BigPicture

Lesson idea: Hearing is believing

Activities to help students understand the role of cells in our ability to hear

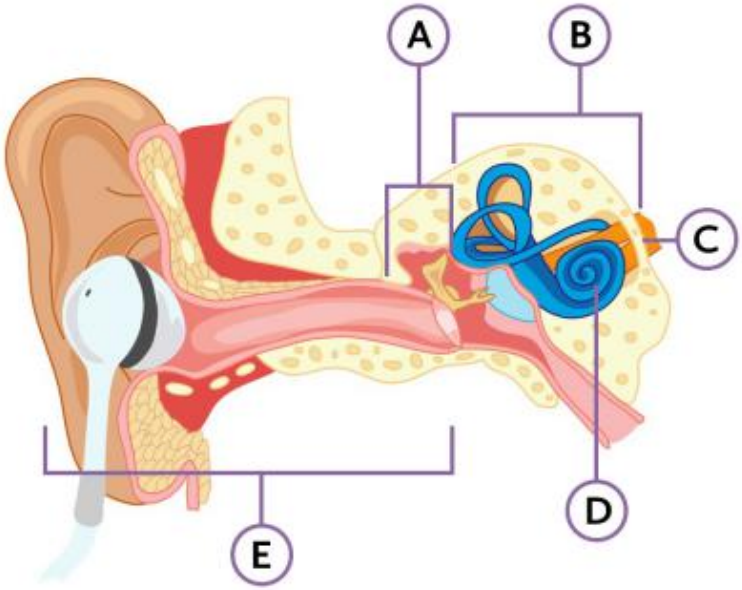
Learning objectives

Students will:

- **understand how the ear translates sound waves so the brain can process sound**
- **consider the potential advantages and ethical implications of stem cell therapy**
- **discuss how science is reported in the media.**

Activity 1

Watch this animation and then answer the following questions.



ABOUT THIS RESOURCE

This resource first appeared in 'The Cell' in January 2011, reviewed in September 2015.
Published by the Wellcome Trust, a charity registered in England and Wales, no. 210183.
bigpictureeducation.com

1a. Label the following parts of your ear.

- middle ear
- inner ear
- cochlear nerve
- cochlea
- outer ear

A = middle ear, B = inner ear, C = cochlear nerve, D = cochlea, E = outer ear.

1b. What is the name of the structure inside the cochlea that contains hair cells involved in translating sounds into nerve impulses?

The organ of Corti

2a. Particular ions entering the hair cells trigger the release of neurotransmitters and the generation of action potentials in the auditory nerve leading to the brain. What ions are involved in this process?

Calcium ions entering the hair cells trigger the release of neurotransmitters.

2b. Name two neurotransmitters.

Could be a number of answers including noradrenaline, acetylcholine, glutamate, dopamine.

3. At the end of the animation, it's mentioned that researchers are investigating the possibility of recreating hair cells as a way of treating people with hearing loss. Read an article about this on the NHS website. How did the researchers recreate mouse hair cells?

The researchers took stem cells from a mouse embryo and, by adding various biological chemical growth factors in several stages, induced them to develop the characteristics of the highly specialised hair cells. They then looked at how similar their cells were to sensory hair cells.

ABOUT THIS RESOURCE

This resource first appeared in 'The Cell' in January 2011, reviewed in September 2015.
Published by the Wellcome Trust, a charity registered in England and Wales, no. 210183.
bigpictureeducation.com

4. The article mentions pluripotent stem cells. What does the term 'pluripotent' mean?

Pluripotent stem cells have the ability to differentiate into any cell type in the body except for those involved in extra-embryonic tissue such as the placenta.

5. The research produced cells that resemble sensory hair cells – in what two ways were they said to be similar?

The cells created were said to be similar to sensory hair cells in terms of shape and their ability to respond to movement.

6a. Some reports of this research heralded it as a 'deafness cure'. Is this an accurate description of the research?

No, this is not an accurate description of the research. The research is at a preliminary stage, and we are still years away from a stem-cell-based treatment for hearing disorders.

6b. Why might the media portray the research as a deafness cure?

The media want to attract the attention of the public and portraying the research as a 'deafness cure' may be seen as more exciting than saying that the research is in its early days.

7a. The research involves mouse embryonic stem cells and if it were applied to humans would involve the use of human embryonic stem cells.
Give one reason why some people are against the use of human embryonic stem cells.

Many possible answers, including: opponents object on the grounds that it is unethical to destroy embryos in the name of science; opponents object on the grounds that life begins at conception; opponents object on the grounds that alternative approaches such as adult stem cells are less controversial.

7b. Give one reason why some people support the use of human embryonic stem cells.

Many possible answers, including: contribution to medical research could alleviate patient suffering; embryonic stem cells are pluripotent so can be used more flexibly than adult stem cells.

ABOUT THIS RESOURCE

This resource first appeared in 'The Cell' in January 2011, reviewed in September 2015.
Published by the Wellcome Trust, a charity registered in England and Wales, no. 210183.
bigpictureeducation.com

Activity 2

The first activity leads students towards a discussion or debate about some of the moral and ethical issues that are raised by the research analysed. Students are asked whether they agree or disagree with the following statements and to then discuss their reasons.

Statement 1: The potential of stem cells outweighs the ethical risks.

Statement 2: If I developed hearing loss I would be happy to be treated using stem cell therapy.

Statement 3: It is irresponsible for newspapers to sensationalise science stories.

They could also be asked to consider what the opinions of other groups might be, for instance:

- the Deaf community
- religious groups
- researchers
- funders of the research.

Additional resources

- More about the central nervous system, action potentials and neurotransmitters
- BBC Q&A about stem cells
- Free debate kit on stem cells from 'I'm a Scientist, Get Me Out of Here'
- New Scientist article about science reporting
- Tips and resources for debating and discussing controversial issues

ABOUT THIS RESOURCE

This resource first appeared in 'The Cell' in January 2011, reviewed in September 2015.
Published by the Wellcome Trust, a charity registered in England and Wales, no. 210183.
bigpictureeducation.com