**ACTIVITY: Saliva, smell and taste**

**Activity idea**

In this activity, students look at the connection between saliva and the senses of taste and smell.

By the end of this activity, students should be able to:

* understand where saliva is produced in the body
* have an awareness that the tongue is responsible for taste and be able to identify papillae
* discuss the functions of saliva and realise that it is not only limited to the process of digestion
* make the link between saliva and the sense of taste
* understand the connection between the sense of smell and the sense of taste.

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**Introduction/background**

The aim of this activity is to look at the structure of the tongue in order to locate the papillae that are home to the taste buds. Once this has been completed, students look at whether or not saliva is important to sense of taste.

***Saliva***

Saliva and the sense of smell play a crucial role in our ability to taste. If food isn’t in a soluble form or our sense of smell is affected in some way, we can’t taste it. Saliva has a very important part to play in our ability to taste food. It mixes with dry food turning it into a soluble form. In the process of taste, soluble food molecules bind to the microvilli of taste receptor cells making up the taste buds of the tongue.

Saliva also has other important functions:

* It binds together chewed up (masticated) food, helping to form it into a slippery ball or bolus ready for swallowing.
* Digestion of starch is started by saliva. Starch is broken down into maltose (C12H22O11 – a disaccharide formed during starch digestion, also known as malt sugar) in the mouth by amylase, a starch-digesting enzyme produced by saliva.
* Saliva contains minerals that help repair early tooth decay. Plaque bacteria produce an acid that saliva helps to neutralise by its buffering effect. Lysozyme is an enzyme found in saliva. It helps oral hygiene as this enzyme destroys (lyses) many bacteria, preventing their growth and removing the cause of infection. It also cleans away the remains of food from the mouth.

***The production of saliva***

When you put food into the mouth, its taste plus the chewing action causes saliva to be produced. Your peripheral nervous system, which includes the sense organs, controls the autonomic nervous system (ANS) responsible for reflex actions (involuntary actions) like the production of saliva.

There are 3 pairs of major glands stimulated by the ANS responsible for saliva production:

* Parotid glands produce a watery, non-mucous liquid.
* Submaxillary or mandibular glands produce a mixture of mucous and serous (watery) fluids.
* Sublingual glands secrete mostly mucous.

***The makeup of saliva***

Saliva is secreted into the mouth. It is made by groups of cells called acini, producing a liquid containing water, enzymes, mucous and electrolytes. This liquid collects in ducts (opening into the mouth) and its composition is changed at this point by reabsorbing sodium ions and secreting potassium and bicarbonate ions.

Mucous is an important component of saliva. Because of its sticky nature, it clings to surfaces acting as a barrier against ‘unfriendly’ substances like gastric juice. There are many mucous-producing cells throughout the body. Mucous is made of mucins (glycoproteins), some salts and water.

***How smell works in relation to our food***

Our sense of smell is thought to be about 10,000 times more sensitive than the sense of taste. Before you even take the first bite of a foodstuff, you actually smell the food. Then, as you chew, molecules containing the odour are released from the broken down food. As an odour is inhaled, its chemical molecules float upwards, hitting the top of your nasal cavity. This surface is covered in a large number of nerve cells that detect smell. These nerve cells are, in turn, covered in a layer of slimy mucous and have hair-like projections sticking up into the mucous. The chemical odour molecules are trapped in these hairs and the odour message is transduced into an electrical message in the nerve cell.

Different smells are detected by differently shaped nerve cells. The chemical molecules fit onto specially shaped sites on the nerve cells like matching puzzle pieces.

Once a specific smell or odour is detected, a signal moves along the olfactory nerve to the part of your brain responsible for recognising smells.

***Safety rules***

* Be aware of students with food allergies (especially when using food colourings).
* Remind students to taste only substances they are asked to taste.
* Don’t share cups, food or drinks.

**What you need**

* Access to the [Taste animation](https://www.sciencelearn.org.nz/image_maps/67-human-taste)
* Quantities of **dry** food items such as mustard, cinnamon, salt, citric acid, icing sugar, coffee powder, curry powder, cocoa powder, cayenne pepper (ONLY FOR THE BRAVE!!)
* Cotton buds
* Tissues or paper towels
* Paper cups and water
* Blue food colouring
* Hand lenses (magnifying glasses)

**What to do**

1. As a class, work through and discuss the [Taste animation](https://www.sciencelearn.org.nz/image_maps/67-human-taste).
2. Ask one student to volunteer to help locate the papillae on their tongue. Paint the entire upper surface of their tongue with blue food colouring using a cotton bud. Using a hand lens, examine the surface of the tongue looking for pale, little bumps, which should stick out. These are papillae (mostly the fungiform type).
3. Explain to students that they are going to taste a variety of foods and that this procedure should be repeated for each separate food item. First they will be investigating whether or not saliva plays an important part in our ability to taste foods:

* Write down the name of the food you are tasting in the [Taste, saliva and smell results](#smell) table.
* Remember to rinse your mouth out with water between each tasting then dry your tongue with a tissue or paper towel.
* Using a clean cotton bud (a new one for each new food item), keep your mouth open and rub the food evenly over the tongue surface using a back and forward motion to get good coverage.
* Decide whether you can taste the food or not, taking care to separate your sense of smell from the actual taste. (You may choose to block your nose at the same time that you do this part of the investigation).
* Fill in the ‘no saliva’ section of the results table.
* Rinse your mouth with water between each different food. Do not swallow this water.

1. Now ask students to repeat the exercise without using their sense of smell:

* Hold your nose with your finger and thumb.
* Using a clean cotton bud (a new one for each new food item), keep your mouth open and rub the food evenly over the tongue surface using a back and forward motion to get good coverage.
* Decide whether you can taste the food or not.
* Fill in the ‘no smell’ sections of the results table.
* Remember to rinse your mouth out with water between each tasting then dry your tongue with a tissue or paper towel.

**Discussion questions**

* What steps should be taken to make this activity a fair test?
* Would you achieve different results for this activity if you were a ‘supertaster’?
* What effect does saliva have on our ability to taste food?
* What effect does not being able to smell have on your ability to taste?

**Taste, saliva and smell results**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Food item** | **No saliva** | | **No smell/saliva** | |
| **Taste**  **✓** | **No taste**  **🗶** | **Taste**  **✓** | **No taste**  **🗶** |
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