microbiology

with Dr Salam A. Ibrahim

Talking points

Knowledge

How can microorganisms be harmful to food?
How can microorganisms be beneficial to food?

Comprehension

3. Why is the collaboration between the Food Microbiology and Biotechnology Lab and industry partners essential for the lab's success?

Application

- 4. Dr Ibrahim's lab combines discovery, education and outreach to advance the field of food science. Using examples, how could different scientific disciplines benefit from a similar approach?
- 5. When developing a new food product or technique, how and why do you think an academic researcher's priorities, motivations and goals may differ from those of a food industry professional?

Analysis

- 6. If you were a farmer, why might you want to collaborate with the lab?
- 7. How have Alaina and Philip benefited from their involvement with the lab?
- 8. Why do you think many bacteria have evolved to produce their own antimicrobial compounds?

Synthesis

9. Your stomach contains acid that kills most bacteria that enter it. How do you think food microbiologists might develop probiotics that evade this acidic trap?

Evaluation

- 10. Of the many careers available in food science, which most interests you, and why?
- 11. The recipes for many famous food products are closely-guarded secrets. How do you think this competitive aspect of the food industry impacts food science research, education and outreach?

More resources

- Watch the animation that inspired Alaina to become a food scientist: www.ted.com/talks/stephanie_warren_the_chemistry_of_cookies
- This TED-Ed animation explores how bacteria contribute to delicious food flavours: <a>www.youtube.com/watch?v=eksagPy5tmQ
- This article examines how probiotics work at the microbiological level: www.livescience.com/what-are-probiotics-and-how-do-they-work

Activities

1. Use microorganisms to create your own food

You can create your own yoghurt by mixing a small amount of shop-bought yoghurt (make sure it contains 'live cultures', which are the bacteria that do the fermentation, such as *Lactobacillus bulgaricus*) with milk and leaving it in a warm place overnight. In the morning, the bacteria in the original yoghurt will have fermented the milk into more yoghurt.

Bake a loaf of bread to observe the role of yeast in fermentation. Mix flour, yeast, salt and water and knead it to form a dough. Cover the dough and leave it for a couple of hours until it has doubled in size. Yeast is a fungus that feeds on the carbohydrates in the flour, converting them to carbon dioxide gas that forms bubbles in the dough, causing it to rise.

2. Explore the role of microorganisms in food production

For thousands of years, humans have taken advantage of microbial processes for food production. Choose a food-related microbial process, such as yeast fermentation to make bread or beer, or bacterial fermentation to produce yoghurt or cheese. Research the process online to discover:

- The characteristics of the microbe(s) involved
- The biochemistry behind the process
- The characteristics of the food product that result from the microbial process
- How (or if) the process is performed on an industrial scale to mass produce the product
- Scientific advances relating to the microbial process (historic or recent)

Then, consider how food microbiologists could improve this microbial process. Could the (cost, time, resource or energy) efficiency of the process be improved? Could the microbe be modified to provide greater health benefits? Could the process be adapted to make the end product suitable for people with specific dietary requirements?

Imagine you are a food microbiologist and you want investigate whether your suggested improvement(s) to the microbial process would result in a better food product. Create a presentation aimed at industry members who currently produce your chosen food product, persuading them to collaborate with you in your research. Consider:

- How will industry members benefit from their involvement in the collaboration?
- What language and level of detail is appropriate for your audience? While they will be familiar with the industrial process, they may have less biochemical knowledge.
- How can you use images and diagrams to make your presentation eye-catching and engaging?

Deliver your presentation to your classmates. Are they persuaded to join your collaboration?

