

BREAKING IT DOWN

with Dr. Michelle Dickinson



GENETICS

Welcome to Breaking It Down with Dr Michelle Dickinson.

This worksheet is to help you to support your teaching after students have watched the 'Genetics' episode. It contains a summary of the science knowledge, experiment instructions, topics for further inquiry, and links to the NZ curriculum at levels 3-5.

Use this sheet alongside the video for the Genetics episode of "Breaking It Down with Dr Michelle Dickinson" to help with your teaching around the science of DNA and inheritance. During the episode, Dr Michelle Dickinson will cover the structure of the DNA molecule, how we inherit genetic material from our parents, and how our physical traits are shaped by our genes. She will talk with Melanie McConnell from Victoria University of Wellington about her research into genetics and disease, and conduct an experiment which students can follow along with.

For this session, your students will each need:

- **Notebook and pen to write down their observations**

Achievement Aims

NZ Curriculum Strand: Living World

Live Processes (L3-4): Recognise that there are life processes common to all living things, and that these occur in different ways

Evolution (L5): Describe the basic processes by which genetic information is passed from one generation to the next

Learning Outcomes

- Understand the structure of vascular plants
- Understand that all living things contain DNA
- Understand the structure and function of the DNA molecule, and understand the difference between DNA, genes and chromosomes
- Understand how genetic information is passed between generations
- Conduct an experiment to investigate the existence of different physical traits among a group of people

BREAKING IT DOWN: Science of Genetics

Genetics is the study of genes. Genes are made up of DNA (deoxyribonucleic acid), a long molecule found in the nucleus and mitochondria of plant and animal cells. The structure of DNA is like a 'ladder' twisted into a double-helix shape. The 'sides of the ladder' are made of alternating sugar and phosphate groups, and the 'rungs of the ladder' are pairs of nucleotides called 'bases'. The four bases in DNA are adenosine, cytosine, guanine and thymine. The order of these 'base pairs' determines your genetic information.

Packets of DNA make up a gene, and genes are found in chromosomes. Humans have 23 pairs of chromosomes, and in each pair, half are inherited from each biological parent.

There are two forms of each gene - dominant and recessive. Dominant genes are more often 'expressed', even if the gene is only inherited from one parent. Recessive genes need to be inherited from both parents to be expressed. An example of this is eye colour - the 'brown eye' gene is dominant while the 'blue eye' gene is recessive.

Working out the inheritance of dominant and recessive traits is important for doctors, as many genetic diseases are carried through generations on a recessive gene. It's also important for forensic scientists to be able to 'read' the genes of an individual to compare it to DNA databases and use it to help identify people involved in a crime.

Genetic research has also broken several boundaries in fields such as cloning and paleogenomics. Debates around the ethics of cloning, and reviving extinct species, are likely to keep going on in the scientific community for years to come.

EXPERIMENT INSTRUCTIONS

Experiment: Express Yourself!

- This population genetics experiment identifies how many people in a population have a particular trait. Start by testing yourself to see if you can do or have the following, then investigate your relatives, or those in your class:
- Tongue-rolling
- Detached earlobes
- Hitchhiker thumbs
- Hair on the back of your second finger section
- Hair colour

EXPLORE FURTHER

(Use these prompts to start a discussion or further inquiry on the topic of genetics)

- Do our genes decide how long a person lives?
- What's the most common hair colour?
- Is height genetic?
- How do DNA mutations happen?
- How are plant and animal DNA different?
- Why is genetic variation a good thing?
- How long does DNA stay at a crime scene?
- How does radioactive material affect DNA?
- Could we change someone's DNA on purpose to make them a mutant or a superhero?
- What happens to the genetic code in animals who are born with two heads or six toes?

FURTHER EXPERIMENTS & INFORMATION

Build your own family tree and figure out where you get your traits from!

Extract DNA from strawberries

<https://www.scientificamerican.com/article/squishy-science-extract-DNA-from-smashed-strawberries/>

Check out the Science Learning Hub's Genetics resources

www.sciencelearn.org.nz

Read the debate around gene editing in New Zealand from the Royal Society Te Apārangi

<https://www.royalsociety.org.nz/major-issues-and-projects/gene-editing-in-aotearoa/>



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