Genetics, DNA and Evolution! Year 10 Science at Home

You can help! Your child is learning how traits are inherited from parents to offspring via DNA, how mutations occur, and how natural selection drives evolution over many generations. This is the foundation of modern biology, medicine and our understanding of life on Earth.

Why are we learning this? Genetics, health and heritage

Genetics is directly relevant to the health of remote communities. Many health conditions — including some types of diabetes, heart disease and certain cancers — have a genetic component, meaning they can run in families. Understanding genetics helps families understand risk and make informed health decisions. DNA evidence has also had profound implications for First Nations peoples — genetic studies have confirmed that Aboriginal Australians are among the oldest continuous populations on Earth, with genetic lineages dating back over 50,000 years. Genetic science can both help and harm communities; understanding it helps families engage confidently with health services and be aware of ethical issues around genetic data.

My child will learn to:

✓ Understand DNA and genes
Describe what DNA is, how it is organised into chromosomes and genes, and how genes carry the instructions for traits.

✓ Explain heredity
Use Punnett squares to predict the likelihood of offspring inheriting dominant and recessive traits.

✓ Understand mutations
Explain what gene mutations are, how they occur, and that they are the source of new variation in populations.

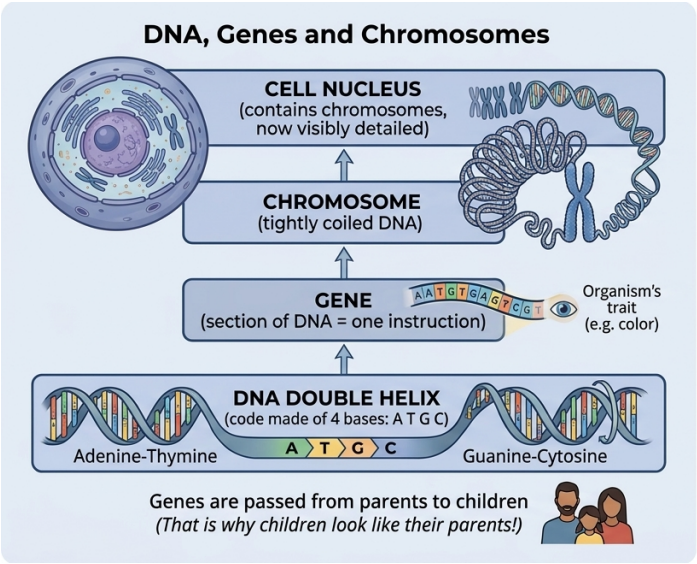
✓ Explain natural selection and evolution
Describe how natural selection operates on variation in a population to drive evolutionary change over time.

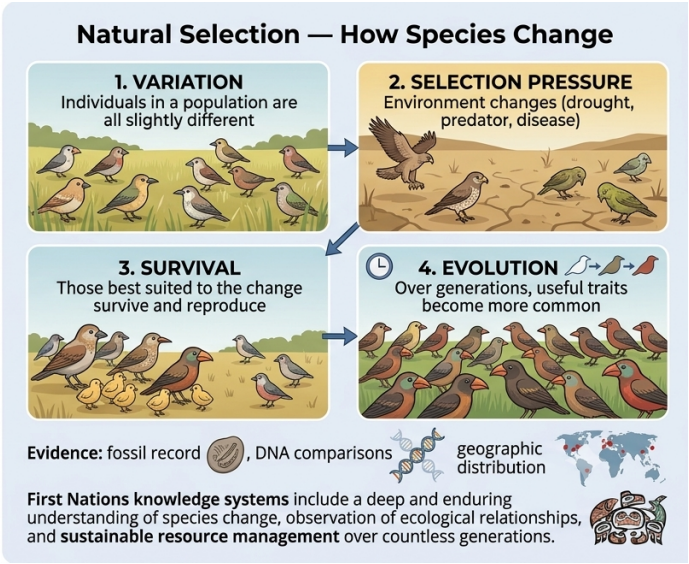
Big ideas to know:

DNA, genes and chromosomes
DNA (deoxyribonucleic acid) is the molecule that carries the genetic code — instructions for building and running a living thing. DNA is shaped like a twisted ladder (double helix). It is coiled tightly into structures called chromosomes, found in the nucleus of every cell. Humans have 46 chromosomes (23 pairs). A gene is a specific section of DNA that codes for a particular trait — like eye colour, blood type, or enzyme production. Humans have about 20,000-25,000 genes.

Heredity — passing on traits
Each parent contributes one copy of each chromosome pair to their offspring. So you inherit one copy of each gene from your mother and one from your father. Many traits are controlled by one gene with two variants — alleles. A dominant allele shows up even if only one copy is present. A recessive allele only shows if both copies are the same recessive version. For example, the allele for brown eyes is dominant over blue. Punnett squares are a tool scientists use to predict the probability of offspring inheriting particular traits.

Natural selection and evolution
In any population, individuals vary in their traits. Some variations make individuals better suited to their environment — they are more likely to survive and reproduce, passing on those helpful traits to offspring. Over many generations, helpful traits become more common in the population while unhelpful ones become rarer. This is natural selection, and it is the main driver of evolution — the change in characteristics of a population over time. It was described by Charles Darwin, who observed extraordinary variation in the animals of the Galapagos Islands.





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Genetics concepts and examples

Concept	What it means	Example
Gene	A section of DNA that codes for a specific trait — a set of instructions for making a protein	The gene for blood type tells the body which antigens to put on red blood cells
Allele	A variant (version) of a gene — different alleles produce different versions of a trait	Blood type has A, B and O alleles — your combination gives you type A, B, AB or O
Dominant allele	Shows up in the phenotype even when only one copy is present (written as capital letter: A)	Brown eye colour is dominant — one copy is enough to give brown eyes
Recessive allele	Only shows in the phenotype if two copies are inherited (written as lowercase: a)	Blue eyes are recessive — you need two copies of the blue-eye allele
Mutation	A change in the DNA sequence — can be caused by radiation, chemicals, or copying errors	Sickle cell anaemia is caused by a single change in one base pair of the haemoglobin gene
Natural selection	The process where individuals with helpful traits survive and reproduce more successfully	Peppered moths: dark moths survived better when trees were soot-covered; light moths survived better after

Think Like a Scientist — Punnett Square Practice

Use a Punnett square to work out the probability of a child having brown eyes vs blue eyes when both parents are "carriers" (have one brown allele B and one blue allele b). Draw a 2x2 grid. Put B and b across the top (parent 1) and B and b down the side (parent 2). Fill in each box to get the four possible combinations. How many of the 4 boxes show brown eyes? How many show blue?

Answer: BB = brown (dominant), Bb = brown (dominant), Bb = brown (dominant), bb = blue. So 3/4 (75%) chance of brown eyes, 1/4 (25%) chance of blue. Ask: "Which boxes represent people who have a hidden blue allele but brown eyes? What does this mean for their future children?"

Steps for working out trait inheritance:

1. Identify dominant (capital) and recessive (lowercase) alleles for the trait
2. Write one parent's alleles across the top, the other down the side
3. Fill in each box by combining the top allele and side allele
4. Count how many boxes show dominant trait vs recessive trait
5. Convert to percentage: 2/4 = 50% chance; 1/4 = 25% chance

Questions to ask your child

1. What does DNA stand for, and where is it found in a cell?
2. What is the difference between a gene and an allele?
3. If a parent has alleles Bb for a trait, what are the two types of gametes (sex cells) they can produce?
4. A mother has blood type A (genotype AO) and a father has blood type B (genotype BO). What blood types could their children have?
5. How do gene mutations create new variation in a population?
6. If a helpful mutation appears in one individual, how does it spread through a population over many generations?
7. How does evidence from DNA studies support the view that Aboriginal Australians have one of the oldest continuous cultures on Earth?

Many families have members with different physical traits — hair texture, eye colour, ear lobe shape (attached vs free), tongue rolling ability. These are all controlled by genetics! Work out whether each trait in your family seems dominant or recessive by noting which traits appear in parents and which in children.

Key words to know:

DNA	The molecule that carries genetic information in living things — shaped as a double helix
Gene	A section of DNA that codes for a specific trait or protein
Allele	A variant (version) of a gene — different alleles produce different forms of a trait
Dominant	An allele that shows in the phenotype when only one copy is present
Recessive	An allele that only shows in the phenotype when two copies are inherited
Mutation	A change in the DNA sequence — the source of new variation in populations
Natural selection	The process where individuals with traits better suited to their environment survive and reproduce more successfully, driving evolutionary change

Key words to look up	What school will check	Try it at home!

DNA · Gene · Allele · Dominant · Recessive · Mutation · Natural selection	By the end of Year 10, your child needs to explain how DNA, genes and chromosomes determine traits, apply Punnett squares to predict inheritance patterns, and explain how natural selection drives evolution through variation and differential survival.	Find out your family's blood types if you know them. Blood type is controlled by one gene with three alleles (A, B and O). Work out possible genotypes for family members. If a child has type O blood, what can you determine about both parents' genotypes? (Both must carry the O allele!)