

Working Scientifically



There are seven science skills we expect children to develop throughout their time at Dunham-on-Trent C of E Primary School. As teachers, we refer to these as working scientifically skills. The skills are as follows: -

- Asking question – asking questions that can be answered using a scientific enquiry.
- Making predictions – *using prior knowledge to suggest what will happen in the enquiry.*
- Setting up tests – *deciding on the method and equipment to use to carry out an enquiry.*
- Observing and measuring – *using senses and measuring equipment to make observations about the enquiry.*
- Recording data – *using tables, drawings and other means to note observations and measurements.*
- Interpreting and communicating results – *using information from the data to say what you found out.*
- Evaluating – *reflecting on the success of the enquiry approach and identifying further questions for enquiry.*

Enquiry approaches – over the course of the academic year, pupils should carry out several investigations which allow children to build upon their working scientifically skills (see above). The different types of enquiries that should be incorporated into Science lessons are as follows: -

- **Research** – *using secondary resources of information to answer scientific questions.*
- **Comparative/fair testing** – *changing one variable to see its effect on another, whilst keeping all others the same.*
- **Pattern seeking** – *identifying patterns and looking for relationships in enquiries where variables are difficult to control.*
- **Observation over time** – *observing changes that occur over a period of time ranging from minutes to months.*
- **Identifying, grouping and classifying** – *making observations to name, sort and organise items.*
- **Problem solving** – *applying scientific knowledge to find answers to problems.*

This document highlights the different enquiry approaches that can be explored in each programme of study. They are identified using the symbols shown in the grid. There is no expectation that all approaches highlighted are covered for each unit of work, however there needs to be at least one investigation per unit and planning over the year needs to show a variety of approaches have been covered. The problem solving approach should be incorporated into all other approaches and is not a stand-alone approach. Suggested specific investigation questions relating to each approach and each year group can be found on a separate document. These are only a guide and teachers can devise own questions to investigate or follow the children's interests.

NB: Only KS2 focus on fair testing however EYFS/KS1 do need to look at comparative testing.

Research	
Pattern Seeking	
Observation over time	
Comparative/Fair testing	
Identifying, grouping and classifying	
Problem solving	

Scientists across the curriculum

Research has shown that, while learning science can be interesting and enjoyable, many children find that what they learn at school is abstract and they cannot see how it relates to their own lives. Consequently, they see science as something that is not for them. Studies have shown that these perceptions can start early in a child's primary school career. Children who think or feel this way have low science capital. One way of increasing children's science capital is for them to learn about scientists that they can identify with.

The suggested scientist section is intended to help the school and teachers include scientists in the curriculum who:

- are relevant to the topics
- illustrate how scientific knowledge has developed over time
- children can identify with and whose work they can relate to.

The scientists meet three different criteria:

- * historical figures who illustrate the development of scientific knowledge over time
- * scientists from under-represented groups
- * modern scientists whose work is relevant to children and who reflect their world and backgrounds.

To help identify which criteria each scientist was included for, they have been colour-coded, as shown below.

Type	Colour code
Historical figures	
Under represented groups	
Modern scientists	

Biology – Animals including Humans							
	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Substantive Knowledge (To know...)	<ul style="list-style-type: none"> • The 5 senses. • What the 5 senses are. • The names of some animals. • Where different animals live. • The names of people in my family. • How to describe people in my family. 	<ul style="list-style-type: none"> • Amphibians live the first part of their lives in the water and the last part on the land. • Reptiles live on land and in water. • All mammals have hair, lungs, are warm bodied and can live on land or in water. • Most animals give birth to live babies. • There are a few mammals who lay eggs. • A fish uses its gills to breathe, they have scales and lay soft eggs. • Birds lay eggs and have a beak. To know they all lay eggs but not all birds can fly. • An omnivore is an animal that eats plant and animals. • Animals that eat only meat are called carnivores. • Animals that eat only plants are called herbivores. • All living things breathe, eat, grow, 	<ul style="list-style-type: none"> • Animals including humans reproduce when they reach maturity. • All animals including humans will eventually die. • That exercise keeps animals including humans, bodies in good condition and increases survival chances. • Animals move in order to survive. • Different animals move in different ways to help them survive. • Animals, including humans need air, water, food and shelter to survive. 	<ul style="list-style-type: none"> • Different animals are adapted to eat different food. • Plants can make their own food from sunlight, however animals, including humans need to eat to stay alive. • Humans need to eat different foods types. • The names of the 5 different food groups. • It is important to eat the right amount of food from each group. • We can measure food using portions. • Humans and many animals have skeletons to support their bodies and protect vital organs. • Muscles are connected to bones and move when they contract. • Movable joints connect bones. 	<ul style="list-style-type: none"> • The oesophagus is a muscular tube which moves food from the mouth to the stomach. • The stomach is an organ in the digestive system where food is broken down with acid and by being churned around. • The small intestine is the part of the intestine where nutrients are absorbed into the body. • The large intestine is part of the intestine where water is absorbed from remaining waste. • Faeces are formed in the large intestines. • A producer is an organism, such as a plant, that produces its own food. • A predator is an animal that hunts and eats other animals 	<ul style="list-style-type: none"> • Prenatal means cells develop and grow into a foetus inside the mother's uterus. • A baby is born after 9 months. • Infancy means rapid growth and development. • Children learn to walk and talk during this stage. • Childhood is when children learn new skills and become more independent. • In adolescence the body starts to change over a few years and the changes occur to enable reproduction during adulthood. • At early adulthood the human body is at its peak of fitness and strength. • In middle adulthood the 	<ul style="list-style-type: none"> • The heart is an organ which constantly pumps blood around the circulatory system. • The heart pumps blood to the lungs to get oxygen and then pumps this oxygenated blood around the body. • Blood vessels are the tube-like structures that carry blood through the tissues and organs. • Veins, arteries and capillaries are the three types of blood vessels. • Oxygenated blood has more oxygen, it is pumped from the heart to the rest of the body. • Deoxygenated blood is blood where most of the oxygen has already been

		<p>move, reproduce and have senses.</p> <ul style="list-style-type: none"> • Non-living things do not eat, grow, breathe, move, reproduce and they do not have senses. • The names of the different parts of our body. • Our eyes help us to see, our ears help us to hear, our nose helps us to smell., our hands help us to feel and our mouth/tongue helps us to taste. 			<ul style="list-style-type: none"> • Prey is an animal that gets hunted and eaten by another animal. • Incisors are used to bite and cut food. • Canines tear and rip food. • Molars grind and pre-molars hold and crush. • Some people have wisdom teeth but they now have no function. 	<p>ability to reproduce decreases.</p> <ul style="list-style-type: none"> • There may be hair loss or hair may turn grey. • In late adulthood leading a healthy lifestyle can help slow down the decline of fitness and health which occurs during this stage. • The changes in girls during puberty - larynx (voice box grows), hair grows under armpits, skin becomes oilier, breasts grow, gain hair on arms and legs, start to menstruate and pubic hair grows. • During puberty boys larynx (voice box) grows 'Adam's apple', hair grows on chest, pubic hair grows, skin becomes oilier, facial hair grows, hair 	<p>transferred to the rest of the body.</p> <ul style="list-style-type: none"> • Drugs, alcohol and smoking have negative effects on the body. • A healthy diet involves eating the right types of nutrients in the right amounts. • Regular exercise strengthens muscles including the heart muscle, improves circulation, increases the amount of oxygen around the body, releases brain chemicals which help you feel calm and relaxed, helps you sleep more easily, and strengthens bones. • Exercise can help to stop us from getting ill. • Nutrients are found in food and water. • Once broken down, the nutrients are absorbed into
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						under armpits grow, gain hair on arms and legs, scrotum, testes and penis develop, become more muscular. <ul style="list-style-type: none"> Both girls and boys grow taller, sweat glands produce more sweat and all parts of the body grow. 	the blood in the small intestine. <ul style="list-style-type: none"> There are tiny hair like villi that help this process happen. Nutrients are carried in the blood to the different parts of the body that need them. Water doesn't need breaking down and moves between membranes in the body to arrive in the correct place, again via our blood.
Key Vocabulary	Land, water, smell, touch, taste, hear, see, family, <i>names of animals/places they live, vocabulary related to family names and descriptions of hair/eye colour.</i>	Fish, Reptiles, Mammals, Birds, Amphibians, Herbivore, Omnivore, Carnivore, senses, names of body parts.	Survival, survive, water, air, food, Adult, teenager, child, elderly, baby, offspring, exercise, hygiene, balanced diet, heartbeat, breathing, germs,	Movement, muscles bones, skull, nutrition, skeleton, nutrition, carbohydrates, sugars, protein, vitamins, minerals, fibre, fat, muscles, joints.	Digestive system, digestion, saliva, oesophagus, stomach, small intestine, large intestine, rectum, anus, incisor, canine, molar, premolar, producer, prey, predator.	Foetus, Embryo, Womb, gestation, Prenatal, Infancy, Childhood, adolescence, Early adulthood, Middle adulthood, Late adulthood/ Elderly, Growth, Development, Puberty, reproduce.	Heart, pulse, rate, pumps, blood vessels, veins, arteries, valve, transported, lungs, oxygen, carbon dioxide, oxygenated, deoxygenated, cycle, circulatory system, respiration.
Links to the National Curriculum	Describe what they see, hear and feel while they are outside Explore the natural world around them. Recognise some environments	To identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals; To identify and name a variety of common animals	To find out about and describe the basic needs of animals, including humans, for survival (water, food and air).	To identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition	To describe the simple function of the basic parts of the digestive system in humans, To identify the different types of teeth in humans and their simple	To describe the changes as humans develop to old age.	To identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood; To recognise the

	<p>that are different from the one in which they live Know and talk about the different factors that support their overall health and wellbeing: - regular physical activity - healthy eating - tooth brushing - sensible amounts of 'screen time' - having a good sleep routine - being a safe pedestrian</p> <p><u>ELG</u> Manage their own basic hygiene and personal needs, including dressing, going to the toilet and understanding the importance of healthy food choices. Explore the natural world around them, making observations and drawing pictures of animals and plants. Know some similarities and</p>	<p>that are carnivores, herbivores and omnivores. To describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals including pets) To identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.</p>	<p>To describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. To notice that animals, including humans, have offspring which grow into adults</p>	<p>from what they eat; To identify that humans and some other animals have skeletons and muscles for support, protection and movement.</p>	<p>functions. To construct and interpret a variety of food chains, identifying producers, predators and prey.</p>		<p>impact of diet, exercise, drugs and lifestyle on the way their bodies function; To describe the ways in which nutrients and water are transported within animals, including humans.</p>
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	differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class.						
Suggested working scientifically enquiries							
Suggested Scientists		Leonardo De Vinci Miller Hutchinson Joan Beauchamp Procter Patricia Bath Tanesha Allen	Florence Nightingale Elizabeth Garrett Anderson Dr Kelly Blacklock Daniella Dos Santos	Wilhelm Roentgen Marie Curie Adelle Davis Michelle Williams	William Beaumont Washington & Lucius Sheffield Paul Sharpe	Virginia Apgar Robert Winston	William Harvey Santorio Santorio Richard Doll Ruth Ella Moore James Miranda Steuart Barry

Biology – Living things and their habitats					
	EYFS	Year 2	Year 4	Year 5	Year 6
Substantive Knowledge (To know...)	<ul style="list-style-type: none"> • How to describe what they see, hear, smell and can feel whilst outside. • Some environments that are different to the one they live in. • How to get information from a simple map. 	<ul style="list-style-type: none"> • That everything is either living, dead or has never been alive. • There are 7 characteristics of living things: movement, respiration, sensitivity, growth, reproduction, excretion and nutrition. • These can be remembered using the acronym: MRS GREN or MRS NERG • Different habitats are suited to different plants and animals i.e. forest, ocean, desert, woodland. • Habitats provide for the basic needs of the animals and plants that live there, such as food and shelter. • A food chain shows how animals get food from plants and other animals. • There are different sources of food e.g. crops, plants, trees, meat and milk from animals. • Living things depend on each other to survive. • Mammals, reptiles, amphibians, birds and fish can be found in habitats which are suited to them. • Microhabitats are small habitats where mini beasts may live (e.g. under a rock, under leaves). 	<ul style="list-style-type: none"> • Living things can be divided into groups based upon their characteristics such as vertebrate animals can be put into groups such as fish, amphibians, reptiles, birds, and mammals; and invertebrates into snails and slugs, worms, spiders, and insects. • Plants can be grouped into categories such as flowering plants (including grasses) and non-flowering plants, such as ferns and mosses. • Classification keys can be used to identify and name living things. • Environmental change affects different habitats differently. • Different organisms are affected differently by environmental change. • Human activity significantly affects the environment. • The positive impacts - the positive effects of nature reserves, ecologically planned parks, or garden ponds. • The negative impacts – negative effects of population and development, litter or deforestation. 	<ul style="list-style-type: none"> • A lifecycle is the journey of changes that take place throughout the life of a living thing including birth, growing up and reproduction. • Different types of organisms have different lifecycles. • Humans develop inside their mothers and are dependent on their parents for many years until they are old enough to look after themselves. • Amphibians such as frogs are laid in eggs then, once hatched, go through many changes until they become an adult. • Some animals, such as butterflies, go through metamorphosis to become an adult. • Birds are hatched from eggs and are looked after by their parents until they are able to live independently. 	<ul style="list-style-type: none"> • Broad groupings, such as micro-organisms, plants and animals can be subdivided. • Animals can be classified into commonly found invertebrates (such as insects, spiders, snails, worms) and vertebrates (fish, amphibians, reptiles, birds and mammals). • A classification key is a set of questions about the characteristics of living things. • A classification key helps to identify a living thing or decide which group it belongs to by answering questions. • Variation exists within a population (and between offspring of some plants) **NB: this key idea is duplicated in Year 6 Evolution and Inheritance. • Organisms best suited to their environment are more likely to survive long enough to reproduce. • Organisms are best adapted to reproduce are more likely to do so. • Organisms reproduce and offspring have similar characteristic patterns.

Key Vocabulary	Environment, plant, tree, bush, flower, vegetable, herb, weed, animal, minibeasts, map, names of plants/animals they see, name of a contrasting environment e.g. beach, forest, jungle.	Living, dead, suited/suitable, energy, food chain, predator, prey, survive/survival, habitat, micro habitat, condition.	Classification, human impact, positive, negative, migrate, hibernate. Vertebrates - Fish, Amphibians, Reptiles, Birds, Mammals, Invertebrates - Snails, Slugs, Worms, Spiders, Insects,	Life cycle, reproduce, sexual, sperm, fertilises, egg, metamorphosis, asexual.	Organisms/micro-organisms, warm blooded, cold blooded, variation.
Links to the National Curriculum	Explore the natural world around them Recognise some environments that are different from the one in which they live <u>ELG</u> Explore the natural world around them, making observations and drawing pictures of animals and plants. Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class.	To explore and compare the differences between things that are living, dead, and things that have never been alive. 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, and how they depend on each other. To identify and name a variety of plants and animals in their habitats, including microhabitats To describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food.	To recognise that living things can be grouped in a variety of ways. To explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment. To recognise that environments can change and that this can sometimes pose dangers to living things.	To describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird. To describe the life process of reproduction in some plants and animals.	To 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. To give reasons for classifying plants and animals based on specific characteristics.
Suggested working scientifically enquiries					
Suggested Scientists		William Kirby Prem Singh Gill Darwood Qureshi	Jacques Cousteau Rachel Carson Wangari Maathai Kelsey Archer Barnhill Liz Bonnin	David Attenborough Jane Goodall Roger Arliner Young Ernest Everett Just	Carl Linnaeus Agnes Arber Hu Xiansu Beatrix Potter

Biology – Plants

	EYFS	Year 1	Year 2	Year 3
Substantive Knowledge (To know)	<ul style="list-style-type: none"> • That plants need looking after. • What a plant needs to grow. • How to grow a plant • Plants start off as seeds and grow in to a plant 	<ul style="list-style-type: none"> • A wild plant seed grows where it fall and It doesn't need to be planted or cared for as it grows. • Garden plants are plants that people choose to grow in their gardens. • A deciduous tree loses its leaves each year. • An evergreen tree keeps its green leaves all year round, even in the winter • Roots take in water and nutrients from the soil and keep the plant in the ground. • The stem holds the plant up and carries the water and nutrients from the roots to the leaves and flowers. • Leaves catch sunlight to help the plant to make its own food. • Flowers attract insects and birds. • Petals are the colourful part of a flower. • Fruit contains the plant's seeds. • Seeds and bulbs grow into new plants. 	<ul style="list-style-type: none"> • Plants are living things that use sunlight to make their own food. • Every plant needs water to grow and survive. • Plants need sunlight to grow well. • All plants need the right temperature to grow well. • Seeds and bulbs can germinate and sprout underground without sunlight because they have a store of food inside the bulb/seed. 	<ul style="list-style-type: none"> • Plants are producers, they make their own food. • Roots take in water and nutrients from the soil and keep the plant in the ground. • The stem holds the plant up and carries the water and nutrients from the roots to the leaves and flowers. • Leaves absorb sunlight and carbon dioxide to help the plant to make its own food. • Flowers attract insects and birds. • Plants need: water, light, nutrients from the soil, air and room to grow. • Different plants vary in how much of these things they need e.g. cacti can survive in areas with little water, whereas water lilies need to live in water. • Seeds/bulbs require the right conditions to germinate and grow. • Seeds contain enough food for the plant's initial growth. • Water evaporates from the leave and this evaporation causes more water to be sucked up the stem. • Flowering plants have specific adaptations which help it to carry out pollination, fertilisation and seed production. • Seed dispersal improves a plants chances of successful reproduction. • Seed dispersal is when the fully formed seeds are moved away from the parent plant. • Germination is when the seed starts to grow. • Growing and flowering is when the plant grows bigger and forms a flower. • Pollination is when pollen from the anther lands on the stigma and travels down the style. • Fertilisation and seed formation is when the pollen joins with an ovule and a seed starts to form.

Key Vocabulary	Tree, bush, herb, plant, flower, water, sun, soil, seed, grow, die/ dead, alive.	Deciduous, evergreen, leaf, blossom, petal, fruit, berry, root, bulb, trunk, branch, stem, bark, stalk, bud, names of trees/garden/wild flowers.	Air, light, shade, warm, cool, space, healthy, germinate, shoot, seedling, temperature, growth.	Photosynthesis, pollen, insect/wind pollination, formation, dispersal, nitrites, minerals, absorb, transportation, reproduction, fertilisation, anther, stigma, ovule, germinate, germination, nutrients, absorb, producer, carbon dioxide,
Links to the National Curriculum	Describe what they see, hear and feel while they are outside Explore the natural world around them. Recognise some environments that are different from the one in which they live <u>ELG</u> Explore the natural world around them, making observations and drawing pictures of animals and plants. Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class.	To identify and name a variety of common wild and garden plants, including deciduous and evergreen trees. To identify and describe the basic structure of a variety of common flowering plants, including trees.	To observe and describe how seeds and bulbs grow into mature plants. To find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.	To explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant. To identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. To investigate the way in which water is transported within plants. To explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.
Suggested working scientifically enquiries				
Suggested Scientists		Maria Sibylla Merian	Daniel Solander Joseph Banks Thomas Wyatt Turner Poppy Okotcha Dr Ben Woodcock Angie Burnett	Jan Ingenhouz Carl Linnaeus Charles Henry Turner Jagadish Chandra Bose George Washington Carver Dr Kelsey Byers

Biology – Evolution and inheritance	
	Year 6
Substantive Knowledge (To know...)	<ul style="list-style-type: none"> • Evolution is the process by which living things gradually change over time. • Fossils provide information about living things from millions of years ago. • Organisms reproduce and offspring have similar characteristic patterns. • Over time the characteristics that are most suited to the environment become increasingly common. • Organisms best suited to their environment are more likely to survive long enough to reproduce. • Variation exists within a population (and between offspring of some plants).
Key Vocabulary	Offspring, sexual reproduction, vary, characteristics, adapted, adaption, inherited, species, evolve, evolution, fossils, genetics, variation, organisms, population.
Links to the National Curriculum	<p>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.</p> <p>To recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents.</p> <p>To identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.</p>
Suggested working scientifically enquiries	
Suggested Scientists	<p>Charles Darwin</p> <p>Mary Anning</p> <p>Alfred Wallace</p> <p>Nettie Stevens</p> <p>Emma Dunne</p> <p>Telma Laurentino</p>