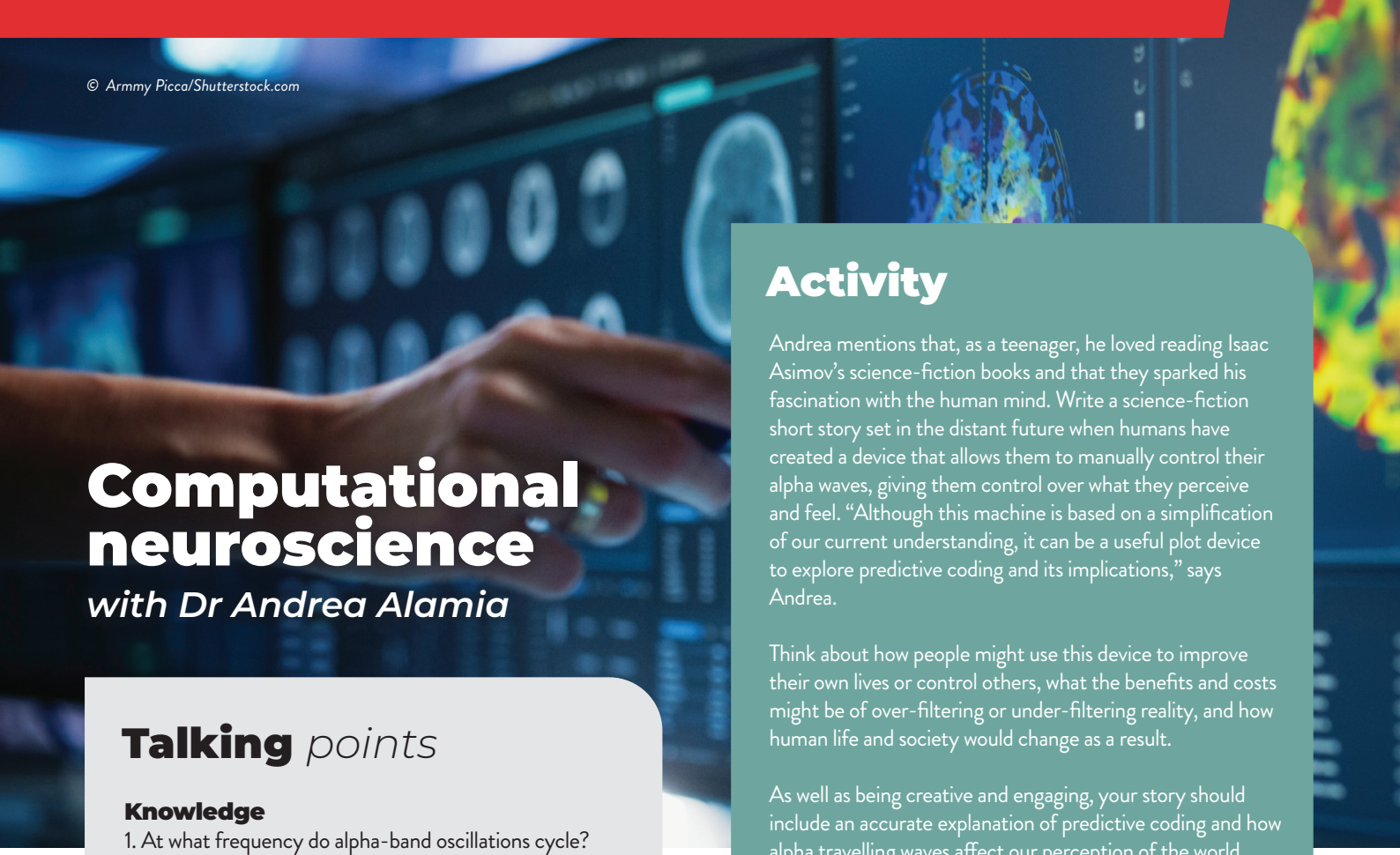

Computational neuroscience

with Dr Andrea Alamia

Talking *points*

Knowledge

1. At what frequency do alpha-band oscillations cycle?
2. What test did Andrea use to study the brain activity of participants with schizophrenia and autism?

Comprehension

3. How does predictive coding challenge traditional theories about how the brain perceives the world?
4. What does the brain do when incoming sensory data matches its internal prediction?
5. How do alpha-band oscillations act like a noise-cancelling filter?

Application

6. How could predictive coding principles be used to improve how an artificial intelligence system processes blurry images?
7. If you were trying to study in a loud cafeteria, how might your brain adjust to help you focus?

Analysis

8. How might stronger backward-travelling waves lead to hallucinations and delusions in patients suffering from schizophrenia?
9. How did Andrea's team use computational simulations and electroencephalogram (EEG) experiments to validate their predictions about predictive coding and brain activity?

Evaluation

10. How well do you think predictive coding theory explains why two people can experience the same event but perceive it completely differently?
11. To what extent do you agree with Andrea's advice that finding a supportive mentor is more important than attending a prestigious university, and why?

Activity

Andrea mentions that, as a teenager, he loved reading Isaac Asimov's science-fiction books and that they sparked his fascination with the human mind. Write a science-fiction short story set in the distant future when humans have created a device that allows them to manually control their alpha waves, giving them control over what they perceive and feel. "Although this machine is based on a simplification of our current understanding, it can be a useful plot device to explore predictive coding and its implications," says Andrea.

Think about how people might use this device to improve their own lives or control others, what the benefits and costs might be of over-filtering or under-filtering reality, and how human life and society would change as a result.

As well as being creative and engaging, your story should include an accurate explanation of predictive coding and how alpha travelling waves affect our perception of the world. Try to include this information as part of your story. For example, you could format your explanation as a narrative description of a character's experience, a conversation between two characters, or an excerpt from the device's instruction manual.

Once you have written your story, swap it with a classmate's. Read each other's stories and provide feedback based on the following questions:

- How well did the story you read explain the science behind predictive coding and alpha waves? Was the science woven naturally into the story?
- Did you enjoy reading the story? Highlight some moments of dialogue, description or plot that you particularly enjoyed.
- How could the writer improve elements of their science communication or storytelling?

More *resources*

- Watch this YouTube video by Psyched! To learn more about predictive coding: **youtube.com/watch?v=5eSxcygk8UM**
- Explore Charlotte Fraza's blog and online community to learn more about studying computational neuroscience: **charfraza.com**
- Consider applying for one of these neuroscience research programmes for high school students: **immerse.education/knowledge-base/15-neuroscience-research-programs-for-high-school-students**