

# SYNTHETIC BIOLOGY

## With Professor Ian Paulsen and the ARC Centre of Excellence in Synthetic Biology

### Talking points

#### KNOWLEDGE

1. What is synthetic biology?
2. Why is reducing cattle methane emissions advantageous?

#### COMPREHENSION

3. Why does genetic engineering of communities of microbes, rather than single microbe species, open up new opportunities?
4. The production of palm oil is a major cause of deforestation. How could synthetic biology help mitigate this issue?

#### APPLICATION

5. How do you think the team progress from identifying a product to aim for, to identifying a suitable metabolic pathway? How would you approach this challenge?

#### ANALYSIS

6. Why do you think that insertion of genes for metabolic pathways rarely works the first time?
7. Why do you think that Ian's team is focusing on agriculture and waste rather than other societal issues?

#### SYNTHESIS

8. Ian says the team is "integrating humanities considerations within our development process from an early stage". Take the development process described in the 'how to engineer a microbe' section, and explain how you would go about integrating these considerations.

#### EVALUATION

9. The Nagoya Protocol is around a decade old, but Ian believes it unlikely that any research institution is fully compliant. Why do you think this is? How might this be overcome?
10. Do you think there are ecological dangers to synthetic biology, for instance if genetically engineered microbes entered natural ecosystems? Why or why not?

### Activity

Ian and his colleagues mention a variety of synthetic biology projects in the article. Choose one:

- Reducing methane emissions from cattle
- Breaking down plastics for 'infinite recycling'
- Production of cooking oil

As Ian emphasises, the field of synthetic biology needs people not just skilled in research but also in entrepreneurship, possessing the skills to take their findings through to application and benefiting the real world. Imagine you are the lead for your chosen project, and are presenting to a panel of potential investors, who could help you scale up your work.

Design a slideshow to promote your project. This should contain:

- A key message: the societal/economic benefit of your project.
- A non-technical overview of how the science works.
- A timeline for development, including past, present and future.
- Why the project needs investment, and how it could benefit investors.

Make sure to make your slideshow engaging and easy to comprehend.

Present your slideshow to your class. Acting as investors, your classmates should ask you challenging questions about your project. Afterwards, reflect on whether you think your project would have secured funding. Why or why not? Ask your peers – would they award you funding?!

### More resources

- The ARC Centre of Excellence for Synthetic Biology gives an overview of its cutting-edge and varied research projects. Explore here: [www.coesb.com.au](http://www.coesb.com.au)
- This article from Science gives a useful insight into how to work towards a career in synthetic biology: [www.science.org/content/article/training-synthetic-biology-jobs-new-bioeconomy](http://www.science.org/content/article/training-synthetic-biology-jobs-new-bioeconomy)
- This video from Freethink gives an overview of synthetic biology and how it might 'save the planet': [www.youtube.com/watch?v=3WYcST7k2wo](https://www.youtube.com/watch?v=3WYcST7k2wo)
- This video from Cemvita Science explains how synthetic biology can be used to directly combat climate change, in this case by using a banana gene: [www.youtube.com/watch?v=uXYnpb3eAsk](https://www.youtube.com/watch?v=uXYnpb3eAsk)