

## **Supplemental Material**

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### **Case 1: Chick Cell Culture**

#### **Title: Jack's Sick Chicks**

Jack Red started raising chickens at his parents' weekend house in Sonoma county when he was 12 years old. With his dad's help, he built a small chicken coop by the creek that ran along the back of the property. Even though he kept only a few dozen birds at a time, he soon gained a reputation among the neighbors for producing some of the tastiest eggs and plumpest roasters around.

But a few weeks before his 18<sup>th</sup> birthday, he noticed something was wrong. The hens began laying fewer eggs than normal. Although the birds seemed otherwise happy and healthy, they began to eat less and to put on weight more slowly. Jack grew increasingly worried.

Everyone seemed to have a different opinion about the cause of the problem. Rancher Dan, who grew corn on 40 acres nearby, said local farmers had recently been using more herbicide and pesticide because of increased rains. That meant more chemical-laden runoff in the creek by the chicken coop. Alice Argyle, a lawyer from town, blamed a spill at the cosmetics factory on Fish Ranch Road, less than five miles from the Reds' house. Joe Ecogreen, a local environmentalist, blamed the recent arrival of an invasive species of prairie grass whose seeds contain a potent toxin. Jack's little sister had the most startling revelation. She admitted that she liked to play vet with the chicks and had once or twice ground tablets from the medicine cabinet into their feed.

"Geez," exclaimed Jack once he had heard all of this. "It's amazing they are still alive at all."

### **Case 2: Cytoskeletal Dynamics**

#### **Title: Death in a Bottle**

Martina and José ran laps together sometimes at the UCSF fitness center. They had met as biology undergrads at Fullerton State. Now José worked in the San Francisco medical examiner's office and Martina was a research associate at FivePrime in Mission Bay.

"You seem a little distracted, José," said Martina one day as they hit the first curve.

“It’s nothing,” José said. “I just keep thinking about this one case. Did you hear about the mayor’s cousin?”

“Yeah, it was the whole front page of the Chronicle for a week,” Martina replied. “He got drunk at a party and fell into the bay, right?”

“That’s what the police are saying, but there’s more to it. We’re still working on the autopsy. Thing is, there’s no way he drowned. No water in the lungs, minimal cyanosis. He died of massive organ failure. We think he was poisoned.”

“Omigod. Poisoned?”

“Yeah,” said José, “but we can’t figure out what the poison was. He had a half-empty water bottle in his back pocket. We’ve tested it for cyanide, arsenic, all the usual suspects. Nothing.”

“Weird. Did you try any cytoskeletal disruptors?”

“Martina, you know I got a D in cell bio.”

“You know, cytoskeletal disruptors. Like that one that kills you if you eat death cap mushrooms. Phalanges, or filopodia or something. Anyway, you should be able to see the effects by histology with the right stains. But you’d never figure it out unless you knew what you were looking for.”

“No way,” said José.

“Way,” said Martina.

“I gotta go,” José said suddenly. “I’ll text you,” he yelled back over his shoulder as he sprinted for the locker room.

### **Case 3: Microarrays**

#### **Title: The Night the Brew Blew**

The day Raven turned 21, she decided to brew her own beer. She bought the ingredients from a local homebrew store, and soon the whole dorm smelled like hops and barley malt. A week or so later, after the stuff was fermented and bottled, Raven had four cases of homebrew happily maturing in the closet. Or so she thought.

The first one blew at about 3 a.m. on a Tuesday morning, just as Raven was cramming for a biochemistry mid-term. BAM! BANG! BLAMMO! One after another, four cases of bottles went off like the Fourth of July. Between explosions, Raven could hear her precious beer trickling down the walls.

When the popping stopped, Raven let out a sigh. Mess or no mess, she had a mid-term to study for. So she opened her textbook to the next chapter. It was as if fate were playing some cruel, sick joke on her. The chapter was entitled *Yeast metabolism: fermentation vs. respiration*. “If I had just kept up on the reading,” Raven said to herself in a flash of realization, “maybe I could have saved my beer.”

### **Case 4: Human Ancestry**

### **Title: Bill Wong's Dilemma**

Bill Wong's grandmother once told him that his family was descended from a line of Chinese emperors who ruled more than 3000 years ago during the Shang Dynasty. Now, with two kids of his own, Bill was beginning to wonder what he would tell his children about their heritage. So he set out to learn if the family lore could possibly be true.

He found several genealogy companies on the Internet that promised to give him the answer if he sent them a scraping of cells from his cheek. The companies said they would extract his DNA and compare it to the DNA of thousands of people from around the world. Bill wasn't sure he trusted the Internet, or DNA analysis for that matter. Even so, he signed up with two companies, figuring if they both gave him the same answer, there might be some truth to it. He mailed in his cells and a hundred dollars to each company and waited.

Three weeks later, a letter arrived from the first company, inyergenes.com, which said, "After a careful analysis of sequences in your Y chromosome and a comparison of your genomic pattern of *Alu* insertions with our worldwide database, we have found that your ancestors inhabited southern Siberia around the peak of the last ice age." The letter also told Bill he shared a common ancestor with most modern Europeans: a man who had lived in Central Asia 35,000 years ago. "I guess maybe mom could have been right," thought Bill, "but what's this about Europeans?"

The next day, Bill got a letter from the other company, geneexpert.com. When he opened it, he got a surprise. "Using the most up-to-date mitochondrial DNA sequence databases," it read, "we have traced your family background to northern Europe, most likely Scandinavia." The letter was accompanied by charts and a long string of A's, C's, G's and T's, but these meant nothing to Bill. He just threw up his hands. "Now what am I going to tell my kids," he sighed. "And what do I tell mom?"

### **Definition of case-based learning used in attitudinal assessments**

Investigative case-based learning (ICBL) uses realistic cases to engage students in a science topic, turning one of humanity's oldest teaching strategies—telling stories—into a tool for collaborative science learning.

Students frequently work as part of a group while they analyze the case and raise questions, as they conduct related scientific investigations, and as they prepare and present their findings.

(Waterman and Stanley 2004)

### **Course goals as stated in the syllabus for Biology 351**

Students who successfully complete Biology 351 will be able to:

1. Apply the cell and molecular laboratory techniques covered in the class,
2. Explain the scientific principles underlying those techniques,

3. Ask questions scientifically,
4. Design experiments with appropriate controls to address those questions,
5. Collect, analyze and interpret laboratory data effectively,
6. Communicate experimental results in a complete, clear and concise way.

### **Videotaped Interview Protocol**

Understanding SFSU Biology Majors' Attitudes Toward Case-Based Learning  
Interview Questions – Spring 2007

#### **Warm-up Q's (5 min)**

- What other classes are you taking this semester?
- What made you choose to be a cellular and molecular biology major?
- *When do you plan to graduate?*
- *Where did you go to High School?*
- *Why did you decide to come to State?*

#### **Bio 351 Q's (10 min)**

**Show student his/her responses if they choose to see them.**

- What aspects of the teaching approach of Bio 351 appealed to you?
- What aspects of the teaching approach of Bio 351 were frustrating for you?
- *Has the format of the Bio 351 class had any impact on your career choices? If so, what impact has it had?*

#### **Case-based approaches**

- If you were to describe case-based learning and teaching to a friend, how would you describe it?
- To what extent do you feel case-based learning was used in the Bio 351 class?
  - Have other classes you've taken at State used case-based methods?
- Do you feel more or fewer case-based modules would improve Bio 351? Why?

#### **Career choices/minority students (10 min)**

- *How (if at all) do you feel your participation in a case-based approach has affected your desire to pursue your science major/career?*
- Do you consider yourself to be a minority student with respect to language, ethnicity, religion, age, or gender?

- If YES: To what extent do you feel like CBL is a more effective approach than the traditional approach for members of your minority group? If so, why?
- If NO: Do you believe that CBL is more effective for certain categories of people? If so, which groups and why?

### Useful websites for case development

BioQuest <http://www.bioquest.org/>

Niños Desaparecidos: A Case Study About Genetics and Human Rights by Katayoun Chamany <http://ublib.buffalo.edu/libraries/projects/cases/ninos/ninos.html>

Problem-Based Learning in Biology <http://www.saltspring.com/capewest/pbl.htm>

### References

Waterman, M. A. and E. D. Stanley (2004). Doing Science Collaboratively with Investigative Case-Based Learning. Strategies for Success. San Francisco, CA, Benjamin Cummings. **41**: 4-6.