



# **CASE TEACHING NOTES**

## **for**

### **Eyes Without a Face:**

## **Stem Cell Research and Corneal Implants**

by  
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### **INTRODUCTION**

"Eyes Without a Face" tells the story of Lucy, a woman who has endured blindness most of her life. She has adapted well to her situation, but has continued to hope that one day she might see. I designed the story to stimulate interest in the use of stem cell therapy to restore vision, the function of the cornea, and the differences between adult and embryonic stem cells. The case should provide introductory knowledge, encourage discussion, and generate questions.

There are ten million people in the world that are affected by corneal blindness ([Kingsley 2002](#)). Cornea transplants have proven to be one of the most successfully transplanted tissues, although lack of donors, cornea transplant failures, and deficient universal access leave many people blinded for life. Additionally, there is a 40 percent failure rate over a 10-year period ([Johnson 2001](#)). Recent scientific developments have shown promise for people suffering from corneal blindness and transplant failure. The advent of artificial and bioengineered corneas may open the world of vision to many struggling to cope without sight.

"Eyes Without a Face" explores the use of adult stem cells and amniotic membranes to restore vision after traditional transplants have failed. The case is appropriate for students in health related curriculums, science exploratory classes, and physiology or biology classes. It is helpful if students have a general understanding of the anatomical and functional elements of the eye.

### **Objectives**

- To appreciate the potential for stem cell research and treatment to improve the quality of life for people suffering from blindness.
- To understand the general difference between adult and embryonic stem cells.
- To gain knowledge of the function of stem cells in daily life activities.
- To be aware of the role stem cells play in replacement of aged and damaged cells.
- To understand the role of the amniotic membrane in corneal transplants.
- To realize that stem cell treatments and research are in the infancy stage of development. Long term ramifications and future prospects remain unknown at this time.

Scientific knowledge about stem cells and methods to use them are evolving very quickly; consequently information and procedures change as new discoveries are made. The use of stem cells has many promising health promoting aspects for replenishing nonfunctional, diseased tissue; on the other hand, the newness of the procedure means there are many unknowns at this time, including the consequences for the recipients. Instructors using this case are advised to keep abreast of new developments.

## CLASSROOM MANAGEMENT

"Eyes Without a Face" is intended to be completed in one 60- to 90-minute class period. One week prior to the case study presentation, students should be provided with a list of exploratory preparation topics. The list can be written on the blackboard or an overhead and may include:

- A. Major anatomy and physiology of the cornea
- B. Cornea blindness
- C. Stem cell function: differentiate adult and embryonic
- D. Cornea transplants
- E. Corneal-limbus stem cells—their function and use in transplants
- F. Amniotic membrane use in cornea transplantation
- G. Cornea transplant success and failure
- H. Concerns with stem cell use in cornea transplants

Students should be instructed to use the library, Internet, their textbook, and reference books to gain knowledge of the topics. Students may be divided into small groups of four to six. The research preparation topics should be divided among group members. Students are expected to come to class prepared to participate in discussions involving the above topics and they should be aware that their grade is dependent on preparation and participation.

On the day of the case presentation, students should assemble into their small groups. The case can be read in three segments by the instructor or a student. After each segment of the case is read, students discuss the questions within their groups. Students may be allotted 10 to 15 minutes for the questions following Parts I and III and 15 to 20 minutes for the questions following Part II. During this time they should discuss and formulate one written, group answer sheet. This may also be used to discuss the questions as a class after each part of the case and will be turned in at the conclusion of the class.

As homework, students are asked to write the ending to the case. Does Lucy regain her sight and live happily-ever-after or does she suffer from initially undetected problems associated with stem cell use? The paper should be at least one but no more than two pages long. It should be written using scientific, referenced evidence gathered from outside research and class participation. All essays should include an overview of the procedure, post surgical follow-up, and supportive reasons for the ending chosen. Examples of possible endings include:

1. Lucy's sight was restored and she was able to see her little girl grow up, appreciate her husband's smile, count the stars, learn to read beyond Braille, etc.
2. Lucy regained some sight, but it was not sufficient to see expressions or details. Her limited sight was frustrating and she found that seeing was more of a hindrance than a benefit. Lucy could function in a blind world, but imperfect sight made her feel clumsy and awkward.
3. The limbal stem cell and cornea transplants were initially successful, but unforeseen complications proved to be devastating. (Possible complications: Creutzfeldt-Jacob Disease from undetectable donor infection, cancer secondary to uncontrolled stem cell division, scarring or rejection.)

Grading for this case study is based on group participation and the individual essay homework assignment. Questions answered and written in class are turned in at the end of class. All participants in the group should have their names printed and signed on the top of the group class assignment. A group grade based on oral and written participation is given that is worth 30 percent of the grade for the case. The remaining 70 percent of the grade is based on creativity, thoroughness, and reliable references used to complete the essay assignment.

## BLOCKS OF ANALYSIS

By answering the questions that accompany the case, students learn about the anatomy and physiology of the eye, specifically the function of the cornea, and about stem cell research and its application to the treatment of blindness.

### 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. For the username and password, contact the National Center for Case Study Teaching in Science administrator at [answerkey@sciencecases.org](mailto:answerkey@sciencecases.org).

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