

NC Global Distinction Initiative Curriculum Projects

1. Principles of Biology (BIO 110)

This course provides a survey of fundamental biological principles for non-science majors. Emphasis is placed on basic chemistry, cell biology, metabolism, genetics, evolution, ecology, diversity, and other related topics. Upon completion, students should be able to demonstrate increased knowledge and better understanding of biology as it applies to everyday life. This course has been approved to satisfy the Comprehensive Articulation Agreement general education core requirement in natural science/mathematics.

State Mandated Student Learning Outcomes (SLOs) :

- Demonstrate an understanding of the principles of scientific inquiry.
- Demonstrate an understanding of the impact of science on technology and society.
- Evaluate the credibility of sources of scientific information.
- Analyze qualitative and quantitative empirical data.
- Demonstrate knowledge of basic biological principles as they apply to broader concepts.
- Demonstrate the ability to write critically about essential questions in Biology.

Global Learning Objectives:

1. Discuss the importance of vaccines in treating infectious disease and global pandemics.
2. Discuss the importance of monitoring fresh water sources for human and ecosystem health.
3. Discuss the controversy of using GMOs to improve the nutritional value of food and to sustain the global food supply.

Global Learning Activity: Submitted by Laurel Young

Infectious Disease

This lab activity involves an infectious disease simulation and the exploration of past epidemics/pandemics.

Purposes:

- Identify modes of infectious disease transmission
- Simulate how an infectious disease spreads through a population
- Explore past/current epidemics/pandemics to gain perspective of global impact
- Select a past/current infectious disease that originated/severely affected part(s) of Europe, Asia, Africa, and/or Central & South America/Caribbean.

Time:

3 hour lab period

Materials:

- Computers with internet access , presentation software (Power Point/Prezi), Google Earth
- Test tubes and dropper (@ student)
- Distilled water
- 0.1 molar NaOH
- phenolphthalein solution (pH indicator)

Procedure:

What is an Infectious disease? (10 minutes)

Work as a group at your lab table to complete this activity:

1. Search the web for a definition of “infectious disease”. In your own words, define infectious disease, using verbiage that clearly articulates how infectious disease differs from other diseases (i.e. diseases due to inheritance or nutritional deficiencies)

2. The information listed below will be used later in this lab. Infectious diseases are spread in different ways (modes) within a population. Read over the modes of transmission and their associated infectious diseases. Note: there can be overlap in some of these categories (i.e., HIV can be transmitted via blood and sexually). In addition, some of these disease-causing organisms can survive on inanimate objects, such as doorknobs or faucet handles and therefore can also be transmitted via indirect contact.

Mode of Transmission	Example of Infectious Disease
Direct skin contact: Disease transmitted by direct skin contact with infected individual	MRSA
Blood Transmission: Direct contact with infected blood or via used needles	HIV
Sexual Transmission: Via intercourse or other sexual contact	Chlamydia
Airborne transmission: Inhalation of droplets or suspended particles due to infected individual coughing or sneezing or to infectious organisms travelling in air currents.	measles
Insect vector: Disease-causing organisms initially infect and multiply within an insect. The insect becomes a vector; capable of transmitting the disease-causing organism when it bites/stings a human	malaria
Food/water contamination: ingestion of contaminated food or water	cholera

Simulating the spread of an infectious disease (45 minutes)

Some infectious diseases become epidemics because their infection and transmission rates are high. Epidemiologists and public health officials study and plan how to prevent infectious diseases from becoming epidemics. This exercise will simulate the spread of one imaginary infectious disease.

Simulating an Epidemic: Instructions for professors

Materials:

- test tube and dropper for each student
 - distilled water
 - 0.1 molar NaOH
 - phenolphthalein solution, dissolved in alcohol and diluted in water (pH indicator)
1. Let students know they are going to model the transmission of a disease by exchanging some of their test tubes' contents with that of other students. Mention that one of the test tubes is "infected" with an imaginary infectious disease. (Prepare the test tubes prior to class: Fill one tube halfway with 0.1 molar NaOH; fill the rest of the tubes halfway with distilled water.)
 2. Distribute prepared test tubes and droppers randomly to the class. Make a mental note of who receives the test tube containing NaOH.
 3. Have students walk around the room with the test tubes. When you say "Stop!" each student should use a dropper to trade a drop of fluid with the person nearest them. Repeat until at least three trades have occurred.
 4. Now it's time to test for the imaginary infection. Put a drop of phenolphthalein in each test tube. If the fluid turns pink, the test tube is "infected" with NaOH. How many students are now "infected"?

CAUTION: Sodium hydroxide (NaOH) and phenolphthalein can irritate the eyes and skin. Alert students to avoid spilling.

An Educators Guide. In A Science Odyssey: Resources for Educators. Retrieved June 29, 2015, from <http://www.pbs.org/wgbh/aso/resources/guide/medact4index.html>

Simulation: Instructions for students

1. Clearly write your first name and initial of your last name on the board.
2. Obtain a test tube and dropper from your instructor. The contents may irritate eyes and skin so use caution.
3. Return to your seat.
4. When instructed, walk casually around the room until signaled to stop.
Place a drop of fluid into the test tube of the person nearest to you and allow them to place a drop in yours. Be careful not to touch the fluid or the dropper of this person.
5. Repeat this fluid trade as guided by your instructor. Each fluid exchange should be novel.
6. Return to your desk and put 2 drops of phenolphthalein into your test tube.
 - If the fluid remains clear, it indicates you have not been infected.
 - If the fluid turns pink, it indicates an infection.
7. If infected, go to the board and draw an asterisk (*) next to your name.

Assignment: Tracing the source of infection

Each table now works together as a team of epidemiologists.
The team's challenge is to trace the path of the epidemic and locating the source of the infection.
Your team grade will be based on

- 1) correctly identifying the source of infection
- 2) turning in a neatly written and organized paper (see instructions)
- 3) teamwork: how quickly the team accomplishes its task; (time is important in an epidemic)

Assignment Instructions:

- Use the list of student names on the board (* = infected) to trace the path of infection from infected team members to the source
- You may have to collect info from other teams (i.e. their names!)
- Infected (*) and non-infected individuals should be named on your paper.
- Use the paper available in lab to answer the seven questions below.
- Turn in the completed assignment for a grade.

Questions

1. Based on the infectious disease simulation;
 - a. What was the mode of transmission of the 'infectious agent'?
 - b. Public health officials educate the public to minimize the impact of disease transmission. How could you have prevented yourself from becoming infected in today's simulation?
 - c. List the challenges your team of epidemiologists encountered when tracing the spread of infection?
 - d. Assume 5 classmates died as a result of this infectious disease. Use the info at this website and calculate the mortality rate:
<http://health.mo.gov/training/epi/CrudeRate.html>
For this exercise n=100.
 - e. Predict how the infection rate might have been different in this simulation if the mode of transmission was suspended airborne particles.
2. Define epidemic:
3. Define pandemic:

Epidemic/Pandemic Group Assignment: (60 minutes)

Each group will be either be assigned to one of the seven infectious diseases listed in the table or submit an infectious disease that originated in a country outside of the US (i.e. Europe, Asia, Africa, and/or Central & South America/Caribbean) . The submission will need to be evaluated and approved by your instructor. Each of the listed diseases was classified as an epidemic or pandemic. Use teamwork to gather information for a 10-15 minute group presentation to be presented at the end of class (see grading rubric in resources). The presentation should provide information enabling your peers to complete the table.

Group Presentation should include:

1. A map pinpointing the geographic origin and spread of the infectious disease. Include this this map in your presentation.
2. A summary of the following important aspects of your disease:
 - a. Epidemic or pandemic?
 - b. Time period(s) of critical concern
 - c. Morbidity & Mortality rates
 - d. Death Toll
 - e. Scientific name & classification of disease causing agent
 - f. Mode of transmission
 - g. What social, cultural or political impacts have been made by this disease?
 - h. How did/does this disease affect global trade, business, and travel?
 - i. Include an article/story from a foreign news agency regarding your specific disease
3. Include the image of an artifact, photo or media headline that epitomizes the epidemic/pandemic.

The table below doesn't include everything that needs to be covered but is an example of a method that may help you to organize your research as you work on your project.

Infectious Disease	Geographic Location: origin and spread Epidemic or Pandemic?	Time Period	Mortality rate: #died/#infected or approximate death toll	Scientific name of disease-causing agent	Classification of disease-causing agent (viral, bacterial, fungal, zoonotic)	Mode of Transmission
Bubonic Plague						
Smallpox						
Spanish Influenza						
Asian Flu						
HIV/AIDS						
SARS						
Ebola						

Connection:

Many infectious diseases are caused by viruses. The fact that you are living today means that your ancestors inhabited uninfected regions of the globe, survived the infection, or resisted infection due to immunity. Our next class period will involve immunity and vaccinations. To be prepared for this class, please complete the following and be prepared to discuss:

- 1) How do vaccines work? (3.5 minutes) <https://www.youtube.com/watch?v=kwVfcc1S7IU>
- 2) How might vaccinations prevent an epidemic? Your answer should involve the concept of herd immunity (4.5 minutes) https://www.youtube.com/watch?v=ZuiHFg_nfnE
- 3) Think about: What immunizations have you received?

Resources:

General

<http://www.who.int/en/>

<http://www.flu.gov/pandemic/global/index.html>

<http://www.cdc.gov/globalhealth/healthprotection/>

<http://worldview.unc.edu/educator-resources/community-college-resources/>

Response to a pandemic:

www.globalsecurity.org (search: write in pandemic)

<http://www.gleamviz.org/challenges/>

Why do we hear about some health alerts but not others?

<http://www.gapminder.org/videos/swine-flu-alert-news-death-ratio-tuberculosis/>

History of vaccines

<http://www.historyofvaccines.org/content/timelines/all>

How vaccines work?

<https://www.youtube.com/watch?v=kwVfcc1S7IU>

How might vaccinations prevent an epidemic? Your answer should involve the concept of herd immunity

https://www.youtube.com/watch?v=ZuiHFg_nfnE

Assessment

- Instructor grading of the 'Tracing the Source of Infection' assignment
- Peer grading of the presentation using grading/scoring rubrics

Grading Rubric

CATEGORY	(FULL) ___ points	(PARTIAL) ___ points	0 points
Clearly identifies infectious disease			infectious disease NOT clearly identified
Group members equally present (list names)			One member of the group dominates the presentation.
Geographic origin and spread of infectious disease is represented by a map			No map is provided.
Morbidity & Mortality rates			No rates given
Scientific name of disease-causing agent			Scientific name (genus and species) is NOT given
Classification of disease-causing agent (viral, bacterial, fungal, zoonotic)			Classification of disease causing agent is NOT given; or is not correct
Mode of Transmission			No mode of transmission was mentioned.
Images of artifact, photo or media headline that epitomizes the epidemic/pandemic			No images given
How did/does this disease affect global trade, business, and travel?			
Peer (Group) Evaluation OPTIONAL	Fills out peer (group) evaluation completely and always gives scores based on the presentation rather than other biased factors (e.g., person in group is a close friend).	Fills out most of the peer (group) evaluation and always gives scores based on the presentation rather than other biased factors.	Fills out most of the peer (group) evaluation but scoring appears to be biased.

Epidemic or pandemic?			
Time period(s) of critical concern			
Death Toll			
What social, cultural or political impacts have been made by this disease?			
Include an article/story from a foreign news agency regarding your specific disease			

Resources for students to use:

<https://www.library.cornell.edu/research/citation/apa>
<http://worldview4.web.unc.edu/>
<http://africa.unc.edu/>
<http://carolinaasiacenter.unc.edu/>
<http://mideast.unc.edu/>
<http://europe.unc.edu/>
<http://cgi.unc.edu/>
<http://jhfc.duke.edu/latinamericauncduke/>
<http://global.unc.edu/>
<https://duke.edu/APSI>
<http://www.cpc.unc.edu/>
<http://library.unc.edu/>
<http://globalhealth.unc.edu/>
<http://www.who.int/en/>
<http://www.idsociety.org/Index.aspx>
<http://www.cdc.gov>
<http://gid.georgetown.edu/>
<http://www.smartglobalhealth.org/issues/entry/infectious-diseases>
<http://www.fic.nih.gov/Pages/Default.aspx>
<http://www.cdc.gov/ncezid/>
<http://www.isid.org/>
<http://www.idri.org/>
<http://www.healthmap.org/en/>
<http://cghid.wustl.edu/>
<http://www.jgid.org/>
<http://www.wvi.org/infectious-disease>
www.seattlechildrens.org/research/global-infectious-disease-research/
<http://www.gsid.org/>

Global Learning Activity: Submitted by Paul Stevens**Global Freshwater Crisis Project**

Students will research the current freshwater crisis in a foreign country and compare/contrast that with the current situation in the United States. Students will give a 10-15 minute group presentation as well as a written summary of their findings.

Purpose:

To help students understand the basic biological importance of freshwater for not only the human race but our earth as a whole. Students will gain a greater knowledge of the current crisis within their own country as well as countries throughout the world.

Time:

10 - 20 hours (this will differ based on each group)

Materials:

access to the internet/computer, some type of presentation platform (PowerPoint, Prezi, other unique idea)

Procedure:

- Discussion/Lecture on the basic chemistry of water as well as its biological importance to our species and the world around us.
- Students will be presented a list of pre-approved (by each instructor) foreign countries currently suffering from a lack of freshwater for human consumption.
- Information found in research will be put together in a written summary and then rendered in a presentation (method is of their choice and approved by instructor) to their peers.
- Assignment: This assignment will be done in groups of 2 or 3 individuals. Groups may be chosen or assigned. A rubric will be provided.

Assignment Instructions

- 1. Research background info:** The basic science of the water molecule (1) properties, (2) its importance in sustaining life, and (3) the current crisis in the US vs. a foreign country (assigned or chosen).
2. Group will select a country.
 - The following are a list of some of the countries (insert your school) travels to (or will travel to) as part of the International Program and Study Abroad: countries will differ by school.

-The link below offers an alternative list for the top 36 most water stressed countries:
<http://www.wri.org/blog/2013/12/world%E2%80%99s-36-most-water-stressed-countries>

3. **Main points that should be researched (ABOUT BOTH COUNTRIES):**

- Scarcity of clean water
- Effects of dirty and unsafe water
- Lack of proper sanitation and hygiene in a community
- Potential effects of dirty water: poor health, fatality rates, increased hunger, perpetual poverty, and lack of access to education
- Methods available to bring clean, safe water to a developing community (challenges of completing ideas and technical solutions)
- Current and possible future water policies
- Impact of climate on the water supply
- Effect of human activities on the water supply
- Identify current freshwater resources
- Role of water in natural and human-made environments
- Identify and describe at least one disease/condition caused by dirty/unsafe water

4. The information researched above should all be compiled and presented to the class in a 10-15 minute presentation. You may use PowerPoint, Prezi, etc. (other ideas can be used but must be approved by the instructor. **EACH PERSON IN THE GROUP SHOULD PRESENT AN EQUAL AMOUNT OF TIME.**

- Groups will make class presentations during the last week of class.
- ONE TYPED written summary WITH ALL GROUP NAMES INCLUDED will suffice. Hand-written OR EMAIL copies will not be accepted.
- At least 5 references required. References used must be from a reputable scientific and/or educational source. No “.com’s” are allowed and points will be taken off if used and cited. References also must be cited. “.org and .edu” are great sources. If you have a story from a reputable NEWS organization please run that by me to see if it will be allowed. If allowed it will NOT count towards the 5 sources.

Formatting for references should be done using the APA style. You may google APA style or simply use this resource from Cornell University to assist you in referencing in and after your summaries/paper.

<https://www.library.cornell.edu/research/citation/apa>

Resources:

<http://waterinstitute.unc.edu/>

<http://www.globalresearch.ca/top-ten-countries-at-risk-of-water-shortages/19996>

<http://www.wri.org/blog/2013/12/world%E2%80%99s-36-most-water-stressed-countries>

<http://water.org/water-crisis/water-facts/water/>

<http://www.worldwatercouncil.org/>

<http://www.globalresearch.ca/top-ten-countries-at-risk-of-water-shortages/19996>

<http://worldview4.web.unc.edu/>

<http://africa.unc.edu/>

<http://carolinaasiacenter.unc.edu/>

<http://mideast.unc.edu/>

<http://europe.unc.edu/>

<http://cgi.unc.edu/>

<http://jhfc.duke.edu/latinamericauncduke/>

<http://global.unc.edu/>

<https://duke.edu/APSI>

<http://www.cpc.unc.edu/>

<http://library.unc.edu/>

<p>___current crisis in the US</p> <p>___current crisis in foreign country selected</p> <p>___scarcity of clean water in foreign country selected</p> <p>___describe improper sanitation and hygiene in foreign country selected</p> <p>___identify and describe at least one disease/condition caused by dirty/unsafe water (4 pts.)</p> <p>___potential effects of dirty and unsafe water: poor health, fatality rates, increased hunger, perpetual poverty, and lack of access to education in foreign country selected (4 pts.)</p> <p>___methods available to bring clean, safe water to a developing community in foreign country selected (challenges of completing ideas and technical solutions)</p> <p>___current and possible future water policies in foreign country selected</p> <p>___impact of climate on the water supply in foreign country selected</p> <p>___effect of human activities on the water supply in foreign country selected</p> <p>___identify current freshwater resources in foreign country selected</p>					
<p>Personal Presentation Grade (25)</p> <p>___ students maintains eye contact with Audience (5)</p> <p>___ seldom returns to notes/screen (5)</p> <p>___ student uses loud, clear voice, (3)</p> <p>___ correct and precise pronunciation of terms. (3)</p> <p>___ asks questions/engages audience (4)</p> <p>___ presents a roughly equal % compared to the rest of the group (5)</p>					
<p>Power Point/Presentation Mechanics (25)</p> <p>___ presentation has no grammatical or spelling errors. (5)</p> <p>___ presentation is creative, easy to follow/read, is professional (8)</p> <p>___ images explain and reinforce screen text and presentation content (5)</p> <p>___ 10-15 images in presentation (2)</p> <p>___ 12-16 slides (5)</p>					
<p>Total Classroom Presentation(100)</p> <p>Total Written Summary(75)</p> <p>Total Points earned: _____</p>					

Notes:
Start Time: _____ End Time: _____ Number of Slides _____ Number of Images _____

Global Learning Activity: Submitted by Andy Salandy/Holly Woodruff

What are GMOs and how do they impact various cultures in a global society?

Students will be writing a blog on a monthly basis (total of four per semester). Topic: What is the Cultural Acceptance of Genetically Modified Organisms (GMOs) in the following regions: Asia, Europe, Africa, and Latin America/Caribbean?

Purpose:

The purpose of these blog activities is to get students to understand the perception in various cultures of what is accepted and what's not. Students will compare and contrast their findings with how GMOs are dealt with in the United States. Students will also develop research and writing skills while being engaged in these blog activities. Students should understand what a GMO is, how you create a GMO, and why they are of importance in a global society.

Time:

1-3 hours for each individual blog/research

Materials:

- Personal computer/Internet to enter blogs on
- NC Live is a wonderful research resource as a starting point for the students. Also, the following link has tremendous information to help students sort through the debate
http://www.nytimes.com/2014/01/05/us/on-hawaii-a-lonely-quest-for-facts-about-gmos.html?_r=0
- Students must use credible research journals or other publications to support their research. SEE Resources below for a good place to get started.
- Some questions to think about (but not limited to) when researching are:
 - What is a GMO?
 - How are GMOs created?
 - What are some commercially grown GMO crops in your specific country?
 - What do various health agencies (like the World Health Organization, the governing health body of your specific country, etc.) say about GM foods?
 - Are there any advantages or disadvantages of GMOs? If so, list them and discuss how they affect the specific country you are currently researching.
 - How do the various laws/regulations in your specific country compare to those found in the US?

Procedure:

1. Each student will be assigned (or may choose) a particular country within each of the four regions (Asia, Europe, Africa, Central/South American/Caribbean) to investigate and write their blog about
2. Students perform individual research on their assigned country
3. Students must cite their sources used to do their research
4. Each blog will be graded with the rubric below

Resources:

Cultural acceptance of Genetically Modified Organisms (GMO's) in the United States versus other Regions of the world . http://www.nytimes.com/2014/01/05/us/on-hawaii-a-lonely-quest-for-facts-about-gmos.html?_r=0 This link will help you get started on this question.

<http://worldview4.web.unc.edu/>

<http://africa.unc.edu/>

<http://carolinaasiacenter.unc.edu/>

<http://mideast.unc.edu/>
<http://europe.unc.edu/>
<http://cgi.unc.edu/>
<http://jhfc.duke.edu/latinamericauncduke/>
<http://global.unc.edu/>
<https://duke.edu/APS/>
<http://www.cpc.unc.edu/>
<http://library.unc.edu/>
<http://www.who.int/en/>
<http://www.nongmoproject.org/learn-more/>
<http://factsaboutgmos.org/>
<http://www.bt.ucsd.edu/gmo.html>
<http://www.isaaa.org/resources/publications/pocketk/1/>
http://www.gmo-compass.org/eng/grocery_shopping/crops/
<http://www.greenfacts.org/en/index.htm>
<http://www.efsa.europa.eu/en/topics/topic/gmo.htm>
http://ec.europa.eu/food/plant/gmo/new/index_en.htm
<http://learn.genetics.utah.edu/content/science/gmfoods/>
<http://www.fda.gov/Food/FoodScienceResearch/Biotechnology/ucm346030.htm>
<http://www.ncbi.nlm.nih.gov/>
<http://genera.biofortified.org/viewall.php>
<http://www.fao.org/home/en/>
<https://www.library.cornell.edu/research/citation/apa>

Assessment: (optional) The example rubric below can be used to assess student blogs

Your Blog Points

- 5 points – content
- 5 points – In your discussion include 5 main ideas with 2 or 3 examples from your experiences and research
- 3 points – coherency and organization, 2 points – somewhat difficult to follow
1 point – not organized
- 2 points – accuracy
- 2 points – few errors in spelling and grammar, 1 points – many spelling or grammar errors, but still comprehensible, 0 point – meaning unclear due to spelling or grammar errors