AN *E.COLI* LESSON PLAN:
Solve an Outbreak of Dysentery

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Purposes of the lesson unit using *E. coli*:

(Students should have been introduced to viruses as well as bacteria before engaging in this project. This lesson plan is not necessarily workable for the AP Biology program because of time constraints to complete a specified curriculum)

- Provide an understanding of mechanisms microorganisms use to enter and manipulate host cells
    - Generate an understanding of interdependence between micro and macro organisms, including endosymbiosis.
    - Introduce CDC fieldwork procedures as well as the need for biotechnology.
    - Expose students to technological methods used in disease identification.
    - Expose students to how bacteria behave, *E. coli* in particular
    - Help students learn how bacteria trade information,.
    - Expose students to the sources of this information.
    - Help students understand human behavior and its relationship to disease acquisition.
    - Help students gain an understanding of the dynamism of interconnections between the earth's species and why there will always be adaptations.
    - Help students learn the mechanisms by which bacteria can be compromised (types of antibiotics and how they work)

Materials:

1. -DVD infectious disease lecture on diarrhea, includes:
    - the numerous types of *E coli*,
    - E coli necessary (endosymbiont?)
    - What makes this species cause disease (Centers for Disease Control and *Guns, Germs, and Steel*, by Jared Diamond)?
    - List of the diseases
    - Animation of how bacteria trade information
    - Animation of how fast *E. coli* multiplies.
    - Disease is accident. Best survival is not to kill host. (or become an endosymbiont)

2. -Video:
    Nova: "What is Killing the Children?"

3. -Notes on epidemiology

4. -Article from Natural History about *E. coli* infectious mechanisms in bladder infections.,

5. Refer to termite lab showing endosymbionts,

(Article on fritillaria symbionts, "The Worm and the Parasite," by T.V. Rajan, from Natural History Magazine, 2002.)

6. -Readings from *Guns, Germs and Steel*, by Jared Diamond

7. -Website topics:
   CDC
   Epidemiology
   E coli general

   E. coli websites:
   http://www.hhmi.org/lectures/biointeractive/web_video/ecoli.htm
   http://www.hhmi.org/lectures/biointeractive/animations/conjugation/conj_frames.htm

   types of plasmids

Procedure:

Day 1:
Announce that this project centers around *E. coli* but is really about interrelationships between organisms—from disease-causing organisms to organisms which enhance each other to those which are so interdependent that they border on being communal organisms. (This last part is a lead in to a subsequent unit tied to ecology.)

Unit begins with a class-wide guided discussion about disease, resulting in definitions, ideas about how one would go about identifying a disease, understanding the need to utilize biotechnological methods to be able to Identify diseases.

Show DVD portion with lecture # 1.

Homework: Assigned reading of article on *E coli* infection mechanisms from Natural History

Day 2:
Read the section from *Guns Germs and Steel* regarding man getting disease from animals (in this case, cows). Populations not exposed to animals susceptible to disease of humans that have been exposed to animal derived diseases.

   What affect on history did and does this have?
   What does knowledge of history have to do with understanding biology?

Homework: Read article about fritillaria. Reread notes on past lab on termite endosymbionts

- or perform a live termite demo showing the prokaryotic and protistan endosymbionts.

Day 3: Lecture # 2 of DVD taking note of mechanisms.

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Day 4.

Hand out question sheet for and show video, "What is Killing the Children?"

Discussion about field protocols of epidemiologists

Question Sheet

Name_____Date_____

WHAT IS KILLING THE CHILREN?

List:

- **Symptoms of the disease**

- **Sequences in the procedure of an epidemiologist**

- **Clues about the disease**

Job description of an epidemiologist as listed by person behind desk in the video.

Define:

Case zero

Plasmid

Vector

CDC

etiology

Question:

Why does the CDC, centered in Atlanta, GA., send agents to other countries around the world?

Day 5:
Specifics on E coli:
Using DVD, lectures and animations.
Hand out assignments for each group.

The Problem:

You are scientists from the CDC who have been sent to a remote village in ALASKA where there has been an outbreak of dysentery .
The village contains 15 families. For generations this village has earned its living in the traditional manner of fishing and hunting the local mammals.
This year one of the children went to college in Japan. It was a great honor. When he came home for winter break, however, he had a fever and mild dysentery.

TASKS AND TOOLS: Who investigates what.
members of your team for separate tasks>
-one to take case histories which should include?
Web search: CDC and public health sites
Go over notes of procedures followed in video.
-one to decide what kind of tests to run
PCR
DNA analysis
Smears
Stool samples

1. First, each participant will have a hard copy of the worksheet. To answer the questions given above, you'll break into groups of four. Within the group, each of you will take on one of the following roles:

The Efficiency Expert: You value time a great deal. You believe that too much time is wasted in today's classrooms on unfocused activity and learners not knowing what they should be doing at a given moment. To you, a good WebQuest is one that delivers the most learning bang for the buck. If it's a short, unambitious activity that teaches a small thing well, then you like it. If it's a longterm activity, it had better deliver a deep understanding of the topic it covers, in your view.	**The Affiliator:** To you, the best learning activities are those in which students learn to work together. WebQuests that force collaboration and create a need for discussion and consensus are the best in your view. If a WebQuest could be done by a student working alone, it leaves you cold.
The Altitudinist: Higher level thinking is everything to you. There's	**The Technophile:** You love this internet thang. To you, the best WebQuest is one that makes the best

too much emphasis on factual recall in schools today. The only justification for bringing technology into schools is if it opens up the possibility that students will have to analyze information, synthesize multiple perspectives, and take a stance on the merits of something. You also value sites that allow for some creative expression on the part of the learner.	use of the technology of the Web. If a WebQuest has attractive colors, animated gifs, and lots of links to interesting sites, you love it. If it makes minimal use of the Web, you'd rather use a worksheet.

2. Individually, you'll examine each of the sites on the list of resources and use the worksheet to jot down some notes of your opinions of each from the perspective of your role. You'll need to examine each site fairly quickly. Don't spend more than 10 minutes on any one site.

3. When everyone in the group has seen all the sites, it's time to get together to answer the questions. One way to proceed would be to go around and poll each team member for the best two and worst two from their perspective. Pay attention to each of the other perspectives, even if at first you think you might disagree with them.

4. There will probably not be unanimous agreement, so the next step is to talk together to hammer out a compromise consensus about your team's nominations for best and worst. Pool your perspectives and see if you can agree on what's best for the learner.

5. One person in each group should open up SimpleText or Inspiration to record the group's thoughts.

6. When debriefing time is called, use this file to speak from as you report your results to the whole class. Do you think the other groups will agree with your conclusions?

Conclusion

Ideally, this exercise will provide you with a larger pool of ideas to work with on your final project. The best WebQuest is yet to be written. It might be yours!

Written by Bernie Dodge. Last updated on September 10, 2000

Science Project Checklist: Grades 9-12

Teacher Name:

Student Name:_____ Reviewer Name: _____

Date: _____

Project: E coli

CATEGORY RESPONSIBILITIES

Background Research I used resources that had data to support my main points.

I used a variety of pertinent resources.

I used up-to-date resources.

I utilized information from scientific journals.

I utilized information from textbooks.

I utilized electronic resources.

I wrote down the source of each piece of information I collected.

I cited my resources in the correct format.

Cooperative Groups I actively participated with other group members.

I showed respect and support for fellow team members.

I listened to my partners' ideas.

I provided ideas that contributed to the success of the project.

I contributed both time and effort.

I did my fair share of the project.

I held myself accountable for high quality work.

I held others in the group accountable for high quality work.

Rubric for Collaborative Work Skills: E coli

Teacher name:_____

Student Name _____

CATEGORY

1**. Quality of Work**

A-Provides work of the highest quality

B-Provides high-quality work

C-Provides work that occasionally needs to be checked/redone by other group members to ensure quality.

D-Provides work that usually needs to be checked/redone by others to ensure quality.

2. Contributions

A-Routinely provides useful ideas when participating in the group and in classroom discussion. A definite leader who contributes a lot of effort.

B-Usually provides useful ideas when participating in the group and in classroom discussion. A strong group member who tries hard!

C-Sometimes provides useful ideas when participating in the group and in classroom discussion. A satisfactory group member who does what is required.

D-Rarely provides useful ideas when participating in the group and in classroom discussion. May refuse to participate.

3. Problem-solving Actively

A-looks for and suggests solutions to problems.

B-Refines solutions suggested by others.

C-Does not suggest or refine solutions, but is willing to try out solutions suggested by others.

D-Does not try to solve problems or help others solve problems. Lets others do the work.

4. Pride

A-Work reflects this student's best efforts.

B-Work reflects a strong effort from this student.

C-Work reflects some effort from this student.

D-Work reflects very little effort on the part of this student.

5. Preparedness

A-Brings needed materials to class and is always ready to work.

B-Almost always brings needed materials to class and is ready to work.

C-Almost always brings needed materials but sometimes needs to settle down and get to work

D-Often forgets needed materials or is rarely ready to get to work.

6. Focus on the task

A-Consistently stays focused on the task and what needs to be done. Very self-directed.

B-Focuses on the task and what needs to be done most of the time. Other group members can count on this person.

C-Focuses on the task and what needs to be done some of the time. Other group members must sometimes nag, prod, and remind to keep this person on-task.

D-Rarely focuses on the task and what needs to be done. Lets others do the work.

7. Working with Others

A-Almost always listens to, shares with, and supports the efforts of others. B-Tries to keep people working well together. Usually listens to, shares, with, and supports the efforts of others.

C-Does not cause "waves" in the group. Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.

D-Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.

8.Monitors Group Effectiveness

A-Routinely monitors the effectiveness of the group, and makes suggestions to make it more effective.

B-Routinely monitors the effectiveness of the group and works to make the group more effective.

C-Occassionally monitors the effectiveness of the group and works to make the group more effective.

D-Rarely monitors the effectiveness of the group and does not work to make it more effective.

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