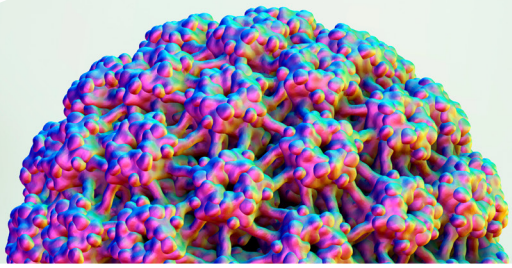
ACTIVITY
SHEET



GROW YOUR OWN AIRBORNE MICROORGANISMS

Collecting and growing your own microorganisms is a fun and simple experiment. Other than some petri dishes (which can be bought online), no specialist equipment is needed. This experiment will get you thinking about the microorganisms floating in the air around you. As well as collecting microorganisms, you will see them, too!

LEARNING OUTCOMES:

- Practical skills in microbiology
- Understanding airborne microorganisms and the factors that affect their abundance
- Understanding the scientific method, making and testing predictions (builds to hypothesis testing)

EQUIPMENT NEEDED:
To make about 30 plates

- Sterile petri dishes (can be bought online, 20 dishes for 10 euros) *
- 4 teaspoons/cubes of beef stock powder
- 8 teaspoons of sugar
- Gelatine or agar (unflavoured, enough to make 1 litre of jelly) **
- 1 litre of water (distilled if available, but tap water is fine)
- Saucepan and lid
- Metal spoon
- Sticky tape or parafilm (to seal the petri dishes)
- Pen or sticky labels (to label the plates)
- Stove or microwave
- Fridge, if storing the plates

* Petri dishes can be substituted with plastic containers like takeaway dishes with lids; simply sterilize with baby bottle disinfectant (e.g., Milton).

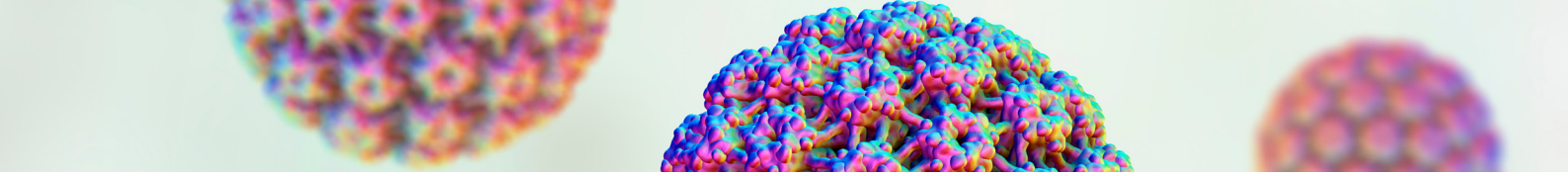
** Pre-prepared sterile agar plates are available to buy online; 10 agar pales will cost about 30 euros. Use any non-selective nutrient medium (e.g., Luria/Lennox (LB), Tryptic Soy Agar (TSA), or Potato Dextrose Agar (PDA)).

CAUTION: With the use of boiling water and other hot liquids, there is a risk of burns. Bacteria and fungi grown on plates may also be hazardous. After exposure to air (or after microbial growth), ensure that the plates are sealed with tape around the edges (parafilm is ideal, but any tape will work). Dispose of the plates in a sealed bag (e.g., steam cooking bag) and then autoclave them (i.e., in a pressure cooker) before disposing them in the bin. An autoclave is a sterilization mechanism that uses pressure and steam to prevent microorganisms and spores from surviving and spreading. Please check local/national disposal regulations.

MAKING THE AGAR PLATES:

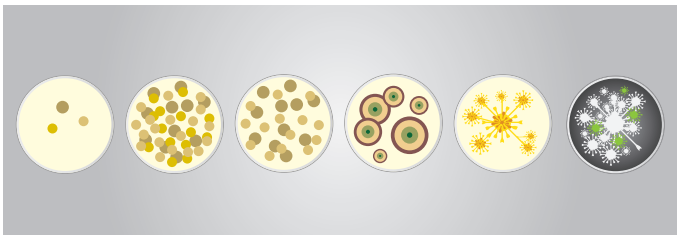
1. Pour the water into the saucepan.
2. Add the beef stock, sugar, and gelatine.
3. Bring to the boil, stirring to dissolve the ingredients.
4. The mixture needs to be sterilized, so keep it boiling for at least 5 minutes.
5. Allow the mixture to cool slightly with the lid on. Avoid exposing the mixture to the air as microbes that land on it now could contaminate it.
6. Pour approximately 20-30 ml of the mixture into each plate.
7. Allow to cool, with the lids on.
8. Store the plates upside down in a fridge. They will last for 2-4 weeks, longer in a humid environment.

NOTE: To keep the plates sterile, only take the lid off when pouring and replace it immediately. Do not touch the inside of the plates; avoid breathing over the plates and mixture, and do not move your hands over the open plates.



COLLECTING YOUR MICROBES:

1. Decide where to place the agar plates in different locations around the classroom (or outside).
   CAUTION: in some countries, there may be restrictions. For example, the use of environmental samples that may contain level 2 microorganisms could be prohibited in the classroom. See the risk classification here: **www.handling-solutions.eppendorf.com/sample-handling/centrifugation/biosafety/biosafety-levels-and-their-meaning**
2. Make a note of which locations you think will collect the most (and least) microorganisms. Explain your reasoning.
3. Place the agar plates in your chosen locations and take the lids off to expose them to the air for 30 minutes.
4. After 30 minutes, close the agar plates and seal them around the edge with sticky tape/parafilm. Label each plate with the location.
5. Place the agar plates upside down in a warm area (30 °C or as close as you can get to this. Room temperature is fine). The agar must be at the top of the plate, not bottom.
6. Leave for 3-4 days. If you need to wait more than 3-4 days, move them to a fridge after 3-4 days of incubation at 30 °C (or room temperature). This is to stop the agar plates becoming overgrown.
7. After this incubation period, inspect the agar plates. You should see circular colonies of microorganisms. Each microorganism that landed on the agar has multiplied and grown into a colony of millions/billions (which you can now see with the naked eye).
8. Count the number colonies on each agar plate and record which location grew the most microbes. Were your predictions correct? If not, why do you think this was the case?



9. Do all the colonies look the same, or do they vary between each location? How do your plates compare with the examples above? Are your plates completely overgrown? If so, you may have incubated them for too long, or contaminated the plates by touching or breathing on them. If you did this, you are in good company as this is how Alexander Fleming discovered antibiotics!

OTHER EXPERIMENT IDEAS

a. Effect of ventilation
Experiment with different types of ventilation (e.g., windows open/closed, air conditioning on and off).

b. Effect of indoor and outdoor air
Compare agar plates left indoors (particularly in rooms with low or poor ventilation) with those left outdoors.

c. Effect of human beings
Compare agar plates left in an empty room with those left in a room full of people.

d. Effect of coughing/talking
Evenly space a line of plates across a desk (see image). Take the lids off and ask someone to stand at one end and talk or cough. Try this again with another line of plates, but with a facemask or hand over the mouth.

NOTE: Before you embark on these experiments, predict which plates you think will grow the most microorganisms. Explain your reasoning. Did your predictions come true? If not, why do you think this is so?