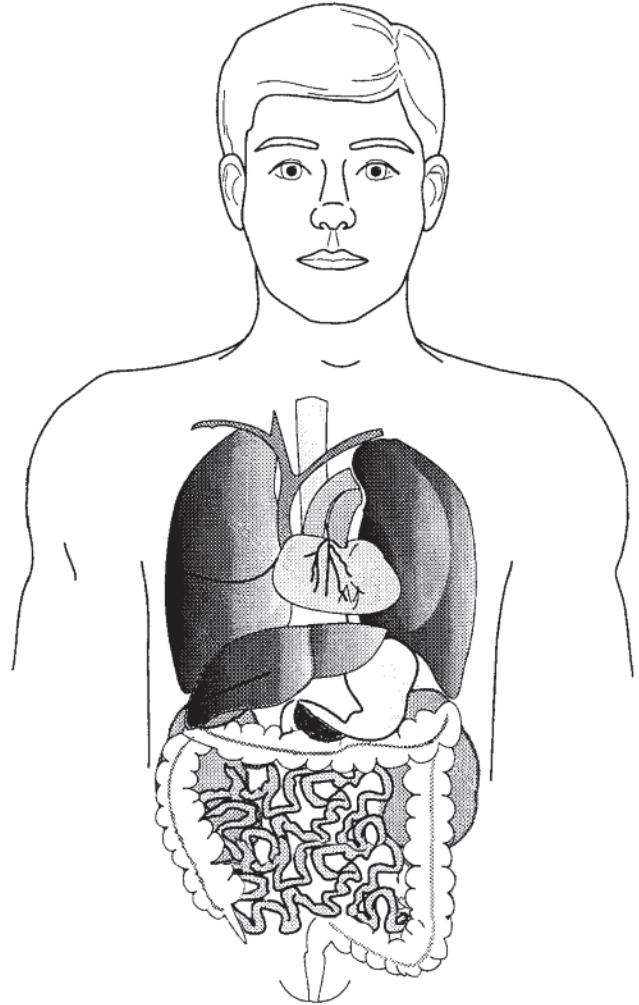
1. Identify and label the liver on the diagram to the right.
2. List four discrete and independent functions of the liver.

- _____

- _____

- _____

- _____



3. Explain how the liver is involved in the regulation of blood glucose levels after a meal high in carbohydrates is consumed. You may use a negative feedback cycle in your answer.

4. What factors must be considered before a patient can be considered for a liver transplant?

5. a. Can liver transplant recipients receive donations from live donors? Explain.

- b. Would your answer in (a) above change if the recipient required a heart from a live donor rather than a liver? Explain.

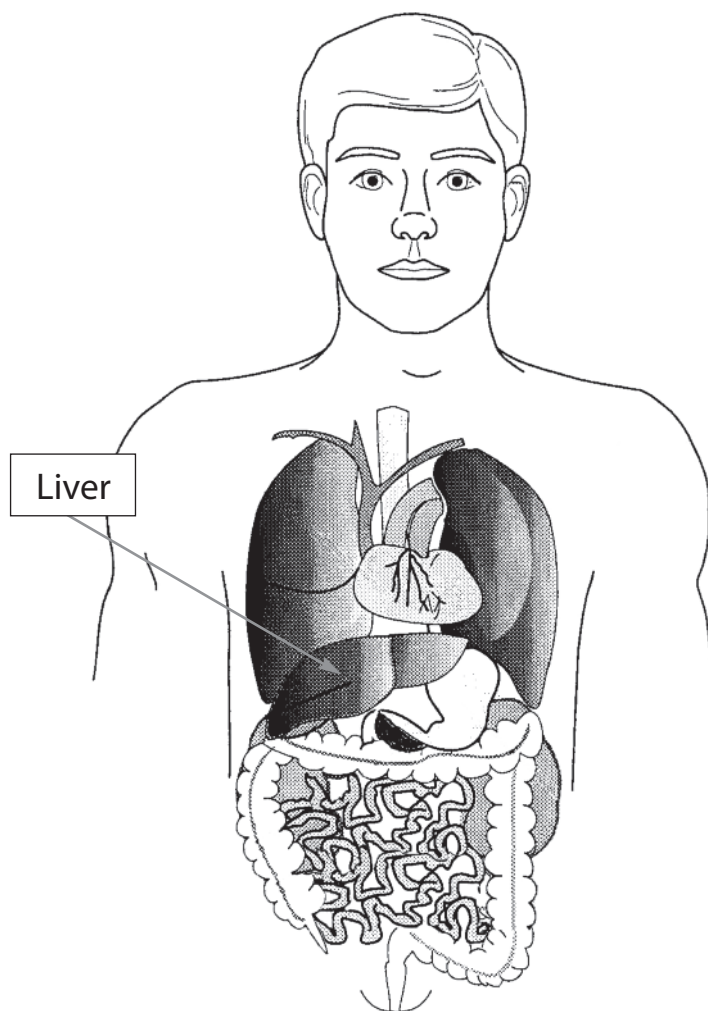
Read the case study provided.

Teacher Note:

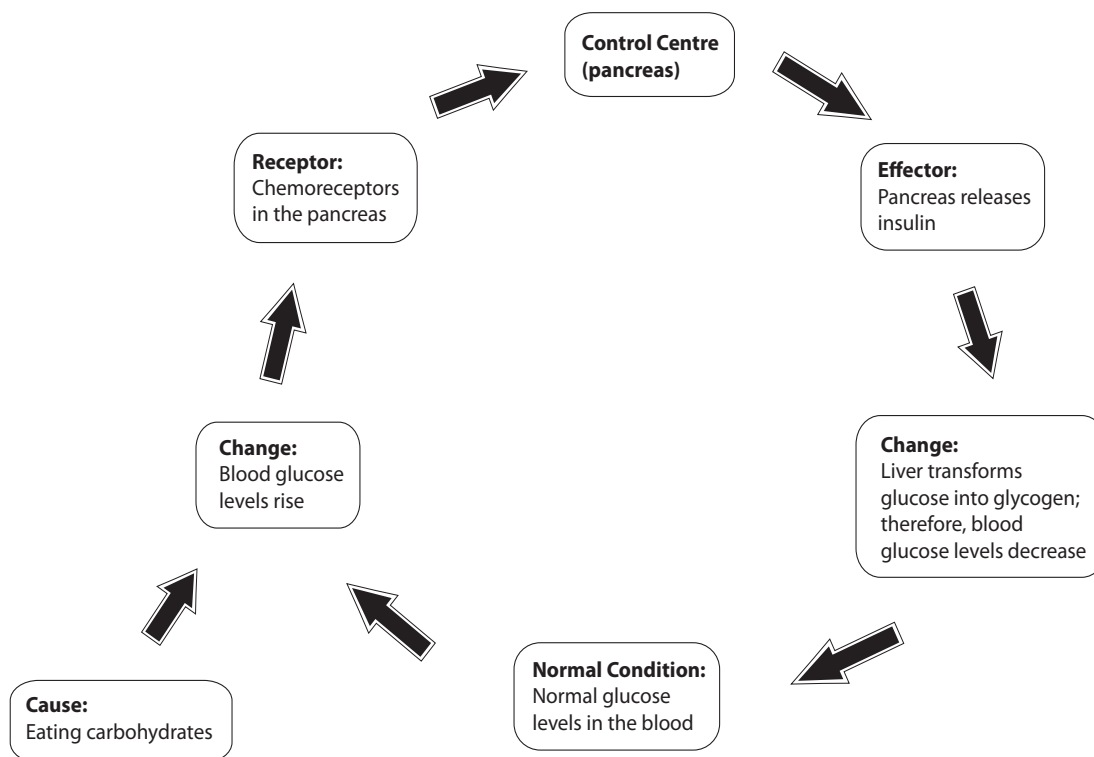
It is recommended that students have satisfactorily achieved Specific Learning Outcome B11-2-07 and have acquired the information cited in Appendix 2.4A of the Grade 11 Biology curriculum document.

Liver Transplant: Prereading Questions

1. Identify and label the liver on the diagram to the right.
2. List four discrete and independent functions of the liver.
 - **stores and releases nutrients and vitamins**
 - **manufactures bile**
 - **aids in blood sugar regulation**
 - **detoxifies blood**



3. Explain how the liver is involved in the regulation of blood glucose levels after a meal high in carbohydrates is consumed. You may use a negative feedback cycle in your answer.



4. What factors must be considered before a patient can be considered for a liver transplant?
- **patient condition (overall health, location in proximity to available organ)**
 - **donor/organ condition (is the liver in overall good health?)**
 - **patient/donor compatibility (blood tests, HLA matches, etc.)**
5. a. Can liver transplant recipients receive donations from live donors? Explain.

Yes, the liver is the only human organ that regenerates. As long as the patient and donor are “matches,” the donor can give a portion of his/her liver (a portion of a lobe) and the portion will not only regenerate in the donor but also continue to generate in the recipient.

- b. Would your answer in (a) above change if the recipient required a heart from a live donor rather than a liver? Explain.

Yes. A person cannot donate a portion of their heart while they are alive. An individual requires their whole heart to live. The heart does not regenerate.

Read the case study provided.

WANTED: Liver

Case Study of the Necessity for Liver Allocation

Case #1: Justin's Story:

Justin was a healthy 18-year-old male. He graduated from high school the previous June and spent the summer working at his part-time job in a local hardware store and spending time with friends, camping. On his camping trips, Justin and his friends would relax and relive their high school memories, occasionally with some alcohol on hand. He maintains that he has never drunk to excess. On one certain camping trip, a friend offered the drug ecstasy to the group. Justin, who admittedly tried marijuana recreationally, had never tried ecstasy and joined in with his friends in trying the drug. Over the course of time while on the drug, Justin became extremely overheated, sweated profusely between momentary instances of chills, and became very thirsty. In the morning, Justin had a huge headache and found that his body craved liquid, so he drank water continuously. Everyone's metabolism is different and their bodies treat the drug in a different manner, but in Justin's case, his reaction was typical among his friends.

Justin still lived with his parents, with whom he had a good relationship; however, on his return home he did not mention his experience with the drug while on the camping trip. His attentive mother and father noted that Justin was extremely exhausted after his weekend trip and allowed him to rest upon his return and provided him with lots of water. A few days later, both Justin and his family forgot about the weekend camping trip.

A few weeks went by and Justin began technical college studying the electrical trade. He enjoyed his studies, and was making new friends in his new school. Justin continued working his part-time job.

Halloween approached, and Justin was invited to a Halloween social with friends and acquaintances from school. At the social, someone Justin did not know offered ecstasy to the group Justin was standing among. Everyone grabbed a tablet, including Justin.

Justin's reaction to the drug in this instance was much the same as his first exposure—at first. The next day, he found himself tired and thirsty again, and treated his symptoms much the same, but two weeks later his health took a much different turn.

Justin's parents noticed that his skin and the whites of his eyes had a slight yellow tinge, and Justin was complaining of a fever. When he was a baby, Justin was afflicted with similar symptoms, as are many infants. Justin's mother immediately recognized this as being jaundice and remembered the doctor explaining that Justin's liver was failing to process a chemical component of bile (a green-yellow liquid used in the physical digestion of fat) called bilirubin. Bilirubin is made from the breakdown of red blood cells—a process known as hemolysis which occurs in the liver. The bilirubin is what gives bile the green-yellow colour, and since it was not being transferred to bile in the liver, it was instead becoming trapped in the fatty tissue layers in Justin's skin, causing his skin to appear yellow.

Justin's mother took him to the hospital to have this condition treated, although she did not realize that this time, the jaundice was much more serious than when he was a baby. Justin's skin continued to yellow and his fever continued to rise. Within hours of being at the hospital, Justin slipped into a coma and had to be admitted to the intensive care unit as a priority.

His liver was beginning to fail completely; jaundice was merely an early warning sign. Toxicology reports showed that this was due to an adverse reaction to the drug ecstasy. Doctors explained to his parents that reactions to the drug may not appear immediately after consumption. Justin's parents assumed that the drug must have been ingested at the Halloween social their son attended two weeks prior. They then deduced that he must have also consumed it over the summer as well, based on common symptoms. Doctors explained that because drugs come from different sources, they may have different ingredients—ingredients that Justin's body may or may not be able to metabolize. The second dosage of the drug could not be processed by Justin's liver, and caused this vital organ to enter into failure.

Soon after, Justin was transferred via air ambulance to the local transplant centre where his condition continued to deteriorate. His parents accompanied him. One day after his arrival at the centre, Justin's parents were informed that the only treatment that could save Justin's life was a liver transplant. Justin was in dire need of a new liver.

Case #2: Michelle's Story

Michelle is a 32-year-old single mother with a young child and has a history of liver problems that began shortly after Michelle received a blood transfusion 17 years prior, when she was 15 years old. Michelle needed the transfusion following a car accident in which she suffered numerous injuries. After suffering from nausea and fatigue for quite some time, she began to lose a lot of weight and developed pain over the right side of her abdomen. When she was 20 years old, Michelle was diagnosed with hepatitis C, a blood-borne disease that doctors traced back to her blood transfusion years earlier.

As a result of being diagnosed with hepatitis C, Michelle immediately stopped consuming alcohol in an effort to not put excess stress on her liver. She has been alcohol-free for 12 years and has never used intravenous drugs (even though her ex-husband and father of her child is in jail for trafficking narcotics) but admits to using marijuana in her youth.

Michelle's disease is progressing and she is beginning to show the early signs of jaundice—her skin is beginning to turn a slightly yellow colour, a indication of liver failure. Even though Michelle is extremely slim, her belly is beginning to distend (swell). Doctors have told her that this is a sign of cirrhosis of the liver. Michelle knew that cirrhosis was a disease typically associated with alcoholism, but doctors explained that it's linked to hepatitis in that healthy liver tissue is replaced with non-functioning scar tissue causing the body to react by developing, among other things, jaundice, distension of the abdomen, fatigue, and lethargy.

Michelle lives in the same city as her parents, her older brother and his family. Due to her ex-husband's incarceration, Michelle has sole custody of her six-year-old daughter, and they live in a townhouse, supported by a government disabilities pension.

Due to the serious and rapid deterioration of her liver, Michelle has been placed on a liver transplant waiting list. She is anxious to receive a new liver and continue to raise her young child. Michelle's long-term goal, when she is healthy enough, is to return to school and become a lawyer. Michelle's daughter does not realize the gravity of her mother's health condition, but often questions who will look after her "when mommy goes away."

Michelle was looking forward to getting on with her new life. However, her disease progressed to the point of her requiring hospitalization. Her parents began looking after her daughter. After a week, Michelle rose to the top of the liver transplant waiting list and was to receive the next available and suitable liver. She is blood type O, which is the same blood type as Justin.

Liver Transplant: Post-reading Analysis

Case #1

Name and Age of Patient	Background Information about Patient
Cause of Liver Failure	
Symptoms of Liver Failure	
Prognosis/Treatment Options Available	

Case #2

Name and Age of Patient	Background Information about Patient
Cause of Liver Failure	
Symptoms of Liver Failure	
Prognosis/Treatment Options Available	

Discussion Questions

1. What are some of the differences between Justin's and Michelle's conditions and reasons for needing a liver transplant?

2. Assume you are the head of the transplant team that is assigned to both Justin and Michelle, who are both placed on the transplant list. On what basis would you make the decision of which person is the priority for the next liver that becomes available?

3. Using your answer to question #2, how would you explain to the other patient and his or her family why the next available liver is not going to him or her?

Liver Transplant: Post-reading Analysis

Case #1

<p>Name and Age of Patient</p> <p>Justin, 18</p>	<p>Background Information about Patient</p> <ul style="list-style-type: none"> • high school graduate • good relationships with family and friends • recreational drug use
<p>Cause of Liver Failure</p> <p>Drug use—Ectasy</p>	
<p>Symptoms of Liver Failure</p> <ul style="list-style-type: none"> <li style="width: 50%;">• tired and thirsty <li style="width: 50%;">• yellowing of eyes <li style="width: 50%;">• jaundice (yellowing of skin) <li style="width: 50%;">• fever 	
<p>Prognosis/Treatment Options Available</p> <p>Liver Transplant</p>	

Case #2

<p>Name and Age of Patient</p> <p>Michelle, 32</p>	<p>Background Information about Patient</p> <ul style="list-style-type: none"> • single mother • 17 years of treatment for liver health, including hospitalization • does not drink/no drugs • cannot work due to liver deterioration • on wait list for liver transplant • blood type O (same as Justin)
<p>Cause of Liver Failure</p> <p>Hepatitis C (due to blood transfusion)</p>	
<p>Symptoms of Liver Failure</p> <ul style="list-style-type: none"> <li style="width: 50%;">• cirrhosis of the liver <li style="width: 50%;">• yellowing of skin (jaundice) <li style="width: 50%;">• lethargy <li style="width: 50%;">• swelling of belly <li style="width: 50%;">• fatigue 	
<p>Prognosis/Treatment Options Available</p> <p>Hospitalization, liver transplant</p>	

Discussion Questions

1. What are some of the differences between Justin's and Michelle's conditions and reasons for needing a liver transplant?

Student-led discussion: _____

2. Assume you are the head of the transplant team that is assigned to both Justin and Michelle, who are both placed on the transplant list. On what basis would you make the decision of which person is the priority for the next liver that becomes available?

Student-led discussion: _____

3. Using your answer to question #2, how would you explain to the other patient and his or her family why the next available liver is not going to him or her?

Student-led discussion: _____



Connections to Curriculum

- ✓ Scientific Inquiry
- ✓ Decision Making
- ✓ Group Work
- ✓ Personal Perspectives/ Reflection
- ✓ B11-3-01 Design and execute an experiment to investigate an aspect of the transportation or respiratory system.
- ✓ B11-3-05 Describe the blood donation process and investigate related issues.
- ✓ B11-3-14 Identify major structures and function of the human respiratory systems from a diagram, model, or specimen.

Senior Years Science Teachers' Handbook

Chapter 4: Science-Technology-Society-Environment Connections

- ✓ 4.14 Case Studies of STSE Issues
- ✓ 4.15 Evaluating Medical Technology

Unit 3 Transportation and Respiration

Giving the Breath of Life Lesson Plan

Objectives

Students will

- demonstrate understanding of lung health issues
- critically assess compatibility issues
- analyze the need for and possibility of receiving a lung transplant

Materials

- straws (one per student)
- coffee stir sticks (one per student)
- Breath of Life: Student Reflections (BLM 3.1) (one per student)
- Giving the Breath of Life (BLM 3.2) (one per student)
- group of balloons tied together (plus a pin to pop)
- blood typing cards (BLM 3.3) (one per student)
- HLA cards (BLM 3.4) (one per student)

Introduction

1. Ask students to count the number of inhalations they take in one minute—time will be kept for 30 seconds and students can then double their count. Students record this number and reflections on the Breath of Life: Student Reflections sheet (BLM 3.1).
Note: Teacher should keep time for students to ensure that students are concentrating on their own breathing and not the time.
2. Hand out straws. Ask students to count their breaths for the same amount of time while breathing through the straw. Students may have to hold their nose to ensure breathing is through the straw alone. Students record this number and reflections on the Student Reflections sheet. *Note: Teacher should instruct students to discontinue breathing through the straw if breathing becomes too heavily strained or they become dizzy.*
3. Hand out coffee stir sticks/thinner straws. Repeat step 2.

(continued)

4. Facilitate a group discussion. Ask students if they know what is being demonstrated by this activity. Answer: Problems with breathing/lung disease.
 - First demonstration is regular breathing.
 - Second demonstration is primary lung disease (due to smoking, lung infection, or other causes).
 - Third demonstration is chronic lung disease (due to emphysema, cystic fibrosis, or pulmonary hypertension—high blood pressure in pulmonary capillaries).

Ask students to record this information on the Student Reflections sheet.

5. To further demonstrate the devastating effects of emphysema present the students with a bunch of balloons tied together with various strings. Balloons may be hidden from the students until this time in a garbage bag and this arrangement can be used to reinforce the parts of the respiratory system (balloons = alveoli; strings = bronchioles; strings tied in a bunch = bronchi; garbage bag containing alveoli = lungs).

Ask students to review the structure and function of the alveoli. (*Answer: numerous, thin membrane, moist surface, facilitates gas transfer*).

Pop the balloons one by one in front of students, informing them that this is what happens due to emphysema; the systematic destruction of alveoli (leave a few balloons unpopped—for now. Ask the students what the effect of this destruction would be on the human system (hard time breathing, shortness of breath, wheezing, decreased tolerance of physical activity, coughing). Inform students that in addition to ineffective alveoli, sometimes the bronchioles become restricted in their ability to facilitate gas transfer. Demonstrate this by cutting the balloons from the string. Inform students that this has the same effect as the destruction of alveoli. Ask students to include this on their reflection sheet as well.

6. Discuss treatment options available for those who suffer from emphysema or other COPD (chronic obstructive pulmonary disease). *Answers include: immediate cessation of smoking (if a smoker), bronchiole dilating medication (puffers), oxygen therapy, and perhaps transplant.*

Lesson and Assessment

1. Hand out Giving the Breath of Life sheets (BLM 3.2).
2. For the learning activity, students are required to have a blood type. If students are aware of their own ABO and Rh antigens, they are more than welcome to use those. If students do not know their own blood type, they are welcome to choose a blood type card from those provided (BLM 3.3). The proportion of cards is somewhat representative of the frequency in the population. They are, in this case, not random.
3. Students are required to have specific HLA antigen markers to determine tissue type compatibility. There are only three provided in this activity (BLM 3.4). Students choose randomly from the HLA marker cards provided by the teacher. By only having three possible HLA markers, the instance of marker compatibility should increase. *Note: Teachers should print the Blood Typing and HLA marker cards (BLMs 3.3 and 3.4). It may be a good idea to laminate the cards to keep them for future use.*

Breath of Life: Student Reflections

Part A: My Regular Breath

Table 1: Timed Breathing Rate

# of breaths after 30 seconds	# of breaths/minute

During this time I felt: _____

Part B: Breathing through a Straw

Table 2: Timed Breathing Rate through a Straw

# of breaths after 30 seconds	# of breaths/minute

During this time I felt: _____

Part C: Breathing through a Narrow Diameter Straw

Table 3: Timed Breathing Rate through a Narrow Diameter Straw

# of breaths after 30 seconds	# of breaths/minute

During this time I felt: _____

Analysis:

Part A represented: _____

Part B represented: _____

Part C represented: _____

My understanding of a chronic lung disease is _____

Name: _____

Giving the Breath of Life

Background

Chronic obstructive pulmonary disease (COPD) is characterized by the substantial restriction of air flow into and/or out of large segments of lung tissue. The result is an extensive loss in total lung volume as well as the amount of oxygen that can be transported around the body. This has great potential to affect the day-to-day life of a person suffering from COPD. Tasks that people with healthy lungs take for granted, such as walking down a hallway, picking up a baby, playing with your pet, suddenly become too much for a person with COPD, and they end up gasping and struggling to breathe the same air that flows so easily into and out of the lungs of a healthy individual.

A lung transplant is a treatment option for some who suffer from very advanced forms of COPD such as cystic fibrosis. The person who receives the lung transplant (the recipient) must first meet with a respirologist who determines if the patient qualifies to be assessed for a transplant (the parameters include, but are not limited to, a non-smoker status, assessment of quality of life after the procedure, and weight restrictions). Once the assessment deems the patient suitable for the surgery, a more involved series of tests take place through meeting with no less than 16 individual medical staff (e.g., doctors, nurses, therapists, transplant staff). These tests include blood tests, CT scans, chest X-rays, and tissue typing. A lung transplant is unique in that it not only must match the donor and recipient in terms of blood and tissue typing (based on blood and major histocompatibility complex [MHC]—human lymphocyte associated [HLA] antigens) but also size.

Even when matches in all areas are found, the recipient must still take high doses of immunosuppressant medication in an effort to reduce the chance of tissue rejection. Immunogeneticists, specialists that study antibody-antigen reactions, monitor the patient closely.

Lung transplants may involve the transplantation of a single lung or a double lung. More often, double lung transplants come from deceased donors, and single lung from deceased and living donors. However, in rare and extremely urgent cases, a double lung transplant from living donors is possible. Two donors are needed, since each donor can only donate a portion of their lung. Tissue typing must be exact in both cases. A living lung donation is still a new procedure and is not currently performed in Manitoba—however, Manitoba at one time did perform the first living double lung transplant.

Learning Activity: To Whom Can You Donate?

Materials

- measuring tape
- Blood Type Card (BLM 3.3) (if necessary)
- HLA Antigens Marker card (BLM 3.4)

In this investigation, you will

- critically assess compatibility issues among classmates
- analyze the need for and possibility of receiving a lung transplant

Learning Activity

1. What Are Your General Characteristics?

- In the space provided below, draw a diagram of the lungs as they would be seen if viewed from a chest X-ray. Label the following structures: lung, trachea, bronchi branch, bronchi. An X-ray cannot pick up the microscopic divisions that follow the bronchi (bronchioles and alveolus).



- Using your measuring tape, record your chest circumference (area around the fullest part of your rib cage) below.

_____ centimetres

- Do you know your blood type? If so, record your actual blood type (ABO and Rh antigens) below. If not, ask your teacher to assign you a blood type.

Blood Type: _____

- Tissue typing plays a large role in determining compatibility in lung transplants. It involves matching HLA antigens. HLA antigens are proteins found on the surface of most cells in your body and allow your body to recognize self from non-self cells. A close match of HLA antigens reduces the chance of the immune system attacking the newly transplanted lung. Medical professionals determine about six of these HLA markers to be the most important to be matched between transplant donors and recipients. *Note: Most transplant centres look at more than just six HLA markers, but we will use six in this instance to expedite the learning activity.*

- e. Find someone who is a match with your criteria. A match is considered to be someone who
- has a chest circumference within 10 centimetres of your own
 - has the same blood type or is a suitable donor according to the chart below
 - has the **exact** same HLA antigen sequence

		CAN RECEIVE (+)							
		O-	O+	B-	B+	A-	A+	AB-	AB+
B L O O D T Y P E	AB+	+	+	+	+	+	+	+	+
	AB-	+		+		+		+	
	A+	+	+			+	+		
	A-	+				+			
	B+	+	+	+	+				
	B-	+		+					
	O+	+	+						
	O-	+							

Record your match's profile beside yours on your Assessment Profile card.

Note: You may or may not find a match among your classmates. If you do not find a suitable match, address this in the discussion section of this learning activity.

Analysis

- Were you able to find a match to your specific needs?

 - If yes, what were the major challenges you faced in finding a match? If no, why do you think you had trouble finding a match?

- What were the limitations presented in this learning activity? Were there any factors left unconsidered? What could be done differently that could add to the realism of this learning activity?

Application—Case Studies

Use your own transplant assessment when responding to the following cases.

1. Jackson is a 13-year-old middle school student who is suffering from cystic fibrosis. His lungs are mostly obstructed making it hard for him to walk from class to class during the school day without gasping for air. He wants to participate in gym class and some other school clubs with his friends, but his breathing makes it difficult for this to be accomplished. His health in other capacities is very good. His chest circumference is 86 centimetres. His blood type is AB+ and HLA antigen sequence is 1+ 2+ 3- 4- 5- 6+

- a. Is Jackson a candidate for a lung transplant? _____
- b. Can you be a possible donor for Jackson? Explain your answer.

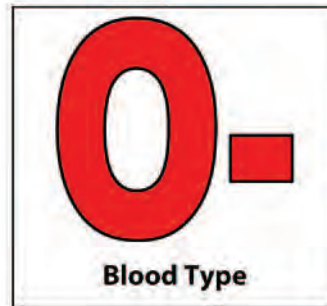
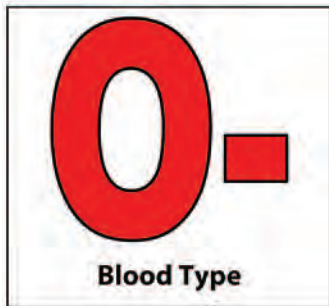
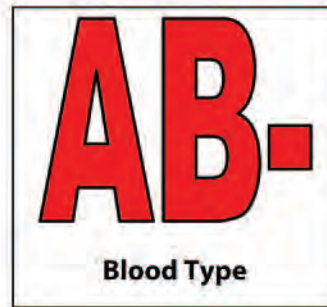
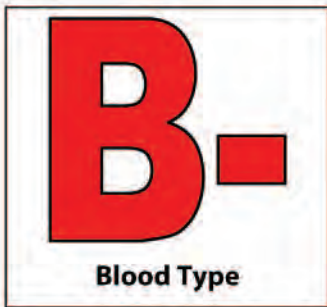
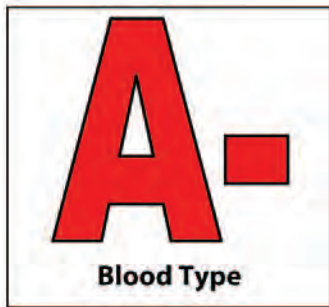
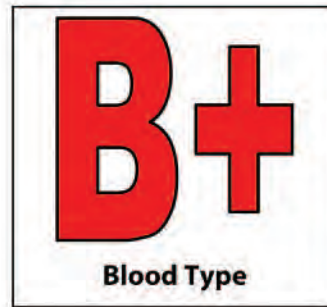
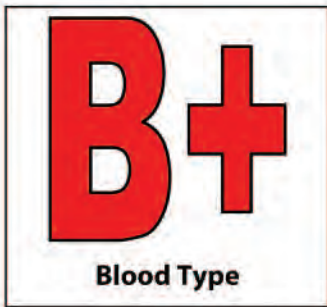
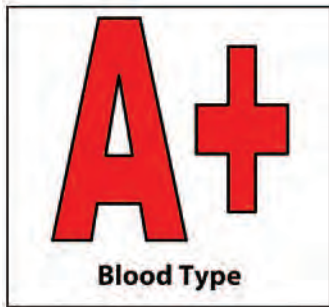
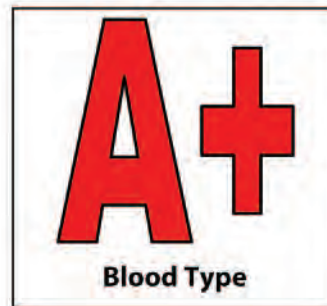
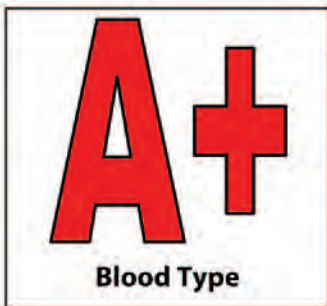
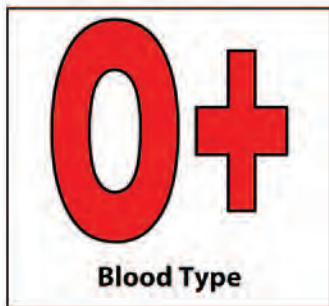
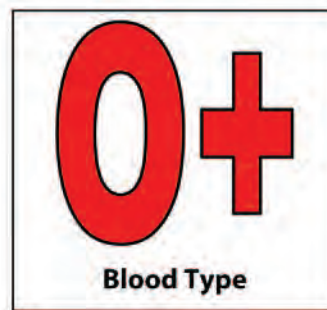
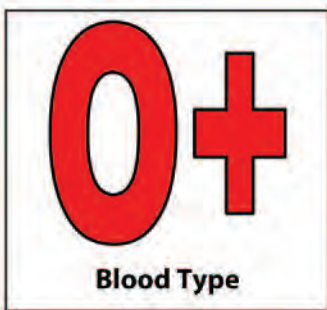
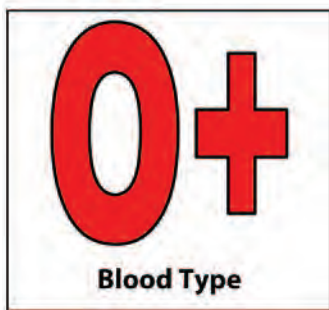
2. Lily is a 28-year-old mother of a young daughter. She suffers from pulmonary hypertension (high blood pressure in arteries that supply blood to the lungs). For most of her life Lily used anticoagulants to reduce the instance of blood clots forming in her pulmonary arteries due to the high blood pressure. Doctors have decided that the medication is now contributing to the other symptoms she is exhibiting. In order to improve her quality of life for the future, they decided that a single lung transplant is her best option. After being admitted to the hospital for a series of tests, it is determined that Lily's blood type is A-, her chest circumference is 71 centimetres, and her HLA antigen sequence is yet to be determined.

- a. Is Lily a candidate for a lung transplant? _____
- b. Based on the information given, can you be a possible donor for Lily? Explain your answer.

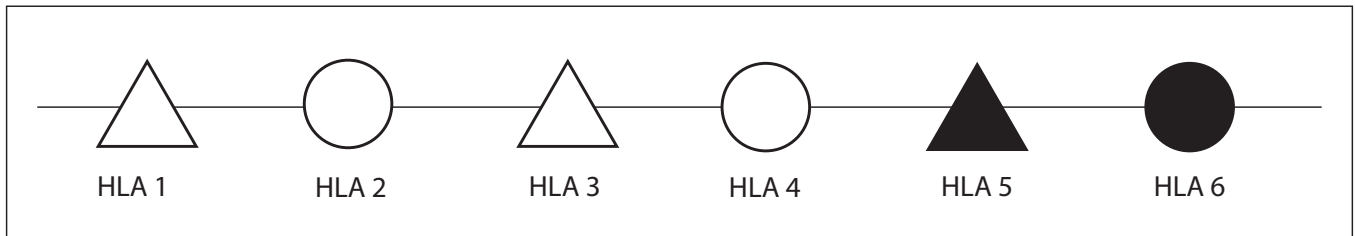
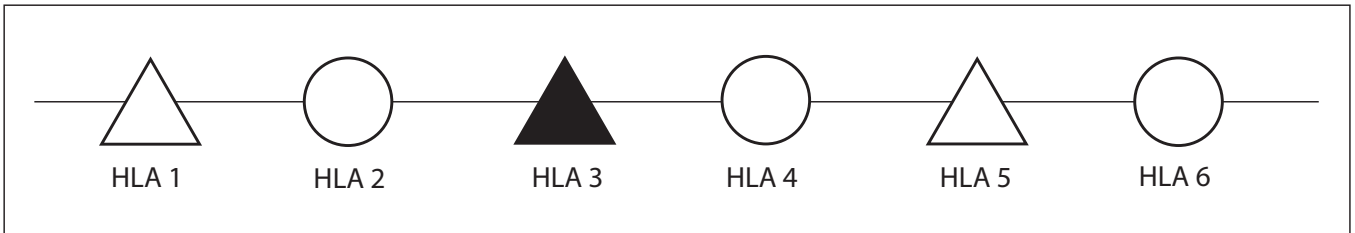
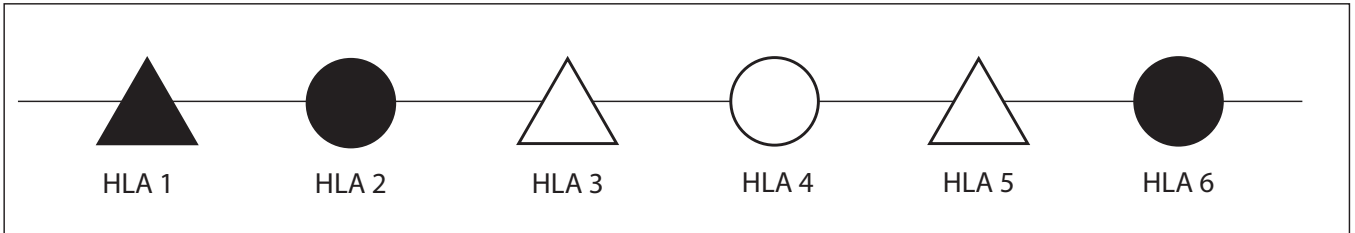
3. Lou is a 62-year-old man who is suffering from emphysema that is the result of 45 years of smoking cigarettes. Lou refuses to give up his addiction even though the emphysema is progressing to the point where he experiences severe shortness of breath. Sometimes his lips turn blue due to lack of oxygen. Lou has been admitted to the hospital eight times due to serious hypoxia (low blood oxygen)—and the condition is only getting worse. During his trips to the emergency room, doctors have determined his blood type to be O- and his chest circumference is 1.3 metres. His HLA antigen sequence is unknown since Lou has not seen the transplant team.

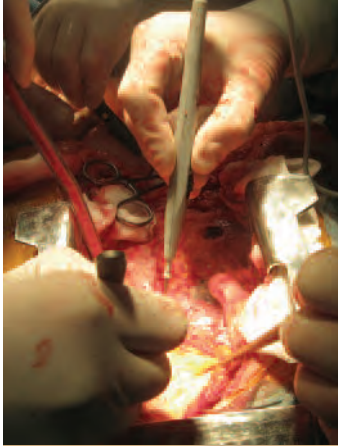
- a. Is Lou a candidate for a lung transplant? _____
- b. Can you be a possible donor for Lou? Explain your answer.

Blood Typing Cards



HLA Antigen Markers





Connections to Curriculum

- ✓ Scientific Inquiry
- ✓ Decision Making
- ✓ Group Work
- ✓ Personal Perspectives/ Reflection
- ✓ B11-3-01 Design and execute an experiment to investigate an aspect of the transportation or respiratory system.
- ✓ B11-3-08 Describe the cardiac cycle. Include: systole, diastole
- ✓ B11-3-16 Investigate and describe conditions/disorders associated with transportation and/or respiration in the human body.
- ✓ B11-3-17 Identify personal lifestyle choices that contribute to cardiovascular and respiratory wellness.

Senior Years Science Teachers' Handbook

- Chapter 4: Science-Technology-Society-Environment Connections
- ✓ 4.14 Case Studies of STSE Issues
 - ✓ 4.15 Evaluating Medical Technology

Operation Heart Transplant Lesson Plan

Objectives

Students will

- have an opportunity to engage in an online simulation of a heart transplant procedure
- work creatively with the vocabulary particular to the human heart anatomy and heart transplantation through building a crossword puzzle

Materials

- Operation Heart Transplant Crossword (BLM 3.5)
- computer with Internet connection (fast connection recommended)
- LCD projector (or similar equipment)

Instructions

1. Guide students through a simulated heart transplant by navigating through the “Electric Heart—Operation: Heart Transplant” simulation on the PBS website at www.pbs.org/wgbh/nova/eheart/transplant.html.
2. Teacher may lead or ask for student participation. This is a great activity for using interactive whiteboards such as Smart Boards.
3. Following the simulation, hand out the Operation Heart Transplant Crossword assignment (BLM 3.5), where students are asked to use the vocabulary from the simulation to create crossword puzzle clues.

Operation Heart Transplant Crossword

Use the word list below (or one developed by you or your class) to create a crossword puzzle. Place the words in the blank grid either horizontally or vertically, making sure to use one letter in at least two words at one time (like a real crossword puzzle).

When complete, number the first letter in each word.

Create clues for each word under the appropriate heading (either “Across” or “Down”).

When this template is complete, use the accompanying grid to make your final copy. This time, **SHADE** in only the **unused** squares in the grid, keeping the squares needed to fill in the words blank. Remember to number the squares the same way you numbered the clues.

Suggested Word List

DEOXYGENATED

DEFIBRILLATOR

HAEMOSTATS

OXYGENATED

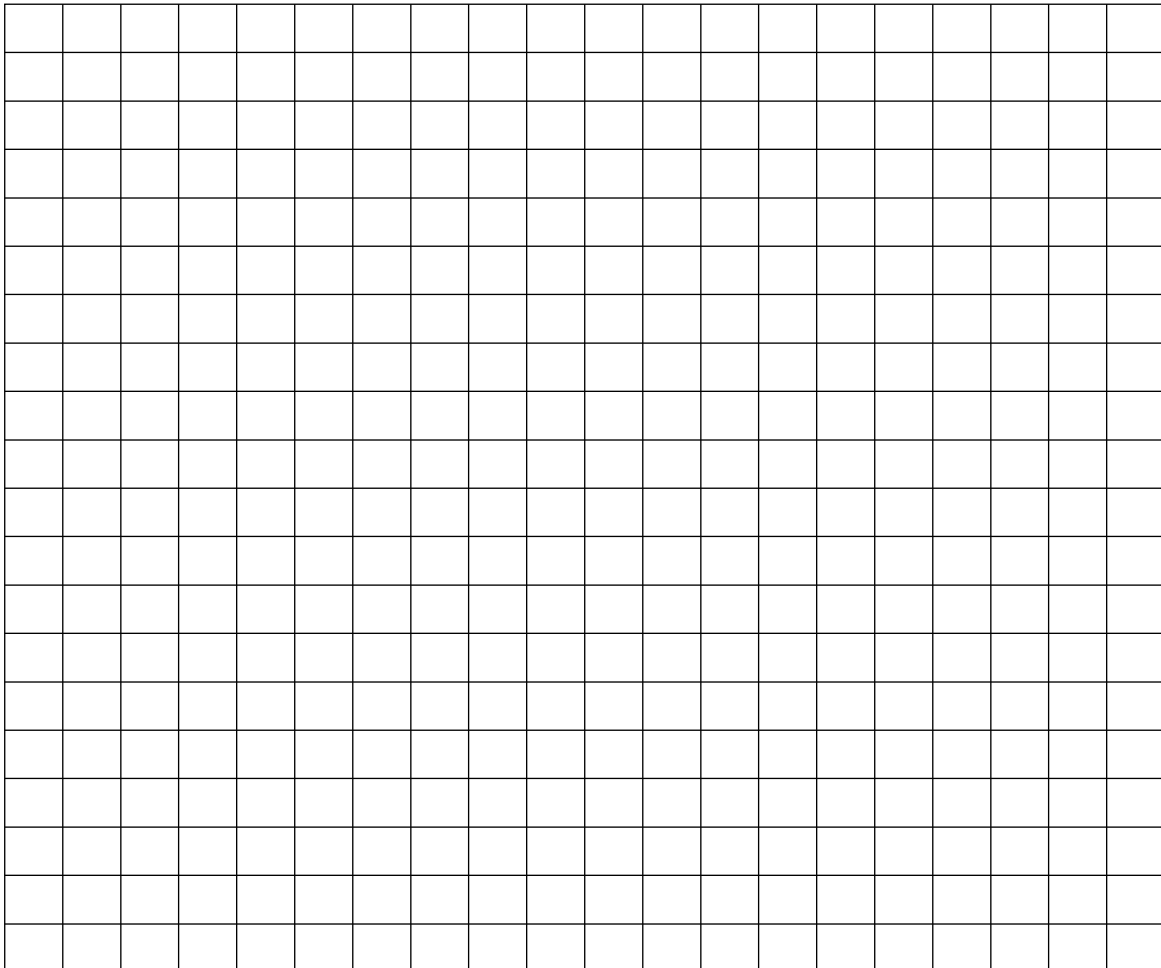
SCALPEL

STERNUM

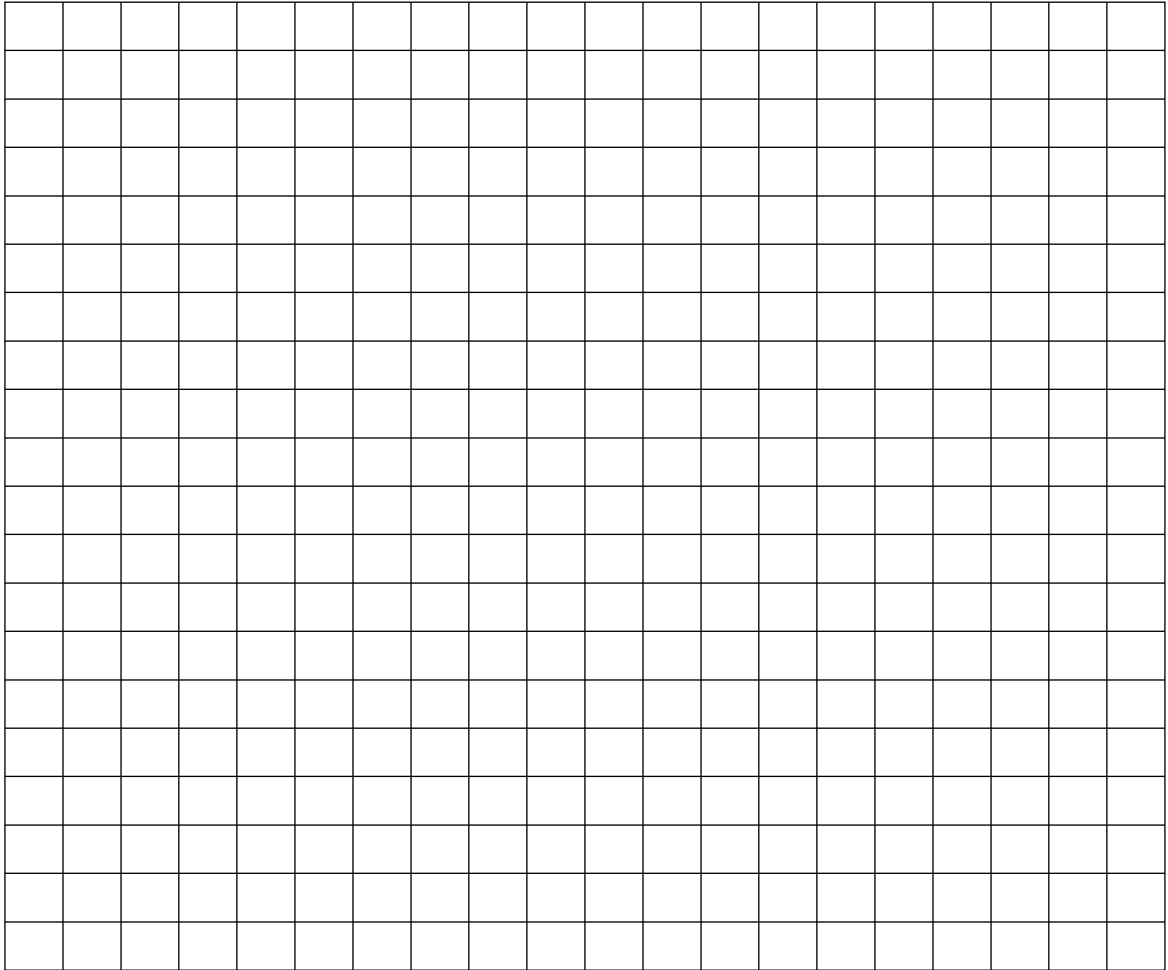
PULMONARY

ATRIA

AORTA



Operation Heart Transplant Crossword Final Draft





Connections to Curriculum

- ✓ Information Management
- ✓ Decision Making
- ✓ Group Work
- ✓ Personal Perspectives/Reflection
- ✓ B11-4-08 Investigate and describe issues related to kidney failure and treatment options available.

Senior Years Science Teachers' Handbook

Chapter 4: Science-Technology-Society-Environment Connections

- ✓ 4.14 Case Studies of STSE Issues
- ✓ 4.18 Role-Playing Scenarios
- ✓ 4.19 Debates

Chapter 11: Developing Scientific Concepts Using Graphic Displays

- ✓ 11.30 Article Analysis Frames

Unit 4

Excretion and Waste Management

The Kidney Dilemma Lesson Plan

Objectives

Students will

- recognize the kidney's importance in the body
- recognize and critically assess controversial issues that may surround kidney transplantation
- show responsibility while working in a group and reporting findings

Materials

- The Kidney Dilemma: Think-Pair-Share (BLM 4.1) (one per student)
- Access to the following articles:
 - Kingsbury, Kathleen. "A Gated Community for Organ Donors." *Time*. 4 June 2007: n.p. Available online at www.time.com/time/magazine/article/0,9171,1633084,00.html
 - Ritter, Peter. "Legalizing the Organ Trade?" *Time*. 19 Aug. 2008: n.p. Available online at www.time.com/time/world/article/0,8599,1833858,00.html
 - Robinson, Simon. "India's Black Market Organ Scandal." *Time*. 1 Feb. 2008: n.p. Available online at www.time.com/time/world/article/0,8599,1709006,00.html.
- The Kidney Dilemma: Donation Debate Organizer (BLM 4.2)
- large sheets of chart paper
- markers
- Optional: copies of Name Tags and Group Roles (BLM 4.3) (one per student)

Anticipatory Set

What do you already know about the kidney?

Hand out The Kidney Dilemma: Think-Pair-Share and ask students to complete their answers individually (about 3 to 5 minutes), and then share their answers with a partner (5 minutes). Upon completion, students should record any new information learned from their partner in the column provided. Brief discussion could follow this warm-up activity.

(continued)

Article Analysis

There are three articles cited at the outset of this section of the resource. One (“India’s Black Market Organ Scandal”) is intended to be an icebreaker to the topic that the teacher should read aloud together with contributions from students as readers. The other two are to be accessed (online or in print) by the class (after students have been assigned to opposing groups).

Divide the class into two groups (e.g., left side of class—right side of class) and assign “A Gated Community for Organ Donors” to in one group and “Legalizing the Organ Trade?” to the other group. The group assigned to “A Gated Community...” will be labelled as **against** organ trade whereas the group assigned to “Legalizing the Organ Trade?” will be labelled as **for** organ trade. It may be useful to write these labels on the front board.

Allow approximately 10 to 15 minutes for reading the article.

Hand out the Donation Debate Organizer (BLM 4.2) and allow students time to fill in their arguments based on the readings and their own opinion.

When most students have completed their organizers, arrange students in large groups based on their articles.

Groups will need to delegate (or have the teacher delegate) the following roles:

- Team Leader: will lead the discussion and ask for input from each member
- Recorder: will record the group’s topic, position, and arguments on chart paper
- Reporter: will present the arguments to the class
- Member at Large: will contribute ideas

Name tags with responsibilities are provided (BLM 4.3) and can be passed out to students for management purposes (may require teacher to photocopy more Member at Large name tags).

Instruct students to discuss their ideas with their group and choose the three best arguments from the entire group. Record these arguments on large chart paper.

Assessment/Closure

The reporters from each group report findings to the class.

If there is time, allow groups to respond to each others’ arguments.

The Kidney Dilemma: Think-Pair-Share

	My Answer	What I Learned From my Partner
Approximately how large is the human kidney?		
Where in the body are the kidneys located?		
Briefly list the tasks the kidney is responsible for.		
What options are available to a person if their kidneys malfunction or stop working altogether?		
When a kidney transplant is performed, where is the new kidney placed?		
Approximately how long is the wait for a kidney transplant in Manitoba?		

The Kidney Dilemma: Think-Pair-Share

	My Answer	What I Learned From my Partner
Approximately how large is the human kidney?	In an average adult human, the kidney is approximately 10 to 15 centimetres long, about the size of a computer mouse. It weighs approximately 150 grams and makes up about 0.5 percent of a person's body weight.	
Where in the body are the kidneys located?	In most people, the kidney is located towards the back of the abdominal cavity, just above the waist. One kidney is normally positioned directly below the liver, making it slightly lower in the body. The other is just below the spleen on the left side and is positioned slightly higher.	
Briefly list the tasks the kidney is responsible for.	The kidney is responsible for the separation of wastes from body fluid (blood) as part of the urinary system. The wastes are then excreted from the body as urine. Approximately 180 litres of blood pass through the kidneys each day to get filtered.	
What options are available to a person if their kidneys malfunction or stop working altogether?	Dialysis, transplant. All kidney transplants in Manitoba are performed at the Health Sciences Centre in Winnipeg. In 2009, Manitoba performed 46 kidney transplants (20 came from living donors).	
When a kidney transplant is performed, where is the new kidney placed?	The new kidney is usually placed by the groin; this is the only transplant where the organ is placed in a different spot from the original one. Old kidneys are rarely removed; they shrivel up to the size of a walnut over time.	
Approximately how long is the wait for a kidney transplant in Manitoba?	In Canada, there are over 4000 people waiting for a life-saving or life-enhancing transplant. In Manitoba, there are approximately 170 people ready and waiting for a kidney transplant at any one time and approximately another 300 people in the process of being evaluated for transplant. On average, Manitobans are waiting four to six years for a kidney transplant if they do not have a living donor.	

The Kidney Dilemma: Donation Debate Organizer

Title of Article:

I believe that:

Three reasons I support this position are

1. _____

2. _____

3. _____

People who disagree with this position would probably argue that

1. _____

2. _____

3. _____

I would respond to these arguments by saying

1. _____

2. _____

3. _____

Name Tags and Group Roles

TEAM LEADER

will lead the discussion and ask for input from each member

RECORDER

will record the group's topic, position, and arguments on chart paper

REPORTER

will present the arguments to the class

MEMBER AT LARGE

will contribute ideas

MEMBER AT LARGE

will contribute ideas



Connections to Curriculum

- ✓ Scientific Inquiry
- ✓ Decision Making
- ✓ Group Work
- ✓ Personal Perspectives/ Reflection
- ✓ Working in Science
- ✓ B11-5-01 Describe the body's defence mechanisms for protection from foreign agents. Include: non-specific and specific defences.

Senior Years Science Teachers' Handbook

Chapter 4: Science-Technology-Society-Environment Connections

- ✓ 4.14 Case Studies of STSE Issues
- ✓ 4.15 Evaluating Medical Technology

Chapter 10: Building a Scientific Vocabulary

- ✓ 10.4 Level One Strategies

Unit 5

Protection and Control

Organ Transplant Rejection Lesson Plan

Objectives

Students will

- understand how the body recognizes its own cells and knows to attack foreign cells
- be able to articulate the importance of matching donor tissue with recipient tissue in organ transplants
- be able to describe the cell membrane, define cell surface markers, and explain the matching process for organ transplants

Materials

- pictures of the following: hockey game (or other sport) including teams, referee, fans (for each team and another team **not** involved in the game)
- whiteboard and whiteboard markers
- leukocyte diagram (BLM 5.1) (one per student)
- Antigen Templates (BLM 5.2) and Antibody Templates (5.3) (two per student)
- scissors, tape/glue
- Organ and Tissue Rejection: Student Analysis/Discussion (BLM 5.4) (one per student)

Anticipatory Set

1. Show the picture of a hockey game (or other team sport, depending upon the season), complete with two teams, referees (officials), and the fans. Ask students to identify which people belong on the playing surface and which have another role. Students should easily identify the players, coaches, and officials. Ask students how they came to their determination. Students should reply that they are all wearing uniforms for identification.
2. Show a close-up picture of a player from each team; ask students what his or her job is at the game.

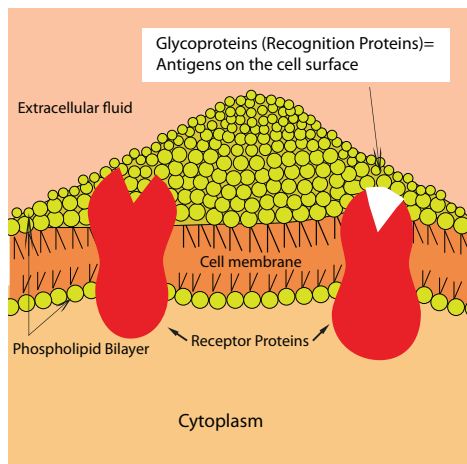
Show a close-up picture of a referee; ask students what his/her job is.

(continued)

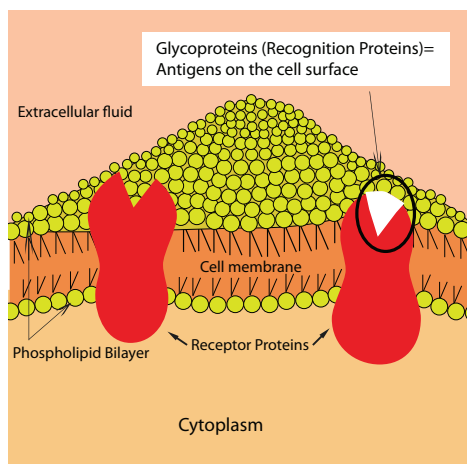
Show a close-up picture of a fan (wearing a team jersey); ask students what his/her job is.

Show a close-up picture of a fan wearing a jersey for a different team, perhaps even for a different sport; ask students what his or her job is—students should reply something like “What are they doing there?”

3. Relate the hockey game to the human body. The body must be able to recognize which cells belong to it (the players, the fans, the referees), which cells don't (fans of the wrong team), where the cells should be, and which job the cell should be doing.
4. Ask students to recall the structure of a cell (plasma) membrane. Make a list on the overhead or whiteboard. Ensure the following structures are mentioned: *phospholipid bilayer*, *receptor protein*, and *recognition protein*.
5. Ask students to draw a diagram of the cell (plasma) membrane in their notebook and add the labels from the list. Students diagrams should resemble the diagram below:



6. Ask students to circle the part of the cell that is involved in identifying “self” cells (i.e., cells that belong to you). (Answer: *glycoproteins, or recognition proteins*).



(continued)

7. Students should identify this now as an antigen and label it accordingly on the diagram. Each person has a unique set of antigens on their cells, different from other peoples' antigens.

If an unknown antigen enters the body, a person's immune system will respond by producing antibodies to combat and destroy the cell with the foreign antigens.

8. The uniqueness of an individual's cell surface markers explains why organ donor tissue and recipient tissue must be carefully matched before transplantation. Human beings have complicated defence mechanisms against bacteria, viruses, and other foreign materials that enter the body. These defences make up the immune system. Unfortunately, the immune system cannot differentiate between the disease-causing organisms (bad), and the cells of a lifesaving transplant (good). Both are looked upon by the body as foreign, and the immune system will attack them. This attack by the immune system (rejection of the transplanted organ) is a great problem in organ transplants.

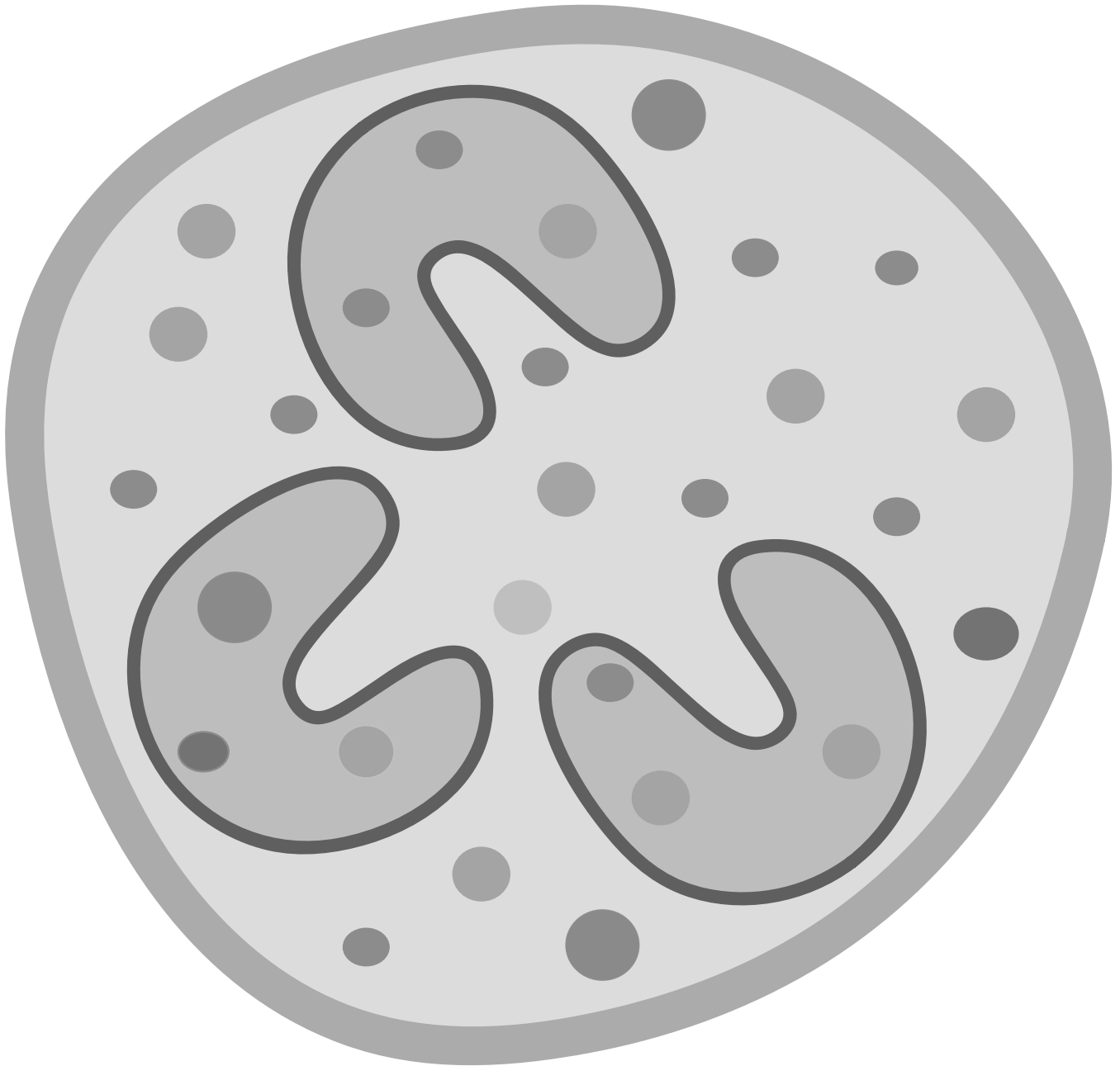
Lesson Sequence

1. Explain the following before the simulation:

“Each of us has several genetic markers (antigens) located on the surface of most of our white blood cells. One of these groups of genetic markers is referred to as the HLA, or Human Leukocyte Antigens. Define *leukocyte* (white blood cell), and *antigen* (genetic marker). The donor cells have Human Leukocyte Antigens on their cells. The recipient might have an antibody (protein) in his or her blood plasma that will attack and destroy these antigens, and destroy the donor organs cells.”

2. Hand out a Leukocyte cell (BLM 5.1) to each student.
3. Ask each student to draw two cards from a bag containing antigens (see BLM 5.2 for templates).
Note: Leukocytes and antigens should be cut out ahead of time by the teacher.
4. Students attach antigens to the surface of the leukocyte using glue or tape. The leukocyte represents the cells of the donated tissue/organ.
5. Ask each student to draw two cards from a bag containing antibodies (see BLM 5.3). Antibodies are not added to the surface of the leukocyte, but rather circulate in the blood plasma of the recipient. These are the proteins that cause rejection when they bind to the antigen.
Note: Antibodies may not cause a rejection with the student's leukocyte. Students should recognize that if the antibody “fits” into the antigen like a puzzle piece, it will cause a rejection reaction and the donated tissue/organ will be destroyed. If the antibody does not “fit” into the antigen the tissue would be accepted.
6. Ask students to work in pairs. Students should be able to determine if the new cell will be rejected by their own antibodies. Students should also be able to determine if they are able to have a successful donation with their partner based on the antigens and antibodies that each drew from the bags.
7. Ask students to complete Organ and Tissue Rejection: Student Analysis/Discussion (BLM 5.4).

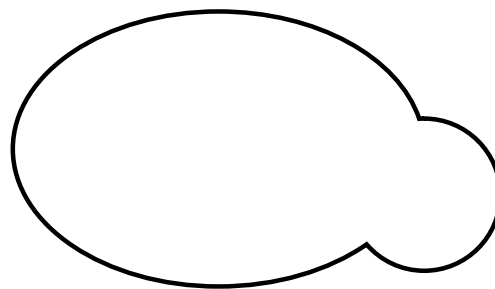
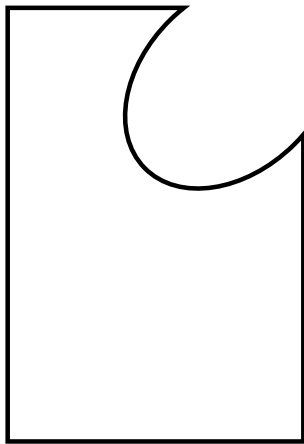
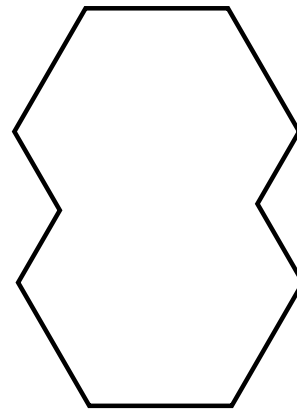
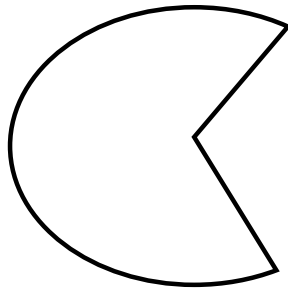
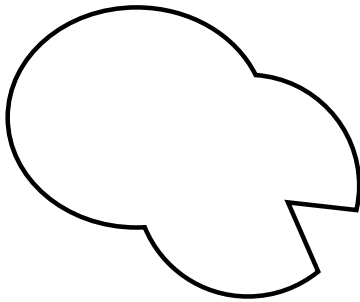
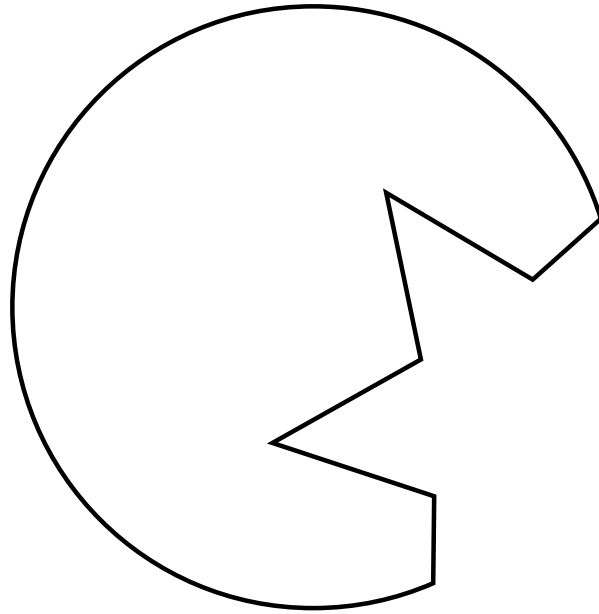
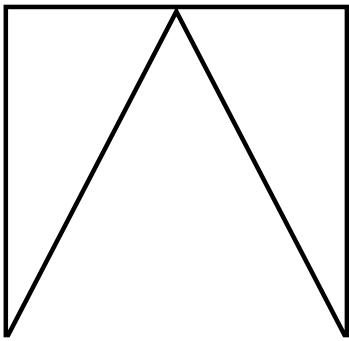
Leukocyte



Note: Ideally this diagram should be enlarged to 11 x 17 paper for student use.

Antigen Templates

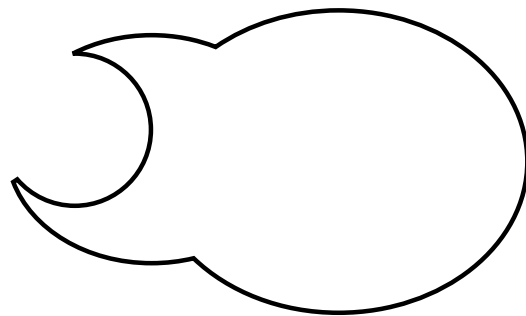
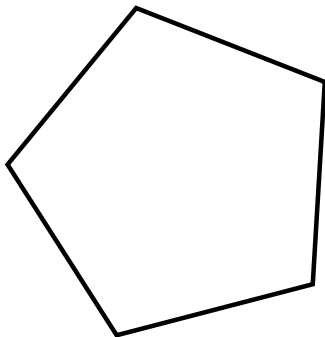
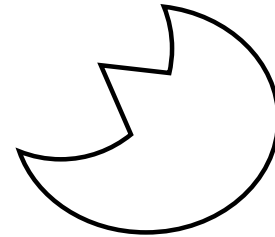
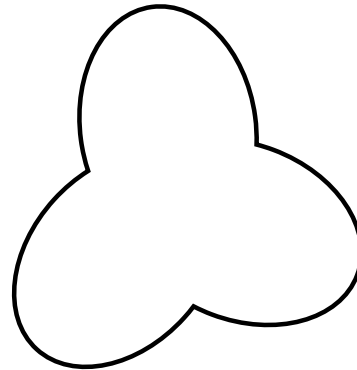
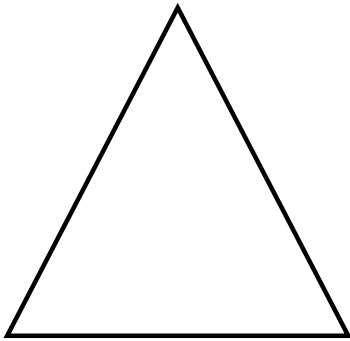
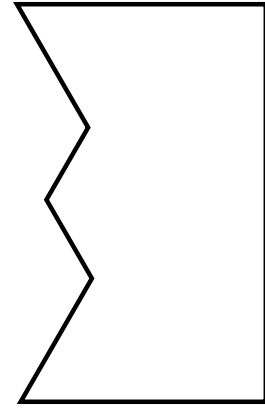
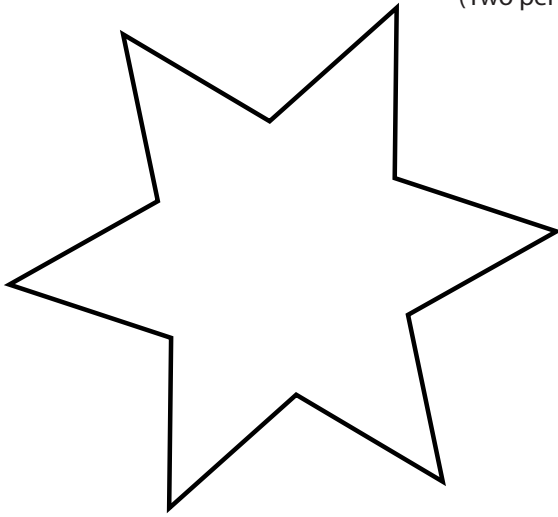
(Two per student)



Note: The shapes are for conceptual purposes only. They do not reflect the actual shapes of antigens.

Antibody Templates

(Two per student)



Note: The shapes are for conceptual purposes only. They do not reflect the actual shapes of antibodies.

Organ and Tissue Rejection: Student Analysis/Discussion

1. Draw your donated leukocyte complete with surface antigens. Remember to include labels for identification purposes.

2. Based on the antigens you were assigned, would a transplant with the leukocyte you drew above be successful? Explain.

3. Your antibodies circulate throughout your body in your blood plasma and have the potential to come in contact with all cells of your body.

- a. If your partner's leukocyte was transplanted and you were the recipient, would it be successful? Explain.

- b. Would you be able to donate your leukocyte to your partner based on his/her antibodies? Explain.

4. Recipients of organ transplants are prescribed anti-rejection medication (also known as an immunosuppressant medication) that is to be taken regularly after the transplant and for the life of the transplanted organ.

- a. Using the vocabulary above (*antigens, antibodies, donor, and recipient*), explain the purpose of the anti-rejection medication.

- b. What do you think would happen if a recipient failed to take the anti-rejection medication(s) for a few days at some point following the transplant?

- c. Predict what could happen to a person's overall health if he/she is taking anti-rejection medication.



Connections to Curriculum

- ✓ Scientific Inquiry
- ✓ Decision Making
- ✓ Group Work
- ✓ Personal Perspectives/ Reflection
- ✓ Working in Science
- ✓ B11-6-04 Identify and analyze social issues related to the process of dying.

Senior Years Science Teachers' Handbook

Chapter 4: Science-Technology-Society-Environment Connections

- ✓ 4.14 Case Studies of STSE Issues
- ✓ 4.15 Evaluating Medical Technology

Chapter 10: Building a Scientific Vocabulary

- ✓ 10.4 Level One Strategies
- ✓ 10.9 Level Two Strategies
- ✓ 10.22 Three-Point Approach for Words and Concepts

Unit 6

Wellness and Homeostatic Changes

Organ Donation in Relation to Society Lesson Plan

Objectives

Students will

- research the various modalities used for organ donation
- summarize printed information and present conclusions
- contemplate their place in society in relation to the issue of organ donation
- examine organ donation campaigns in the media

Materials

- poster/chart paper and markers (amount depends on class size and small group size; enough for two rotational graffiti exercises and poster creation)
- scissors, glue, tape, coloured pencils, et cetera (materials needed for poster creation)
- website information for each of the following topics: Xenotransplants, Religious and Aboriginal Views on Donation, Living Donations, Preparing to Receive an Organ Transplant, Deciding to Become an Organ Donor
- online Information Organizers (BLM 6.1A–6.1G) (one per group of students)
- Concluding Summary (BLM 6.2) (one per student)
- Organ Donation Campaigns in the Media (BLM 6.3) (one per student)

Teacher Preparation

Prepare two class sets of chart paper to be used for rotational graffiti. (Note: In the interest of sustainability, it may be convenient to simply turn the page over to reveal the new topic).

1. Class Set #1—Most Important Inventions/Innovations of the Last 100 Years. Divide chart paper in half. On one half print WORDS and on the other half print PICTURES. Repeat for each group in class.

(continued)

2. Class Set #2—Most Important Innovations in Medicine of the Last 100 Years.

Divide chart paper in half. On one half print WORDS and on the other half print PICTURES. Repeat for each group in class.

Anticipatory Set

1. Divide the students into small groups (three to four students per group).
2. Hand out chart paper and markers to each group.
3. Ask students to brainstorm what they feel are the most important inventions/innovations of the past 100 years. Ask them to draw under the PICTURES heading. Give them a time limit of two to three minutes. (*Note: Expected responses include mp3 players, cell phones, automobiles, the personal computer, etc.*)
4. After two to three minutes, ask the groups to rotate their sheets. Give students a moment to look at their classmates' drawings.
5. Ask students to list all the drawings they see under the WORDS heading. When completed, instruct students to add to the list with other inventions they feel are important. Allow two to three minutes.
6. When completed, discuss the findings. Any consistencies among the groups?
7. Collect the chart paper and hand out the new set.
8. This time, ask students to list under the WORDS heading the most important advances in medicine in the past 100 years. Allow two to three minutes (*Note: Expected responses include cancer treatment, vaccinations, artificial limbs, organ transplants*).
9. After two to three minutes, ask the groups to rotate their sheets. Give students a moment to look at their classmates' list and then instruct the students to diagram the innovations on the sheet under the heading PICTURES.
10. Again, when students are finished, discuss the findings.

Lesson

1. Assign one of six topics to each group of students. Inform them that each topic relates to a major advancement in modern medicine: organ donation. For each topic, provide appropriate website addresses, such as those on pages 62 to 63, for students to visit when researching their topic.
2. Within their groups, students review websites, summarize information by answering questions provided on the appropriate Information Organizer (BLMs 6.1A–6.1G), and create an attractive poster.
3. Assign a time limit.

(continued)

4. When posters are completed, ask students to hang them on the wall.
5. After all of the posters are on the wall, ask students to participate in a gallery walk where they will fill in the information they discover on their Concluding Summary Sheet (BLM 6.2).

Extension

1. Hand out Organ Donation Campaigns in the Media (BLM 6.3).
2. Ask students to select a campaign to examine.
3. Group students according to their selection of campaigns.
4. After group discussions, each group presents its findings.
5. In groups or individually, students create a media poster, web page, or advertisement promoting organ donation to young Canadians.
6. Students present their posters, web pages, or advertisements to the class, explaining the reasons for their choice of imagery and design elements.

Selected Websites from which to Gather Information

Xenotransplants

- Health Canada. “Xenotransplantation.” *Science and Research*. 17 Jan. 2006. <www.hc-sc.gc.ca/sr-sr/biotech/about-apropos/xeno-eng.php> (19 July 2010).

This Health Canada website explains the medical definition and importance of xenotransplants. Easy to read and understand, this website explains which animals are suitable candidates for xenotransplantation and the risks and regulatory procedures for the process in Canada and in other countries.

Religious and Aboriginal Views on Organ Donation

- The Canadian Council for Donation and Transplantation. *Diverse Communities: Perspectives on Organ and Tissue Donation and Transplantation—A Summary Report*. Edmonton, AB: The Canadian Council for Donation and Transplantation, 2005. Available online at <www.ccdt.ca/english/publications/final-pdfs/Diverse-Communities.pdf>.

This document addresses the values, attitudes, and beliefs of organ transplantation of various diverse Canadian communities such as Aboriginal, South Asian, and Chinese. For this learning activity, students should focus on the Aboriginal ideals found on pages 10 to 12 of this document.

- The Canadian Council for Donation and Transplantation. *Faith Perspectives on Organ and Tissue Donation and Transplantation: Report*. Edmonton, AB: The Canadian Council for Donation and Transplantation, 2006. Available online at <www.ccdt.ca/english/publications/final-pdfs/Faith-Perspectives.pdf>.

This report presents the research identifying over 25 major religions in Canada and their positions (support, accept, neutral, or against) on organ donation. Students should refer to pages 7 to 12 for this learning activity.

The Donation Process

- Transplant Manitoba. “The Organ Donation Process.” <www.transplantmanitoba.ca/DonationProcess.html> (19 July 2010).

Transplant Manitoba’s page describing the organ donation process is divided into small, easy-to-read sections (mechanism or injury, what happens in the emergency room and ICU, definition of death, etc.) for student research.

Living Donations

- Transplant Manitoba. Adult Kidney Program. *Being a Living Kidney Donor*. Winnipeg, MB: Transplant Manitoba, 2006. Available online at <www.transplantmanitoba.ca/documents/LivingDonorPamphlet.pdf>.

Besides explaining the procedure that the donor and recipient go through while being part of a living organ donation, this document explains the physiology and importance of kidney function, the treatment options before a transplant, and compatibility.

Preparing to Become a Living Organ Donor

- Transplant Manitoba. “Adult Kidney Transplant Program.”
<www.transplantmanitoba.ca/documents/LivingDonorPamphlet.pdf> (20 July 2010).

This website discusses the pre- and post-transplant processes that a living donor will face. Links to various pamphlets, including the one mentioned above under Living Donations, are provided for further information.

Preparing to Receive an Organ Transplant

- Healthwise Incorporated. “Organ Transplant.” *Health.com*. 24 Jan. 2008.
<www.health.com/health/library/topic/0,,ty7522_tb1065,00.html> (20 July 2010).

Information from Health.com explains the entire organ donation process, including how loved ones can prepare for the procedure, factors that increase the chance for a successful transplant, and how a patient can get on an organ transplant waiting list.

Deciding to Become an Organ Donor

- Canadian Institute for Health Information. “Canada’s Organ Donation Rate Still Too Low to Meet the Need, Reports CIHI.” 14 Apr. 2004.
<www.cihi.ca/cihiweb/dispPage.jsp?cw_page=media_14apr2004_e> (20 July 2010).

This CIHI (Canadian Institute for Health Information) article summarizes wait-list times for many organ transplants. These figures are then used to explain the importance of being an organ donor.

- Transplant Manitoba. “The Organ Donation Process.”
<www.transplantmanitoba.ca/DonationProcess.html> (19 July 2010).

Transplant Manitoba’s page describing the organ donation process is divided into small, easy-to-read sections (mechanism of injury, what happens in the emergency room and ICU, definition of death, etc.) for student research.

Information Organizer: *Xenotransplants*

1. What is a xenotransplant?

2. List three purposes of xenotransplants.

- _____
- _____
- _____

3. List three of the potential risks of xenotransplantation.

- _____
- _____
- _____

4. Why are pigs the animal of “choice” for xenotransplants (at this time, hearts only) rather than apes, which are genetically more similar to humans?

5. Summarize what other countries are doing in the biotechnological field of xenotransplantation.

As a group, use this information to create an informational poster about your topic based on your teacher’s instructions.

Group Members:

Information Organizer:
*Religious and Aboriginal Views
on Organ Transplantation*

1. List and briefly explain the views about traditional Aboriginal values and beliefs in regard to organ transplantation and donation.

2. Choose from among the different religious traditions of Canada, and identify the respective positions of three of them on the issue of organ transplantation and donation.

- ---

- ---

- ---

3. Using the three religious traditions your group has chosen, list the proposed methods/activities for involvement in organ transplantation and donation for each.

- _____

- _____

- _____

4. As a group, have you determined if there are similarities or contrasts among the various religious and Aboriginal groups in terms of organ donation and transplantation? Use these similarities to create a conclusion statement.

As a group, use this information to create an informational poster about your topic based on your teacher's instructions.

Information Organizer: *The Donation Process*

1. a. Define “clinical death” as a condition in relation to organ donation.

- b. Individuals become viable donor candidates when they have reached a state of “brain death.” What is meant by brain death, and what are some events that can cause it?

2. How are Transplant Manitoba—Gift of Life Program and the Donor Coordinator involved in the donation process after brain death is determined?

3. What role does the donor’s family play in the donation process?

4. Suitability, organ placement, organ recovery, and follow-up are important steps in the donation process. Briefly summarize these steps.

Suitability: _____

Organ Placement: _____

Organ Recovery: _____

Follow-Up: _____

As a group, use this information to create an informational poster about your topic based on your teacher’s instructions.

Group Members:

Information Organizer: *Living Donations*

1. What is a living donation?

2. Who makes a “good candidate” for becoming a living donor?

3. List five advantages of living donations.

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4. If there is a desire to do so, how does one become involved in the living donation process?
(Please list four steps.)

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- ---

5. What are the risks involved, if any, to the potential living donor?

*As a group, use this information to create an informational poster
about your topic based on your teacher's instructions.*

Information Organizer: *Preparing to Become a Living Donor*

1. What type of living organ donation is currently being performed regularly in Manitoba?

2. What causes kidney failure and what are some steps taken to treat it? Summarize the treatments.

3. What types of tests must living donors participate in?

4. Summarize the steps involved in the surgery living donors are involved in.

5. What are the risks involved, if any, to the potential living donor?

As a group, use this information to create an informational poster about your topic based on your teacher's instructions.

Group Members:

Information Organizer: *Preparing to Receive an Organ Transplant*

1. What can cause organs to fail so that organ transplantation would be the only option?

2. How might an organ recipient's immune system react to an organ transplant?

3. List the five basic tests that recipients go through before a transplant.

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- ---
- ---
- ---
- ---

4. Summarize factors that may increase the chance for a successful organ transplant.

*As a group, use this information to create an informational poster
about your topic based on your teacher's instructions.*

Group Members:

Information Organizer: *Deciding to Become an Organ Donor*

1. As a group, discuss why it is important to consider becoming an organ donor. Write your ideas below.

2. Which organ has the highest percentage of recipients on the waiting list? followed by? and then?

3. Summarize certain key steps needed before you can become an organ donor.

1.

2.

3.

4.

5.

4. How do you become an organ donor in Manitoba?

As a group, use this information to create an informational poster about your topic based on your teacher's instructions.

Concluding Summary

After analyzing each of the posters created by your classmates, write a conclusion statement based on what you have learned about each topic. When you are finished, hand this in to your teacher.

Topic	Conclusion Statement
Xenotransplants	
Religious and Aboriginal Views on Organ Donation	
The Donation Process	
Living Donation	
Preparing to Become a Living Donor	
Preparing to Receive an Organ Transplant	
Deciding to Become an Organ Donor	

Organ Donation Campaigns in the Media

Background for Students

Internationally, there have been media campaigns to promote awareness of—and the critical need for—committed organ donors. Some of these media efforts have involved techniques that some observers have described as “shock doctrine” or appeals to a culture of fear about considering donation as a decision.

It is important for you, as students of science, to understand that the medical aspects of organ donation are embedded in the larger culture that surrounds you. It is an important attribute of science education to note the connections among science, society, and the cultural environment that we live in.

The online sources listed on page 74 provide examples of images and information that take you on an international examination of some recent advertising campaigns from around the world that make use of (in some cases) graphic imagery and connect this imagery to the need for organ donors.

Online Learning Activity:

1. Select ONE image (or video clip) from an online source that seems to hold a particular interest for you (see the sample web sites at the end of this activity if you need a starting point in your search). Write down a few comments in the space here that indicate what it was about the imagery that made an impression on you and that encouraged you to select it.

2. Gather with a group of classmates who also selected the same image as you did (unless you find that your choice was unique and you are working on your own).
3. Enter into a discussion about the elements contained in the image. Provide brief responses to the following:
 - a. Does the image do something specific to promote organ donation to you?

- b. Are there any characteristics of the image that might actually discourage you from considering organ donation?

- c. If the image does not contain a written message, as a group write a short message that matches the content of the image **and** says something about the importance of considering organ donation.

4. Be prepared to present your group's findings to the class.
5. Prepare YOUR OWN media poster that promotes a positive message about organ donation among *young* Canadians.

Online Sources for International Organ Donation Public Campaigns

Fédération des Associations pour le Don d'Organes et de Tissus humains (in French):
<www.france-adot.org/>

NHS Blood and Transplant (UK):
<www.organdonation.nhs.uk/ukt/adverts/adverts.jsp>

Organ Donor Campaign (UK):
<www.organdonorcampaign.co.uk/>

Donate Life: Organ and Tissue Donation Blog:
<http://donatelife-organdonation.blogspot.com/2009/07/international-organ-donation-awareness_14.html>

National Kidney Foundation:
<www.kidney.org/>

Trillium Gift of Life Program:
<www.giftoflife.on.ca/>

Coloribus Global Advertising Archive:
<www.coloribus.com/>

This site provides access to hundreds of images taken from advertising campaigns. Use “organ donation” as your search keywords—some images are very provocative.

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