

CASE TEACHING NOTES for Kate-Tastrophy: A Case Study in Brain Death



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INTRODUCTION / BACKGROUND

This case was designed for a first year (freshman) Human Biology course with an enrolment of about 300 students. With some modifications to the questions or by shortening, particularly through omission of Part III, it could be used in a neurobiology or psychology course, or even in a philosophy or ethics course.

A Human Biology course usually involves coverage of the anatomy and physiology of the various systems of the human body. However, the course in which this case was used is quite different. It contains four distinct modules of relevance to 18 to 21 year olds, as this is the dominant age group in the class. The four modules are “Sex and Reproduction,” “The Brain,” “Nutrition,” and “Health and the Environment.”

The case presented here was taught in the module on “The Brain” and was designed to complement the lectures. The supporting lectures begin with an overview of modern brain imaging techniques. This permitted the use of a wide range of images to teach the location and functions of the major anatomical sub-divisions of the brain, including areas of the brain necessary for arousal. Additional lectures covered the structure and functions of the ventricles and meninges, the cell types of the brain and their functions, as well as a brief overview of how neurons generate electrical activity. The topics of the final two lectures, on drugs of abuse (where and how they act to produce their behavioural effects) and on sleep, were chosen to provide an opportunity to integrate various aspects of the earlier lectures, and because they are of particular interest to typical members of the class.

The case focuses on brain death but raises related issues such as unconsciousness, subdural hemorrhage, and organ donation. Thus, it complements the lectures and permits the students to re-visit some of the structures considered in lectures, e.g., the brainstem, the reticular activating system, and the meninges.

Objectives

- To examine the concept of unconsciousness.
- To understand how clinicians diagnose death.
- To explore how brain trauma in the form of hemorrhage associated with the meninges can lead to loss of consciousness.
- To explore the legal and ethical framework in which organ donation takes place.

CLASSROOM MANAGEMENT

This case was designed as an “interrupted case”; the major benefit of this format is that the delayed resolution of the case keeps the attention of the students over a two-hour teaching period. It would be

possible to complete it during two 50-minute sessions by reducing the number of questions that students attempt to answer.

Students do not need to prepare, and in fact the lack of preparation means that group discussions are vigorous and occasionally heated. Each of our tutorials contained about 76 students who worked in permanent groups of four students to which they had been randomly assigned at the start of the semester. Although one staff member can manage this case on his or her own, it is helpful to have a tutor present to help seed ideas during group discussions.

To teach the case the two-hour session was carefully timed as follows:

Time (hr.min)	Activity
0.00 - 0.15	Students read Part I; discuss answers to questions
0.15 - 0.30	Class discussion of Part I, with particular emphasis on the differences between sleep and unconsciousness
0.30 - 0.45	Students read Part II; discuss answers to question
0.45 – 1.00	Class discussion of Part II, particularly drawing out the idea that in addition to death by irreversible cessation of cardiovascular function, death may also be declared by irreversible cessation of brain (stem) function
1.00 – 1.15	Students read Part III; discuss answers to questions
1.15 - 1.30	Class discussion of Part III
1.30 - 1.45	Students read Part III; discuss answers to questions
1.45 - 2.00	Class discussion of Part IV, with an emphasis on the legalities surrounding organ donation; how to register for organ donation; and consideration of wishes of the patient's family

Part I is “scene-setting.” It is deliberately ambiguous in relation to whether Kate is breathing or not and whether the car accident or drug overdose is the cause of her state; these ambiguities stimulate conversation. Most groups rapidly reach a consensus that Kate is unconscious but have a great deal of trouble defining the term “unconscious.” Groups who struggle can be prompted by asking them to consider how sleep differs from consciousness and from unconsciousness as found in some critically ill patients. The class discussion provides an excellent opportunity to compare and contrast definitions of consciousness and unconsciousness from the perspective of different disciplines, for example, neuroscience, psychology, and philosophy. A useful idea that usually arises from this discussion is that of “levels” of consciousness. This idea can be used to introduce a clinical scoring system for determination of the level of consciousness in brain-injured patients such as the Glasgow Coma Scale ([Teasdale & Jennet, 1974](#)). The class discussion also provides an opportunity to revisit the ascending arousal system as an important brain substrate for consciousness.

Part II generally leads to lively group discussions. The majority of students are aware of death arising from cessation of cardiac function and some have heard of “brain death.” However, they do not understand what brain death means and most fail to define it in terms of *irreversible* cessation of

function. Students are provided with a definition of death, as set out in documents published by the government in the author's country, and they are also made aware of the special care clinicians must exercise when dealing with patients suffering from hypothermia, drug overdose, or hyperglycemia. It is possible to spend time discussing the reflexes that arise from the brainstem.

Part III is specifically designed to draw on the student's knowledge (from lectures) of the three connective cell layers that make up the meninges (the dura mater, arachnoid, and pia mater) and on their knowledge of brain imaging techniques. They generally make educated guesses about why subdural hemorrhage often produces headache and unconsciousness. It would be possible to omit this part of the case.

The final part of the case deals with an increasingly important issue in society: organ donation. Many students are aware of how to register as organ donors but are not aware of the procedures that will be followed in the event of death or of how clinicians balance the patient's wishes in relation to those of their family. They are prompted to think carefully by answering a set of questions pertaining to a potential conflict of interest between treating clinicians and those retrieving organs/tissues for donation.

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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