Susannah Salter -July 2020

Winogradsky column (mud jar) worksheet

A Winogradsky column is a classic science experiment that allows you to grow a bacterial ecosystem in a container at home.

Bacteria, or "germs", are a sort of microscopic life. They live all around us, in almost every environment on the planet. Bacteria are essential for keeping us healthy – for example they live in our guts and help to digest our food – but they also keep the soil healthy and support plant growth. Different types of bacteria do different jobs and prefer living in different conditions.

In this experiment you use mud as your starting material, add some extra nutrients, and then allow it to sit somewhere warm and bright. Over several weeks, you will be able to see stripes and patches of different colours produced by the billions of bacteria growing there.

Materials:

1 container	- tall, clear glass or plastic. For example a tall jar or bottle.
Soil	- enough mud to fill your container two thirds full. Remove any big stones!
Water	- untreated water, for example from a pond or river, or rainwater.
1 egg yolk	- it does not matter whether the egg is cooked or raw.
1 egg shell	- crushed into small pieces.

1 handful of shredded newspaper or tissue.

Equipment:

A bowl to mix your ingredients in.

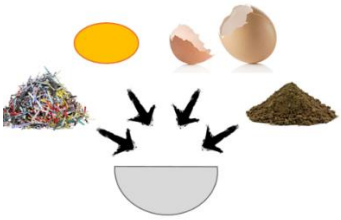
A spoon/funnel to fill your container with mud and water.

A lid for your container. This could be a screwtop for a bottle, or a piece of clingfilm that is attached to the container with elastic or sellotape.

A warm bright place to store your jar, for example a sunny windowsill.

Instructions:

1. In a bowl, mix **half** of your mud with the egg yolk, egg shell, and paper.



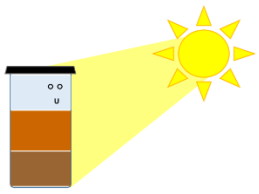
2. Fill your container one third full with this mixture. Flatten the surface.

3. Put plain mud on top, until the container is two thirds full.

4. Carefully pour the water on top, without disturbing the mud layers. Fill the container almost to the top.

5. Put the lid on the container. Do not shake or mix it!

6. Place the container in a bright, warm place (such as a windowsill).



7. Check your jar every week and gently loosen the lid to let it "burp"!
   Record your observations each week: what colours can you see?

What is happening?

The soil you collected contains many different sorts of bacteria. The bottom layer in the jar is enriched with added nutrients: sulphur (from the egg yolk), calcium (from the egg shells), and a source of carbon (the cellulose in the paper). As some bacteria start to grow, they modify the conditions in the jar, which supports the growth of other bacteria, and so on in a cycle. Different micro-environments start to develop within the container. A single bacterial cell is not visible to the naked eye, but as they reproduce in their preferred conditions, you can start to see their presence in stripes of colours: reds, greens, purples….

Tips!

- Your Winogradsky column will grow faster if it is warm, so keep it indoors if possible. You should see it start to change after 2 weeks.

- If your jar is in a sunny position, when you examine it put it back with **the same side facing the sun**. This means that one side of the jar consistently gets sunlight, encouraging certain bacteria to grow, while the shady side of the jar will allow different types of bacteria to thrive.

- **Compare your results** with your friends. Do you see the same colours in your containers?

- Try comparing **different sources of mud**. For example, use soil from woodland in one container, then use soil from a riverbank in a second container. Do they turn out the same?

- **Bonus Items**: try adding something extra to the mud to see if it affects the bacteria growing. For example, you could add a vitamin tablet, or a rusty nail, or Epsom salts… anything you think might have an impact!

Week 1

Draw or photograph your Winogradsky column:	What has changed this week?

Week 2

Draw or photograph your Winogradsky column:	What has changed this week?

Week 3

Draw or photograph your Winogradsky column:	What has changed this week?

Week 4

Draw or photograph your Winogradsky column:	What has changed this week?

Week 5

Draw or photograph your Winogradsky column:	What has changed this week?

Week 6

Draw or photograph your Winogradsky column:	What has changed this week?