Plant pathology

with Professor Jong Hyun Ham

Talking points

Knowledge

- 1. Give an example of a harmful plant-bacteria interaction.
- 2. Give an example of a beneficial plant-bacteria interaction.

Comprehension

- 3. How important are rice and soybean for global food security?
- 4. How does the bacterium *Burkholderia glumae* (*B. glumae*) affect rice plants during bacterial panicle blight (BPB)?
- 5. How did Jong determine which genes control the virulence of *B. glumae*?

Application

- 6. Jong and his team discovered five new genes that control the virulence of *B. glumae*. How do you think plant pathologists could use this knowledge to protect rice from BPB?
- 7. How has Jong's team used their research findings to improve rice and soybean yields?

Analysis

8. Why do you think Jong investigates both harmful and beneficial bacteria-plant interactions, rather than focusing on one or the other?

Evaluation

9. To what extent do you think that Jong's research is contributing to ensuring global food security?

More resources

- BBC Bitesize has a podcast about how to protect plants from disease: www.bbc.co.uk/bitesize/guides/zxrpqhv/revision/2
- Learn more about the role of biotechnology for advancing agriculture from the USDA: www.usda.gov/topics/biotechnology

Activities

1. Take advantage of symbiotic relationships to cultivate crops

If you have access to a patch of garden, use the Indigenous American 'three sisters' planting method to grow beans, corn and squash. These crops are known as the 'three sisters' due to their traditional importance as staple vegetables and the way they support each other when grown together.

First, plant the corn in small mounds of soil. Once it has started to grow, plant beans at the base of each corn plant, and intersperse squash seeds throughout the whole patch.

Each of the three sisters helps the others to grow. Beans are legumes, meaning they have a symbiotic relationship with root bacteria that convert nitrogen into the nutrient, ammonium. In this way, the beans add natural fertiliser to the soil, helping to feed the corn and squash. In return, the beans grow around the corn stalks which provide crucial support as they develop. And the large leaves of the squash plants shade the soil, helping it to retain moisture and preventing weeds from growing.

Read this blog to learn more about the importance of the three sisters and how to lay out your garden: www.nativeseeds.org/blogs/ blog-news/how-to-grow-a-three-sisters-garden

2. Debate the pros and cons of genetically modified crops

As part of his research, Jong is uncovering which genes make rice susceptible or resistant to BPB. With this knowledge, plant breeders can selectively breed disease-resistant rice varieties by artificially fertilising disease-resistant parent plants in the hope of producing offspring that are more likely to be resistant to diseases. However, this is a time-consuming approach. Biotechnology engineers can also genetically modify rice plants to insert disease-resistant genes into their genomes, creating genetically modified disease-resistant rice varieties.

As half the world's population depends on rice, these diseaseresistant varieties have the potential to prevent famine and ensure food security. However, not everyone agrees that genetically modifying plants is a good idea. As this technology is still relatively new, the long-term impacts of altering crop genes are still debated.

Research online to discover the arguments for and against genetically modified organisms (GMOs). As this is a controversial topic, be aware of the agenda behind websites and organisations that only promote one viewpoint. After learning about the pros and cons, what is your opinion of GMOs? Organise a class debate to discuss whether scientists should develop GMOs, such as rice varieties that are resistant to BPB.