Horn's Mill Science Curriculum

*"Science is a way of thinking much more than it is a body of knowledge." – **Carl Sagan***

Curriculum intent:

At Horn's Mill, we aim to provide a progressive and purposeful science curriculum that excites and enthuses our children. Our science teaching ensures that a greater breadth of knowledge and conceptual awareness is covered than following the National curriculum alone. We introduce physics topics in KS1 and we regularly review understanding to ensure that any child that may have missed some learning in KS2 can still achieve age related expectations at the end of key stage. The rationale and aims reflect the school's vision statement in terms of supporting children to reach their full potential. This also ensures that our science curriculum reflects our school context.

Science at Horn's Mill aims to nurture inquisitive minds, instil a lifelong love of learning and deepen children's scientific knowledge and conceptual understanding through the areas of biology, chemistry and physics. We understand the importance of using high quality texts to engage and support the understanding of difficult concepts and our science curriculum incorporates the use of these texts to explore new concepts as well as making links across other subjects.

Through science, we aim to shape children's understanding of the world around them. They will improve their knowledge of the nature, processes and methods of science. By using different types of scientific enquiry, they will come to appreciate the importance of asking questions and seeking rational explanations. Our children will develop the skills required for scientific enquiry through working scientifically which they can then apply to a wide range of subjects and have the necessary knowledge to access secondary education. Our children will leave Horn's Mill with the necessary scientific knowledge to understand the uses and implications of science, today and for the future. We endeavour to ensure that the Science curriculum we provide will give children the confidence and motivation to continue to further develop their skills into the next stage of their education and life experiences.

Whole school focuses:

At Horn's Mill our pupils practise 7 scientific skills within 5 investigation types.

1. Asking questions
2. Making predictions
3. Setting up tests
4. Observing and measuring
5. Recording data
6. Interpreting and communicating results
7. Evaluating

1. Comparative / fair testing
2. Research
3. Observation over time
4. Pattern seeking
5. Identifying, grouping and classifying

EYFS

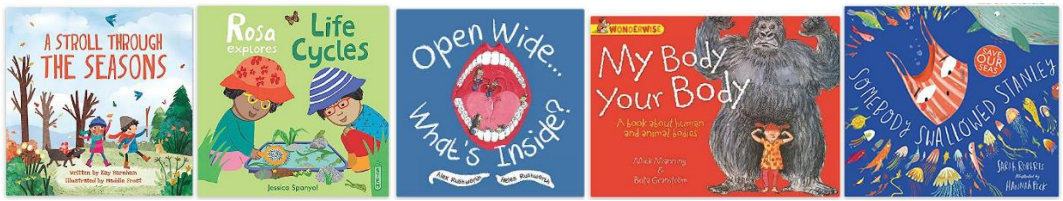
Science knowledge, understanding and skill development in EYFS is taught under the 'Understanding the World' section of Development Matters. It is introduced indirectly through activities that encourage every child to explore, problem solve, observe, predict, think, make decisions and talk about the world around them.
In EYFS the children:

- Explore materials for different properties (natural and man-made)
- Explore and respond to different natural phenomena
- Use all of their senses for hands on exploration
- Explore how things work
- Show the concept of growth, change and decay
- Explore and talk about different forces
- Understand the effect of the changing seasons around them

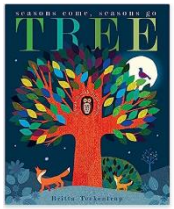
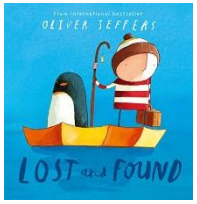
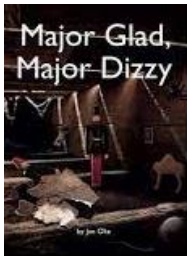
At Horn's Mill our EYFS curriculum includes:

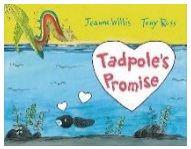
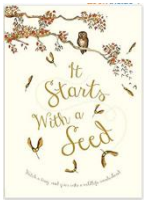
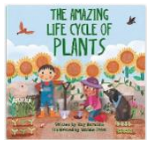
- Seasonal Change - Looking at the noticeable changes between seasons (spring, summer, autumn and winter).
- Animals including Humans - Dental hygiene, Identification and care of wildlife, hands on experience of lifecycles (hatching chicks or butterflies)
- Materials - Identification, clothing and exploration of solids, liquids and gases.

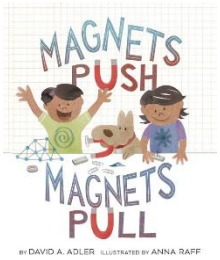
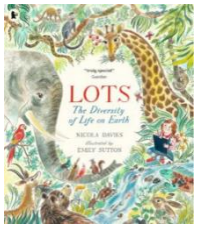
The following books support our EYFS learning.



The lessons provide children with a solid base to allow them to access our science curriculum from Year 1.

Working Scientifically	Year 1	Year 2
Asking simple questions and recognising that they can be answered in different ways Observing closely using simple equipment Performing simple tests Identifying and classifying Using their observations and ideas to suggest answers to questions Gathering and recording data to help in answering questions.	**Context for learning and substantive knowledge**	
	Seasonal Change  Utilising our local natural resources, observe changes across the four seasons over the school year. Children will use the text, Tree: Seasons Come, Seasons Go - (Patricia Hegarty & Britta Teckentrup) and use this knowledge to understand the changes that are happening within their school grounds. Additionally, Team 1 will spot and describe **weather** associated within the different **seasons** and discuss how day length **varies** throughout the year. Key Scientists: **Dr Steve Lyons** (Extreme Weather) **Holly Green** (Meteorologist) Key Question: In which season does it rain the most? Which season has the most daylight?	Living things and their habitats  Our school woodland will be utilised to explore and compare the differences between things that are **living, dead**, and things that have **never been alive**. Using the context of the class text, 'The owl who was afraid of the Dark' children will start to identify that most living things live in **habitats** to which they are suited and describe how different **habitats** provide for the basic needs of different kinds of animals and plants. The class text will also support understanding about how plants and animals depend on each other. Children will utilise their gained knowledge to investigate 'what is living in our woodland?' Here they will learn to name a variety of plants and animals in their specific **habitats** (including **micro-habitats**). Continuing with a focus on local animal species and the text Tad, children will describe how animals obtain their food from plants and other animals and start to explore this using the idea of a simple **food chain**. Key Scientist: **Liz Bonnin** (Conservationist) Key Questions: What is living in our woodland? Why do different animals live in different places?
	Everyday materials  Using the context of the class text, 'Lost and found', explore what material would be best suited for a coat for the boy. Children will learn how to distinguish between an object and the **material** from which it is made and identify and name everyday materials (**wood, metal, plastic, glass, brick, rock, paper** and **cardboard**) Children will further their learning by describing simple physical properties and will compare and group them based on specific criteria. Key Scientist: **Charles Mackintosh** (Waterproof coat) Key Question: What material would be best for a coat?	Everyday materials  Using the context of the class text 'Major Glad and Major Dizzy' and the topic The Reign of Queen Victoria and the Blitz in WW2, identify and compare the **suitability** of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. Children will apply their learning to create protective goggles for a firefighter in WW2. Through investigation, find out how the shapes of solid objects made from some materials can be changed by **squashing, bending, twisting** and **stretching**. Key Scientist: **John McAdam** (Roads) Key Question: How do we choose the best material?

	Animals including humans  Linking with our history topic on Chester Zoo, discuss different known animals. This will then lead to identifying and comparing a variety of **common** animals including fish, amphibians, reptiles, birds and mammals (including our pets). Our learning will then be furthered to identify and name a variety of common animals that are **carnivores, herbivores** and **omnivores** and children will read the book "You're called what?" Children will also be identifying, naming, drawing and labelling the basic parts of the **human body** and say which part of the body is associated with each **sense.** Key Scientist: **Chris Packham** (Animal Conservationist) Key Question: How can we organise all of the animals in a zoo? Which body parts do we use for each sense?	Animals including humans  Using the text, A Tadpoles Promise, (Jeanne Willis) notice that animals, including humans, have **offspring**, which grow into adults. Using the animals from the text and humans, research and describe the basic needs of all animals, for **survival** (**water, food, air**) Furthered through PE sessions, describe the importance for humans of **exercise**, eating the right amounts of different types of food, and **hygiene**. Key Scientist: **Robert Winston** (Human Scientist) Key Question: Do all living things change or stay the same?
	Plants  Using the book, 'It starts with a Seed' and the school grounds, identify and name a variety of common **wild** and **garden plants**, including **deciduous** and **evergreen** trees. We will also utilise our polytunnel where we will plant and grow marigolds, which we will use to identify and describe the basic structure of common flowering plants. Children will compare the marigold structure to that of an oak tree. Key Scientist: **Beatrix Potter** (Author & Botanist) Key Questions: How does my marigold seed change each week? Does an Oak tree have the same structures as a marigold?	Plants  Following the topic of 'Let's get Growing', children will experience planting seeds and bulbs to investigate how dandelions and daffodils, snowdrops or hyacinths need **water**, **light** and a suitable **temperature** to grow and stay healthy. With this knowledge and supported by the book 'The amazing life cycle of plants' children will observe and describe how seeds and bulbs grow into **mature** plants. Key Scientist: **Agnes Arber** (Botanist) Key Question: Do bigger seeds grow into bigger plants? Why do dandelions grow in our school grounds?
	Forces and Light (exploratory learning) In preparation for future science learning, Team 1 will explore the concepts of **pushes** and **pulls**.	Sound (exploratory learning) As a further early introduction to physics, children will explore the concepts of sound where they will consider how sound is made and also why are some sounds **louder** or **quieter** than others.

	For their light topic, they will develop an understanding of sun safety and explore what '**dark**' is.	
Working Scientifically	**Year 3**	**Year 4**
Asking relevant questions and using different types of scientific enquiries to answer them Setting up simple practical enquiries, comparative and fair tests Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including	**Context for learning and substantive knowledge**	
	Forces and Magnets At the start of this unit, pupils will make comparisons regarding how things move on different surfaces. They will later notice that some **forces** need contact between two objects but **magnetic forces** differ as they can act at a **distance**.  Utilising the text 'Magnets Push, Magnets Pull' and their own investigations, Team 3 will observe how magnets **attract** some materials and not others. They will then use grouping and classifying to distinguish whether the materials are **magnetic** or not. This will lead to then finding **magnetic materials**. Children will also explore magnets having **two poles** and that they can **attract** or **repel** each other. Predictions will also be made as to whether two magnets will **attract** or **repel** depending on which poles are facing. Key Scientists: **William Gilbert** (Developed the theory of Magnetism) Key Question: Does the size and shape of a magnet affect how strong it is? What materials are magnetic?	Living Things and their Habitats  With a focus on common UK grassland animals recognise that living things can be grouped in a variety of ways. Children will be introduced to **branch keys** and will use these to help **group, identify** and **name** a variety of living things in their local and wider environment. Pupils will apply these skills to identifying common **native** species in the school grounds and local area. Through the context of the class text, Gorilla, pupils will come to understand that **environments** are constantly changing and that this can sometimes pose dangers to specific habitats and subsequently the animals that live there. Key Scientist: **Cindy Looy** (Environmental Change and Extinction) Key Question: Are Gorilla's under threat? Why and what can we do to help?

thermometers and data loggers.

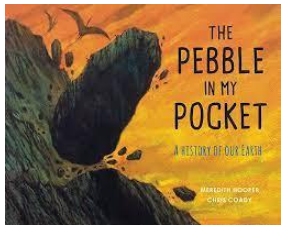
Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions

Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions

Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions

Identifying differences, similarities or changes related to simple scientific ideas and processes

Rocks



Using the topic of Stone Age and the book 'The pebble in my pocket' **compare** and group together different kinds of rocks on the basis of their simple physical properties and recognise that soils are made from **rocks** and **organic matter**. Children will use the properties of given rocks to decide which stone would have made the best weapon during this period, considering **strength** and **durability**.

Describing in simple terms how **fossils** are formed when things that have lived are trapped within rock, children will then research Mary Anning and consider the impact of her work today.

Key Scientist: **Mary Anning** (Discovery of Fossils)

Key Question: Who was Mary Anning?

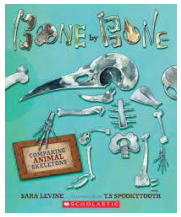
Sound

Looking at the miracles of Ancient Greece (impact of Pythagoras who studied the properties of vibrating string, Aristotle who researched sound waves and their relation with motion and Vitruvius who studied the detailed mechanism of sound transmission), identify how sounds are made, associating some of them with something vibrating and recognising that **vibrations** from sound travel through a **medium** to the ear.
Through links to music, recognise that sounds get **fainter** as the distance from the sound source increases and find patterns between the **volume** of a sound and the strength of the **vibrations** that produced it.

Key Scientists: **Aristotle** (Sound Waves)
Galileo Galilei (Frequency and Pitch of Sound Waves)
Alexander Graham Bell (Invented the Telephone)

Key Question: Which material is best to use for muffling sound within ear defenders?

Animals including Humans



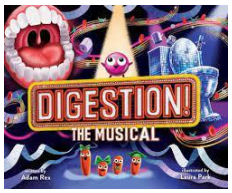
Team 3 will identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food and that they get **nutrition** from what they eat.

Supported by the book 'Bone by Bone' children will learn to identify that humans and some other animals have **skeletons** and **muscles** for **support**, **protection** and **movement**. Make comparisons between skeletons of common woodland creatures and the human skeletal structure.

Key Scientist: **Marie Curie** (X-rays)

Key Question: Are all mammal skeletons the same?

Animals including Humans



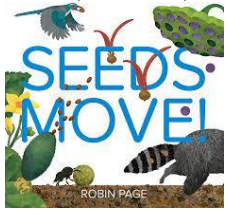
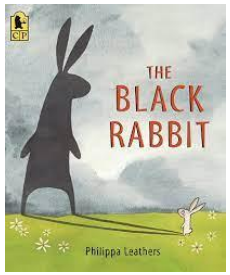
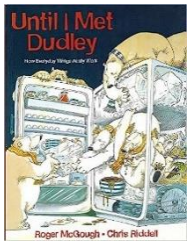
With the support of the text 'Digestion the Musical' describe the simple functions of the basic parts of the **digestive** system in humans and make comparisons between the human digestion system and an owls.

Discuss dental **hygiene** and identify the different types of teeth in humans and understand their simple functions, noting variation between species (e.g. humans and dogs)

Construct and interpret a variety of grassland food chains, identifying **producers, predators** and **prey**.

Key Scientist: **Ivan Pavlov** (Digestive System Mechanisms)

Key Question: What do our bodies do with the food we eat?

Using straightforward scientific evidence to answer questions or to support their findings.	Plants Utilising our outdoor environment plant a variety of flowers and fruits (e.g. blackberries and acorns) and use the growing process to identify and describe the functions of different parts of flowering plants: **roots, stem/trunk, leaves and flowers.** Explore the requirements of plants for life and growth (**air, light, water, nutrients from soil, and room to grow**) through comparative tests and identify how they vary from plant to plant.  Using the book 'Seeds Move', explore the part flowers play in the life cycle of flowering plants, including **pollination, seed formation** and **seed dispersal**. Use an investigative approach to identify how water is transported within plants (carnations). Key Scientist: **Dr Kelsey Byers** Key Questions: Which conditions help seeds germinate faster?	States of Matter  Using the book 'the story of snow' as a starting point compare and group materials together, according to whether they are **solids, liquids** or **gases.** Then develop upon this to observe that some materials **change state** when they are heated or cooled, and measure or research the temperature at which this happens in degrees **Celsius** (°C). Using the text River Story, identify the part played by **evaporation** and **condensation** in the water cycle and associate the rate of evaporation with temperature. Key Scientist: **Anders Celsius** (Celsius Temperature Scale) Key Question: How does and why does an ice cube change when it is left on the windowsill?
	Light  The Black Rabbit text will be used as an introduction to this topic. Through practical activities, recognise that light is needed in order to see things, dark is the **absence of light** and that light is **reflected** from surfaces. Through the creation of shadow puppets, recognise that shadows are formed when a light source is blocked by a solid object and find patterns in the way the size of shadows change. We will also use magnifying glasses to further understand that light from the sun can be **dangerous** and that there are ways to protect eyes and skin. Key Scientist: **Percy Shaw** (Inventor of the Cat's eyes) Key Question: What is a shadow?	Electricity  Utilising the text, 'Until I Met Dudley: How Everyday Things Really Work' (Roger McGough) identify common appliances that run on electricity. Children will then be introduced to the concept of **circuits** and will independently construct a simple series electrical circuit identifying and naming the basic parts (**cells, wires, bulbs, switches** and **buzzers**). Through discussion and testing, identify whether or not a lamp will light in a simple series circuit based on whether or not the lamp is part of a complete loop with a battery and recognise that a switch opens and closes a circuit. Children will then be able to apply this understanding and associate this with whether or not a lamp lights within the **circuit**. Team 4 will also explore and start to recognise some common **conductors** and **insulators**, and associate metals with being good conductors. Key Scientist: **Thomas Edison** (First Working Lightbulb) Key Questions: What is a circuit and how do they work?
Working Scientifically	Year 5	Year 6

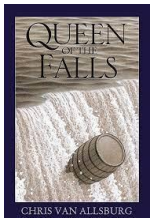
Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary

Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate

Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs

Using test results to make predictions to set up further

Forces

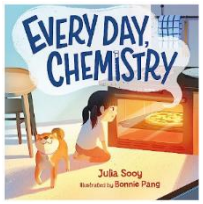


To start this unit, children will learn that unsupported objects fall towards the Earth because of the force of **gravity** acting between the Earth and the falling object. Team 5 will progress their learning by identifying the effect of **air resistance, water resistance** and **friction** that acts between moving surfaces. Utilising the text' Queen of the Falls' discuss the journey of Annie Edison Taylor and apply knowledge to create a safety plan of how to successfully go down the Falls. Children will also recognise that some mechanisms including **levers, pulleys** and **gears** allow a smaller force to have a greater effect.

Key Scientists: **Galileo Galilei** (Gravity and Acceleration)
Isaac Newton (Gravitation)

Key Questions: Do all objects fall through water in the same way?
What forces impacted Annie?

Changes to Materials

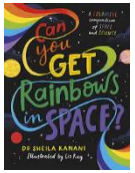


Revisiting learning from Team 5, demonstrate that dissolving, mixing and changes of state are reversible changes
Through the context of WWII, explain that some changes result in the **formation of new materials**, and that this kind of change is not usually **reversible**, for example, changes associated with burning and the action of acid on bicarbonate of soda.
Team 6 will utilise their learning to explore the creation of new materials.

Key Scientists: **Spencer Silver,**
Arthur Fry and Alan Amron (Post-It Notes)
Ruth Benerito (Wrinkle-Free Cotton)

Key Question: How can we change materials reversibly and irreversibly?

Light

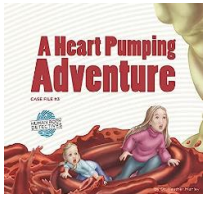


Through studying the work of Ibn al-Haytham (Alhazen), recognise that light appears to travel in **straight lines** and use this to explain that objects are seen because they give out or **reflect** light into the eye.
Further explore this fact to explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes and also why shadows have the same shape as the objects that cast them.

Key Scientist: **Ibn al-Haytham (Alhazen)** (Light and our Eyes)

Key Question: How do our eyes adapt to different conditions?

Animals including humans



Using the text 'A Heart Pumping Adventure', identify and name the main parts of the human **circulatory system**, and describe the functions of the **heart, blood vessels** and **blood** (including the pulse and clotting). Children will also explore and describe the ways in which **nutrients** and water are **transported** within animals, (including humans).

Linking with RSE / PHSE objectives relating to mental and physical health, recognise the impact of **diet**, **exercise**, **drugs** and lifestyle on the way their bodies **function**.

Key Scientist: **Justus von Liebig** (Theories of Nutrition and Metabolism)

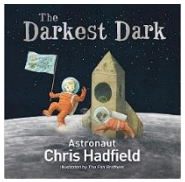
Key Question: How do our choices affect how our bodies work?

comparative and fair tests

Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations

Identifying scientific evidence that has been used to support or refute ideas or arguments.

Earth and Space

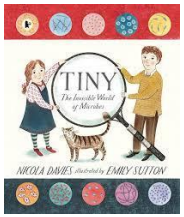


Team 5 will explore the text 'The Darkest Dark' (Chris Hadfield) in their English work and this will act as a starting point for this unit. Utilising the text 'The Skies above My Eyes', pupils will learn to describe the **Sun**, **Earth** and **Moon** as approximately **spherical bodies**. They will extend their learning to describe the **movement** of the Earth, and other planets relative to the Sun in the solar system and also describe the movement of the Moon relative to the Earth. To conclude, they will use the idea of the Earth's **rotation** to explain day and night and the apparent movement of the sun across the sky.

Key Scientists: **Neil Armstrong** (First man on the Moon)
Helen Sharman (First British astronaut)

Key Question: Sun, Earth & Moon: What is moving and how do we know?

Living things and their habitats



Through collecting data on our school grounds, describe how living things are **classified** into broad groups according to common observable characteristics and based on similarities and differences (including **micro-organisms**, plants and animals). The book Tiny: The Invisible World of Microbes will help to develop an understanding of the micro-organisms.

Use previous learning to create a branch diagram and children will develop the knowledge and understanding to give viable reasons for classifying plants and animals based on specific **characteristics**.

Key Scientist: **Carl Linnaeus** (Identifying, Naming and Classifying Organisms)

Key Question: How would you make a classification key for vertebrates/invertebrates or microorganisms found in our school grounds?

Properties of materials

Compare and group together everyday materials based on evidence from comparative and fair tests, including their **hardness, solubility, transparency, conductivity (electrical and thermal),** and **response to magnets.** Using the context of the Vikings, pupils will consider what materials would have been available during these times and how they would have been utilised. They will learn to give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.

Using the context of Viking invasion, consider travelling by sea to know that some materials will dissolve in liquid to form a solution. Explain and describe how to **recover a substance** from a **solution** and use knowledge of solids, liquids and gases to decide how mixtures might be **separated**, including through **filtering, sieving** and **evaporating**.

Building upon work in Team 1 and 2, look at the chronology of the raincoat from early discoveries, Viking clothing, the impact of Charles Mackintosh and how things have developed today.

Sound

Taught through music objectives, identify how sounds are made, associating some of them with something **vibrating** and find patterns between the **pitch of a sound** and features of the object that produced it.

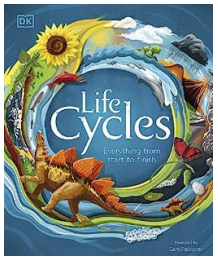
Key Scientist: **Galileo Galilei** (Frequency and Pitch of Sound Waves)

Key Question: How does the length of a guitar string/tuning fork affect the pitch of the sound?

Key Scientist: **Charles Mackintosh** (SOTSOG) and beyond.

Key Questions: What have we learnt from the Vikings use of materials?

Living Things and their Habitats



Utilising the school pond and with the support of the text 'Life Cycles: Everything from Start to Finish' describe the differences in the life cycles of a **mammal** (horse), an **amphibian** (frog) an **insect** (butterfly) and a **bird** (chicken).

Using lilies and tulips, describe the life process of **reproduction** in some plants and applying sketching skills from art to identify and explore the key **reproductive organs** for plants.

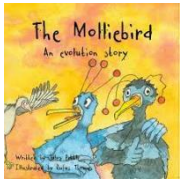
Aspects of this unit will also linking to RSE objectives, notably to describe the life process of reproduction in animals.

Key Scientist: **James Brodie of Brodie** (Reproduction of Plants by Spores)

Key Question: Do all plants and animals reproduce in the same way?

Evolution and Inheritance

Building upon previous learning from Team 5, children will recognise that living things produce **offspring** of the same kind, but normally **offspring vary** and are **not identical** to their parents.
Pupils will then identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.



With the support of the text 'The Molliebird' children will understand and recognise that living things have changed over time and that **fossils** provide information about living things that **inhabited** the Earth millions of years ago.

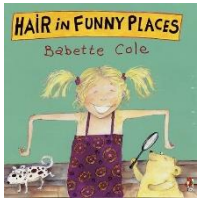
Key Scientists: **Charles Darwin and Alfred Russel Wallace** (Theory of Evolution by Natural Selection)

Key Question: Compare the skeletons of apes, humans, and Neanderthals – how are they similar, and how are they different?
Can you classify these observations into evidence for the idea of evolution and evidence against?

Animals including humans

Following on from learning in living things and habitats, describe the changes that occur as humans **develop** to old age.

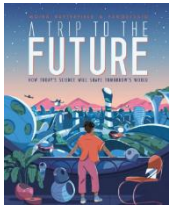
This unit will be taught in conjunction with Chris Winters RSE objectives (human development) to further understand that different animals mature at different rates and live to different ages.



Utilise the book 'Hair in Funny places' to learn that **puberty** is something we all go through, a process which prepares our bodies for being adults, and **reproduction** and it is **hormones** that control these changes, which can be physical and/or emotional.

Key Scientist: **Dr Steve Jones** (Geneticist)

Electricity



Using the text 'A Trip to the future' as a hook, revisit the creation of circuits. Children will learn to associate the **brightness** of a **lamp** or the **volume of a buzzer** with the number and **voltage** of cells used in the **circuit**. Pupils will then compare and give reasons for variations in how **components** function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. Children will also use recognised **symbols** when representing a simple circuit in a diagram and draw these to show a working circuit.

Key Scientists: **Alessandro Volta** (Electrical Battery)
Nicola Tesla (Alternating Currents)

	Key Question: Why and how does the human body change over time?	Key Questions: How does the voltage of the batteries in a circuit affect the brightness of the lamp / volume of the buzzer? Which type of fruit makes the best fruity battery?