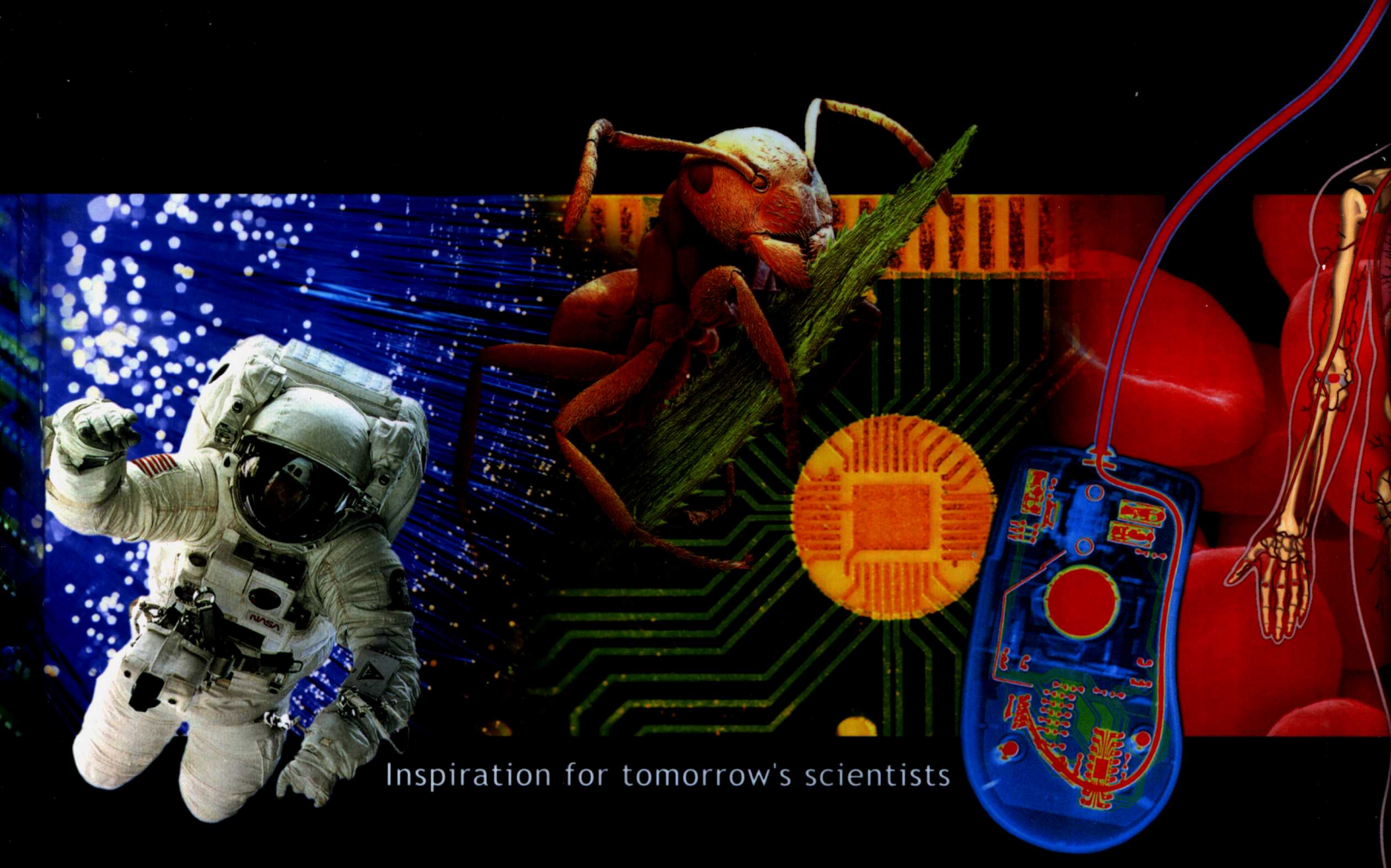
The Young Oxford Encyclopedia of Science

牛津简明科学百科全书

顾问：Professor Richard Dawkins（英）
主编：Robin Kerrod（英）



Inspiration for tomorrow's scientists

外语教学与研究出版社
FOREIGN LANGUAGE TEACHING AND RESEARCH PRESS

《牛津简明科学百科全书》由牛津大学出版社组织专家撰写，经过权威科学家详细审定。本书用精练而生动的语言展示了一个科学的世界，向你讲述人类在科学发展中的成就，以及前沿科学最新的发现。在这个由科学造就的时代，本书将告诉你——世界的未来就在你的手中！

- 包含300篇文章，涵盖3600个科学概念，涉猎广泛。
- 选取最新的科学概念和数据，紧跟科技发展潮流。
- 交叉学科、中英对照索引帮助你更快、更有效地检索内容。
- 精心挑选的彩色插图让科学内容变得更加鲜活生动。

¥：99.90
ISBN 7-5600-4462-X
9 787560 044620 >

一个学术性教育性
出版机构

网址：http://www.fltrp.com

The Young Oxford Encyclopedia of Science

牛津简明科学百科全书

顾问：Professor Richard Dawkins（英）
主编：Robin Kerrod（英）

外语教学与研究出版社
FOREIGN LANGUAGE TEACHING AND RESEARCH PRESS
北京 BEIJING

京权图字：01－2003－3633

图书在版编目(CIP)数据

牛津简明科学百科全书/(英)克罗德(Kerrod, R.)主编. —北京:外语教学与研究出版社, 2004.9
ISBN 7－5600－4462－X

Ⅰ. 牛… Ⅱ. 克… Ⅲ. 自然科学—百科全书—英文
Ⅳ. N61

中国版本图书馆 CIP 数据核字(2004)第 092204 号

牛津简明科学百科全书

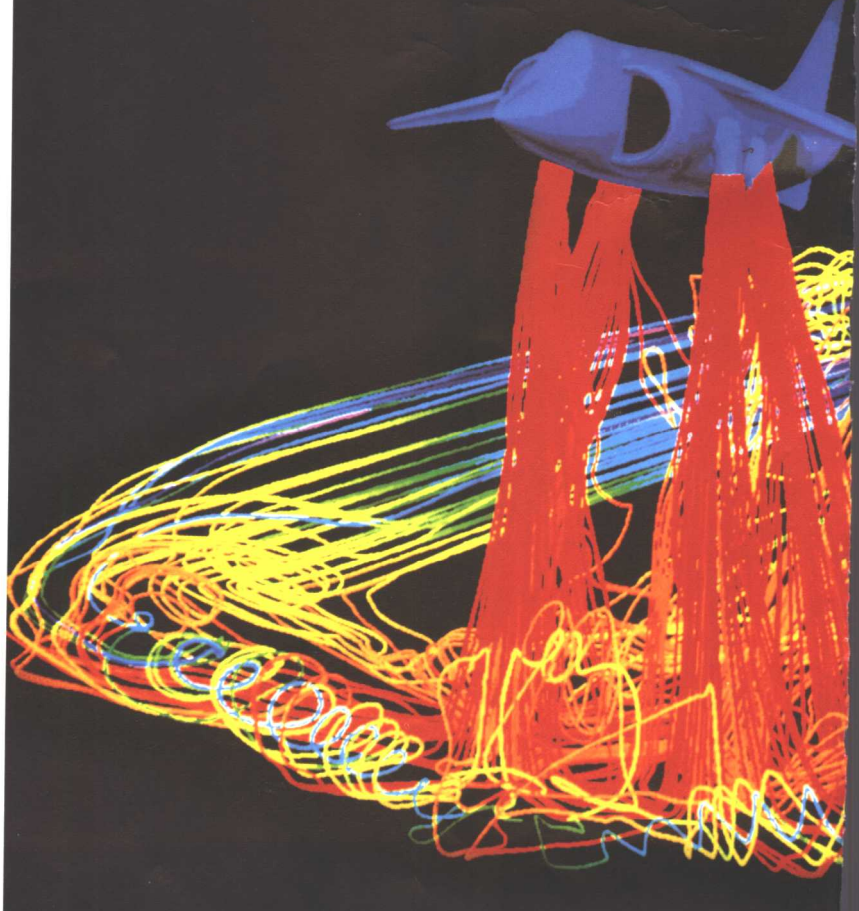
主编: Robin Kerrod (英)

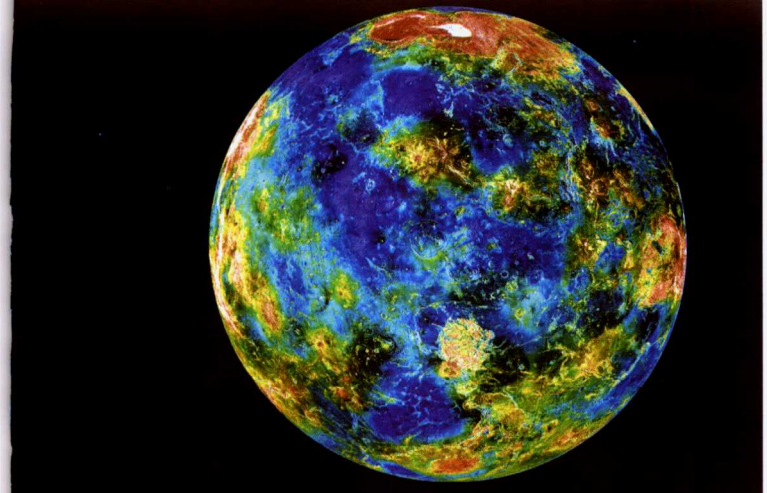
* * *

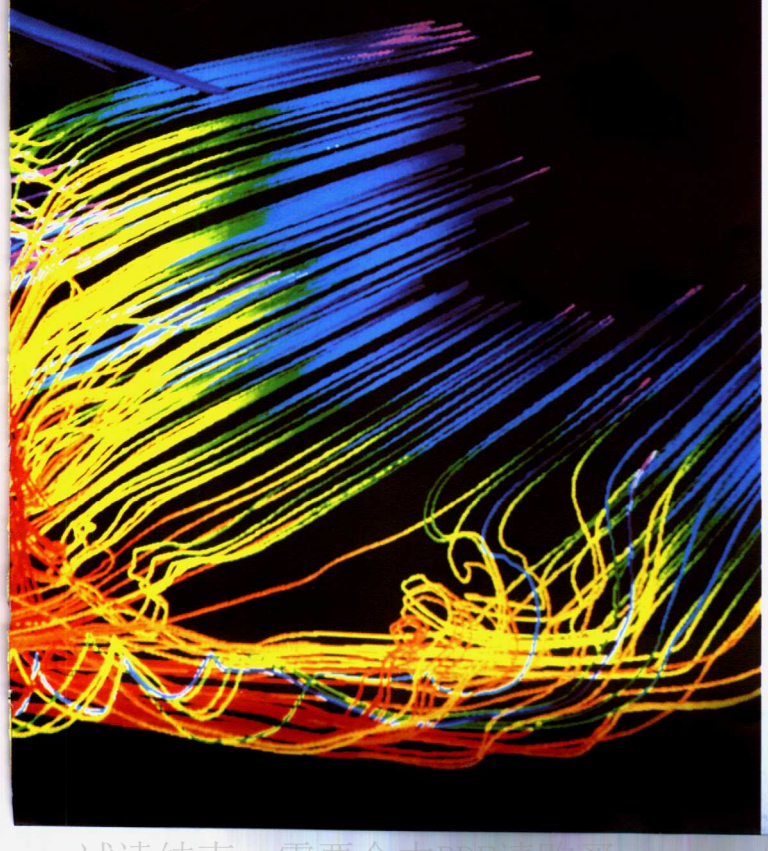
责任编辑: 周 晶
出版发行: 外语教学与研究出版社
社 址: 北京市西三环北路 19 号 (100089)
网 址: http://www.fltrp.com
印 刷: 北京画中画印刷有限公司
开 本: 889×1194 1/16
印 张: 29.25
版 次: 2004 年 9 月第 1 版 2004 年 9 月第 1 次印刷
书 号: ISBN 7－5600－4462－X/H·2100
定 价: 99.90 元

* * *

CONTENTS
目 录







Contributors

Consultant editor
Professor Richard Dawkins
Charles Simonyi Professor of the Public Understanding of Science, Oxford University, UK

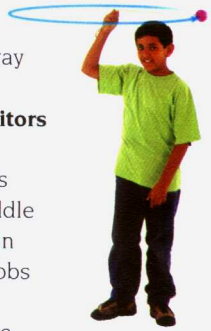
General editor
Robin Kerrod
Royal Astronomical Society

Authors
Jonathan Allday
Head of Science, King's School, Canterbury
Neil Ardley
David Bradley
Freelance science writer
Margaret Carruthers
Formerly Geologist and Educator, American Museum of Natural History, New York, USA
Ian Crofton
Dr David Glover
Robin Kerrod
Paul Marks
Technology Editor, New Scientist magazine
Dr Jacqueline Mitton
Royal Astronomical Society
Barbara Taylor
Freelance science and nature writer
Dr Brenda Walpole

General consultant
Stephen Pople
Former Head of Physics, author of Science to 14 *and co-author of the* Oxford Children's Book of Science

Consultants
Dr Peter Atkins
Professor of Chemistry, Oxford University and Fellow of Lincoln College, Oxford
Michael Chinery
John O. E. Clark
Mick Hamer
Consultant, New Scientist magazine
Dr Stuart Milligan
School of Biomedical Sciences, King's College London, UK
Dr Jacqueline Mitton
Royal Astronomical Society
Dr N. W. Rogers
Department of Earth Sciences, The Open University, UK
Michael Scott
Frank Tapson
Dr Irene G. Turner
Department of Materials Science and Engineering, University of Bath

Managing editor
Ben Dupré



Editor
Andrew Solway

Assistant editors
Lara Dennis
Joanna Harris
Rebecca Heddle
Susan Mushin
Michelle Nobbs
Clare Oliver
Alison Ritchie
Richard Spilsbury
Elizabeth Tatham

Indexing
Ann Barrett

Art editors
Jo Samways
Hilary Wright

Photographic research
Caroline Wood

Finding your way around
使用说明

《牛津简明科学百科全书》编排科学合理，你可以方便快捷地找到所需信息。本使用说明旨在帮助你最大限度地利用本书的资源。

需要查找某个特定**话题**时，第一步要找出书中有没有针对这个话题的文章。本书的文章是按26个英文字母的顺序排序的，查找方便。

如果这个话题没有相应的主题文章，那么下一步你需要查看**页脚**，那里补充了大量的话题并提供了这些话题所在的位置。

你还可以利用书后的**索引**进行查找。这一部分提供了各类信息所在的页码。

在线支持：

《牛津简明科学百科全书》有自己的网站支持，网址为www.oup.com/science-encyclopedia。该网站提供了大量的相关网址，你可以在网上找到丰富的科学资料，包括图片、动画、试验活动等等。该网站设有互动测试，检测你对这些科学知识的掌握程度。此外，这里还有书中的大量的图片供你下载使用。

BIRDS' BILLS

The size and shape of a bird's bill depend mainly on what it eats and where it finds its food. The curlew uses its long bill to find worms hidden deep in the mud. The pelican catches fish in its stretchy throat pouch. The flamingo uses its bill as a sieve to strain tiny creatures from the water. The eagle tears the flesh of its prey with its hooked bill. The hawfinch uses its short, strong bill to crack hard seeds.

Find Out More

- Animals
- Classification
- Ecology
- Life

Bird food

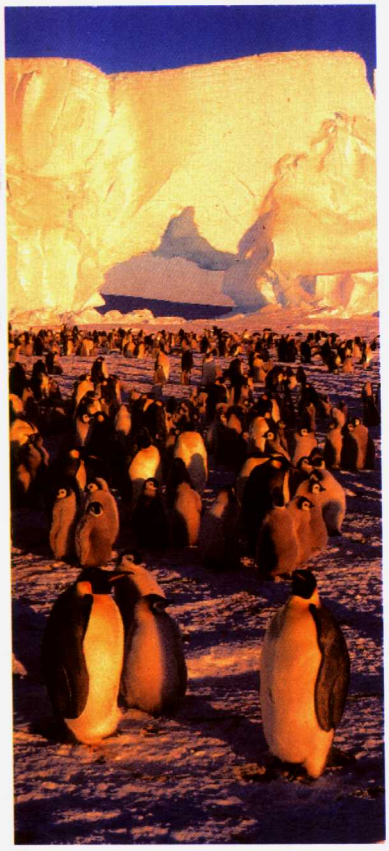
Different kinds of bird eat different kinds of food. Some birds are vegetarians, eating fruit, seeds, nuts or leaves. Others eat insects and worms. Many are meat-eaters, catching fish, amphibians, birds and small mammals. The most efficient hunters are the birds of prey, like the eagle and falcon.

ovenbird

weaver bird

◀ Ovenbirds and weaver birds build unusual nests. A pair of ovenbirds makes a strong nest the size of a football out of mud and cow dung. Male weaver birds make their nests by weaving together pieces of grass.

Did all the dinosaurs really die out 65 million years ago? Perhaps they didn't. Some scientists think that birds – including the birds in your garden – may be the direct descendants of the dinosaurs.



▶ Penguins, such as these emperors, have stiff, strong wings, which they use like flippers to swim very fast underwater. Their wings are no use for flying. Other birds that do not fly include ostriches, emus, and kiwis.

Courtship and mating

Male birds are usually more colourful than females and sing or perform daring acrobatics to persuade females to mate with them. After mating, birds lay eggs. They would be too heavy to fly if they carried their young around inside them.

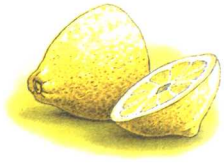
Many baby birds are naked when they hatch from the eggs. They stay safe and warm inside a nest while they grow their feathers. Other birds, such as ducks and geese, hatch out with fluffy feathers. They can run around soon after hatching and feed themselves.

Birth *see* Human reproduction • **Black holes** *see* Galaxies • **Blood** *see* Heart and blood • **Body** *see* Humans

图解：

1. **标题中心词 (headword)**
   按照26个英文字母顺序排列，易于查找。
2. **页眉 (running head)**
   如果有的主题文章超过一页的篇幅，页眉上的标题可以帮助你准确找到这篇文章的位置。
3. **开篇 (opening paragaph)**
   以生动活泼的语言展开话题。
4. **正文 (main text)**
   对话题进行详细讲解。
5. **小节标题 (section heading)**
   简要概括各小节的内容。
6. **图片 (illustration)**
   形式多样，包括照片、图片、表格、地图，突出重点内容，针对主题的重要方面进行讲解。
7. **图片说明 (caption)**
   对照片和图片进行说明，提供更多信息。
8. **专题讲解 (feature box)**
   针对主题的某个方面，进行更深入的阐释。
9. **真相揭秘 (fact flash)**
   介绍令人惊叹的事实真相。
10. **深入探索 (Find Out More)**
    提出相关题材，鼓励读者进一步学习。
11. **页脚 (footer)**
    列出没有主题文章进行讲解、但是在书中其他文章中讲到的主题。

Acids and alkalis
酸和碱

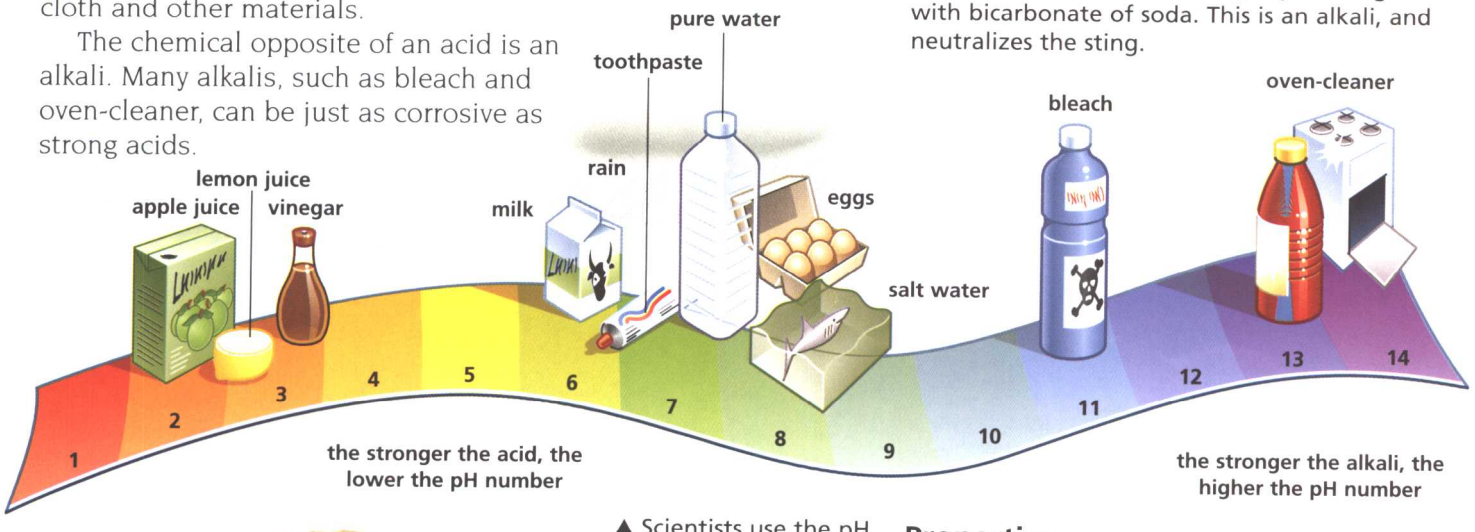


If you taste something sour, like lemon juice, vinegar or milk that's gone off, your tongue is detecting the acid in these liquids. Your body can detect acids in other ways too – when you get stung by an ant or a nettle, it is the acid in their stings that makes it hurt.

▲ Like ant bites, bee stings contain formic acid. People used to treat bee stings by rubbing them with bicarbonate of soda. This is an alkali, and neutralizes the sting.

Lemon juice and vinegar are weak acids. Strong acids are much too dangerous to taste or touch. They are corrosive, which means that they can eat into skin, wood, cloth and other materials.

The chemical opposite of an acid is an alkali. Many alkalis, such as bleach and oven-cleaner, can be just as corrosive as strong acids.



▲ Scientists use the pH scale to measure how acid or alkali something is. Neutral substances, such as pure water, have a pH of 7.

◀ Cola drinks contain phosphoric acid to give them flavour. But the acid combines with the sugar in the drink to rot your teeth.

Properties

Acids form a big group of chemicals that all behave in similar ways. Acids all contain hydrogen, and when they react with metals such as iron and zinc, they give off hydrogen gas. When acids touch a special paper, called litmus paper, they turn it red.

Alkalis are part of a group of chemicals called bases: alkalis are bases that dissolve in water. Many alkalis have a bitter taste and feel soapy. But do not try to taste or touch an alkali – you will be badly burned. Alkalis all contain hydroxide (hydrogen joined to oxygen), and turn litmus paper blue.

Scientists measure the strength of acids and alkalis on a scale of numbers called the pH scale. The scale ranges from 14 (the strongest alkalis) to 0 (the strongest acids).

Acoustics *see* Sound • **Adhesives** *see* Glues and adhesives

Mixing acids and alkalis

When an acid meets an alkali, both are changed – they are neutralized. What happens is that the hydrogen from the acid joins the hydroxide from the alkali to make water (a molecule of water has two hydrogen atoms and one oxygen atom). The parts of the acid and alkali left behind make a salt. For example, when hydrochloric acid reacts with sodium hydroxide (an alkali), the result is water and sodium chloride – common table salt.

Uses

Lots of acids occur in nature, and are found inside your body. For example, your stomach produces hydrochloric acid to help digest your food. DNA, the complicated chemical that stores your genetic code, is deoxyribonucleic acid.

Strong acids, especially sulphuric acid, are used in factories to make fertilizers, explosives, plastics, synthetic fabrics, paints, dyes, medicines, detergents, and many other chemicals.

Weak alkalis such as milk of magnesia are good for indigestion caused by too much acid in the stomach. They work by neutralizing the acid.

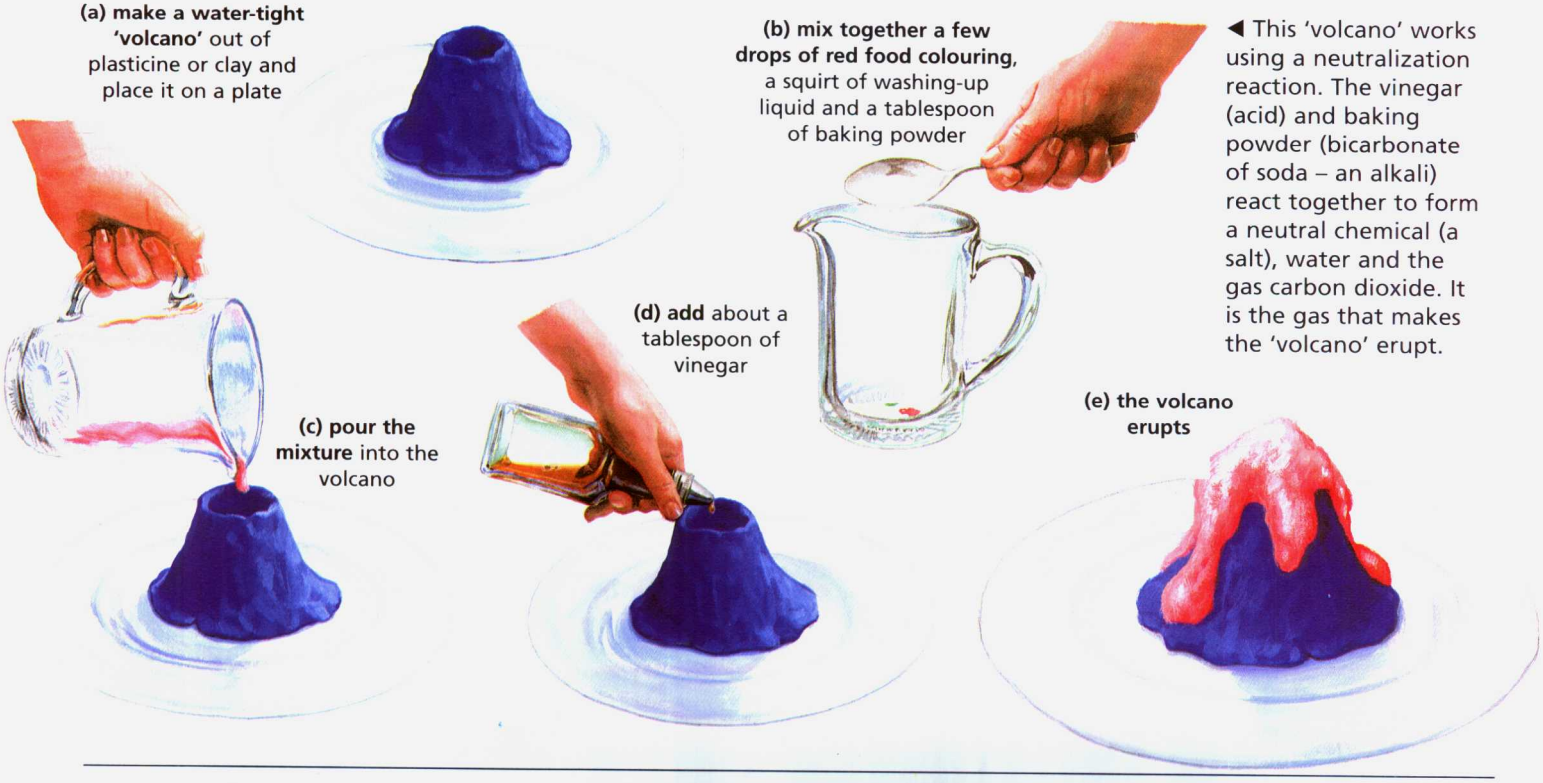
▶ This portrait by the Dutch artist Rembrandt is an etching. Etching is a way of printing pictures that uses acid. The artist draws lines with a steel needle on a copper plate covered in acid-resistant material. The plate then goes into a bath of acid, which bites into the copper where the artist has drawn the lines. The coating is then removed, and the plate is ready to make prints.

Strong alkalis such as sodium hydroxide (caustic soda) feel slippery to touch, because when they react with oils on your skin they form a kind of human soap – don't try this, it will burn your skin. Because sodium hydroxide solution dissolves fats, it is used to clear blocked drains and in oven cleaners.

In industry, alkalis are used in the manufacture of soap, glass, paper and textiles, and in the refining of crude oil.

Find Out More

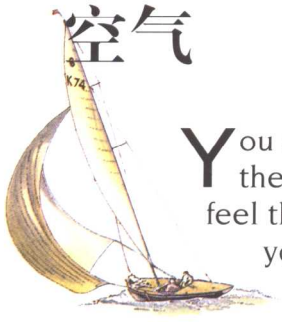
- Chemicals
- Genetics
- Reactions
- Salts



◀ This 'volcano' works using a neutralization reaction. The vinegar (acid) and baking powder (bicarbonate of soda – an alkali) react together to form a neutral chemical (a salt), water and the gas carbon dioxide. It is the gas that makes the 'volcano' erupt.

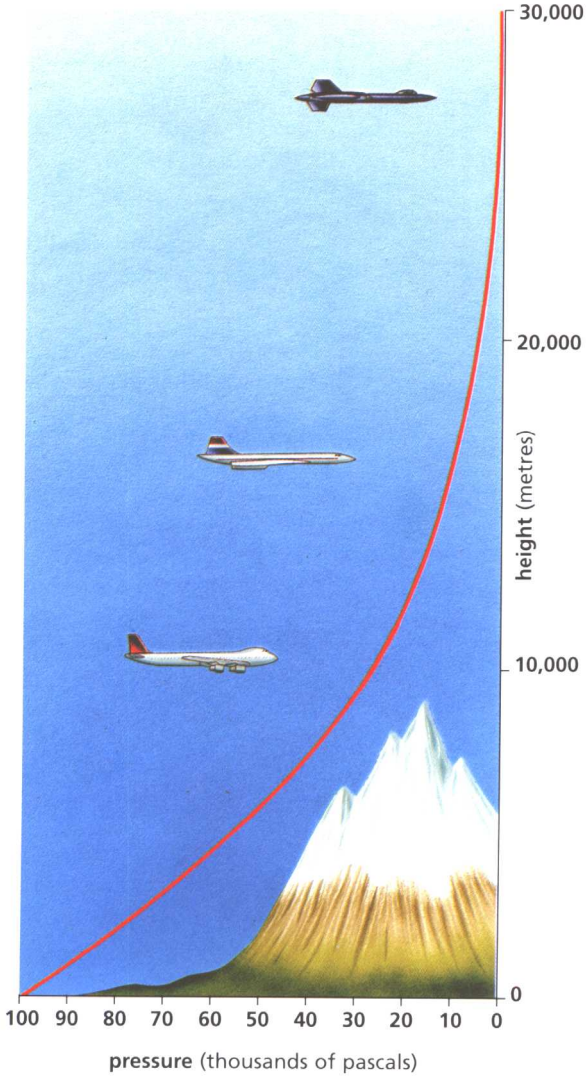
Aeroplanes *see* Aircraft, Flight • **Agriculture** *see* Farming • **AIDS** *see* Bacteria and viruses

Air
空气



You are surrounded by gases. You can't see them, and you can't smell them. But you can feel them gently move in and out of your body as you breathe, or brush against your skin when a breeze blows.

The mixture of gases that surrounds us is called air. Air surrounds the whole Earth in a thick layer called the atmosphere. Air is mostly made up of nitrogen and oxygen, but there are also smaller quantities of other gases, including carbon dioxide.



◀ At sea level, the weight of air is about 1 kg for every square centimetre (100,000 pascals). As you go higher in the atmosphere, the pressure falls rapidly.

The importance of air

For humans and other animals, the most important gas in air is oxygen. We need to breathe in oxygen to make our bodies work – without it we would die. We breathe out another gas, carbon dioxide.

Plants need carbon dioxide. They use the power of the Sun to combine carbon dioxide with water to make their own food. As they do so, they give out oxygen.

The proteins that are an essential part of our bodies are chemicals containing nitrogen. Factories can turn the nitrogen in the air into fertilizers, which help crops to grow. Unfortunately, factories and cars also release other gases into the air, which cause pollution.

▲ If the air inside a balloon is heated, it becomes less dense (thinner) than the surrounding air and rises, lifting the balloon with it.

Air pressure

The atmosphere extends upwards for several hundred kilometres. Although the air gets very thin high up, there is still a lot of air pressing down on us. At sea level, there is a force of about 1 kilogram pressing on every square centimetre of your body. You don't feel this pressure because your body fluids are at pressure too, and push back with the same force.

Find Out More

- Atmosphere
- Carbon
- Lungs and breathing
- Nitrogen
- Oxygen
- Pollution

Aircraft
飞行器

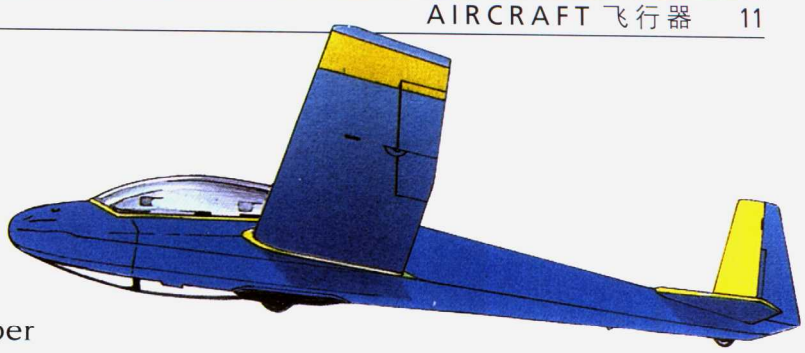
Just after dawn on 21 March 1999, a silvery balloon as tall as a skyscraper landed in the sand of the Egyptian desert. Breitling Orbiter 3 had set off from a snowy village in Switzerland 19 days earlier. Its crew, Bertrand Piccard (Switzerland) and Brian Jones (Britain), had become the first people to fly around the world by balloon.

The first aircraft to lift a human into the skies was a balloon. But it is heavier-than-air craft such as aeroplanes and helicopters that dominate our skies today. Almost every minute of every day, airliners carrying up to 400 people take off from or land at our main airports.

Lighter than air

Balloons fly because they are light: they float in air in the same way that boats float in water. There are two main types – hot-air balloons and gas balloons. Hot-air balloons are filled with air heated by a burner. Because the hot air is lighter (less dense) than the surrounding cold air, the balloon floats upwards. Gas balloons are filled with a light gas, usually helium.

▼ *Breitling Orbiter 3* on its way to becoming the first balloon to fly non-stop around the world. Unlike most balloons, the *Breitling Orbiter* used a combination of helium gas and hot air. Climbing as high as 11,755 metres above the Earth's surface, the crew travelled in a sealed capsule with its own air supply.

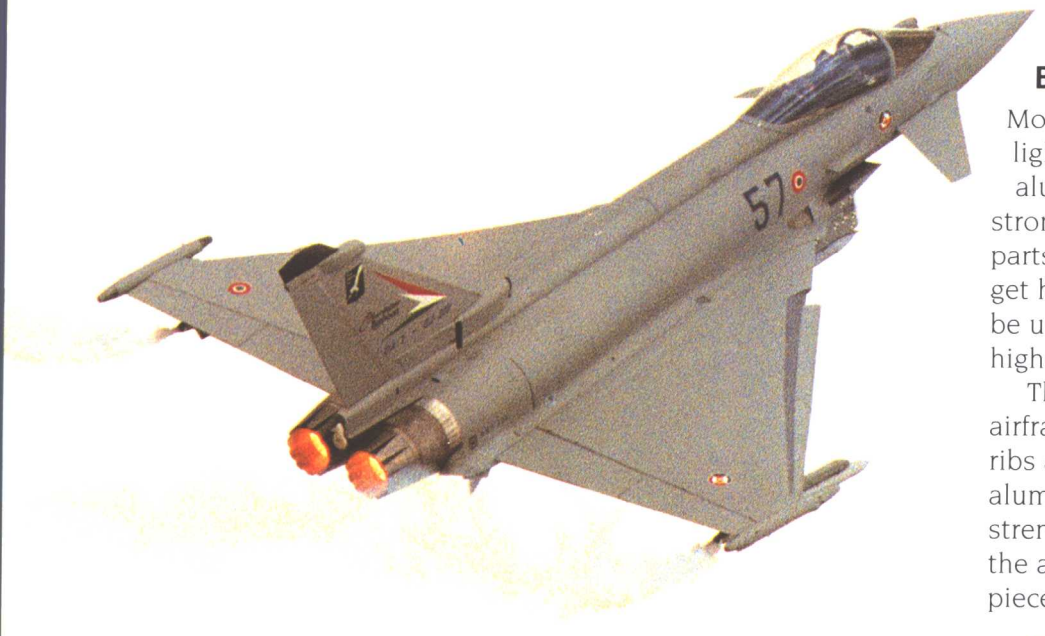


▲ A glider is a heavier-than-air craft with no engine. It has to be towed behind a car or aeroplane to get into the air, but once airborne it can glide for hours.

Airships are elongated balloons, fitted with engines. In the early 20th century, huge airships pioneered long-distance air travel. Today, small airships are used for such things as aerial photography.

Heavier than air

How can something as big and as heavy as a 400-tonne airliner leave the ground and stay in the air? The answer lies in the wings. A wing has a special shaped cross section, called an aerofoil. When air flows across the wing, it tends to lift upwards. It is this lifting force that supports the plane in the air. Like birds, planes need a tail as well as wings. The tail helps to keep the plane steady. It has a vertical tail fin and horizontal tailplanes.



Building aircraft

Most aircraft are made out of lightweight materials, particularly aluminium alloys. These are nearly as strong as steel but much lighter. For key parts of the aircraft, especially those that get hot, titanium or stainless steel may be used. These metals stay strong even at high temperatures.

The main structure of a plane (the airframe) is made up of a framework of ribs and spars. On top is a thin shell of aluminium sheets. In parts where extra strength is required, such as the wings, the airframe may be made out of a single piece of metal.

The jet set

An aeroplane's engines provide the power, or thrust, to move it along. Until the 1950s, most planes were powered by piston engines, which turned large propellers. But most planes now have jet engines.

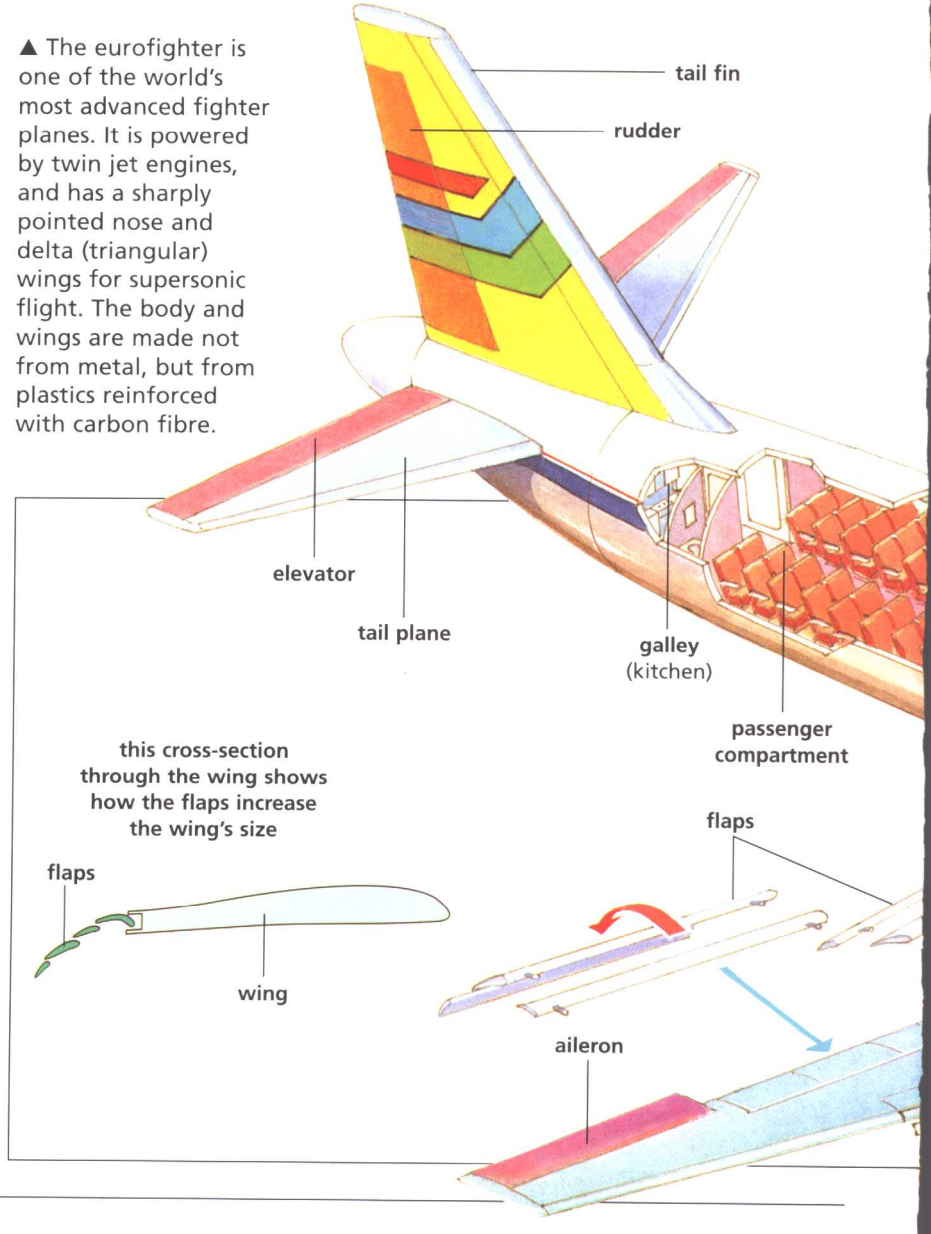
A jet engine burns fuel to produce a jet of high-speed gases. As the jet shoots backwards, it moves the plane forwards. In the turbofan engines used in airliners, the jet of gases also turns a large fan, which pushes large amounts of cooler air out backwards, too. Turboprops are engines which use the jet of gas to spin a propeller.

Keeping in shape

All planes have the same basic parts – wings, fuselage (body), engines and tail – but they vary widely in design. The greatest differences between aircraft lie in the shape of their wings. Slow planes have long wings that stick out from the fuselage almost at right-angles. But higher-speed planes have wings that are swept back at an angle.

The overall shape of a plane is streamlined, so that it slips through the air easily. Aircraft designers test models of their craft in wind tunnels. This gives them a good idea of how the real planes will behave flying through the air.

▲ The eurofighter is one of the world's most advanced fighter planes. It is powered by twin jet engines, and has a sharply pointed nose and delta (triangular) wings for supersonic flight. The body and wings are made not from metal, but from plastics reinforced with carbon fibre.



Vertical take-off

Most aeroplanes need a long runway for taking off and landing. The plane has to be moving quite fast before the wings produce enough lift to get it off the ground. But a few aircraft can take off and land vertically. The Harrier jump-jet is a VTOL (vertical take-off and landing) aeroplane. But the most widely used VTOL craft is the helicopter.

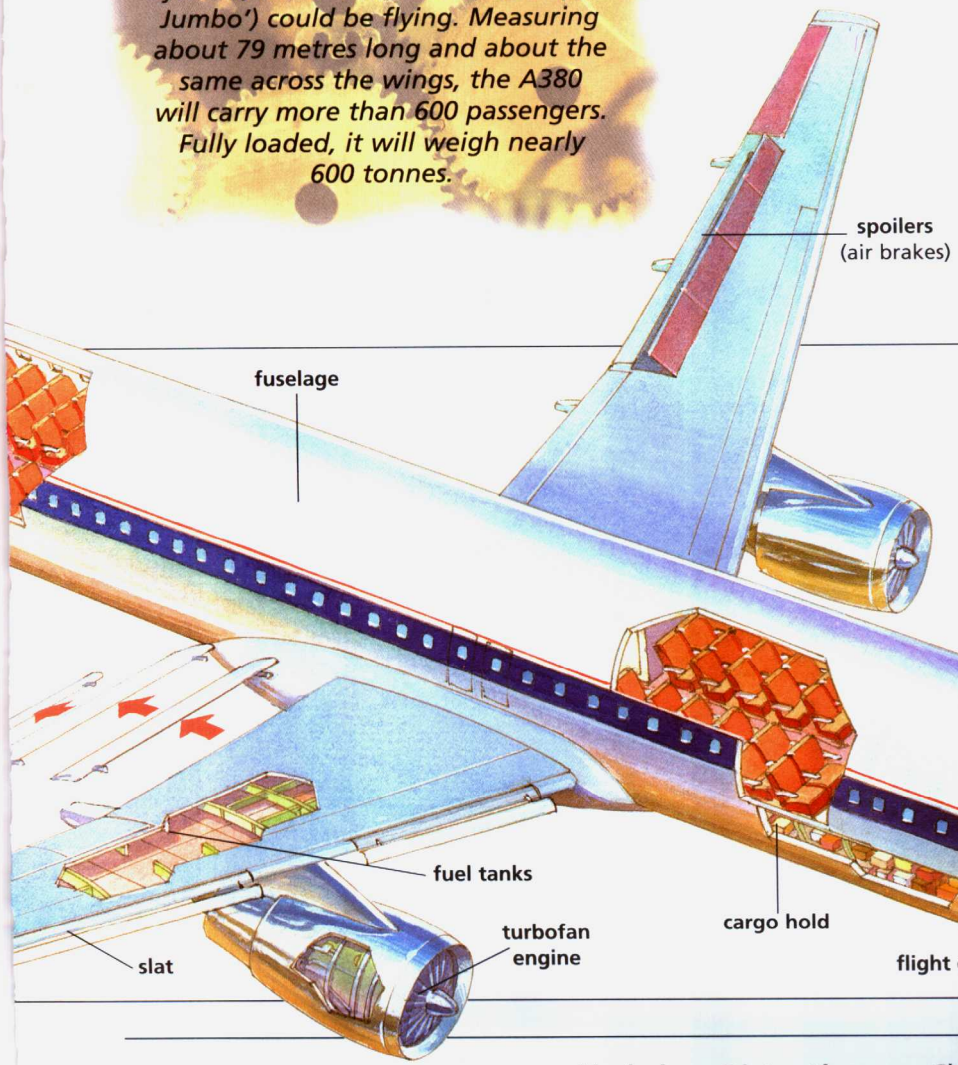
Like an aeroplane, a helicopter is supported in the air by wings. These wings are the blades of the rotor, which spins round on top of the helicopter's body. The rotor blades have the same aerofoil shape as ordinary wings. But instead of the aircraft moving forwards to create lift, the rotor spins round.

▶ A US coastguard helicopter carrying out a rescue on the coast of north California. The rotation of the helicopter's rotor tends to make the body of the helicopter spin. To stop this happening, there is a small rotor at the tail, facing sideways.

Find Out More

- Flight and flow
- Jet engines
- Transport

By 2006, the Airbus A380 (the 'Super-Jumbo') could be flying. Measuring about 79 metres long and about the same across the wings, the A380 will carry more than 600 passengers. Fully loaded, it will weigh nearly 600 tonnes.

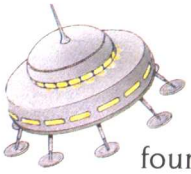


CONTROLLING AN AIRCRAFT

This cutaway drawing of an Airbus airliner shows the many movable control surfaces on the wings and tail. They are operated by the pilot's steering column and foot pedals. The ailerons make the plane bank (tilt) to the left or the right. The elevators on the tail, make the nose come up or go down. The rudder swivels the nose from side to side. Airliners also have large extendable flaps on the wing, which increase the wing area at take-off. This means that the plane gets more lift at slow speeds, and can take off from a relatively short runway. For landing, the flaps are used as air brakes.

Alcohol *see* Diet • **Algae** *see* Classification

Aliens
外星人



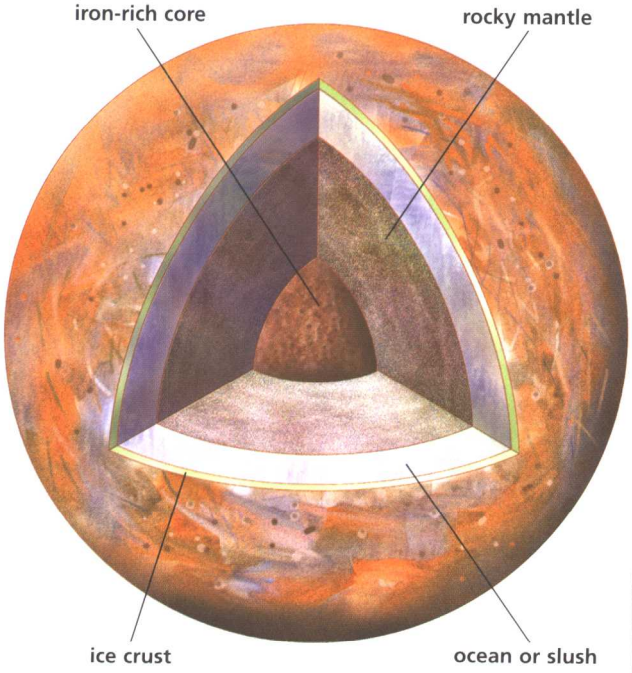
Story writers have dreamed up an incredible variety of fearsome creatures inhabiting other worlds in space. So far, though, scientists have found no evidence for life of any kind beyond the Earth.

Earth seems to be a special place for life. There is plenty of liquid water, and living things can get the energy they need from the warm sunlight, or from the heat inside the Earth.

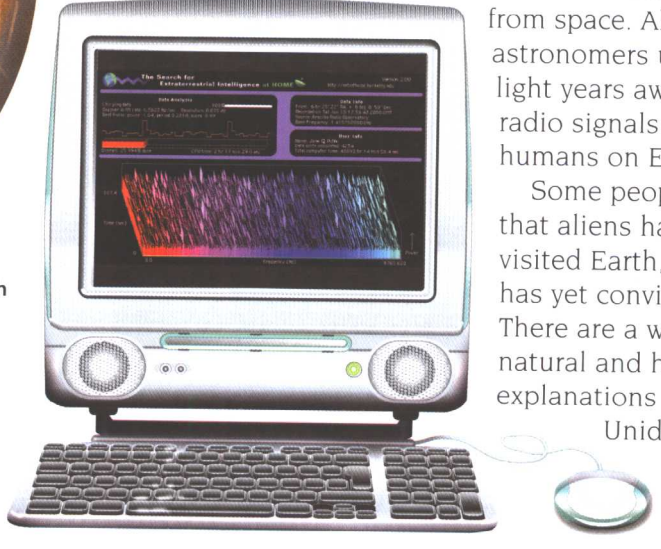
We are now sure that none of the other planets in the Solar System have large plants or animals. Mars, the planet most like the Earth, is one place that might have microscopic life. In the past, Mars was warmer and wetter than it is now. If life started and died out, spacecraft or human explorers might one day find

Find Out More

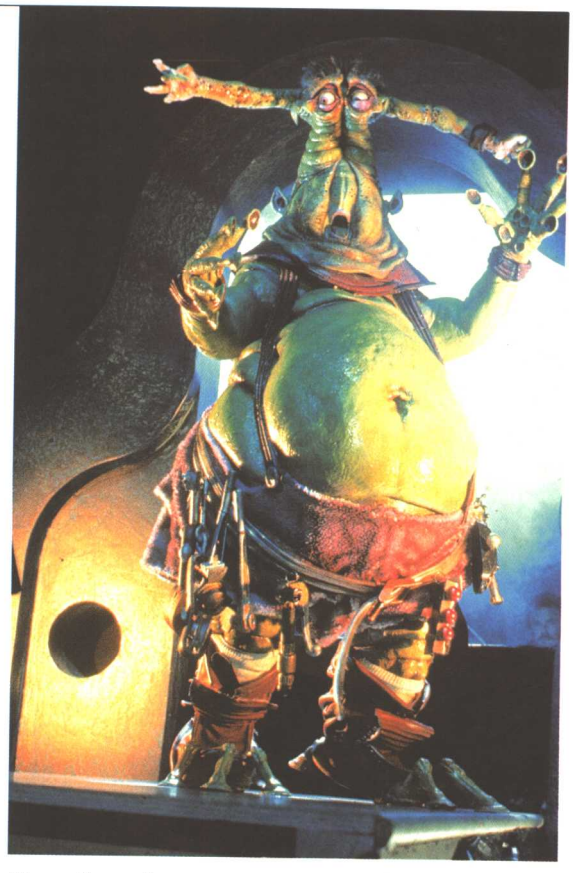
- Life
- Mars
- Planets



◀ Jupiter's moon Europa could possibly have life. There is probably liquid water under its icy crust. The ice melts because it is stirred around by Jupiter's strong gravity. If there is water, there might be life.



▶ Millions of people around the world have used their home computers to help in the search for aliens. They sift through huge amounts of data from radio telescopes, looking for artificial signals. The project is called SETI@home. 'SETI' stands for 'Search for Extraterrestrial Intelligence'.



▶ Writers and artists have imagined all kinds of strange alien life, but no one knows whether creatures like this could exist somewhere in the Universe.

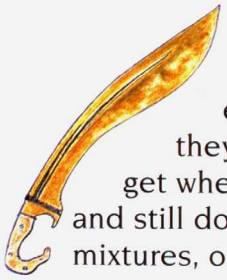
Hunting for extraterrestrials

The Universe is so large, that many people think there must be life of some kind on other planets somewhere. But intelligent life could be very special. We humans might be unique.

Astronomers hope in the future to build telescopes in space to look for telltale signs of life in the atmospheres of planets around nearby stars. Meanwhile, there are projects using large radio telescopes to search for unnatural radio signals from space. Alien radio astronomers up to about 50 light years away could pick up radio signals generated by humans on Earth.

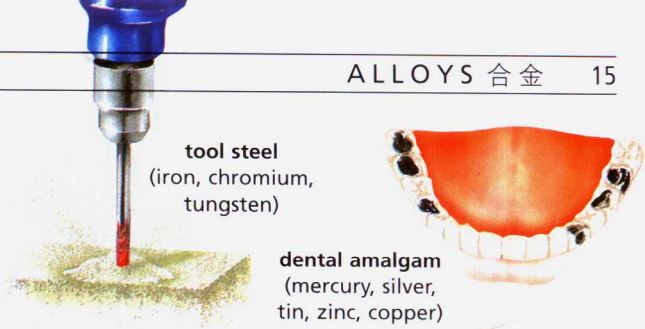
Some people claim that aliens have already visited Earth, but no evidence has yet convinced scientists. There are a whole variety of natural and human explanations for sightings of Unidentified Flying Objects (UFOs).

Alloys
合金



Copper and tin have many useful properties – for example, they do not easily corrode, or rust. The trouble is that they are quite soft and weak. But the metal you get when you mix them together is hard and strong, and still doesn't rust. It is one of our most useful metal mixtures, or alloys, and it is called bronze.

Like copper and tin, most metals are quite soft and weak in their pure state. But they become much harder and stronger when they are mixed with other metals to form alloys. Most metals used today are alloys, from the coins in our pockets and the cutlery we eat with, to the airframes and engines of aircraft.



▶ Some common alloys, with typical uses.

Find Out More

- Aluminium
- Copper
- Iron and steel
- Metals and non-metals

The right recipe

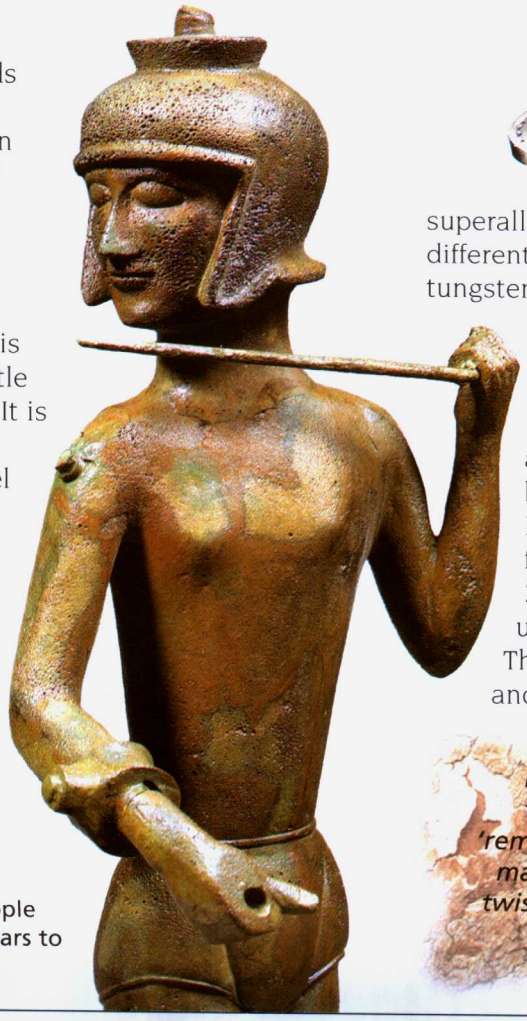
Alloys have been used for thousands of years. Today, metallurgists, the scientists who work with metals, can produce alloys with a wide range of different properties. They do so by carefully selecting the alloying ingredients – choosing the right 'recipe'.

Our most common metal, steel, is an alloy. It is a mixture of iron, a little carbon, and traces of other metals. It is the carbon that makes it so strong.

One drawback with ordinary steel is that it corrodes, or rusts. To stop it rusting, metallurgists add chromium and nickel to it. These metals do not rust and make the steel rust-resistant too. The alloy formed is stainless steel.

Some of the most advanced alloys are found inside jet engines. They have to remain strong at temperatures up to 1000 °C. Some of these so-called superalloys may contain 10 or more different metals, including titanium and tungsten, which melt only at high temperatures.

The value of alloys was discovered in very ancient times. Bronze was made before 3000 BC, and brass (copper and zinc) has been used for nearly as long. Pewter is an ancient alloy made from tin and lead, first used over 2000 years ago. Modern pewter uses other metals instead of lead. This makes it safe to use for plates and mugs.



▶ Bronze is hard and does not rust. People have used this alloy for thousands of years to make things like sculptures.

Memory metals are alloys of titanium and nickel that can 'remember' their shape. If an object made of memory metal becomes twisted, it will return to its original shape if it is gently heated.

AC (alternating current) *see* Electricity generation • **Alternative energy** *see* Renewable resources

Aluminium
铝

Without aluminium, aircraft would probably still be built of wood, wire and fabric. And we would probably not be living in a space age. But thanks to aluminium we can build planes and spacecraft that are both lightweight and strong.

After iron, aluminium is the second-most important metal to us. Over 20 million tonnes of aluminium are produced each year. Its lightness is the main reason why aluminium is so useful. It is less than half as heavy as iron. Unlike iron, it does not corrode, or rust.

Pure aluminium is soft and weak. It is used as thin foil – for cooking, for example. But it becomes much more useful when traces of other metals (such as copper) are mixed with it to form alloys.

▶ Aluminium is used to make bodies for aircraft and other vehicles like cars and coaches.

Find Out More

- Alloys
- Metals and non-metals
- Resources

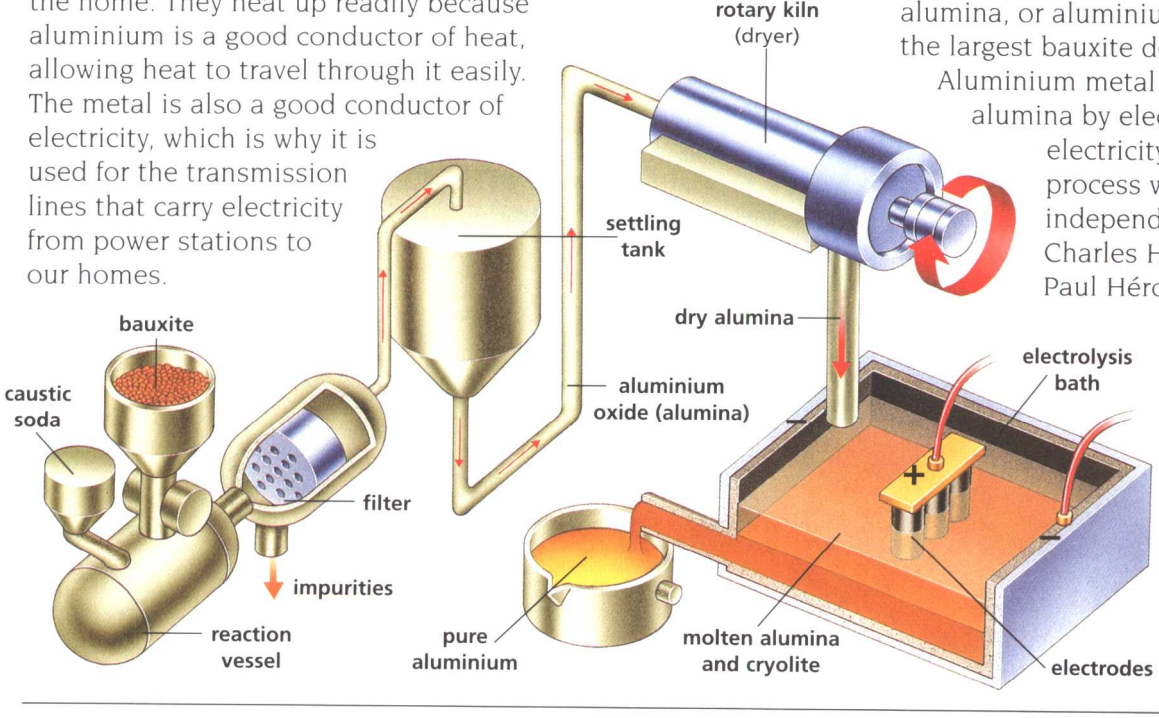
Light conductors

Aluminium alloys have many uses. The alloys from which aircraft and spacecraft are made are as strong as steel but very light. Some are used to make cookware for the home. They heat up readily because aluminium is a good conductor of heat, allowing heat to travel through it easily. The metal is also a good conductor of electricity, which is why it is used for the transmission lines that carry electricity from power stations to our homes.

Making the metal

There is more aluminium in the Earth's crust than any other metal (8 per cent). It is found combined with other elements in many minerals in clays and rocks. But it can only easily be extracted from an ore called bauxite, which contains the mineral alumina, or aluminium oxide. Australia has the largest bauxite deposits.

Aluminium metal is obtained from alumina by electrolysis – passing electricity through it. The process was discovered independently in 1886 by Charles Hall in the USA and Paul Héroult in France.

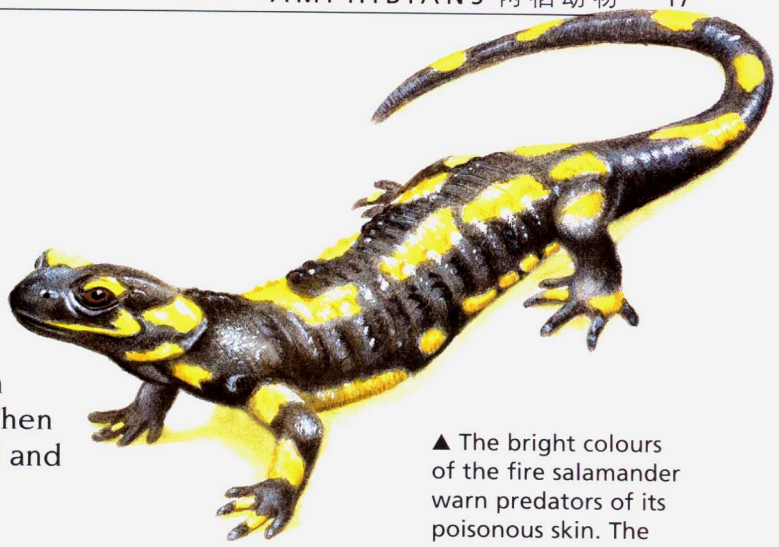


◀ To make aluminium, alumina (aluminium oxide) is first separated from other material in the bauxite ore. Electricity is then passed through a molten (liquid) mixture of alumina and cryolite (another aluminium mineral).

Alveoli *see* Lungs and breathing • **Amino acids** *see* Polymers • **Ammonia** *see* Fertilizers

Amphibians
两栖动物

The male midwife toad hops around for about four weeks with a string of yellow eggs twisted around his back legs. Every so often, he dips the eggs in a pool or a puddle to stop them drying out. When the eggs are ready to hatch, he takes them to a pool and the tadpoles swim away.



▲ The bright colours of the fire salamander warn predators of its poisonous skin. The poison is even powerful enough to kill small mammals.

Like many other amphibians, midwife toads are caring parents. Amphibians were the first vertebrates (animals with backbones) to live on land, and the first to have true legs, tongues, ears and voice boxes. Most amphibians live a 'double life', partly on the land and partly in the water.

Three groups

There are three main groups of amphibians. Salamanders and newts feed on slow-moving animals such as snails, slugs and worms. Most are small and secretive, but giant salamanders grow up to 1.6 metres long, The second group, frogs and toads, are also meat-eaters. They have large, wide mouths to swallow the food that they catch on their long, sticky tongues. The third group, called caecilians, look more like worms than amphibians. They wriggle through the damp soils of tropical forests.

Find Out More
- Animals
- Classification

1 day old frog's soft eggs are protected by a jelly-like covering

10 days eggs hatch into tadpoles with a tail but no legs. They breathe through gills

7–13 weeks as tadpole grows, it loses its gills and develops lungs and legs

▶ A frog has three stages in its life cycle – egg, tadpole and adult frog.

17 weeks frog loses its tail and leaves the water

▲ Caecilians use their heads like garden trowels to dig in the mud for worms, termites and lizards. Adults have a small tentacle on the head to detect chemicals.

Amphibian features

Amphibians do not usually have scales, and their skin is thin, loose-fitting and moist. They usually live in damp places. A few give birth to live young, but most mate and lay their eggs in the water. The eggs hatch into tadpoles, which look very different from the adults. The tadpoles go through a series of changes, called metamorphosis, before becoming adults.

Amplifiers *see* Sound recording • **Anaesthetics** *see* Surgery • **Analogue** *see* Sound recording