

**Home learning activities**

Subject
Science
Year Group
Year 8
Unit of work / Knowledge organiser
Inheritance, Variation and Evolution - 1
Activities
<ul style="list-style-type: none"><li>• Complete the 'Knowledge Check' by clicking on the link below (Mr Tobi has also emailed this link out to you): <a href="https://forms.office.com/Pages/ResponsePage.aspx?id=tWaUKrjGMEuM3bZvypd0-1JR5WsjulFPvbjl4VXu0Y1UMTVSRUpSUEhKS0IEVkdEV0JQUEFKWjhLWS4u">https://forms.office.com/Pages/ResponsePage.aspx?id=tWaUKrjGMEuM3bZvypd0-1JR5WsjulFPvbjl4VXu0Y1UMTVSRUpSUEhKS0IEVkdEV0JQUEFKWjhLWS4u</a></li><li>• Read through each of the Sections of the 'Knowledge Organiser' on 'Inheritance, Variation and Evolution'.</li><li>• Make careful and details notes on the Sections of the first page of the 'Knowledge Organiser', including writing out the 'Key Words', which are written <b>in bold</b>, along with their meanings.</li><li>• Without looking at your notes, state the names of the four different bases of DNA.</li><li>• Describe, in your own words, what are meant by genes, without looking at your earlier notes</li><li>• Learn the meanings of the key words from the 'Inheritance and Variation Keywords' sheet and complete the key words from memory on the 'Keywords Test' sheet. Work out your score using the first sheet.</li><li>• Complete the 'Inherited or Environmental Characteristics', 'Continuous or Discontinuous Variation' and 'Natural Selection' activities on the 'Test Yourself' pages; the answers are provided, but do not look at these until you have tried the work yourself (<b>be strict with yourself here</b>).</li></ul>
Where do you complete the work?
In Study Books.

What to do if you finish the work? (Extension activity)

- Make sure you have completed the previous set work on 'Plants and Photosynthesis' and then complete the 'Mini Project' on 'Variation'.

These websites might help:

- BBC Bitesize -> Secondary -> KS3 -> Science -> Biology -> Inheritance and Genetics

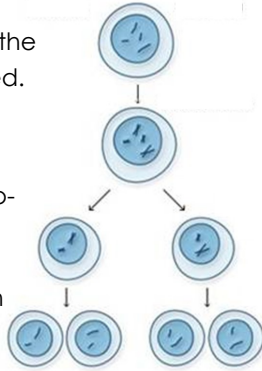
If you are struggling with your work or if you have finished.

**Please email your classroom teacher directly using the email list found in the Home Learning section of the website.**

**Sexual reproduction** involves the **fusion** of two **gametes** (the sperm and the egg, or pollen and egg cells in plants). The mixing of **genetic information** leads to **variation** in the offspring.

Gametes are produced by **meiosis**:

The number of chromosomes in the nucleus is doubled.



The first division produces two diploid cells.

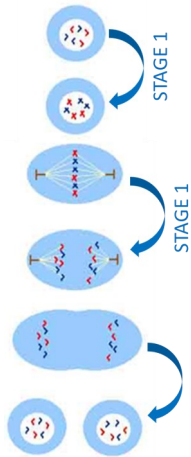
A second division produces four haploid cells.

**Asexual reproduction** only involves one parent and there is no mixing of genetic information. This leads to **genetically identical** offspring called **clones**.

Asexual reproduction happens by **mitosis**:

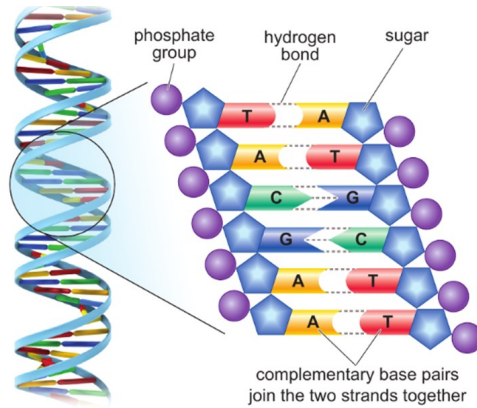
Mitosis happens in three stages:

- 1 - The parent cell replicates its DNA.
- 2—The chromosomes are pulled to either side of the cell.
- 3—The cell divides into two identical cells.



Within the **nuclei** of cells, there are **chromosomes** containing stored genetic information as **DNA**. Small sections of DNA on chromosomes are called **genes**. The full set of genetic information for an organism is called a **genome**.

Scientists have studied the whole human genome which will improve our understanding of inherited diseases.



DNA double helix

DNA is a **polymer** (a repeating pattern of molecules) made up of two strands. It has:

- a **double helix** structure
- sugar-phosphate backbones
- **complementary base pairs** held together by **hydrogen bonding**

DNA contains four different bases: **adenine, thymine, cytosine** and **guanine**. These are always found in complementary pairs: **A-T, C-G**.

Most of the **characteristics** of an individual are determined by more than one gene interacting. However, some characteristics are controlled by a single gene. Examples of these are fur colour in mice and red-green colour blindness in humans.

Different forms of a specific gene are called **alleles**. An individual inherits one allele from each parent so it will have two alleles for each characteristic.

The **genotype** is the combination of two alleles that an individual has for a particular characteristic. The **phenotype** is the expressed characteristic as a result of this combination of alleles (i.e. the displayed physical trait).

When an individual has two of the same alleles for a specific characteristic it is **homozygous**. If it has two different alleles it is **heterozygous**.

**Dominant** alleles are always given capital letters and will always be expressed in the phenotype if an individual has this allele. **Recessive alleles** are given small letters and will only be expressed in the phenotype if the individual is homozygous for this allele.

Example:

The allele for black fur on a mouse is given the capital letter **B** because it is **dominant**. The allele for brown fur on a mouse is given the small letter **b** because it is recessive.

The possible genotypes are therefore:

- BB:** Homozygous for the dominant allele, so the phenotype would be black fur.
- Bb:** Homozygous for the recessive allele, so the phenotype would be brown fur.
- Bb:** Heterozygous, so the phenotype would be black fur.

**Genetic cross diagrams** can be used to show the possible genotypes that an **offspring** could have from two known parents:

This genetic cross diagram shows that there is a 50% chance of the offspring being homozygous for the dominant allele, and 50% chance of the offspring being heterozygous. This means there is a 100% chance of the offspring having black fur.

		Father's alleles	
		B	B
Mother's alleles	B	BB	BB
	b	Bb	Bb

Some diseases, such as cystic fibrosis, are **inherited**. The allele for having cystic fibrosis is recessive (**c**). The allele for not having the disease is dominant (**C**).

The genetic cross diagram below shows how two parents who do not suffer from cystic fibrosis can produce an offspring who has the **phenotype** of having cystic fibrosis:

		Father's alleles	
		C	c
Mother's alleles	C	CC	Cc
	c	Cc	cc

The probability of two parents having a boy or a girl can also be determined using a genetic cross diagram. One of the pairs of **chromosomes** in the nuclei of body cells determines sex: Males have the genotype **XY**. Females have the genotype **XX**.

		Father	
		X	Y
Mother	X	XX	XY
	X	XX	XY

This genetic cross diagram shows that the probability of having a boy (or girl) is always 50%.

There is **variation** in all **species**; there are differences between the characteristics of individuals.

**Genetic variation** is due to inherited genes. **Environmental variation** is caused by the conditions that organisms have developed in.

A **species** is defined as a group of organisms in which two individuals can produce fertile **offspring**.

A lion and tiger can be crossed to produce a liger. Lions and tigers are different species because ligers are infertile.



**Charles Darwin** came up with the theory of **evolution** by **natural selection** which can be explained in four stages:

**Variation:** There is genetic variation within all species.

**Competition:** Individuals within a species compete for food, space and mating partners.

**Survival of the fittest:** Only those individuals who are best adapted to their environment will survive.

**Passing on genes:** The individuals who survive reproduce together and their successful traits are passed on through their genetic information.

Over many generations, this leads to the formation of new species. All species have evolved from simple life forms that first developed more than three billion years ago.

**Selective breeding** is sometimes known as **artificial selection**.

For thousands of years humans have been selectively breeding plants and animals to have desired genetic characteristics. Two individuals of a species who have the desired characteristics are bred together and, over many generations, the offspring also display that characteristic.

Plants can be selectively bred for:

- disease resistance in food crops
- large or unusual flowers

Animals can be selectively bred for:

- ability to produce more food or milk
- calm temperaments

**Inbreeding** is when close relatives within a species are bred together and can cause them to display inherited defects.

**Genetic engineering** is a process where scientists can modify the genome of an organism to give a desired characteristic. This is done by inserting a gene from another organism.

Advantages:

- Plants or crops can be engineered to be resistant to diseases and herbicides, or to produce increased yields (**GM crops**).
- Bacteria can be engineered to produce insulin for treating diabetes.

Disadvantages:

- Concerns over the effect of GM crops on wild flowers and insects.
- Some people are concerned about the effects of GM foods on their health.

**evidence for Darwin's theory of evolution by natural selection:**

Understanding of inheritance:

It has been shown that characteristics are passed to offspring through genes. Darwin did not have knowledge of genes or DNA at the time but he did suggest that character traits were passed down from parents to their offspring.

Fossils:

Fossils are the preserved traces or remains of organisms that lived thousands or millions of years ago. We can learn how organisms have changed over time by examining fossils.

Species of plants or animals are considered to be **extinct** when there are no remaining living individuals of that species.

Species may become extinct due to **natural disasters**, new **predators** or diseases, or changes to their **environmental conditions**.

**Bacteria** can evolve very rapidly due to reproducing at a fast rate.

Some bacteria are evolving to become **resistant** to **antibiotics**, which is concerning for human health.

**MRSA** is an example of a bacterial strain that is resistant to antibiotics.

# 'Inheritance and Variation' Keywords

<b>Word</b>	<b>Pronunciation</b>	<b>Meaning</b>
characteristics		The features of an organism.
DNA		A large molecule that contains genes.
gamete	<b>gam-meet</b>	Scientific word for sex cell.
gene	<i>jeen</i>	A length of DNA that controls one inherited characteristic of an organism.
genetic information		The instructions that control your characteristics. These instructions are found on genes.
inherited		Passed on to an organism from its parents.
variation		The differences between things or organisms.
environment		The surroundings of an organism.
environmental factors		Things in an environment that can change something about an organism.
resistant		Something that is not affected by disease is said to be resistant to it.
species	<b>spee-shees</b>	A group of organisms that can reproduce with each other to produce offspring that will also be able to reproduce.
variety		A set of plants that are in some way different from other members of the same species.
breed		A set of animals that are in some way different from other members of the same species.
breeding		To mate two organisms of the same species to produce offspring.
cross-breeding		When different varieties or breeds are mated with one another.
selective breeding		When humans choose certain animals and plants that have useful characteristics and breed more of these organisms.
yield		How much of something useful to humans that an organism produces.

# 'Inheritance and Variation' Keywords Test

Word	Pronunciation	Meaning
		The features of an organism.
		A large molecule that contains genes.
	<b>gam-meet</b>	Scientific word for sex cell.
	<i>jeen</i>	A length of DNA that controls one inherited characteristic of an organism.
		The instructions that control your characteristics. These instructions are found on genes.
		Passed on to an organism from its parents.
		The differences between things or organisms.
		The surroundings of an organism.
		Things in an environment that can change something about an organism.
		Something that is not affected by disease is said to be resistant to it.
	<b>spee-shees</b>	A group of organisms that can reproduce with each other to produce offspring that will also be able to reproduce.
		A set of plants that are in some way different from other members of the same species.
		A set of animals that are in some way different from other members of the same species.
		To mate two organisms of the same species to produce offspring.
		When different varieties or breeds are mated with one another.
		When humans choose certain animals and plants that have useful characteristics and breed more of these organisms.
		How much of something useful to humans that an organism produces.

# Adaptation and Inheritance Test Yourself

## Inherited or Environmental Characteristics

Place a  in the correct box to show whether the characteristic is inherited or caused by environmental factors.

Feature	Inherited	Environmental
Tattoos		
Brown eyes		
Blood group		
Scars		
Accent		
Skin colour		

## Continuous or Discontinuous Variation

When studying a group of people, continuous variation covers any feature in which there will be a range of results. Discontinuous variation involves no range of results; there is a limited number of outcomes.

Complete the word search, marking the characteristic in blue if it is continuous and green if it is discontinuous.

g	t	t	e	r	l	r	d	r	b	u	d	e	e	b	Blood group
h	n	u	h	g	s	e	e	l	t	e	a	n	u	o	Ear lobes
e	g	i	o	b	a	o	d	h	e	i	g	h	t		Gender
c	r	o	l	o	r	o	s	n	n	u	i	h	o	a	Hand span
e	p	p	h	l	d	d	n	t	u	e	l	s	i	o	Height
o	i	e	o	g	o	e	t	s	a	c	g	i	e	r	Shoe size
h	u	b	r	t	n	r	w	p	a	t	e	n	h	h	Tongue rolling
o	e	o	n	n	m	m	e	e	i	r	u	n	m	c	Weight
s	u	a	h	m	u	h	m	u	i	i	n	t	o	r	
p	n	a	p	s	d	n	a	h	g	g	r	u	d	t	
e	z	i	s	e	o	h	s	o	r	n	h	t	t	e	
x	a	n	t	y	s	e	e	e	g	r	o	t	o	o	
u	s	c	o	u	a	d	a	u	c	s	m	t	h	i	
i	b	e	l	p	d	a	e	g	e	e	r	y	l	s	
e	n	h	i	m	e	h	i	r	n	y	e	t	t	e	

## Natural Selection

Who is the person who studied natural selection and survival of the fittest?

---

---

What is natural selection?

---

---

---

---

Give an example of natural selection.

---

---



# Adaptation and Inheritance

## Test Yourself Answers

### Inherited or Environmental Characteristics

Place a  in the correct box to show whether the characteristic is inherited or caused by environmental factors.

Feature	Inherited	Enviromental
Tattoos		<input checked="" type="checkbox"/>
Brown eyes	<input checked="" type="checkbox"/>	
Blood group	<input checked="" type="checkbox"/>	
Scars		<input checked="" type="checkbox"/>
Accent		<input checked="" type="checkbox"/>
Skin colour	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

### Continuous or Discontinuous Variation

When studying a group of people, continuous variation covers any feature in which there will be a range of results. Discontinuous variation involves no range of results; there is a limited number of outcomes.

Complete the word search, circling the characteristic in blue if it is continuous and green if it is discontinuous.

g t t e r l r d r b u d e e b	Blood group
h n u h g s e e l t e a n u o	Ear lobes
e g i o b o a o d n e i g n t	Gender
c r o l o r o s n n u i h o a	Hand span
e p p h l d d n t u e l s i o	Height
o i e o g o e t s a c g i e r	Shoe size
h u b r t n r w p a t e n h h	Tongue rolling
o e o n n m m e e i r u n m c	Weight
s u a h m u h m u i i n t o r	
p n a p s d n a h g g r u d t	
e z i s e o n s o r n h t t e	
x a n t y s e e e g r o t o o	
u s c o u a d a u c s m t h i	
i b e l p d a e g e e r y l s	
e n h i m e h i r n y e t t e	

### Natural Selection

Who is the person who studied natural selection and survival of the fittest? **Charles Darwin**

What is natural selection? **Organisms with the desired characteristics will survive and pass onto offspring**

Give an example of natural selection. **Any suitable example ie. Peppered Moth or Rabbit**

# Variation

Watch this video: <https://www.youtube.com/watch?v=sNU30T2EmQ8>

Task	Description
1	Create a family tree for your family looking at one inherited characteristic for example noting down the eye colours of each member next to their name.
2	Explain how sexual reproduction promotes variation.
3	Research the reasons why variation is beneficial within a species
4	Define the following key words (in terms of biology): variation, inherited, characteristics, classification, adaptations, habitat, species
5	Make a poster showing the different types of variation (inherited and environmental characteristics) with examples for each.
6	Choose two closely related species that live in two very different environments. Compare and contrast the variations between these species.
7	Research the classification system we use to classify living organisms today. Create a short project about its history and how the species are grouped. Evaluate this system of classification.
8	Make a game based on this topic that could be used as a revision activity for Year 8 pupils preparing for their assessment.