Notes for teachers

At a glance

Our bodies our home to an incredible 10 trillion bacteria cells, many of which live in our gut. Scientists believe that this microbiome may affect our behaviour.

In this activity students read an extract from a paper written by microbiologists and The University of Oxford to understand how bacteria can influence our thoughts and feelings – are they trying to manipulate their hosts for their own benefit or is this simply a side-effect?

Learning Outcomes

- Students draw conclusions from a research paper
- Students understand the link between gut health and behaviour

Each student will need

- Copy of student worksheet
- Access to the internet

https://www.oxfordsparks.ox.ac.uk/content/bacteria-safari-forest-your-fingernail
Possible Lesson Activities

1. **Starter activity**
   - Ask students for a show of hands of anyone who eats probiotic foods, such as probiotic yoghurt drinks or takes probiotics as a supplement. Question students, asking them why they do this. Use this information as a stimulus for a quick discussion on gut health and maintaining a healthy gut microbiome. You may like to point out that most scientists are sceptical about the use of probiotics to improve gut health.
   - Give each student a copy of page 1 of the student worksheet and ask students to read through the information on the left hand side. Discuss how important our microbiome is for our health.
   - Play the animation 'Bacteria Safari: The Forest on your Fingernail', which introduces the work of microbiologists as The University of Oxford.

2. **Main activity: Interpreting a research paper**
   - Inform the students that they will be reading through and interpreting recent research written by the researchers at The University of Oxford into the human microbiome.
   - Give each student a copy of page 2 of the student worksheet, which is part of the paper.
   - First, students should create a glossary to define the words in bold. Supply them with access to the internet. Students should also add any other words that they don’t understand.

**Glossary**

Afferent neuron: sensory neuron that carries nerve impulses from sensory stimuli towards the central nervous system.

Blood-brain barrier: a semipermeable membrane separating the blood from the fluid surrounding the brain, and forming a barrier to the passage of cells, particles, and large molecules.

Lumen: the inside space of a tubular structure

Lymphatic system: the network of vessels through which a fluid called lymph drains from the tissues into the blood.

Vagus nerve: connects the gut and brain. It sends signals in both directions.

- Check their definition then ask them to answer the questions on page 1. They will need access to the internet to watch the clip about an ant fungal parasite. (see weblinks for URL). They may also want to do extra research in the causes of mental health in order to answer question 5.

**Answers:**

1. The fungus spores infect the ant’s brain and affects the ant’s behaviour. It makes it climb upwards. The fruiting body erupts from the ant’s head. The spores burst from the tip. The higher up the spores travel from, the wider the range of infection.
2. There is no clear evidence that our microbiome manipulates our behaviour. Also, the human microbiome is diverse, so any symbiont investing resources to manipulate host behaviour is expected to be outcompeted.
3. The substances may act like neurotransmitters e.g dopamine and serotonin, or their precursors. Humans depend on these substances for synapse transmission in the nervous system.

4. They do not have a microbiome producing the neurotransmitters so the function of their nervous system is compromised.

5. Poor mental health may be caused by underproduction of certain neurotransmitters in the brain. This could be because the patient has an undeveloped or less diverse microbiome. One treatment route could be to treat the patient to improve their microbiome.

3. Plenary
   - Invite students to share answers with the rest of the class and agree with what the research findings were.
   - As an extra source of information, you may wish the students to watch the Facebook LIVE interview with Katerina Johnson, one of the researchers who wrote the paper.

Weblinks

Oxford Sparks animation:

https://www.oxfordsparks.ox.ac.uk/content/bacteria-safari-forest-your-fingernail

Attack of the killer fungi

https://www.youtube.com/watch?v=o57ImEfknMQ

Facebook LIVE interview with Katerina Johnson

https://www.oxfordsparks.ox.ac.uk/content/facebook-live-katerina-johnson