

Grade: 11	Subject: Biology 20	Unit: Body Systems (Circulation and Immunity)
WebQuest: Teaching Immunity and Vaccination Through Infographic Design		
<p>Rationale</p> <p>Students often learn best by teaching others. Not only does this require reproduction of information, it forces students to reword their thoughts and juggle information in their brains before they re-deliver it to the world. Students must thoroughly understand their topic, organize the concepts they have learned, and decide which concepts are most important for their audience. This requires much higher order thinking skill than even complex analysis questions can elicit.</p> <p>Immunology is an incredible deep field of study. To cover such a broad topic with an activity like this would be very difficult. For this reason, it is easier to use a smaller subsection of this unit. Vaccination is a hot topic item in the news that high school students have likely had exposure to. It is also a source of vast misconception in the news, in the public, and in the classroom.</p>		
<p>Background Information</p> <p>The Derda research group at the University of Alberta is part of the GlycoNet organization. They study a wide range of topics, but one area of their current research explores identification of <i>Mycobacterium tuberculosis</i>. The research group, led by Dr. Ratmir Derda, is attempting to develop a field test for the TB bacteria that would enable identification of the disease in poor and remote environments.</p> <p>Though a laboratory test for TB exists, it requires cell culture. This is slow, requires a sterile environment, and is often unavailable in some areas of the world. Having a rapid detection test that requires only a finger prick and provides test results within minutes would be a very beneficial tool. Development of this tool requires a number of biochemical tools. A ligand already exists that detects TB, but it is nonspecific; the same ligand also produces a false positive for other pathogens with similar cell markers. Derda’s group has pioneered a powerful approach for discovery of molecules that may amplify the bond between the ligand and the pathogen. Adding a carbohydrate group to the existing protein agent has allowed these researchers to increase the bond strength 10-fold. This research approach was successfully used to identify a molecule that may lead to the development of a diagnostic test exclusively for TB.</p> <p>The “detection” process behaves in much the same way as in an antigen-antibody complex. We are searching for a molecule that mimics an antibody, but for the purpose of identification rather than destruction. Understanding antigen-antibody complexes is critical to achieving a thorough knowledge of human immunity. Students often struggle with specific (cell mediated) immunity.</p>		

The objective of this lesson is to allow students to develop their own learning resource (a digital infographic) to help them to better understand the subject of vaccination. Due to its prevalence in the media, this lesson also provides students with the opportunity to explore credible sources of information.

Curriculum Connections

- **20-D2.8k** list the main cellular and non-cellular components of the human defence system and describe their role; i.e., skin, macrophage, helper T cell, B cell, killer T cell, suppressor T cell, memory T cell
- **20-D2.9k** describe the ABO and Rh blood groups on the basis of antigens and antibodies
- **20-D2.1s** formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues
- **20-D2.2s** conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information
 - research and design a simulation or model of the functioning of the main components of the human immune system
- **20-D2.1sts** explain how Canadian society supports scientific research and technological development to facilitate a sustainable society, economy and environment

Lesson Objectives/Concepts

- Students will use the website to respond to three tasks.
- Students will explore the concepts surrounding specific (cell-mediated) immunity
- Students will understand the purpose of an antigen-antibody complex and explain why antibodies are critical to this system
- Students will achieve an understanding of how vaccinations work
- Students will create a teaching tool to help educate others about how vaccinations work
- Students will explore deeper into the intricacies of vaccination

Materials

- All student resources are available on the website:
<http://specificimmunity.weebly.com/>
- A class set of laptops or a computer lab

Time

1-3 classes, depending on time availability and whether the presentation option is chosen

Introduction

55 min - (Optional) - If you feel your class would benefit from additional exposure to vaccine information, the PBS document 'The Vaccine War' takes a thorough look at many of the issues surrounding vaccines. This could also work as a follow up activity. Link: [The Vaccine War](#).

20-30 min - Introduce the webquest activity. Show students the homepage and the task description. You can look briefly at the background information page, but that is mostly there for their understanding and reference. It may also be valuable to show them a few examples of what infographics look like (“Your Task” page at the bottom). Finally, review with students the rubric they will be marked on. Make sure you highlight the areas where most of their marks will come from and what they will be expected to hand in.

10 min - After introducing the activity, talk to students about what to trust as a **reliable** resource. Ask some of the following questions:

- Through what medium would you usually hear news of a new cancer drug?
- Do you trust news and social media organizations like CBC? NBC? Facebook? BuzzFeed? Why or why not?
- Do news organization fact-check their stories? Where would you go to verify information from a story on Fox News? (*This is kind of a setup question. News media often do very little sourcing for their stories or rely exclusively on anecdotal accounts of events. This may be a good time to discuss anecdotal evidence as well.*)

Discussion Goals - News sites like Fox News, CNN, or NBC are often looking for shock value stories, not slow, steady science. Clickbait sites like Upworthy and BuzzFeed are even worse – they rely purely on headlines and have almost no substance. Encourage students to look for educational sites like Khan Academy. University sites also generally provide a harder look at the genuine science as well. Explain the importance of citing sources and how even Wikipedia does a lot of this.

Activities/Procedure

90 min - Students will use this time to work on their infographics. You should encourage students to use at least **10-15 minutes** to plan what they want their infographic to look like. This should spark debate about which pieces of information are important and need to be included. Remind students on multiple occasions that they are not producing a list of “interesting” stats for you. A few eye-catching statistics are a good lead-in, but we are looking for the concept of vaccination to be explained, even if it is in a simplistic manner.

Teacher - Your job will mostly be to clarify immunity and vaccination questions and encourage student progress. Students will use the provided website and carry out their task using one of the infographic creation tools. If they have experience with another tool, they are welcome to use it, but should clear it with you first. There are multiple tools out there that work quite well, but do make sure that students are using a free tool before signing off on it.

Summary

Students will be invited to present their findings in front of the class. They will be encouraged to explain why they chose to use the information they presented. Did they teach through metaphor or use literal terminology? How did they choose to address their target audience? Is their diagram flashy or number-heavy? Try to elicit students' motivations in making the decisions they did on their infographics.

Another option: Post all of the student infographics online and get students to vote on different categories. You could use things like:

- Most eye-catching
- Most scientifically accurate
- Most interesting (true) fact

Assessment

Students will be handing in their infographics via email. They will also choose 5 of the extension questions to answer in depth and hand these in as a separate attachment (word document, google doc, etc.). Students will be marked on the rubric provided to them on the website. A print copy has been included for you as a separate file. If you choose to do so, you may include the last (optional) category of the rubric and allow students to present their findings.

Extension

Students can explore the researchers on the Glyconet website (<http://canadianglycomics.ca/>) or the Derda research group website (<http://derda.chem.ualberta.ca/>). Students could also research a vaccine and study how it works. For this activity, they will be encouraged to answer 5 of the questions below. They should use correct terminology and answer each question in depth.

1. What is the difference between a live and a dead vaccine?
2. What types of pathogens do vaccines work against?
3. Why are vaccines injected into the body in the places they are? Are all vaccines injected?
4. Why don't vaccines last forever? Why do we need to get booster shots for some vaccines?
5. What is "herd immunity"?
6. Why can some people not get immunized? (We are **NOT** talking about people who choose not to get vaccinated, but those who can't for medical reasons)
7. Which diseases have been fully or nearly eliminated by vaccination in the last 100 years or so?
8. How do babies acquire some of their mother's immunity?
9. Why is there a different flu vaccine every year? Do we have to get the new vaccine to be

protected?

10. Is there any evidence to the claims from celebrities like Jenny McCarthy and Jim Carrey that vaccines cause autism, multiple sclerosis, or other disease? (*Be careful to use credible sources only if you choose to answer this question*)

Student Name _____ Date _____

Task: WebQuest - Creating an Infographic on Vaccination

Total: _____/30 (25)

Level	Proficient (5)	Adequate (3-4)	Limited (1-2)	Insufficient/ Blank*
Criteria				
Scientific Accuracy	Infographic has thorough and accurate information.	Infographic has mostly accurate information with a few minor misconceptions.	Infographic has many major misconceptions showing lack of student understanding.	No score is awarded because there is insufficient evidence of student performance based on the requirements of the assessment task.
Explanation of Vaccination	Explanation of vaccination is clear and concise. Level of detail is appropriate for audience.	Explanation of vaccination is adequate. It is either lacking in detail, inconsistent, or confusing.	Explanation is incorrect or shows major holes in understanding.	
Relevance of Information Provided	Information provided is relevant with small additional details to create interest.	Information provided is mostly appropriate. Infographic either has few details or is overburdened with information.	Information provided is poor, doesn't match vaccination explanation, or is irrelevant.	
Clean and Organized Design	Infographic is neat and organized in a manner that encourages reading.	Infographic shows some thought to organization, but lacks consistency or purpose.	Infographic is poorly organized with information randomly assorted on the page.	
Extension Questions (5 Answered)	Extension questions are answered thoroughly and accurately.	Extension questions are mostly answered well with minor misconceptions or errors.	Extension questions are incorrectly answered or answered with little explanation.	
Infographic Presentation (Optional)	Presentation displays student understanding. Students all participate in presentation.	Presentation is accurate but brief. Understanding is shown, but very limited outside of the task.	Students show limited or no understanding of the topic or unable to answer questions about their infographic.	