

# Microbiology

with Dr Hannah Halm  
and Dr Sören Woelke

## Talking points

### Knowledge & Comprehension

1. How is salmonella spread between animals?
2. What happens during lactic acid fermentation?
3. What are the similarities and differences between salmonella and lactic acid bacteria (LAB)?
4. What are the advantages of lactic acid fermentation for disinfecting manure, compared to other methods?

### Application

5. How could Hannah and Sören test different mechanisms to understand how and why lactic acid fermentation inactivates salmonella?
6. What might be the next practical steps for rolling out lactic acid fermentation across farms and introducing it as a new method of manure disinfection?
7. Other pathogens can also be spread via manure. How could Hannah and Sören test whether lactic acid fermentation would also disinfect manure from other pathogens?

### Analysis

8. Why do you think that fermentation using hay was too slow?
9. After confirming that lactic acid fermentation inactivates salmonella in the lab, why did Hannah and Sören need to test the process at a larger scale? Why might it work differently at different scales?

### Evaluation

10. What do you think you would most enjoy about a career in microbiology, and why?

## Activities

### 1. Observe fermentation in action

Other microbes also break down carbohydrates by fermentation. For example, yeast ferments glucose (a type of sugar) into ethanol and carbon dioxide, and is used to make products such as bread and beer.

You can create an experiment to observe this fermentation in action. You will need: five narrow-necked bottles, dried yeast, sugar, warm water, five balloons.

In each bottle, place 2 teaspoons of yeast, either 0, 1, 2, 3 or 4 teaspoons of sugar, and 200 ml warm water. Place a balloon over the neck of each bottle, swirl the contents to mix them, then leave them somewhere warm for 1-2 hours.

1. What happens in each bottle? Why do you think this is?
2. How does yeast fermentation contribute to producing bread and beer?

### 2. Farmer outreach

Imagine that the government in your region has approved lactic acid fermentation as a method to disinfect cow manure contaminated by salmonella. You have been asked to meet with a group of local farmers to encourage them to use this new process.

Individually or in small groups, design a presentation to explain what lactic acid fermentation is and the benefits of this process for disinfecting manure. Your presentation should:

- Explain the science behind lactic acid fermentation in clear language
- Consider the priorities and prior knowledge of your audience
- Use persuasive techniques to convince your audience to use lactic acid fermentation.

Deliver your presentation to the rest of the class. Answer any questions they have in their role as farmers in your audience. Then, swap roles and listen to their presentations. What points do you find most engaging and interesting? If you were a farmer, which presentations would most effectively persuade you to adopt lactic acid fermentation, and why?

## More resources

- The Microbiology Society has a wealth of resources and activities for schools: [microbiologysociety.org/resources/education-and-outreach-resources.html](https://microbiologysociety.org/resources/education-and-outreach-resources.html)
- Cornell's College of Veterinary Medicine gives an overview of salmonellosis in farm animals: [vet.cornell.edu/animal-health-diagnostic-center/programs/nyschap/modules-documents/salmonellosis-background-management-and-control](https://vet.cornell.edu/animal-health-diagnostic-center/programs/nyschap/modules-documents/salmonellosis-background-management-and-control)