LifeWorks

Teacher's exhibition notes

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HUMAN TORSO

The torso contains the main organs of the body
They are packed as closely as possible

DESCRIPTION

A sexless human torso is displayed. Pupils can position the internal organs in the torso or can fit them into a base, which names and describes them. Afterwards they can remove the organs as in an autopsy.

CURRICULUM LINKS

Key Stage 1

"Pupils should find out about themselves and develop their ideas about how they grow feed and move."

Key Stage 2

"Pupils should be introduced to the major organs and organ systems of mammals...."

"They should explore some aspects of feeding and support in relation to themselves...."

Key Stage 3

"They should study ... feeding (including digestion and assimilation), removal of waste, ... as they relate to human beings."

RELATED EXHIBITS

Digestion

A talking picture gives information about the digestive system

Body parts

There are various parts of the body in boxes that can be examined by touch.

WHAT TO DO

If the organs are in the display base, fit them into the human torso in the correct positions like a jigsaw.

Q: **Are the positions of the parts the same as in your body?**
(A: Yes. Point to where the organs are on your own or another person's body.)

Q: **Where is the heart?**
(A: In the centre of the chest – just like in your body. We only think it is on the left because that side of the heart beats more strongly to get the blood all round the body.)

Open the heart.

Q: **What can you see?**
(A: The four chambers of the heart: the right auricle which collects blood from the body; the right ventricle which pumps it to the lungs; the left auricle which collects the blood from the lungs; the left ventricle that pumps it round the body again.)

If the organs are in the torso then read the information on the display base and put them in their right places.

Look carefully at the empty torso.

Q: **What else can you see - can you name other parts of the body?**
(A: Major blood vessels - arteries and veins - can be seen, as well as the kidneys, bladder and muscle structures.)

MORE THINGS TO DO

Listen to the chest of another pupil.

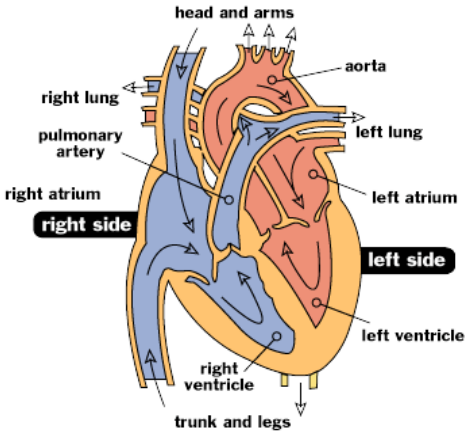
Q: **What noise does the heart make?**
(A: It has a regular beat.)

Q: **What happens if they hold their breath for a time?**
(A: It beats faster.)

HUMAN TORSO: FURTHER INFORMATION

Heart

The heart is a muscular pump which pumps blood around the body. It is about the size of a fist and sits in the middle of the chest. It consists of two halves: the right pumps blood to the lungs to pick up oxygen and return to the left half of the heart where it is pumped to every other part of the body. Because of this it is much larger and beats more strongly than the right half which is why we believe our heart is on our left-hand side.



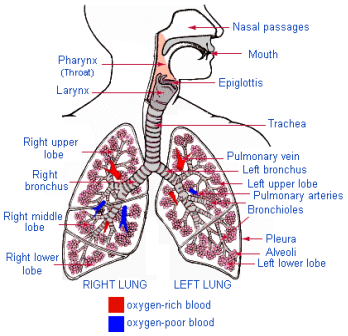
You can listen to the sound of another person's heart beating by putting your ear against their chest. The beat can also be felt at pulse points such as the wrist. Count the number of beats per minute before and after exercise.

Blood vessels

These are the arteries and veins. Arteries take blood containing oxygen and food to the various parts of the body. Veins bring back blood containing the waste products. The vessels get smaller as they get to the organs like motorways leading to small by-roads.

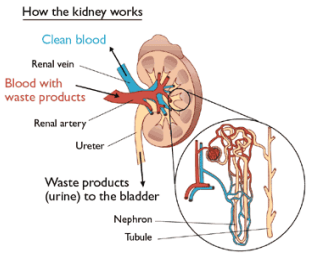
Lungs

These are the organs of respiration. Air is drawn in by lowering the diaphragm and raising the rib cage, like opening a pair of bellows. The air passes down the main trachea, down smaller and smaller tubes, terminating in tiny sacs called alveoli. Oxygen is absorbed into the blood and carbon dioxide passes out of the blood into the lungs.



Kidneys

Kidneys filter blood to get rid of excess water, urea (broken-down proteins) and other substances, which are passed to the **bladder** as urine, where it waits to be voided through the urethra.



Muscles

Muscles are protein structures which can contract to cause movement of limbs and other organs. They can only pull, not push. They are usually found in antagonistic pairs, like the biceps and triceps of the upper arm, or the finger flexor and extensor muscles as discussed in **Skeleton hand**.

Guts

The organs of digestion, the stomach and the intestines and the liver are dealt with in **Digestion**.

DIGESTION

Food enters the body by the mouth and passes into the alimentary canal
It is digested in a series of stages and then absorbed

DESCRIPTION

A 'talking' picture describes the different parts of the body related to digestion and their functions. Pupils can access the information through two phones by passing a hand-piece over the picture. There is also a tube with a ball inside representing the oesophagus or intestine and a piece of food. Pupils can squeeze the tube to move the ball as in peristalsis.

CURRICULUM LINKS

Key Stage 1
“Pupils should find out about themselves and develop their ideas about how they ... feed ...”
Key Stage 2
“Pupils should be introduced to the major organs...”
Key Stage 3
“They should study life processes ... including digestion ...”

RELATED EXHIBITS

Torso
A model of the torso can be fitted with its organs.
Body parts
There are various parts of the body in boxes that can be examined by touch.

WHAT TO DO

Pass the hand-piece over the picture and listen to the phone.

Q: **Can you trace the path that food travels through the body?**
(A: Food travels through the mouth, is chewed by the teeth, then over the tongue, down the oesophagus and into the stomach. From there, it enters the intestines.)

Q: **What can you hear?**
(A: Messages that tell you what each part of the digestive system does.)

Q: **What happens in digestion?**
(A: Food is broken down by enzymes so it can be absorbed into the body.)

Q: **What noises would you hear if you could listen to your own digestion system?**
(A: Chewing, swallowing, burping, rumbling, gurgling and worse!)

Can you find where these organs are in your own body?

MORE THINGS TO DO

Squeeze the **Food tube** just behind the ball.

Q: **What happens to the ball?**
(A: The ball moves forward along the tube. This is how food is moved along the oesophagus and intestines. The walls of the gut have circular muscles which contract behind the food, squeezing it along. This is why you can eat standing on your head.)

DIGESTION: FURTHER INFORMATION

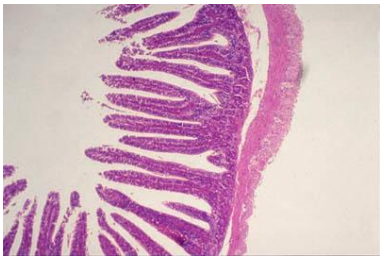
Ingestion
Food enters the body into the mouth where it is chewed by the teeth to reduce it to digestible size and mixed with saliva and mucus to make it easier to swallow. Saliva also contains an enzyme which begins the breakdown of starch.

The chewed food or bolus is passed to the stomach via the oesophagus. It is squeezed along this tube by a wave of muscle contraction just behind the bolus. This is called peristalsis.

Digestion
The purpose of digestion is to change food into a form that can be absorbed. The long and complex molecules of carbohydrate, protein and fat must be broken down chemically into small units so they can pass across cell membranes and be dissolved in blood to be carried to the organs of the body.

Stomach
In the stomach the food is mixed with more enzymes which break down proteins. This process is aided by the addition of hydrochloric acid. The stomach lining is resistant to this but sometime a hiccup can bring some acid to the throat where its burning effect is noticeable. Digestion in the stomach is a long process and food remains here for some time.

Small intestine
Later the half-digested food is passed on to the small intestine where the acid is neutralised and new enzymes are added. These come both from the pancreas and the small intestine itself. They complete the process of digestion. Carbohydrates are broken down into sugars, proteins into amino acids, and fats into fatty acids and cholesterol. These are small molecules that can be absorbed across the lining into the blood and lymphatic system. This is made easier by innumerable projections of the lining called villi which increase the surface area enormously.


Cross-section showing villi

Large intestine
This part of the gut consists of the colon and rectum. In the former, water and mineral salts are absorbed. The latter is where waste products, the faeces, await elimination.

Liver
The absorbed food is taken to the liver, where it is processed. The liver is the most vital metabolic organ in the body. It carries out a large number of functions, such as the breakdown of haemoglobin into bile pigments and unwanted proteins into urea which is eliminated from the blood by the kidneys as urine. Alcohol and other poisons are processed here. It is also concerned with protein and fat synthesis.

Sugar levels
In particular, sugars are stored as starch (glycogen) in the liver when not immediately required. It can be reconverted when necessary. This process is controlled by the hormones, insulin and glucagon, produced by the pancreas. It is not necessary, therefore, to keep eating all the time for fear of falling sugar levels. We feel hungry because our body tells us it is time to eat, not because we have insufficient sugar in our bodies. Just before we usually eat, insulin is released and sugars are removed from the blood (in expectation of an incoming glut) sometimes making us feel, temporarily, slightly weak. If no food is forthcoming a companion hormone, glucagon, is released which causes sugar to be put back into the bloodstream. Like a car we have a fuel tank and contrary to popular belief we don't have to keep topping up for fear of collapsing; that way lies obesity. We also store starch in our muscles and large quantities of potential fuel in our sub-cutaneous fat.

SKELETON HAND

Hands contain bones which articulate together
The bones are connected by tendons to muscles which can contract to bend the fingers

DESCRIPTION

A model of the human hand and wrist shows the bones and tendons. Pupils can flex the fingers of the hand individually to show the basics of how the hand works. They are flexed using a series of fishing lines to simulate the tendons by which the fingers are moved by muscles in the arm.

CURRICULUM LINKS

Key Stage 1
"Pupils should ... develop their ideas about how they ... move ..."
Key Stage 2
"They should explore some aspects of ... movement ..."
Key Stage 3
"They should study ... movement ... particularly as they relate to humans.''

RELATED EXHIBITS

Balance

Trying to balance on a board is difficult trying to co-ordinate leg muscles.

WHAT TO DO

Pull the knobs to flex the fingers - watch how they bend towards the wrist. The tendons (fishing line) are joined in this hand in the same way as in yours.

Q: Where are the muscles that make your fingers move?
(A: They are in your lower arm and are connected to your fingers by tendons.)

Q: What happens when you pull the knob for the little finger?
(A: The third finger is also raised.)

Q: Does this happen when you bend your little finger?
(A: Yes. For most people it is nearly impossible to curl you little finger up without moving the next finger as well. The tendons of the little and third fingers are packed tightly with one another. Practice, e.g. as a musician, can change this.)

Look closely at your own hand, holding the front of your lower arm (near the elbow) and bend your fingers?

Q: What can you feel?
(A: You will feel the muscles responsible move and swell.)

Now turn your hand over and extend your fingers.

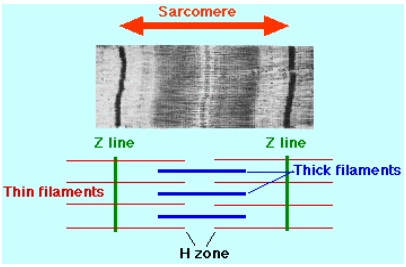
Q: What can you see?
(A: You should see the tendons moving on the back of your hand.)

OTHER THINGS TO DO

If you can get hold of a chicken leg from a butcher, you can pull directly on its tendons and make its claws move.

SKELETON HAND: FURTHER INFORMATION

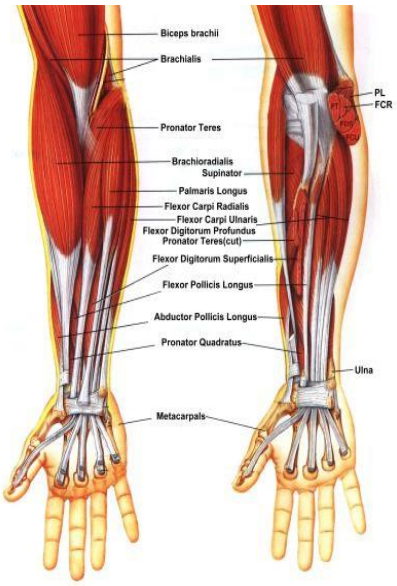
Muscles



All movement in our bodies is caused by muscle action. In the case of limbs this involves groups of paired antagonistic muscles attached to bones. Muscles can only contract or relax - they cannot expand. For a muscle like the biceps to raise the forearm, there must be an opposing muscle to lower it. When the triceps is contracted, it pulls the biceps out. Muscle fibres consist of sarcomeres of two different sets of filaments which slide inside each other, thus contracting the muscle.

Tendons

The muscles that operate the fingers are largely located in the forearm. They connect to the fingers by long tendons. Tendons can be seen in a chicken's foot. If the tendons of this are pulled, the claws are moved in the same way as in the model. When we "pull a muscle" usually we have torn the tendon. These usually recover quite quickly.



Ligaments

Bones are joined together by connective tissue called ligaments. If these are torn, repair and full recovery can take a long time. The transverse carpal ligament creates a tunnel through which the finger flexor tendons pass. The third and little finger tendons are packed tightly together and the movement of one can affect the other. In some individuals the ligament can squeeze the median nerve which passes through it causing pain and muscle weakness. This is known as carpal tunnel syndrome.

KEY

Living things can be arranged into groups
Diagnostic features can be used to create keys to classify them

DESCRIPTION

An exhibit shows a number of resin blocks containing small creatures of the arthropod group (insects, etc.). They can be viewed under two different strength magnifying glasses. Pupils can use a key with a series of diagnostic characteristics to allocate the animals to their correct names.

CURRICULUM LINKS

Key Stage 1

"They should have opportunities, when possible through first hand observation, to find out about a variety of ... plant and animal life." "They should sort living things into broad groups according to similarities and differences using observable features."

Key Stage 2

"Pupils should investigate ... the similarities and differences between ... plants and animals. They should ... develop skills in identifying locally occurring species of ... plants and animals by observing structural features ... and using simple keys."

Key Stage 3

"They should have opportunities to group organisms on the basis of similarities and differences and to use keys to name organisms."

RELATED EXHIBITS

Video microscope

This will allow you to look closely at small living things.

WHAT TO DO

Select a sample and examine it closely, using a magnifying glasses. Follow the descriptions to find the names of each of the samples.

Q: What features do the creatures have in common?
(A: They all have jointed limbs and external skeletons. They are part of the same group (phylum) called Arthropods)

Q: Do they all have the same number of legs?
(A: No - this is a good way to classify them. Insects have six legs, spiders have eight and centipedes and millipedes have many legs. Crabs have ten but they belong to a larger group (class) – crustaceans, which can have different numbers of legs.)

Q: Do the samples differ from the kinds of animals you are more familiar with?
(A: They are small compared with mammals and birds, but they are just as much animals.)

Q: In what other ways do mammals and birds differ from them?
(A: They have internal skeletons and outside coverings to keep them warm: fur in mammals; feathers in birds.)

KEY: FURTHER INFORMATION

Classification
All living things are grouped by their characteristics into phyla, classes, orders, families, genera and species. Biologists can understand how they relate to one another and how they evolved.

Phylum: Arthropoda
This is far the largest group of animals in species and total numbers. They all have the two characteristics - exoskeletons and jointed limbs(Greek: arthro = joint; podos = limb). They include:

Class: Myriapoda
These creatures have many legs. Very different in this respect, they are still related to insects.

Order: Chilopoda
Centipedes have long bodies made up of mainly identical segments, with a pair of legs on each segment (not necessarily a hundred).

Order: Diplopoda
Millipedes have two pairs of legs per segment (not necessarily a thousand).

Class: Crustacea
These are usually aquatic. They include crabs and lobsters, shrimps, lice and barnacles

Order: Decapoda
The crabs have ten legs. The front pair are not used for walking and are modified into claws.

Class: Arachnida
This group includes spiders, scorpions and mites.

Order: Araneida
Spiders have bodies divided into two: the front with eight legs and the back, abdomen, which is swollen. Commonly they spin webs for the capture of their prey.

Class: Insecta
Insects are the biggest group of the arthropods. The body is divided into three parts: head, thorax and abdomen and they have six legs, a pair on each segment of the thorax. Commonly they have two pairs of wings, though they may have disappeared or been modified into wing cases.

Order: Coleoptera
"God must have an inordinate love of beetles" – there are 370,000 species. Their front wings are modified into toughened wing cases which protect their large hind wings. Many are black but some are brightly coloured like the ladybird.

Order: Lepidoptera
Butterflies and moths have large decorated wings. The former fold their wings up at rest while the latter tuck them back on the body. Butterflies are daytime creatures; moths nocturnal.

Order: Odonata
Dragonflies have long thin bodies and large wings, folded upwards when not flying. Damselflies are usually smaller and when at rest the wings are spread out. Both have very large eyes.

Order: Hymenoptera
This group includes bees, wasps and ants. They have narrow waists and most live in colonies. Bees usually have small hairs on their legs and bodies for the collection of pollen. Though the ants are usually workers and are wingless, the males and queen often have wings.

Order: Orthoptera
Grasshoppers & crickets have back legs modified for jumping. The wings are tough and leathery.

There are many other orders not represented here, such as bugs (**Hemiptera**), flies (**Diptera**), stick insects (**Phasmatodea**), caddisflies (**Trichoptera**), termites **(Isoptera**) and cockroaches (**Blattodea**). Each can be distinguished by certain characteristics that can be organised into a key.

SUNFLOWER

Leaves gather sunlight
Sunlight provides energy for plants which they use in making food by photosynthesis

DESCRIPTION

A model plant with solar panels simulates a plant's ability to collect light. The leaves can be raised and lowered. The success of the arrangement is measured on the meter in the flower face. There are panels representing different weather conditions to cover the leaves.

This exhibit stands vertically with two support tubes which fit at the back to ensure stability.

CURRICULUM LINKS

Key stage 1

“They should be introduced ... and investigate what plants need to grow."

“They should have opportunities, when possible through first hand observation, to find out about a variety ... plant life.”

"They should be introduced to the idea that plants are the source of all the food in the living world"

Key stage 2

“They should investigate the factors that affect plant growth."

"They should be introduced to the idea that green plants use energy from the sun."

RELATED EXHIBITS

Video microscope

You can use this to examine leaves in detail.

WHAT TO DO

Raise one of the leaves slowly.

Q: What effect does this have on the meter reading?

(A: As the leaf is raised to a right angle to the light source the meter reading will rise.)

Place your hand over the leaf and shade it from the light.

Q: What effect does this have on the meter?

(A: Covering a leaf reduces the amount of light collected and this is shown by a lower reading on the meter.)

Hold one of the panels above the leaf.

Q: What effect does this have on the meter?

(A: It will reduce the amount of light falling on the leaf and therefore reduce the meter reading. The panels represent conditions like cloudy or hazy weather.)

OTHER THINGS TO DO

Look at green plants in a wood. Which ones do you think will get the most light? Higher leaves get the most, so trees will always win. Land with sufficient water and minerals, left to itself, will become forest.

SUNFLOWER: FURTHER INFORMATION

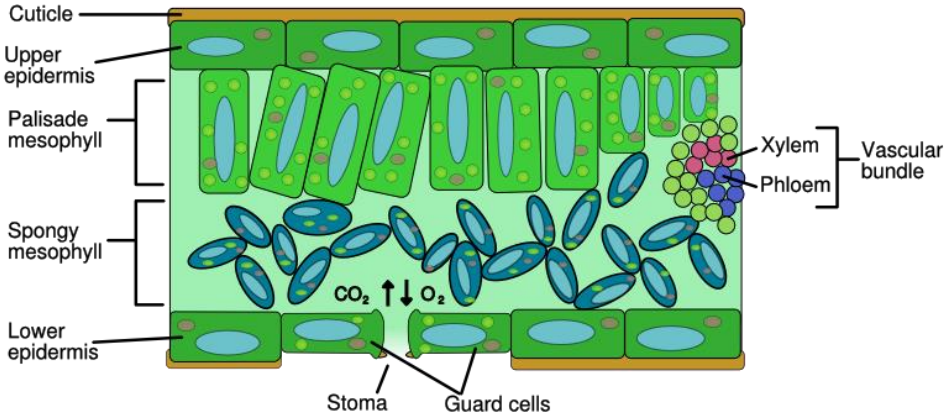
Photosynthesis
Embedded in the leaves of this model are solar cells that pick up light and convert it into electrical energy which is registered on the meter. This is analogous to the process by which green plants take up energy from light. Plants use it to manufacture sugars. This process is called photosynthesis.

Chlorophyll
Green plants contain a substance called chlorophyll which absorbs the red and blue parts of the spectrum of white light; it reflects the green part. It is this substance which uses the light energy to manufacture the sugar glucose out of carbon dioxide from the air and water from the soil; oxygen is the by-product.

Carbon dioxide (CO_2) + water (H_2O) → glucose ($C_6H_{12}O_6$) + oxygen (O_2)

Photosynthesis takes place in the chloroplasts of cell leaves. Plants arrange their leaves to get the most sunlight shading each other as little as possible. This is called phyllotaxis. Height is the best way of maximising light uptake. Thus trees will dominate in any landscape where there is suitable soil and man has not cleared them. Any land with sufficient essential materials and not cultivated by man will tend to climax forest.

Cross-section of a leaf



Food chains
At the base of every food chain lies the process of food synthesis by plants. In the vast majority of cases this is photosynthesis by green plants creating sugar, and from this other foods. Herbivores live off green plants and carnivores off them. The sun is the source of all our power. This is true of power from fossil fuels - the product of photosynthesis in ages past. (The sun also provides the energy for wind and water power. Nuclear reactions in stars like the sun produce the elements for atomic power too.)

ANIMAL VISION

Most animals possess visual sense organs
These vary in the way they work

DESCRIPTION

This exhibit comprises four pairs of goggles each modified with different lenses to mimic different types of eyes. Pupils put them on to experience the vision of different animals.

CURRICULUM LINKS

Key Stage 1

“They should have opportunities, when possible through first hand observation, to find out about a variety of ... animal life ...”

Key Stage 2

“Pupils should investigate ... the similarities and differences between ... animals."

RELATED EXHIBITS

Reaction timer

A fast speed of reaction is only useful if you can spot the predator.

WHAT TO DO

Select a pair of goggles and place them on securely. Look carefully around the room.

Q: What effect do the goggles have on how well you can see?
(A: Different animals have a different view of the world. These goggles give an approximation of that, although your own eyesight limits how much you can alter this view.)

Q: Which are easiest to see with?
(A: All the goggles give an odd view. The answer may be different for each pupil.)

Q: Which ones allow you to move freely?
(A: None of them, really. We have stereo vision - both eyes focus on the same spot, allowing us to judge distance. A predator has front-facing eyes; its prey has them on each side for all-round vision.)

Q: Which animals see like which?
(A: Compound vision - fly.
Side vision - horse.
Blind - mole.
Independent eyes - chameleon.)

Q: Why is a mole blind?
(A: Because it burrows underground and never gets any light.)

MORE THINGS TO DO

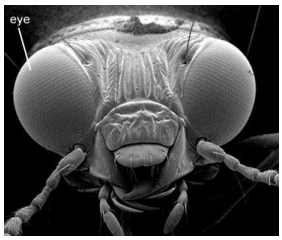
Try closing your eyes and then turn around a few times, slowly, to disorient yourself.

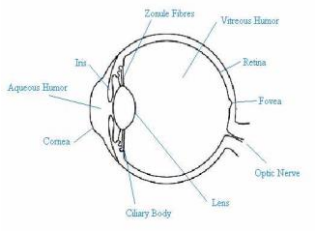
Q: With your eyes still closed, can you tell where the main light source is in the room?
(A: Even though you can not ‘see’, enough light will get through your eyelids for you to be able to point to light. Even a light-sensitive spot helps with orientation.)

ANIMAL VISION: FURTHER INFORMATION

Evolution of vision
Vision is one of the most useful senses and many different types of eye exist from the basic light-sensitive spot of an amoeba to the more complicated eyes with lenses like ours. Those who question evolution often suggest that something as complex as the human eye could only have been designed and never evolved. But the experiment with closed eyes shows even a light-sensitive spot assists in orientation and therefore survival. Protecting a group of such spots by indenting them to form a cup with a small opening acts like a pinhole camera, producing an image. The development of a piece of transparent tissue into a lens shape makes the image clearer. The evolution of the eye was not a one-off jump but a series of small changes selected over immense lengths of time to produce the variety of eyes that exist in nature today.

Compound eyes
Insects have compound eyes - a large number of mini-eyes grouped together in a hemisphere. This is good for a large area of vision and for spotting movement but not so good for detail.





Simple eyes
Vertebrate vision from fish to man uses simple eyes containing a single lens. However they vary greatly in their functioning. Many animals like horses have them on the side of their head. This gives a large area of vision, essential for herbivores who need to look out for predators. Most predators, however, have forward pointing eyes giving stereoscopic vision, allowing good judgement of distance. Chameleons have independently swivelling eyes and contracting pupils letting them to see insects, all around them.

Absence of light
Some animals, like moles, which live underground have no use for eyes at all and so are blind.

Night vision and camouflage
Nocturnal creatures have eyes which are designed to capture as much light as possible and are therefore large for the size of the animal. The light available is too low for colour vision, and they see only in black and white. This is true of some daytime animals. This is why much camouflage like that in zebras and tigers is more effective than it appears to us.

Colour vision
Animals that see colour have special light receptors called cones that respond to different parts of the light spectrum. Most mammals have two types; we usually have three (red, blue and green); goldfish have four. Many insects can see ultra-violet that is invisible to us.

Human eyes
Our eyes are extremely effective both for stereo and colour vision. This is an inheritance from our primate forbears. Moving through trees requires good judgement of distance and distinguishing fruit from leaves requires full colour. It proved a useful pre-adaptation for hunting.

The brain
It must be remembered that though the eyes receives the information it is the brain that makes sense of it. Our eyes turn the image upside down but our brain corrects it. Even the mole will have a 'picture' in its brain of its burrow as it feels its way around.

FOSSIL FIND

Fossils are the remains of animals and plants
They can provide evidence of evolution

DESCRIPTION

This exhibit is a display of a number of fossil casts. They are arranged in a time sequence, the oldest being on the left. Pupils can try to identify the source of the fossils by comparing them with a picture key.

CURRICULUM LINKS

Key Stage 1

“They should have opportunities, when possible through first hand observation, to find out about a variety of ... animal and plant life ...and become aware that some life forms become extinct”

Key Stage 2

“Pupils should investigate ... the similarities and differences between ... animals. They should learn how plants and animals are preserved as fossils."

RELATED EXHIBITS

Key

Modern creatures can be examined for diagnostic features.

WHAT TO DO

Carefully observe the fossils on display.

Q: Can you find any fossil plants?
(A: There is only one plant fossil in this collection. It is the leaf of a giant fossil fern. The sea lily looks like a plant but is actually an animal.)

Try to identify the fossils.

Q: Which ones are the easiest to identify?
(A: The dragonfly and the rodent for example are easy because they are whole creatures and look familiar. Others, like the dinosaur egg, are harder.)

Q: Are there any animals you don't recognise and why?
(A: Some of the species are extinct - the trilobite and the ammonite, for example.)

Q: Which fossils are the oldest?
(A: The ones on the left are the oldest - the trilobite and the sea lily - those on the right the most recent. The ones in the middle like the dinosaurs and the ammonite date from the Jurassic period.)

OTHER THINGS TO DO

Keep you eye out when you look at rocks - you might be lucky and find a fossil. The commonest fossils are ammonites which existed in huge numbers for millions of years in the past but are now extinct. One of the best places to look is the Jurassic Coast in Dorset.

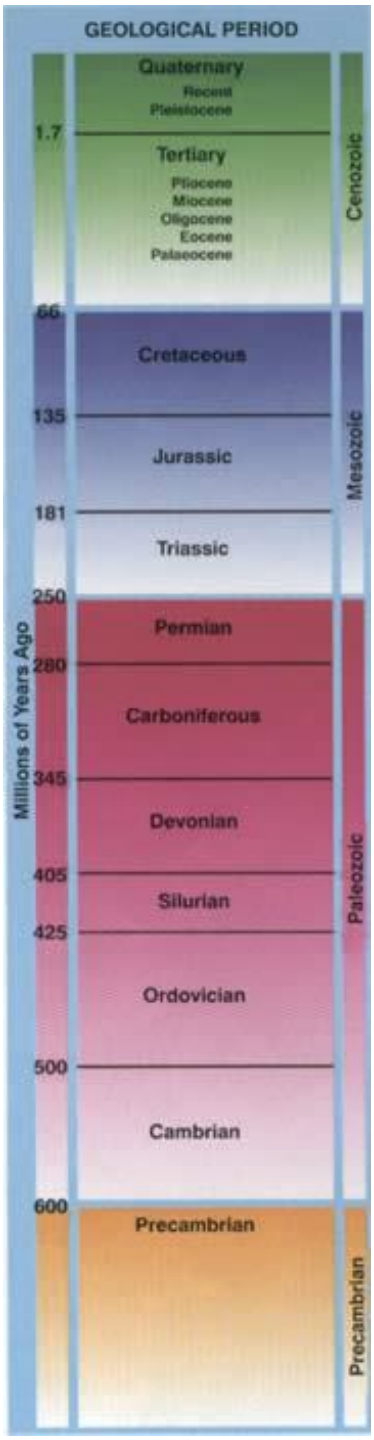
FOSSIL FIND: FURTHER INFORMATION

Fossils

Fossils (from the Latin for "dug up") are the remains or traces of animals and plants which have been buried - usually by sediment in water. This is why aquatic animals and plants are more common fossils than land ones. Occasionally whole creatures can be preserved, such as mammoths in ice or mosquitoes in tree resin. Sometimes it is the harder parts that are preserved, such as teeth, bones, shells or tree trunks. Usually the whole living thing is buried and just leaves its shape while it decays and is replaced by rock minerals in a process called petrification.

Geological strata

Many strata are made entirely of fossil remains such as chalk which is built up of shells from the decaying bodies of microscopic marine organisms. Oil also comes from the decay of marine organisms. Coal seams are the remains of trees buried under great pressure; they were laid down particularly in the Carboniferous period. Oil and coal are referred to as fossil fuels. These deposits usually leave no evidence of structure, but visible fossils are often embedded in them.



Geological dating

It is possible to date rocks by fossils and fossils by rocks. By observing the layers in which fossils are found it is possible to produce a time sequence of biological structural change, showing evolution. Before the Cambrian period few fossils exist. Most living things were soft bodied and therefore left no record of their existence. Many living things are not represented in the record after certain periods - they became extinct. This can happen at any time but there are particular extinction moments. The most dramatic occurred at the Permian - Triassic boundary when 95% of all species became extinct. But the most famous was at the end of the Cretaceous when the dinosaurs disappeared. The causes of these events are not definitely known and probably vary, but the dinosaur extinction may have been caused by the impact of a large asteroid. It would have raised a layer of dust remaining in the atmosphere for a long period, excluding light, causing the death of plants and the animals that lived off them. Other theories account for the event by continuous volcanic activity in the Deccan Traps in India over several millennia. The advantage of these extinctions is that they leave room for new species to evolve.

BALANCE

Animals have sense organs which enable them to maintain their balance
It is very important for humans as they are bipedal

DESCRIPTION

Pupils can stand on a small platform pivoted at its centre. They press a button to set a timer shown on the display and as long as they stay level it will continue to run. When the platform tilts it touches a sensor and stops the timer. They can compare their scores.

CURRICULUM LINKS

Key Stage 1

"Pupils should find out about themselves, how they …move."

"They should consider the similarities and differences between themselves and other pupils and understand that individuals are unique."

Key Stage 2

"Pupils should investigate ...some aspects of support and movement."

RELATED EXHIBITS

Reaction timer

Pupils can test their response speeds to a stimulus.

Skeleton hand

The movement of muscles, tendons and bones in a limb can be examined.

WHAT TO DO

Stand on the board with your feet either side of the centre. Try to balance on the board without holding onto anything. When you are ready press the button to set the timer and see how long you can balance. The time will be shown on the display.

Q: Can you balance easily?
(A: Everyone has different abilities and some people will be able to balance more easily than others.)

Q: Is it easier to balance with your feet apart or together?
(A: It should be easier to balance with your feet apart though this may vary.)

Q: Is it easier standing with one foot at right angles to the other?
(A: It can help, allowing the feet to do some of the balancing, not just the legs.)

Q: What difference does it make if your eyes are closed?
(A: It is harder, because seeing assists in balance.)

Q: Does it make it easier if you put your arms out?
(A: It should improve your balance. Tightrope walkers use long poles to help them.)

MORE THINGS TO DO

You are likely to get better with practice. Time your results and record your scores. Compare them with other children. You may like to make a class chart of the results.

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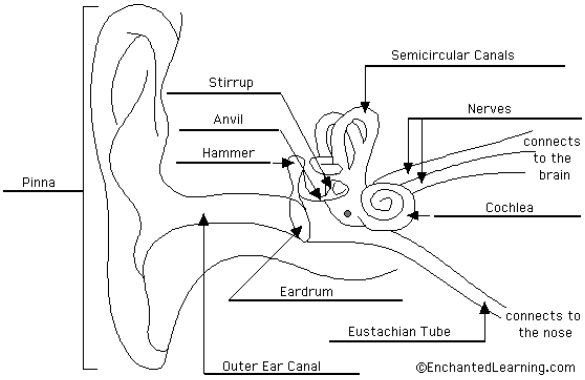
BALANCE: FURTHER INFORMATION

Ears

The principle organs of the balance are the semi-circular canals found in the inner ear. (They have nothing to do with hearing, however.) They consist of 3 loops at different angles to one another, connected to the cochlea, the sense organ of hearing. The internal lining of the canals has sensitive hairs which detect the movement of the fluid in them as the animal moves. They send the information to the brain which collates it with the other inputs it is receiving.



Eye

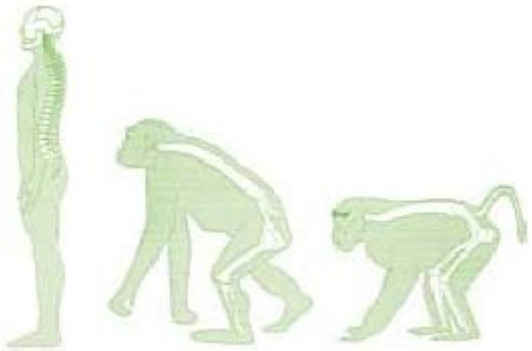
The eyes also play a significant role in balance, detecting orientation and movement. Sometimes this information contradicts that coming from the semi-circular canals, causing confusion in the brain to the point of nausea. This is part of the cause of sea-sickness.

Muscles

In order to maintain balance when standing on the device the muscles of the leg must be continuously contracting and relaxing. (Note that the arrangement of muscles, tendons and bones in the feet is similar to that in the hand.) The degree of stretch is perceived by the sense organs in the muscles called muscle-spindles or proprioceptors. (We have many more senses than the traditional five.) This information is sent via nerves to the brain where it is decided which muscles need to be operated to keep balance. Messages return via other nerves to the muscles. Muscles are continually operating to retain our position which is why it is tiring just to stand still.

Bipedalism

"Four legs good; two legs bad." Any dumb animal can stand on four legs. But the ability to balance on two feet in humans is a difficult one and must be learnt when young. The advantage of being bipedal, however, is that it liberates our hands for the multifarious tasks they can be put to.



ANIMAL SOUNDS

Animals make sounds to communicate with one another
The sounds are characteristic of each species

DESCRIPTION

A picture of an environment is displayed along side a key. At various points there are recorded animal sounds, particularly birds. Pupils can hear them by means of two phones which they can move across the picture. They can compare the sounds with the animals shown in the key.

CURRICULUM LINKS

Key Stage 1

“They should have opportunities, when possible through first hand observation, to find out about a variety of ... animal life.”

Key Stage 2

“Pupils should investigate ... the similarities and differences between ... animals. They should ... develop skills in identifying locally occurring species of ... animals."

“Pupils should investigate…at least two different habitats and the animals that live there.”

RELATED EXHIBITS

Key

Pupils can examine a variety of small creatures.

WHAT TO DO

Hold the phone to your ear and trace the hand-piece over the picture and listen to the sounds that you can hear.

Q: Can you recognise any of the animals?
(A: Use the key to confirm your guess. The sound of each animal can be heard over its picture on the key.)

Q: Why do you think they make these noises?
(A: Animals make sounds to communicate with one another: for group bonding, creating a pecking order, establishing a territory to attract a mate, maintaining contact between mother and young, and warning of danger. Some noises like the bee’s are just the sound of their wingbeats.)

Q: Which sound would you be more likely to hear at dusk or at night?
(A: Owls are largely active at night time.)

OTHER THINGS TO DO

Try listening out for sounds like these in your area. You might hear birds like these, such a blackbirds or swifts in cities like London. For some you would need to go to such places as wildlife centres where you can hear a great variety of bird song. The most pleasing songs are heard in spring as they sing to establish territory and attract mates.

ANIMAL SOUNDS: FURTHER INFORMATION

Animal sounds

Animals make sounds in order to communicate with one another. There are number of reasons to do this. They can warn other members of their species of danger. The "chink..chink..chink" you hear so persistently in suburban gardens, for instance, is the sound of a blackbird warning its fellows of a marauding cat. But equally these birds will produce a beautiful song to establish a territory and attract a mate. These performances show off the bird's vigour and suitability for reproduction in the same way that beautiful plumage does in other species. These songs are most frequently heard in spring and particularly at dawn. But some birds like robins (not nightingales) sing at night in towns confused by the brightness of streetlights into thinking that the sun is about to come up. They are also having to sing louder to be heard above the hubbub. This may lead to their inability to attract mates from among their country cousins who prefer a more conventional volume. Such a development could lead to the creation of two separate species in the long run.

Some noises such as those made by some insects like bees and flies are merely the product of their movement. But others like crickets and cicadas make sound for the same reasons birds and some mammals do to see off rivals and attract mates. Crickets do not rub their hind legs. The left forewing of the male has a rib with ridges. The chirp (which only male crickets can do) is generated by rubbing it against a scraper on the upper hind edge of the right forewing. This action is called **stridulation**.

Cicadas have regions of the exoskeleton called **timbals** which click as they are pulled in and again as they flip out.

Human sounds

Some animals have more elaborate means of communication. In particular humans have developed complex languages that enable us to pass elaborate information and ideas to one another. Much conversation has little purpose other than as a form of social grooming binding us together as a group, like flea-picking in monkeys.

While earlier species of man like Homo erectus and H. neanderthalensis probably had a form of language it is likely that the full modification of breathing and mouth movements and their control by the brain to create modern speech was a crucial evolutionary leap in the development of Homo sapiens.

Habitats and Ecosystems

The environment that animals and plants live in, is called a habitat. An ecosystem consists not only of the physical conditions such as hills and water, but of all the living things that coexist there. The study of such an environment and the interaction of its residents is called ecology.

At the heart of any ecosystem there must be a primary source of food. This must (with a few exceptions) be made by green plants, by photosynthesis. This uses the sun’s energy to manufacture sugars. From these the rest of the food requirements can be made. Animals feed on these plants and sometimes larger animals feed on them. This is called a food chain.

BODY PARTS

Bodies consist of many parts which are similar but not identical in different individuals of the same species
Touch is a useful but rather inaccurate sense in humans

DESCRIPTION

These 'feely boxes' contain hidden casts of body parts that the pupils can feel and try to name. They include hand, foot, teeth, knee, ear and nose. The flaps can be lifted afterwards so that students can check their answers."

CURRICULUM LINKS

Key Stage 1

“They should consider the similarities and differences between themselves and other pupils and understand that individuals are unique.”

Key Stage 2

“Pupils should investigate ...some aspects of behaviour in relation to themselves.”

RELATED EXHIBITS

Skeleton Hand

The skeleton of a hand can be examined.

Digestion

Pupils can listen to a ‘talking picture’ of the digestive system.

WHAT TO DO

Place you hand inside a sleeve and carefully feel what is inside.

Q: **Can you name the body part you are feeling?**
(A: Some of them are easier to name than others.)

Q: **Which pieces feel the most familiar?**
(A: The most commonly recognised part is the hand.)

Lift up the flap after you have made your guess, to see if you were right. Even though you have not seen these particular parts you should be able to recognise them for what they are.

Q: **Which are the most difficult to recognise, even by sight?**
(A: The knee is probably the most difficult.)

MORE THINGS TO DO

Look at the similar body parts on other pupils.

Q: **Do they all look the same?**
(A: Although they are all based on the same plan there is great variety in our body parts - "variety is the spice of life".)

OTHER THINGS TO DO

Try looking at a common species like the ducks (mallards) in a river or pond. Note the variety in their colours, markings and size. The commoner the species the greater the variety

BODY PARTS: FURTHER INFORMATION

Body parts
We should all possess these body parts and their fundamental shapes will be approximately the same. However there are innumerable small differences between them. Certain parts of the body are very distinctive. The face is the most variable part of the body, particularly as it can be manipulated both consciously and unconsciously to convey information.

Other parts of the body are unique to each individual. Fingerprints are the means by which the police can distinguish one person from another. They can also use hair and skin samples to identify a suspect. These days, they frequently use DNA. This is unique to a person and is indeed primarily responsible for the special physical characteristics of everyone, though as in the case of identical twins their external ears and fingerprints do not turn out exactly the same.

Variation is essential for evolution
In all species, though there is a basic body type, there is still great variation in the details. Without this variation there can be no selection and therefore no evolution. Species with greater variety are usually able to survive a significant change in their environment or a major disease better than one with a small gene pool. In ourselves the crude mechanism of evolution which once operated no longer totally dominates our survival. Our culture and our education matter more than our physical type.

Touch
This sense is not very developed in humans but some animals rely on it instead of their other senses. The spider detects the tug of prey struggling on its web; the mole feels its way around its burrow;. So dependent does the latter become on its sense of touch that it has lost the ability to see, but it still creates a picture of its burrow in its mind.

REACTION TIMER

Living things react to stimuli in their environment The speed of their reaction varies, even within a species like human beings

DESCRIPTION

Pupils can test their ability to react using this exhibit. The machine is primed by the start buttons and then after a variable amount of time a light (right) will go on or a buzzer (left) will sound. Pupils react to this by pressing the stop button. Their time is recorded in 100ths of a second. Older pupils may like to compare their scores.

CURRICULUM LINKS

Key Stage 1

"Pupils should find out about themselves, how they …move."

"They should consider the similarities and differences between themselves and other pupils and understand that individuals are unique."

"Pupils should be taught that humans have senses which enable them to be aware of the world around them."

Key Stage 2

"Pupils should investigate ...some aspects of support and movement."

RELATED EXHIBITS

Balance

Pupils can attempt to balance on a board for as long as possible.

Skeleton hand

The mechanism of movement of a hand can be examined.

WHAT TO DO

Prime the machine by pressing one of the **green** start buttons. After a certain amount of time the light (right) or buzzer (left) will be set off. Press the **red** stop button immediately. The timer records the speed of your reaction - from signal to response.

Q: Does every one have the same reaction time?
(A: No - reaction times vary greatly from person to person.)

Q: Does it make any difference if the light or the sound is used?
(A: Some people react more quickly to one sense than another.)

MORE THINGS TO DO

Q: What happens when you are distracted by noise or other things?
(A: Unless you are very good at concentrating, your reaction will be slower.)

Q: Is the time quicker after practice?
(A: Yes. This is a learned response and repetition will improve performance, though the improvement varies from person to person.)

OTHER THINGS TO DO

Think about why reaction times might matter. What difference does it make to our lives today and why would it have been useful as we evolved as hunter-gatherers?

REACTION TIMER: FURTHER INFORMATION

Reflexes

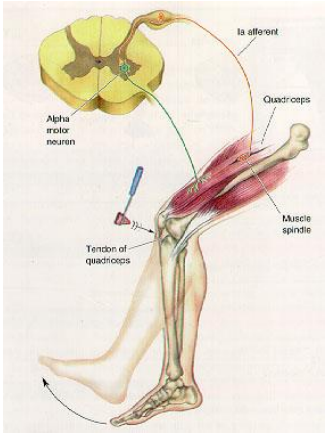
A response to a stimulus is a reflex. The sense organ in this case is the eye or the ear. It perceives the stimulus and triggers a nerve impulse to go via the optic or auditory nerve to the brain, where the information is processed and the response is decided on. The message to act is sent via a motor nerve to the appropriate muscles of the hand, which contract causing the finger to depress the stop button.

Like all learned responses, reaction times improve with practice. Some responses are automatic. If the stimulus in this exhibit was an electric shock, the reaction time would be much quicker! The nerve impulse from the touch receptor would not even have to reach the brain. It would stimulate another nerve in the spinal column which would send an immediate message to the appropriate muscle to remove the finger from the source of pain.

Speedy responses like this are necessary to avoid damage. But learned responses may also need to be fast when attempting to capture prey or flee a predator. Even in the modern human world fast reaction can be essential, particularly in an activity like riding a bicycle or driving a car.

Knee-jerk

The classic simple reflex most frequently tested by doctors is the knee-jerk. A sharp tap on the leg muscle tendon at the knee stretches the muscle spindle (proprioceptors). A nerve impulse travels to the spinal cord eliciting a return impulse via the motor nerve to the muscle causing it to contract thus lifting the lower leg.



Conditioned reflexes

Learned responses can become automatic - these are called conditioned reflexes. They were first investigated by Pavlov, who found that dogs salivated to the sound of a bell, if it had been rung regularly just before they were fed. It is much the same with children - the sound of the lunch bell causes instant hunger.

VIDEO MICROSCOPE

Microscopes can show us the detailed nature of living things
A video allows many people to see at the same time

DESCRIPTION

A video microscope is set up horizontally and connected to a monitor showing what is being observed. A number of samples are provided to put in front of it. Pupils can also examine themselves.

CURRICULUM LINKS

Key Stage 1

“Pupils should find out about themselves.”

“They should consider the similarities and differences between themselves and other pupils and understand that individuals are unique.”

Key Stage 2

“Pupils should investigate ... the similarities and differences between ... animals and plants."

RELATED EXHIBITS

Key

Small creatures can be examined with magnifying glasses.

WHAT TO DO

Put a finger in front of the camera on the left of the television, and move it backwards and forwards to bring it into focus on the screen.

Q: What does your skin look like?

(A: You can see the pits and wrinkles and the details of your fingerprints. It shows any cuts or marks in great detail.)

Try looking at other parts of your body like your eyes or nose.

Q: What can you see?

(A: Probably more detail than you like. Our bodies don't look too good when magnified to this extent.)

MORE THINGS TO DO

Look at the samples provided. You will be able to see great detail of the structure of feathers and wood, etc.

Q: What are feathers for?

(A: They keep the animal warm, like hair on a mammal or clothes with ourselves. The fluffy down does this best. Feathers can be modified to be strong light structures for wings.)

Q: Can you see anything in the samples that is not natural?

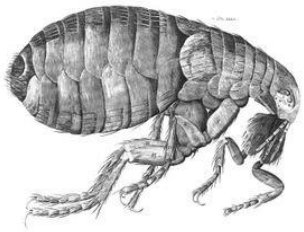
(A: The leaf is actually made out of artificial fibre and woven. Compare it with your own clothing.)

VIDEO MICROSCOPE: FURTHER INFORMATION

Optical microscope

The first microscope was invented in the seventeenth century in the Netherlands. Almost instantly it was used to examine biological specimens too small to be seen by the naked eye. The great scientist Robert Hooke made a book of drawings (Micrographia) of his observations. Optical microscopes rely on glass lenses.

Hooke's microscope



Hooke's drawing of a flea

Video microscope

The advantage of video microscopes is that image can be observed by several people at once. A video camera is attached to a magnifying lens. The lens in this exhibit has low magnification allowing easy appreciation of what is being looked at, but high power ones can be used to observe at the cellular level.

Electron microscope

Electron microscopes, which use beams of electrons instead of light, are designed for very high magnification usage. Electrons, which have a much smaller wavelength than visible light, allow a much higher resolution.