Key Stage 3 – Beneficial Bacteria

Notes for teachers

At a glance

Our intestines are home to a diverse community of bacteria, the vast majority of which are beneficial. Studies have associated these bacteria with a lower incidence of many illnesses such as cancer, heart disease, diabetes, asthma and depression. However, much more research is required to be certain of their role in keeping us healthy.

Probiotics contain species of these bacteria but do they actually work to increase their population in our intestines? This activity is suitable for extending the more able students. They plan an investigation to collect evidence before evaluating how valid their data would be.

Learning Outcomes

- Students understand the importance of bacteria in the intestines
- Students design an experiment to evaluate a claim
- Students evaluate the validity of their method

Each student will need

- Copy of student worksheet

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

1. Starter activity
   - Present to the class an opinion – that the world would be better off without bacteria. Ask them to vote: if they agree they should put their hand up. After voting, invite some students to explain the reason for their vote. Use this as a platform to discuss the fact that less than 5% of bacterial species cause disease (pathogenic). In fact, we could not survive on Earth without bacteria. They play a vital role in decay, which is used to recycle materials and many species are vital to our health.
   - Play the animation 'Bacteria Safari: The Forest on your Fingernail', which outlines this in more detail as well as introducing the work of microbiologists at The University of Oxford.

2. Main activity: Planning the experiment
   - Give each student a copy of page 1 of the student worksheet and ask them to read through it. This explains the important roles of bacteria in the intestines. More information is given in the BBC weblink below.
   - Ask the class if anyone has seen advertisements for probiotics or includes them as part of their diet. Discuss the fact that some people are sceptical that they actually work.
   - Ask students to work in pairs or small groups to plan an investigation that could be carried out in order to find out if the bacteria in probiotic foods would actually survive and reach the intestines. The student sheet gives them a list of equipment they could use plus some useful facts. They can choose to test one probiotic or compare them.
   - A suitable method would be:
     - Use a measuring cylinder to measure out 50 cm³ of 0.2 mol/dm³ hydrochloric acid into a conical flask. This mimics the volume and concentration of acid in the stomach. Use the universal indicator paper to check that the pH is around 1-2.
     - Measure out one serving of a probiotic and add to the acid. Use the stirring rod to mix. Leave for 20 minutes, mixing occasionally. This mimics the churning of the food with the acid in the stomach. This can be repeated for the other probiotics.
     - Add sodium hydroxide drop by drop using the disposable pipette, swirling the mixture, until the pH reaches around 8. This mimics the addition of alkaline juices in the intestines.
     - Use a disposable pipette to add a few drops of the mixture to one agar plate. Keep the other as a control. Leave the plates in an incubator at a temperature of 37°C for a day. Growing the bacteria on the jelly mimics the bacteria growing in the intestines.
     - Study the plate for bacterial growth. If bacteria are present you should see colonies growing on the nutrient jelly. The number of colonies can be counted.
   - If you wish, students can carry out their method. If they do you should carry out a full risk assessment. You may have to demonstrate good aseptic technique so that their plates do not become cross-contaminated. Plates should be incubated at 25°C to avoid growth of pathogenic bacteria.

3. Plenary
   - Ask the class to evaluate the validity of their method: would it provide data that can be used to determine if bacteria in probiotic drinks would survive to reach the intestines? Discuss

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that this is a laboratory method mimicking a natural one so there will be some parts that are not accurately representing what really happens in the human body. Ask them to peer assess another group’s method and highlight these places in the method e.g., the hydrochloric acid is not stomach acid, sodium hydroxide is not the same as the alkaline juices in the body, they only planned to put a small volume of the bacteria mixture onto the plate.

Weblinks

Oxford Sparks animation:

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

What should I eat for a healthy gut? Website from BBC iWonder.

http://www.bbc.co.uk/guides/zq7nj6fzsv8ycw