

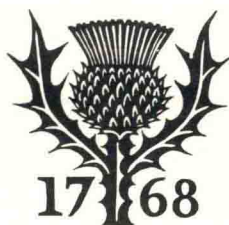


VOLUME 16 SEED to STAR

CHILDREN'S BRITANNICA

Volume 16

SEED—STAR



ENCYCLOPAEDIA BRITANNICA INTERNATIONAL, LTD
LONDON

First edition 1960

Second edition 1969

Third edition 1973

Revised 1975, 1976, 1978, 1981, 1985

1987 printing

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ISBN 0 85229 190 6

*Printed and bound in Great Britain by
Hazell Watson & Viney Limited,
Member of the BPCC Group,
Aylesbury, Bucks*

Children's Britannica

SEED. One of the ways by which a plant produces another plant of its own kind is by seed. The seeds are formed in the ovary of the plant after the ovules have been fertilized by pollen (the way in which this happens is described in the article FLOWER). Each seed contains the beginnings of a new plant, which are called the embryo, and many seeds also contain food for the embryo until it is big enough to establish itself in the soil and make its own food. Around the embryo and its food are one or more protective seed-coats.

The food material in a seed is often stored in the embryo itself. A bean or pea can be split into two parts, which are called *cotyledons*, or seed-leaves, and these are filled with food. Often, however, the cotyledons and the rest of the embryo are very small and are surrounded by a special food-storing tissue called the *endosperm*. An example is the corn grain.

The seeds of some flowering plants have only one cotyledon, and these plants are called *monocotyledons* (*monos* is a Greek word meaning "single"). Plants with such seeds include lilies, grasses, palms and many others that have leaves with parallel veins. Plants that have seeds with two cotyledons are called *dicotyledons* (*di-* means "double") and plants with such seeds include trees, shrubs and herbs with net-veined leaves.

Seed-bearing plants are also classified into two great groups, according to the position of the seeds with regard to the rest of the fruit. Those of the first group belong to the *angiosperms*, and their seeds are completely enclosed by the fruit. Examples are acorns, blackberries and beans.

Plants of the second group are called *gymno-*

sperms. Their seeds are not completely enclosed by the fruit. Cone-bearing trees, such as the pine, cedar and spruce, belong to this class.

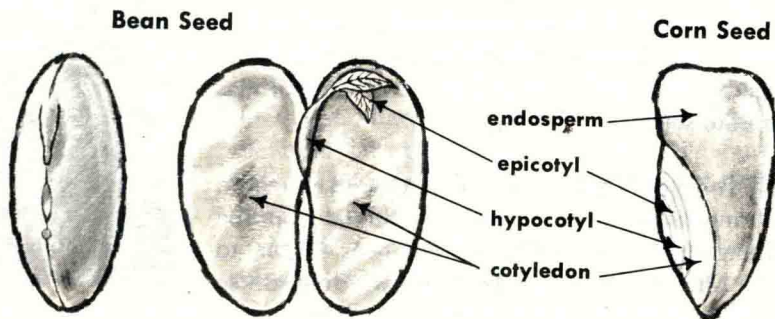
Dispersal and Germination

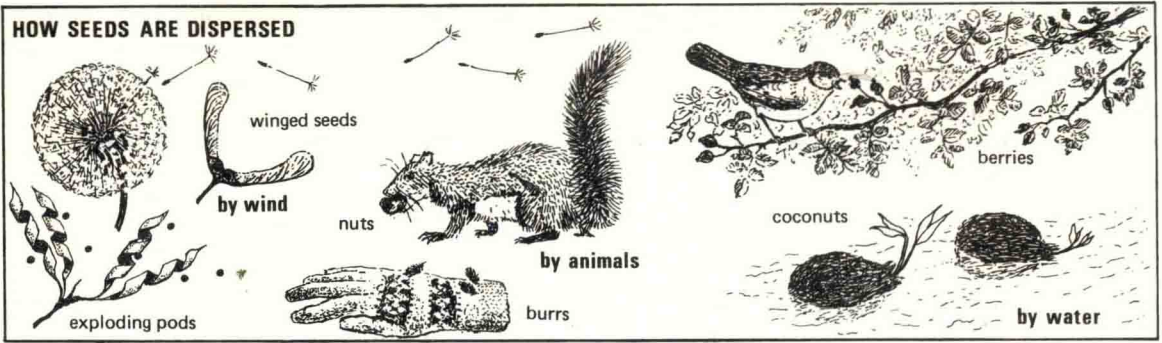
If all the seeds fell to the ground and began to grow directly under the parent plant they would be so crowded for light, air and root room that few of them could grow into plants. Few seeds, however, do this, for there are all kinds of ways in which they are taken to a distance from the parent plant. This is called seed dispersal.

Some seeds—for example, the tiny seeds with soft white "parachutes" attached which make up dandelion clocks or thistledown—are scattered by the wind. Pine seeds have thin, broad wings attached to them and sycamore seeds are carried whirling away from the tree by pairs of papery wings. Rather different wind-scattered seeds are the fine black seeds of the poppy. These are kept in a case shaped somewhat like a pepperpot, and when this sways in the wind the seeds escape through tiny holes just below the top. Some plants, such as the broom and bean scatter their seeds by force. When the seeds are ripe the dry pods which hold them open quickly with a sudden twist and jerk the seeds away.

Animals also help to disperse seeds. The walls of certain fruits, which surround the seeds, have hooks and spines that stick to the fur of passing animals or to the clothing of people. Seeds of this type may be carried far from the parent plant. Other seeds are enclosed in fleshy berries which are eaten by birds and are later passed out of their bodies so that they fall to the ground. Still other seeds float on streams.

A bean seed is a dicotyledon because it has two cotyledons. When they are spread apart, the tiny epicotyl and hypocotyl can be seen. A corn seed has only one cotyledon and is therefore a monocotyledon.





Yet, although plants have so many ways of scattering their seeds, the chances of their germinating (sprouting) are small; some are eaten and digested by birds, some fall on ground where the soil is too thin for them to grow and some fall where there are so many other plants that they are choked to death. Many seeds sprout too soon so that the little plants are killed by frost or hot dry winds, and many are imperfect and so unable to grow. However, because most plants produce enormous numbers of seeds there is a chance that some will grow into mature plants.

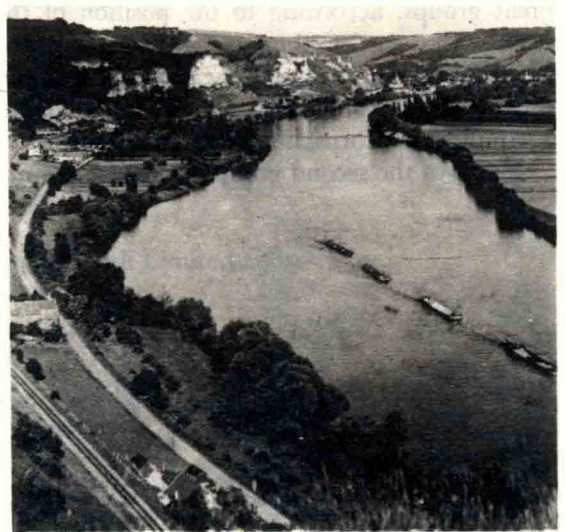
The lifetime of seeds varies. Some seeds, such as those of the poplar, willow and elm, must germinate the same season they are produced or they will not do so at all, but many seeds require rest before they will grow. Most seeds remain alive for several years. Usually older seeds germinate less easily or weak seedlings develop from them. Well dried seeds can often be kept for some time and still be able to germinate, although it is not true that seeds found in tombs many centuries old are still able to germinate. It is true, however, that some seeds are capable of growing even after passing through extremes of heat and cold, for example wattles (*Acacia*) spring up in Australia after forest fires, and the seeds of some alpine gentians and campanulas sprout sooner after being frozen.

SEINE RIVER. The chief river of northern France is the Seine. It flows northwest from the Langres Plateau, or tableland, near Dijon, to the English Channel, following a winding course 780 kilometres long. Its tributaries flow in from several directions, a number of them joining the

Seine near the city of Paris. Most of them can be used by barges so that they bring the produce of the whole river basin to the city. What is really the Seine basin is often called the Paris basin.

The Seine basin is a rich and historic land, the very heart of France, and because of the variety of its soils it is the most productive farming area in western Europe. Its market gardens grow ten or eleven crops a year and it has also chalk soils for vineyards, dry pastures for sheep and wet river meadows for dairy cattle, besides rich clay for wheat and sandy soils fit only for pine trees.

Seagoing ships can reach Rouen on the lower Seine and it is linked by canal with the rivers Meuse, Scheldt, Rhine and Rhône. The Seine is easily the most important waterway in France.



Courtesy, French Government Tourist Office

The Seine flowing past the ruins of a 12th-century castle.

SELKIRKSHIRE was formerly one of the southern counties of Scotland. After the reorganization of local government, the county became part of the Borders region. The Selkirkshire area is now in the Ettrick and Lauderdale district of the Borders.

Southwestern Selkirkshire is hilly and includes part of the mountain of Broad Law. The hills are covered with rough grass, heather and bracken, and sheep are pastured there. In the valleys and to the northeast there are woodlands with oak, birch and beech trees, and some plantations of spruce and larch.

The River Tweed runs through Selkirkshire in the north, but the chief rivers are the Ettrick and the Yarrow, which rise at Ettrick Pen, on the border with Dumfriesshire, and join near Selkirk, the old county town. The Yarrow flows through two lakes, the Loch o' the Lowes and St. Mary's Loch. The old minstrels of the border praised the beauty of Yarrow Vale, as did the poet William Wordsworth.

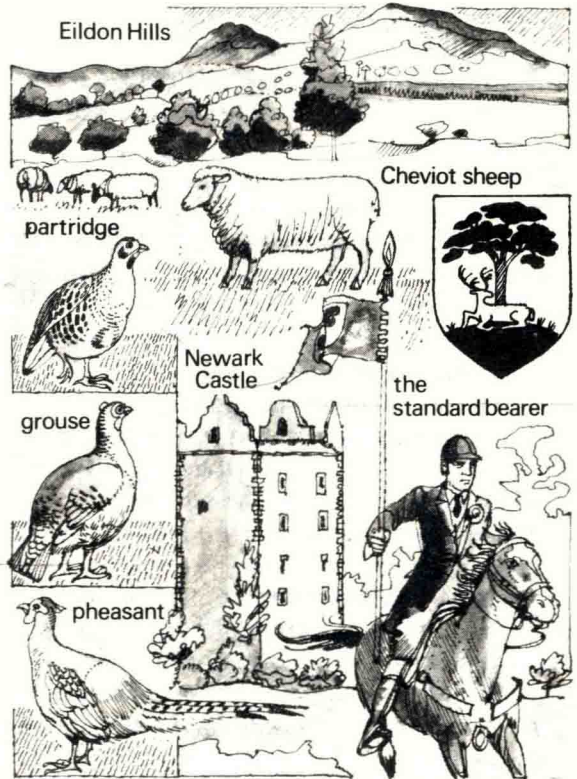
Much of the land used to be covered by Ettrick Forest, but in the time of James V (in the 16th century) the trees were cut down and the area was turned into sheep-grazing ground.

Nearly all the people of Selkirkshire live in the two towns of Selkirk and Galashiels. Selkirk, which is a royal burgh, stands on the Ettrick. The people here are called souters after the ancient craft of shoemaking for which they were famed ("souter" is the Scots word for a shoemaker or cobbler). Today Selkirk is equally well known for its tweed. At one time this was woven from the wool of sheep bred on the hills round the town, but now most of the wool is imported.

Galashiels, north of Selkirk, is another tweed-making town. It was quite a small village until about 1800, but with the Industrial Revolution (see INDUSTRIAL REVOLUTION) and the building of the railway from Edinburgh to Hawick in Roxburghshire and Carlisle in England, Galashiels grew rapidly in size and importance.

Most of the farmers in the area keep Cheviot sheep and there are also some cattle. Only enough wheat, oats, turnips and hay are grown to provide food in winter for the animals.

Westward of Galashiels is the Catrail, which resembles a wide ditch with grassy banks on each



side and was perhaps made by the Romans. At Oakwood near Selkirk there are remains of a Roman fort large enough to hold 500 men.

In the middle ages, when the Scots and English sent armed raiding parties across the border against each other, peel towers or castles were built in Selkirkshire. (See PEEL TOWERS.) They were high, square towers with very few windows and were usually built on hillsides where they could be easily defended. One of these, in the vale of Yarrow, was built for James III in 1470 and still stands.

Selkirk men took part in the Battle of Flodden in 1513 between the Scots and the English. It is said that only one Selkirk man returned, but he brought an English flag with him. Once a year now, a standard bearer rides on a horse round the boundaries of Selkirk, carrying the burgh flag. About 200 other riders from Selkirk and from neighbouring towns go with him, and after a ride of about two hours the standard bearer returns—just as the soldier rode home from Flodden. At the end of the ceremony the townspeople stand silent in memory of the dead of

Flodden and of more recent wars.

A Scottish poet, James Hogg (1770–1835), was a shepherd in the Vale of Ettrick for a time, and is often known as the Ettrick Shepherd.

SENEGAL on the west coast of Africa is a republic about the size of England and Scotland together. It is bounded in the north by Mauritania, in the south by Guinea-Bissau and the Republic of Guinea and in the east by Mali. The Gambia stretches eastwards from the coast. Senegal is flat and low-lying except in the southeast. The climate is very hot. In the north grow gum trees and mimosas and, in the valley of the Senegal River, acacias from which gum arabic is obtained. The central region is a sandy desert-like area. The south has a tropical vegetation.

Farming and fishing are important activities in Senegal, but there are a number of well-run industries including peanut-oil processing, fish canning and a shipyard. Phosphates and leather are also exported. The chief towns are Dakar (see DAKAR), St. Louis and Thiès. There are good roads and railways and an internal air service.

European dealers in slaves and gums visited Senegal in the 17th century. Later the French established themselves there and Senegal became a territory of French West Africa. In 1959 Senegal and French Sudan (now the Republic of Mali) formed the Federation of Mali. In 1960 Senegal broke away to become a republic. It has close links with its neighbour, The Gambia. Its greatest leader, Léopold Senghor, became famous as a poet as well as a statesman.

The population is about 6,000,000.

SENSES: Smell, Taste and Touch. By means of our senses we can identify things and know what is going on around us. This article deals with some less familiar senses, as well as with smell, taste and touch. Hearing and sight are described in the articles EAR and EYE.

Smell. One of the jobs of the nose is to distinguish smells, though it does other things as well (see NOSE). The smell sense organs are a layer of special cells right at the top and back of the inside of the nose. Things which have a smell

—such as a rose or a faulty gas pipe—give off particles into the air around them. In ordinary breathing most of the air goes straight through from the nostrils to the throat, and very little or no smell is noticed. When the nose is brought close to a rose or a gas leak, however, and the air is sniffed, the shape of the inside of the nose is altered. This turns much more of the air upwards to where the sense organs are and so the full effect of the smell is obtained.

Human beings have a much poorer sense of smell than animals which hunt their prey or have to be constantly on the alert for enemies. If the wind is in the right direction a deer can smell a man 800 metres away. A dog can follow the faint scent a rabbit leaves in its tracks, or detect the smell of the crushed grass where the rabbit has passed over it. Not only is the human sense of smell very poor, but it easily gets tired. If a person sniffs at a weak smell for some minutes he is soon unable to smell it at all.

Taste. The taste sense organs are little groups of cells in the mouth. Most are on the tongue but they are also scattered over the inside of the mouth and the back of the throat. Children have more of these sense organs than adults.

There are four main tastes—salt, sour, sweet and bitter—and the flavours of food and drink are mostly mixtures of two or more of these four, plus smell. A cup of tea might be just as sweet and bitter as a cup of coffee, but the sense of smell prevents the two from being confused. The nose passage and mouth passage meet at the back of the throat, and while the taste organs are recording the sweet-and-bitter taste of the tea, the smell of the tea is passing up to the smell organs. Then the brain combines the two tastes and the smell, so the drinker knows that he has tea and not coffee. Different taste cells are used for the different tastes. Sweet things are tasted best at the tip of the tongue and bitter things at the back.

Touch. The sense of touch tells us by feel where an object is and also its texture, whether it is rough or smooth or sticky, for example. It is found in certain spots on the skin, known as touch spots. If the skin on the upper arm is touched here and there with a fine bristle, sometimes nothing can be felt. This is because there are only about 10 touch spots to each square

cm of skin on the upper arm, and it is quite easy to touch between them with a fine bristle. On the hands and face the touch spots are packed closely together, and there are over 150 to each square cm of skin on the finger tips.

Temperature. The sense of temperature also depends on little sensitive spots scattered over the skin. Some of these feel warmth and some cold. The cold spots are the easiest to find. If the skin on the back of one hand is lightly touched with the tip of a lead pencil the lead will now and then feel cold.

The sense of temperature is very limited. Below freezing point and in considerable heat, a person feels pain rather than cold or heat. This sense is also rather strongly influenced by what has happened a moment before. This can be tested by putting one hand in a bowl of cold water and the other in a bowl of hot and keeping them there for a few minutes, then plunging them quickly into a bowl of lukewarm water. It will feel hot to the hand that has been in cold water and quite cool to the other.

Pain. The sense of pain is most useful, for it gives danger signals. Without pain people would be continually cutting, burning or bruising themselves without realizing the damage they were doing. Pain is also a sign that illness is coming on. Over most parts of the skin the little spots that give pain warnings are crowded closely together. In some parts, however, such as the outside of the thigh, it is sometimes possible, by using a fine needle, to find places where pain cannot be felt, unless the needle is pushed right into the skin. Then it will strike a nerve, and most nerves are sensitive to pain.

In addition to the three kinds of sense organs in the skin just described, there are also similar sense organs in internal organs of the body, some of which, for example, tell us when we are hungry.

Kinaesthetic sense. This sense causes no definite sensation but is nevertheless very important. In the muscles and tendons there are little sense organs which help the brain in controlling the position of the limbs, and in keeping the body upright.

A way of showing these sense organs at work is by putting one hand in a certain position with

the eyes shut and then, still without looking, putting the fingers of the other hand in just the same position. The sense organs in the joints tell the brain exactly how much the joints are bent. Others in the muscles tell how hard each muscle is pulling. These little sense organs are also used therefore in every kind of skilled movement, such as playing the piano, typing and judging the weight or strength of objects with the hands.

Sense organs in the soles of the feet and elsewhere help to keep the body erect and to keep balanced when skating, for example. Another of their important actions is to help the body to right itself when falling.

Balance. Our eyes and the sense organs in the muscles help us to balance, but the main organ of balance is connected with the internal ear, which is part of the ear that cannot be seen. Two small rounded cavities in the internal ear are lined in patches by sense organs which are affected by the force of gravity pulling upon them in a characteristic way for each position of the head. In this way a person can tell which way up he is.

There is also a complicated arrangement of three little semi-circular tubes in the internal ear. Liquid inside the tubes is set moving when the head is moved or rotated. The movement of the liquid against groups of sense organs shows which way the head is moving and so helps a person to keep his balance if he is spun around.

SENTENCE. A sentence is one complete thought expressed in words in order to tell somebody something. If you say: "Coming down a country road on a dark night" you have not made a sentence because anyone listening will want to know what happened "coming down a country road". But if you say: "John stumbled", anyone hearing understands exactly what happened. You have made, therefore, a sentence, the kind called a *simple* sentence.

A sentence has to contain two parts, called a subject and a predicate; that is, a noun (or a pronoun) and the verb that goes with it. In other words, it must have the subject we are talking of, and what we say about that subject.

Not every sentence is a simple sentence; there

SENTENCE

are also *complex* and *compound* sentences. If you say: "As he was coming down a country road, on a dark night, John stumbled over a cow" you have made, not a simple sentence, but a *complex* sentence. A complex sentence is one which gives more information by adding other groups of words to the main simple sentence. But suppose you say: "John was coming down a country road, but the night was dark and he stumbled over a cow", you have made a *compound* sentence. A compound sentence is one which is made up of more than one simple sentence joined by words like "and" or "but".

A sentence, whether it is simple, complex or compound, generally begins with a capital letter, and ends with a full stop, question-mark or exclamation-mark. The commonest mistake people make in writing sentences is to run complete sentences together without the necessary full stop or other punctuation mark. A comma is used to separate only the groups of words called phrases and clauses, like those in the compound or complex sentences given above. Commas may *never* be used in the place of full stops, exclamation-marks or question-marks to separate sentences.

Besides dividing sentences into simple, complex and compound, we can also divide them according to their purposes:

- (1) Those which make a statement. Example: *John stumbled.*
- (2) Those which ask a question. Example: *Where are you going?*
- (3) Commands, demands, requests or entreaties. Example: *Keep still! Please help me.*
- (4) Expressions of feeling, exclamations. Example: *How happy I am!*
- (5) Sentences which go against the normal rules by having part of their sense left out, but understood by the speaker and hearer all the same. Example: Where is your hat? *In the car.*

Phrases and Clauses

Immediately a sentence becomes longer than the simplest statement, there are bound to be certain groups of words in it which have special work to do. When these groups of words have no

verb of their own they are called *phrases*. In the example of a complex sentence given earlier in the article, *on a dark night* and *over a cow* were both phrases. When the groups of words have a verb of their own in them they are called *clauses*. A clause in the complex sentence given earlier was *as he was coming down a country road*. There are two general types of clauses: the ones in a complex sentence are called subordinate clauses, because they are less important than the main statement, and the ones in a compound sentence are called co-ordinate because they are equal in importance to the main statement.

According to the work they do in a sentence, there are three main kinds of phrases (and one other which you do not come across in sentences quite so often). The three main kinds are:

- (1) Adjectival: *i.e.*, doing the work of an adjective. Example: I saw the boy *with the red hair* (instead of an adjective such as *red-haired*).
- (2) Adverbial: *i.e.*, doing the work of an adverb. Example: The boy ran *like a deer* (instead of an adverb such as *swiftly*).
- (3) Noun: *i.e.*, doing the work of a noun. Example: She told me *about the secret casket* (instead of a noun such as *the secret*).

The less common kind of phrase is:

- (4) Interjection: *i.e.*, doing the work of an exclamation or interjection. Example: He came, *alas for her*, too late.

Clauses, too, are divided into kinds according to the work they do:

- (1) Adjectival. Example: I saw the boy *who had the catapult*.
- (2) Adverbial. Example: The boy ran *when he saw the bull pawing the ground*.
- (3) Noun. A noun clause may do the work of the subject of a verb or the object of a verb. Examples: *That she went away* is true. (Subject.) She told me *that there was no hope of escape*. (Object.)

The way the words follow each other in sentences is called word-order. The word-order in English is usually subject first, predicate after. When this order is reversed, it is called inversion. The main verb then comes before the subject, as in "Gay was the summer morning." Inversion is

very often used in questions, for example *Are you ready?* but it is not a good idea to use it in other kinds of sentences until you are very sure of your composition. Poets and people making speeches use inversion to avoid monotony, or to give force and expressiveness to what they write or say.

SEPOY. In Hindustani, which is an Indian language, the word *sipahi* means "soldier". In the 18th century, officers such as Robert Clive found that Indian soldiers trained like those of European armies could easily defeat the undisciplined troops of the Indian princes. (See CLIVE.) The name sepoy therefore came to mean an Indian soldier in the British army in India.

In 1857 the sepoys of the army in Bengal mutinied. After this, sepoys were recruited mainly from the Punjab and the northwest part of India (now Pakistan), although the Mahrattas of the Deccan in south central India and the Gurkhas of Nepal also made excellent soldiers. (See GURKHAS.)

In World War I about 1,300,000 sepoys were recruited to help Great Britain and the Allies and in World War II the number was about 2,000,000. In 1947, the old Indian Army was divided into two, the Hindus going to India and the Moslems to Pakistan.

SEQUOIA. Among the world's largest and oldest living things are the sequoia trees. There are two kinds, both related to pines. They are the redwood and the giant sequoia or big tree. The name sequoia comes from Sequoyah, who was a Cherokee Indian chief.

Redwoods and giant sequoias both grow wild in California in the United States, but giant sequoias are much rarer and grow mostly in a few groves protected by the government. Redwoods are the world's tallest living trees. They often grow to a height of 90 metres.

It takes a redwood perhaps 2,000 years to reach this huge size. But the giant sequoia may be even older. The oldest, known as General Sherman, stands in the Sequoia National Park in California, and is thought to be between 3,000 and 4,000 years old. It is 83 metres tall, has a diameter of more than 9 metres, and probably



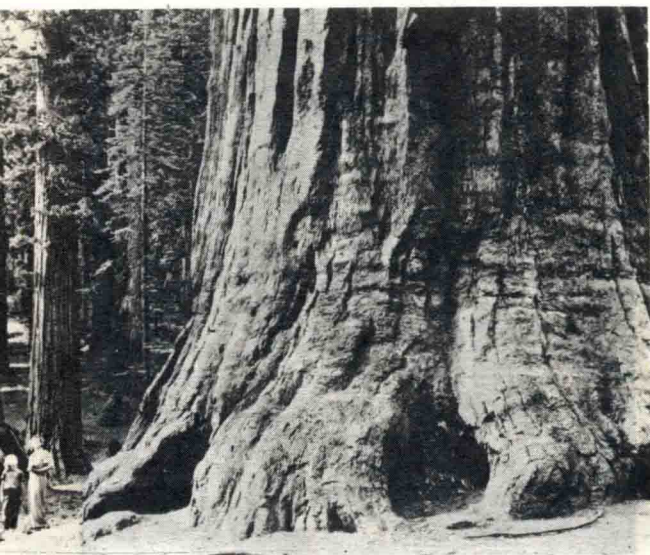
Courtesy, National Park Service
Sequoias in the Yosemite National Park, California.

SERENADE

weighs over 2,500 tonnes.

Both kinds of sequoia have trunks that taper towards the top, with thick, soft, spongy bark that is deeply grooved and rust-red. Both also have branches that sweep downwards, but their leaves are different. Those of the redwood are little dark green straps like those of the yew and the small branchlets on which they grow last for two or three years, so that the tree always looks green. The leaves of the giant sequoia are like little pointed scales covering the twigs. Both trees have small cones and timber that is light in weight but very strong and long-lasting.

The redwood was first discovered in 1795 and the first one grown in England was planted in 1846. There is a redwood plantation at Leighton Park near Welshpool and redwoods can also be seen in other British gardens. So far the tallest redwood in Britain has reached a height of 45 metres.



Courtesy, U.S.I.S.

An enormous mature redwood.

The giant sequoia was discovered in 1841, and in Britain was named *Wellingtonia*, after the Duke of Wellington. The tallest British sequoia (over 50 metres) is at Endersleigh in Devon.

SERENADE. The word serenade comes from the Italian word *serenata* (an evening song) and originally meant music intended to be sung or



Radio Times Hulton Picture Library

A Spanish minstrel of the 1820s.

played at night in the open air. It brings to mind the picture of a lover singing beneath his lady's window and accompanying himself on a guitar or, if he was not himself a singer, the small instrumental concert that he would provide.

There is a famous serenade sung to Zerlina in Mozart's opera *Don Giovanni*. Instrumental serenades have been written by many composers. These are often in several movements. Mozart's *Haffner Serenade*, written to celebrate the wedding of a friend's daughter, and his *Eine Kleine Nachtmusik* (in English this means "a little night music") are among the best known.

SEVENTH DAY ADVENTISTS. There are various small groups of Christians who believe that Jesus Christ will return to earth very soon. They are known as Adventists. The Seventh Day Adventists share this belief but they are different from other Adventists because they keep the day of worship and rest on the seventh day of the week (Saturday) instead of on the first day (Sunday). Hence their name.

Since the beginning of Christianity there have been people who were eager to discover when Christ would return to earth. In 1831 William

Miller, an American who lived in the state of New York, proclaimed that Christ would return about the year 1843 (this was later changed to October 22, 1844), and the people who followed Miller's belief were called Adventists. The year 1844 ended without any Second Coming of Christ, and various other dates have since been suggested by one or other of the Adventist groups. As he became older Miller was less ready to give a date, but he continued to believe that the Second Coming would be very soon. (See also the article ADVENT.)

SEVEN WONDERS OF THE WORLD.

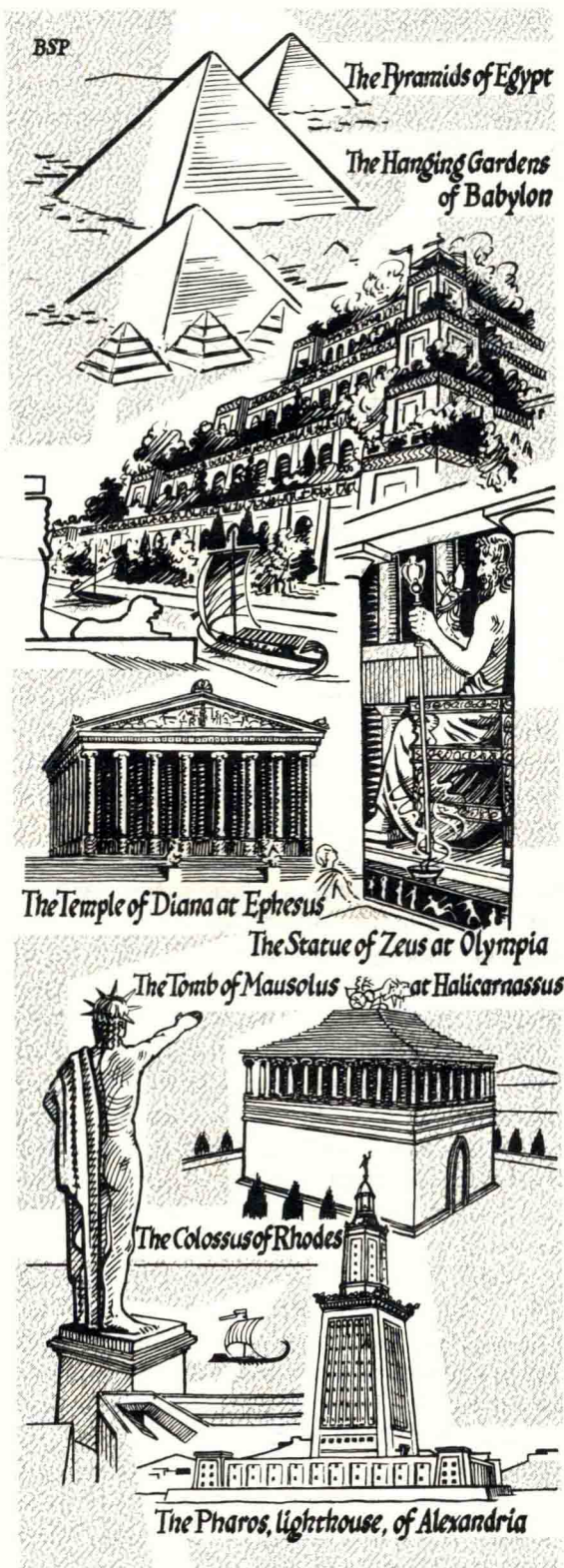
In the 2nd century B.C. a list of the seven buildings and works of art which were considered most worthy of a visit by sightseers was drawn up. Now all except one of these have disappeared, but they are still remembered as the Seven Wonders of the World. They were as follows.

1. *The Pyramids of Egypt* can still be seen today. They were built thousands of years ago as tombs for Egyptian kings. (See PYRAMID.)

2. *The Hanging Gardens of Babylon.* These were built by Nebuchadnezzar, King of Babylon, in about 600 B.C. The story is that they were built to please one of his queens. The gardens rose in a series of terraces, built in the form of a pyramid, and every terrace was planted with trees and flowers from all parts of the known world. These hid the framework of the building, and so appeared to be hanging unsupported in the air. (See BABYLON; GARDENS.)

Sometimes the great *Walls of Babylon* are given as the second wonder, instead of the hanging gardens. These were also built by Nebuchadnezzar, at the same time as the gardens, and are said to have been 335 feet in height. They protected the ancient city of Babylon, but now they are only a mass of ruins.

3. *The Statue of the God Zeus (Jupiter) at Olympia* in Greece, by the great Greek sculptor Pheidias. This was a mighty figure, about 40 feet high, of almost incredible richness. It was seated in a huge chair and reached to the roof of the temple where it was placed. The robes were of gold, the flesh of ivory and the eyes of precious stones. According to legend, Zeus himself sent



SEVEN WONDERS OF THE WORLD

down lightning from heaven to show his approval of the work.

4. *The Temple of the Goddess Diana at Ephesus* in Asia Minor (Turkey). The temple was the fifth built there in honour of Diana. It was probably built before 350 B.C. and finished by the end of that century, and was still standing in St. Paul's day. (St. Paul stayed for two years in Ephesus.) The roof was supported by great stone columns 60 feet high, and inside were some of the finest works of Greek artists, including the sculptors Pheidias and Praxiteles. The temple was sacked and burned by invading Goths in A.D. 262, but parts of the columns can be seen in the British Museum.

5. *The Tomb of Mausolus at Halicarnassus*. Sculptures and reliefs from this can also be seen in the British Museum. Mausolus was a ruler of Caria in Asia Minor and died in about 353 B.C. His devoted queen, Artemisia, caused the finest tomb her vast wealth could pay for to be raised for him in the city of Halicarnassus, and it was decorated by the best artists of the day. It collapsed in an earthquake before the 15th century. Today the word "mausoleum" is used to mean any large and elaborate tomb.

6. *The Colossus of Rhodes*. This was an immense bronze statue of Helios, the sun god, which stood at the side of the harbour of the island of Rhodes—not astride the harbour with ships sailing in between its feet, as is commonly thought. It was about 105 feet high and was made from the melted weapons and instruments of bronze left behind by the soldiers who unsuccessfully besieged the city of Rhodes in 304 B.C. From 280 to 224 B.C. the Colossus served as a landmark to sailors, then it fell in an earthquake which shook the island. From the Colossus of Rhodes, too, came an English word—"colossal".

7. *The Lighthouse of Pharos at Alexandria*. This was built in about 280 B.C. on the island of Pharos, which was later made part of the mainland of Egypt. The accounts of its height vary, but some describe it as being as much as 600 feet. At the top burned a light which guided ships into the harbour of Alexandria. The Pharos, too, met its end by an earthquake, being levelled to the ground in 1375.

SEVERN RIVER. The River Severn, the longest river in Great Britain, flows through parts of Wales and England into the Bristol Channel between Gwent and Avon, and is about 337 kilometres long.

The source of the Severn is near the River Wye in the northeast of the Plynlimon range in Wales. The river's Welsh name is Hafren. It follows a semi-circular course to the Bristol Channel. For about 1.5 kilometres it forms the border between Gwent and the English county of Salop (Shropshire). Then it enters Salop and winds across it into Hereford and Worcester, then into Gloucestershire. South of the city of Gloucester, through Avon, the Severn broadens out and becomes a tidal river.

It is in this last and broadest part of the river that the Severn bore occurs. A high tide from the sea meets the waters of the Severn flowing in the opposite direction, and pushes them up into a steep wave which travels up the river and often causes damage. (See BORE, TIDAL.)

The Severn is a beautiful river for much of its length, and flows through or past several old and historic towns. Besides Gloucester, these include Tewkesbury in Gloucestershire and Shrewsbury and Ironbridge in Salop, where one can see the world's first iron bridge. It was built over the Severn in 1779 by Abraham Darby the third.

Many rivers join the Severn. They include the Teme, Wye, Usk, the Warwickshire Avon (on which Stratford stands) and the Bristol Avon (on which Bristol stands). There are locks on the Severn and a ship canal runs beside it from Sharpness, at the head of the estuary, to Gloucester. A tunnel, almost 7 kilometres long, takes trains beneath the river between Pilning in Gloucestershire and Severn Tunnel Junction in Gwent. A little way upstream is the great Severn bridge, a suspension road bridge 1,596 metres long. Severn water is used for cooling purposes in the atomic power station at Berkeley.

Salmon swim up the Severn from the sea to breed, and lampreys are also found (see LAMPREY). In spring fishermen trap elvers (young eels) as they swim up the estuary.

SEVILLE is the chief city of Andalusia, which is the southern part of Spain. Most of the city is



Courtesy, Spanish National Tourist Office

The Giralda, as the bell tower of the great cathedral of Seville is called. The lower part was built by the Moors.

built on the east bank of the River Guadalquivir about 50 miles from the Atlantic Ocean. Seville lies low in the valley and has a relaxing climate with very hot summers.

Seville was once a Roman town called Hispalis and on its outskirts are the ruins of ancient Roman villas. Then for a long period after the fall of Rome the city was occupied by German barbarian invaders until 712, when it was captured by the Moors from North Africa. Seville remained a Moorish city until King Ferdinand III conquered it for Christendom in 1248. (See MOORS.)

The older parts of the city, with their narrow winding streets and small squares, have many houses in Moorish style. These houses are white, with flat roofs and balconies, often with a central courtyard where a fountain plays. Among other Moorish buildings is the splendid Alcazar

palace, with its beautiful halls and courts, the Tower of Gold on the river bank, which was once part of the fortifications and is now a museum, and the lower part of the cathedral bell-tower. This tower, which was built as the minaret of the chief mosque in about 1190 (see MOSQUE), is covered with beautiful yellow brick and stone panelling. It is called the Giralda. The cathedral itself, most of which was finished by 1506, is the largest of all churches built in the Gothic style. Behind the high altar is a magnificent carved wooden reredos (screen) and the many side chapels are enclosed by iron screens of great beauty. Its paintings include some by Bartolome Murillo (1617-1682) who, like the great Spanish painter Diego Velazquez, was born at Seville. Other fine buildings are the university, the many churches in the baroque style with their domes picked out with brightly coloured tiles, and the bull-ring, which seats 14,000 people.

Seville is famous for the magnificent ceremonies and processions of the week immediately before Easter and for the bright costumes, gipsy music and Andalusian dancing with which the people rejoice in the following week.

In the 16th century Seville became Spain's chief centre for trade with its new empire in America but later conditions favoured the coastal port of Cadiz. However, Seville is still an important outlet for Spanish products and sends overseas cargoes of sherry and other wines, lemons, the bitter Seville oranges used for marmalade, olives, cork and minerals such as mercury and iron and lead ores. Its manufactures include ships, hemp, jute and farm machinery, and Seville has long been famous for its pottery, porcelain and tiles.

SEWER. The pipes and channels carrying waste from the drains inside houses and buildings are called sewers. The other kind of drains, which collect the water from roofs, pavements and roads, are usually separate from the sewers and you can read about them in the article DRAINAGE.

In the old days, human waste was simply tipped out at the back of the house. In the country this did little harm but in the towns the

filth in the streets was disgusting. At the best the waste was tipped where it could run downhill to a river or stream. At the worst a marsh of stinking filth collected in a hollow. It was a step forward when the sewage (as the waste is called) was carried under the road in pipe sewers. However, as long as it was discharged into streams and rivers without being purified it caused outbreaks* of diseases such as typhoid fever, dysentery, cholera and poliomyelitis (infantile paralysis). This was usually because drinking water was drawn from streams which had been fouled with sewage containing the germs of these diseases.

Modern Sewage Systems

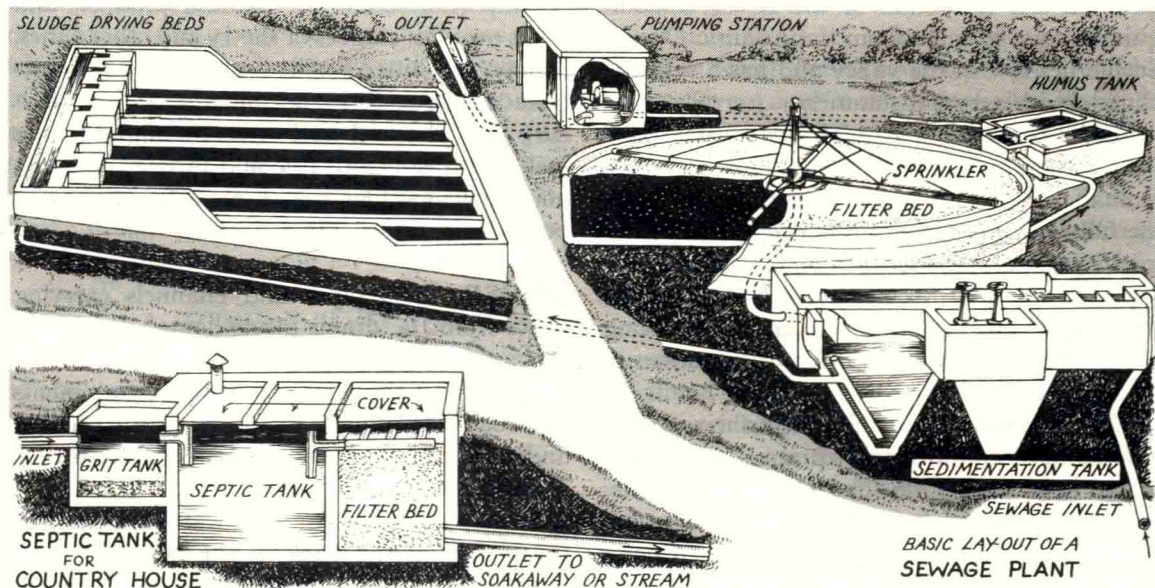
In civilized countries the sewage from inland towns is led through pipe sewers to a sewage treatment plant. In this plant the solids and liquids are separated by letting the sewage flow through large open-air settling tanks. Most of the solids sink to the bottom as a sludge which is pumped to other tanks where it is left to ferment. (See FERMENTATION.) In fermenting, the sludge gives off a gas called methane which is often used for driving the engines that supply power to the pumps and other machinery in the plant. When removed from the tanks the sludge is much thicker and is no longer evil-smelling. It is dried and used by farmers and market gardeners as

manure. (See also FERTILIZERS.)

The liquid part of the sewage flows on to filters, which are circular beds of stone, rock or clinker (cinder slag). Revolving arms sprinkle the liquid on the beds. In the film of slime on the stones live tiny plant germs called bacteria which feed on the impure matter in the waste as it trickles past. These bacteria breed naturally wherever there is sewage. (See BACTERIA.) After filtration the liquid may be passed through another settling tank, after which it is almost pure water and can be led into a river.

Another method of treating the liquid part of the sewage is to run it into a tank and blow air through it. Clumps of bacteria develop in the tank and feed on the impurities in the liquid which settle in the form of what is called activated sludge. In this method the bacteria are carried off in the sludge, so to keep up the activity in the aeration tank some of the sludge is returned for mixing with the incoming liquid. The remaining sludge passes to other tanks for fermentation, as before.

Large houses in the country sometimes have their own sewage systems in the form of a septic tank. The sewage flows into a closed tank underground where the solids settle at the bottom. There they are consumed by the millions of bacteria which breed in the scum floating on the surface. The bacteria change the solids into



liquids and gases. The liquid from the septic tank is led off through a pipe with a number of branches finishing about a metre below the surface of the soil. It therefore seeps into the earth and any remaining solids in it are consumed by the bacteria which live in the upper layer of soil. This system must not be confused with the cesspools sometimes used for houses not connected to the sewers. A cesspool is a covered pit which is pumped out from time to time.

When a town is near the sea or the mouth of a large river the sewage may be discharged untreated through a sewer whose outlet is well away from land. Usually this is done while the tide is ebbing, or going out. It is much cheaper to do this than to have a sewage plant but it is not satisfactory, because the action of wind and tide may sometimes bring sewage ashore to cover beaches and banks with filth. If too much untreated sewage is poured into the sea or into lakes, the natural bacteria cannot deal with it and serious pollution may result.

If storm water (water collecting from rainfall) is allowed into the sewers, the increased volume of liquid requires a much larger sewage treatment plant. This drainage is usually kept separate from the sewage system.

If a factory discharges waste chemicals into the sewers the working of the treatment plant may be slowed down to a serious extent because the chemicals poison the bacteria. This pollution is now prohibited by law if it is harmful.

SEWING is one of the oldest of the arts and crafts still in use. In very early times the simple needles were made from the bones of birds or from the metal called bronze. They were used to pierce holes in the skins or fabric used for clothing. Thin strips of animal hide were used as threads. Nowadays steel needles are made in many different lengths and thicknesses, so that you can choose the right one for the kind of sewing you are going to do—a fine one with a small eye for sewing silk or linen, for instance, a longer one with an eye big enough to take a woollen thread for darning socks. Cotton or silk thread is used for most ordinary sewing.

The more closely fitted and carefully shaped a garment is, the more complicated sewing is

needed, and many kinds of seams and stitches have been worked out over the centuries. They are still used today, but most people who have a sewing machine use it a great deal instead of hand stitching, for it saves time and makes a very strong stitch, especially for seams. Even if you have a sewing machine, however, you still need to use hand stitches as well. This article gives instructions for the main kinds of stitches, and also for some of the processes—such as making buttonholes—that you may need if you are making a dress or some other garment. If you want to know about dressmaking itself, rather than simply about the stitches and processes used, the article **SEWING SKILLS** in the blue pages of volume 6 will help you.

Stitches

Before you begin on any stitches, you need your tools. For ordinary sewing they are very simple ones: (1) a needle of a suitable size, with an eye big enough to make it fairly easy to thread; (2) a pair of scissors, or two pairs if you have them—one large for cutting the material, one smaller for snipping the thread or unpicking stitches; (3) a thimble to wear on the middle finger of your right hand (or left hand if you are left-handed)—it is difficult to sew properly without a thimble, so keep using one even if it is uncomfortable at first; (4) reels of thread, some to match the material and some in a different colour, white if possible, to use for tacking. For nearly all stitches you sew from right to left.

Tacking Stitch. This is used to hold two or more thicknesses of material together until they are sewn properly either by machine or by a stronger hand stitch. Simply put the needle into the cloth and bring it out on the same side a little farther on. Tacking stitches need not be small, but it is a good idea to sew them alternately one long, one short, to keep the material together. If you make a knot at the end of your tacking thread you can pull the whole thread out after the proper stitching is done.

Running Stitch. This is like tacking stitch but much smaller and neater. The stitches and the spaces between them have to be the same length. Running stitch is used for seams and also for gathering, when the cotton is drawn up tight at