

INVESTIGATE!

Activity overview



Age: 9 – 14 years old

Time: 30 – 60 min

Topics: DNA and genes, evolution and inheritance

Learning objectives:

- Changes in DNA can lead to variation.
- Variation is present within a population.
- Genes can give us different characteristics and we inherit our genome from our parents.

BACKGROUND

All the biological instructions for making an organism are contained in a long molecule called DNA (deoxyribonucleic acid). All living things, from humans and mice to plants and bacteria, have a unique set of instructions written in the four chemical letters of DNA: A, C, G, and T. It's like a recipe book but written in code!

All of the DNA in a cell is called the genome. Within the genome there are sections of DNA called genes. Genes provide specific instructions for our individual characteristics, like eye and hair colour. Sometimes there can be small differences in a gene, for example where there's an A in one person there may be a T in someone else. These changes can alter the outcome of the instruction, like giving some people brown eyes and other people blue eyes. These differences are known as genetic variation. It is this variation that makes us all unique, whether in terms of hair colour, skin colour or the shape of our faces.

Researching DNA and comparing lots of genomes helps us to identify where there are differences in our genomes and what effects these differences may have on physical characteristics and our health. Understanding the effects of these small DNA changes can help us to improve our knowledge of the causes of disease and may help us to develop better ways to diagnose and treat them.

This activity will encourage participants to investigate some variable physical characteristics and consider if they are the result of genetic variation. They will learn how differences in the DNA code can have an impact on our appearance, from our eye colour to our hair colour.

Find out more

Read this fact page about DNA:

www.yourgenome.org/facts/what-is-dna

Read this fact page about genes:

www.yourgenome.org/facts/what-is-a-gene

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Read this fact page about how we can be different genetically:

www.yourgenome.org/facts/what-is-genetic-variation

Read more about the genetics of bitter taste:

learn.genetics.utah.edu/content/basics/ptc/

Discover more about variable human characteristics:

learn.genetics.utah.edu/content/basics/observable/

ACTIVITY PREPARATION

Materials

- Powerpoint slides
- Characteristic guide for activity leader
- Pens
- Data collection sheet (1 per participant)
- PTC strips used to test taste or fresh chopped coriander
- Small mirror (1 per group)
- Small jam jars or plastic pots
- Fresh freesias
- Tissues or wet wipes

Set up

1. Source all of the materials ahead of running the activity. Most of the materials for this activity can be purchased in a supermarket, with the exception of PTC strips which can be purchased online from suppliers such as Amazon for around £3 - 4.
2. Testing the PTC strips. A PTC strip is a piece of paper that has been soaked in very low concentrations of phenylthiocarbamide, a chemical that can taste very bitter to some people. We recommend testing the PTC strips before use to check they work, if you cannot taste PTC (25% of the population can't), find a willing colleague who will test it for you.
3. Make the "mystery smell" by crushing up freesia flowers in a small jar or container. Keep it sealed. Ideally make at least 6 jars, one per group.
4. Before the activity starts make sure you have all the testing materials (PTC strips, mystery smell jars, mirrors, and wet wipes) out on a table for everyone to access.



ACTIVITY GUIDANCE

Warm up

1. Begin the activity by discussing with the group that DNA contains the instructions for making all living things. Made up of four chemical letters, A, C, G, and T, the sequence of DNA letters can influence our appearance such as our eye colour and hair colour.
2. Ask the group:
 - Why do they think some people look alike and some people look different?
 - Do they share any features with members of their family, for example the same hair colour or eye colour?
3. Explain that eye colour, skin tone and face shape can all be determined by our DNA. We inherit our DNA from our parents so features such as eye colour, hair colour and even ear shape can be passed down from generation to generation.

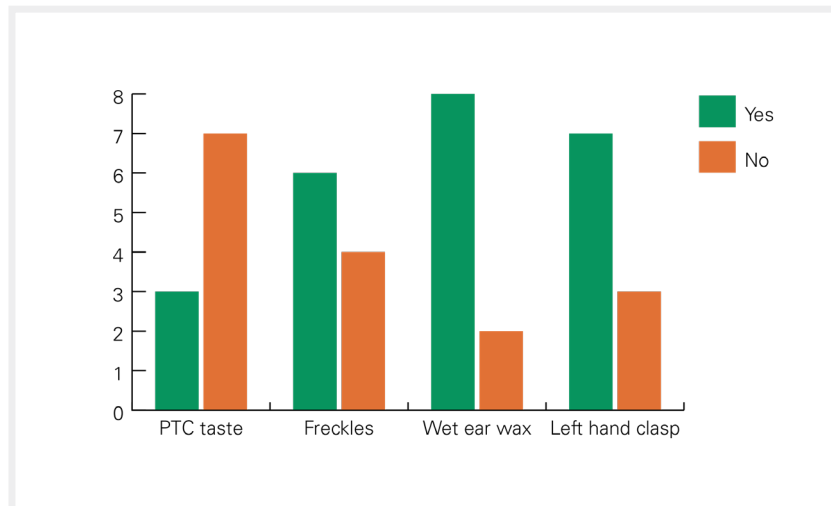
Run the activity

1. Get everyone in the group to work in teams of three.
2. Give everyone a data collection sheet to compete. Explain that they need to collect data from at least 10 people.
3. Show the whole group the testing material table, explain that all these materials can be used to test different characteristics.
4. Run through each material and how to use it:
 - **To test bitter taste perception:** Ask the test subject (the person being tested or observed) to place a PTC strip on the tip of their tongue. Does it taste bitter? Stress to the group that you do not eat the strips and you must put the used strips straight into a bin.
 - **To test smell:** Open the mystery smell jar and get the test subject person to sniff the jar. Can they smell anything? Close the jar after use.
 - **To check ear wax type:** Use a wet wipe or tissue to lightly wipe the entrance to the ear canal. Is there any ear wax present? If not ask if they know whether they know if they have wet or sticky ear wax. Do not stick anything inside anyone's ear.
 - **To check freckles and dimples:** Use the mirror to check for freckles and dimples. The test subject can use it to see if freckles are present and if they have dimples when they smile.
5. Ask everyone to start collecting data from people in the room and recording their answers using the data sheet.

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6. Once data has been collected from the whole group, participants can create a bar graph (example below) to show the distribution of the different characteristics. This could be created using a spreadsheet programme such as Excel or hand drawn on paper. Other creative ways of representing the data can also be used such as Infographics with percentages.



Reflect on it

After all the teams have collated their data, encourage them to discuss which characteristics they think are most determined by genes and which could be down to other factors such as learning or environment. Use the characteristics guide provided to help you with this.

Take it further

If you enjoyed this activity and would like to take it further, try using the blank data collection form to think of and explore other characteristics. What ideas can the group come up with and what could they use to test it?