

NEUROSCIENCE

WITH DR ADAM PACKER

Talking points

KNOWLEDGE

1. How many neurons are in a human brain?
2. What is epilepsy?

COMPREHENSION

3. What does the technique of calcium imaging involve? How can it record neural activity?
4. What does the technique of optogenetics involve? How can it generate neural activity?

APPLICATION

5. What questions do you want to ask Adam, Huriye and Sarah about their research or career paths?
6. How do you think Adam's research into how mice perceive sensations could lead to improved treatments for humans with schizophrenia?
7. What other physical or mental health conditions do you think could benefit from neuroscience research? How could a deeper understanding of the brain help our understanding and treatment of these conditions?

ANALYSIS

8. What are the advantages of Adam's all-optical approach, compared to using just calcium imaging or just optogenetics to explore neural activity?

SYNTHESIS

9. What challenges do you think neuroscientists will face when they try to use optogenetics to control epilepsy in humans? How might they overcome these challenges?

EVALUATION

10. "It is considered ethically justifiable to experiment on animals if the research has the potential to help millions of humans." To what extent do you agree with this statement? What are your views on animal testing for scientific research?

Activities

1. Adam trains mice to lick at a waterspout on either side of their cage, depending on whether their left or right whiskers are flicked. He then uses optogenetics to induce a perceived sensation in the mice's brains, so they think their left or right whiskers have been physically flicked. The mice will lick either the left or right waterspout, informing Adam whether the sensation has been correctly perceived.

Design three new experiments that Adam could conduct to test how mice experience sensations. Consider the following:

- What sensations will you investigate?
- How will you determine which neurons are responsible for each sensation?
- How will you manipulate the mice's neurons to artificially induce the sensation?
- How will the mice indicate to you that they have perceived the sensation?
- How will you control the experiment to ensure the mice are receiving the correct sensation?

2. Huriye mentions how the amazing similarity between the human brain and space inspired her to become a neuroscientist. Take a look at these images, and see if you can tell which is which: www.universetoday.com/148966/one-of-these-pictures-is-the-brain-the-other-is-the-universe-can-you-tell-which-is-which

Design a poster to showcase the wonders of the brain to your classmates. Consider the following:

- What are the most interesting facts you can find about the brain?
- How does the human brain compare to other natural (e.g., space) or artificial (e.g., computers) structures?
- What images will capture your reader's attention?
- How will you inspire readers to consider a career in neuroscience?

More resources

- This video gives a sneak peek into Adam's lab at the University of Oxford: www.youtube.com/watch?v=kUEd65XV1AQ
- Learn more about the neuroscience research conducted in Adam's lab: www.dpag.ox.ac.uk/research/packer-group