

# Considerations for Science Fair Experiments Using Microorganisms



The following contains best practices for students conducting experiments with microorganisms. BASEF recommends that experiments should be conducted, when possible, in a school, research or hospital lab where proper safety protocols can be followed.

## A. Risk Awareness

The human body is covered with potentially harmful microbes. These organisms do not cause disease under normal conditions for two main reasons. There is a physical barrier keeping them outside the body and the number and kind of microbes are limited by the immune system and good hygiene practices.

## B. Know what you are experimenting with - Classification of Microorganisms

**Microorganisms are classified based on Biosafety Level (BSL) or Risk group.**

BSL-1 – low individual risk and low community risk. These are unlikely to cause disease in a healthy person. Organisms in this group include *Lactobacillus* spp, many *Bacillus* spp, various yeasts and certain non-pathogenic *Escherichia coli* strains. **This is the only group of microorganisms science fair projects done at home or at school should use.**

*BSL-1 microorganisms – these include yeast, yogurt, probiotic capsules etc.*

BSL-2, BSL-3, BSL-4 refer to microorganisms that hold moderate to high individual and community risk and should NOT be used in school activities.

**Sources of Microorganisms** – only use microorganisms of low risk, avoid culturing samples from high risk areas such as washrooms, telephones, door knobs etc without the proper lab equipment and supervision. These locations have various pathogens that usually offer a low risk of infection in the environment but can be highly dangerous when cultured in high numbers under certain ideal conditions.

**BE AWARE** – *Enterococcus* spp (BSL-2) are opportunistic pathogens, they can readily invade your cultures and cause personal illness.

## C. Specific Safety Precautions when Conducting Experiments with Microorganisms

1. It is a good practice to always wear protective gloves and a mask. Students with cuts, cold sores, severe acne etc, must wear protective gloves and or masks to avoid infection.
2. The risk of infection increases as the number of microbes increases. When preparing and conducting experiments use the lowest concentration that will still provide clear results.

3. A general rule is to conduct your experiments with the understanding that a more dangerous microorganism could be present. Many microorganisms that could cause disease include the following bacteria *Escherichia coli*, *Staphylococcus aureus* and other *Streptococcus* species are commonly found on many surfaces and can easily contaminate your project.

When using these microbes be sure to use proper cleaning and disinfection protocols.

- DO not eat or drink while conducting experiments
- Long hair should be tied back
- DO not work where food preparation will occur – never in the kitchen or dining table.
- Wash hands before and after conducting experiments
- Contaminated materials must be decontaminated (sterilized) before disposal.

#### **D. How to Sterilize Equipment**

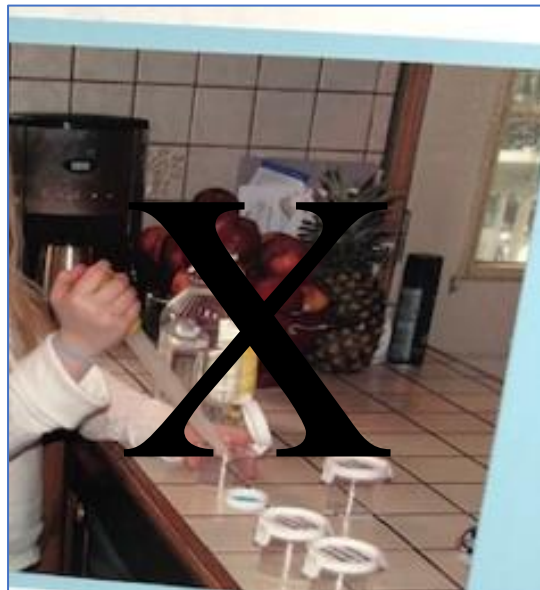
All microbiological experiments require sterile equipment in order to decrease the chance of contamination. In a lab setting this would be done using an autoclave or open flame. At home this is not possible, a pressure cooker can be used to sterilize glassware and equipment. The same pressure cooker can be used to for decontamination of any cultures before disposing of them.

When using a pressure cooker, be sure to read all the instructions carefully and use with adult supervision.

Placing items in boiling water for a minimum of 20 minutes will also kill most bacteria.

NOTE – Plastic containers and equipment, like Petri dishes will melt in the pressure cooker so these are considered one-time use only.

Reference used: *Safe on Science, A Reference Guide for Secondary School Science*, ,STAO/APSO, 2018 ISBN 978-1-894592-61-1





## QUICK REFERENCE FOR EXPERIMENTS USING MICROORGANISMS AND FUNGI



<b>Safety Code for Experiments with Microorganisms</b>	
	Never have any food or drinks in the area.
	DO not work where food preparation will occur – never in the kitchen or dining table.
	Tie back long hair, wear protective gloves
	Cover any cuts or abrasions on your skin
	Keep the work area clear of clutter.
	When culturing, if possible grow bacteria and fungi on solids rather than liquids (broth) to avoid spills and droplet formation. Disposable Petri dishes should be used, if possible, alternatively glass jars/containers that can be sterilized.
	Do not grow cultures of microbes collected from environmental surfaces or the body or home (washrooms, telephones etc.), waste water or polluted water.
	Use sterile equipment.
	Tape shut the Petri dishes/containers to contain all cultures and avoid spills (except yeast). When taping, use a few pieces of tape and tape down the base so space is left for gases from the air to diffuse in and out of the dish
	Never ferment yeast in a closed container – the gas produced by the organism could cause it to explode.
	Date all cultures
	Dispose of all cultures as soon as possible.
	Wash hands thoroughly with liquid soap before and after working with any cultures. Remove and dispose of gloves.
	Use a disinfectant wipe or solution to clean the work area before and after each activity.
	Contaminated materials must be decontaminated (sterilized) before disposal.

