



Science

Evolution and Inheritance

The background of the slide is a light green field populated with numerous cartoon-style sheep. The sheep are depicted in various poses, some facing left, some right, and some slightly angled. They have thick, brown, woolly bodies and small white faces with black outlines for eyes and noses. The overall style is simple and illustrative.

Adaptation, Evolution and Human Intervention

The background of the slide features a repeating pattern of cartoon sheep with thick, brown wool and white faces, standing on a green field. The sheep are positioned around the central text boxes, with some partially visible at the edges.

Aim

- I can explain how adaptations can result in both advantages and disadvantages.
- I can explain how human intervention affects evolution.

Success Criteria

- I can understand that some living things have acquired more adaptive traits than others.
- I can identify advantages and disadvantages of specific interventions.
- I can explain how humans have created new varieties of living things through selective breeding.
- I can demonstrate understanding of the issues raised by human intervention in the evolutionary process.

Adaptation



Read and discuss the following statements.
Are these statements true or false? Explain why to your partner.

Some living things
have a greater
number of
adaptations.
TRUE

All adaptations
enable living things
to survive better.
FALSE



Click the statements to see if
they are true or false.

All living things have
a similar number of
adaptations.
FALSE

Not all adaptations
give living things an
advantage. Some
can cause
disadvantages as
well.
TRUE

Adaptation and Evolution

Remember that **adaptation** is the result of mutations which occur **randomly**.

These can result in **adaptive traits** which confer the living thing with a function that enables it to survive better.

However, the adaptive trait could also do the complete opposite and involve losing a function.

In some cases the adaptive trait neither confers an advantage or disadvantage. It has a neutral effect!

The background of the slide features a repeating pattern of cartoon-style sheep in various shades of brown and tan, grazing on a green field. The sheep are drawn in a simple, friendly manner, with some facing left and others right.

Adaptation and Evolution

Adaptation by natural selection results in evolution if the following 3 conditions are met:

1) The mutation causes a variation in an existing trait.

(The trait exists already, not an entirely new one which is rare).

2) This trait is heritable.

(It can be passed on from parent to offspring. Some traits are dependent on DNA in more than one gene. If the offspring does not inherit all of those genes and DNA then the trait will not be passed on to them.)

3) This version of the trait enables a greater chance of survival than other versions of the trait.

(Having thicker fur is an adaptation that has enabled animals in colder parts of the world to survive better so animals with thinner fur became extinct in those parts of the world. Being taller or shorter as a human confers no advantage in terms of survival and therefore the different versions of this trait have continued to exist.)

Living Fossils

All living things have not adapted or evolved to the same extent.

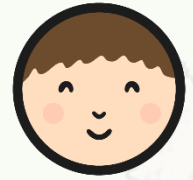
A living fossil is a living species that is highly similar to its ancestors found in fossils. These living things have either had little occurrence of adaptation or the adaptations that did occur did not prove to be an advantage so died out.

Examples of living fossils include:



Photo courtesy of KeresH, James Field (Jame), Ginkgoites_huttoni and Minami Himemiya (commons.wikimedia.org)- granted under creative commons licence – attribution

Advantages and Disadvantages of Adaptation



It is rare that an adaptation will have a completely positive or negative effect on the living thing. Often the adaptive trait confers an advantage but can cause other disadvantages, even if these do not harm the chances of the living thing's survival.

Use the following activity sheet to cut out and match the advantages and disadvantages caused by specific adaptive traits.





Advantages and Disadvantages of Adaptation

Cut out and match an advantage and a disadvantage for each adaptive trait.

Advantage	Adaptive Trait	Disadvantage

twinkl planit Source: twinkl.co.uk and the National Curriculum Framework for Science Class 6

Advantages and Disadvantages of Adaptation

Can eat leaves from tall trees.	 Forward facing eyes	Have to rest more often as can't rest one leg at a time.
Can grow on land that is not always wet.	 long neck	Does not allow a wide view of the environment.
Frees up limbs to carry food.	 Vascular Plants can transport water and food up roots, stems and leaves.	More vulnerable to attack when drinking water.
Allows accurate judgement of distances.	 Broadshank	More likely to desiccate (dry out) and lose more water.

twinkl planit Source: twinkl.co.uk and the National Curriculum Framework for Science Class 6

Evolution and Human Intervention

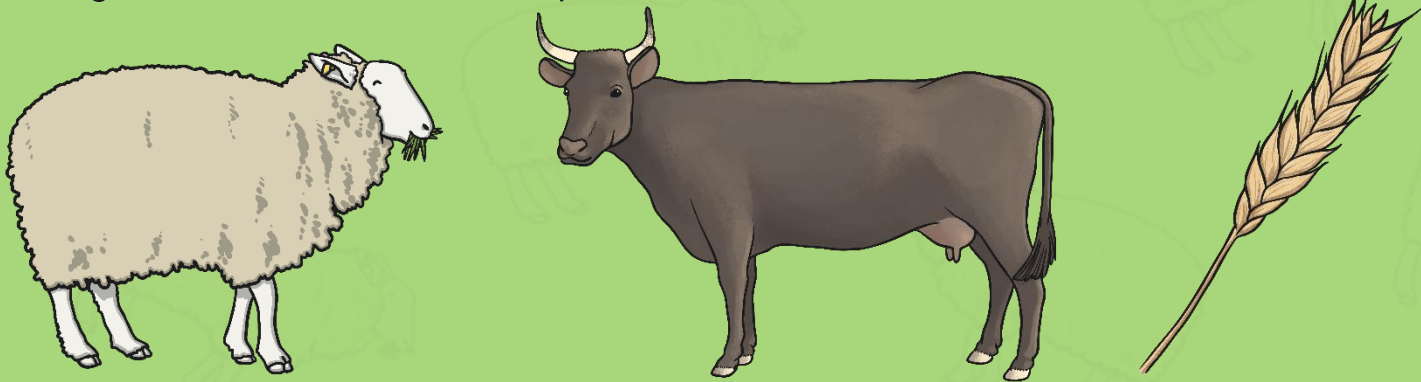
Human beings are unique among living things in their ability to affect the evolutionary process of natural selection. They have done this through a process called **selective breeding**. There is evidence from as long ago as 7000BC that farmers were selectively breeding plants and animals.

Selective breeding (or **artificial selection** as it is sometimes referred to) involves humans deliberately breeding plants and animals to produce **particular characteristics**. This results in **new varieties** of plants or **breeds** of animals.

Evolution and Human Intervention

Examples of selective breeding include cows that can produce more milk, sheep with thicker coats of wool, wheat that produces more grain and different colouring in flowers.

There is **no evolutionary advantage** to the living thing from the selective breeding process. If there had been, these characteristics would have occurred through the natural selection process.

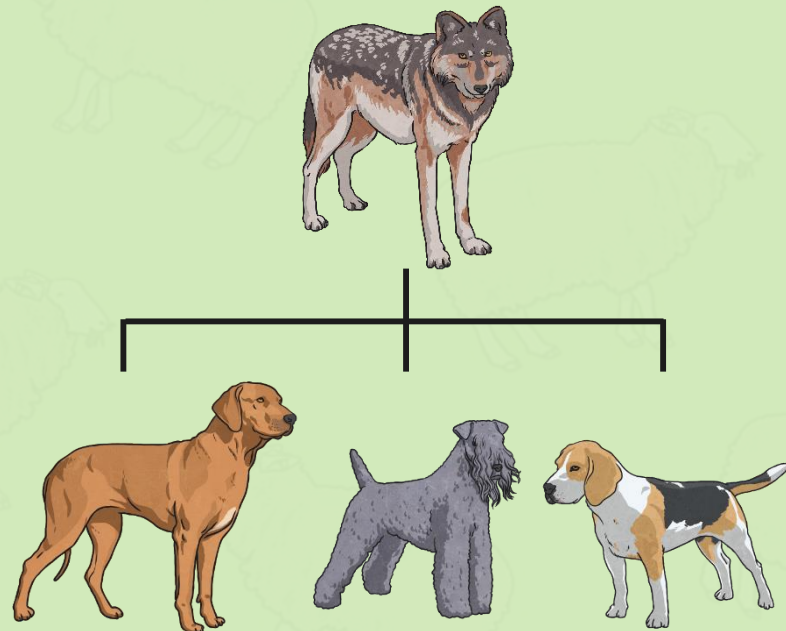


Selective Breeding

Process of Selective Breeding:

1. Decide which characteristic is important e.g. amount of milk produced.
2. Find parents who show this characteristic.
3. From their offspring, choose the ones who share this characteristic and only let them reproduce.
4. Repeat the process continuously.

Selective breeding produces new varieties of an existing **species**, not new species.



Cross Breeding



Cross breeding is a process through which two parents from the **same species** are bred in order to combine particular characteristics from each parent. The process is very similar to the selective breeding process, except the offspring must have the selected characteristics from **both parents**.



Poodle

+



Labrador

=



Labradoodle

Photo courtesy of lifeinmyzoo, Micheal Gwyther-Jones and alexis Farm Photography (@flickr.com)- granted under creative commons licence – attribution

Cross Breeding



Fragaria Chiloensis

+



**Fragaria
Virginiana**

=



**Garden
Strawberry**

Photo courtesy of Mike, Walter Siegmund and Prathyush Thomas (commons.wikimedia.org)- granted under creative commons licence – attribution

Selective and Cross Breeding



In your group, use the Selective and Cross Breeding Cards to match the parent(s) with the offspring that has been selectively bred.

Remember: in some cases the **selective and cross breeding** processes will have taken place over long periods of time so we are looking at the original parent and the current offspring as a result of this process.

Set out the cards as a Carroll Diagram (see below).

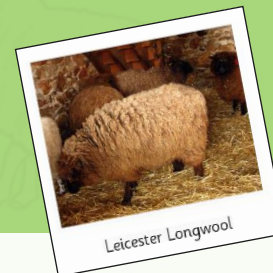
	Parent(s)	Offspring
Selective Breeding		
Cross Breeding		



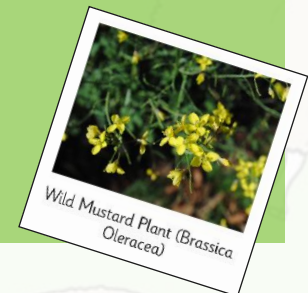
Canary



Shire Horse



Leicester Longwool



Wild Mustard Plant (Brassica Oleracea)

Selective and Cross Breeding Cards Answers



	Parent(s)	Offspring
Selective Breeding	Wild Mustard Plant	Broccoli
	Teosinte	Sweetcorn
	Lincoln Longwool	English Leicester
	Draught Horse	Shire Horse
Crossbreeding	Flagaria Chiloensis and Fragaria Virginiana	Garden Strawberry
	Poodle and Labrador	Labradoodle
	White Carrot and Yellow Carrot	Orange Carrot
	Goldfinch and Canary	Mule

Genetic Modifications



Selective and cross breeding was limited and was not successful in all cases. Typically the living things would have to be from the same species or at a push the same genus. However, some attempts a breeding did not work. Breeding did not result in a successful embryo or plant. At other times, there were offspring but they were sterile (therefore could not reproduce).

Advances in genetics and technology has pushed the science of breeding to a new level.

- **Genetically Modified Foods (GM Foods)**
- **Cloning**
- **Animals growing human parts and organs**

Genetic Modifications



Should humans intervene in this way? Why? Why not?
What effect will this have on living things in the future?



Genetically Modified
Foods (GM Foods)



Cloning



Animals growing human
parts and organs

Photo courtesy of International Rice Research Institute (IRRI) and Toni Barros (commons.wikimedia.org) - granted under creative commons licence — attribution

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