

# Effectiveness of Hand Washing

## Objectives

1. Evaluate the effectiveness of hand washing.
2. Explain the importance of aseptic technique in the hospital environment.

## Background

The skin is sterile during fetal development. After birth, a baby's skin is colonized by many bacteria for the rest of its life. As an individual ages and changes environments, the microbial population changes to match the environmental conditions. The microorganisms that are more or less permanent are called **normal microbiota**. Microbes that are present only for days or weeks are referred to as **transient microbiota**.

Discovery of the importance of hand and skin surface **disinfection** in disease prevention is credited to Ignatz Semmelweis at Vienna General Hospital in 1846. He noted that the lack of aseptic methods was directly related to the incidence of puerperal fever and other diseases. Medical students would go directly from the autopsy room to the patient's bedside and assist in child delivery without washing their hands. Less puerperal sepsis occurred in patients attended by nurses who did not touch cadavers. Semmelweis established a policy for the medical students of hand washing with a chloride of lime solution that resulted in a drop in the death rate due to puerperal sepsis from 12% to 1.2% in one year.

A layer of oil and the structure of the skin prevent the removal of all bacteria by hand washing. Soap helps remove the oil, and scrubbing will maximize the removal of bacteria. Hospital procedures require personnel to wash their hands before attending a patient, and a complete surgical scrub—removing the transient and many of the resident microbiota—is done before surgery. Transient microbiota are usually removed after 10 to 15 minutes of scrubbing with soap. The surgeon's skin is never sterilized. Only burning or scraping it off would achieve that.

In this exercise, we will examine the effectiveness of washing skin with soap and water. Only organisms capable of growing aerobically on nutrient agar will be observed. Because organisms with different nutritional and environmental requirements will not grow, this procedure will involve only a minimum number of the skin microbiota.

## Materials

Petri plates containing nutrient agar (2)  
Soap  
Waterless handcleaner

## Procedure

1. Divide one nutrient agar plates into four quadrants. Label the sections of each plate 1 through 4. Label the plate "Water." Divide the other nutrient agar plate into five sections: Label the sections of each plate 1 through 5. Label the plate "Soap."
2. Do the "Water" plate first. Touch section 1 with your fingers, wash well *without* soap, shake off excess water, and, while still wet, touch section 2. Do not dry your fingers with a towel. Wash again, and while wet touch section 3. Wash a final time and touch section 4.
3. Use the same hand on the plate labeled "Soap." Repeat the procedure in step 2 except wash each time with soap, rinse, shake off excess water, then touch the designated sector.
4. Finally, clean the same hand with a waterless handcleaner and touch section 5
5. Incubate the plates inverted at 35°C for 48 hr.
6. Record your results:
  - (a) Qualitative analysis: "4+" = maximum growth, "3+" = moderate growth, "2+" = some growth, "+" = a little growth, and "-" = no growth.
  - (b) Calculate the percent change\* compared to the control.

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$$* \% \text{ change} = \frac{\text{test score} - \text{control score}}{\text{control score}} \times 100$$

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**Effectiveness of  
Hand Washing**

Name \_\_\_\_\_

Date \_\_\_\_\_

**Purpose** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Expected Results**

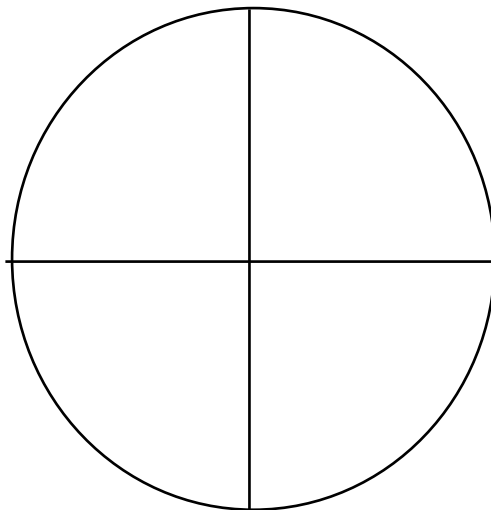
Before the lab, indicate the relative amounts of growth you *expect* in each quadrant.

	Amount of Growth				
Section	1	2	3	4	5
Water alone	(Control)				
Soap & water					(Waterless)

**Data**

	Amount of Growth				
Section	1	2	3	4	5
Water alone	(Control)				
% change (compared to control)					
Soap & water					(Waterless)
% change (compared to control)					

Sketch the appearance of one plate after incubation.



## Conclusions

Compare the effectiveness of washing with water alone and with soap and water.

Compare the effectiveness of washing with soap and water and using a waterless handcleaner.

What is the active ingredient in the waterless handcleaner you used? \_\_\_\_\_

Using your classmates' data compare the effectiveness of washing with bar soap and liquid soap.

Which did you use? \_\_\_\_\_

## Questions

1. Did your results differ from your expected results? \_\_\_\_\_  
Briefly explain why or why not.

2. What is the value of washing with water? With soap?