

CASE TEACHING NOTES

for

“It was a hot August afternoon...”

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INTRODUCTION / BACKGROUND

Proper nervous system (NS) functioning is necessary for many life processes, including many that involve the muscular system, such as respiration. A main function of the nervous system is transmission of information along the peripheral nervous system, which involves several mechanisms, each of which is vulnerable to interruption. This case involves the interruption of signal transmission, and asks students to describe the form and function of the NS to understand exactly how the signal is interrupted.

This case serves several purposes. First, it asks students to learn about nervous system physiology in a student-centered learning environment. Second, it is meant to serve as a bridge between the nervous system and the muscular system, which is typically the unit we cover after the nervous system. Finally, this case links to material taught in an upper division Microbiology course the semester before and to an upper division Ecology course taught the same semester.

The case was designed for an upper division comparative anatomy and physiology class of junior and senior biology majors.

Objectives

- Learn that all vertebrate nervous systems are essentially similar.
- Describe how an action potential is initiated and propagated.
- Describe how neurons communicate with each other and with other cells.
- Describe the neuro-muscular junction.
- Apply knowledge of NS physiology to understanding the mechanisms of action of two neurotoxins.

CLASSROOM MANAGEMENT

As designed, the case unfolds in three parts. Parts I and II are covered on one day, and Part III several days later. I have the students get into their laboratory groups to answer the questions associated with Part II of the case but other instructors may want to put them into groups from the very start of the case.

Part I is read out loud in class by one student to the rest of the class (though it could also be read within the student groups). The students are then asked to list on the board possible reasons why so many animals have suddenly died. The list they generate will be pretty varied and random. Possible causes of death can be stated as hypotheses, some potentially based on data drawn from Part I. Data may include particular details surrounding the animals' deaths, such as time of year, location, type of animal found, etc.

Part II follows, again with a student reading it out loud to the class (or by asking students to read it within their groups), stopping at the point in the storyline where Carl, the veterinary pathologist, says to the student Lauren, “No, what do *you* think?” At this point the students, as a class, are again asked to consider

possible causes of deaths by re-visiting the original hypotheses, keeping or eliminating them depending on the new data. New hypotheses can be added to the list on the board. Students should also consider what new data they might need to support or falsify the remaining (and any new) hypotheses.

Students then finish reading Part II and discuss the hypotheses in light of the main character Carl's hypothesis that the deaths involve a neurotoxin.

At the end of Part II, students break off into their laboratory groups of three or four (if they have not already done so). All groups will work on the physiology of the nervous system, specifically on understanding how an action potential works as well as how neurotransmitters and neurohormones work. Groups can compare information if they want to. Students are expected to use references beyond their textbooks (Kardong's *Vertebrates* and Hill et al.'s *Comparative Physiology*), though both of these are good starting places. They should use neurobiology textbooks, though more adventurous students may find information relating to neurotoxins in the primary literature.

Typically, the student groups have about four to five days to complete the assignment, which is to write a group paper on nervous system physiology, outside of class. In the intervening class sessions, I go over NS physiology with the students—here, the students answer all questions, and the instructor just asks questions, puts answers on the board, and fills in blanks.

We then come back to Part III, in which the students discover the specific neurotoxins. The final stage of the case is for students to research the two neurotoxins, specifically addressing their method of action and how the method of action fits with what they have learned about NS anatomy and physiology.

BLOCKS OF ANALYSIS

Detailed case analysis is provided in a separate file that is password-protected. To access this information, go to the **detailed case analysis**. 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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