DIET

Science background for teachers

VOCABULARY

Diet, healthy, fats, carbohydrates, proteins, vitamins, fibre, minerals, calcium, chemical reactions, carnivores, herbivores, omnivores, balanced, energy

Diet is one of the most important factors affecting the health of animals. A correctly balanced diet is one containing a range of food enabling the body to stay healthy. This varies considerably in the animal kingdom. Physiologically our bodies are adapted to a particular diet regardless of the choices we make and it is important that we meet the needs of our bodies to remain healthy. Some animals are carnivores, some are herbivores and humans are omnivores. This means that we eat both meat and vegetables and even if we choose to be vegetarian we need to make sure that the chemicals usually obtained from meat are in our diet.

The main foods of animals are high-energy chemicals, which fall into three main categories: **carbohydrates, fats and proteins.**

Carbohydrates are chemicals used mostly as a source of energy by the body and any excess is stored as fat. There are two main types, sugars and starches, and the sugar glucose can be used directly with no digestion as a very quick source of energy. Other sugars and starches need to be converted to glucose first by digestion then absorbed by the body for use, particularly in respiration.

Carbohydrates are found in milk, bread, pasta, cereals and sugar.

Fats are also used as an energy source by the body. They are digested and mostly used in respiration and can be stored as an energy reserve if carbohydrate intake is insufficient.

Fats are found in butter, milk, cheese, meat and oil.

Proteins have a more varied role. When digested they produce amino acids which are the building blocks of the body, making and replacing living cells. They are essential especially in childhood for growth and throughout life for the regeneration of tissue. Amino acids cannot be stored and need to be removed from the body as a waste product, urea, removed by the kidneys as urine. It is important therefore that there is a regular intake of proteins.

Proteins are found in meat, soya, eggs and milk

Vitamins are needed by the body in very small quantities and enable the body to carry out complex metabolic changes. The body cannot make these chemicals but a lack of any one of these prevents a particular process from being carried out and results in a distinctive illness.

Vitamins are found in fresh fruit and vegetables, liver and yeast, wholemeal bread and butter and egg yolk.

Minerals are simple chemicals we need in small quantities to stay healthy. They are used for building bones and teeth, for the functioning of nerves and for making haemoglobin in the red blood cell. Haemoglobin carries oxygen around the body.

There are many different minerals. Calcium is found in cheese and milk, iron is found in liver and egg yolk, sodium is found in salt and iodine is found in sea foods and some salt.

Water is essential for the chemical reactions that take place in the body and for transportation of everything around the body. It is essential to all living cells, which are made up mostly of water.

Fibre is made of cellulose and is found in plants. It is not a food for humans since they cannot easily digest it. However it aids the movement of the food within the gut and allows it to be removed from the body more efficiently. It also helps prevent cancer of the large intestine. Herbivores can digest cellulose and use it as a source of carbohydrate.

Key ideas and activities

1. Food diary

Discuss with children the main food groups and a balanced diet. What do they think a balanced diet is? Do they think there are foods we do not need as much as others? Should some foods only be taken in small quantities? What do they think are the most important foods we require?

Children can make a diary of the foods they eat in a day, a weekend or a week and investigate the food groups they belong to.

2. Poster

In groups, children can make posters of food types. They divide the poster into the main food types and collect labels, packets and pictures of foods and put them into the correct type on the poster.

3. Good or bad foods

Draw a large-scale set of traffic lights, red for foods that should be avoided in large quantities, amber for foods that should be eaten in moderation and green for foods that can be eaten freely. After discussion with the children, they stick, draw or write foods around each light.

Using the website

At **www.primaryresources.co.uk/science/foodgroups.htm** (accessed August 2003) children can look up the foods that contain the food types essential for a healthy diet. There is also a comprehension exercise and close procedure that they can use or that can be printed out and given as a paper copy.

The BBC site **www.bbc.co.uk/revisewise/science/** (accessed October 2004) has a section entitled *Living Things* that includes a virtual canteen in which children can test their knowledge of what makes up a balanced diet.

MICRO-ORGANISMS

Science background for teachers

VOCABULARY

Disease, bacteria, virus, fungi, micro-organism, carbon dioxide, cells, respire, waste product, acid

Micro-organisms are living organisms that are often too small to be seen, and that may be beneficial or harmful.

Micro-organisms are tiny organisms that are often too small to be seen and therefore it is not always possible or easy to detect their presence. They are everywhere in enormous numbers, some of them are very useful in our lives but others are harmful. They are not really plants or animals; they fall into four main categories, bacteria, viruses, fungi and protoctista and are mostly made up of very simple cell structures. Like other living organisms, they need to feed and respire to produce energy and they produce waste products as a result. Being simple cell structures, they are capable of reproducing in very large numbers, very quickly, if the conditions are right. They may also be destroyed if the conditions are not appropriate.

Bacteria are single celled organisms of varying shapes and form chains or clumps as they reproduce. They live mostly by obtaining their energy from digesting dead and, occasionally, living material. The result of the digestion of dead material is decay and most bacteria are decomposers, recycling many of the materials in the environment. This is a vital role in the cycle of life allowing plants and animals to be returned to the Earth, not to mention the mounds of bodies and waste that would otherwise accumulate. However a result of the action of bacteria is that they produce toxic waste, which is smelly and harmful if ingested. Food that has been attacked by bacteria may not be obvious but is very harmful if eaten.

Bacteria such as those causing diphtheria, tuberculosis (TB), typhoid and leprosy are parasitic on living bodies and when they attack will cause a disease of that body.

There are harmless bacteria that produce acids as a result of feeding on milk and these are used in a controlled way to produce yoghurt and cheese. In the case of cheese, the milk curdles and separates into curds and whey. The curds are inoculated with other bacteria which feed on the proteins and produce other chemicals that give the cheeses their particular flavour. In some blue cheeses, fungi are inoculated into the cheese and this gives the characteristic blue veins or holes of Stilton, Gorgonzola, Danish Blue and Roquefort.

Fungi are also decomposers and play an important role in the decomposition of materials and natural recycling of waste. They are thread-like structures that spread through the food they are digesting and produce larger 'fruiting bodies', which are the reproductive bodies. Some fungi cause considerable damage such as dry rot in wood and

again, as a result of digestion, chemicals are produced which may be harmful if ingested. Some fungi attack living plants and animals, athletes foot is an example of a fungus.

Wild yeasts live in the sugary liquid of fruits and when their air supply is shut off they can respire without oxygen, converting sugar to alcohol. This is the basis of beer and wine making. Also, as yeast respires aerobically, with oxygen, it produces carbon dioxide and this is the basis of bread making. The yeast feeds on the starch of the flour and produces carbon dioxide which is trapped in the dough making air bubbles and causing it to expand.

Viruses are chemical structures not cells and invade living cells using them as the host cell. This enables them to reproduce by injecting their own DNA into the cell and taking over that cell. Eventually the host cell ruptures releasing the new virus, which invades other cells. Examples of diseases of the body produced by viruses are measles, mumps, influenza, smallpox and HIV.

Children need to understand that most of the time our bodies are protected from the invasion of micro-organisms by the body's natural protection mechanisms, for example our skin or the natural acidity or alkalinity of the body fluids, which are not tolerated by some bacteria or fungi. There are also the white blood cells, which engulf and counter-attack the micro-organisms. However if the body's mechanisms fail in some way *eg* a wound on the skin, or there is a change in the acidity of the body, or the micro-organisms attack in very large numbers, the body does not cope. This is when disease occurs.

Key ideas and activities

1. Discussion

Discuss with the children the different roles of micro-organisms and the health and safety issues that arise as a result.

2. Making yoghurt

If the children are to eat this, scrupulously hygienic conditions need to be observed to prevent the unwanted growth of dangerous bacteria. Boil a pint of milk to sterilise it and allow it to cool down to 36˚C keeping it covered all the time. Stir into the milk a teaspoon of fresh live yoghurt. Sterilise a vacuum flask and put the milk and yoghurt mixture in and leave for 5 hours or overnight. After this time the mixture should have changed to the typical texture and taste of yoghurt.

3. Making bread

Dried yeast is easier to organise in terms of purchasing, but fresh yeast can be added directly to the flour. Put a teaspoon of sugar into 100 cm^3 (common measuring apparatus in primary schools may show the units in ml. 1 cm^3 = 1 ml) water and stir in a sachet or teaspoon of dried yeast. Allow this to stand and go 'frothy'; the yeast becomes active and gives off carbon dioxide. Putting the mixture into a test-tube and putting a balloon over the top can show this. A gas is

obviously produced because the balloon blows up. Mix the yeast with 750 g strong plain flour, 2 teaspoons of salt, a tablespoon of oil and a further 150 cm^3 water. This should produce a clean soft dough. A little more water or flour may be required. Knead the dough for a few minutes and leave covered in a warm place for an hour, until the dough has risen and feels light and airy. Knead again and shape the dough into rolls or a bread shape. Leave this to rest for a further 20 minutes until the dough starts to rise again. Put this into a very hot oven at 220 ˚C for 5 minutes then turn the temperature down to 180 ˚C and cook for a further 5 minutes for rolls, or 20 minutes for a loaf.

This activity could become an investigation or investigative activity by asking the children to consider possible variables, such as the amount of yeast. They can also do an investigation with the yeast and balloon.

4. Decaying food

Since this is an explorative and observational activity children may suggest foods and bring them in from home. The class can then compare their results. Put samples of food in small identical containers such as petri-dishes or foil containers and cover them with clear plastic food wrap. It is a good idea to include some fresh and toasted bread as a point of discussion. The children predict what will happen to the foods as they are left. Some identical containers could be put in the refrigerator as well for further comparison. Dried food, ie the toast, and food kept cool will keep better. The plastic should **NOT** be taken off the containers and there is a serious health and safety issue here to discuss with the children. One is never sure exactly what bacteria or mould will grow and some people are allergic to the spores they produce, which are airborne.

Alternatively, make this an investigation and after an initial activity with growing mould, ask the children to suggest conditions in which to keep the food as a repeat experiment. Then choose a small selection of the same foods and change the conditions for growth, *eg* the temperature, putting food in the refrigerator, freezer, in a warm place. Different groups of children could compare different foods, keeping the conditions the same.

Time	place	prediction	observation
Day 1 bread	classroom		
Day 2 bread	fridge		
Day 3 bread	freezer		
Day 4 bread	radiator		

PHOTOSYNTHESIS

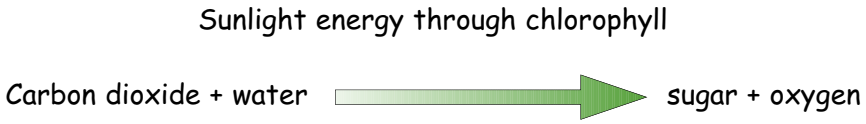
Science background for teachers

VOCABULARY

Balance, carbon dioxide, oxygen, sugar, transported, photosynthesis, chlorophyll, atmosphere

Plants, unlike animals make their own food. For this reason they are vital to all life on Earth as they are the beginning of the food chain and also maintain the balance of gases in the atmosphere. The process by which plants do this is known as photosynthesis and is a chemical process whereby plants make their own sugar.

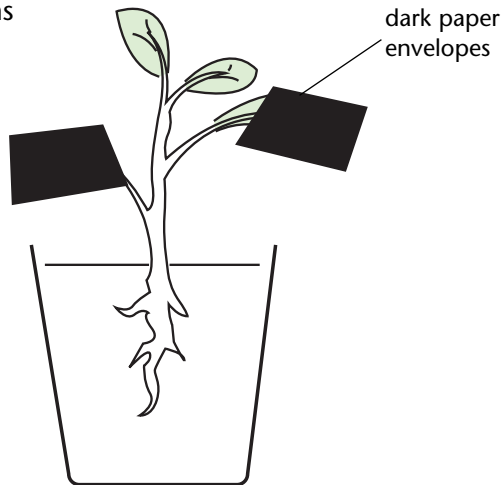
Light from the sun is essential to the beginning of this process and is absorbed by the chlorophyll in the leaves. Chlorophyll is the chemical that makes plants look green; it is not very stable, requires sunlight and a warm temperature and is continuously synthesised by the plant. This light energy combines with hydrogen from water, which has been taken up by the roots and transported to the leaves. Oxygen from the water is left as a waste product and released into the atmosphere as a gas. The next stage does not need light and often happens at night. Carbon dioxide, which is also absorbed by the leaves from the atmosphere, combines with the hydrogen from the water and produces sugars and eventually starch. This is stored by the plant.



Key ideas and activities

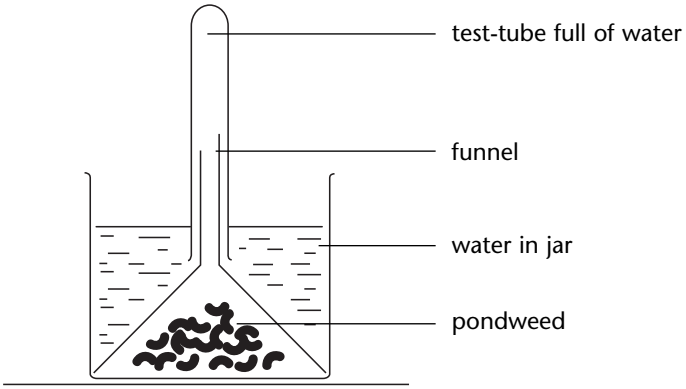
1. Green leaves

It is difficult at this stage to do practical work with children involving this process, as it is an activity carried out at secondary level. If a plant has a few of its leaves covered with dark paper envelopes for 2 days they lose their green. Children can observe this happening and can be given a simple explanation that plants need sunlight to stay green. When the paper is removed, the leaves recover. If the paper remains on some of the leaves, they eventually die. This could be a class demonstration or carried out by groups of children.



2. Plants produce oxygen

This activity shows that plants produce oxygen. Pondweed is used because it naturally lives in the water. Using a jar, funnel and pondweed, submerge them in the water so that the test-tube remains full of water. Now stand the jar in the sunlight. As the plant produces oxygen it bubbles into the test tube and replaces the water.



FERTILISERS

Science background for teachers

Nitrogen comprises 80% of the atmosphere and is 'fixed' by bacteria in the soil as nitrates where it can be absorbed in solution by plants. It is then incorporated into proteins and amino acids (building blocks for protein) by the plant cells and is essential to their healthy growth. Poor soil is often deficient in nitrates, the rain can wash them away or the soil may be over cultivated. Fertilisers may be used to replace the nitrates.

Children often believe that plants obtain their food from the soil. Plants make their own food but need a medium in which to support them as they grow. Seeds have their own food store and will therefore germinate in any medium including paper, providing they have warmth and water. It is after the food store is used up and they have green leaves that they make their own food and they need nitrates and support from the soil as they grow.

If the nitrates can be replaced in another way, any suitable growing medium such as sand will support the plants and they will grow.

Key ideas and activities

Activity 1

For this activity use seedlings (wheat or oats are suitable), silver sand and a liquid house-plant fertiliser. The seedlings are planted in identical pots with silver sand, some are watered with pure water and the others are watered with the liquid fertiliser. After a few weeks the difference in the plants can be observed.

PLANT GROWTH

Science background for teachers

VOCABULARY

Stem, leaves, roots, spindly, growth, light source

Plant growth is affected by a variety of things, including light. Plants respond to the direction of the light source and some parts grow towards it. This is called phototropism. Stems are positively phototropic as they grow towards light, whereas roots grow away from light and are negatively phototropic.

The growth movement is caused by a chemical signal passing down from the growing tip to the rest of the plant. The signal is a growth stimulant called auxin and causes faster cell elongation on the shady side of the stem, causing the stem to bend towards the light.

If a plant is put into a dark container with a small opening allowing light through, then the plant will grow towards the opening and out into the light. Children find this fascinating and great fun.

Similarly, gravitropism is the plant response to gravity and roots are positively gravitropic. The root cap in this case is where the auxins signal comes from and the cells elongate away from the gravity source, causing the root to grow downwards.

Plants make their own food in a process called photosynthesis (See unit entitled **PHOTOSYNTHESIS**). Light and water are essential to this process. Young children do not need to know this but they do need to understand the effect on plants when they are deprived of light or water.

Key ideas and activities

1. Making a plant maze

Beans work well for this and grow quickly. Use a small pot, compost, a bean seed and cardboard box or tube that can have a window cut out of it. Shoeboxes are good because the lid can form the side of the container and can be taken off so that the children can see the way the stem grows. Children can work in pairs or small groups and have fun deciding on their own maze design. The simplest design is the container with a window cut out of the side as in Figure 1. Figure 2 shows another option. Soak the bean first then put it into moist compost and put this into the box. Wait and see it grow towards the light.

Figure 1

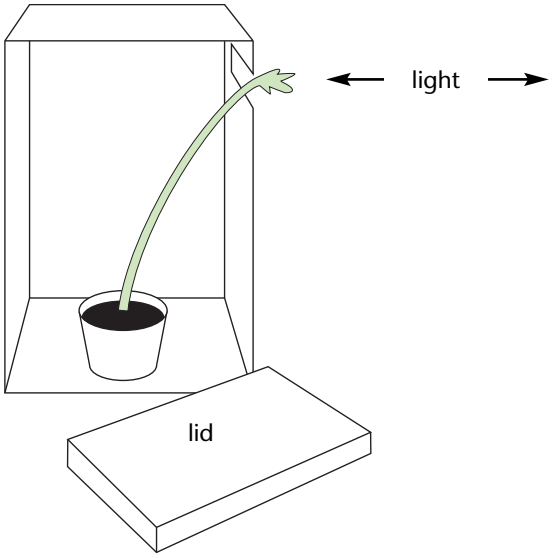
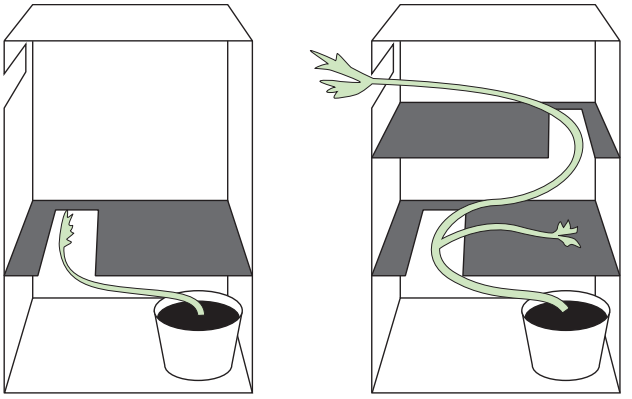


Figure 2



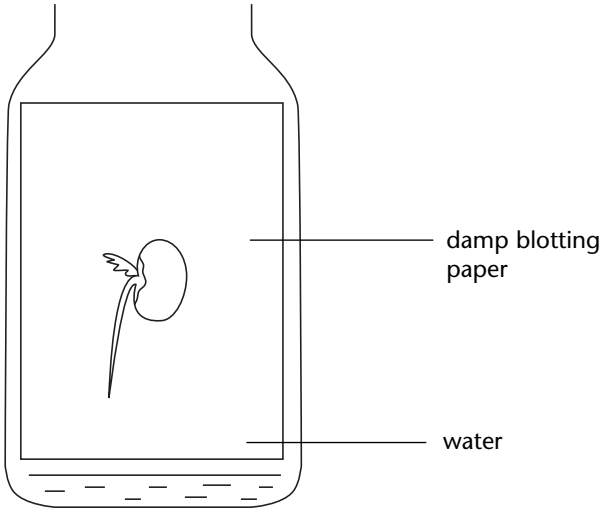
when the bean is planted fit the first piece of card in. Put on the side lid

As the bean begins to grow, put in the second piece of card

2. Watching roots grow downwards

Soak a bean overnight and put it into a jar with damp blotting paper so that the bean is visible from the side of the jar (Figure 3). As the bean germinates, the roots appear growing downwards. At this stage, carefully turn the bean upside down and wait to see what happens!

Figure 3



3 Growing healthy plants

Children can carry out this activity in small groups. Elicit from them first what they think are the necessary requirements for plant growth. They will always include soil in their list. This is not necessarily true (section on fertilisers) as soil is simply a medium for water storage, essential minerals and an anchor for the plant to grow.

Each group prepares three pots A, B and C with compost and soaks three bean seeds overnight. The beans are then planted and the soil kept moist until the beans germinate. This could be done in a jar to show the germination process, carefully transplanting the bean

afterwards into the pots using plastic tweezers. The beans are given different conditions in which to grow. A and B are put on a window sill but B is not given water. C is given water but put in a dark cupboard or put on the windowsill in an enclosed box to cut out the light. Each week the plants are measured. A fourth pot D could be included and left outside on the window ledge where the temperature may be lower. The beans are measured every week as they grow.

Children create a table in which to enter their predictions and results.

	Height of plant A in cm	Height of B in cm	Height of C in cm
Prediction of growth			
Week 1			
Week 2			
Week 3			
Week 4			
Observations of growth			

Children can create a spreadsheet of their own on the computer to insert the data.

Using the data on the spreadsheet, the children can then create a line graph to show the growth over the 4-week period.

RESPIRATION AND EXERCISE

Science background for teachers

VOCABULARY

Sugars, energy, oxygen, carbon dioxide, respiration, breathing, inhale, exhale, chemical reaction, release, evaporation

In order to stay alive, plants and animals need energy. The more we do, the more energy we need. We obtain energy from the breakdown of food, usually in the presence of oxygen and this process is known as respiration. It is a sequence of processes resulting in the release of energy. Oxygen is taken in by plants and breathed in by animals and is used to oxidise glucose. Carbon dioxide and water are formed as a result of this reaction and are breathed out by animals or released from the plant.

glucose + oxygen → carbon dioxide + water + ENERGY

During exercise the body and muscles move more than when at rest. Consequently, the muscles need more energy and more oxygen is needed for increased respiration to take place. Since oxygen is delivered to the muscles in the blood, more blood is needed and the heart has to beat faster. As more oxygen is used and carbon dioxide released the breathing rate increases as well. This increased activity causes the muscles to become warmer and also heats the blood flowing through them. This could lead to the body overheating, so in order to maintain the regular body temperature, blood flow is diverted through the vessels in the skin and heat is lost on the surface of the body. At the same time sweat glands in the skin release water (perspiration) and this evaporates, which has a further cooling effect. This can be shown by licking the back of one hand, blowing across it, and then comparing licked and unlicked hands.

Key ideas and activities

1. Comparing exercises

The children take the resting pulse of each other for a minute and record this. Alternatively they can count their partner's breaths but children often go into 'deliberate' breathing when doing this rather than breathing naturally and the results may be inaccurate.

Select a series of activities for the children to do, *eg* walking, sprinting, skipping, bouncing a ball, hopping, dancing, handwriting and get the children to do each activity for 3 minutes. Take the pulse or count the breaths after each activity and record this.

Activity	Pulse or breaths per minute
Resting	
Running	
Skipping	
Handwriting	
Hopping	

Copy this data onto a spreadsheet and use it to construct a bar chart on the computer.

Questions to ask

- Which activity raised the pulse the most?
- Which activity raised the pulse the least?
- Why are all the pulse rates different?
- Compare your results with those of your partner. What differences do you notice?
- Why are everybody's results a little different?

2. Harvard Step-test

This is an activity involving exercising and then taking the pulse every minute until the resting pulse is reached for each child. The faster this happens, the fitter the individual.

This activity can be done with the whole class and they are usually very tired and subdued at the end! Choose a PE lesson or the children will need to change as they get sweaty! A hall or playground is a good place to do it and you will need some benches and stopwatches or timers. Half the class do this at a time while their partners monitor and record what happens. Pre-prepared record sheets are useful for some children and all the children will need to have their own record sheets ready. The children also need to practice taking the pulse of their partner. Count for 15 seconds then multiply by 4 to get the pulse for 1 minute.

Harvard Step-test record sheet.

Resting pulse	Observations
After 1 min	Face red, breathing noisy, sweating
2 min	
3 min	
4 min	
5 min	

The children take the pulse of the partner who is to exercise first and record this. This is critical, so before you start check there are no silly numbers! The average child's pulse is normally around 70 beats/minute. Then the first of the pair do the test. It involves stepping up onto the bench with one then both feet and down again. Keep the rhythm steady using a drum-beat with all the class staying together – about 15 steps to a minute – point out that this is not a competition. Continue this for 5 minutes. As soon as the time is up they start their own timers and take their partner's pulse for 15 seconds and record it. They can also make other observations such as redness in the face. Then you wait for the rest of the minute and instruct the children to take the pulse again. This continues until each pair reaches the resting pulse they recorded, then they stop their timer. They will have a series of decreasing pulse times, the faster it reaches the resting pulse, the fitter the child.

The other half of the class can then do the activity. The results of this test are excellent data for constructing a line graph of pulse rate against time with older or more able children.

This data can be put onto a spreadsheet and a graph can then be constructed on the computer.

Questions can be asked using the data:

- Compare your data with those of your partner. What differences do you notice?
- Why do you think everybody's data is different?
- What do you notice about the time and the observations?

SMOKING AND DRINKING

Science background for teachers

VOCABULARY

Oxygen, carbon monoxide, disease, tar, nicotine, addictive, lungs, carbon dioxide, alcohol, sedative

Tobacco smoke contains nicotine, an addictive substance that acts as a stimulant, speeding up nervous activity and increasing alertness. In addition, at least 17 different carcinogens, which are chemicals causing some kinds of cancers, have been identified in tobacco smoke. There are also the physical effects of the smoke itself. It causes the air passages of the lungs to pull inwards, becoming smaller and making breathing more difficult. Smoke forms a sticky residue called tar and this irritates the lining of tiny hairs of the trachea. This causes an increase in the secretion of mucus and paralysis of the hairs, which usually remove unwanted particles. The carbon monoxide in the smoke combines with haemoglobin in the blood reducing the amount of oxygen in the blood and also increases the deposits of fat on the arteries. This causes them to become narrower and blocked. The main effects of this on the body are smoker's cough, emphysema, chronic bronchitis, coronary heart disease and lung cancer. Also, pregnant women may risk damage to their unborn babies. There is a risk from any, or all, of these diseases if you smoke or are contaminated by somebody else's smoke. Unfortunately these symptoms may take years to develop, by which time it is too late and the effects are usually severe and often fatal.

Alcohol is a sedative drug. In small quantities it may be beneficial since it causes blood vessels to expand, which helps prevent heart disease. It is also a diuretic, causing the body to dehydrate, which is not beneficial. In large quantities the sedative effect impairs judgement, co-ordination and vision and may lead to unconsciousness and possible coma and death.

Key ideas and activities

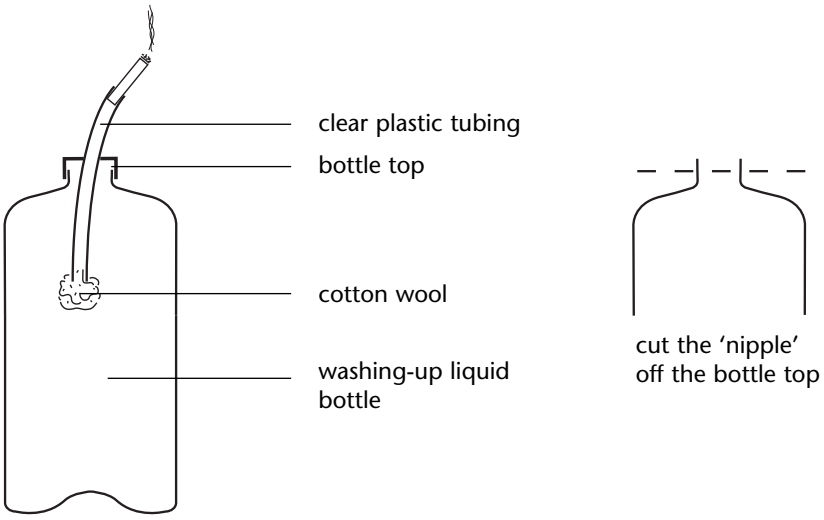
1. Discussion

Discussions about smoking may present a problem as many parents or siblings may smoke and it is not illegal. The same applies to drinking. However both can be addictive and cause social as well as physical problems. It is important that children are made aware of these issues and lessons may also include a discussion about the pressures from their peer group to smoke and drink.

2. Smoking Machine

This activity may be problematic in schools because of the non-smoking policy in schools. However it can be carried out outside as a demonstration. It is extremely effective and the smells and visuals of the tar collected from the smoke are disgusting! Smoking machines can be purchased but are easy to make. They consist of a clear

'squeezy', plastic bottle, and a clear plastic tube, that fits into a cotton wool plug. The cigarette fits in the end and the bottle is squeezed to 'puff' the cigarette. This is where smoke is produced and the device needs to be away from direct contact with the children. After just a few 'puffs' the tar clearly gathers on the cotton wool and this can be shown to the children.



3. Poster activity

Children could work in pairs to design a poster to communicate the effects of smoking.

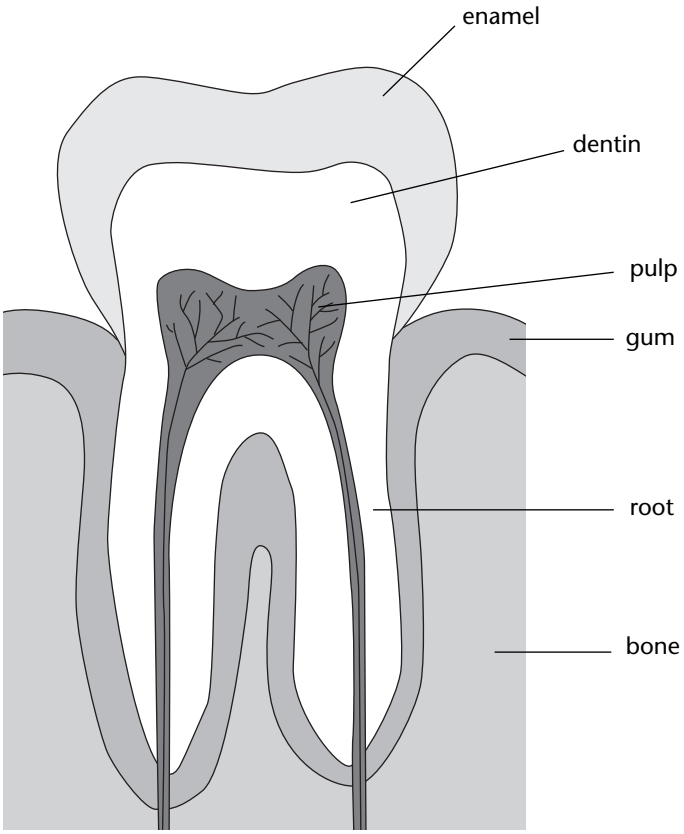
TEETH AND EATING

Science background for teachers

VOCABULARY

Acid, sugars, plaque, enamel, decay, bacteria, nerve endings, dentine, disclosing tablets, dye, stain chemical reaction, irreversible reaction, calcium

The basic structure of the human tooth is shown in Figure 1. The enamel, which forms the outer coating, is almost entirely made of calcium phosphate and is harder than the dentine it protects. This is harder than the bone of the jaw. The blood supply and nerve endings are in the pulp cavity in the centre of the tooth. If the enamel is damaged in any way, the dentine can be exposed and attacked by bacteria. If this is untreated and infection spreads to the nerve endings and blood supply, toothache occurs. Further serious infection may then spread to the jawbone.



Enamel may be damaged physically by being chipped, as in an accident or biting something that is too hard. It may also be damaged chemically. When we chew food some of it sticks to the teeth and is colonised and decayed by bacteria already living in the mouth. The action of this decay and the breakdown of sugars by bacteria produces acid, which attacks the enamel causing roughening and pitting of the surface. This makes it even easier for the bacteria to stick, forming a layer called plaque and further attacking the enamel.

Regular brushing with toothpaste, which is a mild abrasive, and flossing of the teeth help to prevent the build-up of plaque. Regular visits to the dentist may identify problems early. Diet also plays a crucial part in the decay of teeth. Certain foods such as apples, celery and other raw, crisp vegetables help to clean teeth. Other foods exacerbate the problems by encouraging the growth of bacteria or damaging the teeth. Cola drinks, for example, have phosphoric acid and lots of sugar, having a doubly harmful effect on the teeth. Hard sweets may chip the teeth and contain a lot of sugar.

Disclosing tablets are made of a vegetable dye, which stains the plaque on the teeth, showing the build-up of plaque, where you need to focus on brushing teeth and gums and how thoroughly the teeth are being brushed.

Key ideas and activities

Activity 1

Discuss the issues of decay, diet and how and when to clean teeth with the children. You may wish to invite a dental nurse in to talk to the children. He/she may bring in packs of disclosing tablets and dental mirrors for the children.

2. Using disclosing tablets

Parents need to be warned that this activity is taking place and that teeth may remain stained. Alternatively, send it home as a homework! This activity is best done after playtime or lunchtime, when the teeth are suitably dirty and sweets can also be given out to enhance the effect! You will need a supply of disclosing tablets, toothpaste and disposable beakers; the children need their toothbrushes in school. Give out the tablets and allow the children to chew the tablets for a few minutes then spit them out onto a paper towel. They can then look at their mouths with the mirrors and clean their teeth. They look again in the mirrors to see how effective they have been.

The children can also visit **www.aboutsmiles.org/productb.htm** (accessed January 2004) for some good pictures of stained teeth!

3 The effect of acids on teeth

Eggshells (calcium carbonate) will dissolve in acid. The enamel on teeth is a similar chemical to this. Explain this to the children first. Dissolving eggshell in a beaker of clear vinegar is a way of simulating the action of acid on the teeth.

Expect to see some fizzing initially, because of carbon dioxide given off as a result of the chemical reaction. After 24 hours the vinegar begins to change the eggshell, which starts to go soft, an irreversible reaction. Compare this with the action of water on eggshells, which has no effect.

POLLUTION

Science background for teachers

VOCABULARY

Pollution, fossil fuels, toxic, sulfur dioxide

When fuels like coal and oil are burnt, they give off a gas called sulfur dioxide in the smoke, which is toxic. This pollutes our atmosphere affecting both plants and animals and may cause susceptible individuals to have an asthma attack.

A campden tablet mixed with lemon juice gives off sulfur dioxide.

Key ideas and activities

1. The effect of sulfur dioxide on cress

This activity is best done as a demonstration because of the potential hazard of the sulfur dioxide and the susceptibility of asthmatics if they deliberately breathe it in. Children need to be warned.

You will need 2 pots of cress, campden tablets, lemon juice, a beaker and 2 plastic bags. Put one pot of cress in a bag and seal the bag with a tie. Put a crushed campden tablet and two teaspoons of lemon juice into the jam jar and put this into the other plastic bag together with the other pot of cress. Seal very securely with a tie and leave both bags for a few days recording any changes that may take place.

When disposing of this experiment, open the bag in an outside space away from children and adults to release the sulfur dioxide safely.

...THAT'S CHEMISTRY...extra bit!

Science background for teachers

VOCABULARY

rubbish, decompose, deteriorate, plastic, aluminium, metals, paper, rubber, wood, natural, man-made, synthetic, rigid, flexible, waterproof.

(A) Grouping and classifying materials
The properties of materials and their everyday uses.

These activities have very strong cross-curricular links with PSHE and Citizenship. They may be adapted to involve discussions also with older children about global issues such as the sustainability of the environment and the affect of the media and marketing on packaging and purchasing of foodstuffs and other products. Maybe there are some ideas for post-SATs with year 6.

Packaging

Most of what we buy today comes in some form of packaging. Often this is necessary as in bottles containing liquids and sealed bags keeping certain foods hygienic. They are made up of different types of materials that are appropriate to the contents. Glass bottles and rigid plastic bottles for liquids and softer plastic or paper wrappers to protect food. Some packaging is necessary for different reasons. However if one looks back in history to the way things used to be purchased and wrapped, often in simple brown paper bags, we might question the packaging we have today. How much of it is absolutely necessary and how much is a marketing strategy to get us to buy? If you buy from an open market your purchases are put into a paper or simple polythene bag at a fraction of the cost of the elaborate packaging that comes in the supermarket.

There are many issues here that might be discussed with children from the appropriateness of the materials used to the necessity of the amount of packaging and how we dispose of it. An average American has 1300 pounds of rubbish per year! We dispose of our rubbish by dumping, burning and recycling. Rubbish is dumped in national landfills but we have a problem with certain materials that deteriorate but do not completely decompose such as some plastics, glass some paper and aluminium. Plastics make up about 9% of the rubbish by weight compared with paper, which is about 36% and much of this will not decompose. Curb side collection and recycling drop-off points are proving successful and we all have a responsibility to use these.

Key ideas and activities

1. Collecting packaging

Collect lots of different types of packaging and discuss with the children the ways this may be sorted.

- By materials, mostly plastics and paper. Get them to sort into the types of plastics and paper.
- The necessity of the packaging. Get them to label the package with the product and decide on how necessary it was and how appropriate it was. They can also be made aware of health and safety for example plastic bottles versus glass bottles.
- Look at the different types of plastics and how they behave. Rip up a plastic cup and bend it, notice how it goes 'white'. Polystyrene has had air pumped through it, look at it carefully through a magnifying glass.
- Magic plastic bag!! Using a freezer bag, half fill it with water and seal the top. Now push a pencil through the bag and the water. The plastic clings around the pencil keeping the water in!

2. Why do we have packaging?

- Discuss with the children the purpose of packaging: containing a product, keeping it fresh, keeping in smells, keeping out smells, keeping it moist, keeping it dry.
- The previous discussion may then also trigger a further one on the properties of the packaging needed, what will keep moisture in?
- Natural wrappers. Look at a collection of seeds and the 'natural wrappers' they come in. Discuss with the children the purpose of the wrapper and how this might protect the fruit seed and aid in its dispersal.

3. Finding BOB – the Best barrier, an Odour investigation!

Chocolate picks up odours around it very easily. Where do we buy chocolate? Garages, tobacconists, garden centres? Chocolate manufacturers spend a lot of time and money testing their wrappers. Test chocolate with different contaminations of smell for the best wrapper. Discuss with the children the variables and how this test can be made fair.

- Use squares of chocolate or chocolate buttons.
- Wrap each one carefully (except one, your control) in different wrappers, greaseproof, cellophane, foil, etc and put this collection in a freezer bag with something smelly such as a piece of soap or cheese, onion, mint or garlic. Different groups of children could test with a different contaminant.
- Leave the bags overnight or for at least a few hours. Taste the chocolate!
- Which was the best wrapper and which was the worst contaminant?

4. Keeping crisps crispy!

- Using crisps from the same bag, weigh a small quantity and put them in a jar with a lid.
- Using crisps from the same bag and the same quantity put them in a jar with a damp piece of paper towel. Keep the towel damp.
- Leave both jars for a few days and weigh again, are there any other changes?

5. Keeping crisps fresh...

Ultra violet light makes oils on crisps go rancid.

- Put some crisps in a sealed, clear freezer bag and put by the window.
- Repeat with a dark bag made from black plastic.
- Leave both bags for a few days and then smell them. Seal thoroughly.
- Leave for a few more days and smell again.

'Sell by' dates can be discussed with the children with regard to the last 2 activities.

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