

# Finger Thermometers

**Overview:** Your fingers have receptors which perform various jobs. In addition to touch, they can detect pressure, texture, and other physical stimuli. One specialized type of receptors is called Ruffini's receptors. They are good at identifying changes in pressure and temperature...most of the time! In this experiment, we will test their ability to distinguish between hot and cold temperatures. We are actually going to try and trick your Ruffini endings. Do you think it will work?

## Materials

- Glasses (3)
- Celsius/Fahrenheit thermometer
- hands
- clock with second hand
- water, hot
- water, cold
- ice cubes (optional)
- water, room-temperature

## Experiment

1. Place the three glasses in front of you on a table. They should be in a row: left, middle and right.
2. Put hot water from the faucet into the first glass on your right. Pour very cold water from the tap into the far left glass. You can even add a couple of ice cubes if you have them available. Finally, fill the glass that is in the middle with room temperature water.
3. Now use your right hand to hold on to the glass on the right with hot water. Really spread out your fingers and wrap them around the glass. Do the same thing with your left hand and the glass filled with cold water. Be sure to check the clock and leave your hands on the glasses for exactly one minute.
4. After one minute, take your hands and put them both on the middle glass. (You may need to stack one on top of the other if your glasses are narrow). Note the temperature you feel with each hand: *hot*, *cold*, or *medium*. You can use the thermometer to record the actual water temperature.
5. Now repeat steps 1-4. This time, switch the hot and cold glasses so that you are holding the hot water with your left hand and the cold water with your right hand. Compare these results with your initial results. Do both hands respond in a similar way or is one more sensitive than the other?

## Finger Thermometers Data Table

Glass	Right Hand	Left Hand	Temperature
hot			
lukewarm			
cold			

### Reading

Your hands are designed to adapt to temperature. Touching the warm glass relaxes the muscles of your hands, increases circulation, and enhances flexibility. When your hand touches the cold glass, the cells on your skin's surface begin to contract to minimize loss of heat and your hand becomes less flexible. Then, when you grab the middle glass, your hands get a bit confused. Relatively speaking, the middle glass feels warmer to the hand that was holding the cold glass and it feels cooler to the hand that was holding the warm one. The hands are still feeling the temperature, but your brain gets confused.

Did you know that our skin does not have receptors to indicate burning hot? This sensation is actually created by three different receptors which fire at the same time: pain, cold, and warm. This explains why to some people, very hot things actually feel cold. If you could prepare a group of alternating hot and cold metal bars, touching them with your fingers would be an odd experience. Your brain will think they are too hot to touch and will tell you to pull away your hand!

### Exercises

1. Does the temperature of the middle glass feel *warmer*, *cooler*, or the *same* when you touch it with your hand that was holding the warm glass?
2. What does your hand that was touching the cold glass feel when it touches the middle glass?
3. What do you feel when both hands are on the middle glass?
4. Why do you think your hands are not the best instruments for determining temperature?
5. Which nerve endings help to detect changes in temperature?

**Answers to Exercises: Finger Thermometers**

1. Does the temperature of the middle glass feel *warmer*, *cooler*, or the *same* when you touch it with your hand that was holding the warm glass? (cooler)
2. What does your hand that was touching the cold glass feel when it touches the middle glass? (warmer)
3. What do you feel when both hands are on the middle glass? (one feels warm and one feels cool)
4. Why do you think your hands are not the best instruments for determining temperature? (our hands detect changes in temperature, not actual temperature)
5. (Ruffini's endings)