The “Life of bacteria over 200 degrees centigrade” was created by the Public Engagement team at the University of Dundee’s School of Life Sciences, in collaboration with the Nicola-Stanley Wall Lab. This video follows a microbiologist performing an experiment in the laboratory and explains how scientists can study bacteria and biofilms.

The video can be used by teachers to show their pupils how some microbial research is done in a professional laboratory environment. Contents in this video directly or indirectly relate to the following sections of the “Curriculum for Excellence”:

- **HWB 0-33a / HWB 1-33a** (Safe and hygienic practices): I am becoming aware of how cleanliness, hygiene and safety can affect health and wellbeing and I apply this knowledge in my everyday routines such as taking care of my teeth.

- **HWB 2-33a** (Safe and hygienic practices): Having learned about cleanliness, hygiene and safety, I can apply these principles to my everyday routines, understanding their importance to health and wellbeing.

- **SCN 1-13a** (Body systems and cells): I know the symptoms of some common diseases caused by germs. I can explain how they are spread and discuss how some methods of preventing and treating disease benefit society.

- **HWB 0-16a / HWB 1-16a / HWB 2-16a / HWB 3-16a / HWB 4-16a** (Safe and hygienic practices): I am learning to assess and manage risk, to protect myself and others, and to reduce the potential for harm when possible.

After watching the video, you can ask your pupils the questions found on the next page to generate a discussion on the contents seen.
**What are biofilms?**

Many different types of microbes, including bacteria, can create biofilms, and they can be found in a variety of places. Some microbes grow biofilms in the roots of plants, which can protect plants from pathogens and provide them with nutrients to help them grow. Other microbes form biofilms in our bodies, such as the lining of our intestines or the plaque on our teeth. Find out more about here: [https://kids.frontiersin.org/articles/10.3389/frym.2022.626305](https://kids.frontiersin.org/articles/10.3389/frym.2022.626305)

**Why do bacteria need to be stored in a -80C freezer?**

Bacteria have a much shorter lifespan than complex organisms such as yourself, and consequently, reach cell death over less time. Moreover, they can double themselves in a matter of minutes under normal growth conditions, leading to natural mutations and changes in their genomic sequence. For long-term storage of bacteria, these need to be frozen to reduce cell death and the consequences of uncontrolled growth. Using ultralow freezers at a temperature of -80oC allows for the storage of bacteria over many years by slowing down cell activity. However, it's important to use a cryoprotectant such as glycerol to keep the freezing temperatures from damaging the water inside the bacteria.

**Why does the scientist light a flame when putting the bacteria into tubes?**

When working with bacteria, it's important to create a sterile (clean) environment to not contaminate the sample you're working with. A contaminant could alter the outcome of the experiment. Microorganisms are all around us and scientists often use Bunsen burners, a device which produces a strong hot flame, to create sterile environments. The hot air which rises from the flame creates a clean area around the burner by pushing the microbes up and away from the burner. Usually, gloves would be used to ensure no microbes from your hands were transferred. However, it's not safe to have the plastic from gloves in such close contact to a flame, which is why the scientist is not wearing gloves.

**Why would one bacterial strain be able to produce a biofilm while the other strain could not?**

There can be variations within the same species of bacteria and these different types are termed 'strains', as the variation is not significant enough to distinguish them beyond that. These variations are often due to diversity in the genomic sequence, the DNA instructions found inside a cell. These genomic differences lead to changes in behaviour, which might be a reason why one strain can produce a biofilm while the other strain cannot.
Transcript

“Our laboratory studies how bacteria form communities called biofilms. Bacteria are small organisms, and we have billions stored in our -80 degrees Celsius freezers. To revive them, we select the tube with the sample we need and streak some of the frozen material onto an agar plate, which contains the nutrients the bacteria need to grow.

To help the bacteria grow, we place the plate at 37 degrees Celsius in an incubator. It’s like a fridge, but provides a constant heat and then we wait. In the morning, the bacteria have made many more copies of themselves and we can see them. Each of the spots you can see on the plate is called a colony and has millions of bacteria within it. And each colony grew from a single bacterium. We use these bacteria to grow even more. We put some of the bacteria into tubes containing liquid nutrient broth.

We place these tubes at 37 degrees Celsius and let them grow. This time we use a shaker to keep the growing bacteria well-mixed. It helps get oxygen into the liquid medium. When the bacteria have grown, we can start the next part of the experiment. In our case, we want to test if there is a difference between the ability of two different types (called strains) of the bacterium to form a biofilm. We place some of the cells we have grown onto a different type of agar plate, one that contains nutrients that make the bacterium we work with form biofilms. We then placed the bacteria in the incubator. This time we use 30 degrees Celsius and wait.

And now we can look at the shapes they have formed. We use a microscope to take images of the biofilms. We can see that one of the samples of bacteria have formed a biofilm while the other has not. This information helps us understand how the bacteria act and what resources they need to form a stable social community.

Once we have finished our experiment, we throw away our plate with the biofilm. This material is carefully treated by heating it to 121 degrees Celsius in a machine called an autoclave helping to keep everyone and our environment safe.”
Further resources

If you want to find out more about microbes, bacteria, and biofilms, you can have a look at the resources below.

“Bacterial Biofilms: Did You Know They Can Help Us?”
(Frontiers for Young Minds)
Associated Video: [https://youtu.be/aXb4Bg6DXE4](https://youtu.be/aXb4Bg6DXE4)

“Images of Microbiology”

“Hidden Life on your Hands”
Video: [https://youtu.be/CVaAX3Owt3A](https://youtu.be/CVaAX3Owt3A)

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