Key Stage 4 - Sweet success

Notes for teachers

At a glance

In this activity students carry out an activity to see if they can tell the difference between drinks that contain sugar and those that contain sweeteners.

They then use the 'Give us a Hand' video to learn about chiral molecules and how sweeteners can be used to sweeten our food without the calories.

Students use this information, and research from suitable websites, to write a persuasive email to the director of a soft drinks company to convince them to use a chiral form of fructose in their drinks. Students then peer assess each other's work.

Learning Outcomes

- Students explain what chiral molecules are.
- Students describe how we taste using scientific terminology.
- Students write using persuasive language.

https://www.oxfordsparks.ox.ac.uk/hand
Each student will need

- 1 copy of the pupil worksheet
- Cup of a drink which contains sugar labelled A and one that contains a sweetener labelled B. The type of drink should be the same (fruit squash, cola, lemonade etc).

Possible Lesson Activities

1. **Starter activity**
   - In a suitable room away from the science laboratory, ask the students to taste the drink in the two cups. They should make notes on the appearance and taste of each drink, which one they prefer and why.
   - Ask for feedback from the students. Reveal that the drink in one cup contained sugar (sucrose) and the other contained a sweetener. Ask them if they could tell which was which, which one they preferred and why.
   - Ask students to write down how they think they sense taste. They can draw diagrams or write down their ideas.
   - Listen to their ideas and record any keywords used e.g. tongue, taste buds, receptors, nerves, brain. Explain that sugar molecules fit into receptors which are grouped together in taste buds on the tongue. This triggers an impulse to be sent to the brain where it is interpreted as a sweet taste. Explain that your tongue also has other types of receptor e.g. bitter. Note: the model that the different types of receptors are located only in certain regions of the tongue has now been disproved. You may wish to show the animation from the weblinks below.
   - Some artificial sweeteners also trigger bitter receptors making them taste bitter. As an additional interesting fact you can share with them that a person’s genes influences the shape of the receptors and whether they taste this bitterness - some students may not have noticed the bitter taste in the artificial sweetener.
   - Play the video *Give us a Hand*. Students will learn about chirality and how some sweeteners are enantiomers of sugars. Pay special attention to the section 3:10- 3:33 which explains why sweeteners are low calorie. The animation at 3:18 shows how glucose (from the digestion of sugars) can fit into a receptor and be transported across the small intestine into the blood (by active transport) but the sweetener cannot. Make sure students do not confuse this with the taste receptors discussed previously. These receptors are much more specific than those on the taste buds.
2. **Individual activity: Writing an email**
   - Give students a copy of the pupil worksheet and ask them to read through page 1.
   - Tell the students that a famous soft drinks manufacturer (named in the pupil worksheet as 'Popsi') has decided to stop using the artificial sweetener aspartame in its drinks (but only in the USA). Explain that they have decided to take this step to improve sales as they feel that artificial sweeteners have a reputation for being unhealthy, although there is no scientific evidence for this (see weblinks for further details).
   - Students then research an alternative to an artificial sweetener - an enantiomer of fructose called tagatose. They can find many suitable websites by doing a simple internet search. Alternatively, you may wish to do the search yourself and print off useful information for them to use.
   - Students use the information to write an email to the director of Popsi persuading them to use this sugar as a replacement for aspartame. Page 2 of the pupil worksheet contains a template plus tips for persuasive writing.

3. **Plenary**
   - Ask students to swap 'emails' and peer assess each other's work. They act as the director and write a reply email saying if they were persuaded to use tagatose in their drinks.
   - You cannot find foods containing tagatose in the shops. As a class, discuss possible reasons why this is. They include the fact that it is not calorie free, it is more expensive to make than other sweeteners and people are wary of new additives to their foods.

**Web links**

https://www.oxfordsparks.ox.ac.uk/hand

Oxford Sparks *Give us a Hand* video


Animation about how the tongue detects taste

http://www.theguardian.com/world/shortcuts/2015/apr/28/diet-pepsi-dropped-aspartame-in-us-is-artificial-sweetener-dangerous

News article on the soft drinks manufacturer dropping aspartame

http://archive.wired.com/wired/archive/11.11/newsugar_pr.html

Article about tagatose and its development

https://www.oxfordsparks.ox.ac.uk/hand