Evolution and PTC tasting: Discussion session

This activity should be carried out after 'Humans, chimps and PTC' in the workshop.

Students will be considering the evolution of non-tasting in the human and chimp populations.

We have seen that non-tasting evolved independently in humans and chimps. This suggests that there is a reason that non-tasting evolved.

Arrange students into groups (about 5 students per group)

Why do we have non-tasters?

Small Group discussion (10 min)

Each group is given a set of cards with possible reasons for the evolution of non-tasting & cards that say good reason or bad reason.

Students should discuss in their group whether any of these reasons might explain why non-tasters have occurred in the population.

Students sort the reasons into good and bad reasons – or somewhere in between.

If students come up with further reasons they can write them on blank cards.

While they are discussing, go round the groups, listen to their discussions and contribute if needed.

Also encourage the teachers to get involved (but not take over)

(While students are discussing, stick up large cards saying "good reason" and "bad reason" at either end of a wall/white board at the front of the class – this will form the basis of an opinion line)

After about 10 minutes discussion, ask the groups to wind up their discussions and stick their cards up on the opinion line at the front of the class. Students can put their cards by "good reason" or "bad reason" or at any point in the continuum between the two – don't let them take the middle ground with all their cards.

Ask the groups to join together with the rest of the class again.

Whole group discussion (10 mins)

Point out that we don't actually know the answer to this; there are some reasons that are more likely than others though.

Look at the answers put up by all the groups.

It is likely that the groups will put the some of the same answers in different places – these answers will be particularly good for discussion.

Chose a particular example and ask the students to explain why they put it there, then ask another group to explain why they put their answer in a different place. Encourage other students to contribute and try to reach a consensus with the whole class.

You will probably not have enough time to discuss all the points in detail.

- Aliens
  (just a bit of fun)
  - No reason
    - The non-taster gene seems to be at higher frequency in the population than you would expect if it had just happened by random chance and there was no selective pressure. But, there may not be any selective pressure acting on the tasting gene anymore which could mean that non-tasting happened randomly in both humans and chimps.

  - Able to eat more foods
    - Potentially – the ability to eat more foods can give you the chance of surviving longer, as long as it's not fatal to eat the bitter tasting plants that you can't taste.

  - Makes you able to do something else – not to do with taste
    - Genes can have more than one function. Although we know this gene has a tasting function there may also be another function that is advantageously affected by the non-tasting mutations

  - Detect poisonous plants in other ways
    - There may be other ways of detecting poisonous plants but this would not provide selection pressure FOR the non-tasting mutation. Being able to taste PTC when you don't need to be able to is not harmful (presumably) and so would not be selected against. However, if we don't need to detect poisonous plants this way, any mutations that accumulate in the gene won't matter so they won't be selected AGAINST.

  - Makes you more attractive
    - Sexual selection could theoretically be important. Being attractive to a potential mate will increase your chances of reproduction, which will increase the chances of you passing your genes on (e.g. peacock's tails – big, heavy tails which

increase the risk of being caught by a predator are selected for because they are attractive - the attractiveness outweighs other factors).

- Bitter tastes are horrible, better not to taste them
  - Not really a good enough reason, tasting bitter things won't affect your ability to survive or reproduce.

- Tasting wasn't the only job of the taster gene – can still do the other job without tasting
  - It could be that the gene has another function that is not affected by the non-tasting mutations – BUT in order for the non-tasting mutations to be selected for, the non-tasting mutations would need to confer a benefit

- Don't need the gene anymore, have other bitter taste receptors
  - Same as for being able to detect poisonous plants other ways – not needing the gene is not necessarily enough to select against the function of the gene. There should be some advantage to non-tasting that is making it more prevalent

- Heterozygote advantage
  - Sometimes heterozygotes – individuals who have 1 copy of each form of a gene have an advantage. For example, Sickle cell anaemia, individuals with 2 copies of the sickle cell gene will have sickle cell anaemia and will be ill but individuals with only one copy have protection against malaria. Protection against malaria is a strong enough selection pressure to maintain the sickle cell gene in the population even though having 2 copies is a big disadvantage.

- To human PTC non-tasters the plant *Antidesma bunius* tastes bitter and to PTC tasters it tastes sweet. PTC tasting is just a side effect; it is the taste of *Antidesma bunius* that is important.
  - It could be that there is an advantage to tasting *Antidesma bunius* in the way that non-tasters do. If so, this is a potential explanation but we would need to do further investigation to find out.

Remember:

Natural selection = survival of the fittest.

Very, very simply – genes will be selected for if they make an organism have more offspring (who in turn have more offspring and pass on the genes). This often means genes that help an organism's survival will be passed on because the longer an organism survives the more offspring it is likely to have.

If you have plenty of time you could ask students to think about how they might go about testing their ideas.

Round up the discussion

Scientists don't really know the reason why the non-taster allele is so frequent in the population – its frequency seems to be too high to be due to chance, so there must presumably be some selective advantage…

Shows the students that scientists don't know all the answers and that what they are doing is part of current and ongoing research.