

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

## Overview, Purpose and Objectives

Why do you die if your heart stops beating? Why do you have a liver? Why do you need oxygen? Many students don't know the answer to these questions—seeking answers to these and other questions like it provide the foundation for this lab. In the end, students learn that each cell, tissue, organ and system depends on others within the organism to survive. If one part stops working, the rest suffer.

I use this inquiry based lab as a culminating task at the end of the biology unit. It also serves as an excellent activity for developing original research and handling large amounts of data in preparation for science fair projects. I developed this lab in my first year at my current school, in response to a parent's concern over the fact that her child had never developed and written an inquiry based lab from start to finish. The lab itself takes about 10 classes, with numerous development tasks leading up to it.

I teach classes of varying abilities. Some are high achieving students in the International Baccalaureate program, some are French Immersion students, and others struggle to concentrate in school every day. I enjoy teaching every type of learner and want them to become life long learners. This is a lab about the students themselves—about how their bodies work—so they all enjoy and learn a lot from it. This is a lab where the students use each other as lab subjects and they learn how challenging it can be to control all necessary variables to get valid results.

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

## Context and Educational Outcomes/Achievements

The grade 8 unit of Cells, Tissues, Organs, and Systems involves the greatest number of specific expectations in the curriculum. As per the current Ontario Curriculum, the overall goals for the unit are to:

- demonstrate an understanding of the basic structure and function of plant and animal cells, and describe the hierarchical organization of cells in plants and animals;
- investigate basic cellular processes and certain specialized cells in plants;
- describe ways in which study of the structure, function, and interdependence of human organ systems can result in improvements in human health.

For all the science units, three areas of specific expectations are addressed:

1. Understanding of Basic Concepts,
2. Developing Skills of Inquiry, Design and Communication, and
3. Relating Science and Technology to the World Outside the School. The Human Organ Interdependency lab services two Overall Expectations and well as all three broad areas of Specific Expectations.

## Context and Educational Outcomes/Achievements (Cont'd)

The following is an overview of the entire unit:

<b>1.</b> What is life and characteristics of life? (1 class)	<b>2.</b> Debate: Is Fire Alive? Cell Theory (1 class)	<b>3.</b> Organization of life (1 class)	<b>4.</b> Introduction to the microscope (2 classes)	<b>5.</b> Microscope discovery lab and scientific drawings (1 class)
<b>6.</b> Types of cells (1 class)	<b>7.</b> Introduction to cell organelles and cell bingo (1 class)	<b>8.</b> Cell processes intro—what happens in the nucleus of the cell? (1 class)	<b>9.</b> Microscope lab—animal vs. plant cells (2 classes)	<b>10.</b> Unicellular vs. multicellular organisms + intro of edible cell project (1 class)
<b>11.</b> Unicellular organisms lab (1 class)	<b>12.</b> Cell respiration + photosynthesis (1–2 classes)	<b>13.</b> Edible cell project presentations (3 classes)	<b>14.</b> Cell membrane processes (drama + cartoon drawing) (diffusion, osmosis + active transport) (2–3 classes)	<b>15.</b> Osmosis lab (3 classes)
<b>16.</b> Tissues in plants and humans (1 class)	<b>17.</b> Organs and systems in plants vs. humans and measuring the efficiency of our organ systems (2–3 classes)	<b>18.</b> Hypothesis and variables practice (1–2 classes)	<b>19.</b> Introduction to the Human Organ System Interdependency Lab (1 class)	<b>20.</b> Procedural writing and peer editing (2–3 classes)
<b>21.</b> Procedure choices (1 class)	<b>22.</b> Data gathering (4 classes)	<b>23.</b> Lab write up (homework)	<b>24.</b> Follow up research and discussions regarding current research into common diseases	<b>25.</b> Current events in biological research (i.e. GMOs, cloning...)

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

## Context and Educational Outcomes/Achievements (Cont'd)

Within this framework, students are given time to work on their edible cell projects, cell bingo is played to start a number of classes, quizzes and a unit test are given, and some classes may require more time to understand some concepts. Review of the material before unit tests is done through a Jeopardy game format.

As a result of completing this unit, and more specifically the culminating task, students will design and conduct an experiment to test their hypothesis, identify variables (independent, dependent, and control) to ensure a fair test, compile qualitative and quantitative data, present that data in charts and graphs, draw conclusions, and make recommendations for future research and improvements to the lab procedure itself. In order to do this, students must understand the basic processes of the human organ systems involved in their investigations.

## Assessment

Students will be assessed during a number of phases in this project, based on the lab criteria sheet handed out at the start of the year (this rubric is attached at the end of the document).

1. Students will have to write a purpose and a hypothesis, identifying their independent and dependent variables. Reasoning for their hypothesis must be included.
2. A procedure to compare how one organ system affects another must be written, identifying all variables that must be controlled to ensure a fair test. Diagrams may be included.
3. During the data collection phase, individual grades for accuracy and use of equipment will be taken.
4. Data collection, analysis and conclusion is handed in, along with appropriate references.

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

## Procedures

### Pre-Lab

Students have been previously introduced to the lab format and have written a formal lab report involving both peer editing and teacher comments (the osmosis lab). Students also have access to previous lab work and the lab rubric handed out and used since the beginning of the year. Additionally, students have learned that we are made of trillions of cells, that work together to keep us alive. The concept of dependency is not completely new.

Once students can identify the major organs and the main functions of each system, they are assigned the task of writing hypotheses and reasons for a series of problems. For example: “If your kidneys stopped working, then \_\_\_\_\_” or “If you listen to loud music then your heart rate will \_\_\_\_\_”. Students are to use their previous knowledge of the systems and write out a reason for choosing their hypotheses. Students then work in groups, discuss their answers and review the independent and dependent variables in each situation. Whole class discussions are based off of this inquiry. This is the launch point from which students can begin to examine which body systems they will use in their own labs.

### Human Organ Interdependency Lab (Please see Student Sheet, pages 7–10.)

The students are introduced to the lab itself. The role of the teacher is the discussion director and coach throughout the entire lab process. The students are encouraged to be independent in their thinking, but I will help them if I see that they are getting off track.

I make use of 2–3 copies of previously written labs that the students can learn successes and errors from. All research shows that modeling radically improves student performance and long-term understanding. Once students are gathering data, my role is that of observer. Major errors in data collection will be pointed out.

### Post-Lab

Once all data has been gathered, the students are brought back together to briefly go over how to present quantitative and qualitative data. Most students will have remembered the extensive review given after the osmosis lab. Samples of data analysis and conclusions are projected on the screen and important points are reviewed. Students are reminded that in order to analyze the data effectively, scientific fact must be available to back it up. Looking over their notes and possibly doing more research about the two organ systems that were focused on in their lab is crucial to doing well in this section of the lab report write-up.

**2008**  
**Winning Lesson Plan**  
**from Brampton, Ontario,**  
**Canada**

*Human Organ*  
*Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

## Conclusion

This is most likely the first opportunity these students have had to look at the difficulties surrounding gathering accurate data from humans. Not only does this culminating task measure the students' understanding in most aspects of the curriculum, but is it an excellent preparation tool for the development of their science fair project. Most of my students have told me that without this lab, they would not be as effective and comfortable in preparing a science fair project that could compete at the regional level. That is one of the measures I use for success in a large undertaking such as this lab.

In the end, this lab prepares the students for further discussions about current cell research and why finding cures for conditions such as cancer is so difficult and complex. Even more importantly, the students have become more familiar with the functioning of their bodies, more confident in talking about it, and therefore, more likely to provide a better history when visiting their family doctors. The better the information they can provide to their healthcare provider, the better the care they will most likely receive and therefore they will hopefully have a better quality of life.



## Human Organ Interdependency Lab

(Student Sheet)

Have you ever wanted to be a lab rat? Do you like to do experiments? Are you interested in how your body works? If so, this lab is for you! By the end of this lab, you will have tested many of your classmates to see how one organ system can affect another and learned about the challenges in coming up with good experimental data when it comes to dealing with humans.

### Stage 1

- a) Thinking and looking back at your notes, which organ systems do you think we can safely, ethically and effectively measure here at school? How?

Organ System	Ways That We Can Measure Its Efficiency

- b) Which organ systems are you interested in testing?

- c) How can you be sure to test everyone the same to get accurate results?

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

## Human Organ Interdependency Lab

(Student Sheet Cont'd)

### Stage 2

a) After going through the sample lab that Ms. Wilson provided, complete the following:

**Purpose:**

I will be testing how stressing the \_\_\_\_\_ system effects the functioning of the \_\_\_\_\_ system.

**Hypothesis:**

**Reasoning:**

**Independent Variable:** \_\_\_\_\_

**Dependent Variable:** \_\_\_\_\_

b) Peer editing! Be sure to peer edit two classmates' work and have two others edit yours as well. Be sure to use a different colour pen or pencil and write clearly. Have those who peer edited your work, sign in the area below. Some comments are permitted right beside or below what you wrote in part a).

Name	Comments

c) Rewrite your hypothesis, reasoning and variables for part a), based on the peer editing comments. Hand this in on a separate paper tomorrow.

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

## Human Organ Interdependency Lab

(Student Sheet Cont'd)

### Stage 3 – Procedure and Controls

We are reviewing some sample labs this class. Write down at least one positive and one improvement comment for each lab.

Lab 1:	Lab 2:
+	+
-	-

Make use of this information as a model for the lab procedure that you are writing in draft form today. Be sure to write down the hints that have been provided and make use of previous lab work as a model in completing this. Your procedure draft is due next class. You will be given time to have it peer edited and make some changes in class. The final copy is to be typed and handed in two classes from now. Hand in both the rough copy with the peer edit signatures and your good copy. Print out two copies—you will need to use it next class.

### Stage 4 – Which lab will you choose?

Unfortunately, we don't have enough time for everyone in the class to get their lab done. We need to split up into 4 relatively equal groups so that there are enough people to gather data from.

- a) We need to try to control as many possible variables as we can. We don't want to have any other major effect on the dependent variable, other than the independent variable. So, how should we split up the class?
- b) Now that our four groups have been decided, gather around one table and have each group member share their lab idea with the others in the group. You should want the honour of your lab being chosen, so try and convince the others in the group of the merit of your lab idea. Each person should be able to present their lab idea in 3 minutes or less, without being interrupted. Save your questions for when the presenter is done speaking. Make your decision on which lab to choose based on how well the procedure controls all important variables, how quickly and effectively data can be gathered, and whether the lab interests you. In the end, the decision must be made democratically.

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

## Human Organ Interdependency Lab

(Student Sheet Cont'd)

### Stage 4 – Which lab will you choose? (Cont'd)

- c) Let Ms. Wilson know which lab was chosen for your group. Write down what materials will be necessary for starting the lab next class. Design a draft data collection table as a group. Share contact information with each other. Appoint a leader for the group. Come to class next time prepared to start gathering data and have your hypothesis written for this new lab (if it is not your original lab).

### Stage 5 – Gather data!

As we have learned in previous labs, gather as much relevant data as possible. As such, do more than two trials for each person in the group over the lab days that you have been assigned. Be sure to leave enough time to rest the body system in between each trial. Write down any sources of error (if any) as they arise.

### Stage 6 – Type up your report!

Each group member should have the correct data and information from the lab. The final part of the lab report must include a raw data section; the formal data tables, graphs, and your data analysis (discuss any sources of error here). Your conclusion must start with the restatement of your hypothesis and whether it was correct or not. Discuss how you would improve this lab procedure and how we could use the results in everyday life. Make reference to your lab rubric sheet!

## Inquiry Lab Report Grading Rubric

\*\* The criteria (Cri.) mentioned on this rubric are necessary for reporting within the IB program. Students from my other classes ignore these specifications, and simply use the bulleted information.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Each heading refers to the section of the lab report, details the expectations for each section, and specifies the marks available.

### Aim (3 pts) [Cri. D]

Relates to the topic of the lab	3	2	1
---------------------------------	---	---	---

### Hypothesis (9 pts) [Cri. C+D]

Is a prediction of the outcome of the lab	3	2	1
Explains reasoning behind the prediction	3	2	1
Is clear and testable	3	2	1
Hypothesis clearly refutes or defends established knowledge and is fully supported [Cri. C+D]	3	2	1

### Materials (3 pts) [Cri. D]

Complete, and neatly formatted	3	2	1
--------------------------------	---	---	---

### Procedure (9 pts) [Cri. B+D]

Is written in list form [Cri. B+D]	3	2	1
Can be easily repeated by another student [Cri. B+D]	3	2	1
Is a reasonable plan to test the hypothesis	3	2	1

### Data Collection (9 pts) [Cri. E]

Data are presented in a neat table	3	2	1
Appropriate units are included in the table	3	2	1
Presents the data clearly and logically	3	2	1

(Continued Next Page)

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

2008  
Winning Lesson Plan  
from Brampton, Ontario,  
Canada

*Human Organ  
Interdependency*

by Casey Wilson  
William Grenville Davis

Subject: Biology  
Grade Level: 8–12  
Duration: 10 Class Periods

## Inquiry Lab Report Grading Rubric (Cont'd)

### Data Processing (12 pts) [Cri. E]

Graph is present, and neatly constructed	3	2	1
Graph axes are properly labeled with units	3	2	1
Trends in the data are clearly identified	3	2	1
A conclusion is made based on the data	3	2	1

### Conclusion (9 pts) [Cri. C+E]

Explains the conclusion using scientific knowledge [Cri. C+E]	3	2	1
Discusses reliability of the data/anomalous results	3	2	1
Suggests improvements on procedures	3	2	1

### Performance in experiment (6 pts) [Cri. F]

Safety concerns are fully addressed and	6	4	2
<ul style="list-style-type: none"> <li>procedures for conducting the experiment</li> <li>insure that there is little or no risk of safety</li> <li>or discomfort to the student</li> </ul>			

MYP Criterion B Score	/6
MYP Criterion C Score	/6
MYP Criterion D Score	/24
MYP Criterion E Score	/30
MYP Criterion F Score	/6