Winogradsky experiment

**Introduction**

Introducing microbial ecosystems to university students can be a difficult topic without visual aids. Winogradsky columns have been used extensively to demonstrate microbial diversity in soil environments. The soil provides a wide variety of nutrients for the microorganisms to flourish, creating microsites of specific microorganisms depending on energy requirements, carbon sources and environmental factors. This creates visible layers in the soil that can be observed to show anaerobic and aerobic changes. The sediment sits at the bottom of the column as a dark brown or black colour. The layer above will show green sulphur bacteria and purple bacteria which is indicative of low oxygen levels and high sulphur levels. A layer of pink/ red/ orange are non sulphur bacteria, thriving in high salt concentrations. The blue cyanobacteria is near the top in the aerobic water.

The Winogradsky column is an experiment using easy to find supplies to demonstrate the variety of environment microorganisms. Named after pioneering environmental microbiologist, Sergei Winogradsky, who first used the column to understand the complexity of mixed microbial cultures. The Winogradsky column is filled with soil and water as sources for microbes, an egg yolk as a source of sulphur and torn up bits of newspaper as a carbon source. The column is left loosely sealed for 4 to 8 weeks allowing the various microorganisms to proliferate and reside in distinct sections of the column that are more favourable. The upper part of the column remains oxygenated, whilst further down the column oxygen struggles to diffuse through, leading to anoxic environment.

Students are given the freedom to add additional resources to their columns when creating the column. This can include shells, salts, leaves, salt and other materials that may change the dynamics of the Winogradsky column. This allows students to create various columns with differing conditions for them to observe and gain knowledge on microbial communities.

**Equipment**

Tall jar/ plastic bottle (500 ml - optimal)

Soil

Water

Egg yolk

Newspaper

Sunlight/ lamp

**Instructions**

The bottle will be used as a vessel for your microbes over the next 4 – 8 weeks, so ensure the bottle is leak proof before adding anything

Firstly, you will need to collect soil, this could be from a garden or lake but please ask permission before digging up somebody’s prized roses

Whilst out and about see if you can collect some water too, this could be as simple as leaving a cup outside to fill with rain water

Draw a line on your bottle at about ¼ from the top and then another line at about ¼ from the bottom.

Cut the newspaper into small pieces.

In a small mixing bowl, add the egg yolk (raw or hard-boiled) and newspaper and a small amount of mud, at least as much to fill the bottle ¼ of the way. If you are including additional ingredients, add them to this mixture.

Fill the bottle ¼ way with the mud, egg yolk, newspaper mixture.

Add mud to the top line.

Add water almost to the top. Leave a small amount of space.

Cover the column with plastic wrap and a rubber band (do not put a tight lid on because it may explode due to gases released by the microbes).

Set it in the sunlight or under a lamp.

Let your column grow and watch for changes over the next 4 to 8 weeks. Take pictures of the changes