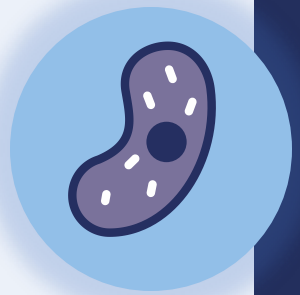
Growth of Bacteria

Answer the questions below.

1. Compare the sizes of eukaryotic and prokaryotic cells.
   Eukaryotic cells are typically between 1-100 µm, whereas prokaryotic cells are typically between 1-10 µm.
2. Describe the function of an inoculating loop.
   To transfer bacteria (or other microorganisms) to a medium.
3. Explain why the aseptic technique is used.
   To prevent contamination when preparing a culture.
4. Name the type of cells that have genetic information stored in a nucleus.
   Eukaryotic cells
5. Name the organelle that controls the entry and exit of substances into and out of cells.
   Cell membrane

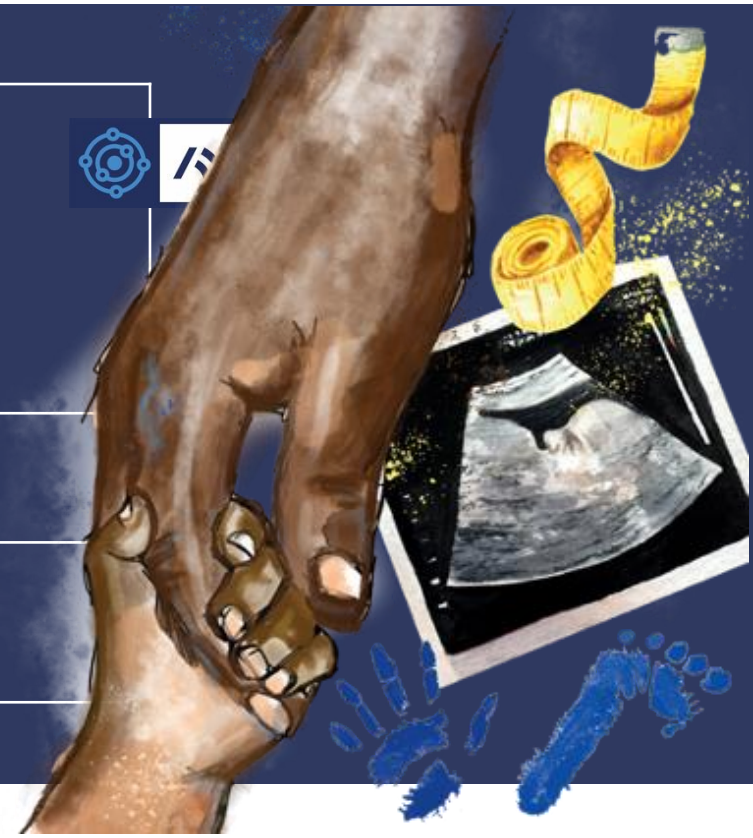
Do Now

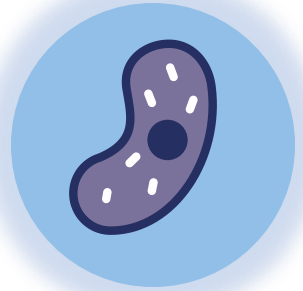


Growth of Bacteria

B3.1.4

Science Mastery

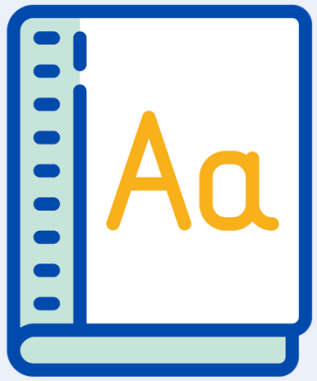




Following this lesson, students will be able to:

- State the steps involved in aseptic technique
- Describe how to calculate how many bacteria are present in a culture from the mean division time
- Prepare a culture sample using aseptic technique

Key Words:



aseptic **culture**

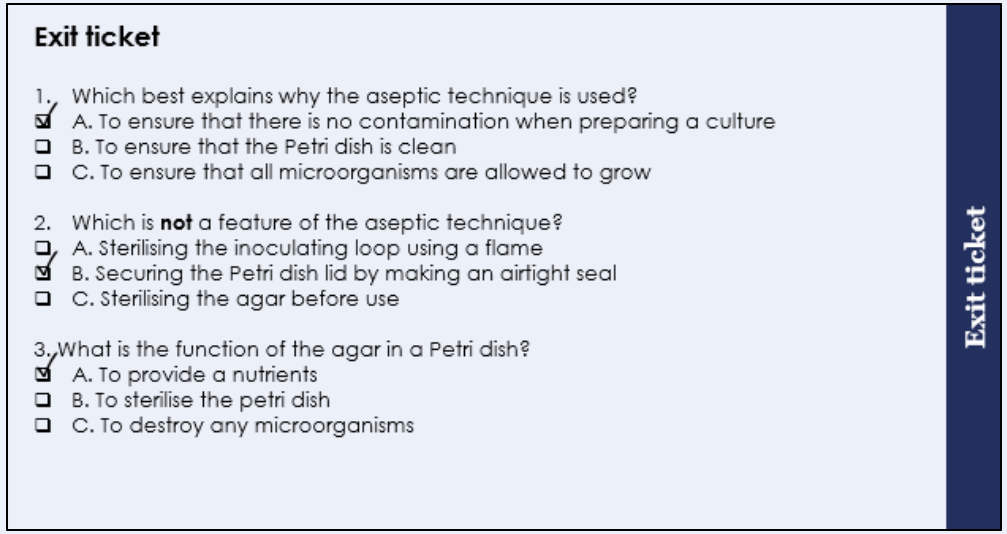
agar medium **inoculating loop**

Lesson Objectives

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

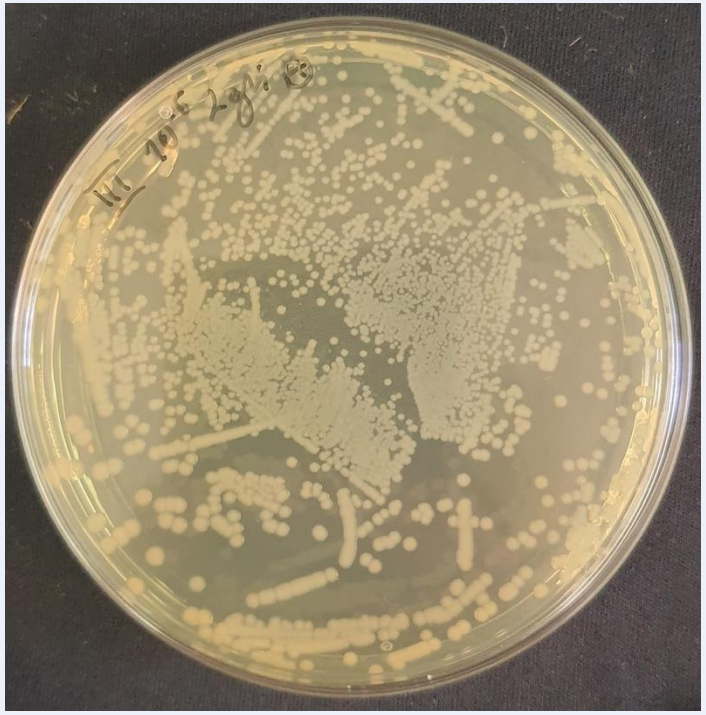
- The teacher should customise this slide as needed, to facilitate
  - **reteach**, **explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.



Fix-it

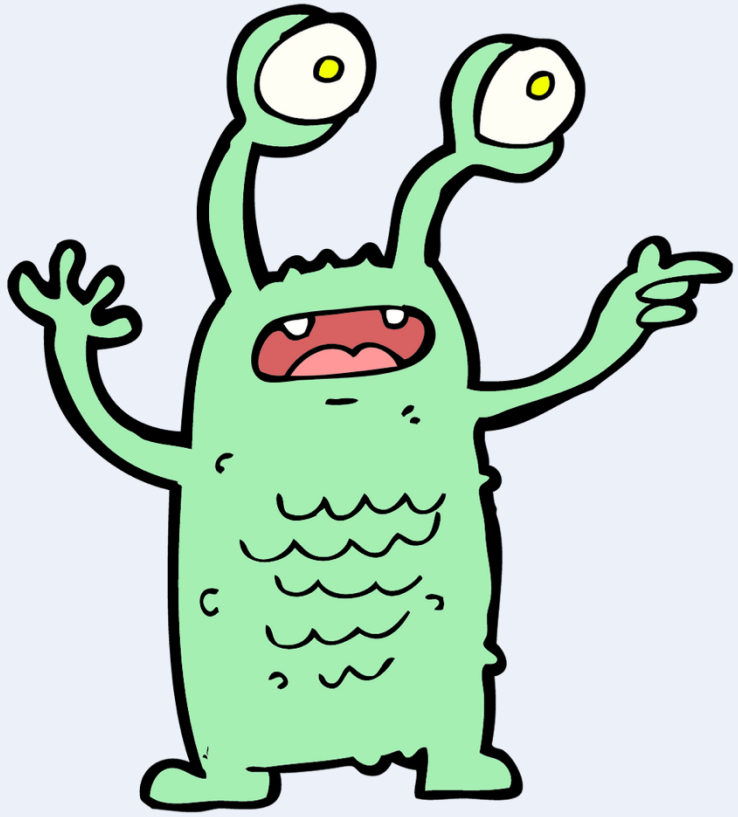
The Growth of Bacteria

- Certain bacteria can cause **diseases**
- In this practical, we are going to swab different areas to look at the bacteria found there

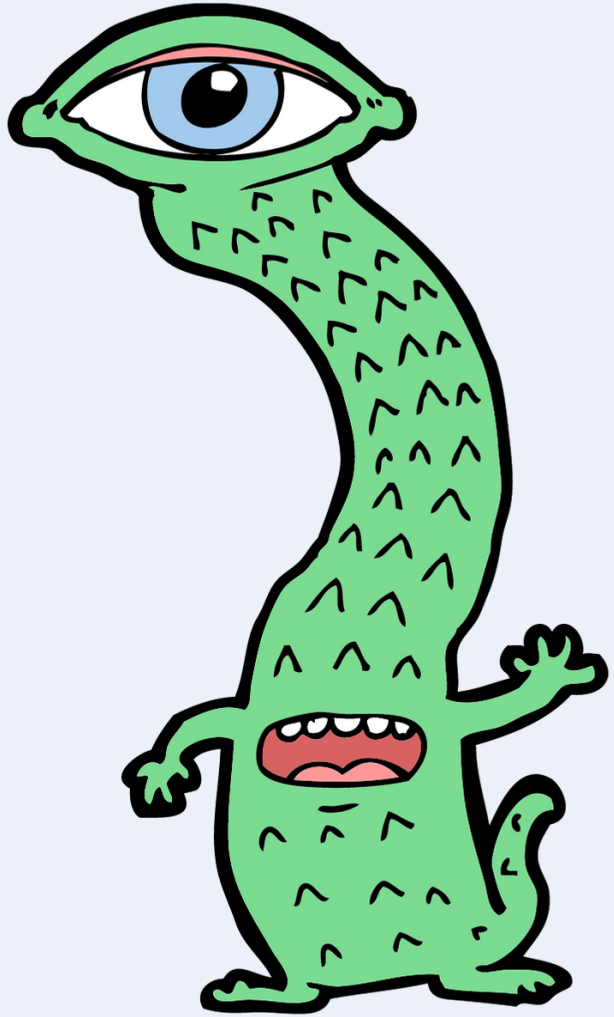


Out of this world!

How would you describe this process to an alien from space?



Aseptic technique



Talk Task

Aseptic Technique

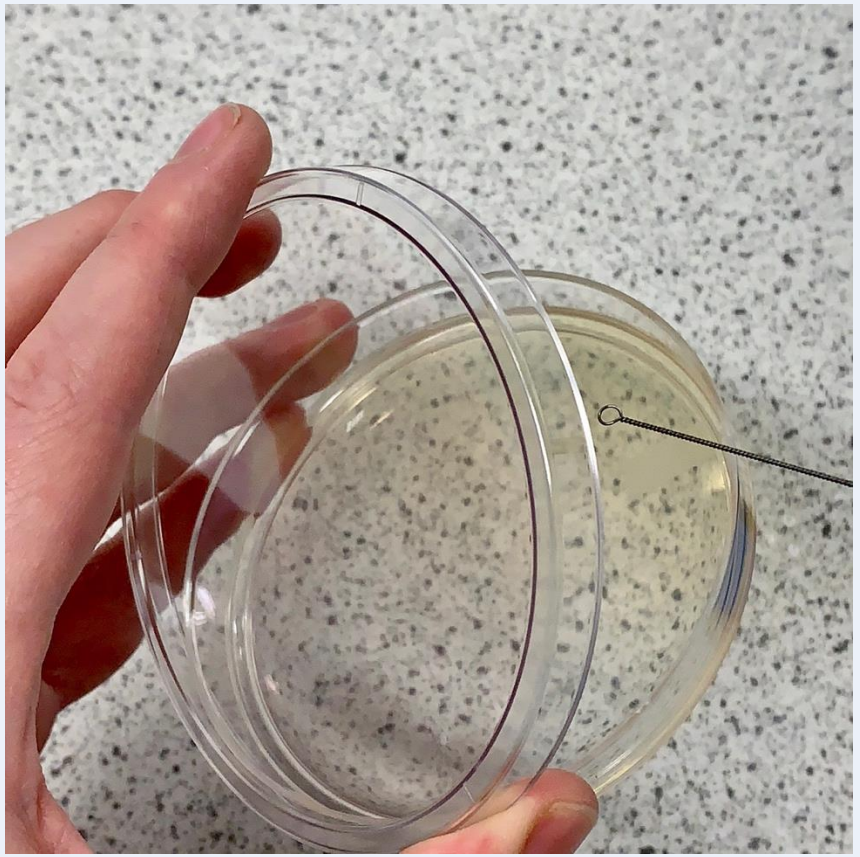
Petri dishes and culture media (**agar**) must be sterilised before use

Agar medium in plates must be set

Inoculating loops are used to transfer the bacteria to the agar but must first be sterilised by passing them through a flame

The lid of the Petri dish should be secured with tape and stored upside down

In school laboratories the culture should be incubated at 25 °C.



Quick Quiz

Choose the correct answer for each question:

1. What is the purpose of using the aseptic technique to prepare the petri dishes?
   - ❑ A. It ensures the growth of as many types of bacteria as possible
   - ☑ B. It ensures that only the bacteria we are investigating is allowed to grow
   - ❑ C. It ensures that no bacteria grow at all

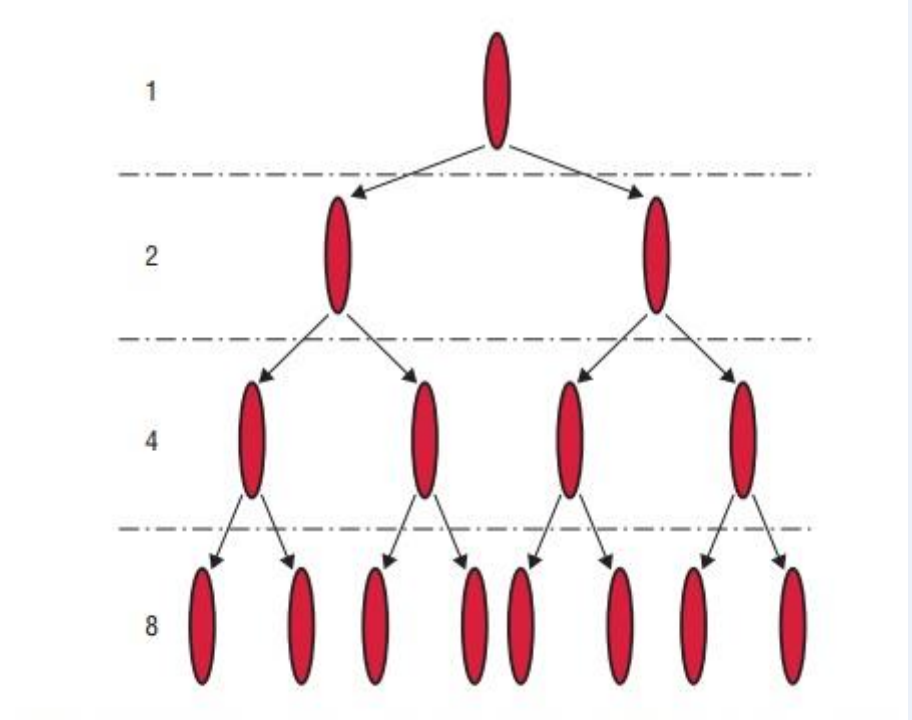
2. What is in independent variable in our practical today?
   - ☑ A. The microorganisms found in different locations
   - ❑ B. The agar in the Petri dish
   - ❑ C. The level of contamination

Check for understanding

Growth of Bacteria

Bacteria are able to divide and multiply rapidly, which is often why they can cause diseases.

We can use their **mean division time** (how long it takes to undergo cell division) and how long the sample has been left to predict or calculate how many bacteria would be present.



Growth of Bacteria

Example:

Bacteria A has a mean division time of 30 minutes. If the culture begins with one bacterium how many bacteria would you expect to be present after 12 hours?

1. Calculate **how many divisions** would have occurred in this time.
   12 hours/0.5 hours = 24 divisions.

2. Every time the bacteria reproduce, the number doubles. Now use this equation:

   Final number of bacteria = Initial number of bacteria x $2^{\text{number of divisions}}$

   Final number = 1×2^{24}

   = **16777216** bacteria (or 1.68×10^{7} in standard form)

Growth of Bacteria

Now you try!

Bacteria Z has a mean division time of 15 minutes. If the culture begins with one bacterium how many bacteria would you expect to be present after 10 hours?

1. Calculate **how many divisions** would have occurred in this time.
   10 hours/0.25 hours = 40 divisions.

2. Every time the bacteria reproduce, the number doubles. Now use this equation:

   Final number of bacteria = Initial number of bacteria x $2^{\text{number of divisions}}$

   Final number = 1×2^{40}

   = **1,099,511,627,776** bacteria (or 1.1×10^{12} in standard form)

Drill

1. State which type of cell divides more rapidly, eukaryote or prokaryote?
2. A bacterium has a mean division time of 30 minutes. If the culture begins with one bacterium, how many divisions would have occurred in 10 hours?
3. Name the kind of replication where the number of bacteria doubles with each reproduction
4. Explain why the agar plate is incubated at 25°C
5. State what bacterial infections are treated with
6. Explain why bacterial growth on an agar will eventually slow down

Check for understanding

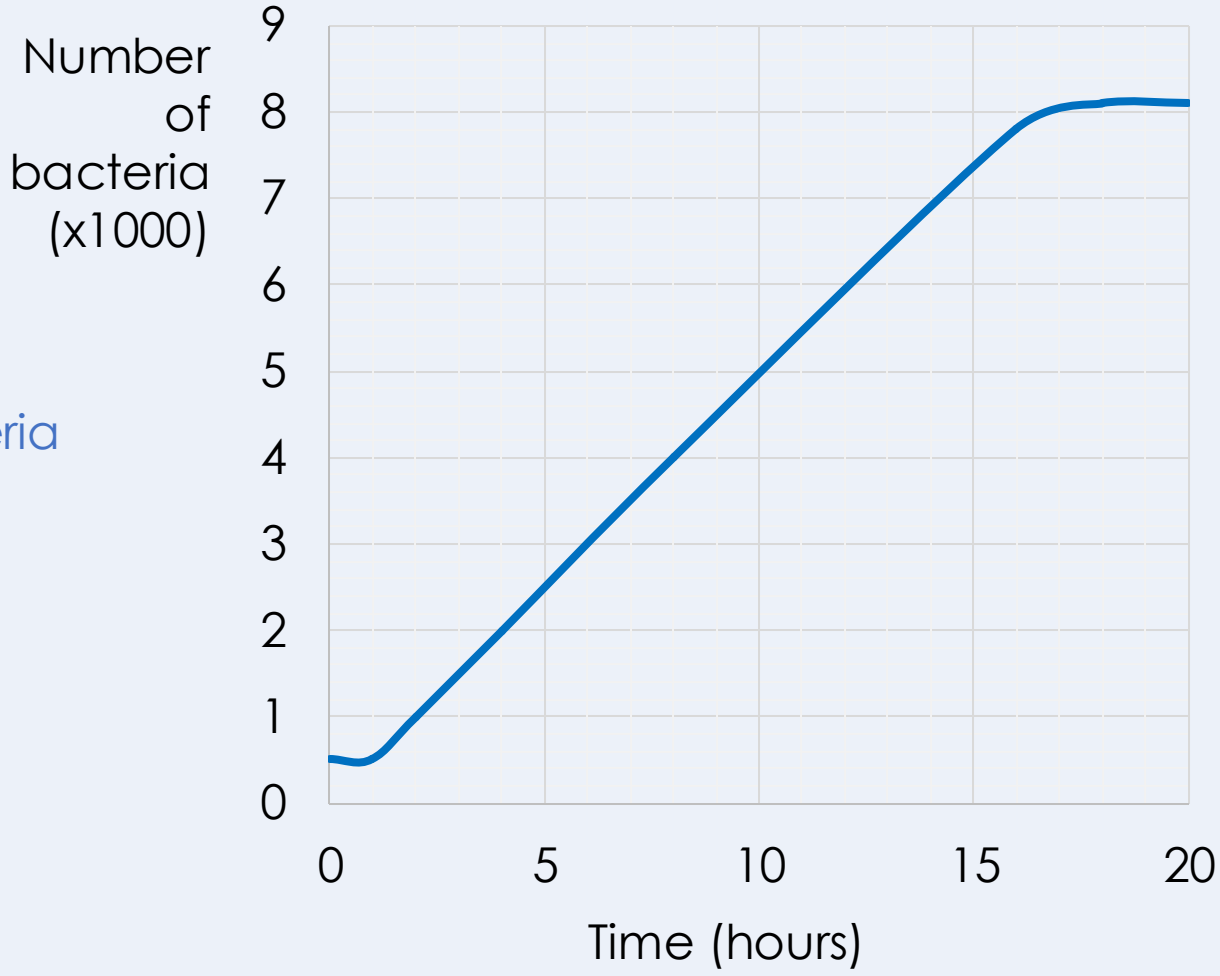
Drill answers

1. Prokaryote
2. 10 hours/0.5 hours = 20 divisions.
3. Exponential growth
4. To minimise the risk of dangerous microorganisms from growing
5. Antibiotics
6. The agar is depleted of nutrients

Check for understanding

I: Interpreting graphs of bacterial growth

Describe the growth of this bacterium.



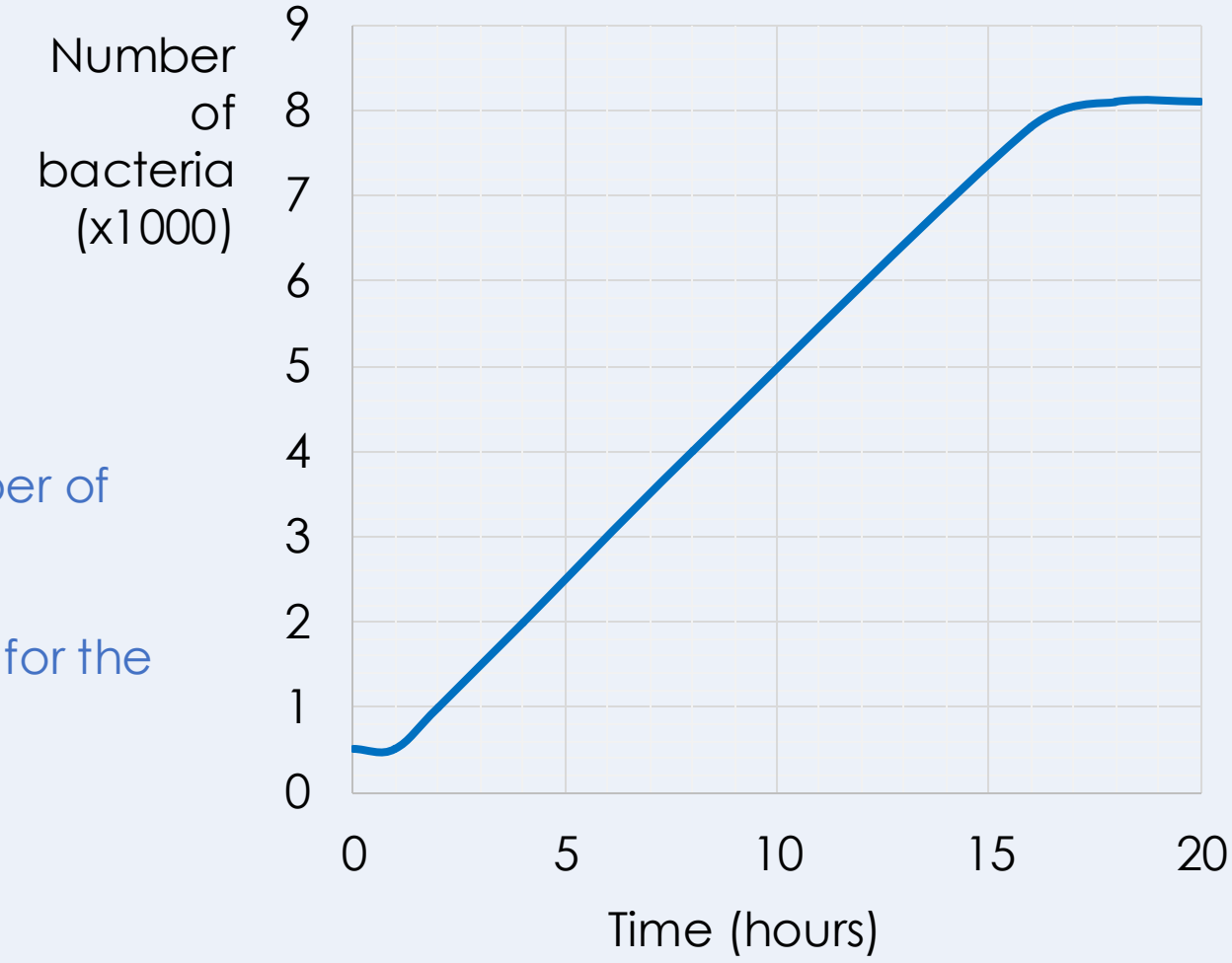
Model answer:

- Between 2 and 17 hours, the growth of bacteria is exponential.
- After 5 hours there are 2500 bacteria present and after 10 hours there are 5000 bacteria.
- The number of bacterial cells doubles every 5 hours
- After 17 hours, the number of bacterial cells plateaus.

Apply

We: Interpreting graphs of bacterial growth

Explain why the number of bacteria increases rapidly between 2 hours and 17 hours.



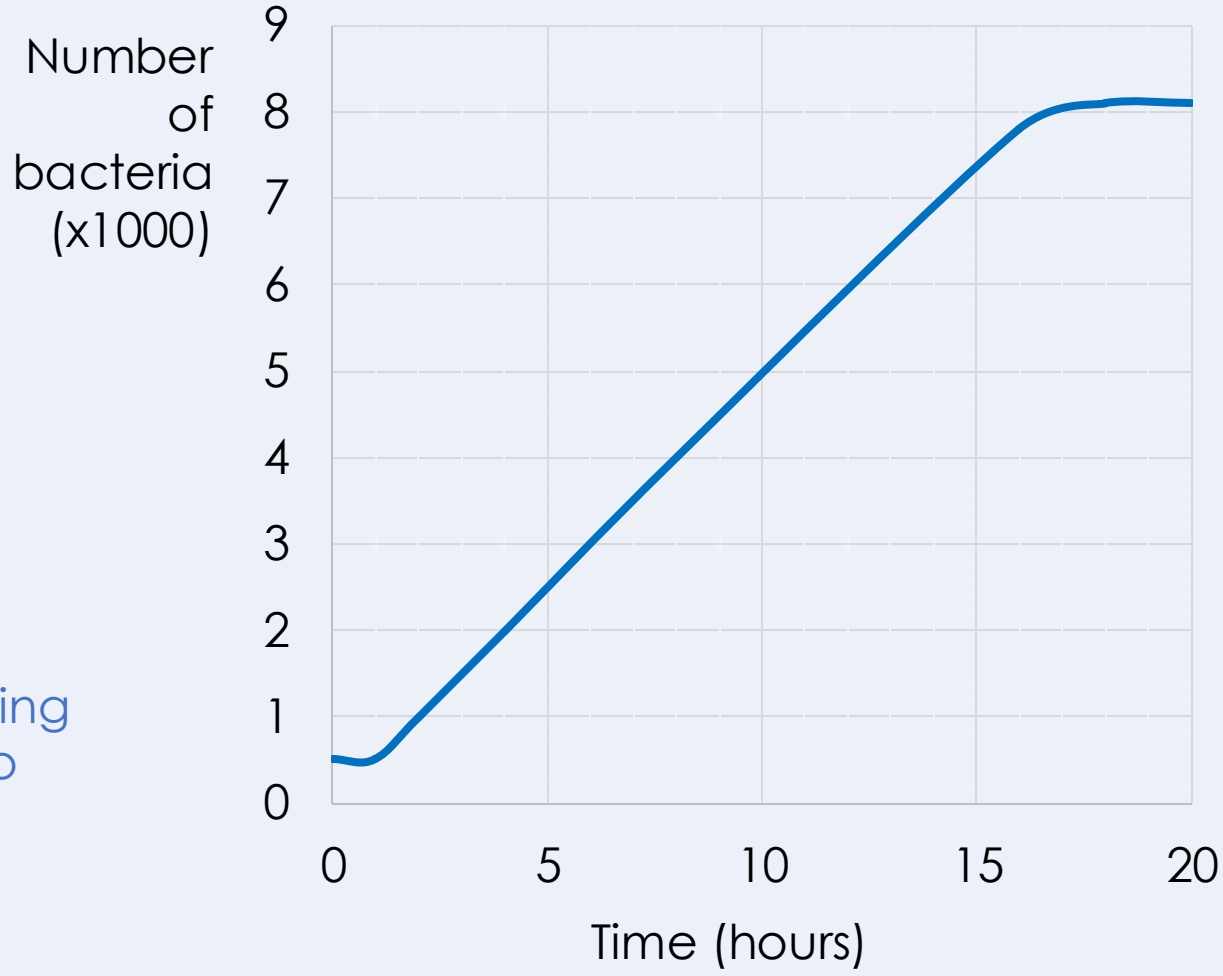
Model answer:

- Exponential growth occurs, where the number of bacteria double every growth cycle
- Because there are many nutrients available for the bacteria to grow

Apply

You: Interpreting graphs of bacterial growth

Explain why the number of bacteria plateaus after 17 hours.



Model answer:

- The agar is depleted of nutrients which are required for the bacteria to grow, so less bacteria are growing
- During this phase, the number of bacteria being produced is the same as the number dying so there is no overall growth in the number of bacterium

Apply

Answer the questions below.

1. Which best explains the purpose of this investigation?

- ❑ To look at how best to make bacteria grow to spread disease
- ❑ To ensure no bacteria is allowed to grow
- ☑ To determine the location with the most/fewest microorganisms

2. Which is a feature of the aseptic technique?

- ❑ Ensuring there are no nutrients in the agar medium
- ☑ Ensuring there is no contamination in the agar medium
- ❑ Ensuring that oxygen is not allowed in to the agar medium

3. Why is the plate incubated at 25°C?

- ❑ To kill all bacteria
- ☑ To minimise the risk of dangerous microorganisms from growing
- ❑ Bacteria will not grow at lower temperatures

Exit ticket

Feedback

Lesson B3.1.4	
What was good about this lesson?	What can we do to improve this lesson?

Send us your feedback by clicking this link
or by emailing sciencemastery@arkonline.org
Thank you!