

DIGGING INTO THE SOIL MICROBIOME WITH THE UNIVERSITY OF MANCHESTER AND THE UNIVERSITY OF MINNESOTA

TALKING POINTS

KNOWLEDGE

1. What is a microbiome?
2. What is the difference between a wet lab and a dry lab, and why does this research project use both?

COMPREHENSION

3. Why are the researchers using genetic engineering techniques in their work?
4. What will the team's computer modelling exercises demonstrate?

APPLICATION

5. What steps do you think would be needed between the team publishing their results, and agriculture deploying microbiome modification techniques?
6. What sort of datasets do you think the team will produce? Why are sophisticated computer programmes a better way of analysing these datasets than everyday statistical techniques?

ANALYSIS

7. How do you think researchers first detected that bacteria were communicating with one another? Can you think of a simple experiment that could be done to demonstrate this communication?
8. Jack mentions that *Streptomyces* can be a difficult bacteria to genetically engineer. Why do you think this might be the case?

SYNTHESIS

9. How do you think the two teams of researchers work together effectively, given they are on different continents?

EVALUATION

10. Do you think Stephen's vision of engineered microbiomes terraforming other planets is realistic? Why or why not?
11. What concerns might people have about genetically engineered microorganisms being released into the world? Do you think these concerns are valid?

ACTIVITIES YOU CAN DO AT HOME OR IN THE CLASSROOM

This project is a complex one with lots of different actors and specialties. Design a flowchart that shows the key steps in the project. Use the guidance below to help you:

- Think about how to divide the key steps – 'wet lab' or 'dry lab'? 'Manchester' or 'Minnesota'? Or both?
- What are the beginning and end points?
- Extra research will help you lay out the flowchart. Research the following items:
 - o Plasmids
 - o Bacterial signalling
 - o Genomics, transcriptomics and metabolomics
 - o Genome engineering
 - o *Streptomyces*
- Include the researchers and their specialisms within your flowchart.
- Consider how to make your design attractive and easy to follow. Think about using colour coding, diagrams, infographics and illustrations.

MORE RESOURCES

Some of the Minnesota team members work within the Smanski, Kinkel and Harcombe labs. Find out more about their cutting-edge projects:

Kinkel Lab: www.plpa.cfans.umn.edu/people/linda-kinkel

Smanski Lab: www.smanskilab.tech/

Harcombe Lab: www.wrharcombe.org/

Find out more about the Manchester team's work in the Takano and Breitling labs:

SYNBIOCHEM: www.synbiochem.co.uk/

Keep up to date with the Signals in the Soil programme: www.nerc.ukri.org/research/funded/programmes/soil/

Two recent podcasts highlight the team's work on soil microbiomes:

The American Society for Microbiology (ASM) Meet the Microbiologist podcast: <https://asm.org/Podcasts/MTM/Episodes/Managing-Plant-Pathogens-Using-Streptomyces-with-L>

The American Phytopathological Society (APS) podcast celebrating the Year of Plant Health (Plantopia): www.plantopiapodcast.org/5