Handwashing/Hygiene Activity
Developed by Maarten Buitendijk

Overview
Bacteria and other micro-organisms are everywhere around us, and the discovery of the importance of hygiene and hand-washing was a key advancement in public health in the 19th and early 20th century. With this experiment students will learn to visualize micro-organisms on growth plates, and learn about the importance and efficacy of various handwashing techniques.

Science Standards
Characteristics of life and cells as the basic building block of life.
Scientific inquiry and hypothesis generation/testing.

Focus Question
How do various ways of washing your hands affect the amount of bacteria we can culture from your fingertips?

Objectives
Through this lesson, students will:

Generate hypotheses about the expected outcome of the experiment.
Learn that there are bacteria on their skin.
Learn which ways of hard washing work best for reducing microbial numbers.

Background
The human skin is home to a wide variety of bacterial organisms, most of which are harmless, but some who are opportunistic pathogens (meaning they can cause disease under certain conditions like if you get a cut or are sick from something else). Hand washing is a simple technique that is proven to reduce the chance of transmitting disease, whether of bacterial (think of MRSA) or viral origin (colds, flu). However, there are many ways in which people wash their hands, and not all are equally effective. With the help of growth plates that will greatly increase the number of bacteria we can visualize and draw conclusions about which techniques of washing your hands reduce bacterial numbers the most.

Materials
Bacterial growth media (LB agar) Water
Petri dishes Soap
Autoclave Markers
Preparation
Make enough bacterial growth plates so that every student has their own plate; you need about 20 mL of agar mixture per plate.
I used 35 g/L LB agar and 5 g/L agarose, mixed it with the appropriate amount of water, and autoclaved it on the liquid cycle for 20 minutes.
Once the agar comes out of the autoclave wait until it’s about 120 F (hot to the touch but not burning) and pour a layer into each pe ridish bottom IN A STERILE LOCATION! Let the plates sit until the agar has completely cooled and solidified, and put the tops back on. Preparation takes approximately 3 hours altogether.

Procedure
- Introduce the topic of hygiene and hand washing (add story of Semmelweis?).
- Promote brief discussion with the class on what they know already, generate ideas.

Experiment
- Get a plate out (DO NOT OPEN THE LID), turn it upside down, and mark the bottom on the outside where the yellow agar is into four quarters with a permanent marker.
- Mark the quarters as follows:
  - No washing
  - Water only
  - Water/soap 5
  - Water/soap 30
- Turn it over, open the lid, and gently press your fingertip to the surface of the agar in the “no washing” quarter. Then close it back up.
- Go wash your hands with water, and dry them off with a towel.
- Press your finger to the second quarter “water only”, and close it back up.
- Wash your hands with water and soap for 5 seconds.
- Press your finger to the third quarter “water/soap 5”, close it back up.
- Wash your hands with water and soap for 30 seconds.
- Press your finger to the fourth quarter “water/soap 30” and close the lid.
- Use some tape to tape the lid to the plate so it can’t fall open easily, and hand it back to Maarten.
- Write a hypothesis explaining which techniques you think will be most effective at reducing bacterial numbers, and explain why you think this will be so.
- Two days later look at the closed plates and count approximate numbers of colonies on each plate, then ask students to compare the results to their hypothesis and draw appropriate conclusions.

Assessment
At the end of the activity students should have a better understanding of the fact that bacteria are everywhere, and what techniques of hygiene are better. Remind them that while these bacteria are probably harmless, hand washing protects equally to disease-causing organisms that are very bad for you.

Extensions
Students should be encouraged to try other techniques and test those, or to test how clean various locations are by using sterile cotton swabs to rub against places in the classroom/school (around the sinks, countertops, door handles, etc), and then touch them on the plate to see how many bacteria live there.