



Transplantation Science Digital Curriculum

Table of Contents

Objectives and Connections to State Standards.....3
Digital Curriculum Outline4
Answer Keys 8-9

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Classroom Curriculum Objective

Transplantation Science is designed to provide an in-depth science curriculum about organ, eye and tissue donation. At the end of the Transplantation Science class students will have a clear understanding of what organ, eye and tissue donation and transplantation are and what it means to be on the Donate Life Colorado or Donate Life Wyoming Organ and Tissue Donor Registry.

While the main objective is to supplement anatomy, biology, health and other courses with relevant knowledge, it is also important to present students with the practical application of this knowledge: everyone has to make this decision at the Driver License Office when being issued or renewing their driver permit, driver license or state ID. After participating in this class and talking with their families, students should feel equipped to make that decision.

Connections to State Standards:

Colorado: Middle School, Standard 2, Life Science, Grade Level Expectation 1

All living things are made up of cells, which is the smallest unit that can be said to be alive.

Colorado: High School, Standard 2, Life Science, Grade Level Expectation 2

Growth and division of cells in complex organisms occurs by mitosis, which differentiates specific cell types.

Wyoming: MS-LS1-3

Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

Wyoming: HS-LS1-4

Use a model to illustrate the role of cellular division and differentiation in producing and maintaining complex organisms.

Digital Curriculum Outline

The Digital Curriculum is based on the Transplantation Science class, which is a hands-on, stations format for students. Although students aren't able to work through each station individually, they are still able to work through each station through our virtual workbook and videos.

Please consider scheduling a 30 minute video conference with an Educator after using these materials.

1. Introduction –
 - a. Explain to students what the program is, why you chose to bring the program to your school, expectations regarding what students need to complete
2. Video – You can find these videos on our [Digital Curriculum website](#)
 - a. Have the students watch the Transplantation Science Intro Video for [CO](#) (about 4 minutes) or [WY](#) (about 2 minutes) before they attend your class or you can watch together during your class
 - b. Pause on the “Facts about Donation” at the end of the video and have students turn to their workbook so they can find this page (Middle School and Sheltered Instruction Workbooks-p. 16; High School Workbooks-p. 46)
 - c. These are important facts that are often considered myths. You can ask students if they've ever heard the opposite of some of these and discuss why these are facts and the opposite are myths.
 - d. You can also point out the infographics throughout the books to make sure students know where to find some of the statistical information they heard in the video.
3. Station rotation – Our Transplantation Science Educators have recorded short videos that show some of these materials to the students so they can still do the following. Have the students do the following:
 - a. Virtual Workbook: Work through the online workbook starting with Station 1 on p. 5. Enter answers into Google Form or in notebook.
 - b. Google Form: Request access to the Google Form via email (transplantationscience@donoralliance.org), then “make a copy” to your Google Drive so you will have access to students' answers.

- c. Videos: Have students watch the video that corresponds to the station before they begin the activities in each station section.

Description of Stations, Inquiry Questions and Fun Facts you can use with students:

4. Station 1: Students have an opportunity to examine organ specimens and identify the functions of the organs.
 - a. Inquiry Questions:
 - i. Where are your kidneys located? (on each side of the lower back)
 - ii. What do your kidneys do for you? 85% of people on the waiting list are waiting for a kidney. Why do you think this is?
 - iii. How big is your liver? What happens to your skin if you have liver disease?
 - iv. Knowing that a living donor can donate a kidney or up to 60% of their liver, would you consider being a living donor? anonymously? for a friend or family member? because you heard someone in your community needed one? Why or why not?
 - v. Look at the black marks on the lungs. This is tar residue that is left in the lungs after smoking. Marijuana leaves an orange residue on the trachea. What type of smoker do you think this person was? a pack a day? here and there? started when they were a teenager? as an adult?
 - b. Fun Facts:
 - i. Your liver can re-generate after you donate part of it; it will also grow to fit the size of the recipient.
 - ii. A living donor's kidney will grow bigger to compensate for the loss of the other one.
 - iii. Our lungs can expand to the size of just below the collarbone to the end of the rib cage.

5. Station 2: Students have the opportunity to allocate a donor heart to a waiting recipient.
 - a. Inquiry Questions: (p. 30 in High School Workbook)
 - i. Given what you have learned about organ matching, why is it important for a computer algorithm to determine the best match rather than a person?
 - ii. Why has the Federal government designated an organization (UNOS) to set policies on how organs will be allocated?
 - iii. Should additional factors such as an individual's contribution to society, whether the person in need has children or economic status

be considered when determining who gets an organ transplant?
Why or why not?

- iv. What would happen if people were allowed to buy and sell organs for transplant?
- v. Why is it difficult to recover a heart after circulatory death?

b. Fun Facts:

- i. Your heart is as big as your fist; if you cover your fist with your other hand, that is the size of your heart + arteries and aorta.
- ii. Heart recipients (and other organ recipients) often crave different types of food after transplant; many times these are connected back to their donors.
- iii. If a child receives a heart transplant, it is likely they will have to have an additional heart transplant during their teenage years.
- iv. There are rare cases of people being living heart donors:
<https://www.newsweek.com/heart-transplant-1065043>

6. Station 3: Students have an opportunity to try on glasses that simulate corneal blindness and learn how donor corneas are matched to recipients.

a. Inquiry Questions:

- i. Find a piece of wax paper, a bag from a cereal box or a piece of white tissue paper. Hold it up in front of your eyes and try to read something on the wall across from where you are sitting. Can you see letters or numbers? Can you see shapes or colors? That is what it is like to have corneal blindness. You can see, but not really.
- ii. What would be different about your life if you had corneal blindness? What would you be able to do the same? differently?
- iii. Have you ever known someone with a glass eye? Read the information on p. 20 (MS) or p. 34 (HS) about how the sclera can improve a blind person's life. If you were blind, would you want to go through with the surgery? Why or why not?

b. Fun Facts:

- i. Corneal transplant surgeries are done while the patient is awake! Think about it, you are blind, so you can't see the needle coming at you.
- ii. There is no waiting list in Colorado and Wyoming for corneal transplants. Many people who aren't eligible to be an organ or tissue donor at the time of death are eligible to donate their corneas.
- iii. There is no blood supply to the cornea so often people who have certain types of cancer are able to donate corneas.

7. Station 4: Students have an opportunity to look at the different tissue grafts that can be made from donor bone and learn about how skin tissue is used to save and heal lives.

- a. Inquiry Questions:
 - i. What would you do if doctors told you that they need to amputate an arm or leg. Would you let them do it? Would you get a second opinion? Would you live with your limb, even though you would be in pain?
 - ii. Do you know anyone that has had an autograft? Why is an autograft (see p. 24 (MS) or p. 41(HS) sometimes a better recommendation for a graft?
 - iii. How can tissue transplantation be life-saving?
 - iv. Compare the organ donation process (beginning on p. 11 (MS) or p. 19 (HS) with the tissue donation process (p. 41 (HS). What are the similarities and differences? Why are more people eligible to be tissue donors than organ donors?
 - b. Fun Facts:
 - i. Using an allograft of donor bone can prevent amputation.
 - ii. Skin grafts using donor skin help a burn victim's skin cells to regenerate more rapidly than synthetic grafts. The donor skin then naturally sloughs itself off as the patient's skin becomes stronger.
8. Family Discussion Surveys –
- a. We ask all teachers for their help in supporting our free program. Please assign the [Family Discussion Survey](#) as an assignment for your students. The surveys provide us with important data we use to make changes to the program and get an idea of public perceptions surrounding donation and transplantation. We do not collect student names, so if you would like us to do that for your classes, please email and let us know.
9. We recommend the following activities as a wrap-up activity at the end of class or a warm-up activity the day after the class. The Kahoot activities should be.
- a. Kahoot activity: (useable via video conference if you share your screen)

Facts About Donation (pre/post-test) - <http://bit.ly/2g2jISX>

Transplantation Science Warm-up (pre/post-test) - <http://bit.ly/2vIONO4>
 - b. Quizziz activity: (can be assigned to students through the Quizziz platform if you have a free account)

Facts About Donation (pre/post-test) - <http://bit.ly/2wChzxW>

Transplantation Science Warm-up (pre/post-test) - <http://bit.ly/2vVRLMy>

TRANSPLANTATION SCIENCE



Answer Key for Teachers - High School Workbook

Station 1 Activities (p. 16-17):

I. Answers:

- F These filter waste products from the blood...
 B This cleans the blood of poisons and toxins...
 C These bring oxygen into the blood...
 D This pumps blood to all the cells in the body.
 E This small organ makes digestive enzymes...
 A This is responsible for absorbing nutrients...

II. Answers:

- Diabetes → Pancreas & Kidney Cirrhosis → Liver
 Hepatitis → Liver Coronary Disease → Heart
 Hypertension → Kidney Cystic Fibrosis → Lung
 Cardiomyopathy → Heart Pulmonary Fibrosis → Lung

III. Answers:

Q: Which (1) whole organ can you donate, and still live without?	A: Kidney. The remaining kidney will enlarge slightly to do the work of two kidneys.
Q: Which organs can you donate a part of and still live without?	A: Lobe of the lung, Portion of the liver, Part of the intestine, Part of the pancreas

IV. Answers:

- One organ donor can save up to eight lives through organ donation. TRUE
 The liver is the only organ that can completely regenerate. TRUE
 The majority of organs for transplant are donated by living donors. FALSE
 The heart is the organ most in need. FALSE
 Many different diseases, both genetic and lifestyle-related, can cause... TRUE

Station 2 Activity (p. 28-29):

Peter should receive the heart transplant.

Station 3—Sclera (p. 35):

Page 34: The right eye (looking at the photo) is artificial.

Page 35: Looking at the photos, the man's right eye is artificial. The woman's right eye is artificial.

Station 3 Activity (p. 36-37):

Patient	Which Cornea?	Why did you assign this cornea to this patient?
1. Sally	A	Sally needs the highest cell count because of age. The donor cornea is large enough.
2. Tim	--	
3. Sue	C	Sue is the next youngest patient, so a higher cell count will be more beneficial to her. The donor cornea is equal to the size she needs.
4. John	B	John is older than Sue, so he should get the cornea with the lower cell count. The donor cornea is larger than the one he needs.

Which recipient does not get a transplant in this round? Tim. None of the donor corneas are large enough to fit his eye.

Station 4 Activities (p. 44-45):

I. Answers: Devin – A; Susan – E; H.C. – D; Andy – C; Debby – B Answers: D – A – B – C – E



Answer Key for Teachers - Middle School Workbook

Station 1 Activities (p. 8-9):

p. 8 Answers:

- F These filter waste products from the blood and turn it into urine. We have two of them.
B This cleans the blood of poisons and toxins (like drugs and alcohol) and also makes bile to aid in the digestion of food.
C These bring oxygen into the blood and remove carbon dioxide. We have two of them.
D This pumps blood to all the cells in the body.
E This small organ makes digestive enzymes and an essential chemical called insulin, which keeps blood sugar...
A This is responsible for absorbing nutrients from digested food.

p. 9 Answers:

Which (1) whole organ can you donate, and still live without?

Kidney. The remaining kidney will enlarge slightly to do the work of two kidneys.

Which organs can you donate a part of and still live without?

Lobe of the lung, Portion of the liver, Part of the intestine, Part of the pancreas

Station 2 Activity (p. 14-15):

Peter should receive the heart transplant.

Station 3—Sclera (p.20):

- The right eye (looking at the photo) is artificial.
- Looking at the photos, the man's right eye is artificial. The woman's right eye is artificial.

Station 3 Activity (p. 21):

Patient	Which Cornea?	Why did you assign this cornea to this patient?
1. Sally	A	Sally needs the highest cell count since she is only three months old. The donor cornea is large enough.
2. Sue	C	Sue is the next youngest patient, so a higher cell count will be more beneficial to her. The donor cornea is equal to the size she needs.
3. John	B	John is older than Sue, so he should get the cornea with the lower cell count. The donor cornea is larger than the one he needs.

Station 4 Exercise (p. 25-26): p. 25 Answers: Devin – A; H.C. – C; Andy – B p. 26 Answers: D – A – B – C – E