YEAR 6: SPRING 1 & 2 – SURVIVAL OF THE FITTEST

SCIENCE: Living things and their habitats

UNDERSTAND, DESCRIBE AND EXPLAIN: CLASSIFICATION OF LIVING THINGS

To understand and describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals

Classify	***Classification***		***Species***	***Characteristics***	***Similarities***	***Differences***	***Traits***	***Phyla/Phylum***
5 Kingdoms	***Plants***		***Animals***		***Fungi***	***Bacteria***		***Viruses***
Vertebrates	***Fish***		***Birds***	***Mammals***	***Amphibians***	***Reptiles***	***Cold-blooded***	***Warm-blooded***
Invertebrates	***Marine Invertebrates***		***Mollusks***	***Crustaceans***	***Worms***	***Insects***	***Arachnids***	***Myriapods***

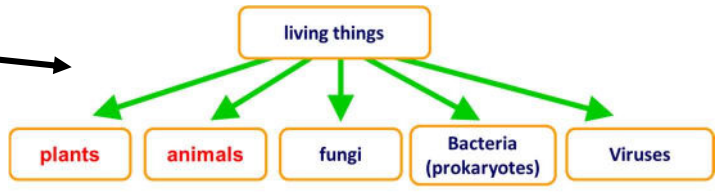
Learning links:

Science:

Y4: Living things and habitats
Classification/Animals/ Mammals/Amphibians/ Birds/ Insects/Traits

Revisit, revise and build upon Year 4 learning journey: Classification

Classification:
All ***living things*** are ***classified*** into ***5*** main groups called ***kingdoms***.
Within each ***kingdom***, these ***living things*** are ***grouped*** more ***specifically*** based on their specific ***characteristics*** and ***traits***.
The animal kingdom is split in to ***2 phyla*** (groups) – ***vertebrates*** and ***invertebrates***.



THINKING POINT:

Can you remember what the 5 kingdoms of living things are without looking?

How animals are classified – vertebrates and invertebrates:
Vertebrates (with backbone) are ***classified*** by the chordate sub-phylum: ***vertebrata***.
Invertebrates (without backbone) are any other animal that is classified outside of that class.
There are currently around ***65,000*** known ***species*** of ***vertebrate*** animals. This sounds like a lot, but vertebrates are only around ***3%*** of all the animals on ***Earth***. ***Most*** of the animal species (97%) are ***invertebrates (around 2.1million)***.

Vertebrates:
Only 3*%* of all the ***animal species*** on ***Earth*** are ***vertebrates***. They can be grouped in to the following way:

- **Fish** - Fish are animals that ***live in the water***. They have ***gills*** that allow them to ***breathe under water***. Different species of fish may live in ***fresh water*** or ***salt water***. Some examples of fish include the brook trout, the great white shark, lionfish, and the swordfish.
- **Birds** - Birds are animals that have ***feathers, wings, and lay eggs***. Many, but not all, birds can fly. Some examples of bird species include the bald eagle, the cardinal, the flamingo, ostriches, and the red-tailed hawk.
- **Mammals** - Mammals are ***warm-blooded*** animals that ***nurse their young with milk*** and have ***fur*** or ***hair***. Some examples of mammals include humans, dolphins, giraffes, horses, and spotted hyenas.
- **Amphibians** - Amphibians are ***cold-blooded*** animals. They ***start*** out their ***lives*** living in the ***water*** with ***gills*** just like fish. ***Later***, they ***develop lungs*** and can ***move*** to ***dry land***. Amphibians include frogs, toads, newts, and salamanders.
- **Reptiles** - Reptiles are ***cold-blooded*** animals which ***lay eggs***. Their ***skin*** is covered with hard and dry ***scales***. Reptile species include alligators, crocodiles, snakes, lizards, and turtles.

THINKING POINT:

Surprisingly, a bat is a mammal even though it has wings. Why is it not a bird?

Vertebrates can be either ***warm-blooded*** or ***cold-blooded***.
A ***cold-blooded*** animal ***cannot maintain*** a constant ***body temperature***. The temperature of their body is ***determined*** by the ***outside surroundings***. Reptiles, amphibians, and fish are all cold-blooded.
Warm-blooded animals are ***able*** to ***regulate*** their ***internal temperature***. They can ***sweat*** or ***pant*** to ***cool-off*** and have ***fur*** and ***feathers*** to help keep them ***warm***. Only ***birds*** and ***mammals*** are ***warm-blooded***.

THINKING POINT:

Which vertebrates are cold blooded?

Invertebrates:
97*%* of all the ***animal species*** on ***Earth*** are ***invertebrates***. They can be grouped in to the following way:

- **Marine Invertebrates** - There are a ***wide variety*** of interesting ***ocean animals*** that are ***invertebrates***. These include sponges, corals, jellyfish, anemones, and starfish.
- **Molluscs** - Molluscs have a ***soft body*** that is covered by an ***outer layer*** called a ***mantle***. ***Many*** molluscs live ***inside a shell***, but not all of them. Some examples of molluscs include squid, snails, slugs, octopuses, and oysters.
- **Crustaceans** - Crustaceans are a type of ***arthropod***, meaning that they have ***jointed legs***. They also have an ***exoskeleton*** (their bones are on the outside like a shell). Some examples of crustaceans are crabs, lobster, shrimp, and barnacles.
- **Worms** - The term "worm" is not a scientific word, but is often used to refer to ***invertebrate animals*** that ***don't have legs***. Worms ***may live*** in the ***soil***, in the ***water***, or even ***inside other animals*** as parasites. Some examples include the tapeworm, the leech, and the earthworm.
- **Insects** - Insects are part of the ***Earth's largest animal phylum***, the ***arthropods***. There are ***over 1 million species*** of insects including such animals as the grasshopper, dragonfly, yellow jacket, butterfly, and praying mantis.
- **Spiders, Centipedes and Scorpions** - These animals are all part of the ***arthropod phylum***. ***Spiders*** and ***scorpions*** are ***arachnids*** because they have ***eight legs***. ***Centipedes*** and ***millipedes*** are ***myriapods*** and have ***lots of legs***.

THINKING POINT:

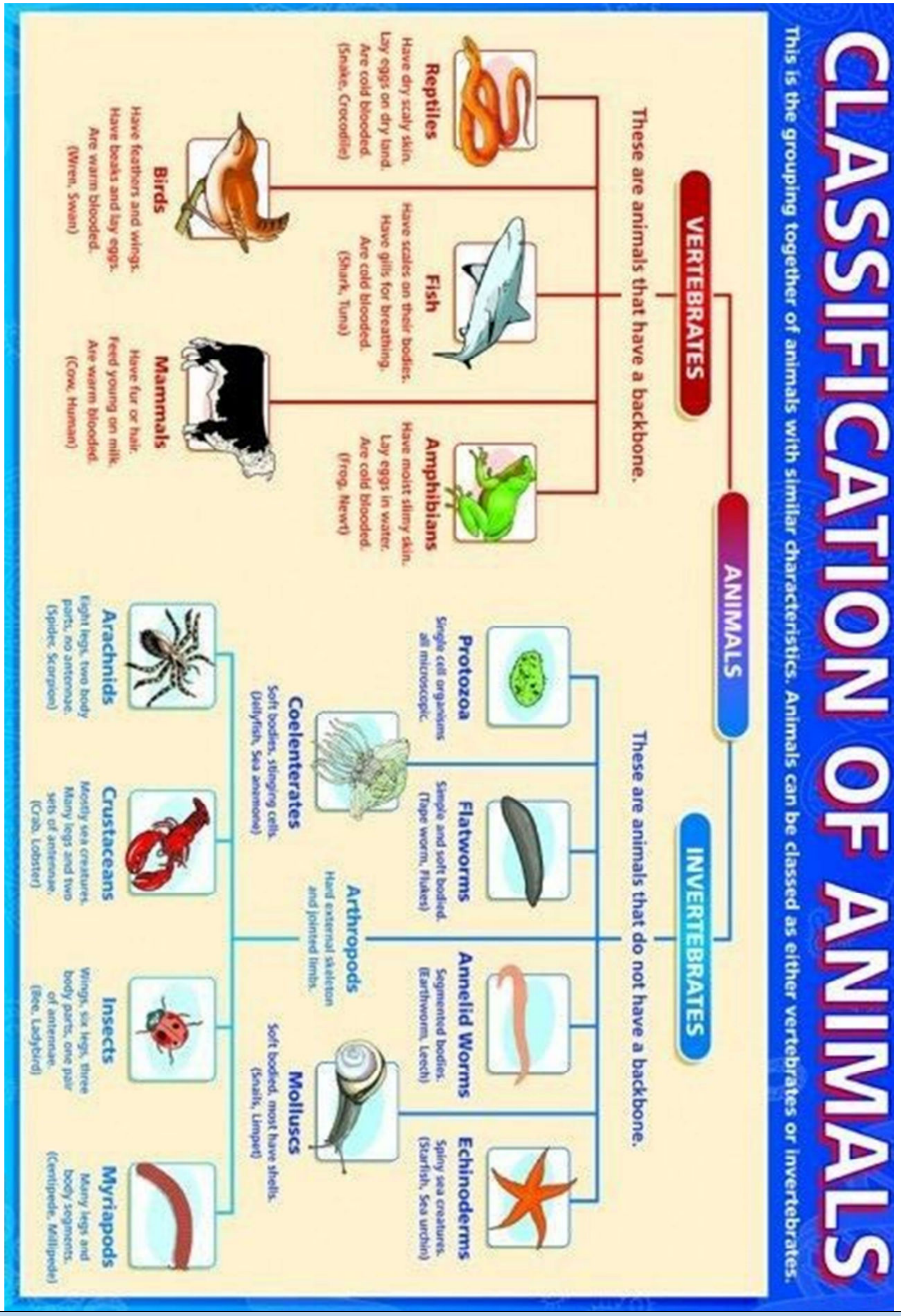
What is one difference between an insect and an arachnid?

Micro-organisms:
Micro-organisms are very ***tiny living things***. They are ***so small*** that you need a ***microscope*** to see them (that's what the prefix micro means).
Micro-organisms are ***all around us***: in the ***air***, in our ***bodies*** and in ***water***. ***Some*** micro-organisms are ***harmful*** to us, but ***others*** are ***helpful*** to us.
There are **3 types** of micro-organism:

Fungi	Bacteria	Viruses

Plants:
There are more than ***350,000 species*** of ***plants*** differing from every other species in one or more ways. However, plants also have many ***features*** in ***common***. Based on these ***similarities***, scientists are able to ***classify*** distinct plants into ***5 groups:***

Seed plants	Ferns	Lycophytes	Horsetails	Bryophytes



ENQUIRE, TEST, RECORD, REPORT AND CONCLUDE:

HYPOTHESISE **ENQUIRE** **TEST** **RECORD** **REPORT** **CONCLUDE**	**The Yeast Growing investigation: What is the best habitat?** To test the growth of bacteria in a variety of settings and with varying food amounts. Using 6 equal-sized bottles, add 30ml of luke-warm water and a 5g sachet of yeast then stir. Change the following variables: 1. Place in a dark cupboard. 2. Place in a dark cupboard and add 10g sugar then stir. 3. Place in a dark cupboard and add 20g sugar then stir. 4. Place on the windowsill in the sunshine. 5. Place on the windowsill and add 10g sugar then stir. 6. Place on the windowsill and add 20g sugar then stir. Attach a balloon to the bottleneck of each bottle before placing. Using a tape measure, record the diameter of the balloon every 30 minutes.

UNDERSTAND, DESCRIBE AND EXPLAIN: CAROLUS LINNAEUS AND HIS CLASSIFICATION SYSTEM

To find out about the significance of the work of scientists such as Carl Linnaeus, a pioneer of classification

Carl Linnaeus	***Classification***	***Classify***	***System***	***Living things***	***Organisms***	***Characteristics***	***Biology***
Kingdom	***Phylum***	***Class***	***Order***	***Family***	***Genus***	***Species***	***Binomial name***

Carolus Linnaeus: 1707 - 1778

First proposed a classification system for living things.

What is classification?

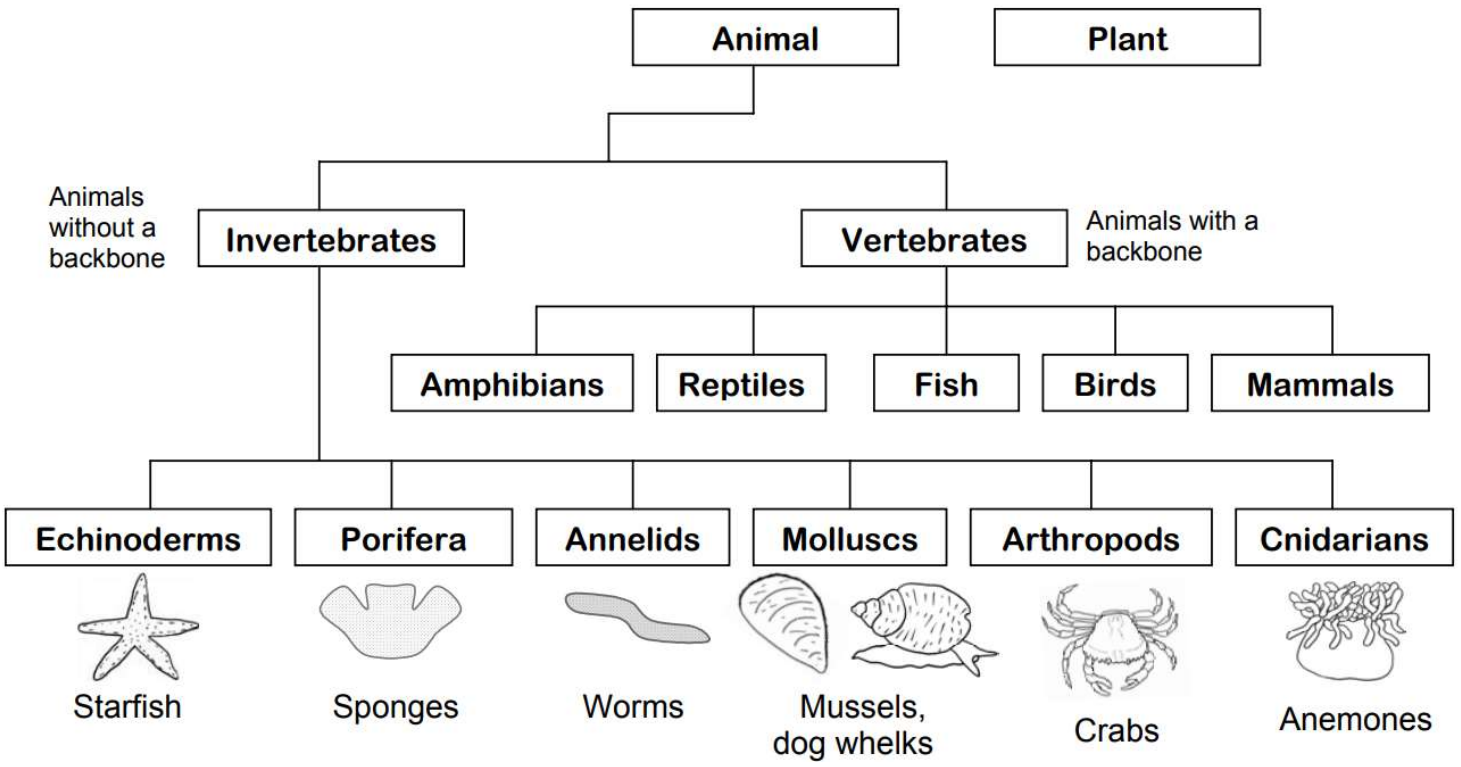
Classification, in the natural world, is ***sorting living things*** into ***groups*** based on ***shared characteristics*** or ***features***. The ***process*** of ***classifying*** living things, or organisms, is referred to as ***taxonomy***. The first living organism classification system was proposed by an 18th Century ***Swedish*** scientist named ***Carolus Linnaeus***. The ***Linnaean classification system*** works on the level of ***similarity*** between ***organisms***. It starts with two distinct ***groups***, or ***Kingdoms***, and goes right down to the ***species*** level. This ***framework*** behind ***Linnaean classification*** is still widely accepted by biologists today!

Why is classification important?

Classification systems, in their broadest sense, help us ***make sense*** of the ***world*** around us. Without them the world would be chaos! Think of how much ***easier classification systems*** make life in an ***everyday setting*** e.g. searching the internet or tracking through for your favourite song on your iPod.
It is exactly the same in the world of ***biological science***. We need to ***group living things*** so that scientists worldwide, who may even speak different languages, have a ***common means of referring to organisms*** they are studying. This ***helps scientists*** share their ***findings*** and ***advance scientific understanding***. We can also ***track*** our ***evolutionary history*** by using ***classification systems***.

How do we classify?

By using a ***hierarchical system***, which is a posh term for a ***tree diagram***! Groups exist other than the ones described below. If we were to include them all, the tree would be much bigger than the one shown!

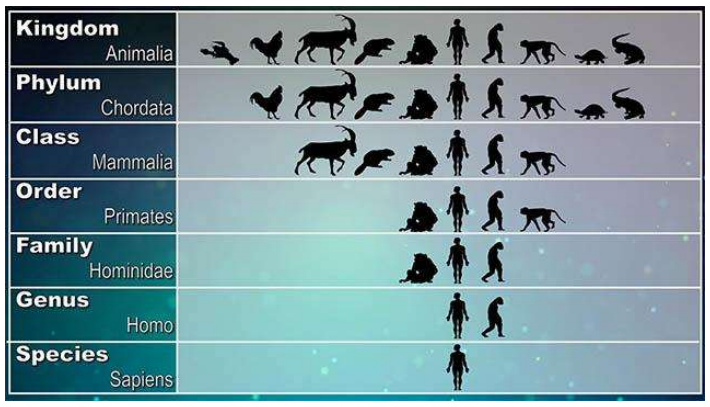


There are ***7 levels of classification*** when classifying or grouping living things.
An example for humans has been done for you:

1. **Kingdom** = Animalia (Animal)
2. **Phylum** = Chordata (Vertebrate)
3. **Class** = Mammalia (Mammal)
4. **Order** = Primates
5. **Family** = Hominidae
6. **Genus** = Homo
7. **Species** = Sapiens

Binomial Name = Genus + Species

Homo Sapiens



There are ***over 2 million species*** in the world, and that's only the ones that ***have been named***. Estimates range from ***10 – 100 million*** in ***existence***. Imagine telling your fellow scientist about one of them without a classification system in place!

THINKING POINT:

Using a classification key, could you classify a lion and work out its binomial name?

KEY ASSESSMENT QUESTIONS AND SCENARIOS:

EXS:

1. Can you explain what type of living thing the following are and why they fall in to this category:
   i. Monarch butterfly
   ii. Fruit bat
   iii. Dolphin

GDS:

1. Why is a classification system so important to understand the living world?

YEAR 6: SPRING 1 & 2 – SURVIVAL OF THE FITTEST

SCIENCE: Evolution and inheritance

UNDERSTAND, DESCRIBE AND EXPLAIN: EVOLUTION AND INHERITANCE

To recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago

To recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents

To identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

Evolution (n)	***Inheritance (n)***	***Adaptation (n)***	***Living thing***	***Offspring***	***Reproduction***	***Sexual***	***Asexual***
Evolve (v)	***Inherit (v)***	***Adapt (v)***	***Traits***	***Characteristics***	***Environment***	***Ancestors***	***Similarities***
Charles Darwin	***Naturalist***	***Biologist***	***Geologist***	***Galapagos islands***	***Natural selection***	***Theory***	***Differences***
Generations	***Habitat***	***Lifestyle***	***Expedition***	***Originate***	***Advantageous***	***Accessible***	***Tree of life***

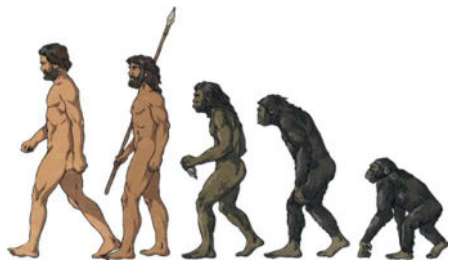
Learning links:
Science:
Y3 – Fossils
Y3 - Plants
Y4 – Living things and their habitats
Y5 – Living things and their habitats
Y6 – Living things and their habitats

Revisit, revise and build upon Year 3 learning journey: Fossils

This learning links to all of the work you have been doing in science at Ocean Academy about living things and their habitats, animals including humans and fossils in year 3. If you cannot remember this or need to refresh your memory, have a read over the previous learning journey maps.

Key Definitions:

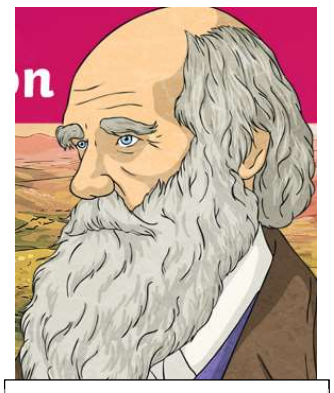
Evolution: The way a ***living thing gradually develops*** and ***changes over time***.
Inheritance: The ***passing on*** of ***traits*** or ***characteristics*** from ***parents*** to their ***offspring*** through ***reproduction***.
Adaptation: The ***process*** of ***change*** by which a ***living thing*** becomes ***better suited*** to its ***environment***.



The Theory of Evolution:

Charles Darwin (1809-1882) introduced the ***theory of evolution***. He was a ***famous English naturalist*** (an ***expert*** in ***studying nature***), ***biologist*** (an expert in ***living things***) and ***geologist*** (an expert in ***rocks and fossils***). He ***discovered*** that ***humans*** and ***apes*** shared common ***ancestors,*** which led to this famous image:

Charles Darwin published his scientific ***theory*** of ***natural selection*** in a book called '***On the Origin of Species'*** in ***1859***. Darwin's ***theory*** explained how ***every living thing*** is ***connected*** in a ***family tree*** that stretches back ***billions*** of ***years*** to the ***beginning*** of ***life*** on ***Earth***.
Charles Darwin observed that, although ***individuals*** in a ***species*** shared ***similarities***, they were ***not exact copies*** of each other; there were ***small differences*** or ***variations*** between them.
He also ***noticed*** that ***everything*** in the ***natural world*** was in ***competition***.



Charles Darwin (1809-1882)

The ***winners*** were those that had ***characteristics***, which made them ***better adapted*** for ***survival***.
These ***living things*** were ***more likely*** to ***reproduce*** and ***pass on*** their ***useful characteristics*** to their ***offspring***.
Animals who were ***poorly adapted*** were ***less likely*** to ***survive*** and their ***characteristics*** were ***less likely*** to be ***inherited***.
Over time, the ***characteristics*** that ***help survival*** become ***more common*** and a ***species gradually changes***.
Given enough time, these ***small changes*** can ***add up to the extent*** that a ***new species*** altogether can ***develop/evolve***.

THINKING POINT:

Why do you think people were/are so sceptical about Darwin's theory of evolution?

Can we see evolution happening?

Evolution happens over a very ***long time*** so we ***do not notice it*** happening.
One ***animal***, ***plant*** or ***person*** does not just ***change or evolve*** over night, ***small changes*** occur across ***generations***.
Evolution happens through ***inheritance*** – meaning that ***tiny changes*** can only ***happen*** through reproduction as ***traits pass*** to the ***next generation***.

What sort of changes?

Animals and plants ***evolve*** through ***generations*** to make ***adaptations*** to ***survive*** and ***survive better***. ***Some*** of these ***changes*** are down to ***habitats and lifestyle***.

As part of his ***most famous expedition*** to the ***Galapagos Islands*** (off of the west coast of ***South America***), ***Darwin studied*** different ***finches*** living in ***different parts*** of the ***Galapagos Islands*** and realised, even though they ***were different***, they all had the ***same ancestors***. However, ***some*** had ***evolved*** to have ***larger beaks*** in certain areas, ***some*** with ***smaller beaks*** in other areas due to ***different food being available***.

Looking at the ***finches above***, you will ***notice*** how ***different*** they are from one another even though they all ***originate from the same single species of finch***.
The Galapagos islands are made up of 127 islands (19 large and 4 inhabited).
As the ***finches spread and settled*** across the ***different islands***, they were ***faced*** with ***differences*** in: the ***habitat***, the ***food available*** and the ***types*** of ***predators*** around – they had to ***adapt***.

On ***some islands***, the ***food*** was only ***accessible*** if the finches had ***larger beaks*** and therefore, ***over time***, the birds with ***smaller beaks*** were ***unable*** to ***survive*** and ***died out***.
As ***only*** the ***finches*** with ***larger beaks*** were able to ***survive*** and ***reproduce***, eventually, only finches with ***large beaks*** were now ***existing*** on these islands.
However, on ***other islands***, a ***smaller beak was advantageous*** for ***gathering food*** and therefore, over ***generations***, all ***finches*** on these islands had ***small beaks***.

This was also the case with the ***patterns and colour*** of the birds' *feathers*. Depending on the plants and colour of these on the island, ***certain finches*** had a ***better chance*** of ***evading predators*** and others did not. Hence why, on different islands, the birds (from the same ancestors) ***now have different colour feathers***.
This is a ***direct observation of evolution over time***.

THINKING POINT:

Explain to a partner why the finches changed over time?

UNDERSTAND, DESCRIBE AND EXPLAIN: EVOLUTION AND INHERITANCE

To recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago

To recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents

To identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

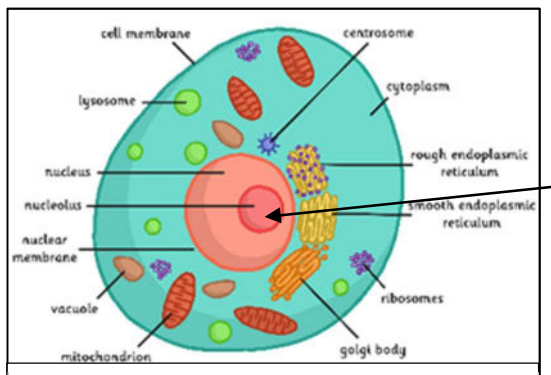
Inheritance (n)	***Cells***	***DNA***	***Living things***	***Amoeba***	***Chromosomes***	***Nucleus***	***Characteristics***
Inherit (v)	***Replicate (v)***	***Relative***	***Genes***	***Genetics***	***Parent***	***Offspring***	***Identical***
Similar	***Similarities***	***Different***	***Differences***	***Mixture***	***Combination***	***Embryo***	***Development***

Learning links:

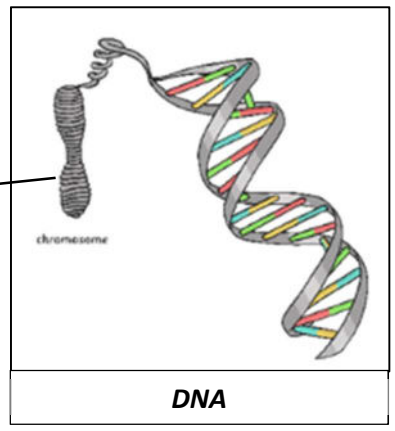
Science:
Y3 – Fossils
Y3 - Plants
Y4 – Living things and their habitats
Y5 – Living things and their habitats
Y6 – Living things and their habitats

Inheritance:

To ***understand inheritance***, we need to ***understand*** a little bit about ***cells*** and ***DNA***.
Cells are the ***building blocks*** of ***all living things***. All living things are ***made up of cells***. ***Amoebas*** have ***one cell***.
Humans have trillions of cells!
Inside each ***cell*** is a ***nucleus***. This part of a cell ***contains chromosomes***, which are made up of ***DNA***.
DNA carries the ***characteristics*** that we ***inherit***. It is ***located*** in the nucleus in the ***cell***.
DNA can ***replicate*** and ***make copies*** of ***itself***. When cells ***divide***, each cell needs to have an ***exact copy*** of the ***DNA*** in the old cell.



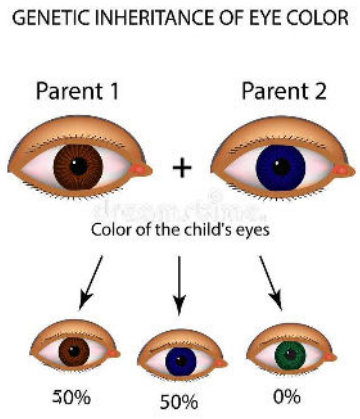
A human cell



DNA

When we talk about ***inheritance***, we often mean things that are ***passed on*** to us when one of our ***relatives*** or friends has ***died***. ***Inherited*** items are sometimes houses or ***important objects***.

In ***science***, ***inheritance*** refers to the ***genes*** that are **passed on** from ***parents to offspring***: The ***DNA coding*** that makes you who you are is a ***mixture*** given to you by ***both of your parents***.
That's why you are ***not exactly identical*** to either of them but you are ***similar to both***.
When we refer to ***inherited characteristics*** we ***tend to focus*** on ***physical characteristics*** as these are easy to spot but ***inherited characteristics*** include ***abilities, such as taste and smell***.



Inheritance is when this ***DNA***, ***coded*** with ***characteristics***, is ***passed on*** to the ***offspring*** from their ***parents*** through ***sexual*** or ***asexual reproduction***. The ***offspring inherit*** the ***characteristics*** from ***both parents*** but the way they ***combine*** makes the ***offspring unique***.
The ***inherited characteristics*** can ***combine*** in ***different ways***, which is the reason why ***siblings inherit*** the ***same characteristics*** but are ***not identical*** to each other. Even ***identical twins*** that ***share*** the ***exact same combination of DNA*** are ***not 100% the same***!
This is due to the fact that ***genes develop separately*** when the ***twins*** are ***embryos*** (early development in the womb) or during later development.

THINKING POINT:

Why, because of inheritance, are you not exactly identical to your siblings?

ENQUIRE, TEST, RECORD, REPORT AND CONCLUDE:

HYPOTHESISE
ENQUIRE
TEST
RECORD
REPORT
CONCLUDE

To analyse the advantages and disadvantages of specific adaptations:
Observing and researching various living things in the local environment or those living in extreme conditions, make observations of their characteristics and try to explain why they have adapted this way.

Comparing similar species living in different climate zones/biomes, make observations of the similarities and differences in characteristics and try to explain why and how these adaptations have occurred. (zebra and horse)

Looking and observing the characterisitics of various living things, analyse the advantages and disadvantages of specific adaptations, such as being on 2 feet rather than 4, having a long or a short beak, having gills or lungs, tendrils on climbing plants, brightly coloured and scented flowers. Can they explain these adaptations?

KEY ASSESSMENT QUESTIONS AND SCENARIOS:

EXS:	**GDS:**
Consider examples of living things in some of the harshest environments of the earth (cactuses, penguins and camels), how have they evolved to suit their habitat? How do they survive? Use all of your understanding of evolution, inheritance and adaptation to answer this question.	Summarise and explain Charles Darwin's, 'Theory of Evolution' so that a targeted audience can understand it. Use diagrams in your answer.

UNDERSTAND, DESCRIBE AND EXPLAIN: FOSSILS AND HOW THEY HELP US TO UNDERSTAND EVOLUTION

To recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago

To recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents

To identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

Learning links:
Science:
Y3 – Fossils
Y3 - Plants
Y4 – Living things and their habitats
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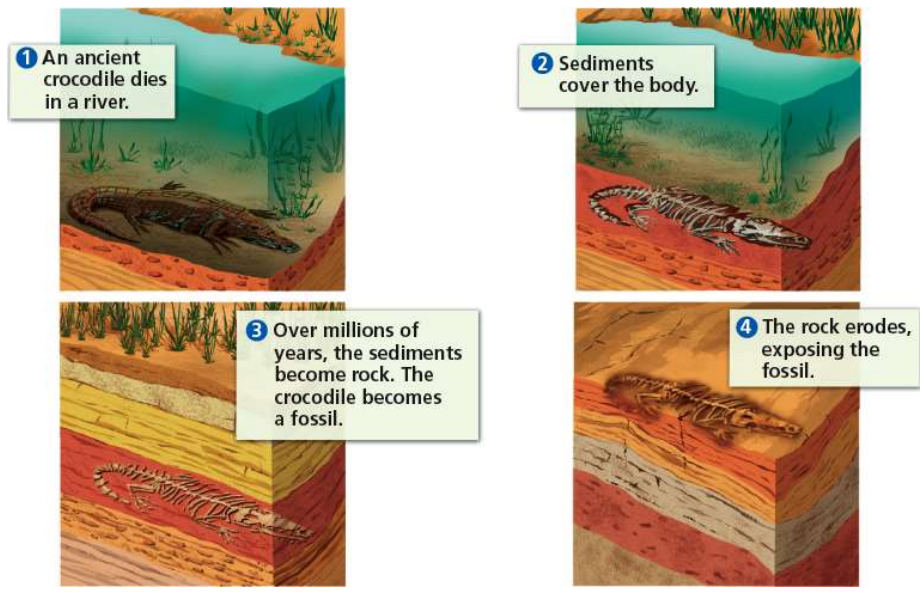
Fossils:

One way of ***observing the effects of evolution and inheritance over time*** is through ***fossils***.



What are fossils and how are they formed?

A ***fossil*** is the ***preserved*** remains or impressions of a ***living organism*** such as a plant, animal, or insect. Some fossils are very old. Studying fossils helps scientists to learn about the history of life on Earth. Fossils are found all over the world: most are found in ***sedimentary rock*** such as shale and sandstone.

Fossils help us to ***understand evolution*** and inheritance further as we can ***see how living things*** have ***changed*** over ***long periods of time*** and ***investigate similarities*** and ***differences*** in and across species.

There are two main types of fossils:

1. ***Body fossils*** - Body fossils are fossils where some portion of the ***actual organism's body remains*** as part of the fossil. This might be a tooth or piece of bone.
2. ***Trace fossils*** - Trace fossils are fossils where there ***isn't any actual part*** of the original organism, but "***traces***" of the organism are ***preserved*** in ***rocks*** and ***minerals***. There are many different types of ***trace fossils*** including ***moulds, animal tracks, casts, and impressions***.

Mary Anning - Victorian Palaeontologist:

Mary Anning was a famous ***fossil hunter*** and collector. She found and identified ***many pre-historic fossils*** from the time of the dinosaurs and sold them to make money for her family.
Anning was one of the ***earliest fossil hunters*** to identify these pre-historic fossils, and she shared her specimens and ***impressive knowledge*** about them with scientists at the time.
Anning was born and grew up in ***Lyme Regis***, on the south coast of ***Dorset***.
Known as the ***'Jurassic Coast'***, this is an area with ***lots of fossils***.
Although recognised by the science community, Anning was ***not admitted*** to The ***Geological Society*** – ***women were not allowed to join*** it until ***1904***.
However, The Geological Society ***did record her death in 1847***, demonstrating her importance.

When she was ***12***, Anning's brother spotted the fossilised skull of an ***Ichthyosaur***.
Anning ***uncovered it*** and ***discovered*** what turned out to be the ***first complete Ichthyosaur fossil*** to be found. In ***1823***, Anning discovered a ***Plesiosaurus*** and, in ***1828,*** she discovered a ***Pterodactylus***.

Many ***scientists*** came to ***visit Anning*** because she was so ***knowledgeable*** about her finds and the many other ***pre-historic fossils.***

THINKING POINT:

Why are fossils such a useful piece of evidence to inform our understanding of evolution and inheritance?