Biomedical engineering
with Dr Christopher Contag

Talking *points*

Knowledge
1. What is a symbiotic relationship?
2. What are the average waiting times for receiving a donated heart, lung and kidney in the US?

Comprehension
3. What are the differences between a prokaryote and a eukaryote?
4. According to the endosymbiont theory, how did eukaryotes initially form and evolve?

Analysis
5. What are Chris' motivations for creating engineered endosymbionts?
6. Before engineered endosymbionts can be used for medical purposes, Chris must overcome challenges in the lab and in society. How do you think he will overcome these?
7. Which challenge do you think will prove the greatest obstacle to using engineered endosymbionts for tissue regeneration?
8. How have Chris' personal experiences influenced the work he does?

Creativity
9. When Chris was 10, he took a cow's eye to school and dissected it for his classmates. While this may not be possible today, how could you 'bring your everyday life into the classroom'? What skills and knowledge could you share to educate your peers?
10. "In biomedical engineering, your primary limitation is your ability, or inability, to imagine the future!" says Chris. As technology and biological understanding advance, what do you imagine biomedical engineers will achieve in the future?

More *resources*

- In this podcast, Chris discusses how genomic approaches to health could redefine illness and disease: **www.iq.msu.edu/2019/09/20**
- These videos from National Geographic introduce different symbiotic relationships in the ocean:
  www.nationalgeographic.org/activity/ecological-relationships
- Learn more about Chris' research (including his previous work in biomedical imaging, before he established the field of endosymbiont engineering): **www.contaglab.org**

Activities

From science fiction to reality

"Controlling tissue regeneration from outside the body still seems like science fiction to many people," says Chris. To receive funding for his research, Chris must convince the scientific community that his work is possible and can have a positive impact on society. And, for engineered endosymbionts to be used to regrow tissues within people, the public must accept that the process is safe.

1. Imagine you are in Chris' research team, and you are responsible for securing funding for the next stages of the project. Write a one-page letter to your funders that explains why you should receive the money you need to continue developing engineered endosymbionts. Your letter should explain the successes you have had so far that prove the concept is possible, state the challenges you are currently facing and how you plan to overcome them, and describe what you hope to do next.

2. Imagine it is several years in the future, and Chris has successfully created engineered endosymbionts that can repair heart tissue. Design a leaflet for people waiting for a heart transplant that explains this new alternative treatment option. As well as being eye-catching and engaging, your leaflet should explain what engineered endosymbionts are in a clear and accessible way, address potential safety issues and describe how the reader could benefit from using engineered endosymbionts instead of waiting for a heart transplant.

3. Imagine you are a TV reporter sent to interview Chris about the success of his project developing engineered endosymbionts that can repair heart tissue. Write out a set of interview questions that you would like to ask him about his research (e.g., what the process involves and what challenges he had to overcome) and career journey (e.g., his inspirations for becoming a scientist and his motivations for developing engineered endosymbionts).

4. With a partner, act out your TV interview. Your partner can play the role of the interviewer and ask the questions you devised, while you play the role of Chris, answering the questions as you think he might. You can then swap roles, and interview your partner using the interview questions they wrote, while they answer pretending to be Chris.