Why Use Case-Based Learning?

- we are all storytellers
- CBL is active, collaborative, student-centered
- CBL engages students in learning
- PBL mirrors real-world
  - Authentic problems (messy, interdisciplinary...)
  - Mix of teamwork & self-directed learning
  - Inquiry and scientific methods
  - Information literacy
CBL Changes Teacher and Student Roles

- **Students own the learning**
  - Identify what is known, what they need to know (formulate own questions)
  - Strategize how to find the answers
  - Research
  - Collaborate, teach each other

- **Teacher as guide**
  - Selects or designs real, authentic CBL
  - Asks questions
  - Uses authentic assessments
  - Debriefs and reviews
  - Monitors group process
Inquiry

- Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Inquiry also refers to the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world. Inquiry is a multifaceted activity that involves:
  - making observations;
  - posing questions;
  - examining books and other sources of information to see what is already known;
  - planning investigations;
  - reviewing what is already known in light of experimental evidence;
  - using tools to gather, analyze, and interpret data;
  - proposing answers, explanations, and predictions;
  - and communicating the results.

- Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations.

- Conducting hands-on science activities does not guarantee inquiry, nor is reading about science incompatible with inquiry.

_from National Science Education Standards (NRC, 1996, p. 23)_
Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity... Scientific literacy means that a person can:

- ask, find, or determine answers to questions derived from curiosity about everyday experiences.
- describe, explain, and predict natural phenomena.
- read with understanding articles about science in the popular press and engage in social conversation about the validity of the conclusions.
- identify scientific issues underlying national and local decisions and express positions that are scientifically and technologically informed.
- evaluate the quality of scientific information on the basis of its source and the methods used to generate it.
- pose and evaluate arguments based on evidence and to apply conclusions from such arguments appropriately.

from National Science Education Standards (NRC, 1996, p. 22)
Scientific information literacy

Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity... Scientific literacy means that a person can:

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- **evaluate the quality of scientific information** on the basis of its source and the methods used to generate it.
- **pose and evaluate arguments based on evidence and to apply conclusions from such arguments appropriately.**

_from National Science Education Standards (NRC, 1996, p. 22)_
Take off your teacher hat!

- Total immersion coming....
“Ingredients: sugar, gum arabic, natural flavor (oil of peppermint), gelatin (from cows!!).”
“Well, they are made in Great Britain and they do have gelatin in them.”
What do you think this case is about?

What do you already know that relates to this case?

What do you need to know to understand the case?
Define the problem

Analyze the problem
- What is known?
- What information do you need to investigate?

Generate hypotheses

Identify resources

Collect new information
- (Internet, books, journals, interviews, labs and simulations)

Exchange new information

Summarize
- (create product/assessment that demonstrates understanding)

Is the case complete?

No

Yes
Contagious Cancer?


- Let’s do a search
PROVENCE POLICE DEPARTMENT
ARLES, FRANCE
Incident Report

General Information:

Date of Incident: 12/24/88
Date of Report: 2/27/89

<table>
<thead>
<tr>
<th>Suspect</th>
<th>Sex</th>
<th>Age</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>36</td>
<td>Arrested, Hospitalized</td>
</tr>
</tbody>
</table>

Chief Inspector:
d’Ornano, Joseph

Narrative:
On Christmas Eve, [redacted] entered into an argument with his house guest. Witnesses saw the gentleman throw a glass at the head of his guest and make “murderous gestures” with an open razor. Upon leaving, the guest checked into a hotel and made no further contact with the suspect.

The morning of Christmas Day, police were alerted by a prostitute Rachel (last name unknown) that [redacted] had delivered a wrapped package containing a bloody ear to brothel No. 1 her place of residence/employ in the night.

Police were dispatched to the home of [redacted] at 10:14 am. At the scene, officers found broken glass and evidence of absinthe consumption. The gentleman was unconscious having lost much blood (as well as much of an ear) and was hospitalized immediately.
Cases can be modular and adapted for different classes

- Neurobiology
  - Mental illness

- Human Physiology
  - Pedigrees
  - Genetic risk factors of disease
Next Steps…

- What content-based topics can we discuss from this case?

- What skills (content-based, quantitative, professional) can we help students develop with this case?

- How can we tie this into a current module/curriculum?

- What other active learning techniques can we use to continue building interest?
Facts? Questions? Goals?

- What questions would your students ask?
- What learning goals could you see stemming from this case?
- How do you get the students to the learning goals you want?
- Brainstorm facilitator questions/prompts.
What could you do to help students research learning issues?

Talk to your neighbor for 2 minutes and then we’ll call out some answers.
From Search to Research:
Developing Critical Thinking Through Web Research Skills
Essential Web Research Skills

- Search efficiently and effectively
- Distinguish kinds of sources, and analyze a source’s validity and reliability
- Cross-check facts, even from reliable sources
- Conscientiously and properly attribute the words and ideas of others
- Cite sources accurately and appropriately

Information Literacy Principles
from National Forum on Information Literacy, infolit.org

- Define: Articulate a need for information as one or more relevant, focused, and manageable questions. Know where to locate and gain understanding of acceptable, common definitions of terms.

- Access: Search, find, and retrieve information from a variety of print and electronic resources (e.g., databases, Internet).

- Evaluate: Judge the currency, appropriateness, and adequacy of information and information sources for a specific purpose.

- Manage: Conduct a rudimentary and preliminary organization of accessed information for retrieval and future application.

- Integrate: Extract and combine information from a variety of sources and draw fundamental conclusions.

- Create: Summarize and adapt information to describe an event, express an opinion, or support a basic argument, viewpoint, or position.
Librarians as the resource?

- Library Guides for specific cases?
- Publish with Case authors?
- Work collaboratively with faculty and students on new cases?
Why Use Cases

- Motivate students and increases retention and persistence in the disciplines (Seymour & Hewitt, 1997)

- Develop skills (Johnson et al 1991, 1998)
  - Critical analysis
  - Observation
  - Computation
  - Written and oral communication
  - Logic
  - Decision-making

- Improves learning and retention of concepts and data (Springer et al, 1997)
Where to find cases?

- ScienceCaseNet (sciencecasenet.org)
- National Center for Case Study Teaching in Science (NCCSTS)
- CasesONLINE (http://www.cse.emory.edu/cases/)
- BioQuest (bioquest.org)
- Text Publishers
The mission of the National Center for Case Study Teaching in Science (NCCSTS) is to promote the nationwide application of active learning techniques to the teaching of science, with a particular emphasis on case studies and problem-based learning.
Finding Cases

http://ublib.buffalo.edu/libraries/projects/cases/case.html
http://bioquest.org/lifelines/index.html
http://www.udel.edu/pbl/
https://primus.nss.udel.edu/Pbl/index.jsp
CASES Online
Center for Science Education, Emory University

- CASES Online: Creating Active Student Engagement in the Sciences
- Searchable database
- Downloadable materials
  - teacher guide
  - student materials
  - sample student products
- >300 complete cases
- Free registration!

http://www.cse.emory.edu/cases
Case It is a project to develop molecular biology laboratory simulations for case-based learning in biology. The project is based at the University of Wisconsin-River Falls, and has been funded by the National Science Foundation. The simulation can be downloaded free of charge for educational purposes, and performs common lab procedures on any DNA or protein sequence. Learn more...

Welcome to the new web site for the Case It project. If you are looking for items from the previous web site, click here for a summary of the new site organization. Contact Mark Bergland if you have any questions.

http://www.caseitproject.org/
Finding Cases

http://www.asmusa.org/edusrc/souvenir/index.html

Souvenirs:

A Case Study for the 90's

Case-based studies are becoming an increasingly popular method for teaching biology by introducing dilemmas which encourage student exploration. The case study **Souvenirs** is provided with extended resources for both instructors and students who wish to try case-based investigations in their courses.

**Souvenirs** offers carefully integrated clues about an emerging disease embedded in a rich social and ethical context. Students may develop a wide range of questions to explore the biological information on hand. In the process of answering these questions, students become involved in the dynamic and integrative thinking needed to solve problems scientifically in their own lives, not just in their life sciences courses.
PBS Anthrax Case

Putting Anthrax in History
(5th or 10th grade biology)

Introduction:
This lesson is a webquest which culminates in the creation of a new section for the students’ textbooks.

Estimated Time:
Two 90-minute periods (one for webquest; one for composition)

Lesson Objectives:
Student will:
- Identify the cause of the anthrax disease.
- List symptoms and treatments for anthrax.
- Identify different forms of anthrax disease.
- Summarize and organize information from several sources.
- Create original text in the style of a science text.
- Evaluate credibility of web information.

Correlation to National Science Standards

- http://www.pbs.org/newshour/extra/teachers/lessonplans/november01/anthrax/
The Science Case Network, a newly established Research Coordination Network for Undergraduate Biology Education, centers on expanding the use of and knowledge about two effective teaching approaches: case studies and problem based learning (PBL). The Science Case Network seeks to connect case study innovators, researchers, and user groups to further the effectiveness of these methods.
The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them. 
Sir William Bragg (1862 - 1942)

and isn’t this true in all our disciplines?
sciencecasenet.org

- Links to case resources
- Discussion groups
- Workshop resources
- SCN New Case Scholars and SOTL Scholars
Our project supports an active community of science educators, learners, researchers, developers, and professional organizations interested in furthering the accessibility, development, and use of cases and problem based learning (PBL) in science education.
Goals of SCN

- Build a community of people who want to use cases to engage students in learning
  - Welcome participants from all institutions, all levels of experience, all branches of biology
- Help the community communicate and collaborate
  - On teaching with cases/PBL
  - On developing cases/PBL
  - On studying impact of cases/PBL
- Share what community is doing
Explore and Join Science Case Net

- at [http://sciencecasenet.org](http://sciencecasenet.org)
- Sign up for or create groups
- Find case studies and PBL problems
- Find collaborators
- Learn about teaching with cases
Thank You!
More sample cases
There wasn’t a mine runnin’ a lump of coal

Teamus Bartley: It was the saddest lookin’ time then that ever you saw in your life. My brother lived over there in the camps then and I was working over there and I was dropping cars onto the tipple. And that, that epidemic broke out and people went to dyin’ and there just four and five dyin’ every night dyin’ right there in the camps, every night. And I began goin’ over there, my brother and all his family took down with it, what’d they call it, the flu? Yeah, 1918 flu. And, uh, when I’d get over there I’d ride my horse and, and go over there in the evening and I’d stay with my brother about three hours and do what I could to help ’em. And every one of them was in the bed and sometimes Doctor Preston would come while I was there, he was the doctor. And he said “I’m a tryin’ to save their lives but I’m afraid I ain’t going to.” And they were so bad off. And, and every, nearly every porch, every porch that I’d look at had—would have a casket box a sittin’ on it. And men a diggin’ graves just as hard as they could and the mines had to shut down there wasn’t a nary a man, there wasn’t a, there wasn’t a mine arunnin’ a lump of coal or runnin’ no work. Stayed that away for about six weeks.
Art, Music, Dance: Is this a Case?

- [https://www.youtube.com/watch?v=8aJw4chksqM](https://www.youtube.com/watch?v=8aJw4chksqM)
The Griswold family loved taking road trips, especially during spring break. This year, their destination was Washington, DC to see the historical sites and take in the beauty of the blooming cherry trees during the annual National Cherry Blossom Festival. As they strolled along the paths lined with trees in full bloom one beautiful morning, the youngest child of the family, Audrey, was running in between the trees and swinging around on their trunks. Suddenly, she came to a halt.

“Look, guys! There are huge bumps on this tree!”

“Heh, that tree has a tumor! Watch out, Audrey, you’ll catch it!” teased Rusty, Audrey’s brother.

“Eh, you can’t catch tumors, Rusty. Weird, only a few trees over here have these bumps. A tree tumor…” murmured Mr. Griswold, as he pulled out his iPhone. “Is there really such a thing?”

What could cause large growths, also known as crown galls, on trees? Provide at least two hypotheses that explain the formation of crown galls on trees.
There wasn’t a mine runnin’ a lump of coal

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Part I – A Suspicious Treatment for Cholera

India, 1926 *

It was cholera season again. Cholera struck twice a year; once after the springtime run-off from the high Himalayas, and once after the monsoons. Dinesh was walking home from the fields when his friend, a merchant at the lassi stand, called him over….

“Harpriet just died of cholera.”…

A few days later, as Dinesh was walking towards the fields, he noticed a group of European men pouring something into the village well. Coming closer, he overheard one of them explaining to the village elder that this was going to prevent and cure cholera. A similar treatment had apparently helped to treat Europeans. Dinesh had no reason to believe these claims and was suspicious. The elder was similarly unimpressed by the promises made by the Europeans. Later that day, he called all the able bodied men in the village to drain the village well. They instructed all the villagers to take water from other wells surrounding the town.
A few days later, the European men returned and asked about the state of the cholera outbreak. Cholera had claimed more lives and new people were getting sick. The foreigners seemed surprised. Their surprise turned to outrage when they discovered that the well in which they poured their treatment had been drained.

In the evening, the European men added a purple dye to all of the town’s wells except for one, in which they poured their treatment. The colored water would be avoided by the town’s people, forcing them to drink from the “treated” well.

After a couple of days, Dinesh noticed that affected individuals were improving, and there were no new cases reported.

Despite his misgivings and anxiety about the contents of the water, the treatment seemed effective.
1. Cholera is caused by bacteria that infect the small intestine. These bacteria are typically contracted by drinking contaminated water. The symptoms are brought about by the secretion of a toxin that disrupts the functioning of the cells of the small intestine. Given this information, what might the European men have poured into the wells? Be as specific as you can in explaining how your proposed treatment cured and prevented cholera. Come up with more than one hypothesis.

2. What ethical issues does imposing a treatment on the villagers without their consent raise? Are there factors that make it more or less acceptable?
What are we waiting for?
"The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn."

Alvin Toffler, American Writer and Futurist