Case Teaching Notes for "It's Like Pulling Teeth: A Case Study in Physiology"

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Introduction

In this interrupted case study, a middle-aged man in apparent good health has been having a problem with his wisdom teeth and it is time to have them surgically removed. He decides to have a general anesthetic, but is unaware of the reaction he will have to halothane. His skeletal muscles go rigid and his body temperature rapidly increases. The anesthesiologist injects a liquid into the patient's IV, which makes his muscles relax. Students use their knowledge of nerve, synaptic, and muscle function to complete flow diagrams, and consider how each step in the flow diagram could produce maintained muscle contraction. In this way, students determine how halothane affects the neuromuscular system.

This case is used in a one-semester animal physiology course, which is taken by sophomore and junior science majors. It could also be used in a freshman general biology course or in an anatomy and physiology course.

Objectives

- To review the physiology of nerves, chemical synapses and skeletal muscle.
- To use flow diagrams to check and organize the students' knowledge.
- To consider and discuss how a foreign agent (halothane) can produce tetanus in skeletal muscle by acting on the nerves, the synapse and the muscle.

Classroom Management

The class is divided into groups of five or six students and the case takes about 75 minutes to fully develop.

I use a whiteboard to record student feedback and ideas. The whiteboard in my lab has four panels. I use the first panel to list the locations where ATP is used in skeletal muscle (Question 4, Part I) and the student hypotheses (Part V). I use the second panel for the flow diagram for motor neuron function (Part II), the third panel for the flow diagram for synaptic function (Part III), and the fourth panel for the flow diagram for muscle function (Part IV).

Students are given each part of the case in sequence and are asked to read the passage, discuss the material, and answer the questions. They are told how much time they have to complete each part of the case and are encouraged to use lecture notes and physiology texts. They are not permitted to use the Internet until the end of the case, since a web search will quickly reveal the answer to the case.

Groups are given about 10 minutes to read and discuss each part of the case, after which the class comes together to share ideas. Groups take turns going first, and different members of each group are called upon for input, allowing all students to participate in the case study.

For Part I, students develop a list of reactions that generate heat in skeletal muscle, which I record on the first panel of my whiteboard.

For Parts II–IV, the groups are asked to discuss each part of the flow diagram and come up with at least one way in which halothane could produce a dysfunction at this stage and thus induce maintained muscle contraction. Depending upon the instructor's inclination, the amount of time available, the class size, and the number of students in each group, these three parts of the case may be conducted as a jig-saw, as follows:

1. For each group, one or more students are assigned one stage of the flow diagram.
2. The students assigned to each stage come together and discuss how a dysfunction could induce a tetanic muscle contraction.
3. After a few minutes, the original groups re-form.
4. Students take turns outlining their ideas on each stage to their original groups.

We then complete each diagram on the whiteboard as a class.

If the class shows little inclination to discuss the case, the instructor can encourage participation by calling for conclusions and ideas on each stage of the flow diagrams. Notes can be made on the appropriate area of the board and students may be asked to explain how the dysfunction takes place; the goal is to promote discussion (and argument) across groups.

Alternatively, the instructor can give the groups more independence, dispense with class discussion, and distribute the next part of the case.

For Part V, I ask each group to form a hypothesis about where halothane has its effect and how the antidote works. After allowing 5 to 10 minutes for this, each group states their hypothesis, which is written on the first panel of the whiteboard. At this point, the case is open for questions and discussion. Students are expected to ask other groups questions and to defend their hypothesis.

When the discussion wanes (or becomes too animated), students are permitted to search the Internet to determine what is wrong with Mr. Thompson and identify the antidote used by the doctor. They usually get the answer within five minutes, and the mechanism soon thereafter.

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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