

# CASE TEACHING NOTES

for  
"Lewis and Clark Reloaded: The 3,041-Mile Bike Trail"  
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## INTRODUCTION / BACKGROUND

This interrupted case provides students with an opportunity to review normal physiology of organ systems, as well as the changes experienced during physical exertion. Through the storyline, students become diagnosticians, using investigative and analytical skills to build an accurate picture of the presenting health emergency. The pivotal point in the case is learning that seemingly harmless and legally available substances can lead to potentially fatal outcomes affecting organ systems already taxed beyond normal limits. As the case unfolds, students may expand the discussion to include legal and ethical issues of using performance-enhancing drugs in endurance sports.

Students are introduced to the case with the information that long distance cycling is a competitive and strenuous sport. It is reinforced that cyclists train for months before attempting any long distance marathon whether competitive or not, and that training is imperative for optimal physical endurance and strength. In this case, the bikers trained for six months, cycling 15 to 20 miles per day during the week and 40 to 50 miles per day on weekends, before attempting their cross-country trek. Both are avid cyclists and savvy competitors. They included additional strength building activities in their training regimen and followed nutritional guidelines for endurance training.

This case can be used to demonstrate physiological changes that occur over time, and during rigorous physical activity, without proper attention to or discretion in using performance enhancing aids. It can be adapted to cover the importance of proper diet, hydration, and nutrition during physical exercise, and to understand the biochemical basis of ergogenic products used for enhancing athletic performance. This case is designed for use in a Human Biology class after students have been exposed to the integumentary, respiratory, cardiovascular, neuromuscular, and urinary systems. The case can be ideally used in a 90-minute, or longer, class period or over two shorter class periods.

## Objectives

- Understand physiological changes and adaptations organ systems make with physical exertion over an extended period of time.
- Define the term "ergogenic aid" as applied in sports and exercise.
- Identify the effects of caffeine on different organ systems.
- Discuss the role of caffeine as an ergogenic aid in endurance sports.
- Explain the side effects of caffeine intoxication.
- Identify potential dangers of caffeine use in combination with other substances.
- Practice critical thinking and analytical skills to make a diagnosis.
- Examine legal implications of caffeine use, or "doping," before competition.
- Analyze ethical issues of using caffeine, or any ergogenic product, to enhance performance in amateur and professional sports.

## CLASSROOM MANAGEMENT / MAJOR ISSUES

This case is structured as an interrupted case, i.e., information is progressively released to the students, with the different sections of the case given out as handouts at phased intervals. The case is written in three parts; each part includes a scenario followed by questions to guide discussion and reporting.

Divide the class into groups of four or five. Structure the group process, explaining logistics for discussion and briefing the entire class. Each group will choose a recorder and spokesperson; however, all students can participate in the briefing session. Learning methodologies include small group facilitation, discussion and recitation, role-play, interview techniques, print and Internet resources, and written summary questions.

The instructor briefly introduces the case, and distributes Part I to all students.

### *Part I—The Adventure Begins . . . and Comes to a Screaming Halt*

Students briefly review Part I. Guided by the questions at the end of Part I, students have 15 minutes to discuss the case within their respective groups, comparing what they know about normal physiology during exercise and what is presented as Joe's symptoms. Each group then reports their observations and analysis of the comparisons to the whole class. The instructor can record the responses on the board or an overhead transparency or computer projection in view of all students. Students can only speculate about any diagnosis at this point.

### *Part II—A Change of Scenery*

Distribute to all students the handout for Part II. In Part II, groups are provided with additional information about the cyclists and events leading up to the accident and subsequent trip to the Emergency Room. Students should start piecing together facts about what the cyclists ate, drank, and physically experienced during their ride to build a picture of what might be wrong with Joe and causing his health emergency. A record of Joe's vital signs, symptoms manifested in the Emergency Room, and analysis of the clinical test results provide the students with information and hard data to determine the basis of Joe's condition. Students should be able to interpret Joe's vital signs and clinical test results using prior knowledge and understanding of normal values and acceptable ranges. However, students may require additional resources—a text, journal articles, supplemental materials, and Internet sources—to explain test results, recommend further testing, and refine possible diagnoses. Student groups report their new insights drawn from the additional data to the entire class. At this point students may question why only one brother was affected when both apparently were experiencing the same energy intake and endurance activity.

### *Part III—A Dangerous Detour*

Distribute to all students the handout for Part III. Explain that this part of the case study is a role-play. The students become medical consultants to Dr. Smith and are instructed to interview Joe and Frank in order to collect missing facts and data needed to make a final diagnosis and recommend treatment. The instructor role-plays the character parts of Joe and Frank, as appropriate, and provides conclusive data and information.

As the “interview” proceeds, the instructor, as Joe and Frank, reveals the following information to the students::

- Joe and Frank are serious competitors, both played soccer, ran track and raced bikes in high school and college. Their summer cycling adventure was featured in the local St. Louis news and promoted by a local cycling organization. This was a ride they had to finish.

- Joe was taking aspirin (Excedrin) at least four times per day for headaches brought on by the direct sunlight. Joe also took a decongestant for a stuffy nose allergy and at least once a day used Vivarin to keep him alert during the grueling mid-day rides.
- Joe brought along and was taking “minithins,” once available over the counter at gas stations, but now harder to acquire.
- Joe and Frank never missed an opportunity to stop and eat, enjoying barbeque at a town summer festival, a latte at Starbuck’s, tea and muffins at a quaint diner or just a Coke or Mountain Dew during a gas station stop.
- Frank ate more carbohydrates than Joe, preferring orange juice to Joe’s grapefruit at breakfast and jelly beans to Joe’s daily 2 or 3 bars of dark chocolate between meals.
- Both experienced some muscle fatigue. Frank could rest for a while, stretch out and be refreshed enough to continue, but Joe had continuous muscle tremors and non-stop tingling in his legs. These tremors were most noticeable right before the accident. Joe was also having problems with small motor movements, gripping the handlebar gears and steering his bike.
- Frank had no trouble sleeping at the end of the day while Joe became an insomniac.
- Joe increasingly experienced heartburn and acid reflux. His stomach was upset most of the time.
- Joe noticed an increase in his heart rate, especially after a long flat stretch of power pedaling or when climbing a steep incline.
- Joe had some bowel irritation, diarrhea, and also stopped to urinate often.
- Both brothers used the same type of professional cycling gear, including approved sun glasses and riding apparel. Yet, Joe continually complained of flashing lights around his eyes and sensitivity to the pants and shirt material.

Instructors can take this bulleted list and create a separate handout from it to provide to students after the role-play interview has concluded.

Guided by the questions at the end of Part III, students will come to a consensus about the diagnosis of dehydration due to caffeine intoxication, and make recommendations for treatment and prevention.

### ***Summary Questions***

Legal and ethical issues relevant to the case are expanded in the case summary questions to be completed outside of class and discussed in the next class period. The summary questions are submitted for a grade at that time.

## **BLOCKS OF ANALYSIS**

This case sets the stage for a discussion of the biochemical and physiological basis of using caffeine as an “ergogenic aid” to enhance athletic performance in competitive and non-competitive endurance sports. The mechanisms by which caffeine operates on the neuromuscular and respiratory systems to improve physical performance are discussed. Several organ systems are identified as being particularly affected by caffeine use or intoxication. Potentially dangerous and irreversible side-effects to caffeine use when combined with other substances are explored. Students are directed to read supplemental material and find relevant research about caffeine use as an ergogenic aid in endurance sports. Students are encouraged to expand this discussion to

current issues about ergogenic product distribution and use in professional sports and Olympic competition. Connecting this case to real world situations, which make front page headlines, should prompt rich discussion about the ethical issues and legal implications of using performance enhancing products.

Throughout the case, students are provided opportunities to practice investigative, analytical, and diagnostic skills in determining the diagnosis and making recommendations for treatment and prevention. Critical thinking and analytical skills should be reinforced so that students make informed decisions based on relevant data and empirical research. This case can be used to encourage students to become healthy skeptics in interpreting and deciphering popular media and Internet information. Students should be able to articulate the benefits and importance of balance and moderation in matters of exercise, diet, and supplemental nutrition.

## ANSWER KEY

Answers to the questions posed in the case study are provided in a separate answer key to the case. Those answers are password-protected. To access the answers for this case, go to **the key**. You will be prompted for a username and password. If you have not yet registered with us, you can see whether you are eligible for an account by reviewing our **password policy and then apply online** or write to **answerkey@sciencecases.org**.

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