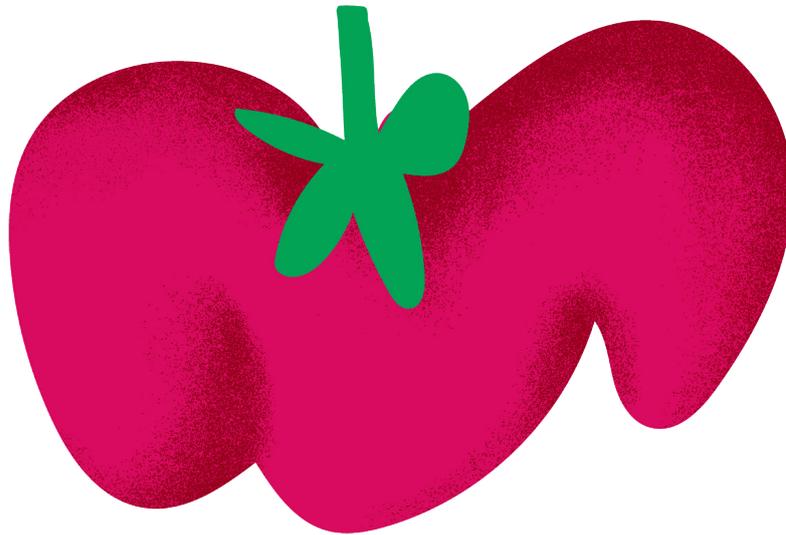


# Hot and Cold

- Year 3 – Science; Health and Physical Education
- Year 4 – Science; Health and Physical Education
- Year 6 – Science; Health and Physical Education



**(Science; Yr 3, ACSSU046)**

A change of state between solid and liquid can be caused by adding or removing heat

**(Science; Yr 6, ACSSU095)**

Changes to materials can be reversible or irreversible

**(HPE; Yr 3&4, ACPPS036)**

Identify and practise strategies to promote health, safety and wellbeing

# Hot and Cold

## Food and temperature – how heat affects taste

The human body, and its digestive system, is truly remarkable. We tend to focus on what food does to run our bodies – providing nutrients and energy – but this lesson helps explore how our nerve-endings and digestive system perceive flavours, particularly the differences when flavours are hot or cold.

### Equipment:

An oven or access to an oven  
(students do not need to access the oven)

A fridge or access to a fridge

2 x 12-hole muffin pans

½ cup amounts of food items from  
the suggestion lists below (one per  
hole in the muffin pans)

Foil

Lots of teaspoons for tasting (and  
some jars of warm water for dirty  
spoons)

Pens and pencils, and notebooks  
or observation sheets

Thermometers (optional)

### Duration:

45 minutes

### Location:

The classroom or kitchen

### Notes:

## Hot Salmon, Cold Cucumber

👁 Watch **The One with the Green Snot Sorbet**



👁 Watch **The One with the Granita**



- ❓ Discuss moments when students have had food that seemed 'wrong' in temperature, such as a cold toasted cheese sandwich (sweaty!) or a squishy banana that is unpleasantly warm from lying in the sun.
- It's personal! Find out what the class thinks – all ideas are accepted. Warm squishy banana is mere moments away from becoming banana pudding!
- ❓ Do students think some foods taste completely different if they are hot compared to when they are cold? Why do they think this is?
- Explore the huge part texture plays in this: a cold uncooked carrot stick is crunchy, the same carrot stick is smooth when cooked, and mushy when it is overcooked. (Think of overcooked, wet broccoli – Yuurgh!)
- Review the fact sheet on the following page.
- ❓ How could we devise an experiment to work out how certain foods taste when cooked and tasted hot, compared to when they are cooked then tasted after they have cooled?

### Taste experiment ideas (feel free to adjust based on what's readily available)

- Cold pumpkin soup
- Hot pumpkin soup
- A hot cooked egg
- A cold cooked egg
- Hot chunks of apple
- Cold chunks of apple
- Hot cooked carrots
- Cold carrot sticks
- Hot cauliflower floret
- Cold cauliflower floret
- Cold hard butter from the fridge
- Melted or almost melted warm butter
- Cold hard ice cream
- Melted or almost melted ice cream
- Warm cooked spinach
- Cold cooked spinach
- Hot salmon
- Cold salmon

## ✍ It's Up to You

- There are several ways to do this experiment, as long as the quantity of food and its exposure to heat remains constant. Below is an example – you may adjust this method when devising a plan with students.
- An easy option is to expose several food items to the same amount of heat. First heat half of each item (in muffin pan 1), then let them cool while you heat the other half of each item (in muffin pan 2).
- Students compare the tastes of the cool and warm items and make written observations (bonus points for illustrations!)
- Several of the vegetable items listed here should taste quite different when both amounts are cooked but one is served cold and the other is hot (e.g. spinach's slight taste is stronger when it is cooked and cold; cauliflower's slight sulphurous taste and smell is likewise stronger when cold and cooked).

### Here's how I'd do it:

1. Prepare half a cup of each food item (hard vegetables chopped into small pieces).
2. Place a quarter cup of each item into a hole in each of the muffin pans. You'll have two identical pans.
3. Cover the muffin pans completely with foil. Place each one of them in the oven to bake at 180°C for 10 minutes.
4. Bake one tray first and let it cool completely! Bake the other tray for the same time just before you do the tasting. It should be warm when students taste it.
5. Place both muffin pans on a heat-proof surface (warn students that one of them is hot – you may like to wrap the used foil around the tray to indicate which is which).
6. Provide teaspoons and facilitate students tasting the cool cooked item followed immediately by the warm cooked item and recording their observations in notebooks or a data-collection sheet.



- 1 • APPLE
- 2 • PUMPKIN SOUP
- 3 • TOMATO
- 4 • COOKED EGG
- 5 • COOKED CARROT
- 6 • SPINACH
- 7 • HAM
- 8 • BUTTER
- 9 • ICE CREAM

Prepare two identical trays

## ? Let's Discuss

- Be clear that the question students are trying to answer is: **Do these foods taste different when served cooked and cool versus cooked and warm?**
- It's quite likely that students will explore food preferences, likes and dislikes in this activity. Encourage them to explore why foods taste the way they do, asking questions about aroma, texture, water content, and similar flavours they have experienced. What have they learned that could be transferred into their homes?

## Get Creative!

- Provide sea salt, olive oil, black pepper, fresh herbs such as mint and thyme, and acids such as lemon and/or lime juice. Allow students to try mixing some of the ingredients (particularly the cooked vegetables) from this lesson and tasting different combinations. This is playtime; they are not making recipes, simply learning to taste and explore how salt, oil, and herbal flavours change a vegetable base.

(Mind you, if they come across a combination that they particularly like, encourage them to write it down or snap a picture for later.)

## Take it Further

- Try taste-testing these common liquids when hot versus cold: milk, diluted lemon juice, sweet tea, plain Greek yoghurt, vegetable soup of any flavour.

👁 Watch **The One where Billy Burns his Mouth**



- Some foods trick your body into thinking they're hot or cold! Can you think of any other examples? What does Billy use to help cool his "burn"?

**From Alice:** Studies show that repeated exposure to foods in low-stress environments has a lasting effect on children's willingness to try unfamiliar foods. Don't press students to try anything, and just let them play with the food – if it doesn't get eaten, have the students help you put the waste in the worm farm or compost. This is not a meal, it's a familiarisation exercise.



## What's Happening Here?

Every food item, whether a vegetable, a piece of fish or a spoonful of peanut butter, is made of atoms and molecules that are bound together. These connections are like Velcro: they hold together the tiny building blocks of every food (the molecules).

Each different arrangement and combination of molecules tastes different. Our taste buds react differently and 'tell' our brain what the flavour is. Imagine biting into a lemon instead of a banana – your taste buds sure tell you the difference!



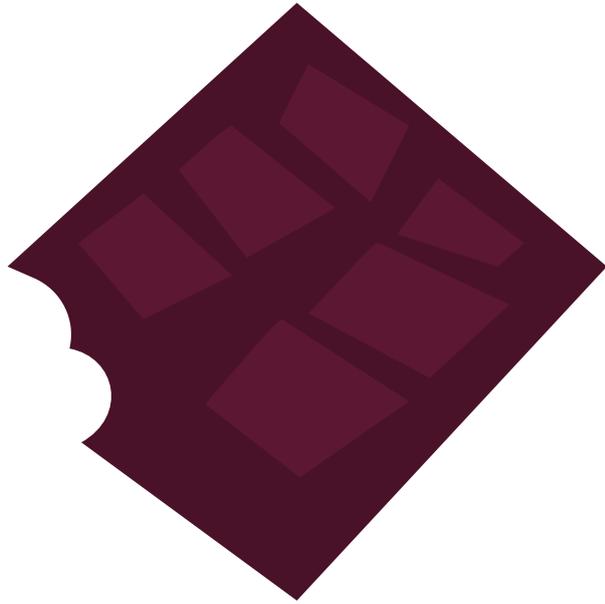
## Heat Changes Everything

If the bonds between molecules are like Velcro, then imagine that the Velcro can be snapped apart by even a small amount of heat.

Heat breaks the bonds between many of the molecules. They don't just break – sometimes they stick to different molecules in the warmth – and the whole flavour changes!

This is why some foods seem like they change their taste completely – like heated milk vs. cold milk, hot spinach and cold spinach, hot lemon juice and cold lemon juice, and so forth.

## Weak and Strong



Weak bonds will change quickly when the substance is heated – think of how easily butter or chocolate melts.

Strong bonds take more heat (energy) to break the bonds and change the substance. Butter may melt in 30 seconds but a carrot can take 7 minutes to soften.

(That's why it's more important to stick to a recipe when there's baking with delicate ingredients involved).

Texture changes too. Try cooked cabbage (soft and a bit sweet) compared to the chopped cold cabbage you might find in a coleslaw (watery and crunchy, more like an apple or lettuce leaf stem).

