

CASE TEACHING NOTES

for

“Taking It on the Chin: A Case Study on the Nervous System”

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INTRODUCTION / BACKGROUND

In this interrupted case, students follow the story of Mr. Gower, who is having a root canal done at his dentist's on a beautiful spring day. All goes well, but that night he feels tired and light headed and the next morning his jaw is stiff and he has no appetite. Over the next several days, Mr. Gower's health deteriorates until he feels so bad that he goes to the Emergency Room.

This case was developed for use in a one-semester Animal Physiology course that is taken by sophomore and junior science majors. It could also be used in an anatomy and physiology course. The case presents information describing Mr. Gower's problems and symptoms in stages, which the students analyze working in small groups.

The students should have some basic knowledge of muscle physiology and may need some microbiology background if the instructor decides to stress this part of the case. To most successfully complete the case, they should also be conversant with the propagation and inhibition of action potentials. In the case, students use their knowledge of synaptic physiology (including transmitter release, postsynaptic effects, and synaptic integration of excitatory and inhibitory inputs) to fit the pieces together and determine what is wrong with Mr. Gower.

Objectives

- To understand nerve function.
- To understand the function of chemical synapses.
- To understand the difference between excitatory and inhibitory effects on a postsynaptic cell.
- To understand synaptic integration, postsynaptic potentials, threshold, and spike initiation.
- To understand the effect of changes in excitatory and inhibitory activity on the postsynaptic response.
- To determine how Mr. Gower's problem can produce the observed response in motor neurons.

CLASSROOM MANAGEMENT

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

Board Management

I use a whiteboard in class to record student answers and ideas. The whiteboard has four panels. I use the first area to list Mr. Gower's symptoms. The second and third areas are used to project the flow chart and diagram that appear in Parts III and V of the case. I project each diagram in turn onto the two central boards and students use markers on the projected image to indicate their answer to the questions. The fourth area is used to list the possible diagnoses and the tests suggested by the students. Entries are made on the first and fourth areas throughout the case as information is provided. If a certain diagnosis loses favor, I ask

the original group if it is reasonable to delete their entry. If they (and the class) agree, an “x” is placed in the margin next to the entry. I do not erase the diagnosis because someone may wish to reconsider it at a later date and it is easier to erase an “x” than write out a diagnosis again.

Case Management

Students are given each part of the case in sequence and asked to read the passage, discuss the material, and then answer the questions. Students are told how much time they have for each part of the case study and are permitted to use books and notes for reference. After the prescribed time period (typically 10 to 20 minutes for each part of the case), the class is called together to share ideas, with the questions forming the basis for discussion. Groups take turns going first, and different members of each group are called upon for input. In this way, all of the students have an opportunity to participate in the case study.

Part I

I list Mr. Gower’s symptoms as the students give them to me on the first area of the board. At this point, students talk about Novocain and how it blocks action potential conduction. This is an opportunity to ask the class whether anyone has had Novocain as an anesthetic. I usually encourage those who have to relate their experience and how they felt after the dental work. Students are often interested in the fact that action potentials are still produced in the sensory nerve endings though the action potentials never reach the brain.

Part II

Additional symptoms presented in Part II are added to the list begun in Part I. This is often a good time to ask whether anyone has ever had a root canal and, if so, how they felt the next day. My students tell me the stiff jaw lasts for days if not weeks. Mr. Gower’s stiff jaw, therefore, is not too surprising. Some groups, however, knowing that something must be wrong, pursue the stiff jaw clue.

Part III

As the group discussions for this part of the case are finishing up, I give a marker to three students and tell them that they will be answering parts a, b, or c of Question 3. I call the class together to discuss answers for Questions 1 and 2. I then ask the students with the markers to draw their responses on the board.

I read Question 4 to the class and ask if everyone understands it. I then go through each part, calling on students to give their answer. I do the same for Questions 5 and 6, and write the two answers for Question 6 under the diagnosis because the class will re-visit these two answers in the next part of the case.

Part IV

If the students understood the previous part of the case, the absence of the regurgitation reflex indicates that Mr. Gower cannot open his mouth. Students are then asked to vote on the possible mechanism, using the two “conditions” written on the board as the answer to Question 6 in Part III.

Part V

The flow diagram in Question 1 has so many blanks that a good number of the students in the class can write on the board. Be careful to start at the top of the chart and work down and to the right, and then to the left. I often write numbers to the left of each blank to indicate the order in which the blanks should be answered. The class can be asked to discuss each stage and make suggestions about how the toxin decreases the postsynaptic response and how diazepam can counteract the toxin. However, I prefer to do this part as a jig-saw*, assigning each group certain parts of the flow diagram. The jig-saw process can then be repeated with possible diazepam effects, but I usually assign different parts of the diagram to the groups to stretch their thinking. Benzodiazepines are not discussed in my course, but at this stage students can think out of

the box and should be encouraged to think about basic mechanisms. I have found that students can learn as much from a wrong answer (as long as their argument is logical) than from a correct one.

This part of the study winds up the case, and student may elect to talk about immunizations and “boosters.”

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.

END NOTE

- * The jig-saw method involves reorganizing groups. Each member of the original group is given a number (say, 1 through 6). Students move around the room so that those with the same number form a new group. Each new group discusses a unique question. After a specified time period, the original groups reform, and each individual is given a brief time period to report their discussion to the others in the original group. This is an excellent way for students to explain what they know and refine their oral communication skills.

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