

COOPERATION IN KOMBUCHA

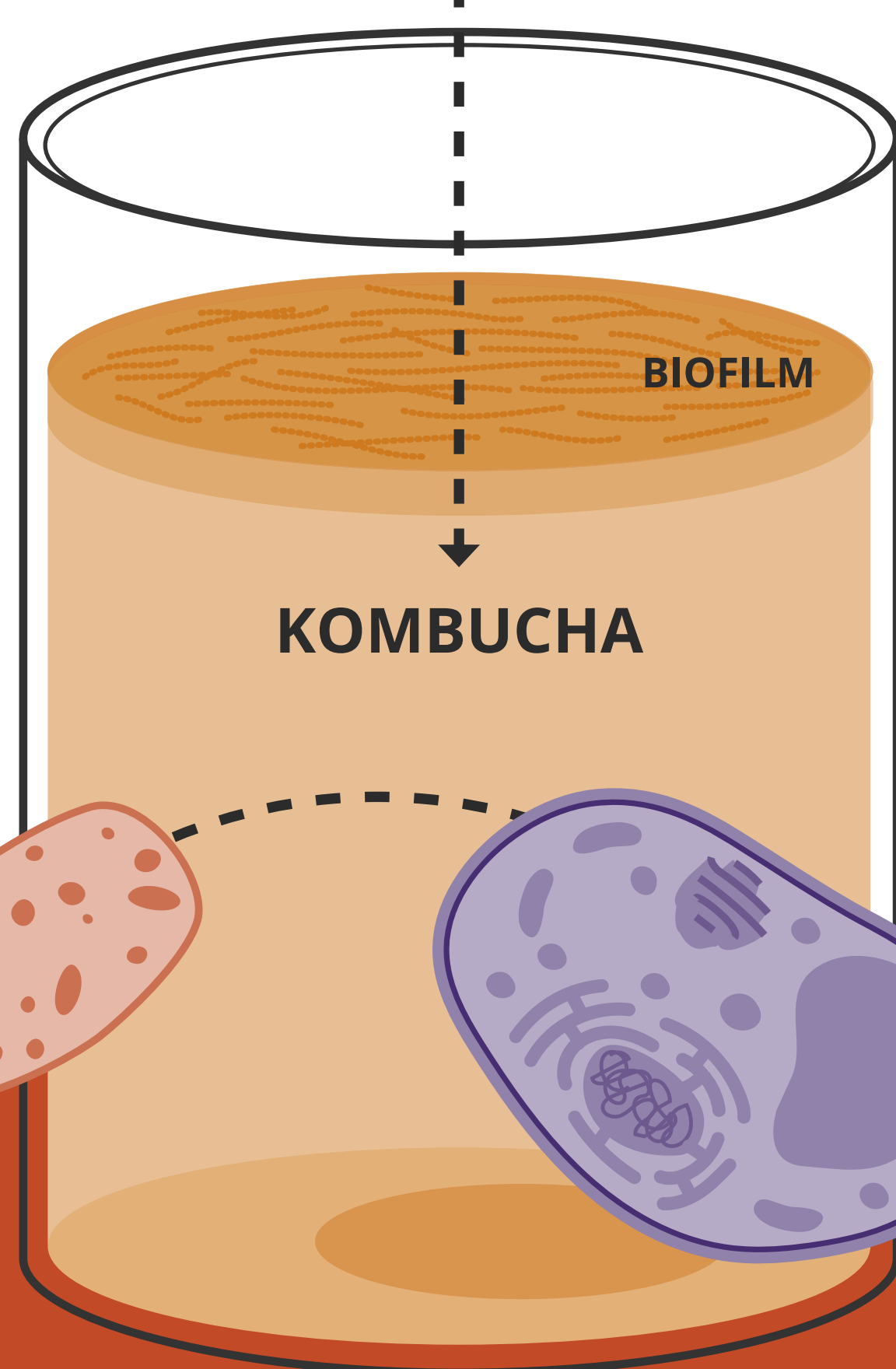
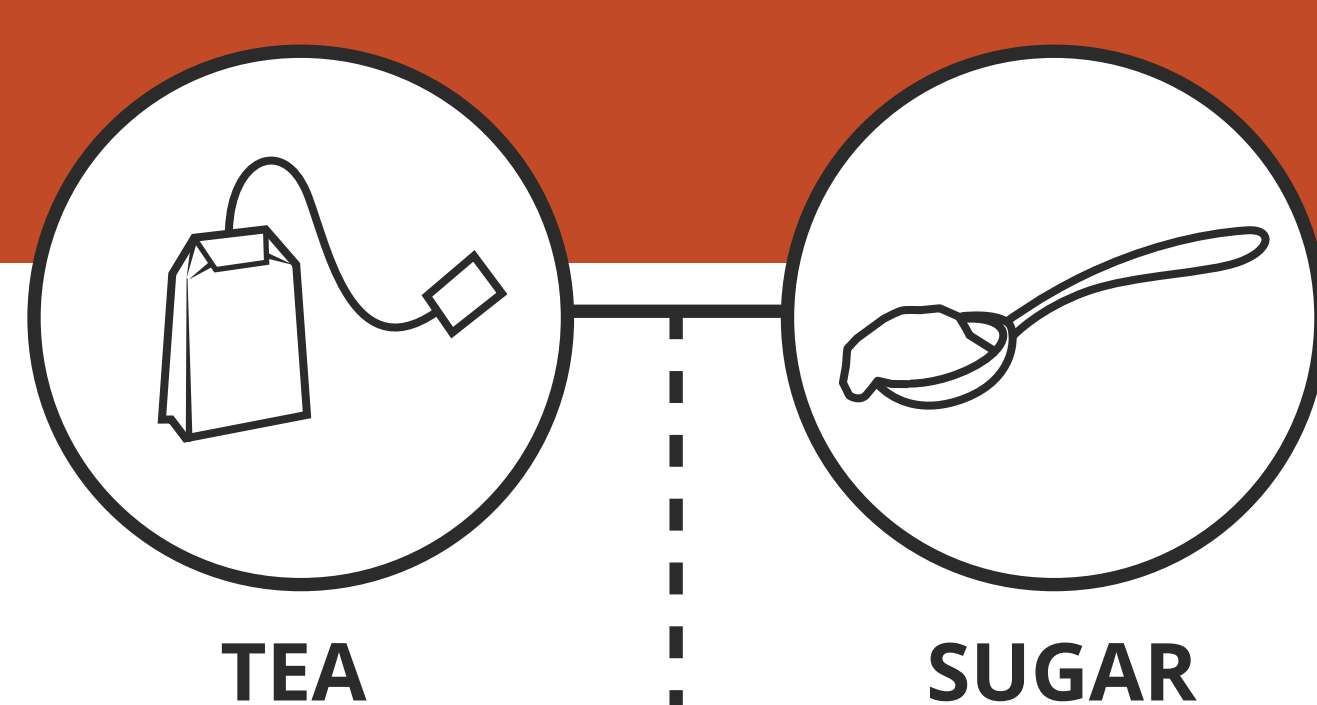
Kombucha: A novel model system for cooperation and conflict in a complex multi-species microbial ecosystem

WHAT IS KOMBUCHA?

Kombucha is a fermented beverage. A **starter tea** is used (usually black or green tea with sugar).

A **complex community of bacteria and yeast** start the fermentation process and produce a biofilm that covers the liquid.

The community cooperates in various ways.

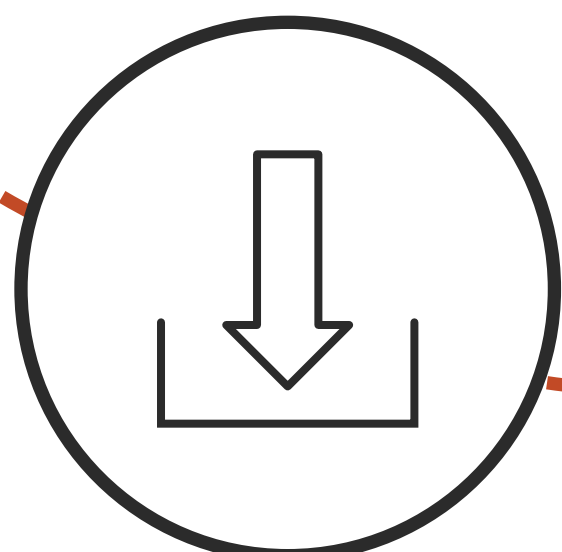


HOW DO BACTERIA AND YEAST WORK TOGETHER?



METABOLIZING RESOURCES

Yeast produce invertase which allows both yeast and bacteria to metabolize sugars



STORING RESOURCES

Bacteria converting sugars to a cellulose which allows them to store energy in the biofilm



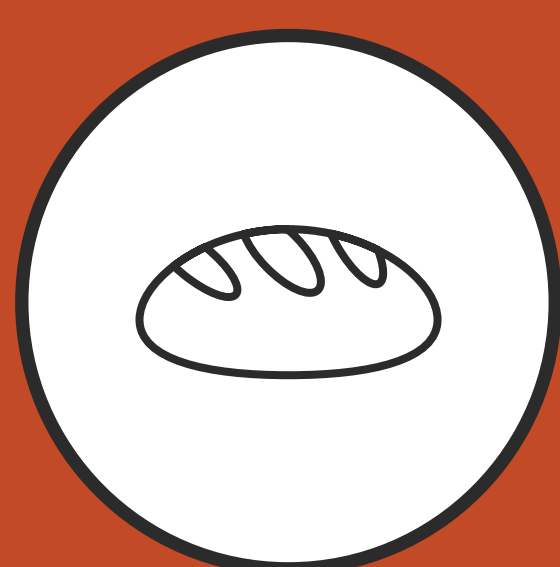
PROTECTING AGAINST INVADERS

Yeast and bacteria inhibit competitors by creating alcohol, acids and a protective biofilm

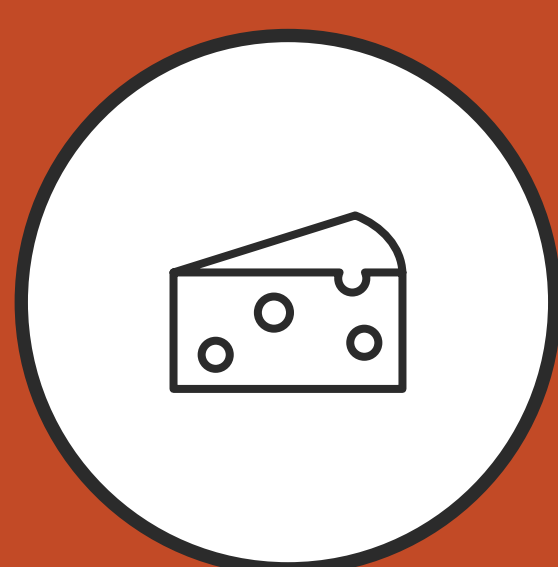
KOMBUCHA AS A MODEL SYSTEM

Fermented foods, like kombucha, can be **useful model systems for studying multi-species cooperation** because they are complex like natural microbial systems that have been studied in the field, but easy to cultivate like artificial microbial systems that have been studied in the lab.

Cooperation between yeast and bacteria creates nutritious and delicious fermented foods that humans around the world eat.



SOURDOUGH BREAD



CHEESE



KEFIR

OTHER USES

Kombucha and other fermented foods could **potentially be used to develop new anti-microbial products** that could help deal with some of the problems of evolving antibiotic resistance.



ANTI-MICROBIAL PRODUCTS