**STUDENT ACTIVITY: Genetics webquest**

**Activity idea**

In this activity, students carry out a genetics webquest using resources from the Science Learning Hub or a genetics animation from the Learn Genetics website.

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

* explain the key terms chromosome, DNA, gene, trait, genotype and phenotype
* describe where DNA is found in the body
* explain that genes code for specific proteins
* explain the basic concept of inheritance – that parents pass chromosomes on to their children
* explain how our phenotypes are a result of an interaction between genetic make-up and environmental factors
* give some examples of environmental factors that affect our phenotypes.

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**Introduction/background**

In this webquest, students use online resources to answer a series of questions about genetics.

The activity is a combination of individual and small group work.

Three levels of questioning are used:

* Level 1 (literal) – reading ‘on the lines’ to find what is actually said on the page.
* Level 2 (interpretive) – reading ‘between the lines’ to infer what the author might mean.
* Level 3 (applied) – reading ‘beyond the lines’ to relate the information to other knowledge and situations.

Students can either use resources from the Science Learning Hub or [Learn Genetics Tour of the Basics](https://learn.genetics.utah.edu/content/basics/traits/) animations.

Before carrying out this activity, with your class it is recommended that you read the teacher resource [Alternative conceptions about genetics](https://www.sciencelearn.org.nz/resources/216-alternative-conceptions-about-genetics).

**What you need**

* Access to these Science Learning Hub resources:
* [Key Terms](https://www.sciencelearn.org.nz/resources/1760-uniquely-me-key-terms)
* [DNA, chromosomes and gene expression](https://www.sciencelearn.org.nz/resources/206-dna-chromosomes-and-gene-expression)
* [Genotype and phenotype](https://www.sciencelearn.org.nz/resources/207-genotype-and-phenotype)
* [Meiosis, inheritance and variation](https://www.sciencelearn.org.nz/resources/208-meiosis-inheritance-and-variation)
* [Role of proteins in the body](https://www.sciencelearn.org.nz/resources/209-role-of-proteins-in-the-body)
* [Twins](https://www.sciencelearn.org.nz/resources/210-twins)
* [Genetics or environment](https://www.sciencelearn.org.nz/videos/63-genetics-or-environment)
* or access to [Learn Genetics Tour of the Basics](https://learn.genetics.utah.edu/content/basics/traits/) animations
* Copies of [Genetics webquest – levels 1 and 2](#level1) and [Genetics webquest – level 3](#level3)

**What to do**

1. Hand out copies of [Genetics webquest – levels 1 and 2](#level1) and ask students to complete it working individually or in pairs using the suggested resources.
2. Discuss responses and address any alternative conceptions.
3. Combine students into small groups and hand out copies of [Genetics webquest – level 3](#level3). Ask students to work together as a group to complete it using the suggested resources.
4. Discuss the answers to the questions as a class, asking each group to contribute.

**Extension ideas**

* Ask students to create a visual mind map with the topic ‘What makes me, me?’

**Genetics webquest – levels 1 and 2**

1. What is DNA and where exactly is it in your body?
2. What are genes and what are they made of?
3. What is a chromosome and how many do humans have in each cell?
4. What is a gene for?
5. What is a trait? Give 2 examples.

**Level 2**

1. How do genes determine how we look and act?
2. How do traits pass from 1 generation to the next?
3. Rank the following items in order from largest to smallest: cell, chromosome, gene, DNA, organism, nucleus.

largest -------------------------------------------------------------------------------------🡪 smallest

**Genetics webquest – level 3**

Genotype: the genetic make-up of an individual organism. Your genotype functions as a set of instructions for the growth and development of your body. The word ‘genotype’ is usually used when talking about the genetics of a particular trait (like eye colour).

Phenotype: the observable physical or biochemical characteristics of an individual organism, for example, height, weight and skin colour.

1. How are your genotype and phenotype related?
2. How can identical twins with identical genetic make-up end up looking different to each other?
3. Can you think of some environmental factors that may affect your phenotype?

**Teacher answer sheet**

**Level 1**

1. What is DNA and where exactly is it in your body?

Deoxyribonucleic acid (DNA) is a molecule that contains the instructions needed for an organism to develop and function. These instructions are stored as a code made up of 4 chemical bases: adenine (A), guanine (G), cytosine (C) and thymine (T). Most of your DNA is found in the cell nucleus. Mitochondria (types of cell organelle) also have a small amount of their own DNA.

1. What is a gene and what are they made of?

Genes are like an instruction manual – they provide the information needed to make proteins and RNA molecules that, in turn, determine the growth and development of our bodies. A gene is a segment of a DNA molecule.

1. What is a gene for?

Each gene provides the instructions for a unique protein (and sometimes for many versions of that protein).

1. What is a chromosome and how many do humans have in each cell?

A chromosome is a structure made up of DNA and proteins that contains genes. Humans have 46 chromosomes that are found in the cell nucleus. Gametes (or sex cells) only have 23 chromosomes.

1. What is a trait? Give 2 examples.

A trait is a characteristic of a living organism, for example, hair colour or a predisposition to a medical condition.

**Level 2**

1. How do genes determine how we look and act?

A gene is a segment of a DNA molecule that contains the instructions needed to make a unique protein. Each cell uses a different combination of genes to build the particular proteins it needs to perform its specialised functions. For example, some genes code for the proteins that affect eye colour or certain behavioural traits.

It is rare that 1 gene determines 1 characteristic (a monogenic trait). Most traits are complex and have genes that affect them at more than 1 locus (polygenic).

1. How do traits pass from 1 generation to the next?

Via chromosomes. A chromosome is a structure made up of DNA and proteins that contains genes. Genes code for the instructions that define our traits. At conception, each parent contributes 1 set of chromosomes. In other words, a zygote has 46 chromosomes – 23 from each parent.

1. Rank the following items in order from largest to smallest: cell, chromosome, gene, DNA, organism, nucleus

Organism cell nucleus chromosome DNA gene

largest -------------------------------------------------------------------------------------🡪 smallest

**Level 3**

Genotype: the genetic make-up of an individual organism. Your genotype functions as a set of instructions for the growth and development of your body. The word ‘genotype’ is usually used when talking about the genetics of a particular trait (like eye colour).

Phenotype: the observable physical or biochemical characteristics of an individual organism, for example, height, weight and skin colour.

1. How are your genotype and phenotype related?

Your genotype acts like a set of instructions for your growth and development. Genes code for particular proteins that make up your cells, tissues and organs, leading to your unique phenotype. Your phenotype is also affected by environmental factors.

The term ‘genotype’ is usually used to refer to specific alleles. Alleles are alternative forms of the same gene that occupy the same location on a chromosome. At any given locus, there are 2 alleles (1 on each chromosome in the pair). In other words, you get 1 allele from your mother and 1 from your father. The 2 alleles might be the same or they might be different. Different alleles of a gene generally serve the same function (for example, they code for a protein that affects eye colour) but may produce different phenotypes (for example, blue eyes or brown eyes) depending on which set of 2 alleles you have.

1. How can identical twins with identical genetic make-up end up looking different to each other?

As a result of the interaction between their genetic make-up and environmental influences from the moment they are conceived.

1. Can you think of some environmental factors that may have affected your phenotype?

Sunlight, chemicals, diet/nutrition, exercise, temperature, maternal nutrition, stress etc.