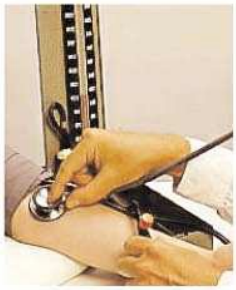
The British Medical Association



A-Z FAMILY MEDICAL ENCYCLOPEDIA

A Reference Guide to over 7,000 Medical Terms including Symptoms, Diseases, Drugs & Treatments

COMPLETELY REVISED & UPDATED

The British Medical Association

A-Z FAMILY MEDICAL ENCYCLOPEDIA

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abdomen

The region of the body between the chest and the pelvis. The abdominal cavity is bounded by the ribs and diaphragm above, and by the pelvis below, with the spine and abdominal muscles forming the back, side, and front walls. The abdominal cavity contains the liver, stomach, intestines, spleen, pancreas, and kidneys. In the lower abdomen, enclosed by the pelvis, are the bladder, rectum, and, in women, the uterus and ovaries.

STRUCTURE

The spine, pelvis, and ribs provide attachments for the layers of muscle that make up the abdominal walls. There is a layer of fat between these muscles and the skin. The inner surface of the abdominal muscles is covered by a thin membrane, the peritoneum, which also covers the organs, such as the pancreas and kidneys, that are fixed to the back wall. Folds of peritoneum also cover the mobile organs, such as the stomach and intestines.

abdomen, acute

The medical term for persistent, severe abdominal pain, of sudden onset, that is usually associated with spasm of the abdominal muscles, vomiting, and fever.

CAUSES

The most common cause of an acute abdomen is *peritonitis* (inflammation of the membrane that lines the abdomen); underlying causes include *appendicitis*, abdominal injury, or perforation of an internal organ as a result of disorders such as *diverticular disease* (the presence of small, protruding pouches in the intestinal wall) or *peptic ulcer*.

SYMPTOMS

Acute abdomen commonly begins as a vague pain in the centre of the abdomen that gradually localizes to a particular region of the body, depending on the condition. For example, pain is felt on the right side of the body in appendicitis.

DIAGNOSIS AND TREATMENT

An acute abdomen requires urgent medical investigation usually comprising detailed questioning about the condition, a physical examination, laboratory tests, and imaging procedures such as *ultrasound scanning*. The investigation may also involve a *laparoscopy* (internal examination using a rigid or flexible viewing tube) or a *laparotomy* (surgical exploration of the abdomen). Treatment depends on the underlying cause.

abdominal

Relating to the *abdomen*.

abdominal hysterectomy

The surgical removal of the uterus (womb) through an incision in the abdomen (see *hysterectomy*).

abdominal pain

Discomfort in the abdominal cavity. Symptoms accompanying abdominal pain may include belching, nausea, vomiting, rumbling and gurgling noises, and flatulence (wind).

CAUSES

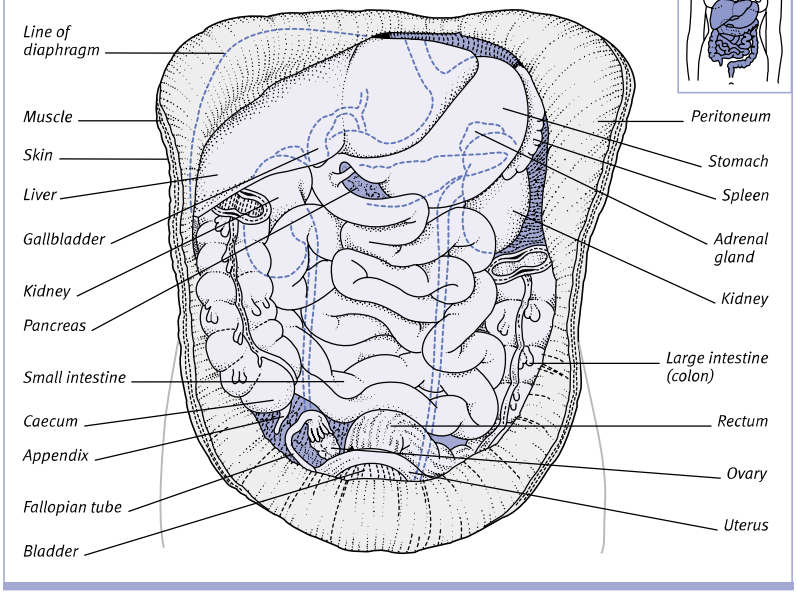
Mild abdominal pain is common and is often due to excessive alcohol intake, eating unwisely, or an attack of *diarrhoea*. Pain in the lower abdomen is common during menstruation but may occasionally be due to a gynaecological disorder such as *endometriosis* (in which fragments of uterine lining are present in abnormal sites within the abdomen). *Cystitis* (inflammation of the bladder) is another common cause of pain or discomfort in the lower abdomen. Bladder distension due to urinary obstruction may also cause abdominal pain.

Abdominal colic is the term used for pain that occurs every few minutes as one of the internal organs goes into muscular spasm. Colic is an attempt by the body to overcome an obstruction such as a stone or an area of inflammation. The attacks of colic may become more severe and may be associated with vomiting (see *abdomen, acute*).

A *peptic ulcer*, which is associated with an increase in the amount of acid formed in the stomach, often produces recurrent gnawing pain. Other possible causes of abdominal pain are infection, such as *pyelonephritis* (infection of the kidneys) and *pelvic inflammatory disease* (infection of the internal female reproductive organs), and *ischaemia* (a lack of blood supply), as occurs when a *volvulus* (twisting of the intestine) obstructs blood vessels. Tumours affecting an abdominal organ can cause pain. Abdominal pain may also have a psychological cause, such as anxiety.

LOCATION OF THE ABDOMEN

The *abdomen* is bounded by the lower ribs at the top and the pelvis below. The illustration shows the position of the abdominal organs in an adult woman.



TREATMENT

For mild abdominal pain, self-treatment measures, such as a wrapped hot-water bottle or a milky drink, are often effective. Pain due to peptic ulcer can be temporarily relieved by consuming food or by taking *antacid drugs*.

Abdominal pain that is not relieved by vomiting, persists for more than six hours, or is associated with sweating or fainting requires urgent medical attention. Urgent attention is also necessary if pain is accompanied by persistent vomiting, vomiting of blood, or passing of bloodstained or black faeces. Abdominal pain that is accompanied by unexplained weight loss or changes in bowel habits should always be investigated by a doctor.

INVESTIGATION AND DIAGNOSIS

The doctor makes a diagnosis of abdominal pain based on a physical examination and a detailed description of the patient's symptoms. Investigation of severe abdominal pain may also include *blood tests*, imaging tests such as *ultrasound scanning*, and endoscopy (examination of a body cavity using a flexible viewing tube) in the form of *laparoscopy* (viewing the abdominal cavity), *gastroscopy* (viewing the stomach and duodenum), or *colonoscopy* (viewing the large intestine).

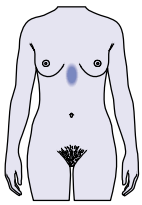
abdominal swelling

Enlargement of the abdomen, which may be due to a variety of causes. Abdominal swelling is a natural result of *obesity* and enlargement of the uterus during pregnancy.

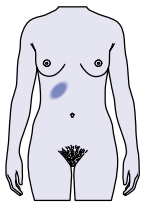
Some causes of abdominal swelling are harmless. Wind in the stomach or intestine may cause uncomfortable, bloating distension. Distension as a result of temporary water retention may occur in some women just before *menstruation*. Other causes may be more serious. For instance, *ascites* (fluid accumulation in the abdominal cavity) may be a symptom of cancer or disease of the heart, kidneys, or liver; swelling may also be due to intestinal obstruction (see *intestine, obstruction of*) or an *ovarian cyst*.

DIAGNOSING **ABDOMINAL PAIN**

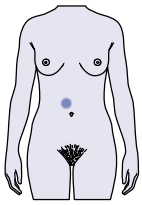
The doctor conducts a physical examination and listens to the patient's description of the pain. More investigations, such as blood tests, X-rays, or imaging tests (including ultrasound scanning), may be carried out. If the diagnosis is still in doubt, endoscopic inspection of the stomach and duodenum (gastroscopy), large intestine (colonoscopy), or abdominal cavity (laparoscopy) may be performed.



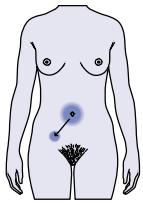
Oesophageal reflux
A burning pain in the chest that is accompanied by regurgitation of stomach acid and is often worse after meals or when lying down at night.



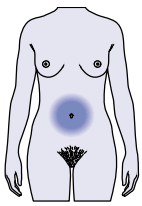
Gallbladder pain
A cramplike or steady pain under the right ribs that is often accompanied by vomiting and fever.



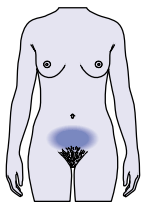
Duodenal ulcer pain
This pain often occurs in the same small area and may be temporarily relieved by eating or taking antacids.



Appendicitis pain
This pain starts around the navel before finally settling in the lower right side of the abdomen.



Wind
Excess wind in the digestive system affects a large area of the abdomen and can cause an uncomfortable, distended feeling.



Pelvic organ inflammation
A constant diffuse pain, usually accompanied by vaginal discharge or fever, that extends over the lower abdomen.

INVESTIGATION

Diagnosis of the underlying cause may involve X-rays (see *abdominal X-ray*), *ultrasound scanning*, *laparotomy* (surgical exploration of the abdomen) or *laparoscopy* (examination of the inside of the abdomen using a rigid or flexible viewing tube). In ascites, some of the fluid in the abdomen may be drained for detailed examination.

abdominal thrust

A first-aid treatment for choking in which a sharp upward pressure is applied to the upper abdomen, just below the rib cage, to dislodge a foreign body that is obstructing the airway. The technique is also known as the Heimlich manoeuvre.

abdominal X-ray

An *X-ray* examination of the abdominal contents. An abdominal X-ray is often one of the first steps in the investigation of acute abdominal disease.

X-rays do not reveal the internal structure of organs, but they do show their outlines. X-rays can therefore show whether any organ is enlarged and can detect swallowed foreign bodies in the digestive tract. X-rays also show accumulations of fluid and gas: distended loops of bowel containing collections of fluid often indicate the presence of an obstruction (see *intestine, obstruction of*); gas outside the intestine indicates intestinal *perforation*.

Calcium, which is opaque to X-rays, is present in most kidney stones (see *calculus, urinary tract*) and in some *gallstones* and aortic *aneurysms*; these can sometimes be detected on an abdominal X-ray.

Abdominal X-rays may need to be followed by procedures that provide more information, such as *ultrasound scanning*, *barium X-ray examinations* (use of a contrast medium to detect disorders of the gastrointestinal tract), *laparoscopy* (internal examination of the abdomen using a viewing instrument), *CT scanning* or *MRI* (techniques that produce cross-sectional or three-dimensional images of body structures).

abducent nerve

The sixth *cranial nerve*. The abducent nerve supplies the lateral rectus muscle of each eye, which is responsible for moving the eyeball outwards. The abducent nerve originates in the pons (part of the *brainstem*) and passes along the

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base of the skull, entering the back of the eye socket through a gap between the skull bones.

The abducent nerve may be damaged in fractures of the base of the skull, or by disorders, such as tumours, that distort the brain. Such damage may give rise to *double vision* or a *squint*.

abduction

Movement of a limb away from the central line of the body, or of a digit away from the axis of a limb. Muscles that carry out this movement are called abductors. (See also *adduction*.)

abductor

Any one of the muscles that carry out the movement of *abduction*.

aberrant

A term meaning abnormal; in medical usage the word is often applied to a blood vessel or nerve that deviates from its normal route.

abetalipoproteinaemia

A rare, inherited *genetic disorder* of *lipoprotein* (a protein that combines with fats or other lipids) metabolism. It is inherited in an autosomal recessive manner and is characterized by *malabsorption* of fats, acanthocytosis (distorted red blood cells), *retinopathy* (disease of the retina), *ataxia* (incoordination and clumsiness), slurred speech, muscle weakness, curvature of the spine, *neuropathy* (peripheral nerve disease), fatty stools, diarrhoea, and *failure to thrive* in infancy.

Treatment with high doses of fat soluble vitamins (*vitamin A*, *vitamin D*, *vitamin E*, and *vitamin K*) may slow the progression of certain abetalipoproteinaemia-related problems such as retinal degeneration.

ablation

The removal or destruction of diseased tissue by excision (cutting away), *cryosurgery* (freezing), *radiotherapy*, *diathermy* (burning), or *laser treatment*.

ablepharia

A *birth defect* in which the eyelids fail to develop normally, leaving the eyeball completely covered over.

abnormality

A physical deformity or malformation, behavioural or mental problem, or variation from normal in the structure or function of a body cell, tissue, or organ.

ABO blood groups

See *blood groups*.

abort

A term meaning to terminate a pregnancy, either spontaneously (see *miscarriage*) or through medical intervention (see *abortion, induced*).

abortifacient

An agent that causes *abortion*. In medical practice, abortion is induced using *prostaglandin drugs*, often given in the form of vaginal pessaries. These cause the softening and widening of the cervix (neck of the uterus) and muscular contractions of the uterus.

abortion

In medical usage, a term denoting either spontaneous abortion (see *miscarriage*) or medically induced termination (see *abortion, induced*) of pregnancy. (See also *complete abortion*; *habitual abortion*; *incomplete abortion*; *septic abortion*.)

abortion, induced

Medically induced termination of pregnancy. In the UK abortion can legally be performed up to the 24th week of pregnancy. Legally, abortion may be performed if continuation of the pregnancy would constitute a greater risk to the woman's life than the termination, if the mental or physical health of the woman or her existing children is at risk, or if there is a substantial risk of serious handicap to the baby.

MEDICAL REASONS FOR ABORTION

A doctor may recommend an abortion if the woman suffers from a life-threatening condition, such as severe heart disease, chronic kidney disease, or cancer, especially of the breast or cervix.

If a serious fetal abnormality is discovered, for example severe developmental defects (such as *anencephaly*) or chromosomal abnormalities (such as *Down's syndrome*), the parents may be offered the option of a termination. Abortion may also be recommended if the mother contracts *rubella* (German measles) during early pregnancy.

HOW IT IS DONE

Early abortion Up to the ninth week of pregnancy termination may be induced by treatment with a combination of two drugs, *mifepristone* and a *prostaglandin drug*. These end the pregnancy by inducing the uterus to contract and expel the embryo and the placenta; the process usually takes at least 48 hours. If this drug treatment is unsuccessful, a surgical termination will be required. Until the 12th week, pregnancy may be terminated by vacuum suction curettage performed under either a general or a local anaesthetic (see *anaesthesia, general*; *anaesthesia, local*). The cervix is dilated with curved metal rods and a thin plastic tube is inserted into the uterus. The tube is connected to an apparatus that sucks out the fetal and placental tissues.

Recovery is generally fast, although strenuous activity should be avoided for several days. There is usually some bleeding, and occasionally mild cramps, for up to a week. Menstrual periods typically return four to six weeks after the termination. Sexual intercourse can be resumed after two to three weeks.

Late abortion Between the 12th and 15th weeks of pregnancy, either the suction procedure used in early abortion or the evacuation procedure may be recommended. In the evacuation procedure, which is routinely performed after the 15th week, the uterus is forced to contract so that the fetus is expelled, as in natural labour. Contractions are induced by oral administration of a dose of mifepristone, followed 36 to 48 hours later by the introduction, high into the vagina, of a prostaglandin hormone pessary. The prostaglandin medication may need to be repeated for the contractions to be maintained.

It usually takes from 12 to 24 hours for the fetus to be expelled using the evacuation procedure, during which time the woman is given *analgesic drugs* (painkillers). She usually remains in hospital for up to 48 hours after completion of the termination in order to be monitored for complications.

COMPLICATIONS

If termination is performed by a qualified gynaecologist in a well-equipped clinic or hospital, complications are rare. Infection, resulting in a condition called *septic abortion*, or serious bleeding occasionally occur. Repeated terminations may increase the risk of miscarriage occurring in subsequent pregnancies; but a single termination is unlikely to affect future fertility. (See also *complete abortion*; *habitual abortion*; *incomplete abortion*.)

abrasion

Also called a graze, a *wound* on the surface of the skin that is caused by scraping or rubbing.

abrasion, dental

The wearing away of tooth enamel, which is often accompanied by the erosion of dentine (the layer beneath the enamel) and cementum (the bonelike tissue that covers the tooth root). Dental abrasion is usually a result of brushing the teeth too vigorously.

Abraded areas are often sensitive to hot, cold, or sweet food and drink; a desensitizing toothpaste and/or protection with a bonding agent (see *bonding, dental*) or filling (see *filling, dental*) may be necessary.

abrasive

A substance that is used in dentistry for polishing and cleaning the teeth. (See also *dentifrice*.)

abreaction

In *psychoanalysis*, the process of becoming consciously aware of painful feelings and memories that have previously been repressed (buried). The emotional discharge of such experiences is believed to have therapeutic benefits. The concept of abreaction originates in Freudian theory, in which the process ideally occurs as a result of *catharsis* (the open expression of emotions that are associated with forgotten memories).

abruption

The medical term for the separation of one structure from another. (See also *placental abruption*.)

abruptio placentae

The medical term for the premature separation of the placenta from the wall of the uterus (see *placental abruption*) during pregnancy.

abscess

A collection of *pus* caused by infection by microorganisms, usually bacteria. Pus is formed from destroyed tissue cells, from leukocytes (a type of white blood cell) that have been carried to the area to fight infection, and from dead and live microorganisms. A lining, known as a pyogenic membrane, often forms around the abscess.

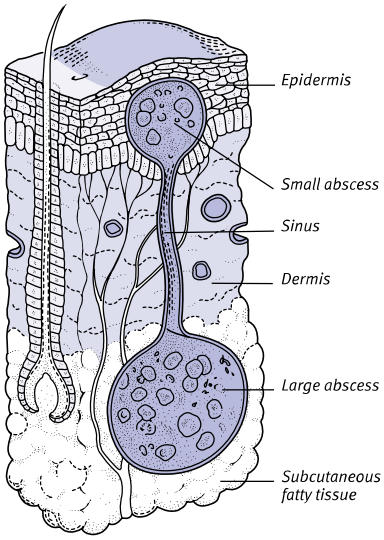
TYPES

An abscess may develop in any organ, and in the soft tissues beneath the skin, sometimes as a collar-stud abscess, a small cavity that connects to a larger cavity in deeper tissues. Common sites of abscesses include the armpit, breast (see *breast abscess*), groin, and gums (see *abscess, dental*). Rarer sites include the liver (see *liver abscess*) and brain (see *brain abscess*).

CAUSES AND INCIDENCE

Common bacteria, such as staphylococci, are the usual cause of abscesses, although fungal infections are another cause. Amoebae (single-celled microorganisms) are an important cause of liver abscesses (see *amoebiasis*). Infectious organisms reach internal organs via the bloodstream or penetrate to tissues under the skin through an infected wound or bite.

People with impaired immunity, such as those who are taking *immunosuppressant drugs* and those with *HIV* infection or *AIDS*, are especially susceptible to abscesses.



Cross section of a collar-stud abscess
A small cavity in the epidermis, just beneath the skin's surface, connects, via a sinus (channel), to a larger cavity in deeper, subcutaneous tissue.

SYMPTOMS

An abscess may cause pain, depending on where it occurs. Most larger abscesses cause fever (sometimes with chills), sweating, and malaise. Abscesses may produce a sensation of intense pressure and those close to the skin may cause redness and swelling.

TREATMENT

Antibiotic drugs are usually prescribed to treat bacterial infections, *antifungal drugs* are used to treat fungal infections, and amoebicides are used for amoebiasis. Most abscesses need to be drained by making a cut in the lining of the abscess cavity to allow the pus to escape; a tube may be left in place to allow continuous drainage (see *drain, surgical*). Some abscesses burst and drain spontaneously.

OUTLOOK

Many abscesses subside following drainage alone; others subside after a combination of drainage and drug treatment. Occasionally the presence of an abscess within a vital organ damages enough surrounding tissue to cause permanent loss of normal function, or even death. (See also *appendix abscess*; *Bartholin's abscess*; *bone abscess*; *caseous abscess*; *cold abscess*; *hot abscess*; *metastatic abscess*; *pelvic abscess*; *periodontal abscess*; *peritonsillar abscess*; *sterile abscess*; *subphrenic abscess*; *tubercular abscess*.)

abscess, dental

Also called a periapical abscess, a pus-filled sac in the tissue around the end of the root of a tooth, usually caused by bacterial infection.

CAUSE

A periapical abscess may occur when bacteria invade the pulp (the tissues in the central cavity of a tooth), causing the pulp to die. This commonly happens as a result of dental caries (see *caries, dental*), as the tooth's enamel and dentine are destroyed allowing bacteria to reach the pulp. Bacteria can also gain access to the pulp when a tooth is injured. The infection in the pulp then spreads into the surrounding tissue to form an abscess.

An abscess that occurs when bacteria accumulate in pockets that form between the teeth and gums is called a periodontal abscess. This type of abscess indicates chronic *periodontal disease*, in which the periodontal membrane (attachment of tooth to bone) is damaged and, in severe cases, the supporting bone eroded.

SYMPTOMS

The affected tooth aches or throbs, and biting or chewing is often painful. The gum around the tooth is tender and may be red and swollen. An untreated abscess may eventually erode a sinus (a channel) through the jawbone to the gum surface, where it forms a gumboil (a swelling). If the gumboil bursts, pus is discharged into the mouth, and the pain usually lessens. As the abscess spreads through the surrounding tissues and bones, glands in the neck and face may become swollen and symptoms of infection, such as headache and fever, may develop.

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TREATMENT
A periapical abscess may be drained by drilling through the crown of the tooth into the pulp cavity in order to allow the pus to escape, followed by *root-canal treatment* (filling of the pulp cavity with dental cement). In some cases, extraction of the tooth (see *extraction, dental*) is necessary. *Antibiotic drugs* are prescribed if the infection has spread. A periodontal abscess can usually be treated by careful scraping away of the infected material by the dentist.

absence
In medical usage, a temporary loss or impairment of consciousness that occurs in some forms of *epilepsy*, typically generalized absence (petit mal) seizures in childhood.

absorption
The process by which fluids or other substances are taken up by body tissues. The term absorption is commonly applied to the uptake of nutrients (from digested food) into the blood and lymph from the digestive tract.

The major site of absorption is the small intestine, which is lined with millions of microscopic fingerlike projections known as villi (see *villus*). The villi greatly increase the surface area of the intestine, thereby increasing the rate of absorption.

abuse
Maltreatment of a person or misuse of a substance. (See also *child abuse*; *drug abuse*; *heroin abuse*; *sexual abuse*; *solvent abuse*; *substance abuse*.)

acamprosate
A drug used in the treatment of *alcohol dependence*.

acanthoma
A noncancerous tumour composed of cells of the outer layer of skin. There are various types of acanthoma. They are most likely to occur on the face, where they develop in hair follicles, or on the legs. (See also *keratoacanthoma*.)

acanthosis nigricans
A rare, untreatable condition in which thickened dark patches of skin appear in the groin, armpits, neck, and other skin folds. Acanthosis nigricans may occur in young people as a genetic disorder or as the result of an endocrine disorder such as *Cushing's syndrome*. The condition also occurs in people with carcinomas (cancerous tumours) of the lung and other organs.

Pseudoacanthosis nigricans is a much more common condition that is usually seen in dark-complexioned people who are overweight. In this form, the skin in fold areas is both thicker and darker than the surrounding skin, and excessive sweating usually occurs in affected areas. Pseudoacanthosis nigricans may improve with weight loss.

acarbose
A drug that is used in the treatment of type 2 *diabetes mellitus*. Acarbose acts on enzymes in the intestines, inhibiting the digestion of starch and therefore slowing the rise in *blood glucose* levels after a carbohydrate meal.

accessory nerve
The 11th *cranial nerve*. Unlike the other cranial nerves, most of the accessory nerve originates from the spinal cord.

The small part of the nerve that originates from the brain supplies many muscles of the palate, pharynx (throat), and larynx (voice-box). Damage to this part of the nerve may lead to *dysphonia* (difficulty in speaking) and dysphagia (difficulty in swallowing).

The spinal part of the accessory nerve supplies large muscles in the neck and back, most notably the sternomastoid (which runs from the breastbone to the side of the skull) and trapezius (the large, triangular muscle of the upper back, shoulder, and neck). Damage to the spinal fibres of the nerve paralyses these muscles.

accidental death
Death that occurs as a direct result of an accident. A high proportion of deaths in young adults, particularly among males, are accidental. Many of these deaths are as a result of road traffic accidents, drowning, or drug overdose; and alcohol is a significant contributory factor.

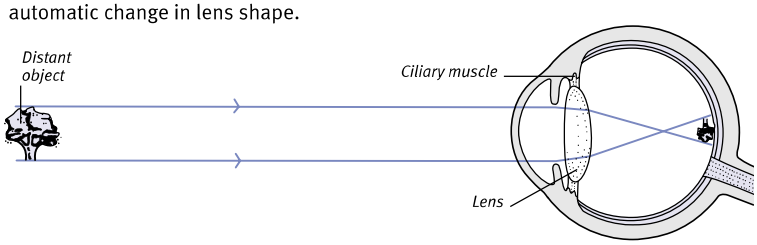
Falls in the home, and burning or asphyxiation as a result of fires, are common causes of accidental death in elderly people. Important causes of accidental death in infants are choking on food or smothering by bedclothes or other materials such as plastic bags. Fatal accidents at work have become less common with the introduction of effective safety measures.

acclimatization
Physical or psychological adjustment to a different climate, environment, or situation. (See also *heat disorders*; *mountain sickness*.)

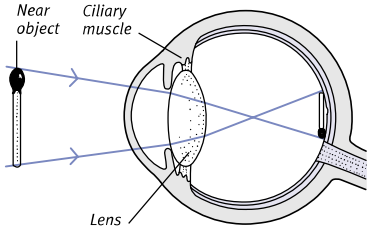
accommodation
Adjustment, especially the process by which the eye adjusts itself to focus on near objects. At rest, the eye is focused

THE MECHANISM OF ACCOMMODATION

In a normal, healthy eye, light reflected from a near object is brought into focus on the retina by a process called accommodation. Focusing is achieved by an automatic change in lens shape.



Focusing on a distant object
The lens focused on a distant object is thin, flat, and completely relaxed.



Focusing on a near object
To bring a near object into sharp focus, the ciliary muscles contract and the lens becomes more convex in shape.

for distant vision, when its lens is thin and flat. To focus on a nearer object, the ciliary muscle of the eye contracts, which reduces the pull on the outer rim of the lens, allowing it to become thicker and more convex.

With age, the lens loses its elasticity. This makes accommodation increasingly difficult and results in a form of longsightedness called *presbyopia*.

accouchement

The French word for the *delivery* of an infant from the uterus (womb). (See also *childbirth*.)

accretion

A manner of growth involving the accumulation of additional material of the same type as that already present. The term accretion is used in dentistry to refer to the collection of foreign material, such as plaque (see *plaque, dental*), on the surface of a tooth or in a dental cavity.

acebutolol

A *beta-blocker drug* used to treat *hypertension* (high blood pressure), *angina pectoris* (chest pain caused by impaired blood supply to the heart muscle), and certain types of *arrhythmia* (abnormal heart rhythm) in which the heart beats too rapidly.

ACE inhibitor drugs

COMMON DRUGS

• Captopril • Cilazapril • Enalapril • Fosinopril • Lisinopril • Moexipril • Perindopril • Quinapril • Ramipril • Trandolapril

A group of drugs that are used to treat *heart failure* (reduced pumping efficiency of the heart), *hypertension* (high blood pressure), and kidney problems associated with *diabetes mellitus*. ACE (*angiotensin-converting enzyme*) inhibitors are often prescribed with other drugs such as *diuretic drugs* or *beta-blocker drugs*.

HOW THEY WORK

ACE inhibitors block the action of an *enzyme* that is responsible for converting *angiotensin* (a protein present in the blood) from inactive angiotensin I to angiotensin II. Angiotensin II encourages blood vessels to constrict; its absence permits them to dilate, thus reducing blood pressure. In diabetic nephropathy, ACE inhibitors slow the progress of the disorder and reduce the loss of *albumin* in the urine.

SIDE EFFECTS

Possible side effects include nausea, loss of taste, headache, dizziness, and a dry cough. The first dose may dramatically reduce blood pressure.

acellular

A term meaning "without cells" that is generally used to describe pertussis (whooping cough) *vaccines* that contain only certain parts, rather than the whole, of the pertussis bacteria cell.

acetabulum

A cuplike hollow in the pelvis into which the head of the femur (thigh bone) fits to form the *hip* joint.

acetaminophen

An *analgesic drug* that is more commonly known as *paracetamol*.

acetazolamide

A drug that is used in the treatment of *glaucoma* (raised pressure in the eyeball) and, occasionally, to prevent or treat symptoms of *mountain sickness* (headache, weakness, and other symptoms occurring at high altitudes).

Possible side effects of acetazolamide include lethargy, nausea, diarrhoea, and reduced libido.

acetic acid

The colourless, pungent, organic acid that gives vinegar its sour taste. In medicine, acetic acid is an ingredient of antiseptic gels that are used to treat certain vaginal infections.

acetone

A chemical produced naturally when the body enters a state known as *ketosis*, in which fats are broken down to produce energy. This can occur as the result of metabolic changes caused by *diabetes mellitus* or, sometimes, as the result of extreme dieting.

Pharmaceutical preparations containing acetone are used as antiseptics and solvents. Acetone is also used in cosmetics such as nail varnish remover. (See also *solvent abuse*.)

acetylcholine

A type of *neurotransmitter* (a chemical that transmits messages between nerve cells or between nerve and muscle cells). Acetylcholine is the neurotransmitter found at all nerve-muscle junctions and at many other sites in the nervous system. The actions of acetylcholine are called cholinergic actions, and these can be blocked by *anticholinergic drugs*.

acetylcholinesterase inhibitors

COMMON DRUGS

• Donepezil • Rivastigmine

A group of drugs that are used in the treatment of mild to moderate *dementia* caused by *Alzheimer's disease*, in which there is a deficiency of the neurotransmitter *acetylcholine* in the brain.

HOW THEY WORK

Acetylcholinesterase inhibitors work by blocking the action of acetylcholinesterase, the enzyme in the brain responsible for the breakdown of acetylcholine. This raises acetylcholine levels, and, in up to half of all patients, the drugs slow the rate of progression of dementia. However, they have no effect on dementia due to other causes, such as stroke or head injury.

SIDE EFFECTS

Common side effects include nausea, dizziness, and headache. Rarely, difficulty in passing urine may occur.

acetylcysteine

A drug that is used in the treatment of *paracetamol* overdose and also as a *mucolytic* drug to loosen sputum in chronic *bronchitis*.

To be effective as an antidote to paracetamol poisoning, acetylcysteine must be given by injection within a few hours of the overdose having been taken. The drug works by reducing the amount of toxic substances produced during the breakdown of paracetamol, thereby reducing the risk of liver damage. When taken orally, acetylcysteine makes the mucus in sputum less sticky and therefore easier to cough up.

When acetylcysteine is taken in large doses, vomiting, rash, or breathing difficulties may occur as rare side effects.

achalasia

A rare condition, of unknown cause, in which the muscles at the lower end of the *oesophagus* and the sphincter (valve) between the oesophagus and the stomach fail to relax to allow food into the stomach after swallowing. As a result, the lowest part of the oesophagus is narrowed and becomes blocked with food, while the part above widens.

SYMPTOMS AND SIGNS

Symptoms include difficulty and pain in swallowing, and pain in the lower chest

A

and upper abdomen. A foul taste in the mouth and bad breath may arise due to the regurgitation of food. The ability to swallow gradually deteriorates until the swallowing of liquids is also impeded.

DIAGNOSIS AND TREATMENT

A barium swallow (a type of *barium X-ray examination*) and *gastroscopy* (in which a narrow viewing tube is passed down the oesophagus) may be performed in order to investigate achalasia.

Drug treatment for achalasia is rarely successful. It is possible to widen the oesophagus for prolonged periods by *oesophageal dilatation* (passing a cylindrical rod or a *balloon catheter* down the oesophagus). Surgery to cut some of the muscles at the stomach entrance may be necessary to widen the passageway for food.

ache

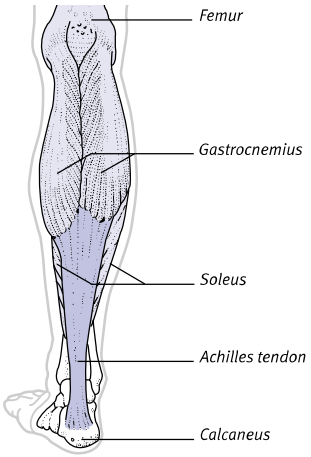
A continuous, fixed, and often dull pain that is distinct from twinges. (See also *bone pain*; *earache*; *headache*; *stomachache*; *toothache*.)

Achilles tendon

The tendon that raises the heel. The Achilles tendon is formed from the calf muscles (the gastrocnemius, soleus, and plantaris muscles) and is attached to the *calcaneus* (the heel-bone). The Achilles tendon is named after Achilles, the legendary Greek hero who was vulnerable only in his heel.

LOCATION OF THE ACHILLES TENDON

The tendon runs from the base of the calf to the calcaneus.



Minor injuries to the Achilles tendon are common. They are usually provoked by too much exercise, faulty running technique, or the wearing of unsuitable footwear. All of these injuries can result in inflammation of the tendon (*tendinitis*) and tearing of the tendon fibres. In most cases, these conditions clear up with rest and physiotherapy.

Violent stretching of the Achilles tendon can cause it to rupture, creating a snapping sensation in the injured area, and pain, swelling, and impaired movement of the affected part. In such cases, surgical repair may be needed, but immobilization of the ankle in a plaster cast may be sufficient.

achlorhydria

Absence of stomach acid secretions. This may be due to chronic atrophic *gastritis* or to an absence or malfunction of acid-producing parietal cells in the stomach lining.

Achlorhydria may not produce symptoms and is not in itself a cause for concern. However, it is sometimes associated with *stomach cancer* and is also a feature of pernicious anaemia, a blood disorder caused by defective absorption of vitamin B_{12} from the stomach (see *anaemia, megaloblastic*).

achondroplasia

A rare genetic disorder of bone growth that leads to *short stature*. Individuals affected with achondroplasia have short limbs, a well-developed trunk, and a head of normal size, except for a protruding forehead.

The condition is caused by a defect of a dominant gene (see *genetic disorders*) but often arises as a new *mutation*, rather than being inherited from a parent. The long bones of the arms and legs are affected mainly. The cartilage that links each bone to its epiphysis (the growing area at its tip) is converted to bone too early, preventing further limb growth.

Achondroplasia is usually obvious at birth or during the first year of life and no treatment is available to alter the outlook. Intelligence and sexual development are not affected, and lifespan is close to normal.

aciclovir

An *antiviral drug* that can be taken orally in tablet or liquid form, applied to the skin as a cream, taken as eye-drops, or given intravenously for viral infections including *herpes simplex* (cold sores), *herpes zoster* (shingles), and varicella zoster (*chickenpox*) in adults.

Aciclovir can be used as a life-saving treatment for *encephalitis* (inflammation of the brain). When it is used to treat *cold sores* or recurrent genital herpes, for which an ointment is available over the counter, aciclovir does not provide a cure but does, however, reduce the severity of the attacks.

Side effects of aciclovir are uncommon, but they can include nausea, vomiting, and fatigue. Local reactions commonly occur after topical use.

acid

A substance that is defined as a donor of hydrogen ions (hydrogen atoms with positive electrical charges). Acid molecules, when mixed with or dissolved in water, split up to release their constituent ions; all acids release hydrogen as the positive ion (positive ions are known as cations; and negative ions are called anions).

Examples of acids within the body include hydrochloric acid (a corrosive mineral acid that is produced by the stomach lining), and many organic acids, such as lactic acid, carbonic acid, ascorbic acid (vitamin C), and pyruvic acid. (See also *acid–base balance; alkali*.)

acid–base balance

A combination of mechanisms that ensures that the body's fluids are neither too *acid* nor too alkaline (*alkalis* are also called bases). The body functions normally only when its fluids are close to chemical neutrality.

Metabolic processes cause fluctuations in the acidity and alkalinity of the blood and other body fluids. The body has three mechanisms for maintaining of normal acid–base balance: buffers, breathing, and the activities of the kidneys. Buffers are substances in the blood that neutralize acid or alkaline wastes. Rapid breathing increases the rate at which carbon dioxide is eliminated from the blood, resulting in the blood becoming less acidic; slow breathing has the opposite effect; the kidneys help to maintain a constant acidity level in the blood by regulating the amounts of acid or alkaline wastes in the urine.

Disturbances of the body's acid–base balance result in either *acidosis* (excessive blood acidity) or *alkalosis* (excessive blood alkalinity).

acid-fast

A characteristic of particular bacteria (especially those responsible for tuberculosis) that are resistant to the acids used to dye specimens for microscopic examination (see *staining*).

acidosis

A disturbance of the body's *acid–base balance* in which there is an accumulation of acid or loss of *alkali* (base). There are two types of acidosis: metabolic and respiratory.

CAUSES

In metabolic acidosis, an increased amount of acid is produced by metabolic processes. One form of metabolic acidosis is ketoacidosis, which occurs in uncontrolled *diabetes mellitus* and starvation. Metabolic acidosis may also be caused by loss of bicarbonate (an alkali) as a result of severe diarrhoea. In *kidney failure*, there is insufficient excretion of acid in the urine.

Respiratory acidosis occurs when breathing fails to remove enough carbon dioxide from the lungs. This causes increased acidity of the blood because the excess carbon dioxide remains in the bloodstream, where it dissolves to form carbonic acid. Impaired breathing leading to respiratory acidosis may be caused by chronic obstructive pulmonary disease (see *pulmonary disease, chronic obstructive*), bronchial *asthma*, or *airway obstruction*.

acid reflux

The regurgitation of acidic fluid from the stomach into the *oesophagus* (the tube that connects the throat to the stomach). Acid reflux is the result of inefficiency of the muscular valve at the lower end of the oesophagus.

Also known as gastro-oesophageal reflux disease (GORD), acid reflux may inflame the oesophagus, resulting in *heartburn* (a burning pain in the chest) due to *oesophagitis* (inflammation of the oesophagus).

Mild acid reflux is common but is not serious. It may occur during pregnancy and often affects overweight people. Repeated episodes of discomfort may indicate a *hiatus hernia* (in which part of the stomach protrudes into the chest).

acne

A chronic skin disorder in which there is inflammation of the *sebaceous glands* at the base of hair follicles in the skin.

TYPES

The most common type of acne is sometimes known as acne vulgaris, which almost always develops during puberty. Chemical acne is caused by exposure of the skin to certain chemicals and oils. This results in the development of acne in areas where the chemical has come into contact with the skin, such as on the thighs. Certain prescribed drugs, such as *corticosteroid drugs*, can also cause acne.

Acne
The spots on this boy's face are typical of acne; the darker marks are healed spots, which fade gradually. Severe acne may leave pits in the skin.

CAUSE

Acne spots are caused by the obstruction of hair follicles by excess sebum (the oily substance secreted by the sebaceous glands). Bacteria multiply in the follicle, causing inflammation. Hormonal changes at puberty, including increased levels of *androgen hormones* (male sex hormones) in both males and females, stimulate the production of sebum. There may also be a genetic predisposition to acne.

SYMPTOMS

Acne develops in areas in which there is a high concentration of sebaceous glands, mainly the face, centre of the chest, upper back, shoulders, and around the neck. Milia (whiteheads), comedones (blackheads), nodules (firm swellings under the skin), and cysts (larger, fluid-filled swellings) are the most common types of spot. Some, particularly cystic spots, leave scars.

TREATMENT AND OUTLOOK

There is no instant cure for acne, although washing the affected areas at least twice a day with a mild soap may help to keep it under control. Over-the-counter topical drug treatments such as benzoyl peroxide or azelaic acid are often effective. Prescribed topical *antibiotic drugs* or retinoic acid (a derivative of *vitamin A*) are used to treat moderate acne. Alternative treatment is with oral antibiotics, often *tetracycline drugs*. In very severe cases, *isotretinoin* may be given under hospital supervision. In all cases, exposure to ultraviolet light (either natural or artificial) may also be beneficial. However, it is important not to burn the skin.

Acne improves slowly over time, and it often clears up by the end of the teenage years.

acoustic nerve

The part of the *vestibulocochlear nerve* (the eighth cranial nerve) concerned with hearing. The acoustic nerve is also called the auditory or cochlear nerve.

acoustic neuroma

A rare, noncancerous tumour arising from supporting cells that surround the *vestibulocochlear nerve*, usually within the internal auditory meatus (the canal in the skull through which the nerve passes from the inner ear to the brain).

CAUSE AND INCIDENCE

Acoustic neuromas most commonly occur in people between the ages of 40 and 60 and are slightly more common in women than in men.

Usually, the cause of an acoustic neuroma is unknown. However, tumours that affect the nerves on both sides of the head simultaneously may be part of a widespread *neurofibromatosis* (a disease characterized by changes in the nervous system, skin, and bones).

SYMPTOMS

An acoustic neuroma can cause *deafness*, *tinnitus* (noises in the ear), loss of balance, and pain in the face and the affected ear. As the tumour enlarges, it may lead to additional complications, such as *ataxia* (loss of coordination) due to the compression of the brainstem and cerebellum.

DIAGNOSIS AND TREATMENT

Diagnosis is made by *hearing tests* followed by *X-rays* or by *CT scanning* or *MRI* (techniques that produce cross-sectional or three-dimensional images of body structures).

Surgery may be necessary to remove an acoustic neuroma, but treatment with *radiotherapy* to shrink it may also be effective.

A

acquired

A term relating to a condition that occurs after birth rather than being attributable to heredity. Acquired contrasts with *congenital*, which means present from birth.

acquired immunity

A form of *immunity* that develops after birth through exposure to microorganisms or through *immunization*.

acrocyanosis

A circulatory disorder in which the hands and feet turn blue, may become cold, and sweat excessively. Acrocyanosis is caused by spasm of the small blood vessels and is often aggravated by cold weather.

Acrocyanosis is related to *Raynaud's disease*, in which the skin of the fingers and toes may be damaged by reduced blood flow.

acrodermatitis

Inflammation of the skin, principally on the hands or feet. *Acrodermatitis enteropathica* is a chronic (long-term), inherited variety of the condition.

acrodermatitis enteropathica

A rare, inherited disorder in which areas of the skin (most commonly of the fingers, toes, scalp, and the areas around the anus and mouth) are reddened, ulcerated, and covered with *pustules* (pus-filled spots).

Acrodermatitis enteropathica is inherited in an autosomal recessive manner (see *genetic disorders*) and is due to the inability to absorb sufficient zinc from food. Zinc supplements usually bring about a rapid improvement.

acromegaly

A rare disease that is characterized by abnormal enlargement of the skull, the jaw, the hands and feet, and also of the internal organs.

CAUSE

Acromegaly is caused by excessive secretion of *growth hormone* from the anterior *pituitary gland* at the base of the brain and is the result of a noncancerous *pituitary tumour*.

If such a tumour develops before puberty, the result is *gigantism* (in which growth is accelerated) instead of acromegaly. More commonly, however, the tumour develops after growth in the long bones of the limbs has stopped. This leads to acromegaly, although it may take several years for the symptoms and signs of the condition to appear.

SYMPTOMS AND SIGNS

Symptoms and signs of acromegaly include enlargement of the hands, feet, ears, and nose; a jutting lower jaw; and a long face. There may also be deepening or huskiness of the voice. Symptoms common to any brain tumour, such as headache and visual disturbances, are also possible.

DIAGNOSIS AND TREATMENT

Acromegaly is diagnosed by the measurement of blood levels of growth hormone before and after a quantity of glucose has been administered. Glucose usually suppresses the secretion of growth hormone; if the glucose has no effect on the blood level of the hormone, uncontrolled secretion of growth hormone by the pituitary gland can be confirmed. *CT scanning* or *MRI* (techniques that produce cross-sectional or three-dimensional images of body structures) may be carried out to reveal a tumour or overgrowth of the pituitary gland.

A tumour of the pituitary gland may be removed surgically or treated by *radiotherapy*. The drug *octreotide* prevents growth hormone production and may be used to control symptoms by a person awaiting surgery or until the effects of radiotherapy are felt. *Bromocriptine* sometimes causes the tumour to become smaller.

Appearance of acromegaly
Enlargement of the hands is a typical feature of acromegaly. The condition is apparent when the acromegalic hand, on the left, is compared to a normal hand.

acromioclavicular joint

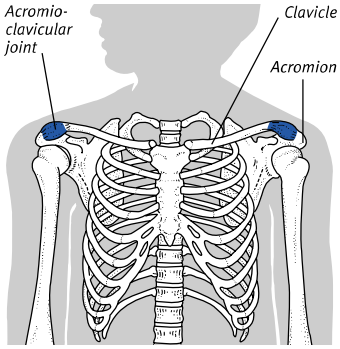
The joint that lies between the outer end of the *clavicle* (collarbone) and the acromion (the bony prominence at the top of the shoulderblade).

INJURIES TO THE JOINT

Injuries to the acromioclavicular joint are rare. They are usually caused by a fall on to the shoulder and may result in subluxation (incomplete dislocation with the bones still in contact) or, rarely, to *dislocation* (complete displacement of the bones so that they are no longer in contact).

LOCATION OF THE ACROMIOCLAVICULAR JOINT

The joint lies at the junction of the outer end of the clavicle and the acromion.



In subluxation, the synovium (joint lining) and the ligaments around it are stretched and bruised, the joint is swollen, and the bones feel slightly out of alignment. In dislocation, the ligaments are torn, the swelling is greater, and the bone deformity is more pronounced. In both cases, the joint is painful and tender, and movement of the shoulder is restricted.

TREATMENT

Treatment for subluxation is by resting the arm and shoulder in a sling. If the pain and tenderness persist, injection of a *corticosteroid drug* and a local anaesthetic (see *anaesthesia, local*) into the joint may help.

Dislocation of the acromioclavicular joint requires strapping around the clavicle and elbow, for about three weeks, to pull the outer end of the clavicle back into position. Surgical correction may occasionally be required.

acromion

The bony prominence at the top of the *scapula* (shoulderblade) that articulates with the end of the *clavicle* (collarbone) to form the *acromioclavicular joint*.

acroparaesthesia

A medical term for tingling sensations that occur in the fingers or toes (see *pins-and-needles*).

ACTH

The common abbreviation for adrenocorticotrophic hormone (also called corticotrophin). ACTH is produced by the anterior part of the *pituitary gland* (at the base of the brain) and stimulates the adrenal cortex (the outer layer of the *adrenal glands*, situated on the top of the kidneys) to release various *corticosteroid hormones*. ACTH is also necessary for the growth and maintenance of the cells of the adrenal cortex.

ACTIONS

The most important function of ACTH is to stimulate the adrenal cortex to increase its production of *hydrocortisone* (cortisol). ACTH also causes the adrenal cortex to release *aldosterone* and *androgen hormones*.

The production of ACTH is controlled by a feedback mechanism that involves both the *hypothalamus* (an area in the centre of the brain) and the level of hydrocortisone in the blood. When ACTH levels are high, the production of hydrocortisone increases, which in turn suppresses the release of ACTH from the pituitary gland. If ACTH levels are low, hydrocortisone production falls and the hypothalamus releases factors that stimulate the pituitary gland to increase production of ACTH.

ACTH levels increase in response to stress, emotion, injury, burns, infection, surgery, and decreased blood pressure. Cancerous tumours, particularly those of the lung, can sometimes produce a chemical that is similar to ACTH and which causes symptoms.

DISORDERS OF ACTH PRODUCTION

A tumour of the pituitary gland can cause excessive production of ACTH, which, in turn, leads to overproduction of hydrocortisone by the adrenal cortex, resulting in *Cushing's syndrome* (a hormonal disorder). Insufficient ACTH production results in decreased production of hydrocortisone, causing *hypotension* (low blood pressure).

MEDICAL USES

Synthetic ACTH was once given in the treatment of *arthritis* or to treat *allergy*, but it is now rarely used.

actin

A *protein* component of *muscle* fibres that, together with myosin (another protein), provides the mechanism for muscles to contract. The microscopic filaments of actin and myosin slide in between each other to make the muscle fibres shorter.

acting out

Impulsive actions that may reflect an individual's unconscious wishes. The term is most often used by psychotherapists to describe behaviour during analysis when the patient "acts out", rather than reports, his or her fantasies, wishes, or beliefs. Acting out can also occur as a reaction to frustrations encountered in everyday life, often taking the form of antisocial, aggressive behaviour that may be directed against oneself or others.

actinic

Relating to changes caused by the ultraviolet rays in sunlight, as in actinic *dermatitis* (inflammation of the skin) and actinic *keratosis* (roughness and thickening of the skin). Both are caused by overexposure to solar radiation.

actinomycosis

An infection caused by *ACTINOMYCES ISRAELII* or related actinomycete bacteria. These bacteria resemble fungi and cause diseases of the mouth, jaw, chest, and pelvis.

TYPES AND CAUSES

The most common form of actinomycosis affects the jaw area. A painful swelling appears and pus and characteristic yellow granules discharge through small openings that develop in the skin. Poor oral hygiene may contribute to this form of the infection.

Another form of actinomycosis affects the pelvis in women, causing lower abdominal pain and bleeding between menstrual periods. This form was associated mainly with a type of *IUD*, no longer in use, that did not contain copper. Rarely, forms of the disorder affect the appendix or lung.

Actinomycosis is usually treated successfully with *antibiotic drugs*.

acuity, visual

See *visual acuity*.

acupressure

A derivative of *acupuncture* in which pressure is applied instead of needles.

acupuncture

A branch of *Chinese medicine* in which needles are inserted into a patient's skin as therapy for various disorders, to relieve pain or to induce *anaesthesia*.

Traditional Chinese medicine maintains that the chi (life-force) flows through the body along channels known as meridians. A blockage in one or more of these meridians is thought to cause ill health. Acupuncturists aim to restore health by inserting needles at appropriate sites, known as acupuncture points, along the affected meridians.

HOW IT WORKS AND WHY IT IS DONE

Research suggests that acupuncture provokes the release within the central nervous system of *endorphins* (substances resembling morphine), which act as natural analgesics (painkillers).

The disorder that is being treated and degree of anaesthesia required determine the needle temperature, place of insertion, whether the needles are stimulated by rotation or electric current, and the length of time the needles remain in position.

Acupuncture may be used as an anaesthetic for surgical procedures as well as to provide pain relief following operations and for chronic conditions. acupuncture is also claimed to help in the treatment of addiction, depression, and anxiety.

SIDE EFFECTS

After treatment with acupuncture, some people experience temporarily exacerbated symptoms. Other people may feel lightheaded, drowsy, or exhilarated for a short while.

It is important that acupuncture is performed by a fully qualified acupuncturist because the use of inadequately sterilized needles could result in the transmission of a variety of infections, including *hepatitis B* and *HIV*.

acute

A term often used to describe a disorder or symptom that develops suddenly. Acute conditions may or may not be severe, and they are usually of short duration. (See also *chronic*.)

acute heart failure

See *heart failure, acute*.

acyanotic

A diagnostic term meaning without *cyanosis*, a bluish coloration of the skin that is seen when blood *oxygen* levels are abnormally low. The term is commonly used in relation to the classification of congenital (present from birth) heart disease (see *heart disease, congenital*).

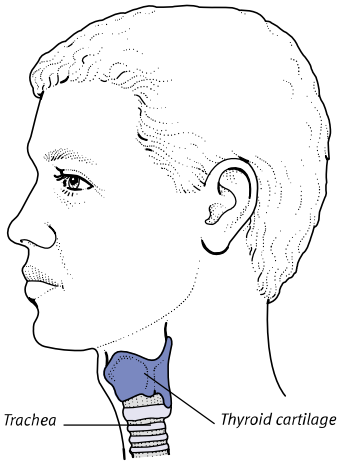
Adam's apple

The projection at the front of the neck, just beneath the skin, that is formed by a prominence on the thyroid

A

LOCATION OF THE **ADAM'S APPLE**

This projection at the front of the neck, beneath the skin, is formed by a prominence on the thyroid cartilage.



cartilage, which is part of the *larynx* (voice-box). The Adam's apple enlarges in males at puberty.

ADD

The abbreviation for attention deficit disorder, more commonly known as *attention deficit hyperactivity disorder.*

addiction

Dependence on, and craving for, a particular drug, such as alcohol, diazepam (a tranquillizer), or heroin. Reducing or stopping intake of the drug may lead to characteristic physiological and/or psychological symptoms (see *withdrawal syndrome*), such as tremor or anxiety. The term addiction may also be used in relation to compulsive behaviour, such as gambling. (See also *alcohol dependence*; *drug dependence*.)

Addison's disease

A rare chronic disorder in which there is deficiency of the corticosteroid hormones *hydrocortisone* and *aldosterone*, which are normally produced by the adrenal cortex (the outer parts of the *adrenal glands*, which are situated on the top of the kidneys). In addition, excessive amounts of the hormone *ACTH* are secreted by the pituitary gland (at the base of the brain) in an attempt to increase output of the corticosteroid hormones. The secretion and activity of another hormone, melanocyte stimulating hormone (MSH), also increase, which leads to increased synthesis of *melanin* pigment in the skin.

CAUSES

Addison's disease can be caused by any disease that destroys the adrenal cortices. The most common cause is an *autoimmune disorder* in which the immune system produces antibodies that attack the adrenal glands.

SYMPTOMS

Symptoms of the disease generally develop gradually over months or years and include tiredness, weakness, abdominal pain, and weight loss. Excess MSH may cause darkening of the skin in the creases of the palms, pressure areas of the body, and the mouth.

Acute episodes, called Addisonian crises, brought on by infection, injury, or other stresses, can also occur. The symptoms of these are mainly due to aldosterone deficiency and include extreme muscle weakness, dehydration, *hypotension* (low blood pressure), confusion, and coma. *Hypoglycaemia* (low blood glucose) also occurs due to a deficiency of hydrocortisone.

DIAGNOSIS AND TREATMENT

Diagnosis of Addison's disease is generally made if the patient fails to respond to an injection of ACTH, which normally stimulates hydrocortisone secretion.

Lifelong *corticosteroid drug* treatment is needed to replace the deficient hormones. Treatment of Addisonian crises involves rapid infusion of saline and glucose and supplementary doses of corticosteroid hormones.

additives

See *food additives*.

adduction

Movement of a limb towards the central line of the body, or of a digit towards the axis of a limb. Muscles that carry out this movement are often called adductors. (See also *abduction*.)

adductor

Any one of the muscles that carry out the movement of *adduction.*

adenitis

Inflammation of *lymph nodes*. Cervical adenitis (swelling and tenderness of the lymph nodes in the neck) occurs in certain bacterial infections, especially *tonsillitis*, and the viral infection glandular fever (see *mononucleosis, infectious*). *Mesenteric lymphadenitis* is inflammation of the lymph nodes inside the abdomen and is usually caused by a viral infection.

In many cases of adenitis, treatment is not necessary. When it occurs as the result of a bacterial infection, treatment of the infection with *antibiotic drugs* will generally also result in an improvement in the condition of the lymph nodes.

adenocarcinoma

The technical name for a *cancer* of a gland or glandular tissue, or for a cancer in which the cells form glandlike structures. An adenocarcinoma arises from epithelium (the layer of cells that lines organs).

Cancers of the colon (the main part of the large intestine), breast, pancreas, and kidney are usually adenocarcinomas, as are some cancers of the cervix, oesophagus, salivary glands, and various other organs. (See also *intestine, cancer of*; *kidney cancer*; *pancreas, cancer of*.)

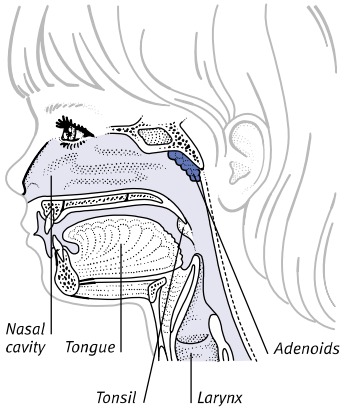
adenoidectomy

Surgical removal of the *adenoids*. An adenoidectomy is usually performed on a child with abnormally large adenoids that are causing recurrent infections of the middle ear or air sinuses. The operation may be performed together with *tonsillectomy*.

There are few after-effects, and the patient can generally begin to eat normally the following day.

LOCATION OF THE **ADENOIDS**

These swellings of glandular tissue are found at the back of the nasal passage above the tonsils. Enlarged adenoids are sometimes implicated in *sleep apnoea.*



adenoids

A mass of glandular tissue at the back of the nasal passage above the tonsils. The adenoids are made up of *lymph nodes*, which form part of the body's defences against upper respiratory tract infections. They tend to enlarge during early childhood, a time when such infections are common.

DISORDERS

In most children, the adenoids shrink after the age of about five years, and disappear altogether by puberty. In some children, however, they enlarge, obstructing the passage from the nose to the throat and causing snoring, breathing through the mouth, and a characteristically nasal voice. The eustachian tubes, which connect the middle ear to the throat, may also become blocked, resulting in recurrent middle ear infections and deafness.

Obstruction to the flow of secretions behind the nose can result in *rhinitis* (inflammation of the nose), which may spread to the middle ear (see *otitis media*) and to the air sinuses behind the nose (see *sinusitis*).

TREATMENT

Infections usually become less frequent as the child grows. If they do not, adenoidectomy (surgical removal of the adenoids) may be recommended.

adenoma

A noncancerous tumour or cyst that resembles glandular tissue and arises from the epithelium (the layer of cells that lines organs).

Adenomas of *endocrine glands* (such as the pituitary gland, thyroid gland adrenal glands, and pancreas can result in excessive hormone production, leading to disease. For example, an adenoma of the pituitary gland can result in *acromegaly* or *Cushing's syndrome*.

adenomatosis

An abnormal condition of glands in which they are affected either by *hyperplasia* (overgrowth) or by numerous *adenomas* (noncancerous tumours).

Adenomatosis may simultaneously affect two or more different *endocrine glands*, such as the adrenal glands, pituitary gland, and pancreas.

adenosine diphosphate

See *ADP*.

adenosine triphosphate

See *ATP*.

ADH

The abbreviation for antidiuretic hormone (also called vasopressin), which is released from the posterior part of the *pituitary gland* and acts on the kidneys to increase their reabsorption of water into the blood.

ACTIONS

Water is continually being taken into the body in food and drink and is also produced by the chemical reactions in cells. Conversely, water is also continually being lost in urine, sweat, faeces, and in the breath as water vapour. ADH reduces the amount of water lost in the urine and helps to maintain the body's overall water balance.

ADH production is controlled by the *hypothalamus* (an area in the centre of the brain), which detects changes in blood concentration and volume. If the blood concentration increases (in other words, the blood contains less water), the hypothalamus stimulates the pituitary gland to release more ADH. If the blood is too dilute, less ADH is produced; as a result, more water is lost from the body in the urine.

DISORDERS OF ADH PRODUCTION

Various factors can affect ADH production and thus disturb the body's water balance. For example, alcohol reduces ADH production by direct action on the brain, resulting in a temporary increase in the production of urine. Urine production is also increased in the disorder *diabetes insipidus*, in which there is either insufficient production of ADH by the pituitary gland or, more rarely, failure of the kidneys to respond to the ADH produced.

The reverse effect, water retention, may result from temporarily increased ADH production after a major operation. Water retention may also be caused by the secretion of ADH by some tumours, especially of the lung.

MEDICAL USES

Synthetic ADH is used in the treatment of a variety of conditions, such as diabetes insipidus. Side effects of the drug may include abdominal cramps, nausea, headache, drowsiness, and confusion.

ADHD

The abbreviation for *attention deficit hyperactivity disorder*.

adhesion

The joining of normally unconnected parts of the body by bands of fibrous tissue. Adhesions are sometimes congenital (present from birth), but they most often develop as a result of scarring after inflammation.

Adhesions are most common in the abdomen, where they often form after *peritonitis* (inflammation of the abdominal lining) or surgery. Sometimes, loops of intestine are bound together by adhesions, causing intestinal obstruction (see *intestine, obstruction of*). In such cases, surgery is usually required to cut the bands of tissue.

adipose tissue

A layer of fat cells lying just beneath the surface of the skin and around various internal organs.

Adipose tissue is made up of fat stored within adipocytes (fat cells). Fat is deposited as a result of excess food intake, thus acting as an energy store; excessive amounts of fat stored within the adipose tissue is a feature of *obesity*. The tissue insulates against loss of body heat and helps to absorb shock in areas subject to sudden or frequent pressure, such as the buttocks, palms of the hands or soles of the feet. Another function of adipose tissue is to cushion organs such as the heart, kidneys, and eyeballs.

After puberty, the distribution of superficial adipose tissue differs in males and females. In men, superficial adipose tissue tends to accumulate around the shoulders, waist, and abdomen; in women, it occurs more commonly on the breasts, hips, and thighs. Adipose tissue tends to make up a larger proportion of the total body weight of women than of men. In obesity, central distribution of body fat around the waist is associated with a greater risk of *cardiovascular disease* and *diabetes*. This may be because fat in this area tends to result in raised blood lipid levels. (See also *brown fat*.)

adjuvant

A substance that enhances the action of another substance in the body. The term is used to describe an ingredient added to a *vaccine* to increase the production of antibodies by the immune system, thus enhancing the vaccine's effect. (See also *adjuvant therapy*.)

adjuvant therapy

Treatment for *cancer*, usually with anticancer drugs, that is given once all the evidence of the original tumour has been removed. The aim of adjuvant

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therapy is to destroy any microscopic deposits of malignant cells that may exist, which reduces the risk of recurrence of the cancer and increases survival times.

Adlerian theory

The psychoanalytical ideas set forth by the Austrian psychiatrist Alfred Adler (1870–1937). Also known as individual psychology, Adler's theories were based on the idea that everyone is born with natural feelings of inferiority. Life is seen as a constant struggle to overcome these feelings; and failure to do so leads to neurosis. (See also *psychoanalytic theory*.)

adnexa

An anatomical term meaning the structures that are adjacent to an organ. Most commonly, the word adnexa is used to refer to the various appendages of the *uterus*: the ovaries, fallopian tubes, and ligaments.

adolescence

The period between childhood and adulthood, which broadly corresponds to the teenage years. Adolescence is a complex stage of psychological development. It commences at and overlaps with, but is not the same as, *puberty*.

Common patterns of adolescent behaviour include moodiness, a general lack of interest, and fluctuating academic performance. Adolescents often worry about their changing body shape and physical appearance. They may lack self-confidence, feel nervous and shy and be unsure of their personal identity.

Adolescents experiment with their appearance, with views and opinions, with allegiances to peer groups, and with political movements or other role models. Gender identity and sexuality may be questioned. Adolescents may also experiment with drugs and alcohol; those who do so to relieve anxiety or depression are more likely to become dependent than those who experiment due to peer-group pressure. Sexual activity is common during adolescence and may result in unwanted pregnancies and *sexually transmitted infections*.

Some adolescents are assertive and strive for independence. Rebellion against parents is common but conflicts with the emotional and financial support that adolescents still require. Aggression and delinquency usually constitute a transient phase. However, a teenager who remains too dependent may not develop sufficiently to make his or her own decisions or to form new relationships outside the family.

Most behavioural problems resolve themselves over time. Maintaining open lines of communication between parents and children is important in easing this process. The most valuable support parents can offer is to encourage self-confidence and responsibility and thus prepare their children for adult life. Parents should also ensure that their children are informed about issues such as *contraception* and safer sex.

ADP

The abbreviation for adenosine diphosphate, the chemical that takes up energy released during biochemical reactions to form *ATP* (adenosine triphosphate), the body's main energy-carrying chemical. When ATP releases its energy ADP is reformed. (See also *metabolism*.)

adrenal failure

Insufficient production of hormones by the adrenal cortex (the outer part of the *adrenal glands*, situated on the top of the kidneys). Adrenal failure can be acute (of sudden onset) or chronic (of gradual onset). The condition may be caused by a disorder of the adrenal glands, in which case it is called *Addison's disease*, or by reduced stimulation of the adrenal cortex by *ACTH*, a hormone produced by the *pituitary gland*. (See also *adrenal glands* disorders box, overleaf.)

adrenal glands

A pair of small, triangular *endocrine glands* (glands that secrete hormones directly into the bloodstream) that are located on the top of the kidneys. Each adrenal gland has two distinct parts: the outer adrenal cortex and the smaller, inner adrenal medulla.

ADRENAL CORTEX

The adrenal cortex secretes *aldosterone*, which, by inhibiting the amount of sodium excreted in the urine, helps to maintain blood volume and blood pressure. The cortex also secretes *hydrocortisone* and corticosterone, as well as small amounts of *androgen hormones*. Hydrocortisone controls the body's use of fats, proteins, and carbohydrates and is also important in helping the body to cope with stress. Hydrocortisone and corticosterone also suppress inflammatory reactions and some activities of the immune system.

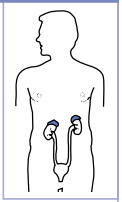
Hormone production by the adrenal cortex is governed by other hormones, such as *ACTH*, that are produced in the *hypothalamus*, in the centre of the brain, and the *pituitary gland* beneath it (see *feedback mechanism* box).

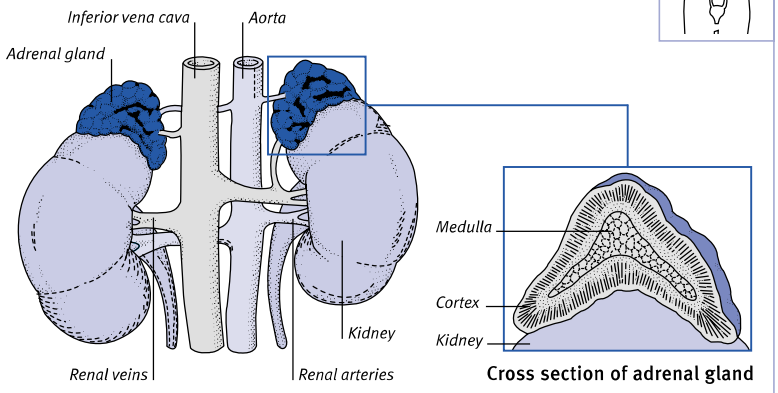
ADRENAL MEDULLA

The adrenal medulla is part of the sympathetic division of the *autonomic nervous system*, which is the body's first line of defence against physical and emotional stress. The medulla secretes the hormones *adrenaline* (epinephrine) and *noradrenaline* (norepinephrine) in

ANATOMY OF THE **ADRENAL GLANDS**

Also sometimes called the suprarenal glands, the adrenal glands are situated on top of the kidneys. Each gland is divided into two regions: the adrenal cortex (which secretes hormones that affect the metabolism) and the adrenal medulla (which is part of the sympathetic nervous system).

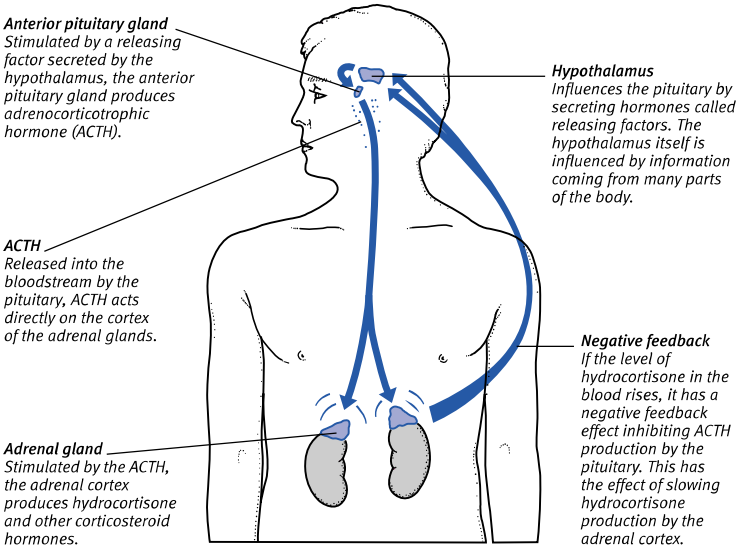




Cross section of adrenal gland

FEEDBACK MECHANISM

The rate at which many glands produce hormones is influenced by other hormones, especially those secreted by the pituitary gland and the hypothalamus. If the amount of hormone produced is increased, negative feedback mechanisms act on the hypothalamus and pituitary so that they produce less of their stimulating hormones, thus reducing the target gland's activity. If the amount of hormone produced is decreased, the feedback weakens, causing increased production of stimulating hormones.



response to stimulation by sympathetic nerves. These nerves are most active during times of stress.

The release of these hormones into the circulation produces effects similar to sympathetic nerve stimulation. The heart rate and force of contraction of the heart muscle increase so that more blood is pumped around the body and the airways are widened to ease breathing. The hormones constrict blood vessels in the intestines, kidneys, and liver, and widen blood vessels supplying the skeletal muscles. Consequently, more blood is supplied to the active muscles and less to the internal organs.

adrenal hyperplasia, congenital

A rare *genetic disorder*, present from birth, in which an *enzyme* (a protein that acts as a catalyst) defect blocks the production of corticosteroid hormones (*hydrocortisone* and *aldosterone*) from the adrenal glands.

SYMPTOMS

The enzyme block results in production of excessive amounts of *androgens* (male sex hormones), which can cause abnormal genital development in an affected fetus. In females, these androgens cause enlargement of the clitoris and some fusion of the outer lips of the vulva, resulting in genital ambiguity (see *sex determination*). Some affected males have an enlarged penis, which may either be evident at birth or may develop later.

Other effects of the enzyme defect include *hypotension* (low blood pressure), *hypoglycaemia* (low blood sugar levels), weight loss, and dehydration. *Hyperplasia* (enlargement) of the adrenal gland occurs due to excessive secretion of the hormone *ACTH*, which is a result of insufficient production of hydrocortisone. Excessive skin pigmentation may occur in skin creases and around the nipples.

In severe cases, congenital adrenal hyperplasia is apparent soon after birth. In milder cases, symptoms appear later, sometimes producing premature puberty in boys and delayed menstruation, *hirsutism* (excessive hairiness), and potential infertility in girls.

DIAGNOSIS AND TREATMENT

A diagnosis is confirmed by measuring corticosteroid hormones in the blood and urine. *Ultrasound scanning* may be carried out to verify that there is no tumour of the adrenal glands.

Treatment of congenital adrenal hyperplasia is with hormone replacement. If the treatment is started early, normal sexual development and fertility generally follow.

adrenaline

Also called epinephrine, a hormone released by the adrenal glands in response to signals from the sympathetic nervous system, part of the *autonomic nervous system*. These signals are triggered by stress, exercise, or emotions such as fear.

Adrenaline increases the speed and force of the heartbeat. It widens the airways to improve breathing and narrows blood vessels in the skin and intestine so that an increased flow of blood reaches the muscles.

Synthetic adrenaline is sometimes given by injection as emergency treatment of *anaphylactic shock* (a severe allergic reaction) and *cardiac arrest* (a halt in the heart's pumping action). Eye-drops containing dipivefrine (a drug that passes quickly into the tissues and converts to adrenaline), may be used to treat acute (closed-angle) *glaucoma*. Regular use can cause a burning pain and, occasionally, blurred vision or pigment deposits on the eye surface. (See also *noradrenaline*.)

adrenal tumours

Rare cancerous or noncancerous tumours in the *adrenal glands*, usually causing excess secretion of hormones.

Tumours of the adrenal cortex may secrete *aldosterone*, causing primary *aldosteronism* (also called Conn's syndrome), or hydrocortisone, causing *Cushing's syndrome*.

Tumours of the adrenal medulla may cause excessive secretion of *adrenaline* (epinephrine) and *noradrenaline* (norepinephrine). Two types of tumour affect the medulla: *phaeochromocytoma* and *neuroblastoma*, which affects children. These tumours may cause intermittent *hypertension* (high blood pressure) and sweating attacks.

Surgical removal of a tumour or an adrenal gland usually cures noncancerous tumours. Cancerous tumours may require additional treatment with *radiotherapy* and/or *chemotherapy*. (See also *adrenal glands* disorders box.)

adrenocorticotrophic hormone

See *ACTH*.

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DISORDERS OF THE **ADRENAL GLANDS**

Adrenal gland disorders are a range of uncommon but sometimes serious conditions that result from deficient or excessive production of hormones by one or both of the adrenal glands.

Congenital defects

A genetic defect causes congenital *adrenal hyperplasia*, in which the adrenal cortex is unable to make sufficient hydrocortisone and *aldosterone*. As a side effect of the reduced hydrocortisone production, the glands are stimulated into producing excess androgens (male sex hormones); this can cause masculinization of female babies.

Autoimmune disorders

Deficient production of hormones by the adrenal cortex is called *adrenal failure*; if the deficiency is due to disease of the adrenal glands themselves, it is called *Addison's disease*. The most common cause of Addison's disease is an autoimmune process (in which the body's immune system attacks its own tissues). Addison's disease can take a chronic course characterized by weakness, weight loss, and skin darkening, or an acute form (Addisonian crisis or acute adrenal failure), in which the patient may become confused and comatose.

Infection

Destruction of the adrenal glands by *tuberculosis* was once a major cause of Addison's disease but is now uncommon. The onset of an infection or other acute illness in someone with Addison's disease can precipitate acute adrenal failure.

Impaired blood supply

Loss or obstruction of the blood supply to the adrenal glands, sometimes as a result of arterial disease, is another possible cause of Addison's disease or acute adrenal failure.

Tumours

Cancerous or noncancerous growths in the adrenal glands are rare but generally lead to excess secretion of hormones. A tumour of the adrenal cortex can secrete aldosterone, causing primary *aldosteronism* (also called Conn's syndrome), a condition that is characterized by thirst and high blood pressure. A tumour can also secrete hydrocortisone, causing *Cushing's syndrome*, which has various features including muscle-wasting and obesity of the trunk. Androgens may also be produced in excess, causing masculinization in females.

Two types of tumour affect the adrenal medulla, *phaeochromocytoma* and *neuroblastoma*, which affects children. These tumours may cause excess secretion of adrenaline (epinephrine) and noradrenaline (norepinephrine).

Other disorders

In many cases, disturbed activity of the adrenals is caused, not by disease of the glands themselves, but by an increase or decrease in the blood level of hormones that influence the activity of the glands. Hydrocortisone production by the adrenal cortex is controlled by the secretion of ACTH (adrenocorticotrophic hormone) by the pituitary gland.

A tumour or other pituitary gland disorder, or tumours in the lung, breast, and elsewhere, can cause excess ACTH secretion, leading to excess production of hydrocortisone by the adrenals and, hence, to Cushing's syndrome. Pituitary disease is a cause of Cushing's syndrome.

INVESTIGATION

Blood and/or urine tests can detect the high levels of adrenal hormones that occur with adrenal tumours. They can also detect the high levels of natural corticosteroids that occur in Cushing's syndrome, and the low levels that occur in congenital adrenal hyperplasia. Blood tests are used to measure salt and potassium levels if Addison's disease is suspected; further blood tests may be carried out to measure corticosteroid hormone levels. Diagnosis of Addison's disease can be confirmed by the response to an injection of ACTH, which, under normal circumstances, will stimulate the adrenal glands. MRI or CT scanning can detect abnormalities of the adrenal glands and can confirm the presence of an adrenal tumour. They can also distinguish between raised hormone levels due to an adrenal tumour, or those due to a pituitary tumour. Ultrasound scanning can rule out an adrenal tumour as the cause of congenital adrenal hyperplasia.

adrenogenital syndrome

See *adrenal hyperplasia, congenital*.

advanced life support

Treatment of *cardiac arrest* (a halt in the heart's pumping action) by medical or paramedical professionals when *basic life support*, (which may be performed by a first-aider) has failed to restore a normal heartbeat and spontaneous breathing. Advanced life support involves the use of drugs and medical equipment.

An *ECG* monitor is used to record the electrical activity of the heart muscle. *Ventilation* delivers oxygen by way of an *endotracheal tube* inserted, via the mouth, into the trachea (windpipe). A *cannula* (a thin plastic tube inserted into a vein) allows administration of drugs such as *adrenaline* (epinephrine). In the event of *ventricular fibrillation* (rapid uncoordinated contractions of the heart), *defibrillation* (a brief electric shock to the heart using two paddles placed on the chest) may be used.

adverse reaction

See *side effect*.

Aedes

A genus of disease-transmitting mosquitoes. Many species of *Aedes* are responsible for spreading important viral infections; *Aedes aegypti* is the main vector of *dengue* and *yellow fever*. (See also *mosquito bites*.)

aerobic

A term that refers to anything that requires oxygen to live, function, and grow. Humans and many other forms of life are dependent on oxygen for "burning" foods in order to produce energy (see *metabolism*). Because of this dependence, they are described as obligate aerobes.

In contrast, many bacteria have fundamentally different metabolisms and thrive without oxygen (some are even killed by exposure to oxygen); such microorganisms are described as *anaerobic*. There are also certain bacteria and yeasts, known as facultative aerobes, that flourish in oxygen but can also live without it. (See also *aerobics*.)

aerobics

Exercises, such as swimming, jogging, and cycling, that allow muscles to work at a steady rate with a constant, adequate supply of oxygen-carrying blood that allows them to be sustained for long periods. Oxygen is needed to release energy from the body's stores. To fuel aerobic exercise, the muscles use fatty acid, burning it completely to produce energy, carbon dioxide, and water.

Anaerobic exercise relies on a different series of biochemical reactions to obtain energy from the muscles' stores of fat and sugar. The waste products of anaerobic exercise are acidic and, as they accumulate in muscles, cause muscle fatigue; high-intensity exercises, which are anaerobic, can be performed only for relatively short periods.

BENEFITS OF AEROBIC EXERCISE

When performed regularly, aerobic exercise improves stamina and endurance. It encourages the growth of capillaries (small blood vessels), thereby improving blood supply to the cells. It improves the body cells' capacity to use oxygen and increases the amount of oxygen that the body can use in a given time.

As the body becomes fitter, the condition of the heart also improves: the heart rate becomes slower, both at rest and during exercise; the heart muscle becomes thicker and stronger; and the amount of blood pumped with each beat (the stroke volume) increases. The overall result is that the heart needs to do less work to achieve the same level of efficiency in pumping blood around the body. (See also *exercise*; *fitness*.)

aerodontalgia

Sudden pain in a tooth brought on by a change in surrounding air pressure. Flying at high altitudes in lowered atmospheric pressure can cause a pocket of air in the dental pulp to expand and irritate the nerve in the root. Aerodontalgia is more likely with improperly fitted fillings or poorly filled root canals.

aerophagy

Excessive swallowing of air, which may occur during rapid eating or drinking or may be caused by anxiety. After *laryngectomy* (surgical removal of the larynx), voluntary aerophagy is used to produce oesophageal speech.

aerosol

A suspension of minute liquid or solid particles in the air, producing a fine mist. Some drugs are prescribed in this form for use in an *inhaler* or in a *vaporizer*. (See also *solvent abuse*.)

aetiology

The cause of, or the study of the various factors involved in causing, a disease.

For some cases of a particular disorder, a specific aetiology can be identified. For example, laboratory studies may show that an attack of diarrhoea is the result of a particular type of virus or bacterium. Other disorders have a multifactorial aetiology: the causative factors of degenerative arthritis, for example, include genetic susceptibility, repeated joint injuries, and excess weight. On the other hand, many disorders, such as schizophrenia, are of unknown aetiology.

afebrile

A medical term meaning without *fever*. (See also *febrile*.)

affect

A term used to describe a person's mood. The two extremes of affect are elation and depression. A person who experiences extreme moods or changes in moods may have an *affective disorder*. Shallow or reduced affect (in which responses to events seem flat) may be a sign of *schizophrenia* or of an organic *brain syndrome*.

affective disorders

Mental illnesses that are characterized predominantly by marked changes in *affect* (mood). Mood may vary over a period of time between *mania* (extreme elation) and severe *depression*. (See also *manic–depressive illness*.)

afferent

A term meaning carrying towards. Afferent is used mainly to describe blood vessels that supply organs, or nerves that carry impulses from peripheral sense *receptors* to the brain and spinal cord.

affinity

A term used to describe the attraction between chemicals that causes them to bind together, as, for example, between an antigen and an antibody (see *immune response*). In microbiology, affinity describes the physical similarity between organisms (viruses, for example). In psychology, the term refers to attraction between two people.

aflatoxin

A poisonous substance produced by *ASPERGILLUS FLAVUS* moulds, which contaminate stored foods, especially peanuts, grains, and cassava. Aflatoxin is believed to be one of the factors responsible for the high incidence of *liver cancer* in tropical Africa.

afterbirth

The common name for the tissues that are expelled from the uterus following the delivery of a baby (see *childbirth*). The afterbirth consists of the *placenta* and the membranes that surrounded the fetus.

aftercare

The medical care of a patient following treatment, particularly after *surgery*.

afterpains

Contractions of the uterus that continue after *childbirth*. Afterpains are normal, indicating that the uterus is shrinking as it should, and are experienced by many women, especially during breast-feeding. Afterpains usually disappear a few days after the birth, but *analgesic drugs* (painkillers) may be needed.

agammaglobulinaemia

A type of *immunodeficiency disorder* in which there is an almost complete absence of *B-lymphocytes* and *immunoglobulins* in the blood.

agar

An extract of certain seaweeds that has similar properties to gelatine. Agar can be taken for constipation to soften and give bulk to faeces, and to relieve indigestion and heartburn. It is also used as a gelling agent in media for growing bacterial *cultures*.

age

A person's age is usually measured chronologically but can also be measured in terms of physical, mental, or developmental maturity. Age may be of medical significance in diagnosis and in determining treatment.

PHYSICAL AGE

The age of a fetus is known as gestational age, which can be calculated from the date of the mother's last menstrual period. Alternatively, it can be assessed by *ultrasound scanning*, which is more accurate. The estimation of gestational age is important in neonatal paediatrics for identification of babies

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who are too small and who may subsequently have problems as a result of their low birthweight.

In children, bone age (the degree of bone maturity as seen on an *X-ray*) can be a useful measure of physical development because all healthy individuals reach the same adult level of skeletal maturity and each bone passes through the same sequence of growth. Assessment of bone age is useful in the investigation of delayed *puberty* or *short stature* in children. A prediction of the final adult height can be made if the chronological age, bone age, and current height are known.

Dental age, which is another measure of physical maturity, can be assessed by the number of teeth that have erupted (see *eruption of teeth*) or by the amount of dental calcification (see *calcification, dental*), as seen on an X-ray, compared with standard values.

In adults, physical age is difficult to assess other than by physical appearance. It can be estimated after death by the state of certain organs, particularly by the amount of atheroma (fatty deposits) lining the arteries.

MENTAL AND DEVELOPMENTAL AGE

Mental age can be assessed by the comparison of scores achieved in *intelligence tests* with standard scores for different chronological ages. A young child's age can be expressed in terms of his or her level of developmental skills, manual dexterity, social skills, and language when compared to those of other children. Patterns of development in these fields have been described for children up to the age of five. (See also *child development*.)

agenesis

The complete absence, at birth, of an organ or a component of the body. Agenesis is caused by developmental failure in the embryo.

agent

Any substance or force capable of bringing about a biological, chemical, or physical change. (See also *reagent*.)

Agent Orange

A herbicide and defoliant of which the major constituent (50 per cent by volume) is the phenoxy acid herbicide 2,4,5 T. The highly toxic contaminant TCDD, commonly known as dioxin, may be added to this substance during manufacture (see *defoliant poisoning*).

age spots

Blemishes that appear on the skin with increasing age. The most common type are brown or yellow slightly raised spots called seborrhoeic *keratoses*, which can occur at any site. Also common in elderly people are freckles, solar keratoses (small scaly patches, often appearing on the backs of the hands, that are a result of overexposure to the sun), and *De Morgan's spots*, which are red, pinpoint blemishes on the trunk.

THE PRACTICAL EFFECTS OF **AGING**

In the body, aging is associated with loss of elasticity in the skin, blood vessels, and tendons. There is also progressive decline in the functioning of organs such as the lungs, kidneys, and liver. Mechanical wear and tear causes cumulative damage to certain organ systems. Brain cells, specialized kidney units, and many other body structures are never replaced after they have reached maturity.

Hip joint in a young person
The X-ray shows the rounded head of the thigh-bone (femur) separated by cartilage from the surrounding hip socket.

Hip joint in an elderly person
This X-ray of an osteoarthritic hip shows almost complete degeneration and disappearance of the cartilage in the joint.

EFFECTS OF AGING

Organ or tissue	Natural effects	Accelerated by
Skin	Loss of elastic tissue causes skin to sag and wrinkle. Weakened blood capillaries cause skin to bruise more easily.	Exposure to sun; smoking.
Brain and nervous system	Loss of nerve cells leads to reduction in ability to memorize or to learn new skills. Reaction time of nerves increases, making responses slower.	Excessive consumption of alcohol and other drugs; repeated head trauma (for example from boxing).
Senses	Some loss of acuity in all senses, mainly due to loss of nerve cells.	Loud noise (hearing); smoking (smell/taste).
Lungs	Loss of elasticity with age, so that breathing is less efficient.	Air pollution; smoking; lack of exercise.
Heart	Becomes less efficient at pumping, causing reduced tolerance to exercise.	Excessive use of alcohol and cigarettes; a fatty diet.
Circulation	Arteries harden, causing poor blood circulation and higher blood pressure.	Lack of exercise; smoking; poor diet.
Joints	Pressure on intervertebral discs causes height loss; wear on hip and knee joints reduces mobility.	Athletic injuries; being overweight.
Muscles	Loss of muscle bulk and strength	Lack of exercise; starvation.
Liver	Becomes less efficient in processing toxic substances in the blood	Damage from alcohol consumption and virus infections

Treatment is usually unnecessary for any of these age spots, apart from solar keratoses, which may eventually progress to skin cancer. Freezing the keratoses with liquid nitrogen or applying a cream containing a *cytotoxic drug* is the usual treatment. They may also be removed surgically under a local anaesthetic (see *anaesthesia, local*).

ageusia

The lack of, or an impairment of, the sense of taste (see *taste, loss of*).

agglutination

See *clumping*.

aggregation, platelet

The clumping together of platelets (small, sticky blood particles). Aggregation takes place when a blood vessel is damaged. It is the first stage of *blood clotting*, helping to plug injured vessels.

Inappropriate aggregation can have adverse effects; if it occurs in an artery, for example, *thrombosis* (a blood clot forming in an undamaged blood vessel) may result. Many drugs, including *aspirin* and *clopidogrel*, help to reduce platelet aggregation.

aggression

A general term for a wide variety of acts of hostility. A number of factors, including human evolutionary survival strategies, are thought to be involved.

CAUSES

Androgen hormones (male sex hormones) seem to promote aggression, whereas *oestrogen hormones* (the female sex hormones) may suppress it. Age is another factor; aggression is more common in teenagers and young adults, and some people believe that it can result from frustration or lack of affection as a child. Sometimes a brain tumour or head injury may lead to aggression.

Psychiatric conditions associated with aggressive outbursts are *schizophrenia*, *antisocial personality disorder*, *mania*, and abuse of alcohol or amphetamine drugs. *Temporal lobe epilepsy, hypoglycaemia*, and *confusion* due to physical illnesses are other, less common, medical causes.

aging

Aging is the physical and mental changes that occur with the passing of time and is associated with degenerative changes in various organs and tissues, such as loss of elasticity in the skin and a progressive decline in organ function. Wear and tear causes cumulative damage to the joints, and the muscles lose bulk and strength. Wound healing and resistance to infection also decline. Gradual loss of nerve cells can lead to reduced sensory acuity and difficulties with learning and memory. However, *dementia* occurs in only a minority of elderly people.

Heredity is an important determinant of life expectancy, but physical degeneration may be accelerated by factors such as smoking, excessive alcohol intake, poor diet, and insufficient exercise. With advances in medical science, life expectancy in the developed world has risen dramatically over the last century.

agitation

Restlessness and the inability to keep still, usually as a result of anxiety or tension. People who are agitated engage in aimless, repetitive behaviour, such as pacing up and down or wringing their hands, and they often start tasks and fail to complete them.

Persistent agitation is seen in *anxiety disorders*, especially if there is an underlying physical cause such as alcohol withdrawal. *Depression* may also be accompanied by agitation.

agnathia

A developmental defect in the fetus in which the lower jaw is only partially formed or may be entirely absent. (See also *birth defects*.)

agnosia

The inability to recognize objects, despite adequate sensory information about them reaching the brain via the eyes or ears or through touch. In order for an object to be recognized, the sensory information it provides must be interpreted, which involves the recall of memorized information about similar objects. Agnosia is caused by damage to areas of the brain involved in interpretative and recall functions. The most common causes of this kind of damage are *stroke* or *head injury*.

TYPES

Agnosia is usually associated with just one of the senses of vision, hearing, or touch and is described as visual, auditory, or tactile respectively. For example, an object may be completely recognizable by hearing and touch, but it cannot be recognized by sight, despite the sense of vision being perfectly normal (an example of visual agnosia). Some people, after suffering a stroke that damages the right cerebral hemisphere, seem unaware of any disability in the affected left limbs. This is called anosognosia or sensory inattention.

OUTLOOK

There is no specific treatment for agnosia, but some of the lost interpretative ability may eventually return.

agonist

A term that means to have a stimulating effect. In pharmacology, an agonist drug, which is sometimes known as an activator, is a drug that binds to a specific area on the surface of a cell (a *receptor*) and triggers or increases a particular activity in that cell.

agoraphobia

Fear of going into open spaces or public places. Agoraphobia may sometimes overlap with *claustrophobia* (a fear of enclosed spaces). Agoraphobic individuals who do venture out may have a *panic attack*, further restricting their activities, and may eventually be housebound. Treatment with *behaviour therapy* is often successful; *antidepressant drugs* may also help.

agranulocytosis

A potentially life-threatening disorder, in which there is a severe acute lack of neutrophils (white blood cells that seek and destroy infective microorganisms). This deficiency seriously weakens the body's defences against infection.

In agranulocytosis, the bone marrow fails to produce adequate neutrophils. This may be an adverse effect of a drug such as *carbimazole* (used to treat thyroid diseases) or an effect of some drug treatments for cancer (see *chemotherapy*). Fever and mouth ulcers commonly occur.

Treatment is with *antibiotic drugs*, which should be started immediately to prevent the development of severe, and potentially fatal, infections.

agraphia

Loss of or impaired ability to write, despite normal functioning of the hand and arm muscles. Agraphia can result from damage to the parts of the *cerebrum* (the main mass of the brain) concerned with writing.

CAUSES

The ability to write depends on a complex sequence of mental processes, including the selection of words and

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recall from memory of these words are spelled, formulation and execution of the required hand movements, and visual checking that written words match their representation in the brain. These processes may take place in a number of connected regions of the brain. Agraphia may be caused by damage to any of these regions (most commonly as a result of a *head injury*, a *stroke*, or a *brain tumour*) and can therefore be of different types and degrees of severity.

Agraphia is often accompanied by *alexia* (loss of reading ability) or may be part of an expressive *aphasia* (a general disturbance in expression of language).

OUTLOOK

There is no specific treatment for agraphia, but some of the lost writing skills may return in time.

ague

An outdated term for the fever in *malaria* and similar diseases, in which the sufferer alternately feels excessively hot and shiveringly cold.

AIDS

The abbreviation for acquired immune deficiency syndrome, a deficiency of the *immune system* due to infection with the human immunodeficiency virus (see *HIV*). The interval between infection and the development of AIDS is highly variable. Without treatment, around half of those individuals infected will develop AIDS within eight to nine years. In about one in ten cases, however, progression to AIDS is very slow, taking up to 20 years or longer. Illness and death from AIDS is a growing health problem worldwide, and there is, as yet, no cure or vaccine.

METHODS OF TRANSMISSION

HIV is transmitted in body fluids such as semen, blood, vaginal secretions, and breast milk. Major methods of transmission are sexual contact (vaginal, anal, or oral), blood to blood (via transfusions, or needle-sharing in drug users), and mother-to-fetus. HIV has also been transmitted through blood products given to treat *haemophilia*, kidney transplants, and artificial insemination by donated semen; but improved screening has greatly reduced these risks. HIV is not spread by everyday contact, such as hugging or sharing crockery.

EFFECTS OF THE VIRUS

The virus enters the bloodstream and infects cells with a particular receptor, called the CD4 receptor, on their surface. These cells include a type of white blood cell called a CD4 lymphocyte (a T lymphocyte with a CD4 receptor), that is responsible for fighting infection, and cells in other tissues such as the brain. The virus reproduces within the infected cells, which then die, releasing more virus particles into the blood. If the infection is left untreated, the number of CD4 lymphocytes falls, resulting in greater susceptibility to certain infections and some types of cancer.

SYMPTOMS AND SIGNS

Some people experience a short-lived illness similar to infectious *mononucleosis* when they are first infected with HIV. Many individuals have no obvious symptoms. After the initial illness, many people remain well. Some may suffer from enlarged lymph nodes, muscle pain, and excessive sweating. Severe bacterial infections, such as pneumonia, are common. Later, vague complaints, such as weight loss, fevers, sweats, or unexplained diarrhoea (described as AIDS-related complex) may herald the development of AIDS.

Other features of infection with HIV include skin disorders and a variety of viral, fungal and bacterial infections. HIV may also affect the brain, causing neurological disorders such as *dementia*.

Certain conditions, known as AIDS-defining illnesses, mark the development of full-blown AIDS. These include cancers (lymphoma of the brain, *Kaposi's sarcoma*, and cancer of the *cervix*) and various infections (*pneumocystis pneumonia*, *cytomegalovirus* infection, *toxoplasmosis*, diarrhoea as a result of CRYPTOSPORIDIUM or ISOSPORA, candidiasis, disseminated *strongyloidiasis*, and *cryptococcosis*), many of which are described as *opportunistic infections*.

DIAGNOSIS

Confirmation of HIV infection involves testing a blood sample for the presence of antibodies to HIV (see *HIV test*), which may not develop for three months after initial infection. The condition is monitored using blood tests that measure the number of CD4 lymphocytes in the blood or by measuring viral load (the amount of virus detectable in the blood). Diagnosis of full-blown AIDS is based on a positive HIV test along with the presence of an AIDS-defining illness.

TREATMENT AND OUTLOOK

Treatment of HIV infection with a combination of *antiviral drugs* can slow the progress of the disease, and may prevent the development of full-blown AIDS. The main types of antiviral drug used are *protease inhibitors*, such as indinavir, and *reverse transcriptase inhibitors* such as *zidovudine*. Several drugs are usually used together to prevent resistance from developing. AIDS-defining illnesses are treated as they develop.

Since the introduction of antiviral drug combination therapies, deaths from AIDS in the developed world have been reduced dramatically. HIV infection remains life-threatening, however, and the most effective strategy for defeating it is prevention of infection.

PREVENTION OF INFECTION

The risk of infection can be reduced by practising *safer sex*. and by intravenous drug users not sharing needles. There is a small risk to health workers handling infected needles or blood products, but this can be minimized by the adoption of safe practices in the workplace.

AIDS-related complex

A combination of symptoms including weight loss, fever, neurological problems, and recurrent infections in an individual who has been infected with *HIV* (the virus that causes *AIDS*) but has not yet developed AIDS. Many people with AIDS-related complex will eventually develop the features of AIDS.

air

The colourless, odourless mixture of gases that forms the Earth's atmosphere. Air consists of 78 per cent *nitrogen*, 21 per cent *oxygen*, small quantities of *carbon dioxide* and other gases, and some water vapour.

The balance of atmospheric gases is maintained largely by the mutual needs of plants and animals. Plants use carbon dioxide and release oxygen in a process called photosynthesis; animals use oxygen during respiration, and produce carbon dioxide as a waste product; However, the level of carbon dioxide in the atmosphere is gradually increasing as a result of large-scale deforestation and the burning of fossil fuels, which may lead to significant global warming, also known as the greenhouse effect. (See also *pollution*.)

air conditioning

A system that controls the temperature, humidity, and purity, of the air in a building. Contaminated air-conditioning systems may cause *legionnaires' disease* (a type of pneumonia) and

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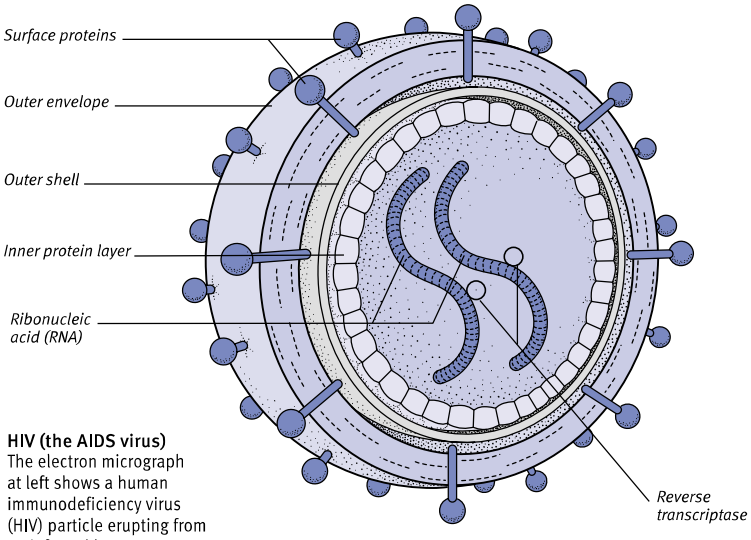
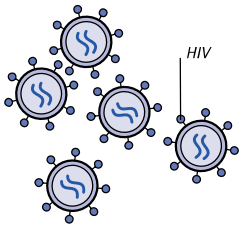
CAUSES AND PREVENTION OF **AIDS**

AIDS is caused by the human immunodeficiency virus (HIV) (right), which consists of some nucleic acid (genetic material) inside two protective shells and an outer envelope. Full-blown AIDS develops in only some people infected with HIV.

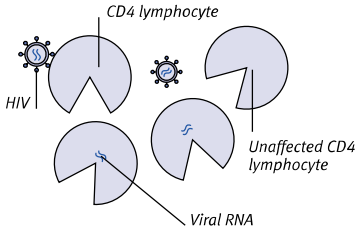


HIV (the AIDS virus)
The electron micrograph at left shows a human immunodeficiency virus (HIV) particle erupting from an infected human lymphocyte (cell of the immune system).

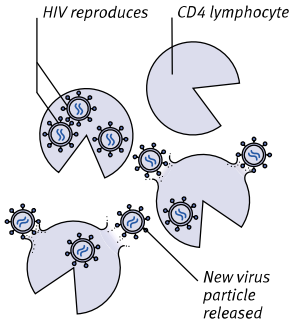
HOW HIV AFFECTS THE IMMUNE SYSTEM



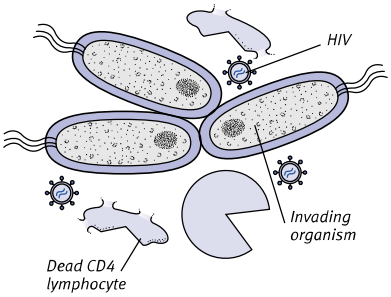
1 HIV enters the bloodstream and infects cells that have CD_4 receptors on their surface, particularly CD_4-lymphocytes, which are responsible for fighting infection.



2 The virus attaches to and enters the CD_4-lymphocytes. It then loses its protective shell, releasing its RNA and reverse transcriptase (an enzyme).



3 Reverse transcriptase enables the viral RNA to use the host CD_4-lymphocyte's genetic material to reproduce itself. The new virus particles are released into the blood, killing the infected CD_4-lymphocyte.



4 When disease organisms invade, immune responses may fail, due to a shortage of CD_4-lymphocytes. The disease organism may then overwhelm the immune system and lead to the features of AIDS.

RECOMMENDATIONS FOR PREVENTING THE SPREAD OF AIDS

- Do not have sexual intercourse with many partners, and especially not with people known to have HIV, without using a condom.
- Do not use intravenous (IV) drugs. If you use IV drugs, do not share needles or syringes.
- Do not have sex with people who use IV drugs.
- People with AIDS or who have had positive HIV antibody test results may pass the disease on to others and should not donate blood, plasma, body organs, other tissues, or sperm. They should not exchange body fluids during sexual activity.
- There is a risk of infecting (or being infected by) others through sexual intercourse, sharing needles, and, possibly, exposure of others to saliva through oral-genital contact or "wet" kissing. Condoms substantially reduce the risk of infection.
- Toothbrushes, razors, or other implements that could become contaminated with blood should not be shared.

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humidifier fever (a lung disease causing coughing and breathing difficulties). Air conditioning is also thought to be a factor in some cases of *sick building syndrome*, which produces headache, irritability, and loss of energy.

air embolism

The blockage of a small artery by an air bubble carried in the blood. Air embolism is rare. In most cases, it is caused by air entering the circulation through a vein, either as a result of injury or following surgery. Air embolism can also occur during scuba-diving or air-travel accidents, in which lung tissue ruptures, releasing air into the bloodstream.

air pollution

See *pollution*.

air swallowing

See *aerophagy*.

air travel

See *aviation medicine*; *barotrauma*.

airway

A collective term for the passages through which air enters and leaves the lungs (see *respiratory system*). The airway is made up of the nasal passages, the oral cavity, the upper part of the pharynx (throat), the larynx (voice-box), the trachea (windpipe), the bronchi (the main air passages to the lungs), and the bronchioles (the smaller air passages in the lungs that branch off from the bronchi).

The term airway is also applied to a tube that is inserted into the mouth of an unconscious person to prevent the tongue from obstructing breathing. Preservation of the airway can also be achieved by inserting an *endotracheal tube* into the trachea, either through the mouth or nose or via an incision in the neck, as in a *tracheostomy* operation. (See also *respiratory system*.)

airway obstruction

Narrowing or blockage of the respiratory passages. The obstruction may be due to a foreign body, such as a piece of food, that becomes lodged in part of the upper airway and may result in *choking*. Certain diseases and disorders, such as *diphtheria* and *lung cancer*, can cause obstruction. Additionally, spasm of the muscular walls of the airway, as occurs in *bronchospasm* (a feature of *asthma* and *bronchitis*), results in *breathing difficulty*. (See also *rescue breathing*; *lung* disorders box.)

akathisia

The inability to sit still, which occasionally occurs as a side effect of an *antipsychotic drug* or, less commonly, as a complication of *Parkinson's disease*.

akinesia

Complete or almost complete loss of movement. Akinesia may result from damage to part of the brain due, for example, to a *stroke* or *Parkinson's disease*.

albinism

A rare, inherited disorder that is characterized by a lack of the pigment *melanin*, which gives colour to the skin, hair, and eyes.

Oculocutaneous albinism (the most common type of albinism) is transmitted as an autosomal recessive trait (see *genetic disorders*). The genetic defect results in deficiency of a specific *enzyme* (a protein that acts as a catalyst); this deficiency interferes with the production of melanin in the affected tissues.

In oculocutaneous albinism, the hair, skin, and eyes are all affected. The skin cannot tan and ages prematurely. In addition, *skin cancers* may develop on areas of skin exposed to the sun. Less often, only the eyes are affected. Visual problems affecting people with albinism include *photophobia* (an intolerance to bright light), *nystagmus* (abnormal flickering movements), *myopia* (short-sightedness), and *squint*.

Glasses are usually needed from an early age, and tinted glasses help to reduce photophobia. If the skin is affected, it should be carefully protected from the sun.

albumin

The most abundant protein in the *blood* plasma. Albumin is made in the liver from *amino acids* that have been absorbed from digested protein.

Albumin helps to retain substances (such as calcium, some hormones, and certain drugs) in the circulation by binding to them to prevent them from being filtered out by the kidneys and excreted in the urine. Albumin also regulates the movement of water between tissues and the bloodstream by *osmosis* (the movement of water to an area with a higher concentration of salts or proteins). (See also *albuminuria*.)

Appearance of albinism
Albinism is characterized by the lack of melanin pigment in the skin, hair, and eyes.

Albinism in an African boy
The condition occurs only rarely, but it is found in people of all ethnic groups.

albuminuria

The presence of the protein *albumin* in the urine; a type of *proteinuria*. Normally, the glomeruli (the filtering units of the kidneys) do not allow albumin to pass into the urine. Albuminuria therefore usually indicates that there is damage to the kidneys' filtering mechanisms. Such damage may be due to a kidney disorder, such as *glomerulonephritis* or *nephrotic syndrome*, or it may be a sign that the kidneys have been affected by *hypertension*. In *diabetes mellitus*, the presence of even small amounts of albumin in the urine (a condition known as microalbuminuria) is an early indicator of kidney damage. Albuminuria can be detected by a simple urine test.

alcohol

A colourless liquid produced from the fermentation of carbohydrates by yeast. Also known as ethanol or ethyl alcohol, alcohol is the active constituent of alcoholic drinks such as beer, wine, and spirits. In medicine, alcohol is used as

an antiseptic and a solvent. *Methanol*, also known as methyl alcohol, is a related, highly toxic, substance.

MENTAL EFFECTS

Alcohol is a drug and produces a wide range of mental and physical effects. The effect of alcohol on the *central nervous system* (the brain and spinal cord) is as a depressant, decreasing its activity and thereby reducing anxiety, tension, and inhibitions. In moderate amounts, alcohol produces a feeling of relaxation, confidence, and sociability. However, alcohol slows reactions, and the more that is drunk, the greater the impairment of concentration and judgment. Excessive consumption of alcohol results in poisoning or acute *alcohol intoxication*, with effects ranging from euphoria to unconsciousness.

PHYSICAL EFFECTS

Short-term physical effects include peripheral *vasodilation* (widening of small blood vessels), causing flushing and increased flow of gastric juices, which stimulates the appetite. Alcohol increases sexual confidence, but high levels can cause *impotence*. Alcohol also acts as a diuretic, increasing urine output.

In the long term, regular excessive consumption of alcohol can cause *gastritis* (inflammation and ulceration of the stomach lining) and can lead to *alcohol-related disorders*. Heavy drinking in the long term may also lead to *alcohol dependence*. However, individuals who drink regular, small amounts of alcohol, (1–2 units (see *alcohol, unit of*) per day) seem to have lower rates of *coronary artery disease* and *stroke* than those who abstain totally.

The consumption of alcohol during pregnancy may result in *fetal alcohol syndrome*, *miscarriage*, or a disruption in normal fetal development.

alcohol dependence

An illness characterized by habitual, compulsive, long-term, heavy alcohol consumption and the development of withdrawal symptoms when drinking is stopped suddenly.

CAUSES

Causative factors that interact in the development of alcohol dependence include: personality, environment, and the addictive nature of alcohol. People of an inadequate, insecure, or immature personality are at greater risk. Environmental factors are important, especially the ready availability, affordability, and widespread social acceptance of alcohol. Genetic factors may play a part in causing alcohol dependence in some cases, but it is now widely believed that anyone, irrespective of personality, environment, or genetic background, is capable of becoming dependent. Stress is often a major factor in precipitating heavy drinking.

DEVELOPMENT OF DEPENDENCE

Alcohol dependence usually develops in four main stages that occur over a number of years and merge imperceptibly. In the first phase, tolerance (being able to drink more alcohol before experiencing its effects) develops in the heavy social drinker. In the second phase, the drinker experiences memory lapses relating to events during the drinking episodes. In the third phase, there is loss of control over alcohol consumption. The final phase is characterized by prolonged binges of intoxication, and mental or physical complications.

SYMPTOMS AND EFFECTS

Behavioural symptoms of alcohol dependence are varied, and they can include grandiose, aggressive, or furtive behaviour; personality changes (such as irritability, jealousy, or uncontrolled anger); neglect of food intake and personal appearance; and lengthy periods of intoxication.

Physical symptoms of the condition may include nausea, vomiting, or shaking in the morning; abdominal pain; cramps; numbness or tingling; weakness in the legs and hands; enlarged blood vessels in the face; irregular pulse; unsteadiness; confusion; memory lapses; and incontinence. Sudden withdrawal from alcohol may lead to *delirium tremens* (severe shakes, hallucinations, and convulsions).

Alcohol-dependent persons are more susceptible than others to a variety of physical and mental disorders (see *alcohol-related disorders*).

TREATMENT

Many problem drinkers require medical help in overcoming their physical withdrawal symptoms (detoxification) when they stop drinking alcohol, followed by long-term treatment. There are different methods of treatment, which may be combined.

Psychological treatments for alcohol dependence involve *psychotherapy* and are commonly carried out as *group therapy*. Social treatments may offer practical help, such as with problems at work, and tend to involve family members in the process. Physical treatment includes the use of *disulfiram*, a drug that sensitizes the drinker to alcohol so that he or she experiences unpleasant side effects when drinking, or acamprosate, which helps to reduce craving.

Alcoholics Anonymous and other self-help organizations can provide support and advice.

Alcoholics Anonymous

A worldwide, independent, self-help organization that is operated locally by people working on a voluntary basis to overcome *alcohol dependence*. Regular group meetings are held in which members are encouraged to help one another to stay sober by sharing their experiences openly and by offering support and advice.

alcohol intoxication

The condition that results from consuming an excessive amount of *alcohol*, often over a relatively short period.

ALCOHOL AND PREGNANCY

The damage to a fetus by alcohol intake during pregnancy has been recognized only recently. Intake of more that two units (see *alcohol, unit of*) per day increases the risk of *fetal alcohol syndrome* (consisting of facial abnormalities such as *cleft lip and palate*, heart defects, abnormal limb development, and lower-than-average intelligence). The risk of miscarriage is also increased. Binge drinking can have the same effect, even if the mother drinks little otherwise. Because a proportion of the alcohol reaches the baby, there is a risk that even small amounts can disrupt normal development (causing, for example, low birth weight).

Fetal alcohol syndrome
An affected baby is abnormally small, with small eyes and a small jaw. He or she may also suffer from heart defects or a cleft lip and palate, may suckle poorly, sleep badly, and be irritable.

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ALCOHOL AND THE BODY

Alcohol is a drug and, even in small amounts, its effects on the body are noticeable. Problems arise when people fail to take into account the effects of alcohol on tasks requiring coordination (such as driving) when they become intoxicated or when they become dependent on the drug. Alcohol dependence can cause early death and is a major factor in crime, marital breakdown, child abuse, accidents, and absenteeism.

Prolonged heavy drinking that stops just short of dependence still may cause a wide variety of diseases, such as cardiomyopathy and cirrhosis of the liver.

The table below highlights the effects of alcohol on the occasional social drinker. These effects occur with higher concentrations as alcohol tolerance increases.

EFFECTS OF INCREASING BLOOD ALCOHOL LEVELS

Concentration (milligrams per 100 millilitres)	**Observable effects**
30-50	Flushed face, euphoria, talkativeness, increased social confidence
50-150	Disturbed thinking and coordination, irritability, reduced self-control, irresponsible talk and behaviour
150-250	Marked confusion, unsteady gait, slurred speech, unpredictable shows of emotion and aggression
250-400	Extreme confusion and disorientation, difficulty remaining upright, drowsiness, delayed or incoherent reaction to questions progressing to coma (a state of deep unconsciousness from which the person cannot be aroused)
400-500	Risk of death due to arrest of breathing (although habitual drinkers may survive even such high levels) and choking on vomit

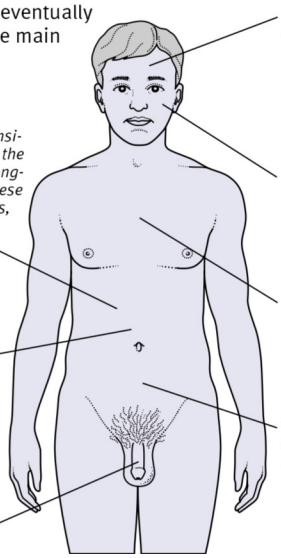
Cumulative effects of alcohol
The body takes some time to eliminate even small amounts of alcohol. If a person has two drinks at lunchtime, and then has one or two early in the evening, the cumulative blood alcohol level could be over the legal limit for driving, even after several hours.

Alcohol levels in different drinks
A unit is the measure used to define the amount of alcohol in an alcoholic drink. One unit constitutes 10 ml of pure alcohol. The number of units per drink is calculated by the volume of the drink and the percentage of alcohol by volume. The drinks shown here each contain approximately one unit of pure alcohol.

Beer (250 ml) (4 per cent by volume)
Wine (100 ml) (10 per cent by volume)
Sherry (50ml) (20 per cent by volume)
Whisky (25ml) (40 per cent by volume)

LONG TERM EFFECTS ON THE BODY

Persistent heavy drinking eventually damages body tissues; the main effects are shown below.



Brain and nervous system
Alcohol depresses the central nervous system. Prolonged alcohol abuse permanently impairs brain function and damages peripheral nerves.

Liver
The liver is the main organ responsible for metabolizing alcohol from the blood; it manifests many of the long-term effects of heavy drinking. These effects include fatty liver, hepatitis, cirrhosis, and liver cancer.

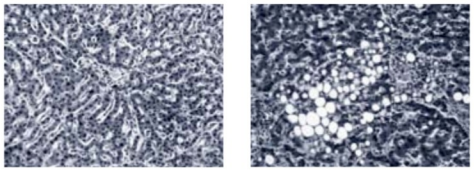
Skin
Alcohol causes facial flushing, which becomes constant in heavy drinkers.

Digestive system
Irritation from large amounts of alcohol can cause gastritis and pancreatitis.

Heart and circulation
Prolonged heavy drinking can cause heart failure, hypertension, and stroke.

Urinary system
Alcohol acts as a diuretic, increasing urine output.

Reproductive system
Alcohol increases sexual confidence, but in the long term can cause shrinkage of testes and breast development in men.



Cirrhosis of the liver
This condition is commonly caused by heavy drinking. When compared to a normal liver (far left), the cirrhotic liver clearly shows the formation of bands of scar tissue, which impair its function.

EFFECTS

The effects of high intake alcohol depend on many factors, including mental and physical state, body size, social situation, and acquired tolerance; but the important factor is the blood alcohol level. Mild intoxication promotes relaxation and increases social confidence.

However, alcohol causes acute poisoning if it is consumed in sufficiently large amounts. It depresses the activity of the *central nervous system*, (the brain and spinal cord), leading to loss of normal mental and physical control. In extreme cases, consumption of a large amount of alcohol over a short period of time may lead to loss of consciousness and even death.

TREATMENT

In most cases, recovery from alcohol intoxication occurs naturally as the alcohol is gradually broken down in the liver. Medical attention is required if the intoxication has resulted in *coma*.

For a description of the effects of long-term heavy drinking, see *alcohol dependence* and *alcohol-related disorders*.

alcoholism

See *alcohol dependence*.

alcohol-related disorders

A wide variety of physical and mental disorders associated with heavy, prolonged consumption of alcohol.

High alcohol consumption increases the risk of cancer of the mouth, tongue, pharynx (throat), larynx (voice-box), and oesophagus (gullet), especially if combined with smoking. Incidence of liver diseases, such as *liver cancer*, alcoholic *hepatitis* and *cirrhosis*, is higher in alcohol-dependent persons. High consumption of alcohol increases the risk of *cardiomyopathy* (disease of heart muscle), *hypertension* (high blood pressure), and *stroke*. Alcohol irritates the digestive tract and may cause *gastritis*. Heavy drinking during pregnancy increases the risk of miscarriage and *fetal alcohol syndrome*. Problem drinkers are more likely to suffer from *anxiety* and *depression* and to develop *dementia*.

Many problem drinkers have a poor diet and are prone to diseases caused by nutritional deficiency, particularly of thiamine (see *vitamin B complex*). Severe thiamine deficiency (see *beriberi*) disturbs nerve function, causing cramps, numbness, and weakness in the legs and hands. Its effects on the brain can cause confusion, disturbances of speech and gait, and eventual coma (see *Wernicke–Korsakoff syndrome*). Severe deficiency can also cause *heart failure* (reduced pumping efficiency of the heart).

A prolonged high level of alcohol in the blood and tissues can disturb the body chemistry, resulting in *hypoglycaemia* (low blood glucose levels) and *hyperlipidaemia* (high blood fat levels). These may damage the heart, liver, blood vessels, and brain; irreversible damage may cause premature death.

aldosterone

A hormone secreted by the adrenal cortex (the outer part of the *adrenal glands*). Aldosterone plays an important role in the control of blood pressure and regulation of sodium and potassium concentrations in the blood and tissues.

Aldosterone acts on the kidneys to decrease the amount of sodium lost in the urine; the sodium is reabsorbed into the blood from urine before it leaves the kidneys and is replaced in the urine by potassium. The sodium draws water back into the blood with it, thereby increasing the blood volume and raising the blood pressure.

Aldosterone production is stimulated mainly by the action of *angiotensin* II, a chemical produced by a series of reactions involving the enzymes *renin* and *angiotensin-converting enzyme*. Production of aldosterone is also stimulated by the action of *ACTH*, which is produced by the pituitary gland.

alcohol, unit of

A measure that is commonly used to define the amount of *alcohol* that is present in a single alcoholic drink. A unit is defined as 10 millilitres of pure alcohol. The number of units in one drink is calculated by multiplying the alcohol content of that drink with its volume, then dividing by 1000. As a rough guide, half a pint (or a bottle) of beer, lager, or cider has one unit; a single measure (25 ml) of spirits has one unit; and a small glass of wine has one unit.

Various countries have official guidelines on the maximum number of units that can be consumed per day without endangering health. In the UK, the Department of Health has defined safe limits for men as three to four units per day (or less) and for women as two to three units per day (or less). In addition, one or two alcohol-free days per week are usually recommended.

aldosteronism

A disorder that results from excessive production of the hormone *aldosterone* from one or both of the *adrenal glands*. Aldosteronism caused by an *adrenal tumour* is known as Conn's syndrome. Aldosteronism may also be due to disorders, such as *heart failure* (reduced pumping efficiency of the heart) or liver damage, that reduce blood flow through the kidneys. This reduction in the flow of blood flow leads to overproduction of *renin* and *angiotensin*, which, in turn, leads to excessive aldosterone production.

SYMPTOMS AND SIGNS

Symptoms of the condition are directly related to the actions of aldosterone. Excess sodium is retained in the body, leading to a rise in blood pressure, and excess potassium is lost in the urine. Low levels of potassium cause tiredness and muscle weakness and impair kidney function, leading to thirst and overproduction of urine.

TREATMENT

Treatment in all cases of aldosteronism includes restriction of salt in the diet and use of the diuretic drug *spironolactone*. This drug blocks the action of aldosterone on the kidneys, leading to increased loss of sodium from the body, lowered blood pressure, and reduced potassium loss. If the cause of aldosteronism is an adrenal tumour, this may be surgically removed.

alendronate sodium

See *alendronic acid*.

alendronic acid

A *bisphosphonate drug* that is used in the treatment of *osteoporosis* and *Paget's disease* of bone. The most common side effect of alendronic acid is inflammation of the oesophagus, which causes heartburn or difficulty in swallowing. Other side effects can include headache, abdominal pain and distension, and diarrhoea or constipation.

Alexander technique

A therapy that aims to improve health by teaching people to stand and move more efficiently.

Developed in the 1920s by F. Mathias Alexander, the technique is based on the belief that bad patterns of body movement interfere with the proper functioning of the body and therefore contribute to the development of disease. By releasing unnecessary muscle

A

ALCOHOL-RELATED DISORDERS

Cancer
High alcohol consumption increases the risk of breast cancer in women and cancers of the mouth, tongue, pharynx (back of the throat), larynx (voicebox), and oesophagus, probably due to irritant action. In each of these cancers, alcohol intake, along with smoking, produces a much higher total risk of cancer than the sum of their separate risks. The risk of *liver cancer*, along with most types of liver disease, is also higher among problem drinkers.

Liver damage and disease
Liver diseases caused by a high alcohol consumption include fatty liver, alcoholic *hepatitis*, cirrhosis, and liver cancer. They develop in sequence over a period of years. It is thought that a breakdown product of alcohol (acetaldehyde) has a toxic effect on liver cells and is the main cause of these diseases, although nutritional deficiency may also play some part. The risk of alcoholic hepatitis and cirrhosis developing increases in proportion to the amount of alcohol consumed and the number of years of high consumption; liver cancer develops in about one in five sufferers of cirrhosis.

Nervous system disorders
Thiamine (vitamin B_1) deficiency, also known as *beriberi* (which disturbs nerve functioning), may develop in problem drinkers. The effect of severe deficiency on the brain produces Wernicke's encephalopathy, with symptoms such as confusion, disturbances of speech and gait, and eventual coma. Korsakoff's psychosis may also occur (see *Wernicke–Korsakoff syndrome*). The effect on the peripheral nervous system (nerve pathways outside the brain and spinal cord) produces polyneuropathy, with symptoms such as pain, cramps, numbness, tingling, and weakness in the legs and hand. Excess consumption of alcohol can also cause *dementia*.

Psychiatric illness
Problem drinkers are more likely than others to suffer from anxiety and depression (frequently related financial, work , or family problems) and from paranoia. They are also more likely to develop dementia (irreversible mental deterioration). The incidence of suicide attempts and actual suicide is also higher among problem drinkers.

Heart and circulatory disorders
Severe deficiency of thiamine in problem drinkers can result in heart failure (reduced pumping efficiency), which is usually combined with oedema (the collection of fluid in tissues). A high consumption of alcohol also increases the risk of hypertension (high blood pressure), cerebral haemorrhage, and *cardiomyopathy*. One type of stroke is also associated with excessive consumption of alcohol.

Genito-urinary system disorders
High consumption of alcohol can lead to fertility problems in women and to impotence in men. Heavy drinking during pregnancy carries the risk of spontaneous abortion and of the baby being born with *fetal alcohol syndrome*.

Other medical disorders
Other physical diseases and disorders that are associated with high intake of alcohol include *gastritis* and acute and chronic *pancreatitis*, (all of which are probably linked to an irritant action of alcohol), *osteoporosis* (thinning of the bones), and damage to the skeletal muscles and those of the genito-urinary tract.

tensions, the Alexander technique aims to eliminate or reduce the severity of many disorders, including back pain, asthma, and stammering.

alexia

Word blindness; the inability to recognize and name written words. Alexia results from damage to part of the cerebrum (the main mass of the brain) by, for example, a *stroke*. The condition severely disrupts the reading ability of an individual who was previously literate. (See also *dyslexia*.)

alfacalcidol

A synthetic form of *vitamin D*.

alginates

Substances used in certain types of *antacid drugs*. Alginates float on top of the stomach contents, forming a raft, which reduces *acid reflux*. and protects the oesophagus.

alienation

Feeling like a stranger, even when among familiar people or places, and being unable to identify with family, a culture, or a peer group. Alienation is common in adolescents, and it also occurs in individuals who are isolated by cultural or language differences. In some people, alienation may be an early symptom of *schizophrenia* or a *personality disorder*.

alignment, dental

The movement of teeth by the use of either fixed or removable *orthodontic appliances* (braces) to correct *malocclusion* (an incorrect bite).

alimemazine

An *antihistamine drug* that is used mainly to relieve the itching that occurs in allergic conditions such as *urticaria* and atopic *eczema*. Alimemazine frequently causes drowsiness.

alimentary tract

Also known as the alimentary canal, the tubelike structure that extends from the mouth to the anus (see *digestive system*).

alkali

Also called a base, an alkali is chemically defined as a donor of hydroxyl ions (each of which comprises an atom of hydrogen linked to an atom of oxygen and has an overall negative electrical charge). *Antacid drugs*, such as sodium bicarbonate (bicarbonate of soda), are examples of alkalis. Some alkalis, such as sodium hydroxide (caustic soda), are corrosive and cause burns. (See also *acid*; *acid–base balance*.)

alkaloids

A group of nitrogen-containing substances that are obtained from plants. *Morphine*, *codeine*, *nicotine*, and strychnine (see *strychnine poisoning*) are examples of alkaloids.

alkalosis

A disturbance of the body's *acid–base balance* in which there is an accumulation of alkali (base) or a loss of acid. There are two types of alkalosis: metabolic and respiratory.

In metabolic alkalosis, the increase in alkalinity may be caused by taking too much of an *antacid drug* or by losing a large amount of stomach acid as a result of severe vomiting.

In respiratory alkalosis, there is a reduction in the blood level of carbonic acid (derived from carbon dioxide). This reduction is a consequence of *hyperventilation* (overbreathing), which

may occur during a panic attack or at high altitudes due to lack of oxygen. (See also *acidosis*.)

Alka-Seltzer

A brand-named analgesic and antacid containing *aspirin*, *sodium bicarbonate*, and citric acid. Alka-Seltzer is used to treat headaches and stomach upset.

alkylating agents

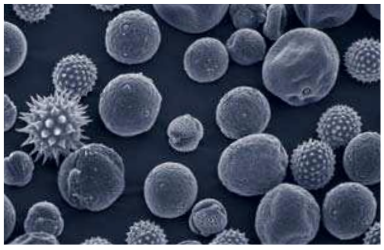
A class of *anticancer drugs*.

allele

One of two or more different forms of a *gene* that occupies a specific position on a *chromosome*. (See also *inheritance*.)

allergen

A normally harmless substance that causes an allergic reaction (see *allergy*) in people who have become sensitized to it. Allergens can include foods (for example, nuts, eggs, and shellfish); inhaled substances (such as pollen, house dust, and fur); and some drugs.



Electron micrograph of various pollen grains
Pollen is a common example of an allergen. The airborne pollen grains from plants (such as grasses and trees) can trigger an allergic reaction, the most common of which is allergic rhinitis (hay fever).

allergic alveolitis, extrinsic

See *extrinsic allergic alveolitis*.

allergic rhinitis

See *rhinitis, allergic*.

allergy

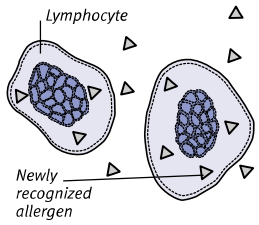
Various conditions caused by inappropriate or exaggerated reactions of the *immune system* to a wide variety of substances known as *allergens*. Many common illnesses, such as *asthma* and hay fever (see *rhinitis, allergic*), are caused by allergic reactions to substances that, in the majority of people, cause no symptoms.

Allergic reactions occur only on second or subsequent exposure to the allergen, after first contact has sensitized the body. It is unclear why only certain drugs, and some foods, most commonly dairy products, seafood, strawberries, and cereals, can also cause allergies. In diagnosing an allergy, the individual's medical history is important. The doctor needs to know if the symptoms vary according to the time of the day or the season, and if there are pets or other likely sources of allergens in the home.

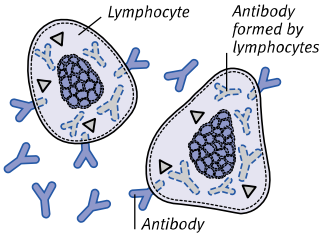
ALLERGY AND THE BODY

THE ORIGIN OF AN ALLERGY

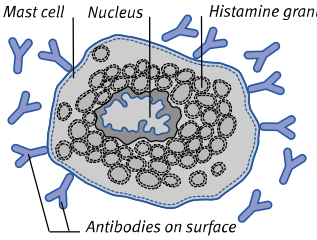
The immune system is sensitized once it has been exposed to an allergen (steps 1 to 3). Symptoms occur when the allergen is met again (step 4).



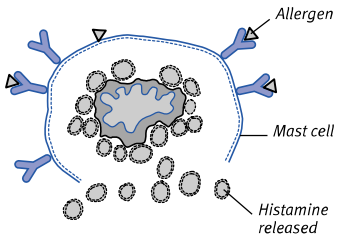
1 An allergen enters the body and is recognized by lymphocytes (blood cells that form part of the body's immune system).



2 A few days to weeks later, the lymphocytes produce antibodies that are specific to the allergens.



3 The antibodies attach to cells in the tissues called mast cells, which contain granules of histamine.



4 Binding of allergens to antibodies on the surface of mast cells leads to the release of histamine and to the symptoms of allergy.

DIAGNOSING SKIN ALLERGY

One type of skin allergy, also known as allergic contact dermatitis, develop slowly. Tests are performed to identify specific reactions to allergens. Small amounts of various substances are applied to the skin to see whether or not a reaction occurs.

1 Tiny samples of allergens are placed on small discs and stuck to the skin with inert tape. The discs are removed after two days.

2 A reddened area of skin where a disc had been in contact denotes a positive reaction. Some reactions may take longer to appear.

people develop allergies, but about one person in eight seems to have an inherited predisposition to them (see *atopy*).

TYPES AND CAUSES

The function of the immune system is to recognize *antigens* (foreign proteins) on the surfaces of microorganisms and to form *antibodies* (also called immunoglobulins) and sensitized *lymphocytes* (white blood cells). When the immune system next encounters these antigens, the antibodies and sensitized lymphocytes interact with them, leading to the destruction of the microorganisms.

A similar immune response occurs in allergies, except that the immune system forms antibodies or sensitized lymphocytes against harmless substances because these allergens are misidentified as potentially harmful antigens.

The inappropriate or exaggerated reactions that are seen in allergies are known as *hypersensitivity* reactions and can have any of four different mechanisms (which are termed Types I to IV hypersensitivity reactions).

TYPE I HYPERSENSITIVITY REACTIONS

Most well known allergies are caused by Type I (also known as anaphylactic or immediate) hypersensitivity, in which allergens cause immediate symptoms by provoking the immune system into producing specific antibodies, belonging to a type called immunoglobulin E (IgE), which coat cells (known as mast cells or basophils) that are present in the skin and the lining of the stomach, lungs, and upper respiratory airways. When the allergen is encountered for the second time, it binds to the IgE antibodies and causes the granules in mast cells to release various chemicals, which are responsible for the symptoms of the allergy.

Among the chemicals released is *histamine*, which causes widening of blood vessels, leakage of fluid into tissues, and contraction of muscles, especially in the airways of the lung. Symptoms can include itching, swelling, sneezing, and wheezing. Particular conditions associated with Type I reactions include asthma, hay fever, *urticaria* (nettle rash), *angioedema*, *anaphylactic shock* (a severe, generalized allergic reaction), possibly atopic *eczema*, and some food allergies.

TYPES II TO IV HYPERSENSITIVITY REACTIONS

Because Types II to IV hypersensitivity reactions have different mechanisms to Type I reactions, they are less often implicated in allergies. However, contact allergic dermatitis, in which the skin reacts to prolonged contact with substances such as nickel, is the result of a Type IV hypersensitivity reaction.

TREATMENT

Whenever possible, the most effective treatment for allergy of any kind is avoidance of the relevant allergen.

Drug treatment for allergic reactions includes the use of *antihistamine drugs*, which relieve the symptoms. Some antihistamines have a sedative effect, which is useful, for example, in treating itching at night due to eczema; many do not cause drowsiness, making them more suitable for daytime use.

Drugs such as *sodium cromoglicate* and *corticosteroids* can be used regularly to prevent symptoms from developing.

Hyposensitization can of valuable for a minority of people who suffer allergic reactions to specific allergens such as bee stings. Treatment involves gradually increasing doses of the allergen to promote formation of antibodies that will block future reactions. Hyposensitization must be carried out under close supervision because a severe allergic reaction can result. (See also *delayed allergy*.)

allograft

Sometimes referred to as a homograft, tissue or an organ transplanted from one person to another. (See also *grafting*.)

allopathy

The practice of conventional medicine. (See also *homeopathy*.)

allopurinol

A drug used in the long-term prevention of *gout* attacks. Allopurinol works by decreasing production of *uric acid* in the body, thereby preventing the formation of uric acid crystals in the joints.

Possible adverse effects of allopurinol include itching, rashes, and nausea. The drug cannot relieve the pain of an acute gout attack and may even precipitate one at the start of treatment. Such attacks can be prevented by taking a combination of allopurinol and a *nonsteroidal anti-inflammatory drug* (NSAID) or *colchicine*.

almond oil

An oil prepared from the seeds of the bitter almond tree (PRUNUS AMYGDALUS). Almond oil is a common ingredient of *emollient* skin preparations.

almotriptan

A *serotonin agonist* drug that is used in the treatment of acute migraine attacks.

aloe

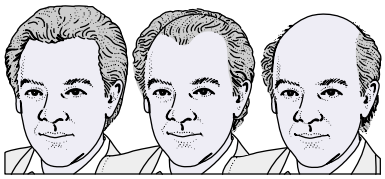
The juice of leaves from various plants of the ALOE genus. Aloe may be added to compound benzoin tincture, an aromatic *inhalation* for relieving *sinusitis* and *nasal congestion*.

alopecia

Loss or absence of *hair*, which may occur at any hair-bearing site on the body but which is usually noticeable only on the scalp.

TYPES

Male-pattern baldness, the most common form of alopecia, is hereditary and most commonly affects men. Normal hair is lost, initially from the temples and crown, and is replaced by fine, downy hair; the affected area gradually widens. Other hereditary forms of alopecia are rare and may be due to absence of hair roots or abnormalities of the hair shaft.



Stages in male pattern baldness
In this common form of alopecia, the man first loses hair from the temples and the crown, then the bald area gradually widens.

In generalized alopecia, the hair falls out in large amounts. Such hair loss occurs when all the hairs simultaneously enter the resting phase; they then fall out about three months later. Causes include surgery, prolonged illness, or childbirth. In such cases, the hair will regrow without treatment. Many *anticancer drugs* cause temporary alopecia. The hair usually regrows when the treatment is completed.

Localized alopecia may be the result of permanent skin damage (for example, following burns or *radiotherapy*) or of trauma to the hair roots by styling or, rarely, *trichotillomania* (a disorder in which sufferers pull out their hair). The most common type of localized hair loss is alopecia areata, an *autoimmune disorder* (in which the immune system attacks the body's own tissues). There is no specific treatment for alopecia areata, but the hair usually regrows within a few months. Alopecia universalis is a rare, permanent form of alopecia areata that causes loss of all hair on the scalp and body, including the eyelashes and

eyebrows. Skin diseases such as scalp ringworm (see *tinea*), *lichen planus*, *lupus erythematosus*, and *skin tumours* may also cause localized hair loss.

TREATMENT

Treatments for male-pattern baldness include *hair transplants* or drug treatments with *minoxidil* or *finasteride*. Generalized alopecia often resolves without treatment. Treatment of localized alopecia depends on the cause.

alpha$_1$-antitrypsin deficiency

A rare *genetic disorder* in which a person is missing the enzyme alpha$_1$-antitrypsin, which protects the body from damage by other enzymes. The disease mainly affects tissues in the lungs, resulting in *emphysema*, and the liver, causing *cirrhosis*. The effects of alpha$_1$-antitrypsin deficiency may not become apparent until after the age of 30. There is no cure, but symptoms can be relieved by drug treatment. In severe cases, a *liver transplant* may be a possibility.

alpha-blocker drugs

COMMON DRUGS

• Alfuzosin • Doxazosin • Indoramin • Prazosin • Tamsulosin • Terazosin

A group of drugs used to treat *hypertension* (high blood pressure) and urinary symptoms resulting from an enlarged prostate gland (see *prostate, enlarged*).

Alpha-blocker drugs interfere with the nerve signals that govern the contraction of blood vessels This causes the vessels to widen (vasodilation), thereby reducing the blood pressure. In the treatment of an enlarged prostate gland, alpha-blockers relax the ring of muscles at the bladder outlet, which improves the outflow of urine.

Side effects may include dizziness and fatigue (caused by a drop in blood pressure on standing up), drowsiness, headache, nausea, and a dry mouth.

alpha-fetoprotein

A protein that is produced in the liver and gastrointestinal tract of the fetus and by some abnormal tissues in adults.

ALPHA-FETOPROTEIN IN PREGNANCY

Alpha-fetoprotein (AFP) is excreted in the fetal urine into the amniotic fluid; the fluid is swallowed by the fetus, which introduces AFP into the fetal digestive system. Most of the AFP is broken down in the fetal intestine, but some of it passes into the mother's circulation. AFP can be measured in the maternal blood from the latter part of the first trimester of pregnancy, and its concentration rises between the 15th and 20th weeks.

Raised levels of AFP are associated with fetal *neural tube defects*, such as *spina bifida* or *anencephaly*, and certain kidney abnormalities. High levels of AFP also occur in multiple pregnancies (see *pregnancy, multiple*) and threatened or actual *miscarriage*.

AFP levels may be unusually low if the fetus has *Down's syndrome*. For this reason, measurement of blood AFP is included in blood tests that are used to screen pregnant women for increased risk of Down's syndrome.

ALPHA-FETOPROTEIN IN ADULTS

AFP levels are commonly raised in adults with hepatoma (see *liver cancer*), cancerous *teratoma* of the testes or ovaries, or cancer of the pancreas, stomach, or lung. For this reason, AFP is known as a "tumour marker".

AFP levels can be used to monitor results of treatment of such cancers; increasing levels after chemotherapy or surgery may indicate recurrence. However, AFP levels are also raised in some noncancerous conditions such as viral and alcoholic *hepatitis* and *cirrhosis*.

alprazolam

A *benzodiazepine drug* that is used in the treatment of *anxiety*, *panic attacks*, and *phobias*.

alprostadil

A *prostaglandin drug* used to minimize the effects of congenital (present from birth) heart defects in newborn babies prior to corrective surgery; it is usually administered in hospital. Alprostadil is also used as treatment for impotence. To produce an erection, it is self-administered, either by injection into the penis or as a gel introduced into the *urethra*.

alternative medicine

Also called *complementary medicine*, any medical system based on a theory of disease or method of treatment other than orthodox Western medicine.

altitude sickness

See *mountain sickness*.

aluminium

A light, metallic element that is found in bauxite and various other minerals. Aluminium compounds are used in *antacid drugs* and in *antiperspirants*. Most of the aluminium taken into the body is excreted. Excessive amounts are toxic and are stored in the lungs, brain, liver, and thyroid gland, where they may result in organ damage.

Certain industrial processes give off fumes containing aluminium into the air. Inhalation of these fumes can cause *fibrosis* of lung tissue. Drugs that contain aluminium interfere with the absorption and excretion of a number of other drugs and should not, therefore, be taken simultaneously.

alveolectomy

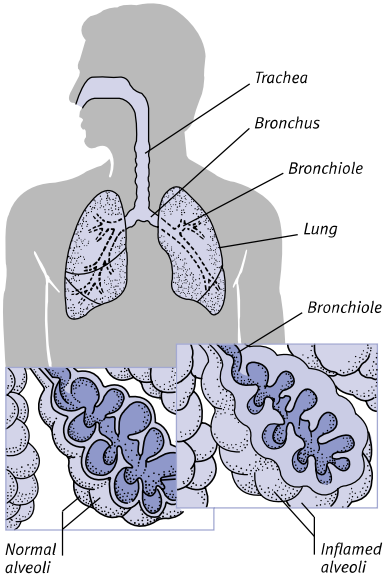
See *alveoloplasty*.

alveolitis

Inflammation and thickening of the walls of the alveoli (the tiny air sacs in the lungs). Alveolitis reduces the elasticity of the lungs during breathing and reduces the efficiency of the transfer of gas between the lungs and the surrounding blood vessels.

CAUSES

Alveolitis is commonly caused by an allergic reaction to inhaled dust of animal or plant origin, as in *farmer's lung* (caused by spores from mouldy hay), *bagassosis* (caused by spores from mouldy sugar-cane residue), and pigeon fancier's lung (caused by particles from bird droppings). This type of alveolitis is known as extrinsic allergic alveolitis.



Effects of alveolitis
The alveoli become inflamed and their walls thicken, causing the lungs to become less elastic and less able to transfer oxygen.

A

Fibrosing alveolitis is an *autoimmune disorder* (in which the immune system attacks the body's own tissues). In some cases, it occurs with other autoimmune disorders, such as *rheumatoid arthritis* or systemic *lupus erythematosus*.

Radiation alveolitis is caused by irradiation of the lungs and may occur as a rare complication of *radiotherapy* for lung or breast cancer.

SYMPTOMS AND DIAGNOSIS

Alveolitis usually causes a dry cough and breathing difficulty on exertion.

A *chest X-ray* of a person suffering from alveolitis usually shows mottled shadowing across the lungs. *Blood tests* may be performed to look for specific antibodies (proteins manufactured by the immune system: see *antibody*) to an allergen. They may also be performed to look for evidence of an autoimmune disorder (in which the immune system attacks the body's own tissues). *Pulmonary function tests* show reduced lung capacity without obstruction to air flow through the bronchi (air passages to the lungs). A lung *biopsy* (removal of a sample of tissue for microscopic analysis) may be the only way to make a conclusive diagnosis of alveolitis.

TREATMENT AND OUTLOOK

For most types of alveolitis, a short course of *corticosteroid drugs* relieves symptoms, but for fibrosing alveolitis the drugs may need to be taken indefinitely. If the cause of allergic alveolitis is recognized and avoided before lung damage occurs, the effects are not permanent. In fibrosing alveolitis, the damage progresses despite treatment, causing increasing breathing difficulty and, sometimes, *respiratory failure*.

alveoloplasty

Dental surgery that is carried out to remove protuberances and to smooth out other uneven areas from tooth-bearing bone in the jaw. Alveoplasty is performed either under a general anaesthetic (see *anaesthesia, dental*) or, more usually, under local anaesthetic. The procedure is usually carried out to facilitate the fitting of dentures on people whose alveolar ridge, underlying the gums, would not otherwise be smooth and even enough for dentures to be fitted easily or worn comfortably.

An incision is made in the gum, which is then peeled back to expose the uneven bone. The bone is then either reshaped with large forceps or filed down to the required shape. Finally, the gum is drawn back over the bone and stitched together. Some bruising and swelling of the mouth may occur, but the gum usually heals within two weeks.

alveolus, dental

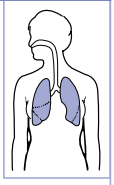
The bony cavity or socket supporting each tooth in the jaw.

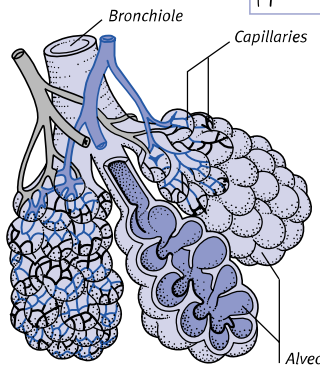
alveolus, pulmonary

One of millions of tiny, balloonlike sacs at the end of a bronchiole (one of the many small air passages in the lungs) where gases are exchanged during *respiration*. In each lung, there are approximately 300 million alveoli that are arranged in groups resembling bunches of grapes.

ANATOMY OF THE **ALVEOLI**

These tiny sacs contain capillaries in their thin walls that allow oxygen to be absorbed into the blood.





Alzheimer's disease

A progressive condition in which nerve cells in the brain degenerate and the brain shrinks. Alzheimer's disease is the most common cause of *dementia* (a general decline in all areas of mental ability). Its onset is uncommon before the age of 60, but incidence increases steadily with age thereafter.

CAUSES

Early onset Alzheimer's disease, in which symptoms develop before the age of 60, is often inherited as a dominant trait (see *genetic disorders*).

Late onset Alzheimer's disease is associated with one of the genes that is responsible for the production of the blood protein *apolipoprotein* E. Genetic factors also result in the abnormal deposition of a protein in the brain called beta amyloid. Other chemical abnormalities include deficiency of the *neurotransmitter* acetylcholine.

SYMPTOMS AND SIGNS

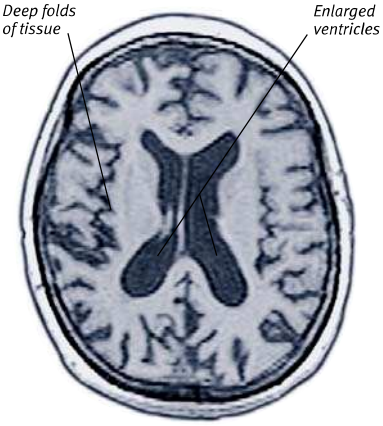
The features of Alzheimer's disease vary, but there are three broad stages. At first, the affected individual becomes increasingly forgetful; and problems with memory may cause *anxiety* and *depression*. Some deterioration in memory is a feature of normal *aging*, and this alone is not evidence of dementia.

In the second stage of the disease, loss of memory, particularly for recent events, gradually becomes more severe, and there may be disorientation as to time or place. The person's concentration and numerical ability decline, and there is noticeable *dysphasia* (inability to find the right word). Anxiety increases, mood changes are unpredictable, and personality changes may occur. If the patient is left unsupervised, he or she may repeatedly wander off.

Finally, confusion becomes profound. There may be symptoms of *psychosis*, such as *hallucinations* and *delusions*. Signs of nervous system disease, such as abnormal *reflexes* (involuntary actions) and faecal or urinary *incontinence*, begin to develop.

DIAGNOSIS

Alzheimer's disease is usually diagnosed from the symptoms, but tests including blood tests and *CT scanning* or *MRI* (techniques that produce cross-sectional or three-dimensional images) of the brain may be needed to exclude other causes of dementia.



MRI of the brain in Alzheimer's disease
The volume of the brain substance has shrunk markedly, resulting in deep folding of the tissue and enlargement of the fluid-filled brain ventricles.

TREATMENT

The most important aspect of treatment for Alzheimer's disease is the provision of suitable nursing and social care for sufferers and support for their relatives. *Tranquillizer drugs* can often improve difficult behaviour and to help with sleep. Treatment with *acetylcholinesterase inhibitors*, such as rivastigmine and donepezil, may slow the progress of the disease for a time, but will not improve mental ability. Side effects such as nausea and dizziness may occur.

amalgam, dental

A material, consisting of an alloy of mercury with other metals, that is used as fillings for teeth. Amalgam is soft enough to be easily workable by the dentist but sets rapidly into a hard, strong solid (see *filling, dental*).

amantadine

An *antiviral drug* that is used in the prevention and treatment of *influenza* A. Amantadine is also used to help relieve symptoms of *Parkinson's disease*.

amaurosis fugax

Brief loss of vision, lasting for seconds or minutes, usually affecting one eye only and caused by the temporary blockage of a small blood vessel in the eye by an *embolus* (a particle of solid matter such as cholesterol or clotted blood). These emboli are carried in the bloodstream from diseased arteries in the neck or, rarely, the heart. Sufferers typically experience a loss or dimming of vision, in one eye only, rather like a shade being pulled down or up.

Attacks may be infrequent, or they may occur many times a day, which indicates an increased risk of *stroke* and requires medical investigation.

ambidexterity

The ability to perform manual skills, such as writing or using cutlery, equally well with either hand because there is no definite *handedness* (preference for the use of one hand in particular). Ambidexterity is an uncommon and often familial trait.

amblyopia

A permanent defect of visual acuity in which there is usually no structural abnormality in the eye. In many cases, there is a disturbance of the visual pathway between the *retina* and the brain. The term amblyopia is also sometimes applied to toxic or nutritional causes of decreased visual acuity, as in tobacco–alcohol amblyopia.

If normal vision is to develop during infancy and childhood, it is essential that clear, corresponding visual images are formed on both retinas so that compatible nerve impulses pass from the eyes to the brain. If no images are received, normal vision cannot develop. If the images from each eye differ markedly, one will be suppressed to avoid double vision.

CAUSES

The most common cause of amblyopia is *squint* (a deviation of one eye relative to the other) in young children. Failure to form normal retinal images may also result from congenital (present from birth) *cataract* (opacity of the lens of the eye), and severe, or unequal, focusing errors, such as when one eye is normal and there is an uncorrected large degree of *astigmatism* in the other. Toxic and nutritional amblyopia may be the result of damage to the retina and/or the optic nerve.

TREATMENT AND OUTLOOK

The usual treatment for amblyopia due to squint is patching (covering up the good eye to force the deviating eye to function properly). Surgery to place the deviating eye in the correct position may be necessary. Glasses may be needed to correct severe focusing errors. Cataracts may be removed surgically. After the age of eight, amblyopia cannot usually be remedied.

ambulance

A vehicle for transporting sick, injured, or disabled people, usually to hospital, that is staffed by trained personnel who can provide emergency treatment during the journey.

ambulatory ECG

In ambulatory *ECG* (electrocardiography), a wearable device called a *Holter monitor* is used to record the electrical activity of the heart by means of electrodes attached to the chest. The monitor is usually worn for at least 24 hours and detects intermittent *arrhythmias* (abnormal heart rates and rhythms). It is also used to assess the programming of a cardiac pacemaker. The wearer presses a button on the monitor to mark the recording whenever symptoms occur. The recording can be analysed later to determine whether the periods of arrhythmia coincide with the symptoms. In some cases, the patient can send the recording over the telephone by means of *telecardiography* (transmission of an impulse to a site that is remote from the patient).

amelioration

In medical usage, improvement in the medical condition of a patient.

amelogenesis imperfecta

An inherited condition of the teeth in which the enamel is either abnormally thin or is deficient in calcium. The teeth of affected individuals may be pitted and discoloured (see *discoloured teeth*) and more susceptible to dental *caries* (tooth decay) and wear.

amenorrhoea

The absence of menstrual periods. Primary amenorrhoea is defined as failure to start menstruating by the age of 16. Secondary amenorrhoea is the temporary or permanent cessation of periods in a woman who has menstruated regularly in the past.

PRIMARY AMENORRHOEA

The main cause of primary amenorrhoea is the delayed onset of *puberty*. The delay may not indicate a disorder but, rarely, may result from a disorder of the *endocrine system*, such as a *pituitary tumour*, *hypothyroidism* (underactivity of the thyroid gland), an *adrenal tumour*, or *adrenal hyperplasia*. Another rare cause of delayed puberty is *Turner's syndrome*, in which one female sex chromosome is missing. In some cases, menstruation fails to take place because the vagina or uterus has been absent from birth. It may also fail to occur because there is no perforation in the hymen (the membrane across the opening of the vagina) to allow blood to escape.

SECONDARY AMENORRHOEA

The most common cause of temporary secondary amenorrhoea is *pregnancy*. Secondary amenorrhoea may also be caused by hormonal changes that occur as a result of stress, *depression*, *anorexia nervosa*, certain drugs, or a pituitary or thyroid disorder. Another possible cause is a disorder of the ovary, such as polycystic ovary (see *ovary, polycystic*) or an ovarian tumour. Amenorrhoea occurs permanently after the *menopause* or following a *hysterectomy* (a surgical operation to remove the uterus).

INVESTIGATION AND TREATMENT

Investigation of amenorrhoea usually involves a physical examination and

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blood tests to measure hormone levels. *CT scanning* or *MRI* (techniques that produce three-dimensional or cross-sectional images) of the skull may be carried out to exclude the possibility of a pituitary tumour and *ultrasound scanning* of the abdomen and pelvis to exclude a tumour of the adrenal glands or ovaries. In some cases, *laparoscopy* (examination of the inside of the abdomen using a rigid or flexible viewing tube) may be required to inspect the ovaries.

Treatment of amenorrhoea, if found to be necessary, is of the underlying cause. (See also *dietary amenorrhoea*.)

amfebutamone

A drug used, along with self-help measures, as an aid to stopping smoking. Side effects include a dry mouth and gastrointestinal disturbances.

amfetamine

An alternative spelling for amphetamine (see *amphetamine drugs*). (See also *controlled drugs*.)

amiloride

A potassium-sparing *diuretic drug*, amiloride is used in combination with loop or thiazide diuretics in the treatment of *hypertension* (high blood pressure) and the oedema (fluid retention) that results from *heart failure* (reduced pumping efficiency of the heart) or liver *cirrhosis*.

amino acids

A group of chemical compounds that form the basic structural units of all *proteins*. Each amino acid molecule consists of amino and carboxyl groups of atoms that are linked to a variable chain or ring of carbon atoms.

Individual amino acid molecules are linked together by chemical bonds (called *peptide* bonds) to form short chains of molecules called *polypeptides*. Hundreds of polypeptides are, in turn, linked together (also by peptide bonds) to form a protein molecule. What differentiates one protein from another is the sequence of the amino acids.

There are 20 different amino acids that make up all the proteins in the body. Of these, 12 can be made by the body; they are known as nonessential amino acids because they do not need to be obtained from the diet. The other eight, the essential amino acids, cannot be made by the body and must be obtained in the diet.

The 20 amino acids that make up proteins also occur free within cells and in body fluids. In addition, there are more than 200 other amino acids that are not found in proteins but play an important role in chemical reactions within cells.

aminoglutethimide

An *anticancer drug* used to treat certain types of breast cancer, prostate cancer, and some endocrine gland tumours.

aminoglycoside drugs

Aminoglycosides, a type of *antibiotic drug*, are given by injection and, because their use can damage the inner ear or kidneys, are generally reserved for the treatment of serious infections. Important examples of these drugs are *gentamicin* and *streptomycin*, which are also used topically for eye and ear infections.

aminophylline

A *bronchodilator drug* that is used to treat chronic *bronchitis*, *asthma*, and, occasionally, *heart failure* (reduced pumping efficiency of the heart).

Aminophylline relieves breathing difficulty by widening the bronchi (the main air passages to the lungs). It also dilates (widens) blood vessels, thereby improving blood flow from the heart, and increases the production of urine.

Possible side effects of aminophylline include nausea, vomiting, headache, dizziness, and palpitations.

amiodarone

An *antiarrhythmic drug* used in the treatment of various types of *arrhythmia* (irregular heart rate or rhythm). Long-term use of amiodarone may result in inflammation of the liver, thyroid problems, and damage to the eyes and lungs. For this reason, amiodarone is usually given only when other drugs have failed to be effective.

amitriptyline

A tricyclic *antidepressant drug* with a sedative effect. Amitriptyline is useful in the treatment of *depression* accompanied by *anxiety* or *insomnia*. Possible adverse effects include blurred vision, dizziness, and drowsiness.

amlodipine

A *calcium channel blocker* drug that is used to prevent *angina* and to treat *hypertension* (high blood pressure). Possible side effects of amlodipine include headaches and dizziness.

ammonia

A colourless, pungent gas that dissolves in water to form ammonium hydroxide, an alkaline solution (see *alkali*). Ammonia consists of one nitrogen atom linked to three hydrogen atoms. Ammonia is produced in the body and helps to maintain the *acid–base balance*.

In severe liver damage, the capacity of the liver to convert ammonia to *urea* is diminished. This leads to a high concentration of ammonia in the blood, which is thought to be a major cause of the impaired consciousness that occurs in *liver failure*.

amnesia

Loss of the ability to memorize information and/or recall information stored in *memory*. Amnesic conditions affect mainly long-term memory (where information is retained indefinitely) rather than short-term memory (where it is only retained for seconds or minutes).

Many people with amnesia have a memory gap that extends back for some time before the onset of the disorder. This condition, known as retrograde amnesia, is principally a deficit of recall. In the majority of cases, the memory gap gradually shrinks over time.

Some people with amnesia are unable to store new information in the period following the onset of the illness. The resultant gap in memory, known as anterograde amnesia, extends from the moment of onset of the amnesia to the time when the long-term memory resumes (if at all). This memory gap is usually permanent.

CAUSES

Amnesia is the result of damage to, or disease of, regions in the brain that are concerned with memory function. Possible causes of such damage are *head injury*; degenerative disorders such as *Alzheimer's disease* and other forms of *dementia*; infections such as *encephalitis*; thiamine deficiency in problem drinkers, which leads to *Wernicke–Korsakoff syndrome*; *brain tumours*; *strokes*; and *subarachnoid haemorrhage*. Amnesia can also occur in some forms of psychiatric illness (in which there is no apparent physical damage to the brain). Some deterioration of memory is a common feature of *aging*.

amniocentesis

A diagnostic procedure in which a small amount of *amniotic fluid* is withdrawn, using a syringe guided by *ultrasound*

scanning, from the *amniotic sac* (the membrane that surrounds the *fetus* in the *uterus*).

WHY IT IS DONE

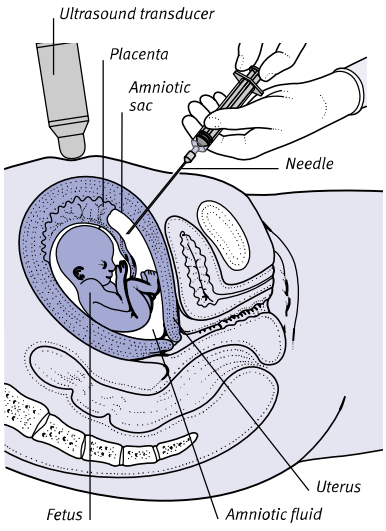
The amniotic fluid contains fetal cells, which can be subjected to *chromosome analysis* in order to identify or exclude chromosomal defects, such as *Down's syndrome*, or genetic analysis to look for *genetic disorders* such as *haemophilia, cystic fibrosis*, and *Tay–Sachs disease*. The amniotic fluid also contains chemicals; and analysis of the fluid can help to diagnose or exclude developmental abnormalities such as *spina bifida*. The severity of *rhesus incompatibility* and the maturity of the fetal lungs can also be checked by amniocentesis.

HOW IT IS DONE

Amniocentesis is usually performed in the 14th to 18th week of pregnancy. It may be performed earlier, but this is technically more difficult a this early stage. The skin of the abdomen is cleaned and a needle is inserted into the amniotic sac; (in all cases, ultrasound scanning is used to avoid contact with the fetus and placenta). An attached *syringe* removes some fluid for analysis.

COMPLICATIONS

Amniocentesis slightly increases the risk of *miscarriage* or early rupture of the membranes, and the procedure is therefore recommended only when the fetus is thought to be at increased risk of an abnormality. (See also *antenatal care*, *chorionic villus sampling*.)



Procedure for amniocentesis
A needle, guided by ultrasound, is introduced through the uterine wall into the amniotic sac; a sample of amniotic fluid is then withdrawn.

amnion

One of the membranes that surrounds the *fetus* in the *uterus*. The outside of the amnion is covered by another membrane called the *chorion*.

amniotic fluid

The clear, watery fluid (popularly called the "waters") that surrounds the *fetus* in the *uterus* and is contained within the *amniotic sac* (a thin, membranous bag). Amniotic fluid cushions the fetus against pressure from the mother's internal organs, allowing movement.

Amniotic fluid is produced by cells that line the amniotic sac and is constantly circulated. The fetus swallows the fluid, which is absorbed into the fetal bloodstream and then excreted by the kidneys as urine. The fluid is 99 per cent water. The remainder consists of dilute concentrations of the substances found in *blood* plasma, along with cells and *lipids* (fats) from the fetus.

Amniotic fluid appears during the first week following conception, and it gradually increases in volume until the tenth week, when it increases very rapidly. After approximately 35 weeks' gestation, the volume of fluid slowly starts to decline.

In a small number of pregnancies, *polyhydramnios* (the formation of excessive amounts of amniotic fluid) occurs; less frequently, *oligohydramnios* (the formation of insufficient fluid) occurs.

amniotic sac

The membranous bag that surrounds the *fetus* and is filled with *amniotic fluid* as pregnancy advances. The sac is made up of two membranes, the inner *amnion* and the outer *chorion*.

amniotomy

Artificial rupture of the amniotic membranes. Amniotomy, which is popularly known as "breaking of the waters", is performed for *induction of labour*.

amoeba

A type of protozoon (see *protozoa*). An amoeba is a microscopic single-celled organism with an irregular, changeable shape. Amoebae live in moist environments such as fresh water and soil. Some types are parasites of humans, causing diseases such as *amoebiasis*.

amoebiasis

An infection caused by the amoeba ENTAMOEBA HISTOLYTICA, a tiny single-celled parasite that lives in the human large intestine. Amoebiasis is spread through eating food or drinking water contaminated by human excreta containing cysts of the amoeba.

Once the cysts are swallowed, the cyst walls break down, and the amoebae hatch out to parasitize the large intestine. In the intestine, the amoebae multiply and develop protective capsules, forming new cysts. These cysts are passed out of the body in the faeces and can survive for long periods before the next person acquires them.

SYMPTOMS

Some individuals carry the ENTAMOEBA HISTOLYTICA parasite in their intestines and excrete cysts without having symptoms. However, some strains of the amoebae invade and ulcerate the intestinal wall, causing diarrhoea and abdominal pain, which may develop into full-blown *dysentery*.

The amoebae may spread through the bloodstream to the liver or, rarely, to the brain or lung, where they cause abscesses. Symptoms of an amoebic liver abscess include weight loss, chills, fever, and painful liver enlargement. Liver abscesses may also sometimes occur in the absence of symptoms.

PREVENTION AND TREATMENT

Travellers to countries where sanitary standards are low can reduce their risk of acquiring amoebiasis by drinking only bottled or thoroughly boiled water and by not eating uncooked vegetables or unpeeled fruit.

Treatment of all forms of amoebiasis is with drugs such as *metronidazole* or diloxanide. These drugs kill the parasite within a few weeks, leading to complete recovery.

amoebic dysentery

See *amoebiasis*.

amoebicides

A group of drugs that are used to treat *amoebiasis*. Examples of amoebicides are diloxanide and *metronidazole*. The drugs work by killing amoebae (see *amoeba*) in the intestine and in other body tissues.

amoxapine

A tricyclic *antidepressant drug*. Possible adverse effects of amoxapine include a dry mouth, blurred vision, dizziness, drowsiness, abnormal muscular movements, menstrual irregularities, and enlargement of the breasts.

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amoxicillin

A *penicillin drug* commonly used to treat a variety of infections, including *cystitis*, *bronchitis*, and ear and skin infections. Allergy to it causes a blotchy rash and, rarely, fever, swollen mouth and tongue, itching, and breathing difficulty.

Amoxil

A brand name for the antibiotic drug *amoxicillin*.

amoxycillin

See *amoxicillin*.

amphetamine drugs

COMMON DRUGS

- Dexamfetamine

A group of *stimulant drugs* used mainly in the treatment of *narcolepsy* (a rare disorder that is characterized by excessive sleepiness).

HOW THEY WORK

Amphetamine drugs stimulate secretion of *neurotransmitters* (chemicals released by nerve endings), such as *noradrenaline* (norepinephrine), which increase nerve activity in the brain and make a person wakeful and alert.

SIDE EFFECTS

In high doses, amphetamines can cause tremor, sweating, anxiety, and sleeping problems. Delusions, hallucinations, high blood pressure), and seizures may also occur. Prolonged use may produce *tolerance* and *drug dependence*.

ABUSE

Amphetamines are often abused for their stimulant effect and, for this reason, they are *controlled drugs*.

amphotericin

An antifungal drug used to treat *candidiasis* of the mouth or intestine. The drug is taken as tablets but is also given by intravenous infusion to treat life-threatening systemic (generalized) fungal infections such as *cryptococcosis* and *histoplasmosis*.

Side effects, which include vomiting, fever, headache, and, rarely, seizures, may occur with intravenous infusion.

ampicillin

A *penicillin drug* commonly used to treat *cystitis*, *bronchitis*, and ear infections. Diarrhoea is a common adverse effect. Some people are allergic to ampicillin and suffer from rash, fever, swelling of the mouth and tongue, itching, and breathing difficulty.

ampoule

A small glass or plastic vessel that can be hermetically sealed to hold liquid substances, in a sterile condition, for *injection*. Each ampoule usually contains a single dose of a drug.

ampulla

An enlarged, flask-shaped area at the end of a tubular structure or canal. There are several ampullae in the body, including those at the end of each fallopian tube, on each of the three semicircular canals of the inner ear, and at the opening of the bile duct leading into the intestine.

amputation

The surgical removal of part or all of a limb. Amputation may be needed if the blood supply to the limb has been permanently lost. It may also be necessary in some instances of cancer. The operation is now quite rarely performed.

WHY IT IS DONE

Amputation is necessary if *peripheral vascular disease*, as a result of *atherosclerosis* or *diabetes mellitus*, has destroyed the blood supply to a limb. If the blood supply cannot be restored, amputation is carried out to prevent the development of *gangrene* (tissue death).

Amputation may also occasionally be performed to prevent the spread of a *bone cancer* or malignant melanoma (see *melanoma, malignant*), a type of skin cancer. If a limb has been irreparably damaged in an accident, a decision may also be taken to amputate.

HOW IT IS DONE

During the operation, skin and muscle are cut below the level at which the bone is to be severed to create flaps that will later provide a fleshy stump. The blood vessels are tied off, the bone is sawn through, the area is washed with saline (salt solution), and the flaps of skin and muscle are stitched over the sawn end of bone to form a smooth and rounded stump.

If a prosthesis (see *limb, artificial*) is to be fitted, the surgeon tries to ensure that nerves are severed well above the stump in order to reduce the risk of pressure pain. In an amputation at the ankle (Syme's amputation), the tough skin of the heel pad is retained to cover the stump, reducing the need for a prosthetic foot.

RECOVERY AND OUTLOOK

The stump is usually swollen for about six weeks after the operation. For some time after amputation, there may also be an unpleasant sensation that the limb is still present. This phenomenon is known as "phantom limb". A prosthesis will usually be fitted, if necessary, once the stump has healed and the swelling has gone down.

amputation, congenital

The separation of a body part (usually a limb, finger, or toe) from the rest of the body, as a result of the blood supply to the part being blocked, in the uterus, by a band of *amnion* (fetal membrane). At birth, the affected part may be either completely separated, or it may show the marks of the "amniotic band". (See also *limb defects*.)

amputation, traumatic

Loss of a finger, toe, or limb through injury. (See also *microsurgery*.)

amylase

An *enzyme* that is found in *saliva* and pancreatic secretions (see *pancreas*). Amylase helps the body to digest dietary starch, breaking it down into smaller components, such as the sugars *glucose* and maltose.

Amsler chart

A diagnostic tool used by ophthalmologists to detect changes in the retina, particularly those changes that indicate *macular degeneration*. A typical Amsler chart consists of a grid of black lines on a white background. In an individual with retinal changes, the lines may appear distorted.

amyl nitrite

A *nitrate drug* that was once prescribed to relieve *angina pectoris* (chest pain as a result of impaired blood supply to the heart muscle). Because it frequently causes adverse effects, the drug has now been superseded by other drugs such as *glyceryl trinitrate* and *isosorbide*. Amyl nitrite is sometimes abused for its effect of intensifying pleasure during orgasm.

amyloidosis

An uncommon disease in which a substance called amyloid, composed of fibrous protein, accumulates in tissues and organs, including the liver, kidneys, tongue, spleen, and heart.

CAUSES

Amyloidosis may occur for no known reason, in which case it is known as primary amyloidosis; more commonly,

it is a complication of some other disease, and in such cases it is called secondary. Conditions that may lead to amyloidosis include *multiple myeloma* (a cancer of bone marrow), *rheumatoid arthritis*, *familial Mediterranean fever*, *tuberculosis*, and other longstanding infections such as chronic *osteomyelitis* (bone infection). Amyloid is also deposited in the brain in *Alzheimer's disease*. Small deposits of amyloid are a normal feature of *aging*.

SYMPTOMS AND SIGNS

The symptoms of amyloidosis vary, depending on the organs affected and the duration of the condition. Affected organs typically become enlarged. An accumulation of amyloid in the heart may result in *arrhythmias* (disturbances of the heart rate or rhythm) and *heart failure* (reduced pumping efficiency of the heart). If the stomach and intestines are affected, symptoms such as diarrhoea may develop, and the lining of these organs may become ulcerated. Primary amyloidosis is often characterized by deposits of amyloid in the skin, which appear as slightly raised, waxy spots. Deposits of amyloid in the kidneys may cause *kidney failure*, which can be fatal.

TREATMENT

There is no treatment for the removal of amyloid deposits. However, it is possible to halt the progression of secondary amyloidosis by treatment of the underlying disorder.

amyotrophic lateral sclerosis

See *motor neuron disease*.

amyotrophy

Shrinkage or wasting away of a muscle, caused by a reduction in the size of its fibres, leading to weakness. Amyotrophy is usually the result of poor nutrition, reduced use of the muscle (as occurs when a limb is immobilized for a long period), or disruption of the blood or nerve supply to the muscle (as can occur in *poliomyelitis* or *diabetes mellitus*). (See also *atrophy*.)

anabolic steroids

See *steroids, anabolic*.

anabolism

The manufacture of complex molecules such as *fats* and *proteins* from simpler molecules by metabolic (chemical and physical) processes in living cells. (See also *catabolism; metabolism*.)

anaemia

A condition in which the concentration of the oxygen-carrying pigment *haemoglobin* in the blood is below normal. Haemoglobin molecules are carried inside red *blood cells* and transport oxygen from the lungs to the tissues. Normally, stable haemoglobin concentrations in the blood are maintained by a balance between red-cell production in the bone marrow and red-cell destruction in the spleen. Anaemia may result if this balance is upset.

TYPES AND CAUSES

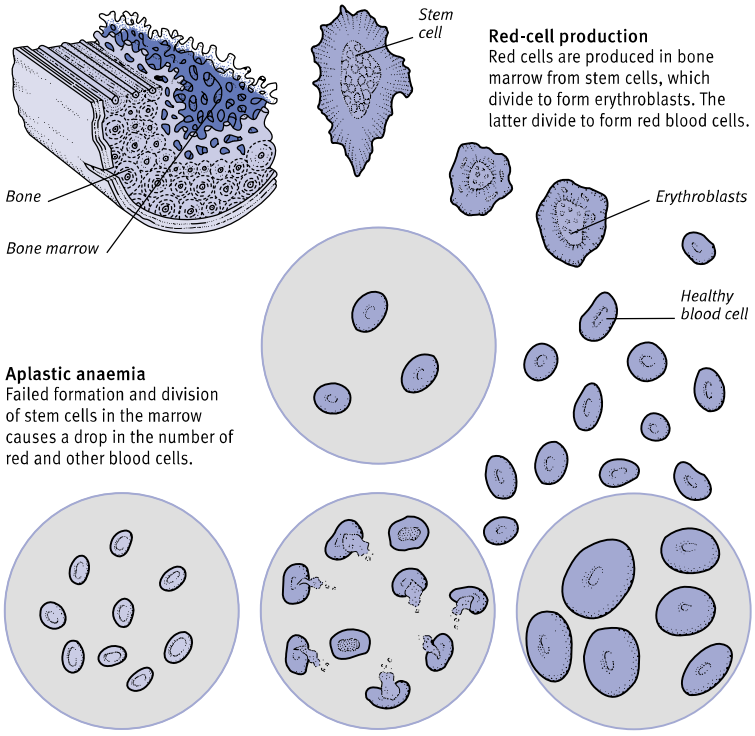
Anaemia is not a disease in itself but a feature of many different disorders. There are various types, which can be classified into those due to decreased or defective red blood cell production by bone marrow (see *anaemia, aplastic*; *anaemia, megaloblastic; anaemia, iron-deficiency*) and those due to decreased survival of the red cells in the blood (see *anaemia, haemolytic*). The illustrated box shows the main types of anaemia.

SYMPTOMS

The symptoms common to all forms of anaemia result from the reduced oxygen-carrying capacity of the blood, and the severity of symptoms depends on how low the haemoglobin concentration has become. Slightly reduced levels can cause tiredness, and lethargy. Severely reduced levels can cause breathing

TYPES AND CAUSES OF **ANAEMIA**

Anaemia results either from reduced or defective production or an excessively high rate of destruction of oxygen-carrying red blood cells. Four of the main types are shown below, but anaemia can have many other causes (such as various forms of leukaemia).



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difficulty on exercise, dizziness as a result of reduced oxygen reaching the brain, *angina pectoris* (chest pain due to impaired oxygen supply to the heart muscle), and palpitations as the heart works harder to compensate. General symptoms include pallor, particularly of the skin creases, the lining of the mouth, and the inside of the eyelids.

Other features may occur with particular forms of anaemia. For example, some degree of *jaundice* occurs in most types of haemolytic anaemia because the high rate of destruction of red blood cells leads to an increased level of the yellow pigment bilirubin (produced by the breakdown of the haemoglobin in red cells) in the blood.

DIAGNOSIS

Anaemia is diagnosed from the patient's symptoms and by blood tests (see *blood count*). A *bone marrow biopsy* (removal of a small sample of bone marrow for analysis) may be required to determine whether or not red blood cell production is defective.

anaemia, aplastic

A rare but serious type of *anaemia* (a reduced level of the oxygen-carrying pigment *haemoglobin* in the blood). In aplastic anaemia, the red cells, white cells, and platelets in the blood are all reduced in number. The condition is caused by a failure of the *bone marrow* to produce stem cells, the initial form of all blood cells.

CAUSES

Treatment of cancer with *radiotherapy* or *anticancer drugs* can temporarily interfere with the cell-producing ability of bone marrow, as can certain viral infections and other drugs. Long-term exposure to insecticides or benzene fumes may cause more persistent aplastic anaemia; and another recognized cause is a moderate to high dose of nuclear radiation. An *autoimmune disorder* (in which the immune system attacks the body' own tissues) is responsible in some cases. Aplastic anaemia sometimes develops for no known reason.

SYMPTOMS

A low level of red blood cells may cause symptoms, such as fatigue and breathlessness, that are common to all types of anaemia. Deficiency of white cells increases susceptibility to infection, resulting in frequent or severe infections; platelet deficiency may lead to a tendency to bruise easily, bleeding gums, and nosebleeds.

DIAGNOSIS AND TREATMENT

Aplastic anaemia is usually suspected from the results of a blood test, particularly a *blood count*, and is confirmed by a *bone marrow biopsy* (the removal of a small sample of bone marrow for microscopic analysis).

Blood and platelet transfusions can control symptoms. Immunosuppression (therapy to suppress the immune system) is used to treat aplastic anaemia due to an autoimmune process. Severe persistent aplastic anaemia may be fatal without a *bone marrow transplant* .

anaemia, deficiency

Forms of *anaemia* (a reduced level of the oxygen-carrying pigment *haemoglobin* in the blood) caused by lack of one or more substance that are essential for normal haemoglobin synthesis and maintenance. Deficiency anaemia may arise by various means, such as by *malabsorption* or insufficient dietary intake of a particular nutrient. *Iron-deficiency anaemia* and *megaloblastic anaemia* are examples of deficiency anaemias.

anaemia, haemolytic

A form of *anaemia* (a reduced level of the oxygen-carrying pigment *haemoglobin* in the blood) caused by premature destruction of red blood cells in the bloodstream (see *haemolysis*). The bone marrow has the capacity to increase its red cell production approximately six-fold over normal rates. Haemolytic anaemia will result only if the shortening of the lifespan of red blood cells is sufficiently severe to overcome the reserve capacity of the bone marrow.

TYPES AND CAUSES

Haemolytic anaemias can be classified in two ways: if the cause of the haemolysis is an abnormality of the red cells themselves, the condition is usually inherited; if the cause of the haemolysis is outside the cells, the condition is usually acquired later in life.

When haemolysis is due to a defect within the red cells, the underlying problem may be abnormal rigidity of the cell membrane (the thin layer of tissue surrounding each cell). This causes the cells to become trapped, at an early stage of their life-span, in the small blood vessels of the spleen, where they are destroyed by macrophages (cells that ingest foreign particles). Abnormal rigidity may result from an inherited defect of the cell membrane (as in hereditary *spherocytosis*), a defect of the *haemoglobin* in the cell (as in *sickle-cell anaemia*), or a defect of one of the cell's *enzymes*. An inherited deficiency of the glucose-6-phosphate dehydrogenase enzyme (see *G6PD deficiency*) may result in episodes of haemolytic anaemia since the red cells are prone to damage by infectious illness or certain drugs or foods. One variety of G6PD deficiency is most common in Mediterranean countries (see *favism*).

Haemolytic anaemias due to defects outside the red cells fall into three main groups. First are disorders in which red cells are destroyed by buffeting (by artificial surfaces such as replacement heart valves, abnormal blood-vessel linings, or a blood clot in a vessel, for example). In the second group, the red cells are destroyed by the *immune system*. Immune haemolytic anaemias may occur if foreign blood cells enter the bloodstream, as occurs in an incompatible blood transfusion, or they may be due to an *autoimmune disorder* (in which the immune system attacks the body's own tissues). In *haemolytic disease of the newborn*, the baby's red cells are destroyed by antibodies, produced by the mother, crossing the placenta. Thirdly, the red cells may be destroyed by microorganisms in the blood; the most common cause is *malaria*.

SYMPTOMS

People with haemolytic anaemia may have symptoms common to all types of anaemia, such as fatigue and breathlessness, or symptoms that are specifically due to haemolysis, such as *jaundice* (caused by an excessive concentration in the blood of bile pigments formed from the destruction of red blood cells).

DIAGNOSIS AND TREATMENT

Diagnosis is confirmed by microscopic examination of the blood (see *blood film*). Treatment depends on the cause. Some inherited anaemias can be controlled by removing the spleen (see *splenectomy*). Others, such as G6PD deficiency and favism, can be prevented by avoiding the drugs or foods that precipitate haemolysis. Anaemias due to immune processes can often be controlled by *immunosuppressant drugs*. Transfusions of red cells are sometimes needed for emergency treatment of life-threatening anaemia.

anaemia, iron-deficiency

The most common form of *anaemia* (a reduced level of the oxygen-carrying pigment *haemoglobin* in the blood).

Iron-deficiency anaemia is caused by a deficiency of iron, an essential constituent of haemoglobin.

CAUSES

The commonest cause of iron-deficiency anaemia is iron loss due to heavy or persistent bleeding; the most common cause in women of childbearing age is particularly heavy periods (see *menorrhagia*). Pregnancy stops menstrual losses, but the baby is an even greater drain on maternal iron stores. Other causes include blood loss from the digestive tract due to disorders such as erosive *gastritis*, *peptic ulcer*, *stomach cancer*, *inflammatory bowel disease*, *haemorrhoids*, and bowel tumours (see *colon, cancer of*). Prolonged use of aspirin and other *nonsteroidal anti-inflammatory drugs* (NSAIDs) can cause gastrointestinal bleeding. In some countries, *hookworm infestation* of the digestive tract is an important cause of anaemia. Rarely, bleeding may also occur as a result of disorders of the urinary tract (such as *kidney tumours* or *bladder tumours*).

Iron deficiency may also be caused or worsened by lack of iron in, or its poor absorption from, the diet. Malabsorption of iron may have various causes, including the removal of part or all of the stomach (see *gastrectomy*) or *coeliac disease* (a disorder that impairs digestion).

SYMPTOMS

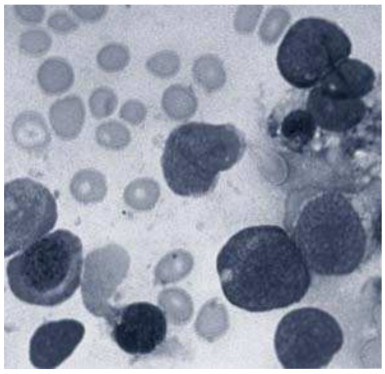
The symptoms of iron-deficiency anaemia are those of the underlying cause, along with a sore mouth or tongue; and those that are common to all forms of anaemia, such as fatigue, headaches, and breathlessness.

DIAGNOSIS AND TREATMENT

Diagnosis is made from a *blood count* that reveals the red blood cells to be microcytic (abnormally small). Measurement of the iron levels in the blood confirms the diagnosis but further investigation will be needed to establish the underlying cause. Treatment is given for the underlying cause, along with a course of iron tablets or, very rarely, iron injections in order to build up the depleted iron stores.

anaemia, megaloblastic

A major type of *anaemia* (a reduced level of the oxygen-carrying pigment haemoglobin in the blood). Megaloblastic anaemia is caused by deficiency of vitamin B_{12} or another vitamin, folic acid. Either of these deficiencies seriously interferes with the production of red blood cells in the bone marrow. An excess of cells known as megaloblasts (abnormal immature red cells) appears in the marrow. Megaloblasts give rise to enlarged and deformed red blood cells known as macrocytes.



Bone marrow in megaloblastic anaemia
In this microscopic view, some of the large cells are abnormal red-cell precursors (megaloblasts).

CAUSES

Vitamin B_{12} deficiency Vitamin B_{12} is found only in foods of animal origin, such as meat and dairy products. It is absorbed from the small intestine by first combining with intrinsic factor, a chemical produced by the stomach lining. The most common cause of vitamin B_{12} deficiency is *pernicious anaemia* in which the stomach lining fails to produce intrinsic factor, usually as a result of an *autoimmune disorder* (in which the immune system attacks the body's own tissues). Total gastrectomy (removal of the stomach) also prevents the production of intrinsic factor, and removal of part of the small intestine prevents B_{12} absorption, as does the intestinal disorder *Crohn's disease*. In a minority of cases, vitamin B_{12} deficiency is due to a vegan diet (which excludes all foods of animal origin).

Folic acid deficiency Folic acid is found mainly in green vegetables and liver. The usual cause of deficiency is a poor diet. It can also be caused by anything that interferes with absorption of folic acid from the small intestine (Crohn's disease or *coeliac disease*, for example). Folic acid is required by rapidly dividing cells, as in the fetus. Women are advised to take folic acid supplements before conception and in early pregnancy, although this is to reduce the risk of the fetus having a *neural tube defect* rather than to prevent anaemia.

SYMPTOMS

Many people with mild megaloblastic anaemia have no symptoms. Others may experience tiredness, a sore mouth and tongue, weight loss, and mild *jaundice*. If B_{12} deficiency continues for a long time, additional symptoms as a result of nerve damage, including numbness and tingling in the feet, may develop.

DIAGNOSIS AND TREATMENT

Megaloblastic anaemia is diagnosed by *blood tests* and confirmed if a *bone marrow biopsy* (removal of a small sample of marrow for microscopic analysis) reveals the presence of large numbers of megaloblasts.

Megaloblastic anaemia caused by poor diet can be remedied with a short course of vitamin B_{12} injections or folic acid tablets and the introduction of a normal diet. A lifelong course of vitamin B_{12} injections or folic acid tablets is required if the underlying cause of malabsorption is incurable.

anaemia, pernicious

See *pernicious anaemia*.

anaemia, sickle cell

See *sickle cell anaemia*.

anaerobic

Capable of living, functioning, and growing without oxygen. Many bacteria are anaerobes and thrive in the intestinal canal or in tissue that has a poor supply of oxygenated blood.

Some human body cells are capable of limited anaerobic activity. When muscular exertion is so strenuous that oxygen is used faster than the blood circulation can supply it (during sprinting, for example), the muscle cells can temporarily work anaerobically. When this happens, lactic acid is produced as a waste product (instead of the carbon dioxide that is produced from *aerobic* activity). This acid buildup can cause muscle fatigue and pain, thereby limiting the time for which anaerobic activity can be carried out. Compensation for this anaerobic activity requires oxygen to convert the lactic acid to glucose or to carbon dioxide, which explains the need to continue to breathe rapidly following vigorous exertion. The deficit of oxygen that builds up in the muscles during exercise is known as the oxygen debt.

anaesthesia

The absence of all sensation; insensibility. The term most commonly refers to anaesthesia that is induced artificially for medical purposes.

A

Two types of anaesthesia may be used: local (see *anaesthesia, local*) and general (see *anaesthesia, general*). A patient given a local anaesthetic remains conscious, and sensation is abolished in only a specific part of the body. A patient under general anaesthesia is rendered unconscious and maintained in this state with a combination of drugs that are either injected into a vein or inhaled.

Damage to nerve tissues by injury or disease can produce anaesthesia in a localized area.

anaesthesia, dental

Loss of sensation induced in a patient to prevent pain during dental treatment. Topical anaesthetics (usually using the drug lidocaine (lignocaine) as a cream or spray) are often used on the surface of the gums before injection of a local anaesthetic (see *anaesthesia, local*).

For minor procedures, a local anaesthetic is injected either into the gum at the site being treated or around the nerve a short distance away (a procedure known as a peripheral *nerve block*). For more complicated procedures, such as periodontal (gum) surgery and multiple tooth extractions, general anaesthesia (see *anaesthesia, general*) is carried out.

anaesthesia, epidural

See *epidural anaesthesia*.

anaesthesia, general

Loss of sensation and consciousness that is induced to prevent the perception of pain throughout the body during surgery. General anaesthesia is also used to abolish muscle tone and cardiovascular reflexes in the patient.

The state of general anaesthesia is produced and maintained by an anaesthetist, who gives combinations of drugs by injection, inhalation, or both. The anaesthetist is also responsible for the pre-anaesthetic assessment and medication of patients, their safety during surgery, and their recovery during the post-anaesthetic period.

HOW IT IS DONE

General anaesthesia is usually induced by intravenous injection of a *barbiturate drug*, usually via a *cannula* (a blunt-ended tube), which is left in place in case further drugs need to be given. Anaesthesia is maintained by the inhalation of anaesthetic gases such as *enflurane* or halothane, which may be introduced into the lungs via a face mask or an *endotracheal tube* (a flexible tube passed into the *trachea* through the nose or mouth). During the anaesthetic, blood pressure, pulse, oxygen saturation (see *oximeter*), and other vital signs are monitored continuously. The principal stages in administering, maintaining, and reversing general anaesthesia are shown in the illustrated box.

POSSIBLE COMPLICATIONS

General anaesthetics have become much safer and serious complications are now rare. However, the presence of severe pre-existing diseases, such as lung or heart disorders, increase the risks of the procedure. Minor after-effects, such as nausea and vomiting, are usually controlled effectively with *antiemetic drugs*.

anaesthesia, local

Loss of sensation induced in a limited region of the body to prevent pain during diagnostic or treatment procedures, examinations, and surgery. Local anaesthesia is produced by administration of drugs that temporarily interrupt the action of pain-carrying nerve fibres.

HOW IT IS DONE

Local anaesthetics may be applied topically, before injections or blood tests, as sprays, skin creams, and ointments. These are often used for children. The throat, larynx (voice-box), and respiratory passages can be sprayed with an anaesthetic before *bronchoscopy* (examination of the bronchi, the main airways of the lungs, using a rigid or flexible viewing tube) and the urethra can be numbed with a gel before *cystoscopy* (examination of the urethra and bladder using a rigid or flexible viewing tube).

For minor surgical procedures, such as stitching of small wounds, local anaesthesia is usually produced by direct injection into the area to be treated. To anaesthetize a large area, or when a local injection would not penetrate deeply enough into body tissues, a *nerve block* (in which the local anaesthetic is injected around nerves at a point remote from the area to be treated) may be used. Nerve impulses can also be blocked where they branch off from the spinal cord, as in *epidural anaesthesia*, which is used in childbirth or caudal block, and *spinal anaesthesia*, which is used for surgery on the lower limbs and abdomen.

POSSIBLE COMPLICATIONS

Serious reactions are uncommon, but repeated use of topical preparations may cause local allergic rashes.

LOCAL ANAESTHETICS

Drug	Common uses	How taken
tetracaine (amethocaine)	Prior to taking a blood sample or inserting a cannula	Gel
benzocaine	To treat painful conditions of the mouth and throat, painful anal conditions (e.g. haemorrhoids), skin wounds	Lozenges, suppositories, spray, cream, ointment
bupivacaine	As nerve block (e.g.epidural anaesthesia and caudal block)	Injection
cocaine	For surgery on the nose, throat and larynx	Spray, liquid
lidocaine (lignocaine)	For relief of pain during dental treatment; for spinal anaesthesia, nerve blocks (e.g. epidural anaesthesia), eye surgery, and before taking blood samples in children; for urethra prior to catheterization and larynx prior to laryngoscopy	Injection, gel, spray, cream, ointment, liquid, eye-drops, suppositories
prilocaine	As nerve block (e.g. epidural anaesthesia and caudal block)	Injection

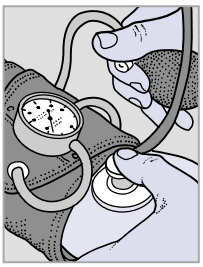
A

TECHNIQUES FOR **GENERAL ANAESTHESIA**

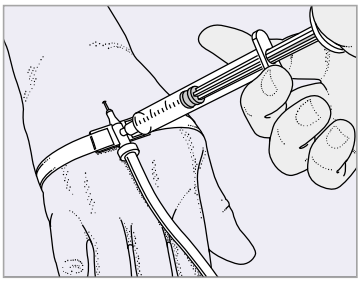
The main phases in the administration of a general anaesthetic are induction (bringing about unconsciousness), maintenance (of unconsciousness), and emergence (returning the patient to consciousness). Some of the main stages are shown below. Often, to allow surgical manipulation, a muscle relaxant must be given in addition to anaesthetic gases or injections. Because the relaxant temporarily paralyses the breathing muscles, the patient's lungs must be ventilated artificially. Modern general anaesthetics have few side effects, and recovery is usually prompt.

DRUGS USED IN GENERAL ANAESTHESIA

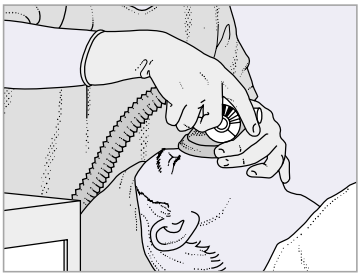
Type	Action	Examples
Drugs given as premedication	Relax patient, relieve anxiety; some reduce saliva and mucus formation	Atropine, diazepam, hyoscine, lorazepam, temazepam
Induction agents	Induce unconsciousness	Etomidate, ketamine, propofol, thiopental sodium
Anaesthetic gases and volatile agents	Induce and/or maintain unconsciousness	Enflurane, halothane, isoflurane, nitrous oxide
Analgesics	Abolish pain	Fentanyl, ketoprofen, morphine
Muscle relaxants	Relax (paralyse) muscles	Pancuronium, vecuronium
Reversal agents	Reverse muscle relaxation	Neostigmine



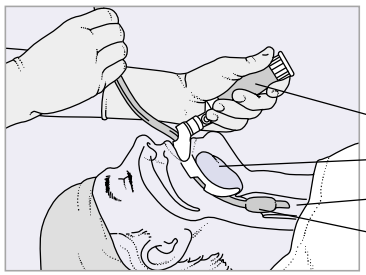
1 Before the operation, the anaesthetist talks to and examines the patient to assess his or her fitness for anaesthesia and surgery. He or she also answers any questions the patient may have.



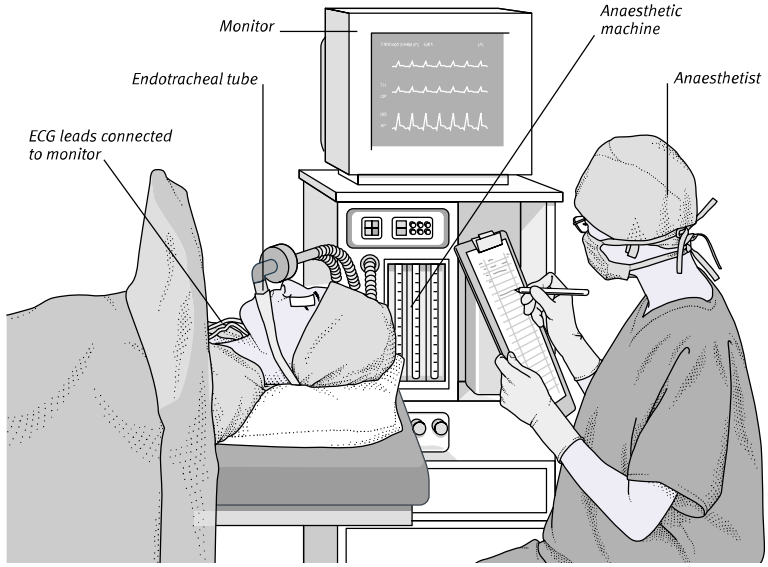
2 The induction agent is usually given via a cannula inserted into a vein. The cannula is left in position so that other drugs can be given rapidly if needed.



3 Sometimes, anaesthesia is induced or maintained with gases delivered by mask. If no muscle relaxant is used, the patient may be able to continue breathing naturally.



4 In other cases, an endotracheal tube is inserted for delivery of the anaesthetic gases. If a muscle relaxant is used, artificial ventilation is necessary.



5 During surgery, the patient is kept at a level of anaesthesia deep enough for him or her to be unaware of the operation. The composition of the gas mixture, and the patient's heart rate, breathing, blood pressure, temperature, blood oxygenation, and exhaled carbon dioxide are monitored. After surgery, anaesthesia is stopped, and reversal agents are given if necessary.

A

anaesthesia, spinal

See *spinal anaesthesia*.

anaesthetics

A term for the group of drugs that produce *anaesthesia* and for the medical discipline that is concerned with their administration.

An anaesthetist is a specialist who administers anaesthetics. Before a patient goes to the operating theatre, the anaesthetist assesses the condition of the patient's heart, lungs, and circulation. He or she decides the type and amount of drugs needed to induce and maintain anaesthesia, determines the patient's position on the operating table, watches for problems, and decides on the action to be taken if an emergency develops. The anaesthetist is also responsible for monitoring the progress of the waking patient, and watching for and treating any post-anaesthetic complications.

anal dilatation

A procedure in which the anus is stretched. Anal dilatation is used to treat conditions in which the anus becomes too tight, such as *anal stenosis* and *anal fissure*. It is also used to treat *haemorrhoids*. Anal dilatation is usually performed under general anaesthesia (see *anaesthesia, general*).

Reflex anal dilatation, in which the anus dilates in response to local contact, may occur in certain anal disorders or after repeated anal penetration.

anal discharge

The loss of mucus, pus, or blood from the anus. *Haemorrhoids*, *anal fissures* (tears), and *proctitis* (inflammation of the rectum) can all cause anal discharge.

analeptic drugs

Drugs that stimulate breathing. Replaced by *ventilation*, analeptic drugs are now seldom used.

anal fissure

A common disorder of the anus that is caused by an elongated ulcer or tear that extends upwards into the anal canal from the anal sphincter (the ring of muscle that surrounds the anal orifice). An anal fissure may be caused by the passage of hard, dry faeces.

There is usually pain during defaecation, and the muscles of the anus may go into spasm. There may also be a small amount of bright red blood on faeces or toilet paper.

The tear often heals naturally over a few days, although spasm of the anal muscles may delay healing. Treatment of recurrent or persistent fissures is usually by *anal dilatation* (a procedure to enlarge the anus) and a high-fibre diet, including whole-grain products, fruit and vegetables, and plenty of fluids, to help soften the faeces. Surgery to remove the fissure is occasionally necessary.

anal fistula

An abnormal channel connecting the inside of the anal canal with the skin surrounding the anus.

An anal fistula may be an indication of *Crohn's disease*, *colitis*, or cancer of the colon or rectum (see *colon, cancer of*; *rectum, cancer of*). In most cases, it is the result of an *abscess* that develops for unknown reasons in the anal wall. The abscess discharges pus into the anus and out on to the surrounding skin.

An anal fistula is treated surgically by opening the abnormal channel and removing the lining. The operation is performed under a general anaesthetic (see *anaesthesia, general*). The wound is then left to heal naturally.

analgesia

The loss of or reduction in pain sensation. Analgesia differs from *anaesthesia* (loss of all sensation) in that sensitivity to touch is still preserved. Analgesia can be induced by the use of *analgesic drugs*.

analgesic drugs

COMMON DRUGS

OPIOIDS • Co-codamol • Co-codaprin • Codeine • Co-dydramol • Co-proxamol • Diamorphine • Dipipanone • Fentanyl • Meptazinol • Methadone • Morphine • Pentazocine • Pethidine • Phenazocine • Tramadol

NSAIDS • Aspirin • Celecoxib • Diclofenac • Diflunisal • Etodolac • Fenbufen • Fenoprofen • Flurbiprofen • Ibuprofen • Indomethacin • Ketoprofen • Ketorolac • Mefenamic acid • Naproxen • Piroxicam • Rofecoxib

OTHER NONOPIOIDS • Nefopam • Paracetamol

Drugs used to relieve pain. The two main types are nonopioid and *opioid* analgesics. Nonopioid analgesics are useful for treating mild to moderate pain. They include *paracetamol* for headache; or toothache and nonsteroidal anti-inflammatory drugs (NSAIDs) such as *aspirin* and *ibuprofen*, which can help to relieve mild pain and stiffness in arthritic conditions. Combinations of a weak opioid (such as *codeine*) with a nonopioid analgesic (such as aspirin) relieve more severe pain. Potent opioids such as *morphine* can produce *tolerance* and *drug dependence* and are used only when other preparations are ineffective.

HOW THEY WORK

When body tissues are damaged, they produce *prostaglandins* (chemicals that trigger the transmission of pain signals to the brain). Except for paracetamol, nonopioid analgesics work by preventing the production of prostaglandin; paracetamol works by blocking the pain impulses within the brain itself, preventing the perception of pain. Opioid analgesics act in a similar way to *endorphins* (pain-relieving substances formed by the body) by blocking pain impulses at specific sites in the brain and spinal cord.

SIDE EFFECTS

Side effects are uncommon with paracetamol; aspirin and most NSAIDs may irritate the stomach lining and cause nausea, abdominal pain, and, rarely, a *peptic ulcer*. Nausea, drowsiness, constipation, and breathing difficulties may occur with opioid analgesics. The euphoric effect produced by some opioid analgesics have led to their abuse.

WARNING

Over-the-counter (nonopioid) analgesic drugs should not be taken for longer than 48 hours, after which time medical advice should be sought. If pain persists, becomes more severe, recurs, or differs from pain previously experienced, a doctor should be consulted. For precautions on specific drugs, see the individual drug entries.

anal phase

A term used in *psychoanalytic theory* to refer to a stage of a person's psychosexual development. The anal phase begins at around 18 months of age and lasts for up to two years. (See also *genital phase*; *oral phase*.)

anal stenosis

Tightness of the anus, sometimes known as anal stricture. Anal stenosis prevents normal passage of faeces, causing constipation and pain during defaecation.

Anal stenosis may be present from birth or may be caused by a number of conditions in which scarring has occurred, such as *anal fissure*, *colitis*, or cancer of the anus. The condition sometimes occurs after surgery on the anus (for example, to treat *haemorrhoids*).

Anal stenosis is treated by *anal dilatation* (a procedure that expands or enlarges the anus).

anal stricture

See *anal stenosis*.

anal tag

A type of *skin tag*.

analysis, chemical

Determination of the identity of a substance or of the individual chemical constituents of a mixture. Analysis may be qualitative (as in determining whether or not a particular substance is present), or it may be quantitative (that is, measuring the amount or concentration of one or more constituents). (See also *assay*.)

analysis, psychological

See *psychoanalysis*.

anaphylactic shock

A rare, life-threatening allergic reaction. Anaphylactic shock is a Type I hypersensitivity reaction (see *allergy*) that occurs in people with extreme sensitivity to a particular substance (an allergen), most commonly insect venom or certain foods or drugs.

When the allergen enters the bloodstream, massive amounts of *histamine* and other chemicals are released, causing sudden, severe lowering of blood pressure and constriction of the airways. Other symptoms of anaphylactic shock may include abdominal pain, diarrhoea, swelling of the tongue and throat, and an itchy rash.

Anaphylactic shock requires emergency medical treatment. An injection of *adrenaline* (epinephrine) may be lifesaving. If the person's breathing or heartbeat has stopped, *cardiopulmonary resuscitation* should be performed, and *antihistamine drugs* and *corticosteroid drugs* may also be given. (See also *hyposensitization*.)

anastomosis

A natural or artificial communication between two blood vessels or between tubular cavities that may or may not normally be joined.

Natural anastomoses usually occur when small *arteries* are attached directly to *veins* without passing through capillaries. Anastomoses occur in the skin where they are used to help control temperature regulation.

A surgical anastomosis is used to create a bypass around a blockage in an artery or in the intestine. They are also used to rejoin cut ends of the bowel or blood vessels. (See also *bypass surgery*.)

anastrozole

An *anticancer drug* that is used to treat advanced *breast cancer* in postmenopausal women.

anatomical snuffbox

A depression on the back of the wrist that is formed between the tendons of the thumb when the thumb is stretched outwards. The anatomical snuffbox is of significance because tenderness in this area is a feature of a fracture of the *scaphoid* bone.

anatomy

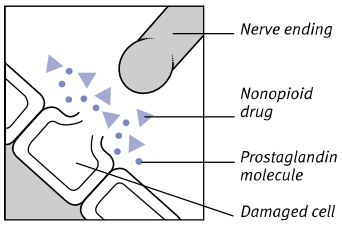
The structure of the body of any living thing, and its scientific study. Human anatomy, together with *physiology* (the study of the functioning of the body), dates back to ancient Egyptian times and forms the foundation of all medical science. The dissection of human corpses has provided the primary source of information for anatomists.

Anatomy as a scientific study today is subdivided into many branches. These include comparative anatomy (the study of the differences between human and animal bodies), surgical anatomy (the practical knowledge required by surgeons), *embryology* (the study of structural changes that occur during the development of the embryo and fetus), systematic anatomy (the study of the structure of particular body systems), and *cytology* and *histology* (the microscopic study of cells and tissues respectively).

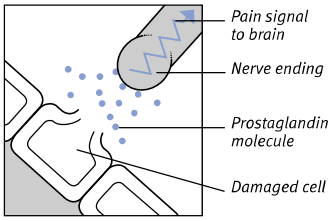
Every anatomical structure is scientifically named in Latin, but today anatomists prefer to use simpler terms,

HOW **ANALGESICS** WORK

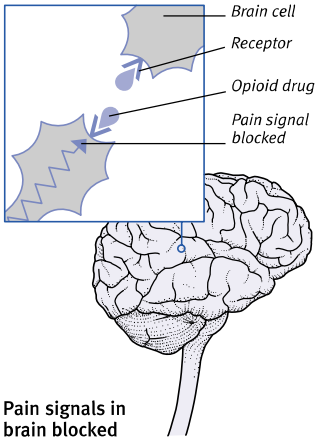
When tissue is damaged (for example, by injury, inflammation, or infection) the body produces prostaglandins. These substances combine with receptors (specific sites on the surface of cells in the brain and spinal cord). As a result, a signal is passed along a series of nerve cells to the brain, where the signal is interpreted as pain by brain cells. Analgesics (except for paracetamol) work either by preventing the production of prostaglandins at the site of damage or by blocking pain impulses in the brain and spinal cord. Paracetamol works by blocking prostaglandin production in the brain, which prevents pain impulses from being transmitted in the brain.



Action of NSAIDs
Nonopioid drugs block the production of prostaglandins (chemicals released in response to tissue damage). This action prevents stimulation of the nerve endings, so that no pain signal passes on to the brain. As a result, these drugs provide pain relief.



Action of opioids
When tissue damage occurs, the body produces prostaglandins, chemicals that trigger the transmission of pain signals (above). Normally, the pain signal is transmitted between brain cells, but opioid drugs (below) combine with opiate receptors to prevent the signals from being transmitted.



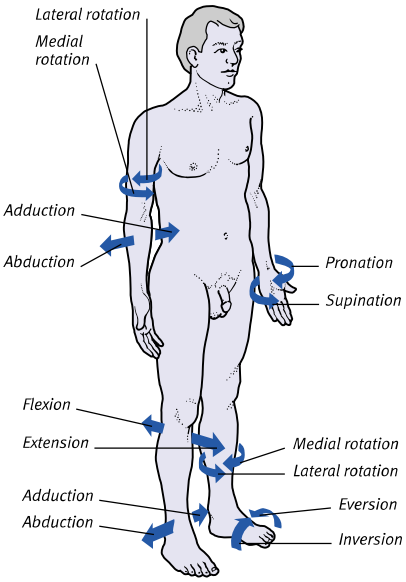
Pain signals in brain blocked

A

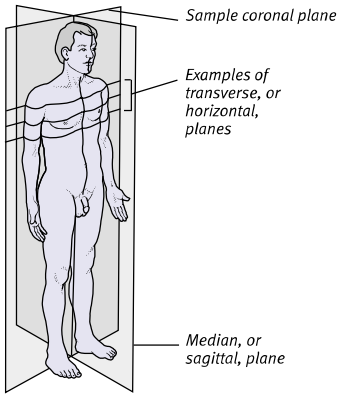
DESCRIPTIVE TERMS IN **ANATOMY**

The relative positions and movements of body parts are conventionally described with reference to the "anatomical position" (that is, an upright posture with the eyes and palms facing forwards). In this position, the parts of the body can be described in relation to various geometrical planes.

In radiology, body imaging pictures (such as CT scans and MRI) are often taken in a series of transverse planes through part of the body.



Joint movements
Extension is straightening, and flexion is bending; abduction is moving away from, adduction is moving towards, the midline of the body. Other movements are forms of rotation around an axis.



Planes through the body
The median plane divides the body into right and left halves. Coronal planes are vertical planes at right angles to the median plane; the coronal plane most often referred to divides the body into front and back halves. Transverse planes are horizontal slices through the body.

where they exist, as alternatives. For example, the main blood vessel in the femur (thigh) is usually referred to as the femoral artery rather than the arteria femoralis. For further information on the descriptive terms used in anatomy, see the illustrated box.

ancylostomiasis

Infestation of the small intestine by the *ANCYLOSTOMA* hookworm species. (See also *hookworm infestation*.)

androblastoma

See *arrhenoblastoma*.

androgen drugs

Natural or synthetic *androgen hormones* (male sex hormones) that are used as drugs, of which one of the most important is *testosterone*. Androgen drugs are used in the treatment of male *hypogonadism* (underactivity of the testes) to stimulate the development of male sexual characteristics.

Androgen drugs are occasionally used to treat certain types of *breast cancer*. They have also been widely used by athletes and bodybuilders wishing to increase their muscle bulk and strength, which can be dangerous to health (see *steroids, anabolic*).

Possible side effects include fluid retention, weight gain, increased blood cholesterol, and, rarely, liver damage. When taken by women, the drugs can lead to the development of male characteristics, such as facial hair.

androgen hormones

A group of hormones (the male sex hormones) that stimulate *virilization* (the development of male secondary sexual characteristics such as growth of facial hair, deepening of the voice, and increased muscle bulk).

FORMATION

Androgens are produced by specialized cells in the *testes* in males and the adrenal glands in both sexes. The ovaries secrete very small quantities of androgens until the menopause. The most active androgen is *testosterone* (produced in the testes). Androgen production by the testes is controlled by certain pituitary hormones called *gonadotrophins*. Adrenal androgens are controlled by *ACTH*, another pituitary hormone.

EFFECTS

Androgens stimulate the appearance, at *puberty*, of male secondary sexual characteristics such as deepening of the voice and the growth of facial hair. They have an anabolic effect (they raise the rate of protein synthesis and lower the rate at which it is broken down), which increases muscle bulk and accelerates growth. At the end of puberty, androgens cause the long bones to stop growing. They also stimulate the secretion of sebum, which, if excessive, causes *acne*. In early adult life, androgens promote male-pattern baldness.

DEFICIENCY

Androgen deficiency may occur if the testes are diseased or the pituitary gland fails to secrete gonadotrophins. Typical effects include high-pitched voice, decreased body and facial hair, underdeveloped genitalia, reduced sexual drive, and poor muscle development.

EXCESS

Overproduction of androgens may be the result of adrenal disorders such as *adrenal tumours*, congenital adrenal hyperplasia (see *adrenal hyperplasia, congenital*), testicular tumours (see *testis, cancer of*), or, rarely, androgen-secreting ovarian tumours (see *ovary, cancer of*).

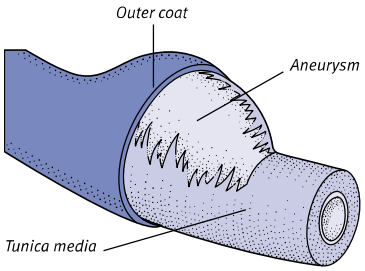
In men, excess androgens accentuate male physical characteristics; in boys, they cause premature sexual development. In women, excess androgens cause virilization, features of which include increased body hair, deepening of the voice, enlarged *clitoris*, and *amenorrhoea* (the absence of menstruation).

anencephaly

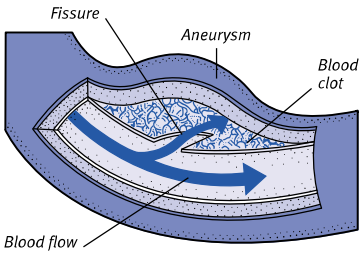
Absence of the brain and cranial vault (top of the skull) at birth. Most infants with anencephaly are stillborn or survive for only a few hours. Anencephaly is detectable early in pregnancy by measurement of the maternal *alpha-fetoprotein*,

TYPES OF **ANEURYSM**

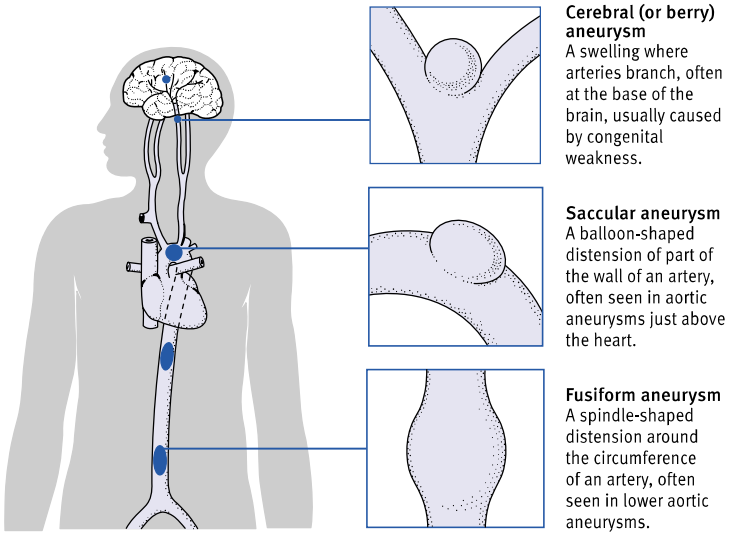
An aneurysm forms when pressure from the blood flow causes a weakened artery wall to distend or forces blood through a fissure. Aneurysms can form anywhere in the body, although the most common sites are the aorta and the arteries supplying the brain.



Common aneurysm
This type forms when the tunica media, the artery's middle wall, is weakened; the strong force of the blood flow distends the wall of the artery.



Dissecting aneurysm
In this type, blood is forced through a fissure in the internal wall of the artery. The internal lining is stripped away, forming a false channel.



Cerebral (or berry) aneurysm
A swelling where arteries branch, often at the base of the brain, usually caused by congenital weakness.

Saccular aneurysm
A balloon-shaped distension of part of the wall of an artery, often seen in aortic aneurysms just above the heart.

Fusiform aneurysm
A spindle-shaped distension around the circumference of an artery, often seen in lower aortic aneurysms.

by *ultrasound scanning*, by *amniocentesis*, or by *fetoscopy*; if anencephaly is detected, termination of the pregnancy may be considered (see *abortion, induced*).

Anencephaly is caused by a failure in the development of the neural tube, which is the nerve tissue in the embryo that normally develops into the spinal cord and brain (see *neural tube defects*).

aneurysm

Abnormal dilation (ballooning) of an *artery* caused by the pressure of blood flowing through a weakened area. The weakening may be due to disease, injury, or a congenital (present from birth) defect of the arterial wall. Aneurysms most commonly affect the *aorta* and arteries supplying the brain.

TYPES AND CAUSES

The most common cause of an aneurysm is *atherosclerosis*, a condition in which fatty deposits weaken the artery wall. The aorta is the usual site of atherosclerotic aneurysms.

Less commonly, aneurysms may be due to a congenital (present from birth) weakness of the artery walls. Most cerebral aneurysms, known as *berry aneurysms* because of their appearance, are congenital. *Marfan syndrome*, an inherited disorder in which the wall of the aorta is defective, is often associated with aneurysms just above the heart. The arterial wall can also be weakened by inflammation, as occurs in *polyarteritis nodosa*. A dissecting aneurysm is one in which the inner layer of the artery wall ruptures, allowing blood to track along the length of the artery and block any branching arteries. Ventricular aneurysms are aneurysms that sometimes develop in the heart wall due to weakening of an area of heart muscle as a result of a heart attack (see *myocardial infarction*).

Some of the common types, sites, and shapes of aneurysm are shown in the illustrated box.

SYMPTOMS AND SIGNS

Most aneurysms are symptomless and remain undetected. However, if the aneurysm expands rapidly and causes pain, or is very large, the symptoms are due to pressure on nearby structures. Aneurysms may eventually rupture, cause fatal blood loss, or, in the case of a cerebral aneurysm, loss of consciousness (see *subarachnoid haemorrhage*). A *dissecting aneurysm* usually causes severe pain, and there is a high risk of the vessel rupturing. Ventricular aneurysms seldom rupture, but they interfere with the pumping action of the heart.

DIAGNOSIS AND TREATMENT

Aneurysms of the aorta may be detected by *ultrasound scanning*, and cerebral aneurysms by *CT scanning* or *MRI*. *Angiography* can provide more detailed information on all types of aneurysm. A ruptured or enlarged aneurysm requires immediate *arterial reconstructive surgery*. (See also *microaneurysm*.)

angina

A strangling or constrictive pain. The term angina has become synonymous with the heart disorder *angina pectoris*. Other types of angina include abdominal angina (abdominal pain after eating caused by poor blood supply to the intestines) and Vincent's angina, which is pain caused by inflammation of the mouth (see *Vincent's disease*).

angina pectoris

Pain in the chest that is the result of insufficient oxygen being carried to the heart muscle in the blood. The pain of angina pectoris usually occurs when the heart is working harder and requires more oxygen, such as during exercise or at times of stress.

CAUSES

Inadequate blood supply to the heart is usually due to *coronary artery disease*, in which the coronary arteries are

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narrowed by *atherosclerosis* (fat deposits on the artery walls). Other causes include coronary artery spasm, in which the blood vessels narrow suddenly for a short time, *aortic stenosis*, in which the heart's aortic valve is narrowed, and *arrhythmias* (abnormal heart rhythms).

The pain of angina pectoris is brought on by exertion and is relieved by rest. If the pain continues, it may be due to a heart attack (see *myocardial infarction*). Rarer causes of the pain include severe *anaemia*, which reduces the blood's oxygen-carrying efficiency, and *polycythaemia*, which thickens the blood and causes its flow through the heart muscle to slow down.

SYMPTOMS

The chest pain of angina varies from mild to severe and is often described as a sensation of pressure on the chest. The pain usually starts in the centre of the chest but can spread to the throat, upper jaw, back, and arms (usually the left), or between the shoulderblades. If it develops during sleep or without provocation, it is called unstable angina.

Other possible symptoms of angina pectoris include nausea, sweating, dizziness, and breathing difficulty.

DIAGNOSIS AND TREATMENT

Diagnostic tests usually include an *ECG* (measurement of the electrical activity of the heart), which may register normal between attacks, and a *cardiac stress test* (an ECG undertaken while the patient is exercising enough to cause chest pain). Blood tests and coronary *angiography* (*X-ray* examination of the blood vessels) may also be performed to look for an underlying cause.

To help to control the symptoms of angina pectoris, it is important for the person to stop smoking and to lose weight if necessary. Attacks may be prevented and treated by *nitrate drugs*, which increase blood flow through the heart muscle. *Beta-blocker drugs*, *calcium channel blockers*, *lipid-lowering drugs*, and *antiplatelet drugs* may also be prescribed.

Drug treatment can control the symptoms for many years but cannot cure the disorder. If attacks become more severe or more frequent, despite treatment, *coronary artery bypass* surgery or *angioplasty* may be necessary.

angina, Prinzmetal's

A type of unstable angina pectoris (see *angina, unstable*) in which the attacks of chest pain occur while the body is at rest and are not brought on by exertion.

angina, unstable

A type of *angina pectoris* (chest pain due to impaired blood supply to the heart muscle) that occurs during sleep or without provocation (such as exertion).

angioedema

A type of reaction caused by *allergy*. Angioedema is similar to urticaria (hives) and is characterized by large, well-defined swellings, of sudden onset, in the skin, larynx (voice-box), and other areas. If they are left untreated, the swellings may last a number of days.

CAUSES

The most common cause of angioedema is a sudden allergic reaction to a food. Less commonly, the condition may be due to a drug allergy (such as to *penicillin*), a reaction to an insect bite or sting, or it may occur as a result of infection, emotional stress, or exposure to animals, moulds, pollens, or cold conditions. There is also a hereditary form of angioedema.

SYMPTOMS

Angioedema may cause sudden difficulty in breathing, swallowing, and speaking, accompanied by swelling of the lips, face, and neck, depending on the area of the body affected.

Angioedema that affects the throat and the larynx is potentially life-threatening because the swelling can block the airway, causing asphyxia (suffocation).

TREATMENT

Severe cases are treated with injections of *adrenaline* (epinephrine) and may require intubation (a breathing tube inserted via the mouth into the windpipe) or *tracheostomy* (surgical creation of a hole in the windpipe) to prevent suffocation. *Corticosteroid drugs* may also be given. In less severe cases, *antihistamine drugs* may relieve symptoms.

angiogenesis

The growth of new blood vessels. Angiogenesis is the process that enables tumours to grow: cancerous cells produce chemicals (called *growth factors*) that stimulate new blood vessels to form near the tumour, supplying it with nutrients and oxygen.

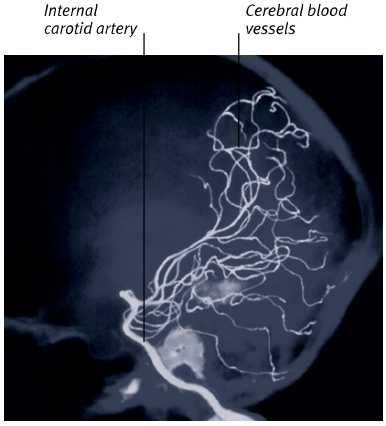
angiography

An imaging procedure that enables blood vessels to be seen clearly on X-ray film following the injection of a *contrast medium* (a substance that is opaque to *X-rays*). Digital subtraction angiography uses computer techniques to process images and remove unwanted background information. Magnetic resonance angiography (MRA) can produce images of blood vessels without the use of a contrast medium.

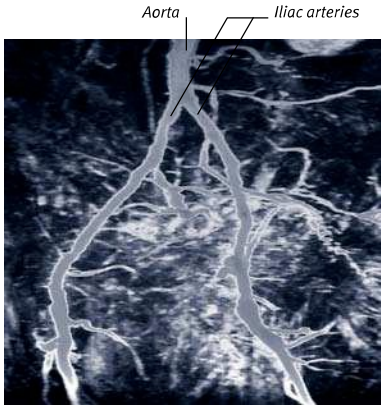
WHY IT IS DONE

Angiography is used to detect conditions that alter the appearance of blood vessels, such as an *aneurysm* (ballooning of an artery) and narrowing or blockage of blood vessels by *atherosclerosis* (fatty deposits lining artery walls), a *thrombus* (abnormal clot), or an *embolus* (fragment of a clot that is carried in the blood). Angiography is also used to detect changes in the pattern of blood vessels that supply organs injured or affected by a tumour.

Carotid angiography (angiography of the arteries in the neck) may be used to



Angiogram of brain
Contrast medium is passed through a catheter into the arteries at the back of the brain, and a series of X-rays is taken.



Magnetic resonance angiogram of groin
This MRA provides a clear image of the arteries of the groin area without the need for X-rays or the injection of radio-opaque dye.

investigate *transient ischaemic attacks* (symptoms of *stroke* lasting for less than 24 hours). Cerebral angiography can be used to detect an aneurysm in the brain or to pinpoint the position of a brain tumour. Coronary angiography, often combined with cardiac *catheterization*, can identify sites of narrowing or blockage in *coronary artery disease*.

During angiography, some types of treatment, such as balloon angioplasty (see *angioplasty, balloon*) and *embolization*, that sometimes eliminate a previous need for surgery may be carried out. (See also *aortography*.)

angioma

A noncancerous tumour made up of blood vessels (see *haemangioma*) or lymph vessels (see *lymphangioma*).

angioplasty, balloon

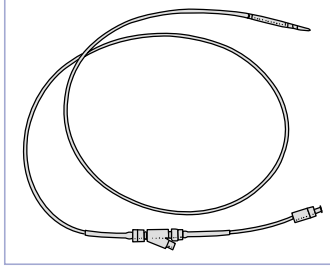
A technique for widening a narrowed or blocked section of blood vessel by the introduction of a balloon-tipped catheter (flexible tube) into the constricted area of the vessel.

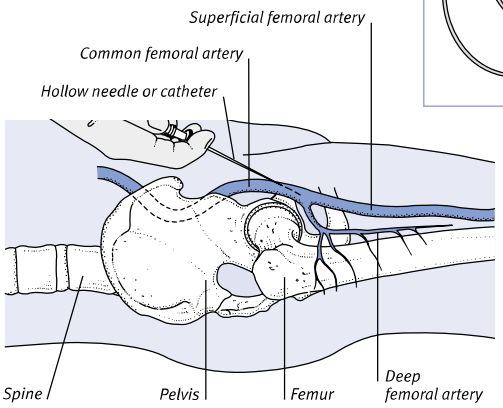
The balloon is inflated to widen the narrowed area, deflated, then removed. Balloon angioplasty is used to increase or restore blood flow in a significantly narrowed artery in *peripheral vascular disease* and *coronary artery disease*.

Coronary balloon angioplasty is usually successful in the short term, but narrowing of the affected vessel may recur, requiring repeat treatment. Angioplasty of peripheral vessels is most successful in treating the iliac and femoral arteries in the legs. Results have improved further with the introduction of stents (metal mesh structures), which are inserted into an artery following balloon dilation to help keep the blood vessel open.

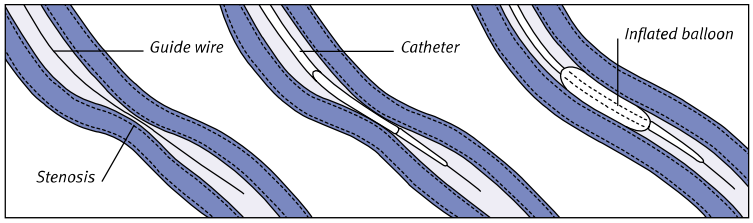
PROCEDURE FOR BALLOON **ANGIOPLASTY**

A blockage or narrowing of a blood vessel may be treated by introducing a balloon catheter into the area and then inflating the balloon to stretch the constricted part. The balloon is then deflated and the catheter withdrawn. The procedure is carried out using a local anaesthetic.





How it is done
A hollow needle is inserted into the femoral artery (left). A guide wire is pushed through the needle into the artery, then along it (using X-ray imaging) towards the blood vessel or heart valve to be treated. Then the steps shown below are carried out.



1 The thin guide wire is manoeuvred through the arteries (using X-ray control) until it is just past the stenosis (narrowing) to be treated.

2 A balloon-tipped catheter (top right) is then threaded over the guide wire and pushed along it until it reaches the narrowed area.

3 A sausage-shaped balloon at the end of the catheter is inflated and deflated a few times, to widen the narrowed part, and then withdrawn.

angiotensin

The name of two related proteins involved in regulating blood pressure. The first, angiotensin I, is inactive and is formed when renin, which is produced by the kidneys, acts on the substance angiotensinogen. Angiotensin I is then converted to the second, active, form, angiotensin II, by angiotensin-converting enzyme.

Angiotensin II causes narrowing of the small blood vessels in tissues, resulting in increased blood pressure. It also stimulates release (from the adrenal cortex, the outer part of each *adrenal gland*) of the hormone *aldosterone*, which also increases blood pressure.

Certain kidney disorders can increase the production of angiotensin II, resulting in *hypertension* (high blood pressure). Hypertension can be treated with *ACE inhibitor drugs*, which reduce the formation of angiotensin II, or with angiotensin II antagonists.

angiotensin-converting enzyme

A substance that converts angiotensin I to its active form, angiotensin II. Drugs that reduce the action of angiotensin-converting enzyme are known as *ACE inhibitor drugs* and are used in the treatment of *hypertension* (high blood pressure) and *heart failure* (reduced pumping efficiency of the heart).

angiotensin-II antagonists

COMMON DRUGS

• Candesartan • Irbesartan • Losartan • Valsartan

A group of drugs used in the treatment of *hypertension* (high blood pressure). Angiotensin-II antagonists have a similar action to *ACE inhibitor drugs* (in that they block the action of *angiotensin* II) but do not cause the persistent dry cough that is a common side effect of treatment with ACE inhibitors.

angular stomatitis

See *stomatitis*.

anhedonia

Total loss of the feeling of pleasure from activities that would normally give pleasure. Anhedonia is often one of the common symptoms of *depression*.

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anhidrosis

Complete absence of sweating. (See also *hypohidrosis*.)

animal experimentation

The use of live animals in research and safety testing to provide information about animal biology or, by inference, human physiology or behaviour. Animal research has contributed to the development of surgical techniques, such as transplant surgery and drugs, such as vaccines. Due to ethical concerns, however, alternative practices, such as cell cultures, are now used whenever possible.

animals, diseases from

See *zoonosis*.

anion

An *ion* of negative charge, such as a chloride ion. (See also *electrolyte*.)

anisometropia

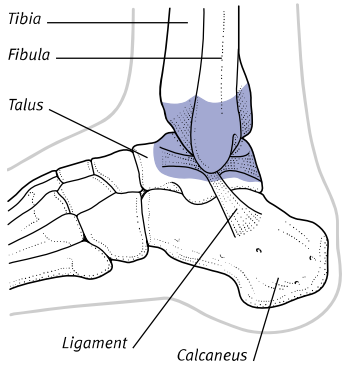
Unequal focusing power in the two eyes, usually due to a difference in size and/or shape of the eyes, that causes visual discomfort. For example, one eye may be normal and the other affected by *myopia* (shortsightedness), *hypermetropia* (longsightedness), or *astigmatism* (uneven curvature of the cornea). Glasses or contact lenses correct the problem in most cases.

ankle joint

The hinge joint between the foot and the leg. The talus (uppermost bone in the foot) fits between the two bony protuberances formed by the lower ends of the tibia (shinbone) and the fibula (outer bone of the lower leg). Strong ligaments on either side of the ankle joint give it support. The ankle joint allows for up-and-down movement of the foot.

LOCATION OF THE ANKLE JOINT

The hinge joint is formed where the top of the talus fits in between the lower ends of the tibia and fibula.



DISORDERS

An ankle *sprain* is one of the most common injuries. It is usually caused by twisting of the foot over on to its outside edge, which causes overstretching and bruising of the ligaments. Severe sprains can result in tearing of the ligaments, which may need to be repaired surgically.

Violent twisting of the ankle can result in a combined fracture and dislocation, known as *Pott's fracture*, in which the fibula breaks above the ankle and either the tibia breaks or the ligaments tear, resulting in dislocation of the ankle.

ankylosing spondylitis

An uncommon inflammatory disease affecting joints between the vertebrae of the spine and the sacroiliac joints (the joints between the spine and the pelvis). Ankylosing spondylitis may also affect other large joints, such as those in the hips.

CAUSES AND INCIDENCE

The cause of ankylosing spondylitis is usually unknown, but in some cases the disease may be associated with *colitis* (inflammation of the colon) or *psoriasis* (a skin disease). Ankylosing spondylitis may run in families; and about 90 per cent of people with the condition have the genetically determined *histocompatibility antigen* (HLA-B27).

SYMPTOMS

Ankylosing spondylitis usually starts with pain and stiffness in the hips and lower back that are worse after resting and are especially noticeable in the early morning. Other, less common, symptoms include chest pain, painful heels due to additional bone formation, and redness and pain in the eyes due to *iritis* (inflammation of the iris). In time, inflammation in the spine can lead to *ankylosis* (permanent stiffness and limited movement) and *kyphosis* (curvature of the spine).

DIAGNOSIS AND TREATMENT

Ankylosing spondylitis can be diagnosed by *X-rays* and *blood tests*. There is no cure, but treatment with a programme of exercise and physiotherapy and *anti-inflammatory drugs* can reduce the pain and limitation of movement. In some cases, DMARDs (see *disease-modifying antirheumatic drugs*) are also prescribed. To prevent curvature of the spine, patients are taught breathing exercises and exercises to improve posture.

ankylosis

Complete loss of movement in a joint that results from fusion of the bony surfaces. Ankylosis may be caused by degeneration as a result of inflammation, infection, or injury. The condition can also be produced surgically by an operation to fuse a diseased joint to correct deformity or to alleviate persistent pain (see *arthrodesis*). (See also *ankylosing spondylitis*.)

annular

A term meaning shaped like a ring. Annular is a description applied to certain body structures, such as ligaments, and, in dermatology, to the appearance of skin rashes, such as ringworm. The term may also be applied to a cancer that encircles an organ.

anodontia

Failure of some or all of the teeth to develop. Anodontia, which can be partial or total, may be due to the absence of tooth buds at birth, or it may be the result of damage to developing tooth buds by infection or other widespread disease. Both primary and permanent teeth may be affected. Partial anodontia is far more common than total.

If only a few teeth are missing, a dental *bridge* (false teeth that are attached to natural teeth on either side of the gap) can be fitted. If all the teeth are missing, a *denture* is required. Recently, however, dental implants (see *implant, dental*) have become the treatment of choice in selected cases (in which the individual has the correct anatomy and bone density).

anomaly

A deviation from what is accepted as normal, especially a birth defect such as a limb malformation.

Anopheles

A genus of disease-transmitting mosquitoes, many species of which are carriers of *malaria*. (See also *mosquito bites*.)

anorexia

The medical term for loss of appetite (see *appetite, loss of*).

FEATURES OF ANOREXIA NERVOSA

- Weight loss
- Overactivity and obsessive exercising
- Tiredness and weakness
- Lanugo (babylike) hair on body, thinning of hair on head
- Extreme choosiness over food
- Binge eating
- Induced vomiting
- Use of laxatives to promote weight loss

anorexia nervosa

An eating disorder that is characterized by severe weight loss and altered self-image that leads sufferers to believe that they are fat even when they are, in fact, dangerously underweight.

CAUSES AND INCIDENCE

The causes of anorexia are unclear, but the condition may be linked to a lack of self-worth that leads to excessive concern over physical appearance. Sufferers may feel that they can have some control over their lives by controlling their eating. Normal dieting may develop into starvation.

Anorexia nervosa most commonly affects teenage girls and young women, but the incidence in young men is rising.

SYMPTOMS AND SIGNS

In the early stages, sufferers may be overactive and may exercise excessively. They are obsessed with food, and often make complicated meals for others, but are reluctant to eat socially and avoid eating the meals themselves. As their weight loss continues, they become tired and weak, the skin becomes dry, lanugo hair (fine, downy hair) grows on the body, and normal hair becomes thinner. Starvation leads to *amenorrhoea* (the absence of menstrual periods) in many women.

Some sufferers of anorexia nervosa have food binges and then make themselves vomit, or take *laxative drugs* or *diuretic drugs*, to promote weight loss (see *bulimia*). Chemical imbalances as a result of starvation, with or without vomiting, can cause potentially fatal cardiac *arrhythmias*.

TREATMENT AND OUTLOOK

Hospital treatment is often necessary and is usually based on a closely controlled feeding programme combined with *psychotherapy* or *family therapy*. For some people, *antidepressant drugs* may be helpful. Many sufferers relapse after treatment, and long-term psychotherapy is required.

anorgasmia

Inability to achieve orgasm (see *orgasm, lack of*).

anosmia

Loss of the sense of *smell*.

anovulatory menstruation

The occurrence of a menstrual cycle during which there is no *ovulation* (release of an egg from the ovary). Anovulatory menstruation is often the result of reduced production of the hormone *oestrogen* and occurs most commonly at the beginning and the end of reproductive life, in which case it is normal. However, anovulatory menstruation may also be a sign of a hormonal abnormality. (See also *fertility*; *menstruation*.)

anoxia

The total absence of oxygen within a body tissue such as the brain or a muscle. Anoxia causes disruption of cell *metabolism* (chemical activity) and results in cell death unless it is corrected within a few minutes.

Anoxia is rare, occurring during cardiopulmonary arrest or asphyxiation. It will cause permanent organ damage or even death if not corrected. *Hypoxia* (the reduction of oxygen supply to a tissue) is a more common problem.

Antabuse

A brand name for *disulfiram*, a drug used to treat *alcohol dependence*. Antabuse is a powerful deterrent, which, if taken with even a small amount of alcohol, produces extremely unpleasant side effects such as nausea, headache, dizziness, and *palpitations*.

antacid drugs

COMMON DRUGS

• Aluminium hydroxide • Calcium carbonate • Hydrotalcite • Magnesium hydroxide • Sodium bicarbonate

Drugs that are taken to relieve the symptoms of *indigestion*, *heartburn*, *acid reflux* (the regurgitation of stomach acids into the oesophagus), *oesophagitis* (inflammation of the oesophagus), and *peptic ulcer*.

HOW THEY WORK

Antacids usually contain compounds of *magnesium* or *aluminium*, which neutralize stomach acid. Some also contain alginates, which protect the oesophagus by reducing *acid reflux*, or dimeticone, an antifoaming agent, which helps to relieve flatulence.

SIDE EFFECTS

Aluminium may cause constipation, and magnesium may cause diarrhoea. These effects can be avoided, however, if a preparation contains both ingredients. Antacids interfere with the absorption of many drugs and should therefore not be taken at the same time as other medications.

WARNING

Antacids should not be taken regularly except under medical supervision because they may suppress the symptoms of a more serious disorder or provoke serious complications.

antagonist

Having an opposing effect. For example, antagonist drugs counteract the effects of naturally occurring chemicals in the body. (See also *agonist*.)

antenatal care

The care of a pregnant woman and her unborn baby throughout pregnancy to ensure that both are healthy at delivery. Antenatal care involves regular visits to a doctor or midwife, who performs blood and urine tests and abdominal examinations and also monitors blood pressure and fetal growth in order to detect disease or potential problems (see the antenatal screening procedures chart, overleaf).

High-risk pregnancies, in which, for example, the woman suffers from *hypertension* (high blood pressure) or diabetes (see *diabetic pregnancy*), require more frequent antenatal visits. In some cases, the woman may be admitted to hospital for closer observation.

Ultrasound scanning is carried out to identify any abnormalities in the fetus. *Amniocentesis* or *chorionic villus sampling* may be performed if the fetus is thought to be at increased risk of a *chromosomal abnormality* or a *genetic disorder*. Electronic fetal monitoring may be carried out, in order to check the fetal heartbeat, in pregnancies that are high-risk or overdue.

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ANTENATAL SCREENING PROCEDURES

When performed	Procedure	Reason for procedure
First visit	Medical history and examination	To look for pre-existing risk factors, such as long-term illnesses.
	Urine tests	To check the urine for glucose, which may indicate diabetes developing in pregnancy and for protein, which may indicate pre-existing kidney disease.
	Blood test	To determine the woman's blood type and to check for anaemia; antibodies to rubella; hepatitis B virus; and, sometimes, after discussion, HIV infection which might be transmitted to the baby. Genetic counselling may be offered to couples with a family history of inherited disease or from ethnic groups at high risk.
	Weight and blood pressure	To provide initial measurements against which later ones are compared.
Between 11 and 20 weeks	Ultrasound scans (one or more)	To check the age of the fetus and to look for fetal abnormalities.
Follow-up visits at regular intervals from 11 weeks to delivery	Weight (not routine in women of normal weight) and examination	To assess the growth of the fetus and to see which way it is lying in the uterus.
	Urine tests	To detect diabetes or pre-eclampsia.
	Blood pressure	To detect developing pre-eclampsia.
	Blood tests (at some visits only)	To look for anaemia and, in combination with ultrasound scanning, to assess the risk of fetal abnormalities such as neural tube defects or Down's syndrome. A test to screen for diabetes mellitus in the mother may also be necessary.

The woman is also advised on general aspects of pregnancy, such as diet, exercise, and techniques to help her with childbirth. (See also *childbirth, natural.*)

antepartum haemorrhage

Bleeding from the vagina after the 28th week of pregnancy.

Antepartum haemorrhage is most commonly due to a problem with the placenta (the organ in the uterus that sustains the developing fetus), such as *placenta praevia* (in which the placenta is positioned too close to the birth canal) or *placental abruption* (detachment of part of the placenta from the wall of the uterus). Bleeding can also be caused by *cervical erosion* or other disorders of the cervix or vagina.

SYMPTOMS

The bleeding is often painless but may be accompanied by abdominal pain if the placenta becomes partly separated from the uterus.

Investigation and treatment requires hospital admission. *Ultrasound scanning* is used to diagnose problems with the placenta. In some cases, it is necessary only to keep a careful watch on the condition of the woman and her baby. If the bleeding is severe, the woman is given a *blood transfusion*; the baby may be delivered immediately by *caesarean section*.

anterior

Relating to the front of the body. In human *anatomy*, the term is synonymous with *ventral*.

anterior knee pain syndrome

See *chondromalacia patellae.*

anterior compartment syndrome

See *compartment syndrome; shin splints*.

anthelmintic drugs

COMMON DRUGS

• Albendazole • Diethylcarbamazine • Ivermectin • Levamisole • Mebendazole • Niclosamide • Piperazine • Praziquantel • Tiabendazole

A group of drugs that are used to eradicate *worm infestation* of the body. Anthelmintic drugs kill or paralyse worms in the intestines, preventing them from gripping the intestinal wall, and causing them to pass out of the body in the *faeces*.

Possible side effects of anthelmintic drugs include nausea, abdominal pain, rash, headache, and dizziness.

anthracosis

An outdated term for coal workers' *pneumoconiosis*. Anthracosis is a lung disease caused by inhalation of large amounts of coal dust over many years.

anthrax

A serious bacterial infection of livestock that occasionally spreads to humans. The most common form of the infection in humans is cutaneous anthrax, which affects the skin. Another form, pulmonary anthrax, affects the lungs and is potentially fatal.

CAUSES

Anthrax is caused by BACILLUS ANTHRACIS. This bacterium produces spores that can remain dormant for years in soil and animal products and are capable of reactivation.

Animals become infected by grazing on contaminated land. Infection can occur in humans via a scratch or a sore if materials from infected animals are handled. Pulmonary anthrax occurs as a result of inhaling spores from infected animal fibres.

SYMPTOMS AND TREATMENT

In cutaneous anthrax, a raised, itchy, area develops at the site of entry of the spores, progressing to a large blister and finally a black scab, with swelling of the surrounding tissues. Cutaneous anthrax is treatable in its early stages with *antibiotic drugs*. Without treatment, infection may spread to lymph nodes and the bloodstream and may be fatal.

Pulmonary anthrax causes severe breathing difficulty and may be fatal despite intensive treatment.

antiallergy drugs

Drugs used to treat or prevent allergic reactions (see *allergy*). There are several types of antiallergy drug, including *antihistamine drugs*, *leukotriene receptor antagonists*, *sodium cromoglicate*, and *corticosteroid drugs*.

antianxiety drugs

A group of drugs that are used to relieve the symptoms of *anxiety*. *Benzodiazepine drugs*, buspirone, and *beta-blocker drugs* are the three main types of antianxiety drug, although *antidepressant drugs* are often used. In most cases, the underlying disorder is best treated by counselling, psychotherapy, or other forms of therapy.

Benzodiazepine drugs promote mental and physical relaxation by reducing nerve activity in the brain; they can also be used to treat insomnia but their use for this purpose is avoided because they are addictive; buspirone is less addictive. Beta-blockers reduce only the physical symptoms of anxiety, such as shaking and palpitations, and are not addictive.

antiarrhythmic drugs

A group of drugs used to prevent or treat different types of *arrhythmia* (irregular heartbeat).

A number of drugs are used to prevent intermittent arrhythmias or slow the rate if an arrhythmia is persistent. These include *beta-blocker drugs*, *calcium channel blockers*, *digitalis drugs*, *amiodarone*, *disopyramide*, flecainide, *lidocaine* (lignocaine), mexiletine, and *procainamide*. Some antiarrhythmic drugs, such as adenosine and bretyllium, may only be used in hospital. They may be given intravenously to treat arrhythmias that are causing symptoms such as breathlessness or chest pain.

HOW THEY WORK

The heart's pumping action is governed by electrical impulses. Some antiarrhythmics alter these impulses within, or on their way to, the heart; others affect the heart muscle's response to the impulses received.

SIDE EFFECTS

Side effects of antiarrhythmic drugs are common, and they often include nausea and a rash. Some can result in tiredness or breathlessness because they reduce the pumping ability of the heart.

antibacterial drugs

A group of drugs that are used to treat infection due to *bacteria*. The term antibacterial was once used to describe only those *antibiotic drugs* that had been produced synthetically rather than naturally. The two terms are now used interchangeably.

antibiotic drugs

COMMON DRUGS

AMINOGLYCOSIDES • Amikacin • Gentamicin • Neomycin • Netilmicin • Streptomycin • Tobramycin

CEPHALOSPORINS • Cefaclor • Cefadroxil • Cefalexin • Cefamandole • Cefazolin • Cefixime • Cefotaxime • Cefoxitin • Cefpodoxime • Cefradine • Ceftazidime

MACROLIDES • Azithromycin • Clarithromycin • Erythromycin

PENICILLINS • Amoxicillin • Ampicillin • Azlocillin • Aztreonam • Benzylpenicillin • Co-amoxiclav • Co-fluampicil • Flucloxacillin • Imipenem • Phenoxymethylpenicillin

TETRACYCLINES • Doxycycline • Oxytetracycline • Tetracycline

OTHERS • Chloramphenicol • Ciprofloxacin • Colistin • Fusidic acid • Metronidazole • Rifampicin • Spectinomycin • Teicoplanin • Trimethoprim • Vancomycin

A group of drugs used to treat infections caused by *bacteria* and to prevent bacterial infection in individuals who are *immunocompromized*. Most of the commonly used antibiotic drugs belong to one of the following classes: *aminoglycosides*, *cephalosporins*, *macrolides*, *penicillins*, and *tetracyclines*. Some antibiotics are effective against only certain types of bacteria; others, which are known as broad-spectrum antibiotics, are effective against a wide range.

ANTIBIOTIC RESISTANCE

Some bacteria develop resistance to a previously effective antibiotic drug. This resistance is most likely to occur during long-term treatment. Some alternative antibiotics are available to treat bacteria that have become resistant to the more commonly prescribed drugs.

SIDE EFFECTS

Most antibiotic drugs can cause nausea, diarrhoea, or a rash. Antibiotics may disturb the normal balance of "good" bacteria in the body. This can cause problems such as *candidiasis* (thrush), in which there is excess growth of fungus. Some individuals experience a severe allergic reaction to the drugs, resulting in facial swelling, itching, or breathing difficulty.

WARNING

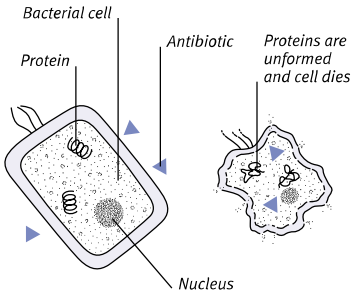
Patients should inform their doctor of any previous allergic reaction that they have had to an antibiotic drug.

antibody

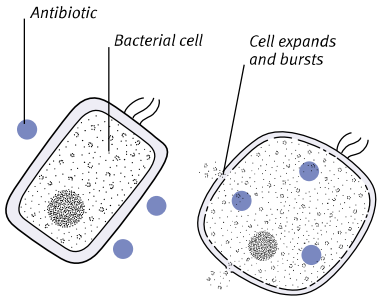
A protein that is made by certain lymphocytes (white blood cells) to neutralize an *antigen* (foreign protein) in the body. Bacteria, viruses, and other microorganisms contain a number of antigens; antibodies that are formed

HOW ANTIBIOTICS WORK

Antibiotic drugs are either bactericidal or bacteriostatic. Bactericidal antibiotics, such as penicillins and cephalosporins, kill bacteria directly. Bacteriostatic antibiotics, such as erythromycin, halt growth and multiplication of the bacteria, allowing the immune system to cope with the infection.



Bacteriostatic antibiotics
These drugs prevent the production of proteins that the bacterial cell needs in order to grow and multiply, and the cell eventually dies.



Bactericidal antibiotics
These kill bacteria directly by causing the cell wall to disintegrate; water is taken into the cell, which expands and then bursts.

A

against these antigens help the body to neutralize or destroy the invading microorganisms. Antibodies may also be formed in response to *vaccines*, thereby giving immunity against certain infections. Antibodies are also known as *immunoglobulins*.

Inappropriate or excessive formation of antibodies may lead to illness, as in an *allergy*. Antibodies against antigens in organ transplants may result in rejection of the transplanted organ. In some disorders, antibodies are formed against the body's own tissues, resulting in an *autoimmune disorder*.

antibody, monoclonal

An artificially produced *antibody* that neutralizes only one specific *antigen* (foreign protein).

Monoclonal antibodies are produced in a laboratory by stimulating the growth of large numbers of antibody-producing cells that are genetically identical. In effect, this process enables antibodies to be tailor-made to react with a particular antigen.

Monoclonal antibodies are used in the study of human cells, hormones, microorganisms, and in the development of vaccines. They are also being used in the diagnosis and treatment of some forms of cancer. Genetically engineered monoclonal antibodies are designed to bind to the proteins on the surface of certain cancer cells, marking them out for destruction. The immune system can then recognize these marked cells and destroy them.

anticancer drugs

COMMON DRUGS

ALKYLATING AGENTS • Chlorambucil • Cyclophosphamide • Melphalan

ANTIMETABOLITES • Cytarabine • Fluorouracil • Mercaptopurine • Methotrexate

CYTOTOXIC ANTIBIOTICS • Doxorubicin • Epirubicin

HORMONE TREATMENTS • Anastrozole • Bicalutamide • Cyproterone acetate • Flutamide • Goserelin • Letrozole • Leuprorelin • Medroxyprogesterone • Megestrol • Tamoxifen

CYTOKINES • Interferon alfa • Interleukin 2

TAXANES • Docetaxel • Paclitaxel

OTHERS • Carboplatin • Cisplatin • Etoposide • Irinotecan • Rituximab

Drugs that are used to treat many forms of *cancer*. Some tumours respond to drug treatment better than others. Anticancer drugs are particularly useful in the treatment of *lymphomas*, *leukaemias*, *breast cancer*, cancer of the testis (see *testis, cancer of*), and *prostate cancer*.

HOW THEY WORK

Most anticancer drugs are cytotoxic (they kill or damage cells or prevent them from dividing). Cytotoxic drugs fall into several classes, including alkylating agents, antimetabolites, cytotoxic antibiotics, and taxanes. *Cytokines* (proteins released by cells in response to the presence of harmful organisms) such as interferon alpha bind to other cells, activating the immune response (see *immune system*).

In some cases, drug treatment is used alone, but it is often combined with surgery or *radiotherapy*. Anticancer drugs are often given in combination to maximize their effects. Treatment with cytotoxic drugs is commonly given by injection in short courses repeated at intervals.

SIDE EFFECTS

Some cytotoxic drugs cause nausea and vomiting and may cause hair loss and increased susceptibility to infection. Others (such as tamoxifen for breast cancer) are given continuously by mouth for months or years and cause few side effects.

anticholinergic drugs

COMMON DRUGS

AS BRONCHODILATORS • Ipratropium bromide • Oxitropium

FOR IRRITABLE BOWEL SYNDROME • Atropine • Dicycloverine • Hyoscine • Propantheline

FOR PARKINSONISM • Benztropine • Biperiden • Orphenadrine • Procyclidine • Trihexyphenidyl (Benzhexol)

FOR URINARY INCONTINENCE • Flavoxate • Oxybutynin • Propiverine • Tolterodine • Trospium

A group of drugs, also called antimuscarinics, that are used in the treatment of *irritable bowel syndrome*, urinary incontinence (see *incontinence, urinary*), COPD (see *pulmonary disease, chronic obstructive*), *Parkinson's disease*, and *bradycardia* (an abnormally slow heartbeat). Anticholinergic drugs are used to dilate the pupil before eye examination or surgery. They may also be used as *premedication* before general anaesthesia (see *anaesthesia, general*) and to treat *motion sickness*.

HOW THEY WORK

Anticholinergics block the effects of *acetylcholine*, a chemical released from nerve endings in the parasympathetic *autonomic nervous system*. Acetylcholine triggers activity in a number of cells. For example, it stimulates muscle contraction, slows the heartbeat, and increases secretions in the mouth and lungs.

SIDE EFFECTS

Possible side effects of anticholinergics may include dry mouth, blurred vision, urinary retention, and confusion.

anticoagulant drugs

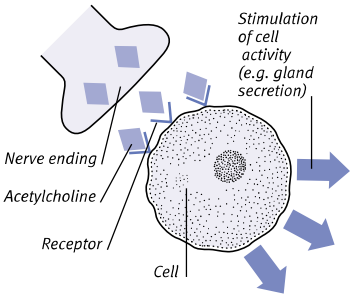
COMMON DRUGS

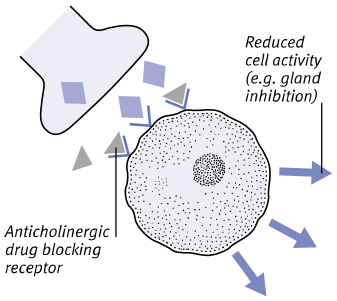
• Certoparin • Dalteparin • Danaparoid • Enoxaparin • Heparin • Nicoumalone • Tinzaparin • Warfarin

A group of drugs used to treat and prevent abnormal *blood clotting*, to treat *thrombosis*, and to prevent and treat

HOW ANTICHOLINERGICS WORK

Acetylcholine combines with a receptor on the cell's surface. This interaction stimulates activity in that cell (e.g. contraction of a muscle fibre or secretion of a fluid). Anticholinergic drugs block the stimulatory action of acetylcholine by combining with the acetylcholine receptors. This action produces, for example, muscle relaxation (e.g. in the bladder, intestine, and bronchi) and dries up secretions in the mouth and lungs. Anticholinergic drugs are used to treat COPD and other conditions.





stroke and *transient ischaemic attack* (symptoms of stroke lasting less than 24 hours). Anticoagulant drugs are also given long-term to prevent abnormal blood clotting after major surgery (especially heart-valve replacement) or during haemodialysis (see *dialysis*).

The most common anticoagulants are *heparin* and the newer heparin-derived drugs, such as tinzaparin, all of which have to be given by injection, and *warfarin*, which is taken orally. Heparin is usually given initially and is then withdrawn when warfarin therapy has become effective.

HOW THEY WORK

Anticoagulant drugs reduce the activity of certain enzymes, known as blood clotting factors, that are needed for the blood to clot. Anticoagulants do not dissolve clots that have already formed, which can be treated with *thrombolytic drugs*, however they may help to stabilize an existing clot so that it does not brake away causing an *embolism* (blockage of an artery by a blood clot).

SIDE EFFECTS

Excessive doses of warfarin or its use with other drugs, such as aspirin and alcohol, may increase the risk of unwanted bleeding. Regular monitoring with *blood-clotting tests* is required.

WARNING

A doctor should always be consulted before any other drug is taken during anticoagulant treatment.

anticonvulsant drugs

COMMON DRUGS

• Carbamazepine • Clobazam • Clomethiazole • Clonazepam • Diazepam • Ethosuximide • Gabapentin • Lamotrigine • Lorazepam • Phenobarbital • Phenytoin • Piracetam • Primidone • Sodium valproate • Tiagabine • Topiramate • Vigabatrin

A group of drugs used to treat or prevent seizures. Anticonvulsant drugs are used mainly in the treatment of *epilepsy*, but they are also prescribed to prevent seizures following serious *head injury* or some types of brain surgery. They may be needed to control seizures in children with a high fever (see *convulsions, febrile*). Different drugs are effective at treating different types of seizure.

HOW THEY WORK

Seizures are caused by an abnormally high level of electrical activity in the brain. Anticonvulsant drugs have an inhibitory effect that suppresses this excessive electrical activity, thereby preventing its spread throughout areas of the brain. If seizures continue following treatment with an anticonvulsant, two drugs may be used in combination.

SIDE EFFECTS

Anticonvulsants may produce various side effects, including impaired memory, reduced concentration, poor coordination, and fatigue. If the side effects are troublesome, an alternative anticonvulsant can be tried. The dose of an anticonvulsant drug may need to be monitored using *blood tests*.

WARNING

The dosage of anticonvulsants should not be reduced or the treatment stopped without a doctor being consulted first. the doctor will supervise a gradual reduction in dosage. Stopping the drugs abruptly could cause withdrawal symptoms and a recurrence of the original problem.

antidepressant drugs

COMMON DRUGS

SELECTIVE SEROTONIN REUPTAKE INHIBITORS (SSRIS) • Citalopram • Fluoxetine • Fluvoxamine • Paroxetine • Sertraline

TRICYCLICS (TCAS) • Amitriptyline • Amoxapine • Clomipramine • Dosulepin • Doxepin • Imipramine • Lofepramine • Nortriptyline • Trimipramine

MONOAMINE OXIDASE INHIBITORS (MAOIS) • Isocarboxazid • Moclobemide • Phenelzine

OTHERS • Flupentixol • Maprotiline • Mianserin • Mirtazapine • Reboxetine • Trazodone • Venlafaxine

Drugs used in the treatment of *depression*. Most of the commonly used antidepressant drugs belong to one of the following groups: *tricyclic antidepressants* (TCAs), *selective serotonin reuptake inhibitors* (SSRIs), and *monoamine oxidase inhibitors* (MAOIs).

HOW THEY WORK

Normally, brain cells release enough *neurotransmitters* (chemical messengers) in the brain to stimulate nearby brain cells. Neurotransmitters are constantly being reabsorbed into the brain cells by another chemical, monoamine oxidase. Depression is thought to be due to a reduction in the release of neurotransmitters. TCAs increase the level of the neurotransmitters noradrenaline (norepinephrine) and serotonin by preventing their reabsorption. MAOIs work by blocking the action of monoamine oxidase, which increases neurotransmitter levels. SSRIs only prevent the reabsorption of serotonin.

Antidepressants usually relieve the symptoms of depression, but it often takes two to three weeks for any beneficial effects to be felt. Treatment usually lasts for at least six months; and the dosage is reduced gradually before being stopped altogether.

SIDE EFFECTS

TCAs may cause constipation, a dry mouth, drowsiness, blurred vision, urinary difficulty, and irregular heartbeat. SSRIs may cause nausea, indigestion, loss of appetite, or sexual difficulties but are less dangerous in overdose than other antidepressants. MAOIs may interact with foods and other drugs, although *moclobemide* is less likely to cause problems.

Antidepressants are not addictive, but abrupt withdrawal of some types can result in physical symptoms and should therefore be avoided.

WARNING

Food and drink containing tyramine (for example, cheese and red wine) and other drugs may cause a dangerous rise in blood pressure when taken during treatment with an MAOI. Always tell your doctor if you are taking an MAOI.

antidiabetic drugs

COMMON DRUGS

SULPHONYLUREA DRUGS • Chlorpropamide • Glibenclamide • Gliclazide • Glimepiride • Glipizide • Gliquidone • Tolbutamide

OTHERS • Acarbose • Glucagon • Guar gum • Insulin • Insulin lispro • Metformin • Repaglinide • Rosiglitazone

A group of drugs that are used to treat *diabetes mellitus*, in which a lack of *insulin*, or resistance to its actions, results in *hyperglycaemia* (high levels of glucose in the blood). A wide range of antidiabetics are used to keep the blood glucose level as close to normal as possible, thereby reducing the risk of complications such as vascular (blood vessel) disease. Antidiabetic drugs include insulin, which must be administered by injection, and oral hypoglycaemics (see *hypoglycaemics, oral*) such as *glibenclamide* and *metformin*.

HOW THEY WORK

Most antidiabetic drugs promote the uptake of glucose into the body tissues, helping to prevent an excessive rise in blood glucose levels. However, different antidiabetics work in different ways. *Acarbose* and *guar gum* reduce or slow the absorption of carbohydrate from the intestines after meals. *Repaglinide*

stimulates release of insulin from the pancreas. *Rosiglitazone* reduces resistance to the effects of insulin in the tissues and may be used together with other hypoglycaemics.

SIDE EFFECTS

Certain antidiabetics may lower the blood glucose level too much, leading to *hypoglycaemia* (low blood glucose levels). Rarely, these drugs may also cause a decreased blood cell count, a rash, or intestinal or liver disturbances.

Metformin does not cause hypoglycaemia, although treatment with this drug may result in nausea, appetite loss, abdominal distension, and diarrhoea. It should not be taken by people with liver, kidney, or heart problems.

antidiarrhoeal drugs

COMMON DRUGS

ANTISPASMODICS • Atropine • Dicycloverine • Hyoscine

OPIOIDS • Codeine • Diphenoxylate • Loperamide

BULK-FORMING AGENTS AND ADSORBENTS • Ispaghula • Kaolin • Methylcellulose

Drugs that are used to reduce or stop diarrhoea and to help regulate bowel action in people who have had a *colostomy* or *ileostomy*. In most acute (of sudden onset) cases of diarrhoea, the only treatment recommended is *oral rehydration therapy*. Antidiarrhoeal drugs are not suitable for children.

HOW THEY WORK

Antidiarrhoeal drugs include adsorbents (such as kaolin), which can absorb the toxic substances that cause diarrhoea; bulk-forming agents (such as ispaghula), which absorb water from the faeces thereby making them firmer; and antimotility drugs (including the opioid drugs, *morphine* and *codeine*, and loperamide, which is chemically similar to opioids but does not have an opioid effect), which slow movement through the intestine.

SIDE EFFECTS

Antidiarrhoeal drugs may cause constipation. In cases of diarrhoea that has resulted from an infection, antidiarrhoeals may delay recovery by slowing down the elimination of the causative microorganisms.

Bulk-forming agents may cause intestinal obstruction if taken without sufficient drinking water or if the bowel is narrowed.

Prolonged use of opioid antidiarrhoeals may lead to physical dependence (see *drug dependence*), producing nausea, abdominal pain, and diarrhoea if the drug is stopped suddenly.

WARNING

Antidiarrhoeals should not be taken regularly except on medical advice since they may mask a serious underlying disorder.

antidiuretic hormone

See *ADH*.

antidote

A substance that neutralizes or counteracts the effects of a poison.

A chemical antidote works by combining with a poison to form an innocuous substance or by, in some way, blocking or diverting the action of the poison. A mechanical antidote prevents the absorption of poison into the blood from the stomach and intestine.

anti-D(Rh$_0$) immunoglobulin

An *antiserum* that contains antibodies (see *antibody*), proteins that are manufactured by the immune system against Rhesus (Rh) D factor, a substance present on the red blood cells of people with Rh-positive blood.

Anti-D(Rh$_0$) immunoglobulin is given to all Rh-negative women routinely at intervals during normal pregnancy and at delivery. A dose is also given after an *amniocentesis*, miscarriage, or any event in which the baby's blood may enter the mother's circulation. The injected antibodies destroy any red blood cells from the fetus that have entered the woman's bloodstream. This helps to prevent the woman from forming her own antibodies against Rh-positive blood, which might adversely affect a subsequent pregnancy. (See also *haemolytic disease of the newborn*; *Rhesus incompatibility*.)

antiemetic drugs

COMMON DRUGS

ANTICHOLINERGICS • Hyoscine hydrobromide

ANTIHISTAMINES • Cinnarizine • Cyclizine • Dimenhydrinate • Meclozine • Promethazine

BUTYROPHENONES • Haloperidol

PHENOTHIAZINES • Chlorpromazine • Perphenazine • Prochlorperazine

SEROTONIN ANTAGONISTS • Granisetron • Ondansetron • Tropisetron

MOTILITY STIMULANTS • Domperidone • Metoclopramide

OTHERS • Betahistine • Nabilone

A group of drugs used in the treatment of the *nausea* and *vomiting* that are associated with *motion sickness*, *vertigo*, *Ménière's disease*, *radiotherapy*, and certain drugs. Antiemetics are not normally used in the treatment of food poisoning because the body needs to rid itself of harmful substances.

HOW THEY WORK

Antihistamines and *anticholinergic drugs* reduce vomiting associated with vertigo by suppressing the vomiting reflex (in which the stomach muscles contract to expel the stomach contents), which is triggered by nerve activity in the balance centre of the inner ear. *Motility stimulants* work by increasing movement through the gastrointestinal tract. The most powerful antiemetics are used to control nausea and vomiting associated with radiotherapy or *anticancer drugs* and include *serotonin antagonists*, such as *ondansetron*, and *nabilone*. These drugs act on *neurotransmitters* in the brain.

SIDE EFFECTS

Only certain antiemetics are used to treat vomiting in early pregnancy because some can damage the developing fetus. Many antiemetics can cause drowsiness.

WARNING

Antiemetics should not be taken regularly except on medical advice since they may mask a serious underlying disorder.

antifreeze poisoning

Most antifreeze in the UK contains ethylene glycol, which is poisonous. Most cases of antifreeze poisoning, which is extremely rare, occur as a result of accidental swallowing.

SYMPTOMS

Drinking antifreeze initially produces effects similar to *alcohol intoxication*, but vomiting, stupor, seizures, and coma may follow; acute *kidney failure* may occur within 24 to 36 hours.

TREATMENT

Any person believed to have drunk antifreeze requires immediate medical attention. Until such help arrives, small amounts of alcohol (preferably a spirit such as brandy or whisky) should be given, if possible, because alcohol reduces the rate at which antifreeze is metabolized by the body.

Hospital treatment may include removing the antifreeze from the stomach using a stomach pump (see *lavage, gastric*) and giving *diuretic drugs*, alcohol, and bicarbonate, intravenously, to correct excess acidity in the body fluids. Haemodialysis (see *dialysis*) may be required to remove ethylene glycol from the blood and to treat kidney failure.

antifungal drugs

COMMON DRUGS

• Amorolfine • Amphotericin • Benzoyl peroxide • Clotrimazole • Econazole • Fenticonazole • Fluconazole • Griseofulvin • Itraconazole • Ketoconazole • Miconazole • Nystatin • Sulconazole • Terbinafine • Tioconazole

A group of drugs used to treat infections caused by *fungi*. Antifungals are commonly used to treat different types of *tinea* (including *athlete's foot* and scalp ringworm); *candidiasis* (thrush) and rare infections, such as *cryptococcosis*, that affect internal organs. Antifungals are available in various forms, including tablets, injection, creams, and pessaries.

HOW THEY WORK

Antifungal drugs work by damaging the cell walls of fungi, causing chemicals essential for normal cell function and growth to escape. The fungal cells are unable to survive without these chemicals.

SIDE EFFECTS

Topical antifungals rarely cause side effects but may occasionally increase skin irritation. Prolonged treatment, by mouth or injection, of serious fungal infections can result in side effects including liver or kidney damage.

antigen

A substance that can trigger an *immune response*, resulting in production of an *antibody* as part of the body's defence against infection and disease. Many antigens are foreign proteins such as parts of microorganisms and toxins or tissues from another person that have been used in organ transplants. Sometimes, harmless substances (such as pollen) are misidentified by the immune system as potentially harmful antigens, which results in an allergic response (see *allergy*).

antihistamine drugs

COMMON DRUGS

NON-SEDATING • Acrivastine • Cetirizine • Fexofenadine • Loratadine • Mizolastine

SEDATING • Azatadine • Brompheniramine • Chlorphenamine • Clemastine • Dimenhydrinate • Diphenhydramine • Diphenylpyraline • Doxylamine • Promethazine • Trimeprazine • Triprolidine

A group of drugs that block the effects of *histamine*, a chemical released during allergic reactions (see *allergy*).

Antihistamines are used to treat rashes such as *urticaria* (hives) and to relieve sneezing and a runny nose in allergic *rhinitis*. They are also sometimes included in *cough remedies* and *cold remedies*, and they are used as *antiemetic drugs* because they suppress the vomiting reflex. Antihistamines are usually taken by mouth but may be given by injection for *anaphylactic shock*.

HOW THEY WORK

Antihistamine drugs block the effect of histamine on tissues such as the skin, eyes, and nose. Without drug treatment, histamine dilates small *blood vessels*, resulting in *inflammation* of the surrounding tissue due to leakage of fluid from the circulation. Antihistamines also prevent histamine from irritating nerve fibres, which causes itching.

SIDE EFFECTS

Many antihistamines cause drowsiness, but newer drugs have little sedative effect. Other uncommon side effects include loss of appetite, nausea, dry mouth, blurred vision, and difficulty in passing urine.

WARNING

A person should not drive or operate potentially dangerous machinery while taking an antihistamine drug unless he or she is certain that the treatment is not causing dizziness, drowsiness, or impaired concentration.

antihypertensive drugs

COMMON DRUGS

ACE INHIBITORS • Captopril • Cilazapril • Enalapril • Fosinopril • Lisinopril • Moexipril • Perindopril • Quinapril • Ramipril • Trandolapril

ALPHA-BLOCKERS • Doxazosin • Prazosin • Terazosin

ANGIOTENSIN-II ANTAGONISTS • Candesartan • Irbesartan • Losartan • Valsartan

BETA-BLOCKERS • Acebutolol • Atenolol • Betaxolol • Bisoprolol • Carvedilol • Celiprolol • Labetalol • Metoprolol • Nadolol • Pindolol • Propranolol • Sotalol • Timolol

CALCIUM CHANNEL BLOCKERS • Amlodipine • Diltiazem • Nicardipine • Nifedipine

CENTRALLY ACTING HYPERTENSIVES • Clonidine • Methyldopa • Moxonidine

DIURETICS • Amiloride • Bendroflumethiazide • Bumetanide • Chlorothiazide • Chlortalidone • Cyclopenthiazide • Ethacrynic acid • Furosemide • Hydrochlorothiazide • Hydroflumethiazide • Indapamide • Metolazone • Spironolactone • Torasemide • Triamterene • Xipamide

A group of drugs that are used in the treatment of *hypertension* (high blood pressure) to prevent complications such as *stroke*, *heart failure* (reduced pumping efficiency of the heart), *myocardial infarction* (heart attack), and kidney damage. There are several types of antihypertensive, each one working in a different way to lower blood pressure.

HOW THEY WORK

Antihypertensive drugs work in a variety of ways to lower blood pressure. ACE inhibitors and angiotensin-II antagonists act on enzymes in the blood to dilate blood vessels; alpha-blockers block nerve signals that trigger the constriction of blood vessels; beta-blockers reduce the force of the heartbeat, thereby lowering the pressure of blood flow; diuretics increase the amount of salts and water excreted in the *urine*, thereby reducing blood volume; calcium channel blockers and ACE inhibitors control the size of blood vessels by preventing constriction of arterial wall muscles; and centrally acting hypertensives act on the mechanism in the brain that controls the size of blood vessels.

SIDE EFFECTS

Side effects depend on the type of antihypertensive used, but all types can cause dizziness if the blood pressure falls excessively.

WARNING

The dosage of antihypertensives should not be reduced or the treatment stopped without first consulting a doctor, who will supervise a gradual reduction in dosage. Abrupt cessation of the drug could cause a dangerous rise in blood pressure.

anti-inflammatory drugs

Drugs that reduce *inflammation*. The main groups of these drugs are *corticosteroid drugs* and *nonsteroidal anti-inflammatory drugs* (NSAIDs). (See also *analgesic drugs*.)

antimalarial drugs

Drugs used to treat *malaria*. One antimalarial drug, *chloroquine*, is also used to treat arthritis.

antimotility drugs

See *antidiarrhoeal drugs*.

antimuscarinic drugs

See *anticholinergic drugs*.

antiobesity drugs

A group of drugs that includes *appetite suppressants* and *orlistat*, a drug that acts on the gastrointestinal tract to prevent the digestion of fats.

A

anti-oestrogen drugs

A group of drugs that oppose the action of the hormone *oestrogen*. The most important of these drugs is *tamoxifen*, which is used in the treatment of certain breast cancers.

antioxidant

A type of chemical that neutralizes potentially damaging oxidizing molecules known as *free radicals* (molecules that bind to and destroy body cells).

Some antioxidants occur naturally in the body; others (vitamin C, vitamin E, and beta-carotene, for example) are obtained through food intake or from dietary supplements.

antiperspirant

COMMON DRUGS

• Aluminium chloride

A substance applied to the skin in the form of a lotion, cream, or spray in order to reduce sweating. High concentrations are sometimes used to treat *hyperhidrosis* (abnormally heavy sweating).

HOW IT WORKS

An antiperspirant reduces the production of sweat by the *sweat glands* and blocks the ducts that drain sweat on to the surface of the skin.

SIDE EFFECTS

Antiperspirants may cause skin irritation, particularly if they are used on broken skin. (See also *deodorants*.)

antiphospholipid syndrome

See *Hughes' syndrome*.

antiplatelet drugs

COMMON DRUGS

• Abciximab • Aspirin • Dipyridamole • Clopidogrel • Ticlopidine

Drugs that reduce the tendency of *platelets* to stick together to form blood clots (see *blood clotting*) when blood flow in the arteries is disrupted. Antiplatelet drugs reduce the risk of *thromboembolism* (in which a clot breaks off and is carried in the bloodstream to lodge elsewhere in the body), which can cause potentially fatal disorders such as a *myocardial infarction* (heart attack) or *stroke*.

Aspirin and dipyridamole are commonly used antiplatelet drugs. Others, such as ticlopidine, are used specifically to protect against the stroke or formation of blood clots in the *coronary arteries* in people who have had a stroke or heart attack or have *angina*.

antipruritic drugs

COMMON DRUGS

ANTIHISTAMINES • Antazoline • Diphenhydramine • Trimeprazine

CORTICOSTEROIDS • Hydrocortisone

LOCAL ANAESTHETICS • Tetracaine (amethocaine) • Benzocaine • Lignocaine

EMOLLIENT AND COOLING PREPARATIONS

• Aqueous cream • Calamine lotion • Cold cream • Emulsifying ointment

OTHERS • Colestyramine • Doxepin

Drugs that are used to relieve persistent itching (*pruritus*), including pruritus that occurs as a result of a specific condition. For example, colestyramine (a *lipid-lowering drug*) is used to relieve pruritus associated with primary *biliary cirrhosis*. Antipruritic drugs can be applied as creams and *emollients* and may contain *corticosteroid drugs*, *antihistamine drugs*, or *local anaesthetics*. Oral antihistamines may also be used to relieve itching.

HOW THEY WORK

Irritation of the skin causes the release of substances, such as histamine, that cause the blood vessels to dilate and fluid to accumulate under the skin, which results in inflammation and itching. Antipruritic drugs work either by reducing inflammation, and therefore itching, or by numbing the nerve impulses that transmit sensation to the brain.

SIDE EFFECTS

Prolonged or heavy use of any antipruritic, especially antihistamine and local anaesthetic creams, may lead to further skin irritation. Oral antihistamines may cause drowsiness. Prolonged use of potent topical corticosteroids may result in permanent skin changes, most commonly thinning of the skin.

antipsychotic drugs

COMMON DRUGS

PHENOTHIAZINES • Chlorpromazine • Fluphenazine • Levomepromazine (methotrimeprazine) • Pericyazine • Perphenazine • Pipotiazine • Thioridazine • Trifluoperazine

BUTYROPHENONES • Benperidol • Droperidol • Haloperidol

OTHERS • Amisulpride • Clozapine • Flupentixol • Olanzapine • Pimozide • Quetiapine • Risperidone • Zotepine • Zuclopenthixol

A group of drugs used to treat *psychoses* (mental disorders involving loss of contact with reality), particularly *schizophrenia* and *mania* (abnormal elation and overactivity) in bipolar disorder (see *manic–depressive illness*). Antipsychotic drugs may also be used to sedate people who are suffering from other mental disorders (such as *dementia*) and who are very agitated or aggressive.

HOW THEY WORK

Most antipsychotic drugs block the action of *dopamine*, a chemical that stimulates nerve activity in the brain. Antipsychotic drugs include *phenothiazine drugs*, butyrophenones such as *haloperidol*, and several new drugs including risperidone.

SIDE EFFECTS

Antipsychotic drugs can cause drowsiness, lethargy, *dyskinesia* (abnormal muscular movements), and *parkinsonism*. Other possible side effects include dry mouth, blurred vision, and difficulty in passing urine. However, newer drugs may have fewer side effects when used long term.

antipyretic drugs

Drugs that reduce fever. Examples of antipyretic drugs include *paracetamol*, *aspirin*, and other *non-steroidal anti-inflammatory drugs*.

antiretroviral drugs

COMMON DRUGS

NUCLEOSIDE REVERSE TRANSCRIPTASE INHIBITORS

• Didanosine • Lamivudine • Stavudine • Zalcitabine • Zidovudine (AZT)

PROTEASE INHIBITORS • Indinavir • Nelfinavir • Ritonavir • Saquinavir

NON-NUCLEOSIDE REVERSE TRANSCRIPTASE INHIBITORS • Efavirenz • Nevirapine

Drugs that are used to slow or halt the spread of viruses (see *retrovirus*) in individuals who have *HIV* infection and *AIDS*. There are three main types of antiretroviral drug: nucleoside reverse transcriptase inhibitors, non-nucleoside reverse transcriptase inhibitors and protease inhibitors. A combination of antiretroviral drugs from different groups is often used.

HOW THEY WORK

Antiretroviral drugs work by interfering with the action of enzymes used by the virus to produce genetic material.

SIDE EFFECTS

Antiretroviral drugs can have a range of side effects, including nausea, vomiting, diarrhoea, tiredness, and a variety of effects on blood chemistry, particularly those that involve fats. (See also *antiviral drugs*.)

antirheumatic drugs

COMMON DRUGS

CORTICOSTEROIDS • Dexamethasone • Hydrocortisone • Methylprednisolone • Prednisolone • Triamcinolone

GOLD-BASED DRUGS • Auranofin • Sodium aurothiomalate

IMMUNOSUPPRESSANTS • Azathioprine • Cyclophosphamide • Ciclosporin • Methotrexate

NSAIDS • Aspirin • Celecoxib • Diclofenac • Etodolac • Felbinac • Ibuprofen • Ketoprofen • Mefenamic acid • Meloxicam • Naproxen • Piroxicam

OTHERS • Chloroquine • Hydroxychloroquine • Penicillamine • Sulfasalazine

A group of drugs that are used to treat *rheumatoid arthritis* and types of arthritis that are the result of other *autoimmune disorders* (in which the immune system attacks the body's own tissues) such as systemic *lupus erythematosus*. Antirheumatic drugs affect the disease process and may, therefore, limit joint damage, unlike NSAIDs (see *nonsteroidal anti-inflammatory drugs*), which only relieve pain and stiffness. The most commonly used antirheumatic drugs are *corticosteroid drugs*, *immunosuppressant drugs*, *chloroquine*, *penicillamine*, *gold*, and *sulfasalazine*.

HOW THEY WORK

Different types of antirheumatic drug work in different ways, by suppressing either the production or the activity of *lymphocytes* (white blood cells). All antirheumatics reduce *inflammation* caused by the autoimmune reaction and slow down the degeneration of the cartilage that lines the joints.

SIDE EFFECTS

Many antirheumatic drugs can have serious side effects, and treatment, other than with NSAIDs, is therefore given only under specialist medical supervision.

antiseptics

Chemicals that are applied to the skin in order to destroy bacteria and other microorganisms, thereby preventing sepsis (infection). Antisepsis (the use of antiseptics to prevent infection) is not the same as asepsis, which is the creation of a germ-free environment (see *aseptic technique*). Antiseptics are milder than *disinfectants*, which decontaminate inanimate objects but are too strong to be used on the body.

Antiseptic fluids are generally used for bathing wounds; antiseptic creams are applied to wounds before they are dressed. Common antiseptics are *chlorhexidine*, *cetrimide*, *hexachlorophene*, and compounds containing *iodine*.

antiserum

A preparation containing antibodies (proteins manufactured by the immune system, see *antibody*) that combine with specific *antigens* (foreign proteins), usually components of microorganisms, leading to the deactivation or destruction of the microorganisms.

Antiserum is usually used, along with *immunization*, as an emergency treatment when an individual has been exposed to a dangerous infection, such as *rabies*, and has not previously been immunized against it. The antiserum helps to provide some immediate protection against the infective microorganisms while full immunity is developing. Such measures are not as effective in preventing disease as earlier (pre-exposure) immunization, however.

antisocial personality disorder

Impulsive, destructive behaviour that often disregards the feelings and rights of others. People who have an antisocial personality lack a sense of guilt and cannot tolerate frustration. They may have problems with relationships and are frequently in trouble with the law.

Behaviour therapy and various forms of *psychotherapy* may help to improve social integration. In general, the effects of the condition decrease with age.

antispasmodic drugs

COMMON DRUGS

• Atropine • Dicycloverine • Hyoscine • Mebeverine

A group of drugs that relax spasm in smooth (involuntary) muscle in the wall of the intestine or bladder. Antispasmodic drugs are used in the treatment of irritable bowel syndrome and irritable bladder.

HOW THEY WORK

Some antispasmodic drugs have an anticholinergic action (that is, they work by blocking the action of *acetylcholine*, a neurotransmitter chemical released from nerve endings that stimulates muscle contraction). Others work by direct action on smooth muscle.

SIDE EFFECTS

Possible side effects of antispasmodic drugs include a dry mouth, blurred vision, and difficulty in passing urine. (See also *anticholinergic drugs*.)

antithyroid drugs

COMMON DRUGS

• Carbimazole • Iodine • Propylthiouracil

A group of drugs that are used to treat *hyperthyroidism*, in which the thyroid gland is overactive. They may be used as the sole treatment for hyperthyroidism or may be given prior to thyroid surgery.

HOW THEY WORK

Carbimazole and *propylthiouracil* work primarily by interfering with production of thyroid hormones by the thyroid gland. Radioactive iodine works by destroying part of the thyroid tissue in people with hormone-secreting thyroid nodules.

SIDE EFFECTS

Side effects of carbimazole and propylthiouracil include nausea, headaches, mild gastrointestinal disturbances, dizziness, joint pain, itching, and rash. Carbimazole can suppress white blood cell production. Iodine can cause hypersensitivity reactions resembling coryza (nasal symptoms of the common cold).

antitoxin

Any of a variety of commercially prepared substances containing *antibodies* (proteins manufactured by the *immune system*) that can combine with and neutralize the effect of a specific *toxin* that has been released into the bloodstream by particular bacteria (such as those that cause *tetanus* and *diphtheria*).

Antitoxins are usually given by injection into a muscle. Occasionally, an antitoxin may cause an allergic reaction (see *allergy*); rarely, it may cause *anaphylactic shock* (a severe allergic reaction requiring emergency treatment).

antitussive drugs

Drugs that suppress or relieve a *cough* (see *cough remedies*).

antivenom

A specific treatment for bites or stings inflicted by venomous animals such as snakes, spiders, and scorpions.

Antivenom is prepared by the inoculation of animals, such as horses, with venom from a particular poisonous animal, thereby provoking the production of *antibodies* (proteins manufactured by the *immune system*) that neutralize the poisons in the venom. A preparation of these antibodies can be produced from samples of the animal's blood.

Antivenoms are given by intravenous injection and may cause allergic reactions (see *allergy*).

A

antiviral drugs

COMMON DRUGS

ANTIRETROVIRALS • Didanosine • Efavirenz • Indinavir • Lamivudine • Nelfinavir • Nevirapine • Ritonavir • Saquinavir • Stavudine • Zalcitabine • Zidovudine

OTHERS • Aciclovir • Amantadine • Cidofovir • Famciclovir • Foscarnet • Ganciclovir • Idoxuridine • Inosine pranobex • Interferon • Penciclovir • Ribavirin • Valaciclovir • Zanamivir

Drugs used in the treatment of infection by *viruses*. No drugs have been developed that can eradicate viruses completely, and at present *immunization* is the most effective way of preventing serious viral infections. However, antiviral drugs can reduce the severity of some viral infections (most notably *herpes*, *influenza*, viral *hepatitis*, and *cytomegalovirus* infections), particularly in people who have reduced immunity. Advances have also been made in the treatment of HIV infection (see *antiretroviral drugs*).

HOW THEY WORK

Most antiviral drugs destroy viruses by disrupting the chemical processes necessary for the virus to grow and multiply within a cell. Some antivirals actually prevent viruses penetrating the cells.

SIDE EFFECTS

Side effects of antiviral drugs used in the treatment of HIV infection and AIDS may include nausea, diarrhoea, and tiredness. These drugs may also affect blood chemistry, leading to conditions such as *anaemia* (a reduced level of the oxygen-carrying pigment *haemoglobin* in the blood).

Most other antivirals rarely cause side effects. Antiviral creams may cause skin irritation and those given by mouth or injection may lead to nausea, dizziness, and rarely, in prolonged treatment, to kidney damage.

antral irrigation

Irrigation (flushing out) of the maxillary antrum, one of the nasal sinuses. More commonly known as a sinus washout, antral irrigation is used to treat persistent *sinusitis*. The procedure is performed less often nowadays since the introduction of nasal *endoscopy*, (examination of the nasal cavity using a flexible viewing tube).

anuria

Complete cessation of urine output. Anuria may be caused by a severe malfunction of the kidneys, but a much more common cause is a complete blockage of the flow of urine as a result of enlargement of the prostate gland (see *prostate, enlarged*), a *bladder tumour*, or a bladder or kidney stone in the (see *calculus, urinary tract*). Failure of the kidneys to produce urine may be due to oxygen depletion as a result of reduced blood flow through the kidneys, as occurs in *shock*, or to severe kidney damage caused by a disease such as *glomerulonephritis*.

Anuria requires urgent investigation to establish the cause and to allow treatment (such as rehydration or removal of the blockage) to begin. Treatment of the cause may restore urine production, but any delay can result in permanent kidney damage, leading to *uraemia* (excess urea and other waste products in the blood).

anus

The end of the alimentary tract through which faeces are expelled from the body. The anus is an extension of the rectum as it passes downwards and backwards through the pelvic floor.

The orifice at the end of the anal canal is open only during defaecation; at other times it is kept closed by the muscles of the anal sphincter. These muscles are arranged in two layers: the internal sphincter, which cannot be controlled voluntarily, and the external sphincter, which can be relaxed at will for defaecation. Disorders of the anus include anal cancer (see *anus, cancer of*) and imperforate anus (see *anus, imperforate*). (See also *digestive system*.)

anus, cancer of

A rare cancer of the skin of the anus. Possible early signs of anal cancer are the development of swelling or an ulcer at the anus, accompanied by bleeding and discomfort. Treatment is by surgical removal and/or *radiotherapy*.

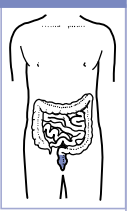
anus, imperforate

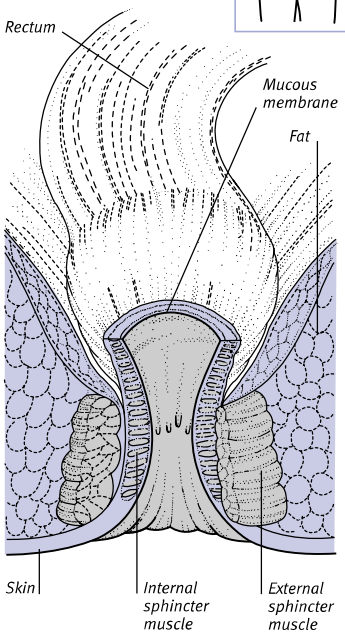
A rare congenital (present from birth) abnormality in which the anal opening is missing or covered over. The severity of the condition varies from complete absence of the anal canal to only a layer of skin covering the anal opening.

Treatment is with surgery. In severe cases, a *colostomy* may be needed initially before definitive surgery to construct an anus. Where surgery simply involves removal of a layer of skin over the anal opening, *anal dilation* (a procedure to enlarge the anus) may be required for several months afterwards.

STRUCTURE OF THE ANUS

The anus is a canal at the end of the alimentary tract, with internal and external sphincters to open and close the orifice.





anxiety

An unpleasant emotional state that ranges from mild unease to intense fear. Anxiety is a normal response to stressful situations and prepares the mind and body to respond effectively. However, anxiety that occurs without reason may be a symptom of an *anxiety disorder* or another psychological disorder such as *depression*.

SYMPTOMS

A variety of physical symptoms are associated with anxiety. The most common include palpitations (a more forceful or faster heartbeat), chest pains, a feeling of tightness in the chest, and a tendency to overbreathe (see *hyperventilation*). Muscle tension leads to headaches and back pains.

Gastrointestinal symptoms of anxiety include dry mouth (see *mouth, dry*), bloating, diarrhoea, nausea, and difficulty in swallowing. Other symptoms

DISORDERS OF THE ANUS

Most anal disorders are minor but may cause considerable discomfort and concern. Many are aggravated by constipation and may be helped by regular toilet habits, an increased intake of fluids, wholemeal products, fruits, and vegetables to soften the faeces, and the use of glycerine suppositories, if necessary.

Congenital defects

Imperforate anus is an uncommon birth defect in which the anus is sealed (see *anus, imperforate*).

In *anal stenosis*, the anus is too narrow to allow the normal passage of faeces. This is sometimes a congenital abnormality, but it can also result from scarring following surgery to treat another disorder.

Injury

Anal fissures originate from small tears in the lining of the anus, usually as a result of straining to pass hard, dry faeces.

Tumours

Cancer of the skin around the anus is rare (see *anus, cancer of*).

Other disorders

Haemorrhoids are enlarged blood vessels under the lining of the anus and may cause bleeding during defaecation, itching, and pain.

An *anal fistula* is an abnormal tunnel connecting the inside of the anal canal with the skin surrounding the anus. These fistulas usually result from an abscess in the wall of the anus.

Itching of the anus (pruritus ani) may be a direct result of another disorder, such as an anal fistula, haemorrhoids or *threadworm* infestation.

Anal warts (see *warts, genital*) are transmitted by sexual contact and are caused by a papillomavirus.

INVESTIGATION

Investigation of anal disorders is usually by visual inspection, sometimes involving *proctoscopy* (use of a rigid internal viewing tube) and digital examination (feeling with a finger). Sometimes a *biopsy* (small sample of tissue removed for microscopic analysis) or *swab* may be taken for bacteriological culture.

include lightheadedness, sweating, pallor, blushing, and a frequent need to urinate or defaecate.

People with anxiety may have a constant feeling that something bad is going to happen. They may fear illness or worry about the health and safety of family and friends. Fear of losing control is also common. Anxiety often leads to increasing dependence on others, irritability, a sense of fatigue, and frustration. Inability to relax may lead to difficulty in sleeping.

TREATMENT

People suffering from anxiety may be helped by *counselling* or *psychotherapy*. If there is an underlying disorder, such as depression, treatment with *antidepressant drugs* can help. Antianxiety drugs are used for short-term control of symptoms but are avoided for long-term treatment because they are addictive.

anxiety disorders

A group of mental illnesses, including several specific syndromes, in which symptoms of *anxiety* are the principal feature. Anxiety disorders are common and mainly affect young adults.

TYPES

In *generalized anxiety disorder*, the affected individual suffers from persistent tension and apprehension that has no specific focus or cause, together with physical or psychological symptoms that disrupt normal activity. *Panic disorder* is characterized by sudden and recurrent attacks of extreme, unreasonable fear and anxiety. *Phobias* are irrational fears, such as the fear of open spaces or of spiders, that lead to avoidance of certain situations or objects. *Post-traumatic stress disorder* is a form of anxiety that develops following a stressful or traumatic event and *obsessive–compulsive disorder* is a condition in which a person's obsessions and fears lead them to carry out repetitive, ritualized acts.

TREATMENT

Counselling, *psychotherapy*, and group or individual *cognitive–behavioural therapy* are used to treat anxiety disorders. *Antidepressant drugs* are often used, and *antianxiety drugs* (especially *benzodiazepine drugs*) may be used for short-term treatment but are addictive.

anxiolytics

See *antianxiety drugs*.

aorta

The main *artery* of the body, which supplies oxygenated blood to all other parts. The aorta arises from the left ventricle (the main pumping chamber of the *heart*) and arches up over the heart before descending, behind it, through the chest cavity. It terminates in the abdomen by dividing into the two common iliac arteries of the legs. The aorta is thick-walled and has a large diameter to cope with the high pressure and large volume of blood passing through it.

DISORDERS

The aorta, like other arteries, can become narrowed as a result of *atherosclerosis* (fat deposits on its walls), which may cause *hypertension* (high blood pressure). *Coarctation of the aorta* (in which the aorta is abnormally narrow at birth) and *aortitis* (inflammation of the aorta wall) are examples of aorta-specific disorders. Both aortitis and atherosclerosis may result in an aortic *aneurysm* (ballooning of the aorta wall), which may require surgery. (See also *arteries, disorders of*; *circulatory system*.)

aortic incompetence

Leakage of blood through the aortic valve (one of the *heart valves*), resulting in a backflow of blood from the aorta into the left ventricle (the heart's main pumping chamber).

CAUSES

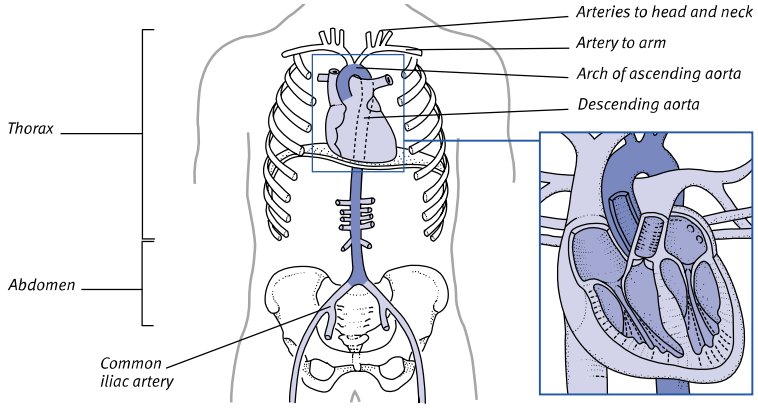
Failure of the aortic valve to close properly may be due to a *congenital* (present from birth) abnormality in which the valve has two leaflets (flaps) rather than three. The valve leaflets can be destroyed by infective *endocarditis* (inflammation of the membrane lining the heart). Long-term *hypertension* can sometimes cause the root of the aorta to stretch so that the valve does not close properly.

Aortic incompetence is also associated with *ankylosing spondylitis* (a disorder that affects the spine), and *Marfan syndrome*, a congenital disorder of connective tissues. *Rheumatic fever*, which is now rare, may damage the valve, causing a combination of *aortic stenosis* (narrowing of the aortic valve) and incompetence. In addition, aortic incompetence may occur in untreated *syphilis*.

A

LOCATION AND STRUCTURE OF THE AORTA

From its origin at the left ventricle, the aorta passes upwards, curves behind the heart, and runs downwards, passing through the thorax (chest) and into the abdomen, where it terminates by dividing into two common iliac arteries. The aorta is thick-walled and large in diameter (about 2.5 cm at its origin) to cope with the high pressure and large volume of blood that passes through it. The thick walls of the aorta have an elastic quality that helps to even out the peaks and troughs of pressure that occur with each heartbeat.



SYMPTOMS AND SIGNS

Aortic incompetence may not cause symptoms; it is sometimes found during a routine medical examination when the doctor hears a murmur (abnormal heart sound) over the front of the chest wall to the left of the sternum (breastbone).

The heart compensates for the backflow of blood into the left ventricle by working harder, until the combination of hypertrophy (muscle thickening) and dilatation (ballooning) of the left ventricle wall eventually leads to *heart failure* (reduced pumping efficiency of the heart); this causes breathing difficulty and *oedema* (a buildup of fluid).

DIAGNOSIS AND TREATMENT

A *chest X-ray*, *ECG* (measurement of the electrical activity of the heart), and *echocardiography* (imaging of the heart structures by measuring the pattern of reflection of sound waves from them) may be carried out to diagnose aortic incompetence. A cardiac catheter (flexible tube inserted into the heart via blood vessels) is sometimes used to demonstrate the degree of incompetence (see *catheterization, cardiac*).

Heart failure resulting from aortic incompetence can be treated with *diuretic drugs* or other drugs to remove retained fluid from the lungs. *Heart-valve surgery* to replace the damaged valve may eventually be necessary.

aortic stenosis

Narrowing of the opening of the aortic valve (one of the *heart valves*), causing obstruction of blood flow into the circulation. Aortic stenosis makes the heart work harder and causes the muscle in the wall of the left ventricle (the main pumping chamber of the heart) to thicken. Narrowing of the valve also reduces the amount of blood flowing into the *coronary arteries* (the main arteries that supply the tissues of the heart with oxygen-rich blood).

CAUSES

The most common cause of aortic stenosis is deposition of calcium on the aortic valve. This deposition is usually associated with *atherosclerosis* (fatty deposits). Aortic stenosis may also be the result of a *congenital* (present from birth) abnormality.

SYMPTOMS AND SIGNS

Aortic stenosis may not cause any symptoms; it is sometimes found during a routine medical examination when the doctor hears a murmur (an abnormal heart sound) over the front of the chest wall to the right of the sternum (breastbone) and sometimes up into the neck. Symptoms, when they do occur, include fainting, lack of energy, chest pain on exertion as a result of *angina pectoris*, and breathing difficulties. Other features, which occur at a late stage, include a weak pulse and *cardiomegaly*, (enlargement of the heart).

DIAGNOSIS AND TREATMENT

A *chest X-ray*, an *ECG* (measurement of the electrical activity of the heart), and *echocardiography* (imaging of the heart structures by measuring the pattern of reflection of sound waves from them) may be carried out to diagnose aortic incompetence. A cardiac catheter (flexible tube that is inserted into the heart via blood vessels) can be used to demonstrate the degree of stenosis (see *catheterization, cardiac*).

Heart-valve surgery may be needed to widen or replace the damaged valve.

aortitis

Inflammation of the *aorta* (the main artery of the body). Aortitis is a rare condition that occurs in people with *arteritis* (inflammation of the arteries) or untreated *syphilis* and in some people with *ankylosing spondylitis* (a disorder affecting the spine).

Aortitis may cause part of the aorta to widen and its walls to become thinner. This may lead to an *aneurysm* (ballooning of the artery), which may burst and cause severe, sometimes fatal, blood loss. Aortitis may also damage the ring around the aortic valve in the heart, leading to *aortic incompetence* (a condition which allows the backflow of blood into the heart), which may eventually result in *heart failure* (reduced pumping efficiency of the heart).

aortography

An imaging technique that enables the *aorta* (the main artery of the body) and its branches to be seen clearly on *X-ray* film following injection of a *contrast medium* (a substance that is opaque to X-rays) into the aorta.

HOW AND WHY IT IS DONE

The contrast medium is usually injected into the aorta through a fine catheter (a flexible plastic tube) that is inserted either into the femoral artery at the groin, the brachial artery on the inside of the elbow, or directly into the aorta within the lower abdomen.

Aortography is used if surgery is needed to treat an *aneurysm* (ballooning of the aorta).

apathy

The absence of feelings that is often associated with a lack of energy. Healthy people may be described as apathetic, but true apathy is a feature of certain

APGAR CHART

Sign	0	1	2
Colour	Blue, pale	Body pink; extremities blue	Completely pink
Respiratory effort	Absent	Weak cry; irregular breathing	Good strong cry; regular breathing
Muscle tone	Limp	Bending of some limbs	Active motion; limbs well-flexed
Reflex irritability	No response	Grimace (on nasal stimulation)	Cry
Heart rate	Absent	Slow (below 100 beats per minute)	Over 100 beats per minute

mental illnesses, such as *schizophrenia*. An affected person fails to take interest in everyday activities and tends to be inactive and lacking in volition (drive).

aperient

A mild *laxative drug*.

apex

The tip or uppermost surface of an organ or structure, such as the lungs or the heart. The apex of a tooth is the tip of its root.

apex beat

A normal heartbeat felt through the chest wall. As the heart contracts, its tip hits the chest wall and the beat can be felt between the fifth and sixth ribs on the left side of the chest. The apex beat is displaced when the heart is enlarged.

Apgar score

A system devised by Virginia Apgar, an American anaesthetist, to assess the condition of a newborn baby and help to direct appropriate care. Five features (breathing, heart rate, colour, muscle tone, and response to stimulation) are scored one minute, and again five minutes, after birth.

aphakia

The absence of the *lens* from the eye. Aphakia may be congenital (present from birth), may result from surgery (for example, *cataract surgery*), or may be due to a penetrating injury.

Aphakia causes severe loss of focusing in the affected eye and requires correction by implanting a lens or with contact lenses or glasses.

aphasia

Complete absence of previously acquired language skills caused by a brain disorder that affects the ability to speak and write, and/or comprehend and read. Related disabilities that may occur as a feature of aphasia are *alexia* (word blindness) and *agraphia* (writing difficulty).

CAUSES

Language function in the brain lies in the dominant cerebral hemisphere (see *cerebrum*). Two particular areas in this hemisphere, Broca's and Wernicke's areas, and the pathways connecting the two, are important in language skills. Damage to these areas, which most commonly occurs as a result of *stroke* or *head injury*, can lead to aphasia.

TYPES AND SYMPTOMS

Broca's aphasia causes difficulty in expressing language. Speech is laboured and normal rhythm is lost, but the few words uttered tend to be meaningful. Writing may also be impaired.

Wernicke's aphasia causes difficulty in language comprehension. Speech is fluent but its content is disturbed, with errors in word selection and grammar. Writing is also impaired, and spoken and/or written language may not be understood.

In *associative aphasia*, comprehension is normal, and the affected individual can write and speak. However, he or she is unable to repeat what has been heard and cannot read aloud.

Global aphasia comprises the total, or near total, inability to speak, write, or understand language.

Nominal aphasia is restricted to difficulty in naming objects or in finding words, although the sufferer may be able to choose the correct word from several offered.

In *jargon aphasia*, an affected individual cannot form grammatical sentences and utters meaningless phrases composed of jumbled words or neologism.

TREATMENT AND OUTLOOK

Some recovery from aphasia is usual following a stroke or head injury, but the more severe the aphasia, the less the chances of recovery. *Speech therapy* is the main treatment. (See also *aphonia; dysarthria; dysphasia; dysphonia*; *speech*; *speech disorders*.)

apheresis

A procedure in which blood is withdrawn from a donor or patient and reinfused after one or more selected components have been separated and removed. For example, in *plasmapheresis*, *antibodies* (proteins manufactured by the *immune system*) that are causing a disease (such as *Guillain–Barré syndrome* or *Goodpasture's syndrome*) are removed; in leukapheresis, white blood cells (see *lymphocyte*) are removed either to reduce their number or to harvest them for use in a *blood transfusion*.

aphonia

Complete loss of the voice, which may result from surgery to the *larynx* (voice-box) or may be temporary, sudden in onset, and due to emotional stress. In aphonia, the vocal cords fail to meet as normal when an individual tries to speak, although they may come together when the person coughs.

There is no particular treatment for aphonia, but in the temporary form of the condition, the sufferer's voice usually returns as suddenly as it disappeared. (See also *dysphonia*.)

aphrodisiac

Any substance that is thought to stimulate erotic desire and enhance sexual performance. Aphrodisiacs are named after Aphrodite, the Greek goddess of love, beauty, and fertility.

For centuries, various substances (most notably oysters and rhinoceros horn) have been used as aphrodisiacs. In fact, no substance has a proven aphrodisiac effect.

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aphthous ulcer
See *ulcer, aphthous*.

apical
A term used to describe the position of structures that are found at the *apex* (tip) of particular organs and structures, including the lungs and heart.

apicectomy
The surgical removal of the tip of a tooth root in order physically to eliminate an infection or an infected cyst at the root tip. The procedure was once performed as part of *root-canal treatment* but is now used less often because root-canal treatment alone usually achieves the desired result.

aplasia
Absent or severely reduced growth and development of any organ or tissue. For example, in bone marrow aplasia, the rate of cell division in the bone marrow is reduced, leading to insufficient blood-cell production (see *anaemia, aplastic*). Some birth defects, such as stunted limbs (see *phocomelia*), occur as a result of incomplete tissue formation during prenatal development.

aplastic anaemia
See *anaemia, aplastic*.

apnoea
Cessation of breathing that can occur either temporarily (for a few seconds or up to a minute or two) or for a prolonged period.

CAUSES

Breathing is an automatic process that is controlled by the respiratory centre in the *brainstem* (a stalk of nerve tissue linking the brain to the spinal cord). The respiratory centre sends nerve impulses that regulate contraction of the diaphragm and muscles in the chest wall, thereby controlling the rate and depth of breathing. Failure of this centre to maintain normal breathing is known as central apnoea. The condition may occur in babies, particularly those who are premature, and can be detected by an apnoea alarm. Central apnoea can also be the result of damage to the brainstem (following a *stroke* or *head injury*, for example).

In obstructive apnoea, breathing is prevented by a blockage in the airway. The most common type is *sleep apnoea*, in which blockage of the upper airway occurs repeatedly during sleep.

Deliberate temporary apnoea occurs in *breath-holding attacks*. Another type of apnoea occurs in *Cheyne–Stokes respiration*, in which cycles of deep, rapid breathing alternate with episodes of breathing stoppage.

TREATMENT

Treatment depends on the cause; in newborn babies, apnoea resolves itself as they mature. In cases of stroke or head injury, artificial ventilation may be necessary, temporarily, until recovery occurs.

apocrine gland
A gland that discharges cellular material in addition to the fluid that it secretes. The term apocrine is usually applied to the type of *sweat glands* that appear in hairy areas of the body after puberty. (See also *eccrine gland*.)

apocrinitis
Inflammation of the *apocrine glands*, which are located in the armpit, groin, and perineum.

apolipoprotein
Any of a group of proteins that are constituents of *lipoproteins*, the carriers of fat in the bloodstream. Apolipoproteins are also involved in the growth and repair of nerve tissues.

apomorphine
A drug that is used in the treatment of *Parkinson's* disease. Nausea and vomiting are common side effects of apomorphine at the start of treatment.

aponeurosis
A wide sheet of tough, fibrous tissue that acts as a tendon by attaching a muscle to a bone or a joint.

apophysis
An outgrowth of bone at the site of attachment of a tendon to bone. Inflammation may occur, as in *Osgood–Schlatter disease*.

apoplexy
An outdated term for a *stroke*.

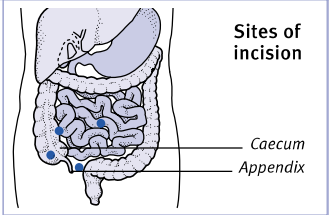
apoptosis
The natural process of programmed cell death. Apoptosis occurs in embryonic development, when the shaping of body parts is taking place, and continues throughout life in the constant cycle of death and renewal of body cells. Failure of apoptosis is implicated in the development of cancers.

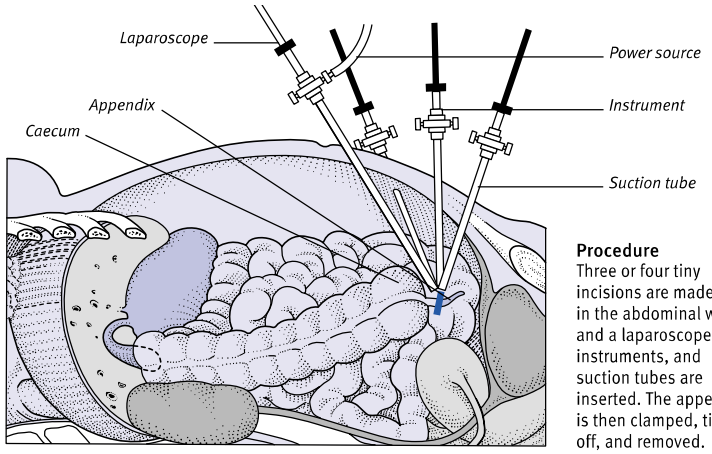
apothecary
An outdated term for a *pharmacist*.

LAPAROSCOPIC APPENDICECTOMY

Surgery to remove the appendix can be carried out, under general anaesthesia, either conventionally or laparoscopically.

Laparoscopic appendicectomy takes approximately an hour, which is three times as long as conventional surgery, but recovery is quicker.





Procedure
Three or four tiny incisions are made in the abdominal wall, and a laparoscope, instruments, and suction tubes are inserted. The appendix is then clamped, tied off, and removed.

appendage

An additional piece of *tissue* that is attached to a main structure. An auricular appendage is a small tag of tissue attached near the ear that may be present from birth.

appendicectomy

Surgical removal of the appendix to treat acute *appendicitis* (inflammation of the appendix).

WHY IT IS DONE

Appendicectomy is performed to prevent an inflamed appendix bursting and causing *peritonitis* (inflammation of the peritoneum, the lining of the abdominal cavity) or an abdominal abscess.

HOW IT IS DONE

The two methods of appendicectomy are conventional appendicectomy and *minimally invasive surgery*. Conventional surgery involves making a hole in the abdominal wall that is large enough for the surgeon's instruments and fingertips to be introduced. In minimally invasive surgery, three or four small holes are made in the abdominal wall; a laparoscope (viewing instrument) that incorporates a video camera is inserted into one of the openings, and instruments and suction tubes into the others. In both types of operation, the appendix is identified, clamped, tied off at its base, and removed.

If the appendix has burst, the infected area of the abdominal cavity is washed out with saline and drained via a tube inserted into one of the incisions. Antibiotic drugs may also be given to prevent peritonitis.

COMPLICATIONS AND OUTLOOK

Possible complications are infection of the incision wound, an abscess at the site from which the appendix was removed, or localized peritonitis.

In the absence of complications, normal physical activities can usually be resumed within two to three weeks.

appendicitis

Acute inflammation of the *appendix* (a narrow, finger-shaped tube that branches off the large intestine), which is a common cause of abdominal pain and *peritonitis* (inflammation of the lining of the abdominal cavity).

CAUSE AND SYMPTOMS

The cause of appendicitis is usually not known, but the condition is sometimes caused by obstruction of the appendix by a lump of faeces. The closed end of the appendix beyond the obstruction becomes inflamed, swollen, and infected. This may lead to *gangrene* (tissue death) in the appendix wall, which may perforate (burst).

The first symptom is usually vague discomfort around the navel. Within a few hours, this develops into severe, more localized pain, which is usually most intense in the lower right-hand side of the abdomen. Symptoms may differ if the appendix is not in the most common position. For example, if the appendix impinges on the ureter, the urine may become bloodstained.

DIAGNOSIS AND TREATMENT

Diagnosis may be difficult because the symptoms of appendicitis are similar to those of many other abdominal disorders. Sometimes a *laparotomy* (surgical investigation of the abdomen) is necessary in order to confirm or exclude a diagnosis of appendicitis.

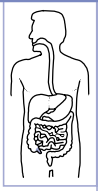
The usual treatment for appendicitis is *appendicectomy*, which is often performed endoscopically (see *minimally invasive surgery*).

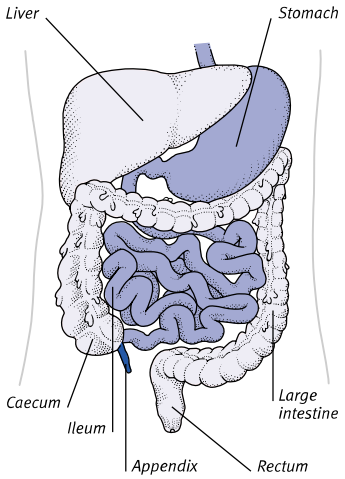
COMPLICATIONS

If treatment is delayed, an inflamed appendix may burst, releasing its contents into the abdomen. At this point, the pain ceases abruptly, but the perforation leads to peritonitis. In some cases, the omentum (fold of peritoneum that covers the intestines) envelops the inflamed appendix; this prevents the spread of infection but may result in a localized *abscess* around the appendix.

LOCATION OF THE APPENDIX

In the lower right-hand side of the abdomen, the appendix may lie behind the caecum, or in front of or behind the ileum.





appendix

A small, narrow tube that projects out of the caecum (the first part of the colon) at the lower right-hand side of the abdomen. The appendix may lie behind or below the caecum, or in front of or behind the ileum (part of the small intestine).

The appendix has no known function, but it contains a large amount of lymphoid tissue, which provides a defence against localized infection. The position of an individual's appendix partly determines the symptoms produced by acute *appendicitis* (inflammation of the appendix).

appendix abscess

An *abscess* (a collection of pus) that may form after the rupture of an inflamed appendix (see *appendicitis*).

appetite

A desire for food; a pleasant sensation that is felt in anticipation of eating. Appetite is distinct from *hunger*, which is a disagreeable feeling caused by the need for food.

Appetite, which is regulated by two parts of the *brain* (the *hypothalamus* and cerebral cortex), is learned by enjoying a variety of foods that smell, taste, and look good. It combines with *hunger* to ensure that the right amount of a wide range of foods is eaten in order to stay healthy. (See also *appetite, loss of*.)

appetite, loss of

Loss of appetite, known medically as anorexia, is usually temporary and due to an emotional upset or minor illness. Persistent loss of appetite may be a symptom of a more serious underlying physical or psychological disorder and requires investigation by a doctor.

CAUSES

In adolescents and young adults, loss of appetite may be due to *anorexia nervosa* (an eating disorder) or to *drug abuse*, particularly of *amphetamine drugs*. *Depression* or *anxiety* may result in loss of appetite at any age.

Possible physical causes of appetite loss include a *stroke* (damage to part of the brain caused by an interruption to its blood supply), a *brain tumour*, or a

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head injury that has damaged the *hypothalamus* or cerebral cortex (the parts of the brain that control appetite). Other physical causes include intestinal disorders, such as *gastritis* (inflammation of the stomach lining, which is common in problem drinkers), *stomach cancer*, a *gastric ulcer*, and liver disorders such as *hepatitis*. Many infectious diseases, such as *influenza*, can also lead to loss of appetite.

Between the ages of about two and four, some children go through a period of refusing food. If there are no other symptoms, this phase should be regarded as a normal part of a child's development.

For an otherwise healthy person, a period of two or three days without food is not harmful, provided that plenty of nonalcoholic fluids are drunk. A doctor should always be consulted, however, if there are other health problems (particularly *diabetes mellitus*) or if regular medication is being taken.

All cases of appetite loss that last for more than a few days should be investigated by a doctor. Appetite generally returns to normal once any underlying illness has been treated. (See also *appetite stimulants*.)

appetite stimulants

Various tonics and remedies that have been traditionally prescribed to stimulate the appetite. None are proven to be effective.

Some drugs, such as *corticosteroid drugs*, may stimulate the appetite when used to treat unrelated disorders.

appetite suppressants

A group of drugs that reduce the desire to eat. Sibutramine is the only appetite suppressant now commonly prescribed. Appetite suppressants may be used in the treatment of severe *obesity*, along with dieting and exercise, when serious attempts at dieting and exercise have previously failed to bring about sufficient weight loss.

HOW THEY WORK

Sibutramine works by inhibiting the reuptake of *noradrenaline* (norepinephrine) and *serotonin*.

SIDE EFFECTS

Common side effects of sibutramine include constipation, a dry mouth (see *mouth, dry*), insomnia, nausea, palpitations, *hypertension* (high blood pressure), headache, anxiety, sweating, and disturbance of the sense of taste.

The use of sibutramine is strictly controlled and is limited to a maximum of one year.

appliance

See *orthodontic appliances*.

apraxia

The inability to carry out purposeful movements despite normal muscle power and coordination. Apraxia is caused by damage to nerve tracts in the *cerebrum* (the main mass of the brain) that translate the idea for a movement into an actual movement. People with apraxia usually know what they want to do but are unable to recall from memory the sequence of actions necessary to achieve the movement. Damage to the cerebrum may be caused by a *head injury*, an infection, a *stroke* (damage to part of the brain caused by interruption to its blood supply), or a *brain tumour*.

TYPES

Apraxia takes various forms, and each is related to damage in different parts of the brain. Ideomotor apraxia is the inability to carry out a spoken command to make a certain movement, but to make the same movement unconsciously at other times. In sensory apraxia, a person may not be able to use an object due to loss of ability to recognize its purpose.

Agraphia (difficulty in writing) and *aphasia* (severe difficulty in expressing language) are special forms of apraxia.

OUTLOOK

Recovery from apraxia is highly variable and is dependent on the cause. Lost skills may need to be relearned.

APUD cell tumour

A growth composed of cells that produce various hormones. APUD (amine precursor uptake and decarboxylation) cells occur in different parts of the body.

Some tumours of the thyroid gland, pancreas, and lungs are APUD cell tumours, as are carcinoid tumours (tumours of the intestine or lung, see *carcinoid syndrome*) and *phaeochromocytoma* (a type of adrenal tumour).

aqueous cream

An *emollient* preparation that is commonly used to treat dry, scaly, or itchy skin in conditions such as *eczema*.

aqueous humour

A watery fluid that fills the front chamber of the *eye*, behind the *cornea* (the transparent front part of the eyeball).

arachidonic acid

One of the fatty acids in the body that are essential for growth.

arachis oil

Peanut or ground-nut oil. Arachis oil is used in *enemas* to lubricate and soften impacted faeces and to make bowel movements easier. It can also be applied to the scalp, followed by shampooing, in the treatment of *cradle cap*.

arachnodactyly

A term for long, thin, spiderlike fingers and toes. Arachnodactyly sometimes occurs spontaneously but is also characteristic of *Marfan syndrome*, an inherited connective tissue disease.

arachnoiditis

A rare condition that is characterized by chronic inflammation and thickening of the arachnoid mater, which is the middle of the three *meninges* (membranes) that cover the brain and spinal cord.

The cause of arachnoiditis is often unknown. However, the condition may develop following an episode of *meningitis* (inflammation of the meninges) or a *subarachnoid haemorrhage* (a type of brain haemorrhage). It may also be a feature of *syphilis* or *ankylosing spondylitis* (a disorder affecting the spine). Arachnoiditis may also result from injury or certain medical procedures.

Symptoms may include headache, epileptic seizures, blindness, or difficulty with movements due to increased muscle tension. There is no effective treatment for arachnoiditis.

arachnoid mater

The middle of the three layers of membrane (see *meninges*) that cover the *brain* and spinal cord.

arbovirus

Any of the many viruses transmitted by a member of the arthropod group of animals, including insects, mites, and ticks. (See also *insects and disease; mites and disease; ticks and disease*).

ARC

An abbreviation for *AIDS-related complex*. (See also *AIDS*.)

arcus senilis

A grey-white ring near the edge of the *cornea* (the transparent front part of the eyeball) overlying the iris (the coloured part of the eye).

Arcus senilis
The arcus senilis is the lighter ring that overlies the edge of the iris (the coloured part of the eye).

Arcus senilis, which is caused by degeneration of fatty material in the cornea, develops gradually during adult life. The ring never spreads to the centre and does not affect eyesight. The development of the condition in early adulthood may be associated with an abnormally high level of fats in the blood (see *hyperlipidaemia*).

areola

The pigmented circular area surrounding the *nipple*. The term is also used to describe an inflamed area around a pimple (see *pustule*).

Aricept

A brand name for donepezil, an *acetylcholinesterase inhibitor* used to treat *Alzheimer's disease*.

aromatherapy

A form of *complementary medicine* that uses aromatic oils extracted from plants to treat a wide range of disorders. Practitioners claim that aromatherapy is particularly effective in treating stress-related and *psychosomatic* conditions.

The oil is applied in small quantities through massage; it may also be inhaled, incorporated into creams or lotions, or, very occasionally, taken internally. There is no conclusive scientific evidence of the benefits.

arousal

The awakening of a person from unconsciousness or semiconsciousness. The term is also used to describe any state of heightened awareness, such as that caused by sexual stimulation or fear. Arousal is regulated by the reticular formation in the *brainstem*.

arrhenoblastoma

A rare tumour of the ovary that occurs in young women. The tumour is non-cancerous, but it secretes *androgen hormones* (male sex hormones) that cause *virilization* (development of male characteristics). Treatment of arrhenoblastoma is by surgical removal of the affected ovary.

arrhythmia, cardiac

An abnormality of the rhythm or the rate of the *heartbeat*. Arrhythmias are the result of a disturbance in the electrical impulses within the *heart* (see *Cardiac arrhythmia* box, below). Any isolated irregular beat is known as an *ectopic heartbeat*. Ectopic beats do not necessarily indicate the presence of an abnormality, however.

TYPES

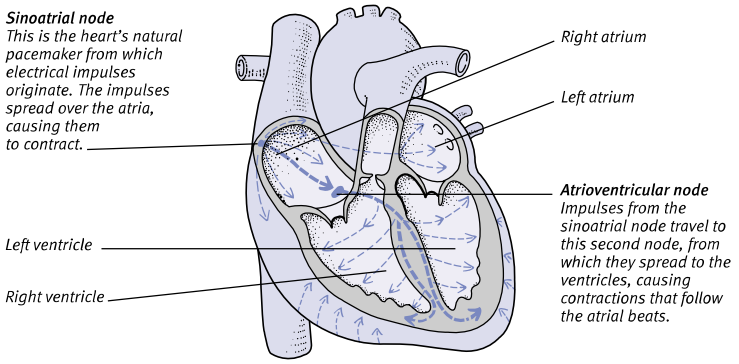
Arrhythmias can be divided into two main groups: tachycardias, in which the rate of the heartbeat is faster than normal, and bradycardias, in which the rate is slower. The rhythm may be regular, with each beat of the atria (upper chambers, see *atrium*) being followed by one beat of the *ventricles* (lower chambers).

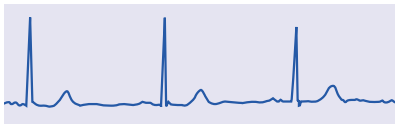
Tachycardias In sinus tachycardia, the rate is raised, the rhythm is regular, and the beat originates in the sinoatrial node (see *pacemaker*). *Supraventricular tachycardia* is faster and the rhythm is regular. It may be caused by an abnormal electrical pathway that allows an impulse to circulate continuously in the heart and take over from the sinoatrial node. A rapid, irregular beat that originates in the ventricles is known as a *ventricular tachycardia*. In *atrial flutter*, the atria beat regularly and very rapidly, but not every impulse reaches the ventricles, which beat at a slower rate. Uncoordinated, fast beating of the atria is known as *atrial fibrillation* and produces totally irregular ventricular beats. *Ventricular fibrillation* is a form of *cardiac arrest* in which the heart does not pump blood because the ventricles are twitching very rapidly in a disorganized manner.

Bradycardias *Sinus bradycardia* is a slow, regular beat. In *heart block*, the conduction of electrical impulses through the

CARDIAC ARRHYTHMIA

Any disorder that interferes with the generation or transmission of impulses through the heart's electrical conducting system (below) can lead to a disturbance of cardiac rate or rhythm. These ECG recordings show two kinds of arrhythmia: sinus bradycardia and atrial fibrillation.





Sinus bradycardia
The heart rate is slow, but the rhythm normal, with each atrial beat (small rise) followed by a ventricular beat (spike). Sinus bradycardia is common in athletes but can also be caused by hypothyroidism.

Atrial fibrillation
The atria beat rapidly and irregularly. Ventricular beats (spikes) do not follow each atrial beat and are irregularly spaced. This arrhythmia is common in the elderly and in people with hyperthyroidism.

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heart muscle is either partially or completely blocked, leading to a slow, irregular heartbeat. Periods of bradycardia may alternate with periods of tachycardia due to a fault in impulse generation (see *sick sinus syndrome*).

CAUSES

A common cause of arrhythmia is *coronary artery disease*, in which the coronary arteries are narrowed by *atherosclerosis* (fat deposits on the artery walls), particularly when following *myocardial infarction* (heart attack). Some tachycardias are the result of a *congenital* (present from birth) defect in the heart's conducting system.

Caffeine can cause tachycardia in some people. *Amitriptyline* and some other *antidepressant drugs* can cause serious cardiac arrhythmias if they are taken in high doses.

SYMPTOMS

An arrhythmia may be felt as palpitations, in which the individual becomes aware of an abnormally rapid heartbeat. However, in some cases, arrhythmias cause fainting and dizziness as a result of reduced blood flow to the brain, or chest pain and breathlessness if there is a reduction in blood flow to the lungs. These may be the first symptoms.

DIAGNOSIS

Arrhythmias are diagnosed by an *ECG*, which shows the pattern of electrical activity within heart muscle. If the arrhythmia is intermittent, a continuous recording may need to be made using an *ambulatory ECG*.

TREATMENT

Treatments for arrhythmias include *antiarrhythmic drugs*, which prevent or slow tachycardias. With an arrhythmia that has developed suddenly, it may be possible to restore normal heart rhythm by using electric shock to the heart (see *defibrillation*).

Repeated attacks of tachycardia can sometimes be treated by radio frequency ablation (the removal of dead or diseased tissue) of the heart's abnormal conduction pathway. This may be carried out during cardiac catheterization (see *catheterization, cardiac*). In some cases, a pacemaker can be fitted to restore normal heartbeat by overriding the heart's abnormal rhythm.

arrowroot

A starchy substance that is obtained from the roots of the West Indian plant MARANTA ARUNDINACEA. Arrowroot was traditionally used an an easily digestible invalid or baby food, being either mixed to a paste with milk or water or used as an ingredient in biscuits.

arsenic

A poisonous metallic element that occurs naturally in its pure form and various compounds. Arsenic poisoning, which is now rare, once occurred as a result of continuous industrial or pesticide exposure.

arterial reconstructive surgery

An operation to repair *arteries* that are narrowed, blocked, or weakened.

WHY IT IS DONE

Arterial reconstructive surgery is most often performed to repair arteries that have been narrowed by *atherosclerosis* (fatty deposits on artery walls). It is also used to repair *aneurysms* (ballooning of arteries) and arteries damaged as a result of injury.

HOW IT IS DONE

A narrowed or blocked section of artery, particularly a coronary artery, can be bypassed by sewing in a length of vein above and below the constricted area. Elsewhere in the body. the affected section is commonly replaced using an artificial tube or a section of vein. (See also *angioplasty, balloon*; *coronary artery bypass; endarterectomy*.)

arteries, disorders of

Disorders of the arteries may take the form of abnormal narrowing (which reduces blood flow and may cause tissue damage), complete obstruction (which may cause tissue death), or abnormal widening and thinning of an artery wall (which may cause rupture of the blood vessel).

TYPES

Atherosclerosis, in which fat deposits build up on the lining of artery walls, is the most common arterial disease. It can involve arteries throughout the body, including the brain (see *cerebrovascular disease*), heart (see *coronary artery disease*), and legs (see *peripheral vascular disease*). Atherosclerosis is the main type of *arteriosclerosis*, a group of disorders that cause thickening and loss of elasticity of artery walls.

Hypertension (high blood pressure) is another common cause of thickening and narrowing of arteries. Hypertension predisposes people to coronary artery disease and increases the risk of a *stroke* or *kidney failure*.

Arteritis is inflammation of artery walls that causes narrowing and sometimes blockage.

Aneurysm is ballooning of an artery wall caused by the pressure of blood flowing through a weakened area.

Thrombosis occurs when a thrombus (blood clot) forms in a blood vessel, causing obstruction of the blood flow.

An *embolism* is blockage of an artery by a fragment of blood clot or other material travelling in the circulation.

Raynaud's disease is a disorder in which there is intermittent spasm of small arteries in the hands and feet, usually precipitated by the cold.

arteriography

An alternative name for *angiography*, an X-ray technique for imaging arteries.

arteriole

A blood vessel that is a branch from an *artery* and which branches further to form *capillaries*. Arterioles have muscular walls, and their nerve supply enables them to be narrowed or widened to meet the blood-flow needs of tissues they supply.

arteriopathy

Any disorder of an artery (see *arteries, disorders of*).

arterioplasty

Surgical repair of an artery (see *arterial reconstructive surgery*).

arteriosclerosis

A group of disorders that cause thickening and loss of elasticity of artery walls. *Atherosclerosis* is the most common type of arteriosclerosis, and the two terms are often used synonymously.

Other types are medial arteriosclerosis (in which muscle and elastic fibres in larger arteries are replaced by fibrous tissue) and Monckeberg's arteriosclerosis (in which there are calcium deposits in the arterial lining).

arteriovenous fistula

An abnormal communication directly between an artery and a vein. An arteriovenous fistula may be present at birth or may result from injury. A fistula can also be created surgically for easy access to the bloodstream, as occurs in *dialysis*.

If the fistula is close to the skin surface it may cause a small, pulsating swelling. If several are present in the lungs, uptake of oxygen into the blood

may be impaired, resulting in *cyanosis* (blue skin colour) and breathing difficulty on exertion.

An isolated fistula that is causing symptoms can often be cut away and the ends of the blood vessels stitched closed. However, if there are many fistulas, surgery is not practicable.

arteritis

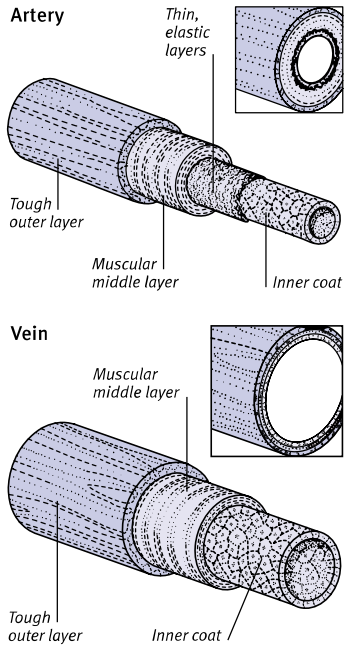
Inflammation of an artery wall, which causes narrowing or complete blockage of the affected artery, reduced blood flow, and, in some cases, *thrombosis* and tissue damage.

TYPES

There are several types of arteritis. *Buerger's disease* is an arteritis that affects the limbs, causing pain, numbness, and, in severe cases, *gangrene*. *Polyarteritis nodosa*, a serious *autoimmune disorder* (in which the immune system attacks the body's own tissues), can affect arteries in any part of the body, especially the heart and kidneys. *Temporal arteritis* affects arteries in the scalp over the temples and may also affect the retinal artery in the eye. Takayasu's arteritis is thought to be an autoimmune disorder. This rare type of arteritis usually affects young women and involves the arteries that branch from the *aorta* into the neck and arms.

STRUCTURE OF AN ARTERY

The walls of an artery consist of three layers: a smooth inner lining, a thick, muscular, elastic middle layer, and a tough, fibrous outer covering. Veins have thinner walls, and most of them contain valves.



artery

A blood vessel that carries blood away from the *heart*. Systemic arteries carry blood that has been pumped from the left ventricle (lower chamber) of the heart to all other parts of the body except the lungs. The largest systemic artery is the *aorta*, which emerges from the left ventricle; other major systemic arteries branch off from the aorta. The pulmonary arteries carry blood from the right ventricle to the lungs.

STRUCTURE

Arteries are tubes with thick, elastic, muscular walls able to withstand the high pressure of blood flow, to which they are subjected on each heartbeat. The structure of arteries helps to even out the peaks and troughs of blood pressure caused by the heartbeat, so that the blood is flowing at a relatively constant pressure by the time it reaches the smaller blood vessels (*arterioles*, which branch directly off the arteries and connect to the even smaller *capillaries*). The pulmonary arteries are thinner-walled than systemic arteries and contain blood at a lower pressure. (See also *arteries, disorders of*.)

arthralgia

Pain in the joints or in a single joint. (See also *arthritis*; *joint*.)

arthritis

Inflammation of one or more joints that is characterized by pain, swelling, and stiffness. Arthritis can vary in severity from a mild ache and joint stiffness to severe pain and, subsequently, deformity of the joints.

TYPES AND CAUSES

There are several different types of arthritis, each having different characteristics. The most common type is *osteoarthritis*, which most often involves the knees, hips, and hands. It usually affects middle-aged and older people because it results principally from wear and tear on the joints. *Cervical osteoarthritis* is a form of osteoarthritis that affects the joints in the neck.

Rheumatoid arthritis is a damaging *autoimmune disorder* (in which the immune system attacks the body's own tissues) that causes inflammation in the joints and other body tissues such as the pericardium (the membrane covering the heart), the lungs, and the eyes. The disorder has different effects in children (see *juvenile chronic arthritis*).

Arthritis in the hands
The joints in the hands of a person suffering from rheumatoid arthritis are painful, swollen, and stiff. In severe cases, the joints become deformed.

Ankylosing spondylitis is another persistent type of arthritis that initially affects the spine and the joints between the base of the spine and the pelvis. Other tissues, such as the eyes, may also be affected. Eventually, the disorder may cause the vertebrae (the bones of the spine) to fuse.

Reactive arthritis typically develops in susceptible people following an infection, most commonly of the genital tract or intestines.

Gout and *pseudogout* are types of arthritis in which crystals are deposited in a joint, causing swelling and pain.

Septic arthritis is a relatively rare condition that can develop when infection enters a joint either through a wound or from the bloodstream.

DIAGNOSIS

Diagnosis of particular types of arthritis is made from *blood tests* and, in some cases, microscopic examination of fluid from the affected joint. *X-rays* or *MRI* (a technique that produces cross-sectional or three-dimensional images of body structures) can indicate the type and extent of joint damage.

TREATMENT

Physiotherapy and exercises can help to minimize the effects of arthritis, and there are specific treatments for certain types (*antibiotic drugs* for septic arthritis, for example).

In severe cases, one or more of the diseased joints may require *arthroplasty*

A

(replacement of a joint with an artificial substitute) or *arthrodesis* (fusion of the bones in a joint).

arthrodesis

A surgical procedure in which the two bones in a diseased joint are fused to prevent the joint from moving, which relieves pain in the affected area.

HOW AND WHY IT IS DONE

Arthrodesis is performed if a joint is painful or unstable and other treatments, such as drugs or *arthroplasty* (replacement of the joint with an artificial substitute), have failed or are inappropriate.

Arthrodesis of a small joint, such as a finger joint, may be carried out under local anaesthetic (see *anaesthesia, local*). Otherwise, a general anaesthetic (see *anaesthesia, general*) is used. In most cases, cartilage (smooth, shock-absorbing tissue) is removed from the ends of the two bones, along with a surface layer of bone from each. The two ends are then joined so that they will fuse when fresh bone cells grow. The bones may need to be kept in position with plates, rods, or screws; a *bone graft* may also be carried out in some cases.

In arthrodesis of the knee or ankle joints, additional immobilization of the joint (by transfixing it with pins inserted through the skin) may be necessary to keep the area stable until healing is complete.

RECOVERY AND OUTLOOK

Complete union of the bones can take up to six months but may be much quicker. In some cases the bones fail to fuse, but fibrous tissue usually fills the gap between them and is strong enough to provide the same effect and strength as bone fusion.

Following arthrodesis, no movement can take place in the affected joint, unlike after arthroplasty. However, the advantage of arthrodesis over arthroplasty is that, once it has been performed, it requires no regular surveillance or further care; and the patient can be reasonably confident that the problem with the joint has been resolved permanently.

arthrography

A diagnostic technique in which the interior of a damaged joint is X-rayed following the injection of a radiopaque (visible on *X-ray*) solution. The procedure is gradually being replaced by *MRI*, *ultrasound scanning*, and *arthroscopy*.

arthrogryposis

See *contracture*.

arthropathy

A medical term for any disease or disorder that involves the *joints*. (See also *diabetic arthropathy*.)

arthroplasty

Replacement of a joint or part of a joint by metal or plastic components. A *hip replacement* is one of the most common operations of this type, as is a *knee-joint replacement*. Replacement of other joints, such as the finger (see *finger-joint replacement*), shoulder, and elbow, is also common.

arthroscopy

Inspection through an *endoscope* (a viewing tube) of the interior of a joint, usually for diagnostic purposes.

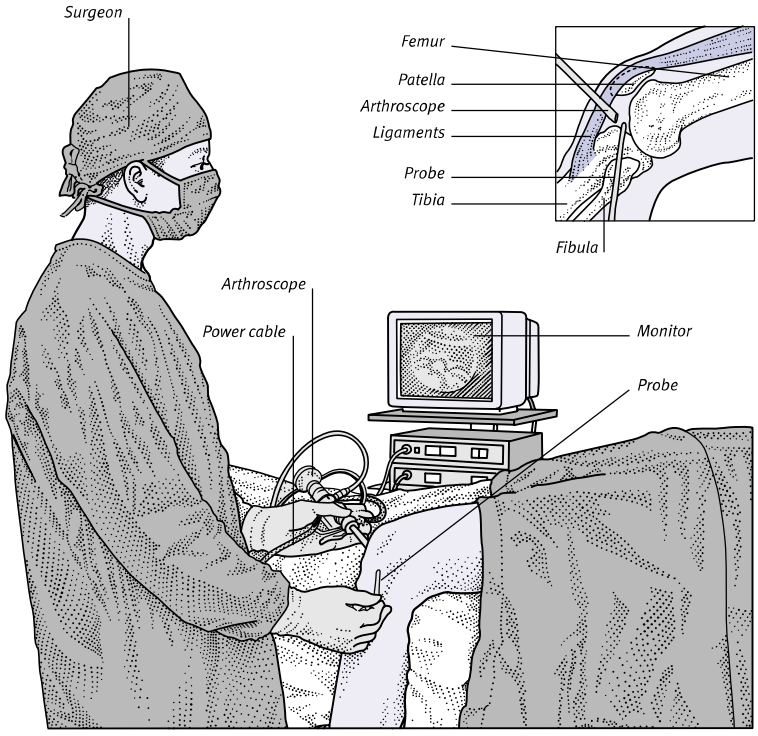
WHY IT IS DONE

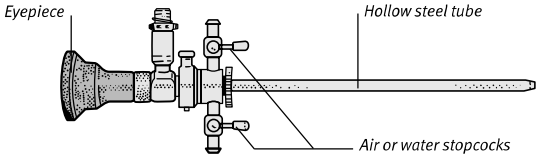
Arthroscopy is most often used to diagnose disorders of the knee joint but can also be used in other joints such as the shoulder, hip, or wrist. The procedure allows the surgeon to see the surface of the bones, the ligaments, the cartilages, and the synovial membrane. Specimens can be taken for examination.

Some surgical procedures that used to involve making a large incision, such as removal of damaged cartilage, repair of ligaments, and shaving of the patella

HOW ARTHROSCOPY IS DONE

The procedure is usually performed under general anaesthesia. The joint is distended by injecting air or a saline solution, and the arthroscope and a probe are inserted into it through small skin incisions. While watching the monitor, the surgeon can repair or remove tissue, such as damaged cartilage, or drill or shave the surface of the patella (kneecap).





Arthroscope
An arthroscope is a type of rigid endoscope – a hollow stainless steel tube containing optical fibres, a lens, and a light source.

(kneecap), are now usually performed arthroscopically. Arthroscopic surgery substantially reduces the amount of recovery time required.

Arthrotec

The brand name of an *antirheumatic drug* containing *diclofenac* and *misoprostol*.

articulation

The junction point of two or more bones (see *joint*).

artificial feeding

See *feeding, artificial*.

artificial heart

See *heart, artificial*.

artificial insemination

A form of assisted conception in which semen is introduced artificially into the uterus, instead of by sexual intercourse, with the aim of inducing conception and pregnancy.

TYPES

There are two types of artificial insemination: AIH, artificial insemination with the semen of the woman's male partner; and AID, insemination with a donor's sperm. AIH is usually used for couples who are unable to have intercourse, or if the man has a low sperm count or a low volume of ejaculate. It is also used when a man's semen has been stored prior to his having treatment (such as chemotherapy) that has made him sterile. AID is available to couples if the man is infertile or a carrier of a genetic disease. It may also be used by a woman who wants children but has no male partner.

HOW IT IS DONE

Artificial insemination is carried out at centres that are specially staffed and equipped to obtain, test, and store semen, to carry out the insemination, and to give counselling before and after the procedure. Semen donors are screened for a wide variety of physical and mental disorders.

Insemination is performed by injecting a sample of semen into the woman's cervix using a small syringe. The procedure is timed to coincide with her natural ovulation (the development and release of an egg from the ovary), or it may be combined with treatment to stimulate ovulation.

artificial kidney

The common name for the machine used in *dialysis*.

artificial limb

See *prosthesis*.

artificial respiration

See *rescue breathing*.

artificial rupture of membranes

See *amniotomy*.

artificial saliva

A preparation used to relieve a persistently dry mouth, which may be a side effect of certain drugs or *radiotherapy* or may be due to *Sjögren's syndrome* (an autoimmune disorder in which the immune system attacks the body's own tissues). Artificial saliva, as a spray, gel, or pastilles, is formulated to resemble natural saliva as closely as possible.

artificial sweeteners

Synthetic substitutes for sugar that are used by people on slimming diets and by the food industry.

Saccharin and aspartame are often recommended for use in calorie-controlled diets. They are, however, of questionable value because the *appetite* compensates for the lack of calories from sugar, therefore other foods are eaten to maintain the calorie intake.

artificial tears

Preparations that are used to supplement tear production in disorders, such as *keratoconjunctivitis sicca*, that cause dry eye and to relieve irritation.

arytenoid

One of two pyramid-shaped cartilages that form part of the *larynx* (voice-box).

asbestos-related diseases

A variety of diseases that are caused by inhalation of asbestos fibres. Asbestos is a fibrous mineral formerly used as a heat- and fire-resistant insulating material. There are three main types of asbestos fibre: white, which is widely used, blue, and brown. Blue and brown are the most dangerous types of asbestos. The use of all types is now carefully controlled.

TYPES

In asbestosis, widespread fine scarring occurs in the lungs. The disease causes breathlessness and a dry cough, eventually leading to severe disability and death. Asbestosis develops mostly in industrial workers who have been heavily exposed to asbestos. The period from initial exposure to development of the disease

Electron micrograph of asbestos fibre in lung
An inhaled asbestos fibre impales and kills a macrophage (a scavenger cell that would normally engulf and destroy foreign particles in the lungs).

is usually at least 20 years. Diagnosis is by *chest X-ray*. Asbestosis increases the risk of developing *lung cancer*.

Mesothelioma is a cancerous tumour of the *pleura* (the membrane surrounding the lungs) or the *peritoneum* (the membrane lining the abdominal cavity). In the pleura, mesotheliomas cause pain and breathlessness; in the peritoneum they cause enlargement of the abdomen and intestinal obstruction. The condition cannot be treated and usually leads to death within one or two years. The average interval between initial exposure to asbestos and death is between 20 and 30 years. Mesothelioma affects people who have been exposed to blue or brown asbestos.

Diffuse pleural thickening is a condition in which the outer and inner layers of the pleura become thickened, and excess fluid may accumulate in the cavity between them. This combination restricts the ability of the lungs to expand, resulting in shortness of breath. The condition may develop even after short exposure to asbestos.

asbestosis

See *asbestos-related diseases*.

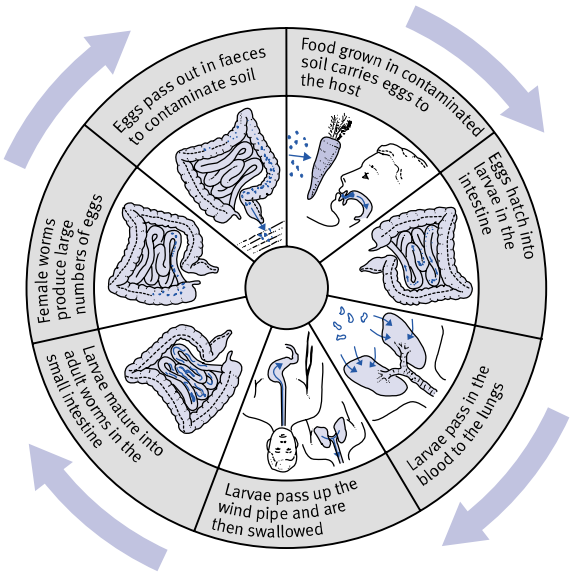
ascariasis

Infestation with the roundworm *ASCARIS LUMBRICOIDES*, which lives in the small intestine of its human host. Ascariasis is common worldwide, especially in the tropics. One or several worms may be present, but symptoms usually only occur with heavy infestation.

A

LIFE CYCLE OF THE ASCARIS WORM

The person becomes infested by swallowing the eggs, which hatch into larvae in the intestine. The larvae travel in the blood through the wall of the intestine to the lungs, up the windpipe, and are swallowed back into the small intestine. There they become adult worms.



CAUSES

The parasite that causes ascariasis is a pale, cylindrical, tapered roundworm, which reaches between 15 and 35 cm in length in its adult form.

Ascariasis is spread by ingestion of worm eggs, usually from food grown in soil that has been contaminated by human faeces. In some dry, windy climates, airborne eggs may be swallowed after being blown into the mouth.

SYMPTOMS

Light infestation may cause no symptoms, although mild nausea, abdominal pain, and irregular bowel movements may occur. A worm may be passed via the rectum, or it may be vomited. A large number of worms may compete with the host for food, leading to malnutrition and *anaemia*, which, in children, can retard growth.

TREATMENT

The worm infestation is treated with *anthelmintic drugs*, such as levamisole, which usually bring about complete recovery. The worms are passed out of the body via the rectum some days after the drug is taken.

ascites

Excess fluid in the peritoneal cavity, the space between the two layers of the peritoneum (the membranes that line the inside of the abdominal wall and cover the abdominal organs).

CAUSES

Ascites may occur in any condition that causes generalized *oedema* (excessive accumulation of fluid in the body tissues), such as in congestive *heart failure*, *nephrotic syndrome*, and *cirrhosis* of the liver. Ascites may occur in *cancer* if metastases (secondary growths) from a cancer elsewhere in the body develop in the peritoneum. The condition also occurs if *tuberculosis* affects the abdomen.

SYMPTOMS

Ascites causes abdominal swelling and discomfort. Additionally, it may cause breathing difficulty as a result of pressure on, and the immobilization of, the diaphragm, the sheet of muscle that separates the thorax (the chest) from the abdomen.

DIAGNOSIS

The doctor diagnoses the cause of ascites by removing and analysing a sample of ascitic fluid via a sterile needle inserted through the abdominal wall.

TREATMENT

The underlying cause is treated if possible. *Diuretic drugs*, particularly *spironolactone*, are often used to treat ascites associated with cirrhosis. If the ascites is causing discomfort or breathing difficulty, fluid can be drained from the peritoneal cavity.

ascorbic acid

The chemical name for *vitamin C*.

ASD

The abbreviation for *atrial septal defect*.

aseptic necrosis

Death of an area of bone tissue in the absence of infection. The cause of aseptic necrosis is almost always damage to the blood supply to bone, often as a result of a fracture. In some cases, the condition is associated with treatment with *corticosteroid drugs*.

Aseptic necrosis often results in chronic (long-term) pain and may cause stiffness in adjacent joints. Early treatment of fractures reduces the risk of the condition developing.

The head of the *femur* (thigh-bone) and the *scaphoid* (a bone in the wrist) are particularly likely to be affected. Aseptic necrosis may be diagnosed from *X-rays*; the affected area of bone appears denser than the surrounding bone.

aseptic technique

The creation of a germ-free environment to protect a patient from infection. Aseptic technique is used during surgery and other minor procedures, such as the insertion of a urinary catheter. It is also used during the care of people suffering from diseases in which the *immune system* is suppressed, such as *leukaemia*. Such conditions result in a weakening of the body's natural defences against infection.

All people who come in contact with the patient must scrub their hands and wear disposable gloves and masks and pre-sterilized gowns. Surgical instruments are sterilized in an *autoclave*. The patient's skin is cleaned with *antiseptic* solutions of, for example, iodine or *chlorhexidine*. In operating theatres, special ventilation systems purify the air. (See also *barrier nursing*; *isolation*.)

aspartame

An *artificial sweetener* used in some foods and drugs.

Asperger's syndrome

A developmental disorder that is usually first recognized in childhood because of stilted speech, difficulties with social interactions, and very specialized interests. Intelligence is normal or high.

Asperger's syndrome is one of a group of conditions known as pervasive developmental disorders; it is considered to be an *autism spectrum disorder* (a developmental disorder characterized by obsessive behaviour and impaired com-

munication and social skills). Special educational support may be necessary, often within mainstream education. Asperger's syndrome is a lifelong condition.

aspergillosis

An infection caused by inhalation of spores of aspergillus, a fungus that grows in decaying vegetation. Aspergillus is harmless to healthy people but may proliferate in the lungs of people with *tuberculosis*. It can also worsen the symptoms of *asthma* and may produce serious, even fatal, infection in people with reduced immunity, such as those taking *immunosuppressant drugs*.

aspermia

See *azoospermia*.

asphyxia

The medical term for suffocation. Asphyxia may be caused by the obstruction of a large airway, usually by a foreign body (see *choking*), by insufficient oxygen in the surrounding air (as occurs when, for example, a closed plastic bag is put over the head), or by poisoning with a gas, such as carbon monoxide, that interferes with the uptake of oxygen into the blood.

The person initially breathes more rapidly and strongly to try to overcome the lack of oxygen in the blood. There is also an increase in heart rate and blood pressure.

First-aid treatment is by clearing the airway of obstruction followed by *rescue breathing*. Untreated asphyxia leads to death within a few minutes.

aspiration

The withdrawal of fluid or cells from the body by suction. The term also refers to the act of accidentally inhaling a foreign body, usually food or drink. If consciousness is impaired, for example by a head injury or excess alcohol intake, aspiration of the stomach contents is common.

Aspiration *biopsy* is the removal of cells or fluid, using a needle attached to a syringe, for examination. Aspiration biopsy is commonly used to obtain cells from a fluid-filled cavity (such as a *breast cyst*). The procedure is also used to obtain cells from the bone marrow (see *bone marrow biopsy*), or from internal organs, when a fine needle is guided to the site of the biopsy by *CT scanning* or *ultrasound scanning*.(See also *aspiration pneumonia*.)

aspiration pneumonia

A form of pneumonia that results from accidental inhalation of vomit. Aspiration pneumonia usually occurs in people whose cough reflex is not functioning, such as those who have drunk excessive amounts of alcohol, taken certain illegal drugs, or suffered a head injury.

aspirin

A nonopioid *analgesic drug* (painkiller) that may be given in tablet or suppository form to treat disorders such as headache, menstrual pain, and muscle discomfort. Aspirin has an *anti-inflammatory* action. It also reduces fever and is included in some *cold remedies*.

In small doses, aspirin reduces the stickiness of platelets (blood particles involved in clotting). This has led to its use in preventing *thrombosis* (abnormal blood clots) in people at risk of developing *stroke* or *myocardial infarction* (heart attack) and as an initial treatment of chest pain that may be due to myocardial infarction. Aspirin may also reduce the risk of *colon cancer* and slow the progress of *dementia*.

In children, aspirin can cause *Reye's syndrome*, a rare but serious brain and liver disorder. For this reason, it should not be given to children under the age of 16 years, except on the advice of a doctor. Aspirin may cause irritation of the stomach lining, resulting in indigestion or nausea. Prolonged use may cause bleeding from the stomach due to *gastric erosion* (disruption of the stomach lining) or *peptic ulcer*.

Aspro

A brand name for *aspirin*.

assay

The analysis or measurement of a substance to determine its presence or effects. A qualitative assay determines only whether or not a substance is present, whereas a quantitative assay determines the actual amount present.

Biological assays (known as bioassays) measure the response of an animal or organ to particular substances. Assays can be used, for example, to assess the effects of a drug or to measure hormone levels. (See also *immunoassay*; *radioimmunoassay*.)

assisted conception

Treatment for *infertility* involving techniques that assist the fertilization and implantation of eggs.

association area

One of a number of areas in the cortex (outer layer) of the *brain* that are concerned with higher levels of mental activity. Association areas interpret information received from sensory areas and prompt appropriate responses, such as voluntary movement.

associative aphasia

Also known as conductive aphasia, a form of *aphasia* (loss of language skills, including comprehension and/or speech production) in which comprehension is normal, and the affected individual can write and speak, but he or she is unable to repeat what has been heard and cannot read aloud. Associative aphasia is caused by damage to a localized area in the brain, often as a result of a *stroke*.

astereognosis

The inability to recognize objects by touch when they are placed in the hand, even though there is no defect of sensation in the fingers or difficulty in holding the object. Astereognosis is either left- or right-sided; tactile recognition is normal on the other side. If both sides are affected, the condition is called tactile *agnosia*.

Astereognosis and tactile agnosia are caused by damage to parts of the *cerebrum* (the main mass of the brain) that are involved in recognition by touch. The conditions may occur as a result of a *stroke* or a *head injury*.

asthenia

An outdated term for loss of strength and energy (see *weakness*).

asthenia, neurocirculatory

See *cardiac neurosis*.

asthma

A lung disease in which there is intermittent narrowing of the *bronchi* (airways), causing shortness of breath, wheezing, and a cough. The illness often starts in childhood but can develop at any age. At least one child in seven suffers from asthma, and the number affected has increased dramatically in recent years. Childhood asthma may be outgrown in about half of all cases.

During an asthma attack, the muscle in the walls of the airways contracts, causing narrowing. The lining of the airways also becomes swollen and inflamed, producing excess mucus that can block the smaller airways.

A

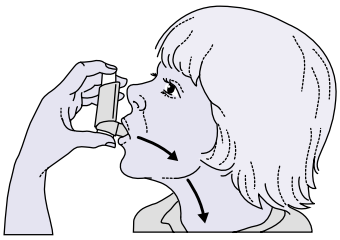
THE CAUSE OF **ASTHMA**

Breathlessness and wheezing in asthma are caused by narrowing of the bronchioles (small airways in the lungs). Asthma can be triggered by a wide variety of stimuli, including exercise, infection, pollen, and dust, which would have no effect on non-asthmatic people.

Inflammation of the linings of these bronchioles results in increased production of sputum (phlegm), which makes the obstruction worse. A dry cough often develops as the sufferer attempts to clear the airways.

TREATMENT OF AN ASTHMA ATTACK

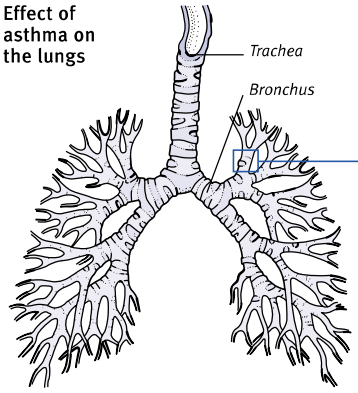
Attacks are treated by inhalation of a bronchodilator drug from an inhaler. For a severe attack, a nebulizer can be used to dispense the drug as fine mist through a face mask or mouthpiece. Babies, young children, or any adults who are unable to coordinate their breathing, require a spacer.

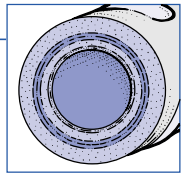


Using an inhaler
To use the inhaler correctly, exhale first then tilt the head back. Take in a slow, deep breath while releasing the drug by depressing the canister. Two puffs should increase air flow within 15 minutes.

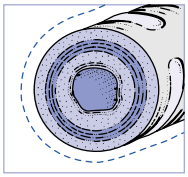
Using a spacer
The inhaler, fitted with a spacer and face mask, is placed over the baby's nose and mouth. This allows the baby to inhale the drug while breathing normally.

Effect of asthma on the lungs

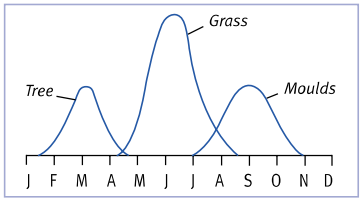




Healthy bronchiole
Inhalation of the bronchodilator widens the bronchiole and improves airflow.



Obstructed bronchiole
Before treatment, the airflow is obstructed by a narrowing of the bronchiole.



Seasonal asthma
When symptoms occur only during a few months, the cause is likely to be allergy to pollen or spores.

TYPES AND CAUSES

In some people, an allergic response triggers the swelling and inflammation in the airways. This allergic type of asthma tends to occur in childhood, and it may develop in association with the allergic skin condition, *eczema* or certain other allergic conditions such as hay fever (see *rhinitis*, *allergic*). Susceptibility to these conditions frequently runs in families.

Some substances are known to trigger attacks of allergic asthma (see *allergens*). These include pollen, house-dust mites, mould, feathers, and dander (tiny scales) and saliva from furry animals such as cats and dogs. Rarely, certain foods, such as milk, eggs, nuts, and wheat, provoke an allergic asthmatic reaction. Some people with asthma are sensitive to *aspirin*, and taking it may trigger an attack.

When asthma starts in adulthood, there are usually no identifiable allergic triggers. The first attack is sometimes brought on by a respiratory tract infection, stress, or anxiety.

In some cases, a substance that is inhaled regularly in the work environment can result in the development of asthma in a previously healthy person. This is known as occupational asthma, and it is one of the few occupational lung diseases that are still increasing in incidence.

There are currently about 200 substances used in the workplace that are known to trigger symptoms of asthma, including glues, resins, latex, and some chemicals, especially isocyanate chemicals used in spray painting. However, occupational asthma can be difficult to diagnose because a person may be regularly exposed to a particular trigger substance for weeks, months, or even years before the symptoms of asthma begin to appear.

Factors that can provoke attacks in a person with asthma include cold air, exercise, smoke, and occasionally emotional factors such as stress and anxiety. Although industrial pollution and exhaust emission from motor vehicles do not normally cause asthma, they do appear to worsen symptoms in people who already have the disorder. Pollution in the atmosphere may also trigger asthma in susceptible people.

SYMPTOMS

Asthma attacks can vary in severity from mild breathlessness to *respiratory failure*. The main symptoms are wheezing, breathlessness, dry cough, and a tightness in the chest. In a severe attack, breathing becomes increasingly difficult, resulting in a low level of oxygen

in the blood. This causes *cyanosis* (a bluish discoloration) of the face, particularly of the lips. Left untreated, such attacks can be fatal.

TREATMENT

There is no cure for asthma, but attacks can be prevented to a large extent if a particular allergen can be identified and consequently avoided.

Treatment involves inhaled *bronchodilator drugs* (sometimes known as relievers) to widen the airways, thereby relieving symptoms. When symptoms occur frequently, or are severe, inhaled *corticosteroids* are also prescribed. These drugs (also known as preventers) are used continuously to prevent attacks by reducing inflammation in the airways.

Other drug treatments include *sodium cromoglicate* and nedocromil sodium, both of which are useful in the prevention of exercise-induced asthma. The use of a *leukotriene receptor antagonist* in combination with a corticosteroid drug may enable the required dose of corticosteroid to be reduced. *Theophylline* or the inhaled *anticholinergic drug* ipratropium bromide may also be used as bronchodilators. An asthma attack that has not responded to treatment with a bronchodilator needs immediate assessment and treatment in hospital.

asthma, cardiac

Breathing difficulty in which *bronchospasm* (narrowing of the airways) and wheezing occur as a result of fluid accumulation in the lungs (*pulmonary oedema*). Cardiac asthma is usually due to reduced pumping efficiency of the left side of the heart (see *heart failure*) and is not true asthma. Treatment is with *diuretic drugs* or other drugs for heart failure.

astigmatism

A condition in which the front surface of the *cornea* does not conform to the normal "spherical" curve, even though the eye is perfectly healthy. Because the cornea is unevenly curved, it refracts (bends) the light rays that strike it to differing degrees. The *lens* is then unable to bring all the rays into focus on the light-sensitive *retina*. A minor degree of astigmatism is normal and does not require correction. More severe astigmatism causes blurring of lines at a certain angle and does require correction.

TREATMENT

Correction may be achieved by using special "cylindrical" glasses that can be framed at a precise angle; contact lenses that can give an even spherical surface for focusing; or by undergoing *laser treatment* on the cornea.

astringents

COMMON DRUGS

• Aluminium acetate • Potassium permanganate • Silver nitrate • Zinc sulphate

Substances that causes tissue to dry and shrink by reducing its ability to absorb water. Astringents are widely used in *antiperspirants* and to promote healing of broken or inflamed skin. They are also used in some eye or ear preparations. Astringents may cause burning or stinging when applied.

astrocytoma

A type of cancerous *brain tumour*. Astrocytomas are the most common type of *glioma*, a tumour that arises from the glial (supporting) cells within the nervous system.

Astrocytomas most commonly develop in the cerebrum (the main mass of the brain) and are classified in four grades (I to IV) according to their rate of growth and malignancy. A grade I astrocytoma is a slow-growing tumour that may spread widely throughout the brain but may be present for many years before causing symptoms. The most severe and fast-growing type is called *glioblastoma multiforme* (a grade IV astrocytoma).

Symptoms are similar to those of other types of brain tumour. Diagnostic tests include *CT scanning* or *MRI*. Treatment is with surgery as well as, in some cases, *radiotherapy*.

asylum

An outdated term for an institution that provides care for the mentally ill.

asymptomatic

A medical term meaning without *symptoms* (indications of illness noticed only by the patient). For example, *hypertension* (high blood pressure) is often asymptomatic and is usually discovered during a routine blood pressure test and *diabetes mellitus* is often diagnosed from a routine blood or urine test.

Most disorders have no symptoms in their early stages. In the case of *cancer*, much effort has been made to devise screening tests for the detection of tumours at their early, asymptomatic, stage. (See also *sign*.)

asystole

A term meaning absence of the heartbeat (see *cardiac arrest*).

ataxia

Incoordination and clumsiness that may affect balance and gait (see *walking*), limb and eye movements, and/or speech.

CAUSES

Ataxia may be the result of damage to the *cerebellum* (the part of the brain concerned with coordination) or to nerve pathways in the *brainstem* (a stalk of nerve tissue linking the brain to the *spinal cord*) and/or spinal cord.

Possible causes include injury to the brain or spinal cord. In adults, ataxia may be caused by *alcohol intoxication*; a *stroke* or *brain tumour* affecting the cerebellum or brainstem; a disease of the balance organ in the ear; or *multiple sclerosis* or other types of nerve degeneration. In children, causes include acute infection, brain tumours, and the inherited condition *Friedreich's ataxia*.

SYMPTOMS

Symptoms of ataxia depend on the site of damage within the nervous system, although a lurching, unsteady gait is common to most forms. In addition, damage to certain parts of the brain may cause *nystagmus* (jerky eye movements) and slurred speech.

DIAGNOSIS AND TREATMENT

CT scanning or *MRI* (techniques that produce cross-sectional or three-dimensional images of body structures) may be used to determine the cause of ataxia. Treatment of the condition depends on the cause.

atelectasis

Collapse of part or all of a *lung* caused by obstruction of the bronchus (the main air passage through the lung) or the bronchioles (smaller air passages). When obstruction occurs, air already in the lung cannot be breathed out and is therefore absorbed into the blood, leading to the collapse of all or part of the lung. After collapsing, the lung loses its elasticity and cannot take in air; consequently, the blood passing through it can no longer absorb oxygen or dispose of carbon dioxide.

In an adult, atelectasis is not normally life-threatening because unaffected parts of the lung and/or the other lung can compensate for the loss of function in the collapsed area. However, when a newborn baby's lung collapses, the baby's life is at risk.

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CAUSES

Obstruction of a bronchus or bronchiole may be caused by the accumulation of mucus. This buildup of mucus most commonly occurs in a baby at birth; in people with asthma; following an abdominal or chest operation that has made coughing difficult because of pain; in certain infections such as *pertussis* (whooping cough) in children or chronic *bronchitis* (inflammation of the bronchi) in adults.

Obstruction may also result from an accidentally inhaled foreign body, a tumour in the lung, or enlarged *lymph nodes* (which occur in *tuberculosis*, some other lung infections, or certain forms of *cancer*) exerting pressure on the airway. The collapsed lung may become infected.

SYMPTOMS

The main symptom of atelectasis is shortness of breath. There may also be a cough and chest pain, depending on the underlying cause.

DIAGNOSIS AND TREATMENT

Atelectasis can be diagnosed by *chest X-ray*, and treatment is aimed at removing the cause of the blockage. The treatment may include *physiotherapy* or *bronchoscopy*, a procedure that involves removal of the blockage using a rigid or flexible viewing tube (see *endoscope*). If the obstruction can be removed, the lung should reinflate normally.

atenolol

A *beta-blocker drug* that is commonly used to treat *hypertension* (high blood pressure), *angina pectoris* (chest pain caused by an impaired blood supply to the heart muscle), and certain types of *arrhythmia* (irregular heartbeat) in which the heart beats too rapidly.

atheroma

Fatty deposits on the inner lining of an artery that occur in *atherosclerosis* and restrict blood flow. The deposits are also known as atheromatous plaques.

atherosclerosis

The accumulation of *cholesterol* and other fatty substances (lipids) in the walls of arteries, causing the arteries to narrow. Atherosclerosis can affect arteries in any area of the body and is a major cause of *stroke*, heart attack (see *myocardial infarction*), and poor circulation in the legs.

The arteries become narrowed when fatty substances carried in the blood accumulate on the inside lining of the arteries and form yellow deposits known as atheromatous plaques. These deposits restrict the blood flow through the arteries. In addition, the muscle layer of the artery wall becomes thickened, which narrows the artery even further. Platelets (tiny blood cells that are responsible for blood clotting) may collect in clumps on the surface of the deposits and initiate the formation of blood clots. A large clot may completely block the artery, resulting in the organ it supplies being deprived of oxygen. A complete blockage in a coronary artery can cause a sudden, often fatal, heart attack.

CAUSES

The risk of developing atherosclerosis is determined largely by the level of cholesterol in the bloodstream, which depends on dietary and genetic factors. Atherosclerosis is more common in developed countries, where most people eat a diet high in fat. Some disorders such as *diabetes mellitus* can be associated with a high cholesterol level, regardless of diet.

SYMPTOMS

Atherosclerosis usually produces no symptoms in its early stages. As the condition progresses, symptoms occur as a result of reduced, or total absence of, blood supply to the organs supplied by the affected arteries.

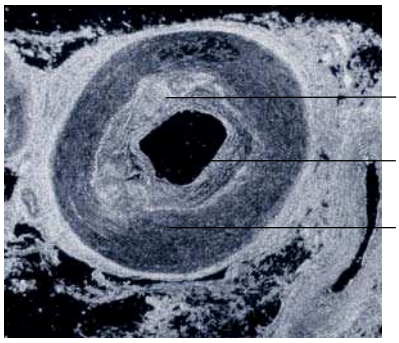
Partial blockage of the coronary arteries (which supply the heart muscle) may produce symptoms such as the chest pain of *angina pectoris*. Narrowing of the arteries supplying blood to the brain may cause *transient ischaemic attacks* (symptoms and signs of a *stroke* that last for less than 24 hours) and episodes of dizziness.

ARTERIAL DEGENERATION IN **ATHEROSCLEROSIS**

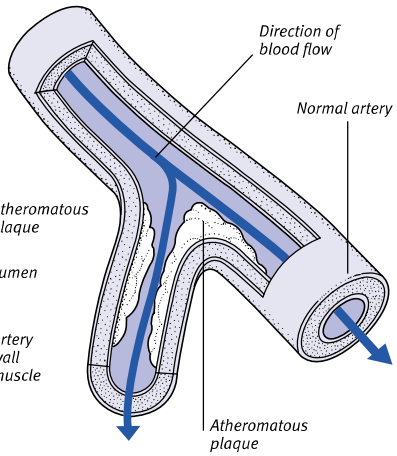
Atherosclerosis is narrowing of the arteries due to plaques of atheroma on their inner linings. The plaques are composed mainly of fats, deposited from the bloodstream, that disrupt normal blood flow through the artery. Men are affected earlier than women because premenopausal women are protected by natural oestrogen hormones.

RISK FACTORS

- Cigarette smoking
- Hypertension
- Male gender
- Obesity
- Physical inactivity
- Diabetes mellitus
- Heredity
- High cholesterol



Micrograph of artery in atherosclerosis
The artery shown here has an atheromatous (fibrous and fatty) plaque deposit on its inner wall. The lumen (channel) has been narrowed, disrupting blood flow.



Atherosclerotic artery
A deposit of atheromatous plaque disrupts normal blood flow through the artery at the point where it branches. This occurs because of the greater level of turbulence in this area.

Intermittent *claudication* (a cramplike pain on walking) is often the first symptom of atherosclerosis in the leg arteries. If the condition is associated with an inherited lipid disorder (see *hyperlipidaemias*), fatty deposits may develop on tendons or as visible lumps under the skin.

DIAGNOSIS AND TREATMENT

Blood flow through an artery can be investigated by *angiography* (X-rays after injection of a *radiopaque* substance) or *Doppler* ultrasound scanning

The best treatment for atherosclerosis is to prevent it from progressing by the maintenance of a healthy lifestyle. This includes adoption of a low-fat diet, not smoking, regular exercise, and maintenance of the recommended weight for height. These measures lead to a reduced risk of developing significant atherosclerosis.

Those individuals found to have high blood cholesterol levels but who are otherwise in good health will be advised to adopt a low-fat diet. They may also be given drugs that decrease blood cholesterol levels (see *lipid-lowering drugs*). For people who have had a heart attack, research has shown that there may be a benefit in lowering blood cholesterol levels, even if the level is within the average range for healthy people.

People with atherosclerosis and those at risk may be prescribed a drug such as *aspirin* to reduce the risk of blood clots forming on the damaged artery lining.

Surgical treatment of atherosclerosis, such as coronary angioplasty (see *angioplasty, balloon*), may be recommended for those people thought to be at high risk of severe complications. If blood flow to the heart is severely obstructed, a *coronary artery bypass* may be carried out to restore blood flow.

athetosis

A disorder of the nervous system that is characterized by involuntary slow, writhing movements, most often of the face, head, neck, and limbs. These movements commonly include facial grimacing, with contortions of the mouth. There may also be difficulty in balancing and walking.

Athetosis tends to be combined with *chorea* (involuntary irregular, jerky movements). Both athetosis and chorea arise from damage to the *basal ganglia*, clusters of nerve cells in the brain that control movement.

Causes of athetosis include brain damage prior to or at birth (see *cerebral palsy*), *encephalitis* (brain infection), degenerative disorders such as *Huntington's disease*, or as a side effect of *phenothiazine drugs* or *levodopa*. If drug treatment is the cause of the condition, the abnormal movements may stop when the drug is withdrawn.

athlete's foot

A common condition in which the skin between the toes becomes itchy and sore and may crack, peel, or blister.

Athlete's foot
The typical appearance of athlete's foot is of fissuring in the cleft between the fourth and fifth toes. There is usually an annoying itch.

CAUSES

Athlete's foot is usually the result of a fungal infection known medically as tinea pedis, but the condition may also be caused by bacteria.

Because the fungi thrive in humid conditions, athlete's foot is more common in people with particularly sweaty feet and those who wear shoes and socks made from synthetic fibres, which do not absorb sweat.

TREATMENT

Self-treatment with topical *antifungal drugs* is usually effective and should be combined with careful washing and drying of the feet.

atlas

The topmost cervical *vertebra* in the human *spine*. The atlas is attached to and supports the skull. A pivot joint attaching the atlas to the second cervical vertebra, the *axis*, allows the atlas to rotate, thereby turning the head from side to side.

atony

Loss of tension in a muscle, so that it is completely flaccid. Atony can occur in some nervous system disorders or after injury to nerves. For example, the arm muscles may become atonic after injury to the *brachial plexus* (nerve roots in the neck passing into the arm).

atopic eczema

Atopic *eczema* is the most common form of eczema (an inflammatory skin condition). It usually begins in infancy but may flare up during adolescence and adulthood. The cause of atopic eczema is unknown, but people with *atopy* (a predisposition to allergic reactions) are more susceptible.

atopy

A predisposition to various allergic reactions (see *allergy*). Atopic individuals have a tendency to suffer from one or more allergic disorders, such as *asthma*, *eczema*, *urticaria* (nettle rash), and allergic *rhinitis* (hay fever).

The mechanism that underlies the predisposition is unclear, but atopy seems to run in families.

ATP

An abbreviation for the compound adenosine triphosphate, the principal energy-carrying chemical in the body. (See also *ADP*; *metabolism*.)

atresia

Congenital (present from birth) absence or severe narrowing of a body opening or tubular organ due to a failure of development in the uterus. Examples are *biliary atresia*, in which the bile ducts between the liver and duodenum are absent; *oesophageal atresia*, in which the oesophagus comes to a blind end; and anal atresia (see *anus, imperforate*), in which the anal canal is shut off. Most forms of atresia require surgical correction early in life.

atrial fibrillation

A type of abnormality of the heartbeat (see *arrhythmia, cardiac*) in which the atria (see *atrium*), the upper chambers of the heart, beat irregularly and very rapidly. The *ventricles* (the heart's lower chambers) also beat irregularly but at a slower rate. As a result, the pumping ability of the heart is reduced.

CAUSES

Atrial fibrillation can occur in almost any longstanding heart disease, but it is most often associated with *heart-valve* disorders or *coronary artery disease*.

SYMPTOMS AND SIGNS

Sudden onset of atrial fibrillation can cause *palpitations* (awareness of a fast

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heartbeat), *angina pectoris* (chest pain as due to impaired blood supply to the heart muscle), or breathlessness. The inefficient pumping action of the heart reduces the output of blood into the circulation. Blood clots may form in the atria and may enter the bloodstream and lodge in an artery (see *embolism*).

DIAGNOSIS AND TREATMENT

Diagnosis of atrial fibrillation is confirmed by an *ECG*, which shows the electrical activity of the heart.

Digoxin or *beta-blocker drugs* may be given to control the heart rate. If the atrial fibrillation is of recent onset, it may be reversed by *defibrillation* (the application of a short electric shock to the heart). In most cases, *anticoagulant drugs* or *aspirin* are also given to reduce the risk of an embolism occurring.

atrial flutter

A type of abnormality of the heartbeat (see *arrhythmia, cardiac*) in which the atria (see *atrium*), the heart's upper chambers beat regularly but very rapidly. Symptoms and treatment of atrial flutter are the same as for *atrial fibrillation*.

atrial natriuretic peptide

A substance that is produced in special cells in the muscular wall of the atria (see *atrium*), the upper chambers of the heart. Atrial natriuretic peptide is released into the bloodstream in response to swelling of the atrial muscle due, for example, to *heart failure* or *hypertension* (high blood pressure).

Atrial natriuretic peptide increases the amount of sodium excreted in the urine. Sodium draws water out with it, which decreases the volume of the blood, thereby reducing blood pressure.

Children who have congenital (present from birth) heart disorders that result in heart disease (see *heart disease, congenital*) possess high levels of atrial natriuretic peptide. Following successful surgery to correct the heart abnormality, the levels of atrial natriuretic peptide fall.

atrial septal defect (ASD)

A congenital (present from birth) heart abnormality (see *heart disease, congenital*) in which there is a hole in the dividing wall (see *septal defect*) between the heart's two upper chambers, or atria (see *atrium*).

atrioventricular block

A type of *heart block*.

atrioventricular node

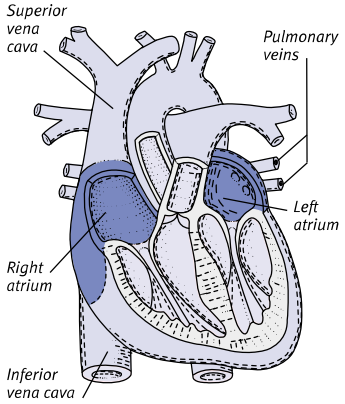
A small knot of specialized muscle cells in the right *atrium* (upper chamber) of the *heart*. Electrical impulses from the *sinoatrial node* (a cluster of muscle cells that act as the heart's natural pacemaker) pass through the atrioventricular node and along conducting fibres to the *ventricles* (the lower chambers of the heart), causing them to contract and pump blood around the body.

atrium

Also known as an auricle, either of the two (right and left) upper chambers of the *heart*. The atria open directly into the *ventricles* (the lower chambers of the heart). Deoxygenated blood from the body enters the right atrium through the *venae cavae*. Oxygenated blood from the lungs enters the left atrium through the *pulmonary veins*.

ANATOMY OF THE **ATRIUM**

Deoxygenated blood flows into the right atrium through the venae cavae; oxygenated blood flows into the left atrium via the pulmonary veins.



atrophy

The wasting away or shrinkage of a normally developed tissue or organ that results from a reduction in the size or number of its cells.

Atrophy is commonly caused by disuse (such as when a limb has been immobilized in a plaster cast) or inadequate cell nutrition as a result of poor blood circulation. Atrophy may also occur during prolonged illness, when the body needs to use up the protein reserves in the muscles. In some circumstances, atrophy is a normal process (as in ovarian atrophy, for example, which occurs in women who have passed the *menopause*.

atropine

An *anticholinergic drug* that is derived from the deadly-nightshade plant (see *belladonna*). Atropine is used to dilate the pupil in eye conditions such as *iritis* (inflammation of the iris) and *corneal ulcer*. It is also used in young children, in the form of eye-drops, to dilate (widen) the *pupil* for examination.

Atropine was often given (by injection) as a *premedication* before a general anaesthetic (see *anaesthesia, general*) to reduce secretions from the lungs, but it is now rarely used for this purpose. It is used as emergency treatment for *bradycardia* (abnormally slow heartbeat) and is also sometimes prescribed for its anticholinergic effects; it is combined with an *antidiarrhoeal drug* to relieve the abdominal cramps that accompany diarrhoea.

Side effects include dry mouth, blurred vision, retention of urine, and, in the elderly, confusion. Atropine eye-drops are rarely given to adults because they cause disturbance of vision that lasts for two to three weeks and may precipitate acute *glaucoma* in susceptible people.

attachment

An affectionate bond between individuals, especially between a parent and child (see *bonding*) or between a person and an object, such as a young child and a security blanket.

The term attachment is also used to refer to the site at which a muscle or tendon is attached to a bone.

attempted suicide

See *suicide, attempted*.

attention deficit hyperactivity disorder (ADHD)

A behavioural disorder in which a child has a consistently high level of activity and/or difficulty in attending to tasks. Attention deficit hyperactivity, or hyperkinetic, disorder affects up to five per cent of children in the UK.

The disorder, which is more common in boys, should not be confused with the normal boisterous conduct of a healthy child. Children with ADHD show abnormal patterns of behaviour over a period of time. An affected child is likely to be constantly restless, unable to sit still for more than a few moments, inattentive, and impulsive.

CAUSES

The causes of ADHD are not fully understood, but the disorder often runs in families, which suggests that genetic factors may be involved. ADHD is not, as popularly believed, a result of poor parenting or abuse.

SYMPTOMS AND SIGNS

Symptoms of the condition develop in early childhood, usually between the ages of three and seven, and may include the inability to finish tasks; inability to concentrate in class; a short attention span; difficulty in following instructions; a tendency to talk excessively, frequently interrupting other people; difficulty in waiting or taking turns; inability to play alone, quietly; and physical impulsiveness.

Children with ADHD may have difficulty in forming friendships. Self-esteem is often low because an affected child is frequently scolded and criticized.

TREATMENT AND OUTLOOK

Treatment of ADHD includes behaviour modification techniques, both at home and at school. In some children, avoidance of certain foods or food additives seems to reduce symptoms. In severe cases, *stimulant drugs*, usually *methylphenidate*, may be prescribed. Paradoxically, the use of stimulant drugs in the treatment of ADHD reduces hyperactivity and improves concentration.

In general, the condition improves by adolescence but may be followed by antisocial behaviour and *drug abuse* or *substance abuse*.

attenuated

A term used to refer to microorganisms that have been treated to reduce their ability to cause disease. Attenuated organisms are used in some *vaccines*.

atypical

A term used to describe something that is not the usual type or that does not fit into the usual pattern. The atypical presentation of a disease or disorder is one in which the early symptoms and signs differ from those that normally occur, which may make diagnosis of the condition more difficult.

audiogram

A graph that is produced as a result of *audiometry* (measurement of the sense of hearing). An audiogram shows the hearing threshold (the minimum audible decibel level) for each of a range of sound frequencies.

audiology

The study of hearing, especially impaired hearing.

audiometry

Measurement of the sense of hearing. The term audiometry often refers to *hearing tests* in which a machine is used to produce sounds of a defined intensity (loudness) and frequency (pitch), and in which the hearing in each ear is measured over the full range of normally audible sounds. (See also *impedance audiometry*.)

auditory nerve

The part of the *vestibulocochlear nerve* (the eighth *cranial nerve*) concerned with hearing. The auditory nerve is also known as the acoustic nerve.

aura

A peculiar "warning" sensation that precedes or marks the onset of a *migraine* attack or a seizure in *epilepsy*.

A migraine attack may be preceded by a feeling of elation, excessive energy, or drowsiness; thirst or a craving for sweet foods may develop. A migraine may also be heralded by flashing lights before the eyes, blurred or tunnel vision, or difficulty in speaking. There may also be weakness, numbness, or tingling in one half of the body. As these symptoms subside, the migraine headache begins.

An epileptic aura may occur as a distorted perception, such as a hallucinatory smell or sound or a sensation of movement in a part of the body. One type of attack (in people who have *temporal lobe epilepsy*) is often preceded by a vague feeling of discomfort in the upper abdomen, sometimes followed by borborygmi (rumbling or gurgling bowel sounds, and by a sensation of fullness in the head.

auranofin

A *gold* preparation used as an *antirheumatic drug* in the treatment of *rheumatoid arthritis*. Unlike other gold preparations, which are given as intramuscular injections, auranofin can be taken by mouth.

auricle

Another name for the pinna, the external flap of the *ear*. The term is also used to describe the earlike appendages of the atria (the upper chambers of the heart, see *atrium*).

auriscope

Also called an *otoscope*, an instrument for examining the ear.

auscultation

A procedure that involves listening to sounds within the body, using a *stethoscope*, to assess the functioning of an organ or to detect disease.

AUSCULTATION OF THE HEART

To listen to the heart, the doctor places the stethoscope on the chest at four points which correspond to the location of the heart valves. With the patient either sitting up, lying in a semi-reclining position, or lying on his or her left side, the doctor listens for any abnormality in the rate and rhythm of the heartbeat and for a heart *murmur* or other abnormal *heart sound* that may indicate a heart defect.

AUSCULTATION OF THE LUNGS

When listening to the lungs, the doctor places the stethoscope on numerous areas of the chest and back. The patient breathes normally, and then takes deep breaths, so that the doctor can compare the sounds on the right and left sides. Abnormal breath sounds may indicate *pneumonia*, *bronchitis*, and *pneumothorax* (in which air enters the space between the *pleura*, the membranes lining the outside of the lungs and the inside of the chest cavity). Cracking or bubbling sounds (known as crepitations) are caused by fluid in the lungs; wheezing sounds result from spasm of the airways, usually as a result of *asthma*. *Pleurisy* (inflammation of the pleura) causes a scratching sound as inflamed areas of the lung rub together.

The doctor may also test for vocal resonance by asking the patient to whisper something. The sound is louder if there is pus in the lung due to a condition such as pneumonia.

AUSCULTATION OF THE BLOOD VESSELS

Blood vessels near the skin surface (usually the carotid artery in the neck, the abdominal aorta, or the renal artery) may be listened to for bruits (sounds made by turbulent or abnormally fast blood circulation). Bruits occur when blood vessels are narrowed (for example by fatty deposits in *atherosclerosis*) or widened (by an *aneurysm*, for example). They may also be present if heart valves have been narrowed or damaged (for example by *endocarditis*).

AUSCULTATION OF THE ABDOMEN

The abdomen is auscultated for borborygmi (loud rumbling, gurgling sounds

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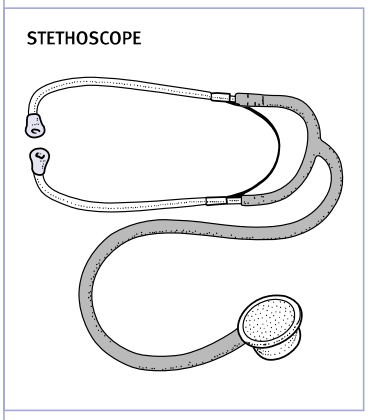
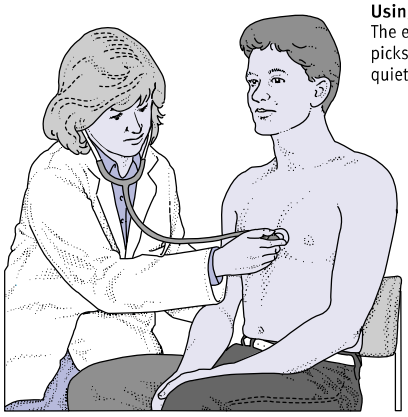
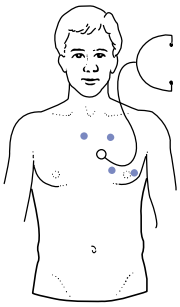
PROCEDURE FOR **AUSCULTATION**

A doctor's examination often includes auscultation (listening to sounds within the body using a stethoscope). Some sounds, such as movement of fluid through the stomach and intestine, opening and closing of heart valves, and flow of air through the lungs and airways, are made during normal functioning of organs. The presence of abnormal sounds usually indicates disease of that tissue, however. An obstetrician listens for the baby's heartbeat as part of routine antenatal examination.

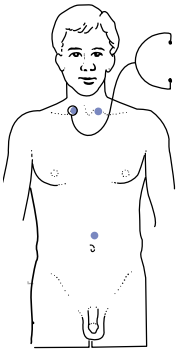




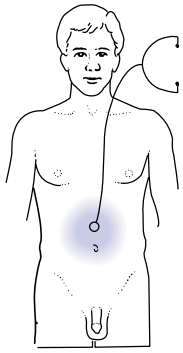
Using a stethoscope
The end is held against the skin. The diaphragm picks up most noises, while the bell detects quiet, deep noises.



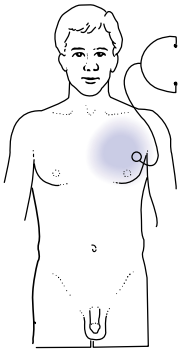
The heart
The stethoscope is usually placed at four places on the chest overlying the sites of the heart valves. The doctor listens for the presence of murmurs, clicks, and extra heart sounds that may indicate disease of a heart valve.



Carotid artery and abdominal aorta
The doctor may listen to the flow of blood through a blood vessel that passes just beneath the skin. The presence of bruits (sounds of turbulence) usually indicates abnormal narrowing or widening of an artery.



The abdomen
The doctor may listen to the abdomen for the sounds made by the movement of fluid through the intestine. A disorder of the intestine may cause these sounds to be absent, abnormal, or very loud.



The lungs
The doctor places the stethoscope over several different areas of the chest and back to listen to the sounds made during breathing. The presence of crackles and dry or moist wheezes indicates various types of lung disease.

that are made by the movement of air and fluid in the intestine), and also for abnormal bowel sounds that may indicate intestinal obstruction (see *intestine, obstruction of*).

autism

A rare condition in which an affected person has difficulty with social relationships, communication, and with imagination, together with repetitive patterns of behaviour. Autism is more common in boys. The condition is, by definition, evident before the age of 30 months and is usually apparent in the first year of life. The precise causes of autism are unknown.

SYMPTOMS AND SIGNS

Autistic children often seem normal for the first few months of life, before becoming increasingly unresponsive to parents or other stimuli. The child fails to form relationships, avoids eye contact, and has a preference for playing alone. Extreme resistance to change of any kind is an important feature of the condition, which can make it very difficult to teach the autistic child new skills.

Rituals develop in play, and there is often attachment to unusual objects or obsession with one particular idea. Delay in speaking is common and most autistic children have a low *IQ*. Other behavioural abnormalities may include walking on tip-toe, rocking, self-injury, screaming fits, and *hyperactivity*.

Appearance and coordination are normal. Some autistic people have an isolated special skill, such as musical ability or an outstanding rote memory.

TREATMENT AND OUTLOOK

There is no cure for autism, which is a lifelong condition. Special schooling, support and *counselling* for the families, and, sometimes, *behaviour therapy* (such as to reduce violent self-injury) can be helpful. Medication is useful only for specific problems, such as hyperactivity.

The outlook depends on the intelligence and language ability of the individual. The majority of autistic people need special care.

autism spectrum disorders

A range of developmental disorders that are characterized by obsessive behaviour and impaired communication and social skills (see *Asperger's syndrome; autism*). Autism spectrum disorders are usually diagnosed during childhood.

autoantibody

An *antibody* (a protein that is manufactured by the immune system) that reacts against the body's own cells (see *autoimmune disorders*).

autoclave

A piece of apparatus that produces steam at high pressure within a sealed chamber; the heat of the water vapour destroys microorganisms. Autoclaving is used in hospitals for the *sterilization* of surgical equipment.

autograft

Tissue that has been transplanted from one part of an individual's body to another (see *grafting*). Autografting is often used to treat severe burns.

autoimmune disorders

Any of a number of disorders caused by a reaction of the body's *immune system* against its own cells and tissues. Such disease-producing processes, known as *hypersensitivity* reactions, are similar to the reactions that occur in *allergy*, except that in autoimmune disorders the hypersensitivity response is to the body itself rather than to an external substance.

CAUSES

The immune system normally distinguishes "self" from "nonself". Some *lymphocytes* (a type of white blood cell) are capable of reacting against self, but these lymphocytes are generally suppressed. Autoimmune disorders occur when there is interruption of the normal control process, allowing such lymphocytes to escape from suppression, or when there is alteration in a particular body tissue meaning that it is no longer recognized as self and is attacked.

Bacteria, viruses, and drugs may play a role in initiating an autoimmune disorder in someone who already has a genetic (inherited) predisposition, but in most cases the trigger is unknown.

TYPES

Autoimmune processes can have various results, such as the destruction of a particular type of cell or tissue, stimulation of an organ into excessive growth, or interference in an organ's function.

Autoimmune disorders are classified into organ-specific and non-organ-specific types. In organ-specific disorders, the autoimmune process is directed mainly against one organ. Examples include *Hashimoto's thyroiditis* (thyroid gland), pernicious *anaemia* (stomach), *Addison's disease* (adrenal glands), and type 1 *diabetes mellitus* (pancreas).

In non-organ-specific disorders, autoimmune activity is towards a tissue, such as connective tissue, that is widespread in the body. Examples of such disorders are systemic *lupus erythematosus* and *rheumatoid arthritis*.

TREATMENT

Initial treatment for any autoimmune disorder is to reduce the effects of the disease by, for example, replacing hormones, such as insulin, that are not being produced.

In cases in which the disease is having widespread effects, treatment is also directed at diminishing the activity of the immune system while maintaining the body's ability to fight disease. *Corticosteroid drugs* are most commonly used for this purpose but may be combined with other *immunosuppressant drugs*.

AUTOIMMUNE DISORDERS

Specific (organs or cells affected)

- Addison's disease (adrenal glands)
- Autoimmune haemolytic anaemia (red blood cells)
- Autoimmune chronic active hepatitis (liver)
- Autoimmune infertility (sperm or ovary)
- Diabetes mellitus type 1 (pancreas)
- Goodpasture's syndrome (lung and kidney)
- Graves' disease (thyroid gland)
- Hashimoto's thyroiditis (thyroid gland)
- Idiopathic thrombocytopenia purpura (platelets)
- Myasthenia gravis (muscle receptors)
- Pernicious anaemia (stomach lining)
- Vitiligo (melanocytes)

Nonspecific

- Behcet's syndrome
- Rheumatoid arthritis
- Sjogren's syndrome
- Systemic lupus erythematosus

autologous blood transfusion

See *blood transfusion, autologous*.

automatism

A state in which behaviour is not controlled by the conscious mind. An individual carries out activities without being aware of doing so, and later he or she has no clear memory of what happened. Episodes of automatism start abruptly and are usually no more than a few minutes in duration.

Automatism is uncommon and may be a symptom of *temporal lobe epilepsy*, *dissociative disorders* (psychological illnesses in which a particular mental function is lost), drug or *alcohol intoxication*, or *hypoglycaemia* (low blood sugar levels).

autonomic nervous system

Also called the involuntary nervous system, the part of the *nervous system* that controls the involuntary activities of a variety of body tissues, including blood vessels, organs, and glands. The autonomic nervous system consists of a network of nerves divided into the sympathetic and parasympathetic nervous systems.

The two systems act in conjunction and normally balance each other. However, during exercise or at times of stress, the activity of the sympathetic system predominates, while during sleep the parasympathetic system exerts greater control.

SYMPATHETIC NERVOUS SYSTEM

The sympathetic nervous system comprises two chains of nerves that pass from the spinal cord throughout the body tissues. Into these tissues, the nerve endings release the *neurotransmitters* (chemical messengers) *adrenaline* (epinephrine) and *noradrenaline* (norepinephrine). The sympathetic nervous system also stimulates the release of adrenaline from the adrenal glands.

In general, the actions of the sympathetic nervous system heighten activity in the body. This activity is known as the *fight-or-flight response*. Among the most important effects produced are the acceleration and strengthening of the heartbeat, widening of the airways, widening of the blood vessels in muscles and narrowing of those in the skin and abdominal organs (in order to increase the blood flow through the muscles), and the inducement of sweating. In addition, the activity of the digestive system is decreased and the pupils are dilated.

PARASYMPATHETIC NERVOUS SYSTEM

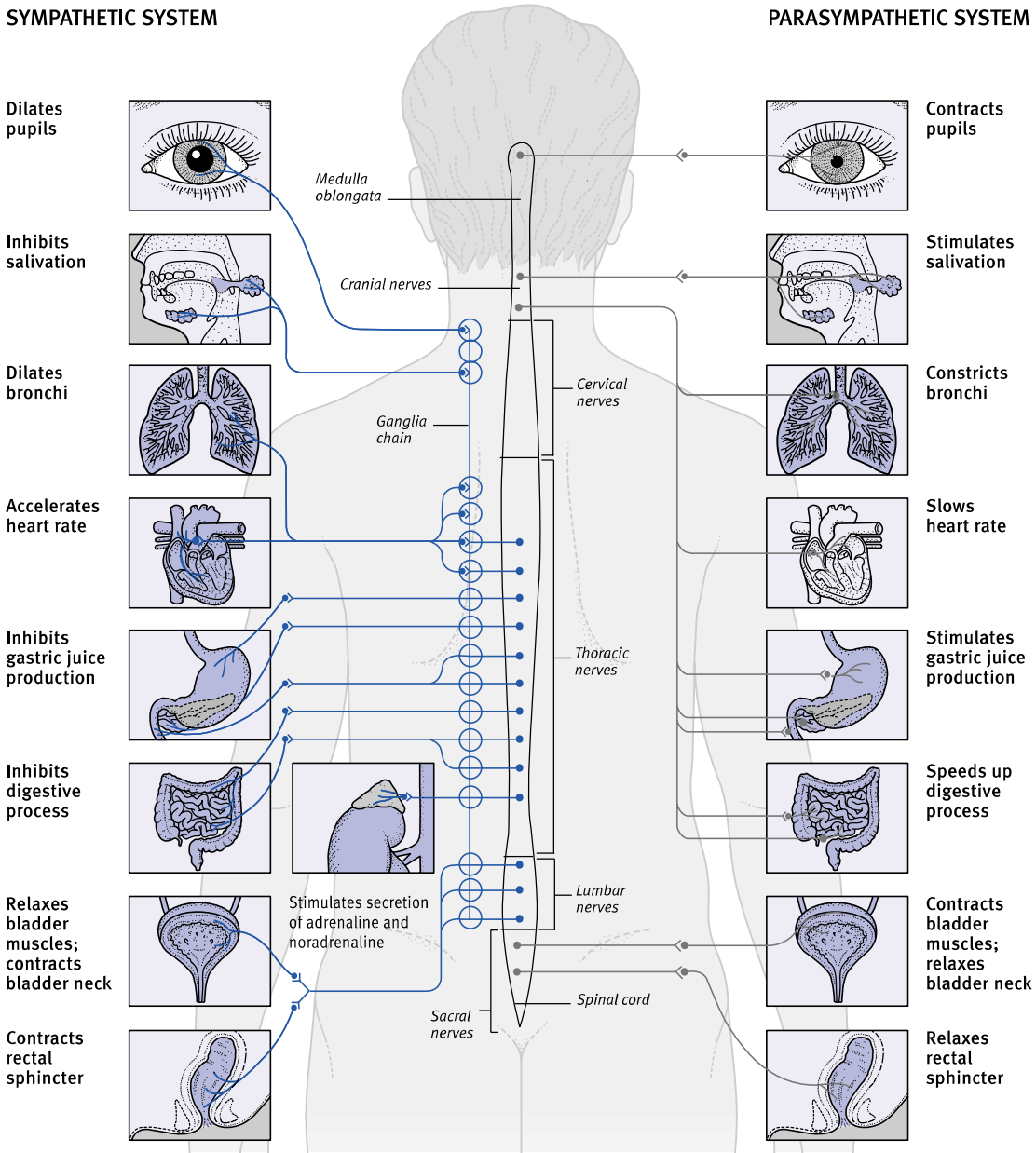
The parasympathetic nervous system is composed of a chain of nerves that passes from the brain and another that leaves the lower spinal cord. The nerves are distributed to the same tissues that are supplied by the sympathetic nerves. The parasympathetic nerves release the neurotransmitter *acetylcholine*, which has the opposite effect to those of adrenaline and noradrenaline.

The parasympathetic system is concerned mainly with everyday functions such as digestion and excretion.

A

FUNCTIONS OF THE **AUTONOMIC NERVOUS SYSTEM**

The autonomic nervous system (also known as the involuntary nervous system) is responsible for controlling the involuntary body functions, such as sweating, digestion and heart rate. The system affects smooth muscles, such as those of the airways and the intestine, rather than the striated muscles, which are under the body's voluntary control.



The autonomic nervous system

The autonomic nervous system is divided into two separate systems: the sympathetic nervous system and the parasympathetic nervous system. The sympathetic system is primarily concerned with preparing the body for action; it predominates at times of stress or excitement. The sympathetic system stimulates functions such as heart-rate and sweating and dilates the blood vessels to the muscles so that more blood is diverted to them. Simultaneously, it subdues the activity of the digestive system. In contrast, the parasympathetic nervous system is concerned mainly with the body's everyday functions such as digestion and the excretion of waste products; this system dominates during sleep. The parasympathetic system slows the heart rate and stimulates the organs of the digestive tract. Most of the time, activity is balanced between the two systems, with neither dominating. Both of the systems play an important part in sexual arousal and orgasm in both men and women.

EFFECT OF DRUGS

Certain disorders can be treated by administration of drugs that affect the autonomic nervous system. *Anticholinergic drugs*, for example, block the effect of acetylcholine, which can reduce muscle spasms in the intestine. *Beta-blocker drugs* block the action of adrenaline (epinephrine) and noradrenaline (norepinephrine) on the heart, thus slowing the rate and force of the heartbeat.

autopsy

A postmortem examination of the body, including the internal organs, which is usually undertaken to determine the precise cause of death. An autopsy is sometimes required by law.

When the cause of death is known and there are no legal requirements for an autopsy to be carried out, hospitals and/or doctors may seek the next-of-kin's permission to perform an autopsy in order to advance knowledge of the disease that caused death, thereby helping in the care of future patients with the same condition. Relatives are free to refuse such consent.

autoregulation

Processes occurring within the body that maintain ideal conditions for normal function. Such processes include the distribution of blood between different organs, and balance of the body's salt and water content.

autosomal disorders

See *genetic disorders*.

autosome

Any *chromosome* that is not a sex chromosome. Of the 23 pairs of chromosomes in each human cell, 22 pairs are autosomes.

autosuggestion

Putting oneself into a receptive hypnotic-like state as a means of stimulating the body's ability to heal itself. The idea that symptoms could be relieved merely through attitude was put forward by the Frenchman Emile Coué at the end of the nineteenth century.

Although, autosuggestion enjoyed only brief popularity, some techniques used today are based on its premise. For example, in one method used to control anxiety symptoms, people are taught muscular relaxation techniques (see *biofeedback*) and learn to summon up calming imagery or pleasant thoughts.

avascular

A term meaning without blood vessels.

avascular necrosis

Cell death in body tissues as a result of damage to the blood vessels that supply the area.

aversion therapy

An outdated form of *behaviour therapy* in which unpleasant stimuli, such as electric shocks, are administered at the same time as an unwanted behaviour in an attempt to alter behavioural patterns. Other forms of therapy are now generally considered to be more appropriate.

aviation medicine

The medical speciality concerned with the physiological effects of air travel, such as the effects of reduced oxygen, pressure changes, and accelerative forces, as well as with the causes and treatment of medical problems that may occur during a flight.

Aviation medicine includes assessment of the fitness of the aircrew, and sometimes of passengers, to fly, the management of medical emergencies in the air, the consequences of special types of flights (such as in helicopters and spacecraft), and the investigation of aircraft accidents.

AIR TRAVEL-RELATED PROBLEMS

Increasing altitude causes a fall in air pressure and with it a fall in the pressure of oxygen. *Hypoxia* (a seriously reduced oxygen concentration in the blood and tissues) is a threat to anyone who flies at altitude. Aviator's *decompression sickness* has the same causes as the related condition that affects scuba divers but it is not normally a risk for passengers on regular flights. Rapid decompression (a sudden drop in air pressure) in civil aircraft is extremely rare, but passengers and crew are provided with oxygen masks for use in emergencies while the aircraft descends to a safe altitude.

Hypoxia or, more commonly, anxiety during flight can lead to *hyperventilation* (overbreathing), in which increased breathing results in excess loss of carbon dioxide. This loss alters the body's acidity and gives rise to symptoms such as tingling around the mouth, muscle spasms, and lightheadedness. If such symptoms develop, the treatment is to rebreathe air from a paper bag held over the nose and mouth, which reduces the loss of carbon dioxide.

The changes in altitude or cabin pressure during a flight affect the body's gas-containing cavities, principally the middle ears, the facial sinuses, the

CONDITIONS AFFECTING PASSENGER SUITABILITY FOR AIR TRAVEL

Conditions	Comments
Lung disease (such as chronic bronchitis or emphysema) **Severe anaemia** **Heart condition (such as angina pectoris, heart failure, or recent heart attack)**	The lowered cabin pressure (and thus the oxygen level) at higher altitudes aggravates an already impaired ability to oxygenate the blood and/or tissues and may cause severe respiratory distress or collapse. Seek your doctor's advice. Flying may be possible if you are able to walk 50 metres without breathlessness or chest pain.
Recent stroke	Seek your doctor's advice. You may need to wait some weeks before flying.
Recent surgery to inner or middle ear, abdomen, chest, or brain; a recently collapsed lung or a fractured skull.	Seek your doctor's advice. You may need to wait before flying to avoid damage to your hearing mechanism from the expansion of gas trapped in the chest, abdomen, or skull.
Pregnancy	No flying after 34 to 36 weeks on most airlines.
Newborn baby	An infant should not fly until at least 48 hours old.
Psychiatric disorder	May need trained escort.
Infectious disease, terminal illness, or vomiting	May be refused entry to aircraft: Check with airline.

lungs, and the intestines. When pressure drops during ascent, the volume of gas in these cavities increases and usually escapes freely. On descent, the gas volume decreases as pressure outside the body rises. Unless preventative measures are taken, this may cause pain and, rarely, damage (see *barotrauma*).

There is increasing concern about the risk of developing deep vein thrombosis (see *thrombosis, deep vein*) during air travel. The condition may be caused by long periods of sitting in one position or compression of the tissues, both of which occur during long-haul flights.

The accelerative forces experienced by civil aircraft passengers are mild, even during take-off and landing, and no medical precautions are necessary. Military aircraft pilots, on the other hand, may experience severe accelerations and must wear special suits and use a reclined seat to prevent pooling of blood in the feet, which would cause immediate loss of consciousness.

Motion sickness usually causes fewer problems during air travel than during road or sea travel. Passengers who are prone to motion sickness may benefit from taking an anti-motion sickness preparation.

Air travel allows the rapid crossing of several time zones within a short period of time, which can affect sleep-waking cycles, causing *jet-lag*.

AVIATION MEDICINE SPECIALISTS

Most large airlines have doctors who are specially trained in aviation medicine who are responsible for the healthcare of the airline staff. The doctors also give advice on the transportation of sick passengers, the provision of training and equipment to deal with illness during flight, and the maintenance of airline hygiene.

avitaminosis

See *hypovitaminosis*.

Avloclor

A brand name for *chloroquine*, a drug that is used to prevent and treat *malaria*. Avloclor is also used in the treatment of some rheumatic disorders, such as *rheumatoid arthritis*.

avulsed tooth

A tooth that has become completely dislodged from its socket following an injury. If the tooth is kept clean and moist (ideally by being stored in milk, saliva, or contact-lens solution), is not otherwise washed, and treatment is sought immediately, reimplantation (see *reimplantation, dental*) may be possible.

avulsion

The tearing away of a body structure from its point of attachment. Avulsion may be due to an injury, for example excessive contraction of a *tendon* may avulse a small piece of bone at its attachment point. Avulsion may also be performed as part of a surgical procedure, as in the surgical removal of *varicose veins*.

axilla

The medical name for the armpit.

axis

The second cervical *vertebra* in the human *spine*. The axis is attached by a pivot joint to the *atlas*, the topmost vertebra, which in turn is attached to the base of the skull. The pivot joint allows the head to turn to either side.

axon

The thin, elongated part of a *neuron* (nerve cell) that conducts nerve impulses. Many axons in the body are covered with a fatty *myelin* sheath.

Ayurvedism

See *Indian medicine*.

azathioprine

An *immunosuppressant drug* used to treat severe *rheumatoid arthritis* and other *autoimmune disorders* (in which the *immune system* attacks the body's own tissues). The drug is also used to prevent organ rejection after *transplant surgery*. Azathioprine may be injected or given in tablet form. Side effects include increased susceptibility to infection.

azelaic acid

A *topical* (applied to the skin) drug that is used to treat mild to moderate *acne*.

azithromycin

A macrolide *antibiotic drug* used to treat infections of the skin, chest, throat, and ears. Azithromycin is also used to treat genital infections due to chlamydia (see *chlamydial infections*).

azoospermia

The absence of sperm from semen, causing *infertility* in males. Azoospermia may be caused either by a congenital (present from birth) disorder or by one that develops later in life. It can also occur following a *vasectomy*.

CAUSES

Congenital azoospermia may be due to a *chromosomal abnormality* such as *Klinefelter's syndrome* (the presence of an extra sex chromosome); failure of the testes to descend into the scrotum; absence of the vasa deferentia (ducts that carry sperm from the testes to the seminal vesicles, where it is stored prior to ejaculation); or *cystic fibrosis* (a genetic disease of the lungs and pancreas that may also cause defects of the vasa deferentia).

In some males, azoospermia may be the result of hormonal disorders affecting the onset of puberty. Another cause is blockage of the vasa deferentia, which may follow a *sexually transmitted infection*, *tuberculosis*, or surgery on the groin.

Azoospermia can also be the result of damage to the testes. This can follow *radiotherapy*, treatment with certain drugs (for example, *anticancer drugs*), prolonged exposure to heat, or the effects of occupational exposure to toxic chemicals. In some cases, production of sperm ceases permanently for no known reason.

TREATMENT AND OUTLOOK

If the cause is treatable (with hormones to bring on puberty or surgery to unblock ducts closed by infection, for example), sperm production may restart. However, in some cases the testes will have been permanently damaged.

AZT

The abbreviation for azidothymidine, the former name for *zidovudine*.

aztreonam

An *antibiotic drug* used to treat some types of *meningitis* and infections by certain types of bacteria, including PSEUDOMONAS.

azygous

A term meaning not paired. Azygous describes a structure such as the heart, which does not have a twin organ on the opposite side of the body. The azygous vein drains blood from the abdomen and chest and travels along the right side of the spine.

B

babesiosis

A general term covering a number of diseases that are caused by the BABESIA genus of *protozoa* (single-celled parasites). Babesiosis is mainly a disease of animals; it may affect sheep, cattle, horses, and other domestic animals. Babesiosis can be transmitted from animals to humans by tick bites, producing symptoms similar to those of *malaria*.

Treatment is with the antimalarial drug *quinine* and an *antibiotic drug*. (See also *ticks and disease*.)

Babinski's sign

A *reflex* movement in which the big toe bends upwards when the outer edge of the sole of the foot is scratched. In babies, Babinski's sign is a normal reflex action. In adults, Babinski's sign is an indication of damage to, or disease of, the *brain* or the *spinal cord*.

baby blues

A common name for a mild form of depression that sometimes occurs in women after childbirth. The baby blues almost always disappear without treatment but can occasionally develop into a more serious depressive illness (see *postnatal depression*).

baby teeth

Also known as milk teeth, an alternative term for the first teeth (see *primary teeth*).

bacillary dysentery

A type of *dysentery* (infection of the intestinal tract) caused by bacteria of the SHIGELLA genus (see *shigellosis*).

bacille Calmette-Guérin

See *BCG vaccination*.

bacilli

Rod-shaped *bacteria*. Bacilli (singular: bacillus) are responsible for causing a variety of diseases, including *infectious diseases* such as tuberculosis, tetanus, typhoid fever, pertussis (whooping cough), and diphtheria.

bacitracin

A type of *antibiotic drug* used in combination with other drugs to treat infections of the eyes and skin. Bacitracin is most commonly applied as an external skin preparation or as eye-drops.

back

The area between the shoulders and buttocks. The back is supported by the spinal column (see *spine*), which is bound together by *ligaments* (bands of tough, fibrous tissue) and supported by muscles that also help to control posture and movement.

DISORDERS

Back problems are numerous and may be the result of a variety of factors affecting the spine. They can be related to disorders of bones, muscles, ligaments, tendons, nerves, and joints in the spine, all of which can cause back pain. (See also *spine* disorders box.)

background radiation

The small amounts of natural *radiation* that emanate from such sources as rocks and the soil.

back pain

Most people suffer from back pain at some time in their lives. In many cases, no exact diagnosis is made because the pain gets better with rest and because analgesic drugs (painkillers) are used before any tests, such as X-rays, are carried out. In such cases, doctors may use the term "nonspecific back pain" to describe the condition.

CAUSES

Nonspecific back pain is one of the largest single causes of working days lost through illness in the UK. The people most likely to suffer from back pain are those whose jobs involve a lot of heavy lifting and carrying or those who spend long periods sitting in one position or bending awkwardly. Overweight people are also more prone to back pain – their backs carry a heavier load and they tend to have weaker abdominal muscles, which usually help to provide support to the back.

Nonspecific back pain is thought to be caused by a mechanical disorder affecting one or more structures in the back. This may be a ligament strain, a muscle tear, damage to a spinal facet joint, or *disc prolapse* (slipped disc).

In addition to pain from a damaged structure, spasm of surrounding muscles will cause pain and tenderness over a wider area. This can result in temporary *scoliosis* (an abnormal sideways curvature of the spine).

Abnormalities of a facet joint and prolapse of an intervertebral disc can both cause *sciatica* (pain in the buttock and down the back of the leg into the foot). This condition is the result of pressure on a sciatic nerve root as it leaves the spinal cord. Coughing, sneezing, or straining will increase the pain. Pressure on the sciatic nerve can also cause a *pins-and-needles* sensation in that leg as well as weakness in muscles that are activated by the nerve. Rarely, pain may radiate down the femoral nerve at the front of the thigh.

Osteoarthritis in the joints of the spine can cause persistent back pain. *Ankylosing spondylitis* (an inflammatory disorder in which arthritis affects the spine) causes back pain and stiffness with loss of back mobility. *Coccydynia* (pain and tenderness at the base of the spine) may occur after a fall in which the coccyx has struck the ground, during pregnancy, or spontaneously for unknown reasons.

Fibrositis is an imprecise term that is sometimes used to describe pain and tenderness in muscles, which may affect the back. Fibrositis is often worse in cold and damp weather and is occasionally associated with feeling generally unwell. Unlike other causes of back pain, fibrositis is not accompanied by muscle spasm or restriction of back movement. It often improves when treated with *nonsteroidal anti-inflammatory drugs*.

Pyelonephritis can cause back pain as well as pain and tenderness in the loin, fever, chills, and pain when passing urine. Cancer in the spine can cause persistent back pain that disturbs sleep and is not relieved by rest.

SELF-HELP

People with back pain and sciatica are usually advised to remain as mobile as possible. Sleeping on a firm mattress and taking analgesic drugs can help to relieve pain. However, if pain persists, is very severe, or is associated with weakness in a leg or bladder control problems, immediate medical advice should be sought.

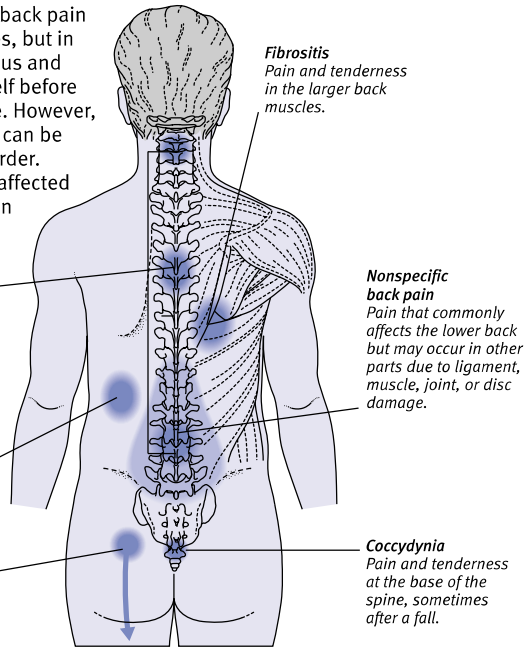
INVESTIGATION

Examination of the back may show tenderness in specific areas or loss of back mobility. Weakness or loss of sensation in the legs implies pressure on a nerve root, which needs prompt investigation.

X-rays of the spine may reveal narrowing between the intervertebral discs; osteoarthritis; *osteoporosis*; ankylosing

BACK PAIN

Most people experience back pain at some time in their lives, but in most cases it is not serious and the problem corrects itself before investigation takes place. However, some kinds of back pain can be related to a specific disorder. The most common sites affected by back pain are shown in this diagram.



Fibrositis
Pain and tenderness in the larger back muscles.

Osteoarthritis
Pain and stiffness in the back due to degeneration of the joints between the vertebrae in one (or more) of the cervical, thoracic, or lumbosacral regions.

Nonspecific back pain
Pain that commonly affects the lower back but may occur in other parts due to ligament, muscle, joint, or disc damage.

Pyelonephritis
Pain in the loin due to infection of the kidney.

Coccydynia
Pain and tenderness at the base of the spine, sometimes after a fall.

Sciatica
Pain in the buttock and down the back of the leg into the foot due to pressure on a nerve.

spondylitis; compression fracture; stress fracture; *bone cancer*; or *spondylolisthesis* (displacement of vertebrae). X-rays will not reveal ligament, muscle, facet joint, or disc damage. To detect pressure on a nerve root (due to disc prolapse, for example), *myelography*, *CT scanning*, or *MRI* is performed.

TREATMENT

If a specific cause is found for the back pain, treatment will be for that cause. Research has shown that acute nonspecific back pain is best treated by early return to normal activity, helped by analgesic drugs. Bed rest should not be continued for more than two days. Chronic nonspecific back pain is often more difficult to treat. Treatment may include use of *aspirin* and related drugs, *nonsteroidal anti-inflammatory drugs*, *muscle-relaxant drugs*, *acupuncture*, or spinal injection. Exercise, spinal *manipulation*, or wearing a surgical *corset* may also be helpful; and spinal surgery may sometimes be necessary.

baclofen

A *muscle-relaxant drug* that blocks nerve activity in the spinal cord. Baclofen is used to relieve muscle *spasm* and stiffness caused by injury to either the brain or spinal cord, by neurological disorders such as *multiple sclerosis*, or by a *stroke*. The drug does not cure the underlying disorder but helps to facilitate movement and allows *physiotherapy* to be more effective. The drug is taken in either tablet or liquid form.

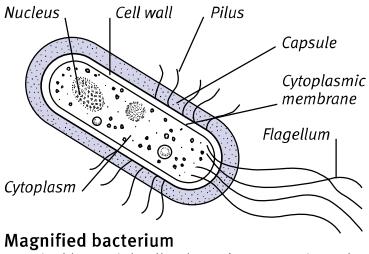
Side effects of baclofen may include drowsiness and muscle weakness. These effects can be reduced if the dose of the drug is increased gradually under medical supervision until the desired degree of relaxation is achieved.

bacteraemia

The presence of *bacteria* in the bloodstream. Bacteraemia commonly occurs for a few hours after minor surgical operations and dental treatment and may also occur in infections such as tonsillitis. The *immune system*, the body's natural defence mechanism, usually prevents the bacteria from multiplying and causing damage. However, in people with abnormal heart valves (due to conditions such as a congenital defect or scarring from rheumatic fever), the bacteria may cause *endocarditis* (inflammation of the heart lining and valves). If bacteraemia affects a person whose immune system is weakened by illness or major surgery, *septicaemia* (an infection of the blood) may develop.

bacteria

Single-celled *microorganisms* that are invisible to the naked eye. The singular form of the term is bacterium. Abundant in the air, soil, and water, most bacteria are harmless to humans. Some, such as those that live in the intestine, are beneficial and help to break down food for digestion.



Magnified bacterium
A typical bacterial cell enlarged to approximately 20,000 times its normal size.

DISEASE-CAUSING TYPES

Disease-causing bacteria are known as pathogens and are classified, according to shape, into three main groups: *cocci* (spherical); *bacilli* (rod-shaped); and *spirochaetes* or spirilla (spiral-shaped).

Among the wide range of diseases caused by cocci are pneumonia, tonsillitis, bacterial endocarditis (inflammation of the lining inside the heart), meningitis (inflammation of the membranes surrounding the brain and spinal cord), toxic shock syndrome, and various disorders of the skin.

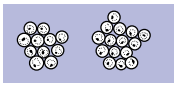
Diseases that are caused by bacilli include tuberculosis, pertussis (whooping cough), typhoid fever, diphtheria, tetanus, salmonellosis, shigellosis (bacillary dysentery), legionnaires' disease, and botulism.

Bacteria from the third, and smallest, group, the spirochaetes, are responsible for causing syphilis, yaws, leptospirosis, and Lyme disease.

GROWTH AND MOVEMENT

The bacteria that colonize the human body thrive in warm, moist conditions.

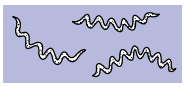
Common types of bacteria



Staphylococcus
(causes boils)

Streptococcus
(causes sore throat)

Salmonella typhi
(causes typhoid fever)



Spirochaete
(causes syphilis)

Some of these bacteria are aerobic (they need oxygen to grow and multiply) and are therefore most commonly found on the skin or within the respiratory system. Others are anaerobic, thriving where there is no oxygen, deep within tissue or wounds.

Some types of bacteria are naturally static; if they move around the body at all, they do so only when carried in currents of air or fluid. However, there are also highly motile types of bacteria, such as salmonella, which move through fluids by lashing with their whiplike tails (known as flagella) and can anchor themselves to other cells with filamentous threads called pili.

REPRODUCTION

Bacteria reproduce by simple cell division, which can occur every few minutes in ideal conditions (exactly the right temperature and sufficient nourishment for all cells). Some bacteria multiply by each producing a spore (a single new bacterium). Spores, which are protected by a tough membrane, can survive high temperatures, dry conditions, and lack of nourishment.

HOW BACTERIA ENTER THE BODY

Bacteria can enter the body through the lungs if they are inhaled in infected droplets spread by coughs and sneezes. The digestive tract may become infected if contaminated food is eaten. Some bacteria cause diseases, such as sexually transmitted infections, by entering the genitourinary system.

Bacteria can also penetrate the skin in various ways: through hair follicles; by way of superficial cuts and abrasions; through burns; and via deep, penetrating wounds.

HOW BACTERIA CAUSE DISEASE

Some bacteria release poisons (toxins) that are harmful to human cells. The toxins either destroy the cell or disrupt its chemical processes. Less commonly, certain types of bacteria directly enter, and multiply within, body cells, causing tissue damage as they spread.

THE BODY'S DEFENCES

The body's first defences against disease-causing bacteria are the skin and the *mucous membranes* lining the respiratory tract, the digestive tract, and the genitourinary system. The eyes are protected by an *enzyme* in tears and the stomach secretes hydrochloric acid, which kills many of the bacteria found in food and water.

If bacteria pass through these barriers, the body's *immune system* responds by sending various types of white blood cell to seek and destroy the bacteria.

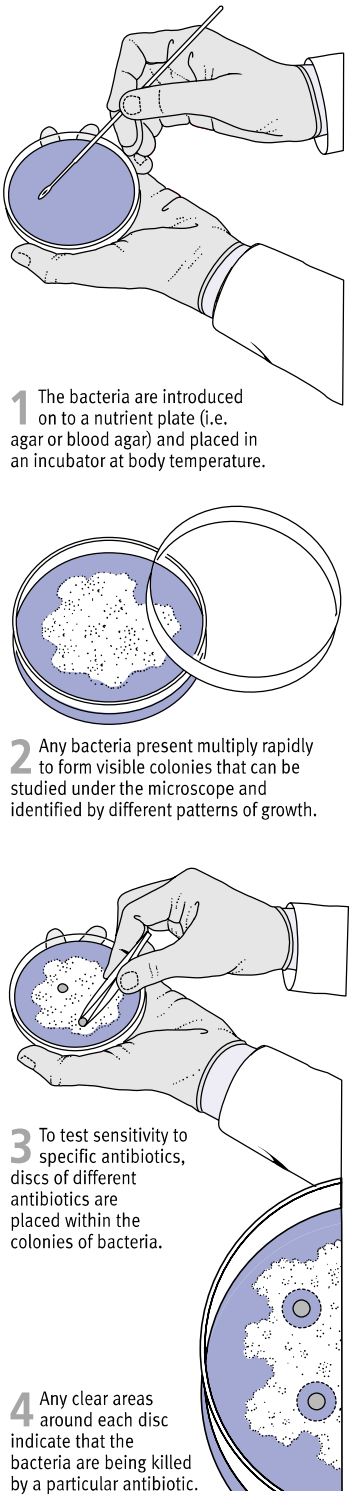
Immunity can also be generated by *immunization*. This involves injecting a weakened form of the bacterium or its poison into the body to stimulate an immune response. Immunization is now routine for a number of conditions, including *diphtheria*, *tetanus*, and some forms of *meningitis*.

TREATMENT OF BACTERIAL DISEASES

The immune response is sometimes enough to bring about recovery, and mild bacterial infections may not need any treatment. However, *antibiotic drugs* are the main form of treatment for more severe infections. Superficial infected wounds may be treated with *antiseptics*.

Some bacteria, such as *MRSA*, are now becoming resistant to treatment with antibiotics. In these circumstances, bacterial infections can be difficult or even impossible to treat and may be life-threatening. (See also *infectious disease*.)

CULTURING AND TESTING BACTERIA



1 The bacteria are introduced on to a nutrient plate (i.e. agar or blood agar) and placed in an incubator at body temperature.

2 Any bacteria present multiply rapidly to form visible colonies that can be studied under the microscope and identified by different patterns of growth.

3 To test sensitivity to specific antibiotics, discs of different antibiotics are placed within the colonies of bacteria.

4 Any clear areas around each disc indicate that the bacteria are being killed by a particular antibiotic.

bacterial endocarditis

See *endocarditis*.

bacterial food poisoning

See *food poisoning*.

bacterial vaginosis

An infection of the *vagina* that causes a greyish-white discharge and itching. The disorder is due to excessive growth of *bacteria* that normally live in the vagina. Bacterial vaginosis occurs most commonly in sexually active women and is treated with *antibiotic drugs*.

bactericidal

A term that is used to describe any substance that kills bacteria. (See also *antibiotic drugs*; *bacteriostatic*.)

bacteriology

The study of *bacteria*, particularly of the types that cause disease. Bacteriology includes techniques used to isolate and identify bacteria from specimens such as a throat swab or urine. Bacteria are identified by their appearance under a microscope, including their response to stains (see *Gram's stain*; *staining*), and by the use of *culture*. Testing for sensitivity to *antibiotic drugs* may be performed.

bacteriostatic

A term used to describe a substance that stops the growth or multiplication of *bacteria* but does not kill them. (See also *antibiotic drugs*; *bactericidal*.)

B

bacteriuria

The presence of *bacteria* in the urine. It is common for small, harmless numbers of bacteria to be found in the urine of healthy people. Bacteriuria is of significance only if more than 100,000 bacteria are present in each millilitre of urine, or if 100 white blood cells (pus cells) per millilitre of urine are present (which is an indication of the body's response to the infection).

Bacteroides

A genus of *anaerobic* (capable of living without oxygen) bacilli (rod-shaped *bacteria*) that normally inhabit the intestines. One particular type, BACTEROIDES FRAGILIS, is commonly found in abdominal wound infections and in the blood when the intestines are diseased.

bad breath

See *halitosis*.

bagassosis

An occupational disease affecting the lungs of workers who handle mouldy bagasse (the fibrous residue of sugarcane after juice extraction). Bagassosis is one cause of allergic *alveolitis,* a reaction of the lungs to inhaled dust containing fungal spores. Symptoms develop four to five hours after inhalation of the dust and may include shortness of breath, wheezing, fever, headache, and cough; typically, they last for about 24 hours. Repeated exposure to dust may lead to permanent lung damage. Protective measures taken by industry have made the disease rare.

Baker's cyst

A firm, fluid-filled lump behind the knee. A Baker's cyst occurs as a result of increased pressure in the knee joint due to a buildup of fluid. Such a buildup is a feature of disorders such as *rheumatoid arthritis*. The cyst is created by a backward ballooning-out of the synovial membrane covering the knee joint.

Most Baker's cysts are painless, and some disappear spontaneously, sometimes after many months. Occasionally, a cyst may rupture, causing fluid to seep down between the layers of the calf muscles. This can produce pain and swelling in the calf that may mimic a deep vein thrombosis (see *thrombosis, deep vein*).

Diagnosis of a Baker's cyst is confirmed by *ultrasound scanning*. Treatment is rarely needed, but in a few cases surgery may be performed.

balance

The ability to remain upright and move without falling over. Keeping one's balance is a complex process that relies on a constant flow of information to the brain about body position. The integration of all of this information, and continual instructions from the brain, enable the body to make the changes needed to maintain balance.

The brain receives data on body position from various sources: the eyes; the sensory organs (called proprioceptors) in the skin, muscles, and joints; and the three semicircular canals of the labyrinth of the inner *ear*. The part of the brain called the *cerebellum* collates this information and sends instructions to muscles to contract or relax to maintain balance.

DISORDERS

Balance can be affected by various disorders, particularly inner-ear disorders such as *labyrinthitis* (inflammation of the ear's labyrinth) and *Ménière's disease* (an abnormally high pressure of fluid in the labyrinth). Less commonly, *otitis media* (a disorder of the middle ear) may disturb balance.

Damage to nerve tracts in the spinal cord that carry information from position sensors in the joints and muscles to the brain can also impair balance. This damage to the nerves may result from spinal tumours, circulatory disorders, nerve degeneration due to deficiency of vitamin B_{12}, or, rarely, tabes dorsalis (a complication of *syphilis*). A tumour or *stroke* that affects the cerebellum in the brain may cause clumsiness of the arms and legs as well as other features of impaired muscular coordination.

balanitis

Inflammation of the foreskin and the glans (head) of the penis. Balanitis results in pain and/or itchiness, and the entire area may be red and moist. Causes of balanitis include bacterial or fungal infection, *phimosis* (tightness of the foreskin), or chemical irritation by contraceptive creams (see *contraception*) or laundry products.

Treatment is usually with *antibiotic drugs* or *antifungal drugs* (either applied to the skin as cream or taken orally) and careful washing of the penis and foreskin. If balanitis recurs frequently, or is due to phimosis, *circumcision* (surgical removal of the foreskin) may be recommended.

baldness

See *alopecia*.

ball-and-socket joint

A highly mobile *joint*, such as the shoulder or hip.

ballismus

Violent jerking and twitching of the limbs that is caused by brain damage within the area below the *thalamus* (a structure that relays sensory information). In most cases, only one side of the body is affected, in which case the condition is known as hemiballismus.

balloon angioplasty

See *angioplasty, balloon*.

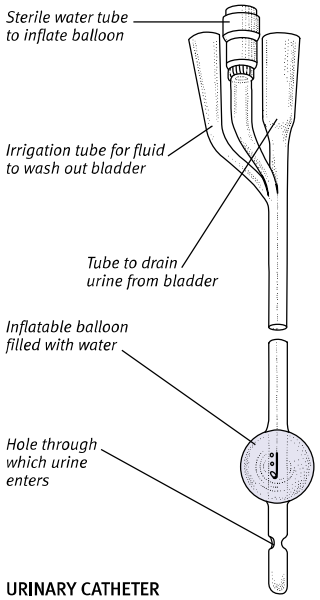
ballottement

A technique occasionally used during a physical examination (see *examination, physical*) to check the position of an organ, particularly in a fluid-filled area of the body. It involves flicking or tapping the area with the fingers, causing the organ to move up and down. The technique was once widely used to confirm pregnancy; when the wall of the uterus is tapped, the fetus moves away and floats back with a responding tap.

balloon catheter

A flexible tube with a balloon at its tip, which, when inflated, keeps the tube in place or applies pressure to an organ or vessel. One type of balloon catheter is

BALLOON CATHETER



URINARY CATHETER

used to drain urine from the bladder (see *catheterization, urinary*). Balloon catheters are sometimes used to expand narrowed arteries (see *angioplasty, balloon*). They may also be used to control bleeding from widened veins in the lower part of the oesophagus (known as *oesophageal varices*) before surgery.

balm

A soothing or healing medicine applied to the skin.

balsam

An aromatic oily liquid that is obtained from various evergreen trees. Balsam is an *antiseptic* substance and was once also widely used in remedies for respiratory disorders.

bambuterol

A *bronchodilator drug* that is taken orally for the relief of *asthma*.

bandage

A strip or tube of fabric used to keep *dressings* in position, to apply pressure, to control bleeding, or to support a sprain or strain. Roller and tubular bandages are the type most widely used. Tubular gauze bandages require a special applicator and are used mainly for areas that are awkward to bandage, such as a finger. Triangular bandages are used to make *slings*. (See also *wounds*.)

banding

A procedure for treating *haemorrhoids* (piles) that are large or are causing particular discomfort. Using a special instrument, a doctor places a rubber band around the base of the haemorrhoid, which causes it to shrink and, eventually, to fall off. Banding is virtually painless and the procedure can be performed in a doctor's surgery.

barber's itch

See *sycosis barbae*.

barbiturate drugs

COMMON DRUGS

• Amobarbital • Butobarbital • Phenobarbital • Secobarbital • Thiopental

A group of sedative drugs that work by depressing activity within the brain. Barbiturate drugs include thiopental, which is very short-acting and is used to induce anaesthesia (see *anaesthesia, general*), and phenobarbital, which is long-acting and is sometimes used as an *anticonvulsant drug* in the treatment of epilepsy. In the past, barbiturates were widely used as *antianxiety drugs* and *sleeping drugs*, but they have been largely replaced by *benzodiazepine drugs* and other nonbarbiturates. Because barbiturates are habit-forming and are widely abused for their sedative effect, they are now classed as *controlled drugs*.

HOW THEY WORK

The sedative action of barbiturate drugs is produced by the drug molecules blocking the conduction of stimulatory chemical signals between the nerve cells of the brain and reducing the ability of the cells to respond. Barbiturates, especially phenobarbital, also reduce the sensitivity of brain cells to abnormal electrical activity.

POSSIBLE SIDE EFFECTS

The possible adverse effects of barbiturate drugs include excessive drowsiness, staggering gait, and, in some cases, excitability. An overdose of barbiturates can be fatal, particularly when taken in combination with alcohol, which dangerously increases their depressant effect on the brain (including suppression of the respiratory centre).

Barbiturates are likely to produce *drug dependence* if used for longer than a few weeks, and withdrawal effects, such as sleeplessness and twitching, may then occur when treatment is stopped.

Bardet–Biedl syndrome

A very rare *genetic disorder* characterized by *learning difficulties*, *retinopathy* (an eye defect), *obesity*, *polydactyly* (the presence of extra fingers or toes) and *hypogonadism* (underactivity of the testes or ovaries).

barium sulphate

A salt that is used in solution as a *contrast medium* in X-ray examinations of the intestinal tract (see *barium X-ray examinations*). Barium is opaque to X-rays and is used to view the outline of hollow internal organs, which would otherwise not be visible.

barium X-ray examinations

Procedures used to detect and follow the progress of some disorders of the gastrointestinal tract. Because barium (a metallic element) is opaque to X-rays, it is used to outline organs, such as the stomach, which are not normally visible on an X-ray image. Barium sulphate mixed with water is passed into the part of the tract requiring examination before X-rays are taken. In some cases, barium X-ray examinations can be used as an alternative to *endoscopy* (internal examination using a rigid or flexible viewing tube), although endoscopy is often the preferred form of investigation.

Barium X-rays may be single- or double-contrast. Single-contrast X-rays use barium sulphate alone. The barium fills the section of the tract under examination and provides an outline image that shows up any prominent abnormalities. In double-contrast barium X-rays, the barium forms a thin film over the inner surface of the tract and the tract is subsequently filled with air so that any small surface abnormalities can be seen.

TYPES OF EXAMINATION

Various types of barium X-ray examination are used to investigate different parts of the gastrointestinal tract. A barium swallow involves drinking a solution of barium; this procedure is used to investigate the swallowing mechanism or the oesophagus. A barium meal is carried out to look at the lower oesophagus, stomach, and duodenum.

A barium follow-through examination can be used to investigate disorders of the small intestine; after barium has been swallowed, a series of X-rays are taken at intervals as the barium travels down the oesophagus to the intestine. A barium enema can be used to investigate disorders of the large intestine and the rectum; the barium is introduced into the body through a tube inserted in the rectum.

Any barium that remains in the intestine may be a cause of constipation. For this reason, it is important to ensure that a patient has a high-fibre diet and drinks plenty of water following a barium examination, until all the barium has passed through. (See also *Barium X-ray procedures* box, overleaf.)

barotrauma

Damage or pain, mainly affecting the middle *ear* and the facial *sinuses*, that is caused by changes in surrounding air pressure. Air travellers are at the greatest risk of barotrauma, but scuba divers face similar problems.

CAUSE

Aircraft cabin pressure decreases as the plane ascends and increases as it descends. As the aircraft ascends, the ears may seem to "pop" as the air in the middle ear expands and is expelled via the eustachian tubes, which connect the middle ear to the back of the throat. On descent, the higher pressure may push the eardrum inwards and cause pain.

B

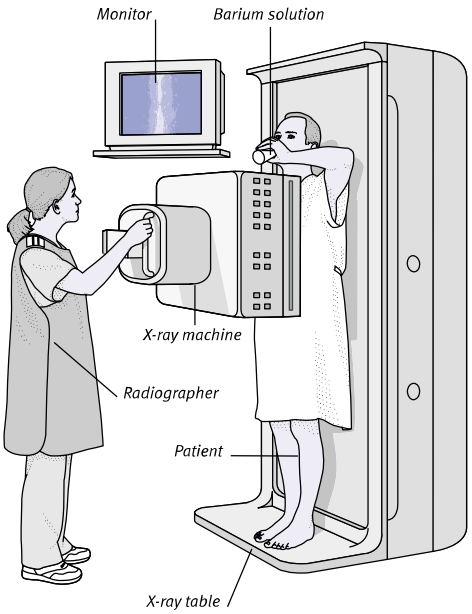
BARIUM X-RAY PROCEDURES

Barium X-ray examinations are used to reveal abnormalities or disorders within the upper and lower gastrointestinal tract. Barium swallows are used to investigate the oesophagus, and barium meals are used for the examination of areas such as the stomach and duodenum. The large intestine is examined by means of a barium enema.

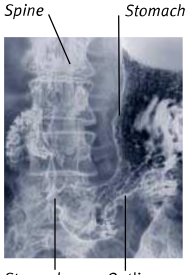
BARIUM SWALLOW/MEAL

Barium swallows and meals are used to investigate the upper gastrointestinal tract. No food or drink is permitted for six to nine hours beforehand. At the examination, the patient swallows a glass of barium mixed with a flavoured liquid, or is given a piece of bread or a biscuit soaked in barium if a disorder of the swallowing mechanism is being investigated.

Taking the X-ray
The radiographer takes X-ray pictures while the patient swallows. For a barium swallow, the patient stands; for a barium meal, the patient lies on the table in different positions; for a barium follow-through, the patient lies on the right side and X-rays are taken at intervals until the barium has progressed through the small intestine.



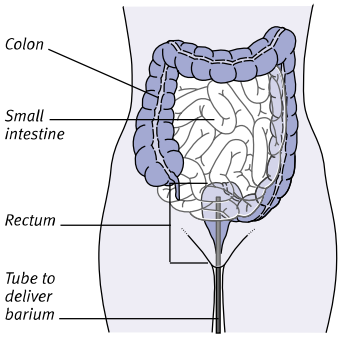
Barium swallow result
This contrast X-ray has revealed a narrowed area, known as an oesophageal stricture, in the lower section of the oesophagus.



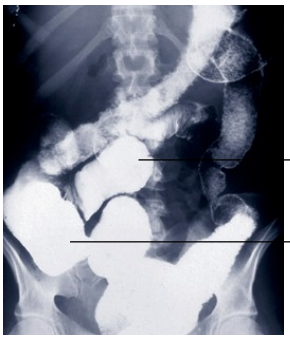
Barium meal result
In this X-ray, a thin film of barium has outlined the stomach lining. The introduction of air into the stomach has revealed the presence of a large tumour.

BARIUM ENEMA

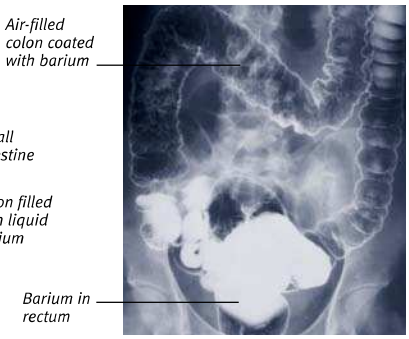
A barium enema is carried out for examination of the large intestine and rectum. In order for an examination to be successful, the large intestine needs to be as empty and clean as possible because faeces can obscure or simulate a polyp or tumour. For this reason, the patient's intake of food and fluids is sometimes restricted for a few days before the examination, and laxatives are given to make sure that the bowel is empty prior to the procedure.



The procedure
The radiographer or radiologist introduces the barium into the patient's intestine via a tube inserted into the rectum. The patient lies on his or her left side while the barium is infused. He or she then turns on to the other side, front, and back, and X-rays are taken.



Single-contrast result
In single-contrast barium enemas, the section of intestine to be examined is filled with liquid barium. Because barium is opaque to X-rays, it provides an outline image that shows up prominent abnormalities such as narrowing.



Double-contrast result
In double-contrast, barium and air are introduced into the tract. The barium forms a film on the tract's inner surface only, providing an image of small surface abnormalities that would not be visible using single-contrast.

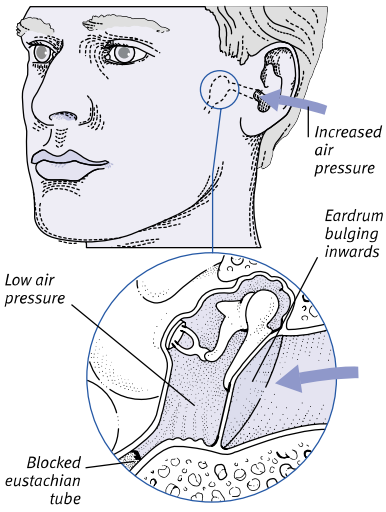
SYMPTOMS

Minor pressure damage in the middle ear may cause pain, hearing loss, and *tinnitus* (ringing in the ears) for a few days; damage in the facial sinuses may also cause pain, and possibly a discharge of mucus or blood. Symptoms usually wear off within hours or days, but treatment may be needed if they worsen or persist. Large changes in pressure can rupture the eardrum (see *eardrum, perforated*).

PREVENTION

Barotrauma can be avoided by vigorous swallowing or by forcibly breathing out with the mouth closed and the nose pinched, which is known as the Valsalva manoeuvre. This action serves to equalize the internal and external pressures in the middle ear and sinuses.

If the eustachian tubes are blocked, as commonly occurs with a cold, use of a nasal spray containing a *decongestant drug* is recommended shortly before the descent of the aircraft. Anyone with a severe head cold should avoid air travel if possible. Infants should be breast- or bottle-fed during descent to encourage swallowing. (See also *aviation medicine*; *scuba-diving medicine*.)



Mechanism of barotrauma
The diagram above shows the location of the middle ear and the pressure changes that occur when the eustachian tube is blocked and there is an increase in surrounding air pressure.

barrel chest

A prominent, rounded chest that is sometimes the result of lung distension in people with longstanding *emphysema* (enlarged air sacs in the lungs). Lung distention leads to an increase in distance between the front and back of the chest, thereby resulting in a change in the shape of the chest wall. (See also *pulmonary disease, chronic obstructive*.)

Barrett's oesophagus

A complication of long-term gastro-oesophageal reflux (see *acid reflux*), in which the cells that line the lower part of the oesophagus are replaced by cells that are normally found in the stomach. People with Barrett's oesophagus are at increased risk of developing cancer of the oesophagus (see *oesophagus, cancer of*). The condition may be monitored regularly by *endoscopy* (internal examination using a viewing instrument) of the oesophagus.

barrier cream

A cream that is used to protect the skin against the effects of irritant substances and excessive exposure to water. (See also *sunscreens*.)

barrier method

A method of preventing pregnancy by blocking the passage of sperm to the uterus (see *contraception, barrier methods of*). An example of a barrier method is the use of a condom or a diaphragm.

barrier nursing

The nursing technique by which a patient with an infectious disease is prevented from infecting other people (see *isolation*). In reverse barrier nursing, a patient with reduced ability to fight infections (for example, because of an *immunodeficiency disorder* or following certain types of surgery) is protected against outside infection. (See also *aseptic technique*.)

bartholinitis

An infection of the *Bartholin's glands* at the entrance to the *vagina*. The disorder, which may be due to a *sexually transmitted infection* such as *gonorrhoea*, causes an intensely painful red swelling at the opening of the gland ducts. Treatment is with *antibiotic drugs*, *analgesic drugs*, and warm baths.

Bartholinitis sometimes leads to the formation of an abscess (see *Bartholin's abscess*) or a painless cyst, known as a Bartholin's cyst, which may become infected. Abscesses are drained under general anaesthesia (see *anaesthesia, general*). Recurrent abscesses or infected cysts may require surgery to convert the duct into an open pouch (see *marsupialization*) or remove the gland completely.

Bartholin's abscess

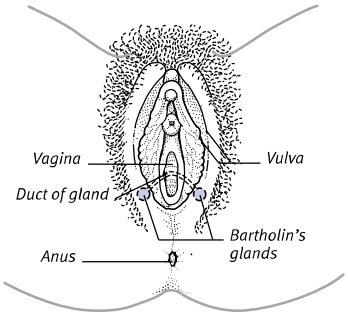
The formation of pus in one or both of the *Bartholin's glands*, which are located on either side of the vulva (the folds of flesh that surround the opening of the vagina). Bartholin's abscesses develop as a result of bacterial infection of the glands (see *bartholinitis*).

Bartholin's glands

A pair of oval, pea-sized glands whose ducts open into the vulva (the folds of flesh that surround the opening of the vagina). During sexual arousal, the Bartholin's glands secrete a fluid that lubricates the vulval region. Infection of these glands causes *bartholinitis* or the development of a *Bartholin's abscess*.

BARTHOLIN'S GLANDS

These glands are located on each side of the entrance to the vagina.



basal cell carcinoma

A type of skin cancer, also known as a rodent ulcer or BCC, that occurs most commonly on the face or neck, but can affect any part of the body. The cells of the tumour closely resemble, and are possibly derived from, cells in the basal (innermost) skin layer.

Basal cell carcinoma is caused by skin damage from the ultraviolet radiation in sunlight. Fair-skinned people over the age of 50 are most commonly affected by this form of cancer; dark-skinned people are protected by the larger amount of *melanin* (a pigment that absorbs ultraviolet radiation) in their skin. The incidence of basal cell carcinoma is much higher among people living in sunny climates, especially those who have outdoor occupations; in parts of the US and Australia, over half the white population has had a basal cell carcinoma by the age of 75.

B

SYMPTOMS

The majority of basal cell carcinomas occur on the face, often at the side of an eye or on the nose. It starts as a small, flat nodule and grows slowly, eventually breaking down at the centre to form a shallow ulcer with raised edges.

Diagnosis is confirmed through a biopsy (removal of a small sample of cells for microscopic analysis). Without treatment, the tumour gradually invades and destroys the surrounding tissues, but it virtually never spreads to other parts of the body.

TREATMENT

Treatment of basal cell carcinoma is usually with surgery (or in some cases *radiotherapy*) and is often completely successful. *Plastic surgery* may also be required, however, depending on the size and site of the tumour.

PREVENTION

The risk of developing this form of skin cancer can be reduced by avoiding overexposure to strong sunlight, by using *sunscreens*, and by wearing protective clothing such as sun hats. People who have previously had a basal cell carcinoma may develop further tumours and should be especially alert to any new changes in their skin. (See also *melanoma, malignant*; *squamous cell carcinoma*; *sunlight, adverse effects of*.)

basal ganglia

Paired nerve cell clusters deep within the cerebrum (the main mass of the *brain*) and the upper part of the brainstem. The basal ganglia play a vital part in producing smooth, continuous muscular actions and in stopping and starting movement. Any disease or degeneration affecting the basal ganglia and their connections may lead to the appearance of involuntary movements, trembling, and weakness, as occur in *Parkinson's disease*.

basal metabolic rate (BMR)

The rate at which energy is used by the body just to maintain vital functions. Such vital functions include breathing, circulation, and digestion. (See also *energy requirements*; *metabolism*).

base

See *alkali*.

basement membrane

The thin membrane that lies directly beneath the *epithelium* (the layer of cells that covers surfaces of the body and lines most hollow structures within it). The basement membrane is composed of protein fibres and carbohydrates.

base pair

Part of a *DNA* molecule comprising two chemicals known as nucleotide bases that are linked together by means of hydrogen bonds. A base pair forms one "rung" of the DNA "ladder". There are only two possible pairings of the four bases: guanine always pairs with cytosine and adenine with thymine. The sequence of base pairs in each DNA chain provides the code for the activities of the cell (see *genetic code*). (See also *nucleic acids*.)

basic life support

Resuscitation techniques that may be performed by a first aider (see *rescue breathing*; *cardiopulmonary resuscitation*). If basic life support measures fail to restore a normal heartbeat and spontaneous breathing, *advanced life support* must then be administered by trained medical personnel.

basilar membrane

A membrane within the cochlea (the inner *ear* structure containing the receptor for hearing). Sound waves cause the basilar membrane to vibrate, stimulating sensory hair cells to send electrical signals to the brain.

basophil

A type of *white blood cell* that plays a part in inflammatory and allergic reactions.

Batten's disease

One of a group of hereditary metabolic diseases (see *metabolism, inborn errors of*) to which *Tay–Sachs disease* also belongs. In Batten's disease, abnormal fatty substances accumulate in the cells of the *nervous system*, causing progressive dementia, worsening seizures, and loss of vision. Symptoms of the condition usually first appear during early childhood.

There is no known treatment for Batten's disease, which is generally fatal during childhood.

Bazin's disease

A rare disorder, mainly affecting young women, in which tender swellings develop under the skin in the calves. In most cases no cause can be found, although Bazin's disease may sometimes be linked to *tuberculosis*.

B-cell

See *B-lymphocyte*.

BCG vaccination

A vaccine that gives immunity against *tuberculosis*. The BCG vaccine is prepared from an artificially weakened strain of bovine (cattle) tubercle bacilli, the rod-shaped *bacteria* that are responsible for causing tuberculosis. The letters BCG stand for "bacille Calmette–Guérin", after the two men who developed the tuberculosis vaccine.

WHY IT IS DONE

The BCG vaccine is given to people who are at risk of tuberculosis and to those whose tuberculin test is negative, indicating that they are likely to have no immunity to the disease. People at risk include health workers, contacts of people with tuberculosis, and immigrants from countries where there is a high rate of tuberculosis. Infants born to immigrants in this category are immunized, without having a tuberculin test, within a few days of birth. The vaccine is also recommended for children aged 10 to 14 years for whom the tuberculin test is negative.

HOW IT IS DONE

The vaccine is usually injected into the upper arm. About six weeks later, a small pustule appears. This normally heals completely, leaving a small scar, but can occasionally develop into a chronic *ulcer* (open sore).

Becker's muscular dystrophy

A type of *muscular dystrophy*.

beclometasone

A *corticosteroid drug* that is used in the treatment of *asthma* and hay fever (see *rhinitis, allergic*). When prescribed as a nasal spray, beclometasone controls the symptoms of these conditions by reducing inflammation and the production of mucus in the lining of the nose. Prescribed as an inhaler for the treatment of asthma, the drug reduces inflammation of the airways, thereby controlling wheezing and coughing.

Beclometasone is often given with *bronchodilator drugs* in the management of asthma. A severe asthma attack may require the dose to be increased. The action of beclometasone is slow, however, and its full effect takes several days to occur. Possible adverse effects of the drug include hoarseness, throat irritation, and, on rare occasions, fungal infections in the mouth.

Beclometasone is also prescribed in the form of a cream or as an ointment to treat inflammation of the skin resulting from *eczema*.

beclomethasone

The former name for the corticosteroid drug *beclometasone*.

Beconase

A brand name for a nasal spray that contains the corticosteroid drug *beclometasone*. Beconase is used to treat hay fever (see *rhinitis, allergic*) and also some other nasal allergies.

Becotide

A brand name for an inhaled form of the corticosteroid drug *beclometasone* that is used to treat *asthma*.

becquerel

A unit of radioactivity (see *radiation units*).

bed bath

A method of washing a bedridden person. A small area is washed and dried at a time, while the rest of the body is kept covered to prevent chilling.

bedbug

A flat, wingless, brown insect that is about 5 mm long and 3 mm wide. Bedbugs live in furniture and furnishings, especially in beds and carpets, emerging at night to feed on humans by sucking their blood. Bedbugs are not known to transmit disease, but their bites are itchy and they may develop into sores that become infected.

bedpan

A metal, plastic, or fibre container into which a patient can defaecate or urinate without getting out of bed.

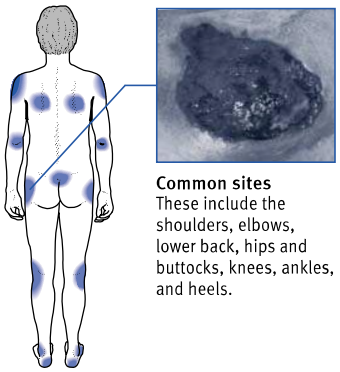
bed rest

A term used to describe periods spent in bed. Bed rest is sometimes part of the treatment for certain illnesses, such as *rheumatic fever*, and for some types of injury, such as a fractured vertebra.

Prolonged bed rest carries risks such as muscle wasting, *bedsores*, and development of blood clots in the legs. Bed rest was once considered an essential part of the treatment of many common conditions, but it is now avoided when possible. Patients are usually encouraged to be mobile as soon as they are able following illness or surgery.

PREVENTING BEDSORES

Once a bedsore has developed it will heal only if pressure on it is minimized, so good nursing care of a bedridden or immobile patient is crucial. The patient's position should be changed at least every two hours; and it is important to wash and dry pressure areas carefully, especially if there is incontinence. Barrier creams can be used for additional protection.



Common sites
These include the shoulders, elbows, lower back, hips and buttocks, knees, ankles, and heels.

bedridden

A term used to describe a person who is unable to leave bed due to illness or injury. People most likely to be bedridden are the very elderly, the terminally ill, and those paralysed as the result of an accident.

bedsore

Also known as a decubitus ulcer or pressure sore, an ulcer that forms on the skin of patients who are unconscious or immobile. Common sites for bedsores include the shoulders, elbows, lower back, hips, buttocks, ankles, and heels.

CAUSES

Bedsores may develop following a *stroke* or *spinal injuries* that result in loss of sensation. Incontinence (see *incontinence, urinary*), if it results in constantly wet skin, may also be a causative factor.

SYMPTOMS

Bedsores start as red, painful areas that become purple before the skin starts to break down, producing open sores. At this stage, the sores may become infected and take a long time to heal.

TREATMENT AND PREVENTION

Deep, chronic *ulcers* may require treatment with *antibiotic drugs* and, in some cases, *plastic surgery*. Good nursing care, including changing the patient's position regularly, skin care, protection of vulnerable areas, and use of cushions and special mattresses, should prevent bedsores from developing in most cases.

bedwetting

The common name for poor bladder control at night (see *enuresis, nocturnal*).

bee stings

See *insect stings*.

behavioural problems in children

Behavioural problems range from mild and short-lived periods of unacceptable behaviour, which are common in most children, to more severe problems such as conduct disorders and refusal to go to school. Behavioural problems may occasionally occur in any child; specialist management is called for when the problems become frequent and disrupt school and/or family life. Some behavioural problems can occur whatever the family or home situation of the child. In some cases, however, stressful external events, such as moving home or parental divorce, may produce periods of problem behaviour.

Behavioural problems that are common in young children include sleeping problems, such as waking repeatedly in the night. In toddlers, *breath-holding attacks*, *tantrums*, separation anxiety, and *head-banging* are problems best dealt with by a consistent and controlled approach. Problems with *toilet-training*

BEHAVIOURAL PROBLEMS BY AGE

- **Babies up to 18 months**
  Sleeping and feeding difficulties, colic, crying
- **Toddlers and children 1–4 years**
  Head-banging, tantrums, biting, breath-holding attacks, separation anxiety, poor social interaction, difficulty in changing from one activity to another, toilet training problems
- **Early childhood 4–8 years**
  Nail-biting, thumb-sucking, aggression, clinginess, anxiety about illness and death, nightmare, enuresis
- **Middle childhood/adolescence 9–18 years**
  Lying, stealing, smoking, truancy, disobedience, aggression, low achievement in school, drug or alcohol use, running away, sexual promiscuity

are usually avoided if the training is delayed until the child is physically and emotionally ready.

In children between the ages of four and eight years, minor behavioural problems, such as *thumb-sucking* and nail-biting, clinginess, bedwetting (see *enuresis, nocturnal*), and disruption during the night due to *nightmares*, are so common as to be almost normal. Such problems are best dealt with by using a positive approach that concentrates on rewarding good behaviour. In most cases, the child grows out of the problem, but medical help from a child guidance counsellor or a child psychiatrist may occasionally be needed.

behaviourism

An American school of *psychology* founded by John Broadus Watson early in the 20th century. He argued that, because behaviour, rather than experience, was all that could be observed in others, it should constitute the sole basis of psychology.

behaviour therapy

A collection of techniques, based on psychological theory, that are used to change abnormal behaviour or to treat anxiety. Behaviour therapy is based on two main ideas: that repeated exposure to a feared experience under safe conditions will render it less threatening, and that desirable behaviour can be encouraged by using a system of rewards, often self-administered.

TYPES

Specific behaviour therapy techniques include exposure therapy (also known as desensitization), flooding, response prevention, and modelling.

Exposure therapy A technique that is commonly used to treat phobic disorders, such as *agoraphobia* (a fear of open spaces and/or public places), animal phobias, and fear of flying. It consists of exposing the patient to the cause of the anxiety in stages: for example, the therapist may accompany an agoraphobic patient on a short journey. At the same time, the patient is taught to cope with anxiety symptoms by using relaxation techniques. The intensity of the exposure is increased, until eventually, he or she is able to deal with the full situation.

Flooding In flooding, the patient is confronted directly and for a lengthy period with the anxiety-provoking stimulus. He or she is supported by the therapist until the fear is reduced. This technique can be emotionally traumatic and is now used less commonly.

Response prevention The patient is prevented from carrying out an obsessional task. For example, someone with a handwashing compulsion is prevented from carrying out the washing rituals. This technique is used in combination with other methods.

Modelling In this approach, the therapist acts as a model for the patient, performing the anxiety-provoking activity first, and encouraging the patient to copy.

behaviour, types A and B

Behaviours characteristic of two personality types described in the early 1970s, when studies were performed to examine the behaviour patterns of people with coronary artery disease.

It was proposed that a particular behaviour pattern (called Type A) was associated with increased vulnerability to stress-related illnesses, such as *hypertension* (high blood pressure). Type A personalities are said to feel constantly under pressure to perform many tasks at the same time, and to be competitive and self-critical. They are also impatient and easily irritated by others. In contrast to this, people with Type B personalities are said to be calmer and more relaxed.

Behçet's syndrome

A rare, multisystem disorder with recurrent *mouth ulcers* and *genital ulcers* and inflammation of the eyes, skin, joints, blood vessels, brain, and intestines.

The cause of Behçet's syndrome is unknown, but the disorder is strongly associated with HLA-B51, a genetically determined *histocompatability antigen*. It affects twice as many men as women. Treatment of Behçet's syndrome is often difficult and may involve *corticosteroid drugs* and *immunosuppressant drugs*. The condition often becomes long term.

belching

The noisy return of air from the stomach through the mouth. Swallowing air is usually an unconscious habit, which may result from eating or drinking too much and/or too quickly. Occasionally, belching may help to alleviate discomfort caused by indigestion.

belladonna

An extract of the deadly nightshade plant that has, since ancient times, been used medicinally. Belladonna contains *alkaloids* (substances containing nitrogen), such as *atropine*, that are used as *antispasmodic drugs* to treat gastrointestinal disturbances. (See also *anticholinergic drugs*.)

Bell's palsy

The most common form of *facial palsy* (facial muscle weakness).

Bence–Jones protein

An abnormal protein found in the urine of people with *multiple myeloma*, which is a cancer affecting one type of cell in the bone marrow.

bendrofluazide

The former name for the diuretic drug *bendroflumethiazide*.

bendroflumethiazide

A thiazide *diuretic drug* that is used to treat *hypertension* (high blood pressure) and *heart failure*.

bends

The nonmedical term for *decompression sickness*. The term is used especially to refer to the severe bone and joint pains that are a common symptom in divers who rise to the surface too rapidly.

benign

A term used to describe a disease that is relatively harmless. When used to refer to tumours, benign means noncancerous tumours that do not invade or destroy local tissues and do not spread to other sites within the body.

benign prostatic hyperplasia (BPH)

A medical term for noncancerous enlargement of the prostate gland (see *prostate, enlarged*).

Bennett's fracture

A fracture of the base of the thumb, which is often accompanied by partial dislocation of the joint.

benorilate

A *nonsteroidal anti-inflammatory drug* (NSAID) that contains *aspirin* and *paracetamol*. Benorilate is mainly used to relieve joint pain and stiffness in *osteoarthritis* and *rheumatoid arthritis*. Side effects of benorilate are not usually serious, but the aspirin in the drug may cause nausea, indigestion, or bleeding from the stomach lining.

benorylate

The former spelling of the nonsteroidal anti-inflammatory drug *benorilate*.

benzalkonium chloride

A preservative that is widely used in eye-drops and products such as cosmetics and mouth washes.

benzocaine

A local anaesthetic (see *anaesthesia, local*) commonly used as an ingredient in over-the-counter preparations for relieving the pain of conditions such as *mouth ulcers* and *sore throat*.

benzodiazepine drugs

COMMON DRUGS

SLEEPING DRUGS • Flunitrazepam • Flurazepam • Loprazolam • Lormetazepam • Nitrazepam • Temazepam

SEDATIVES • Alprazolam • Chlordiazepoxide • Clorazepate • Diazepam • Lorazepam • Oxazepam

A group of sedative drugs given for short periods either as *sleeping drugs* for *insomnia* or to control the symptoms of *anxiety* (see *tranquillizer drugs*). Common benzodiazepine drugs include diazepam, which is used as a tranquillizer, and nitrazepam, which is used to relieve insomnia. Benzodiazepine drugs are also used in the management of alcohol withdrawal and in the short-term control of an epileptic seizure.

HOW THEY WORK

Benzodiazepine drugs promote sleep and relieve anxiety by interfering with chemical activity in the brain and nervous system. This reduces the communication between nerve cells and depresses brain activity.

POSSIBLE ADVERSE EFFECTS

Adverse effects of benzodiazepines include excessive daytime drowsiness, dizziness, and forgetfulness. Unsteadiness and slowed reactions may also occur. If taken with alcohol, benzodiazepines may increase the alcohol's effect to a dangerous extent.

After as little as two weeks, users of a benzodiazepine drug may become psychologically and physically dependent on the drug. For this reason, most doctors are now reluctant to prescribe the drugs unless they are absolutely necessary, and then only for a maximum of three weeks.

When benzodiazepine treatment is stopped suddenly, withdrawal symptoms, such as anxiety, restlessness, and nightmares may occur. People who have been taking benzodiazepine drugs long term need to have them gradually withdrawn over the course of several months to prevent withdrawal symptoms. Benzodiazepines are sometimes abused for their sedative effects.

benzoyl peroxide

An *antiseptic* agent used in the treatment of *acne* and fungal skin infections (see *fungal infections*). In acne, benzoyl peroxide also works by removing the surface layer of skin, thereby unblocking sebaceous glands.

benzylpenicillin

A type of *penicillin drug* that is given by injection.

bereavement

The emotional reaction following the death of a loved one. The expression of grief is individual to each person, but there are recognized stages of bereavement, each of which is characterized by a particular attitude.

STAGES OF BEREAVEMENT

In the first stage of bereavement, which may last from three days to three months, there is often a feeling of numbness and an unwillingness to recognize the death. These emotions are defence mechanisms against admitting, and therefore accepting, the loss and the associated pain. Often, the reality of the death does not penetrate completely at this time, and many people continue to behave as though the dead person were still alive. Hallucinations, in which the deceased person is seen or sensed, are a common experience among the recently bereaved. This sensation can be quite comforting for some people, but others may find it disturbing.

Once the numbness wears off, the person may be overwhelmed by feelings of anxiety, anger, and despair that can develop into a depressive illness (see *depression*). Gastrointestinal disturbances, insomnia, malaise, agitation, and tearfulness are also common.

Gradually, but usually within two years, the bereaved person adjusts to the loss and begins to look more towards the future. This process can involve periods of pain and despair, alternating with periods of enthusiasm and interest.

SUPPORT AND COUNSELLING

Family and friends can often provide the support a bereaved person needs. Outside help is sometimes required and may be given by a social worker, health visitor, member of the clergy, or self-help group. For some people, when depression, apathy, and lethargy impede their chances of recovery, specialized *counselling* or *psychotherapy* is necessary. (See also *stillbirth*.)

beriberi

A nutritional disorder resulting from a lack of *thiamine* (vitamin B_1) in the diet. Thiamine, found in wholemeal cereals, meat, green vegetables, potatoes, and nuts, is essential for the metabolism of carbohydrates. Without it, the brain, the nerves, and the muscles (including the heart muscle) are not able to function properly. In developed countries, the illness is seen only in people who are starving or those who have an extremely restricted diet, such as alcoholics.

SYMPTOMS AND SIGNS

There are two forms of the illness: "dry" and "wet" beriberi. In dry beriberi, thiamine deficiency mainly affects the nerves and skeletal muscles. The symptoms include numbness, a burning sensation in the legs, and muscle wasting. In severe cases, the affected person becomes virtually paralysed, emaciated, and bedridden.

In wet beriberi, the main problem is *heart failure* (the inability of the heart to maintain efficient pumping of blood around the body). This in turn causes *oedema* (swelling caused by fluid accumulation) in the legs and sometimes also in the trunk and face. Other symptoms of wet beriberi include poor appetite, rapid pulse, and breathlessness. Without treatment, heart failure worsens and can lead to death.

TREATMENT

Beriberi is treated with thiamine, given either orally or by injection, which usually brings about a complete cure. A permanent improvement in diet is also required to prevent recurrence.

Bernard–Soulier syndrome

A *genetic disorder* in which platelets (the *blood cells* responsible for initiating blood clotting) do not function properly. The syndrome is characterized by abnormal bleeding in the skin and internal organs.

berry aneurysm

An abnormal swelling that occurs at the junction of *arteries* supplying the brain. Berry aneurysms are usually due to a congenital (present at birth) weakness in the artery wall. They may occasionally rupture, which results in a *subarachnoid haemorrhage*. (See also *aneurysm*; *intracranial aneurysm*.)

B

berylliosis

An occupational disease that is caused by the inhalation of dust or fumes containing beryllium, a metallic element that is used in high-technology industries such as nuclear energy, electronics, and aerospace. Short exposure to high concentrations of beryllium may lead to an episode of severe *pneumonitis* (lung inflammation). Exposure over a number of years to smaller concentrations may lead to permanent damage to the lungs and the liver.

Treatment with *corticosteroid drugs* can reduce damage to the lungs. In most cases, the introduction of safe working practices prevents exposure to dangerous levels of beryllium.

Best's disease

A *genetic disorder* in which the macula (part of the light-sensitive retina at the back of the eye) is abnormal. The disorder is congenital (present from birth) and results in progressive loss of vision.

beta-blocker drugs

COMMON DRUGS

CARDIOSELECTIVE • Atenolol • Betaxolol • Bisoprolol • Celiprolol • Metoprolol

NONCARDIOSELECTIVE • Acebutolol • Carvedilol • Labetolol • Nadolol • Oxprenolol • Pindolol • Propranolol • Sotalol • Timolol

A group of drugs, also known as beta-adrenergic blocking agents, prescribed principally to treat heart and circulatory disorders such as *angina pectoris* (pain in the chest due to an insufficient supply of blood to the heart muscle) and *hypertension* (high blood pressure). The drugs block the effects of the *sympathetic nervous system*, which releases *adrenaline* (epinephrine) and *noradrenaline* (norepinephrine) at nerve endings known as beta receptors.

There are two types of beta receptor: $beta_1$ and $beta_2$. $Beta_1$ receptors are present mainly in the heart and $beta_2$ are found in the lungs, blood vessels, and elsewhere in the body. Certain beta-blockers (such as atenolol, bisoprolol and metoprolol) are termed cardioselective and, because they act mostly on $beta_1$ receptors, are used principally to treat heart disease such as angina, hypertension, and cardiac *arrhythmia* (abnormal heartbeat). These drugs are sometimes given following a *myocardial infarction* (heart attack) in order to reduce the likelihood of further damage to the heart muscle.

HOW **BETA-BLOCKERS** WORK

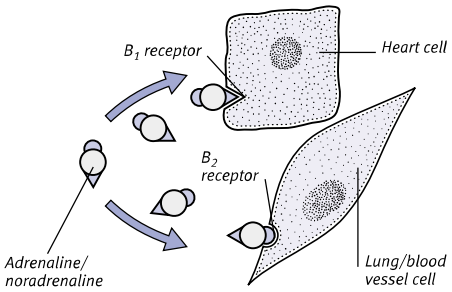
Beta-blockers block specific sites on body tissues where neurotransmitters (chemicals released from nerve endings) bind. These sites are called beta receptors, and there are two types: $beta_1$ receptors, found in heart tissue, and $beta_2$ receptors, found in the lungs, blood vessels, and other tissues. At these receptors, two chemicals, adrenaline (epinephrine) and noradrenaline (norepinephrine), are released from nerve endings in the sympathetic nervous system, the part of the involuntary nervous system that enables the body to deal with stress, anxiety, and exercise. These neurotransmitters bind to beta receptors to increase the force and speed of the heartbeat, to dilate the airways to increase air flow to the lungs, and to dilate blood vessels.

Cardioselective beta-blockers bind predominantly to $beta_1$ receptors; noncardioselective beta-blockers bind to both types. Beta-blockers slow the heart rate and reduce the force of contraction of heart muscle. These effects can be used to slow a fast heart rate and regulate abnormal rhythms.

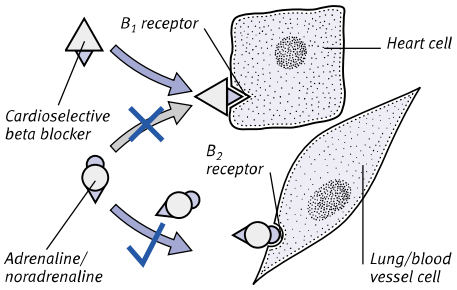
Beta-blockers prevent attacks of angina pectoris by reducing the work performed by the heart muscle and therefore the heart's oxygen requirement. High blood pressure is reduced because the rate and force at which the heart pumps blood into the circulation is lowered.

The effect of blocking beta receptors on muscles elsewhere in the body is to reduce the muscle tremor of anxiety and an overactive thyroid gland. Beta-blockers may help to reduce the frequency of migraine attacks by preventing the dilation of blood vessels surrounding the brain, which is what causes the headache. In glaucoma they lower pressure in the eye by reducing fluid production in the eyeball.

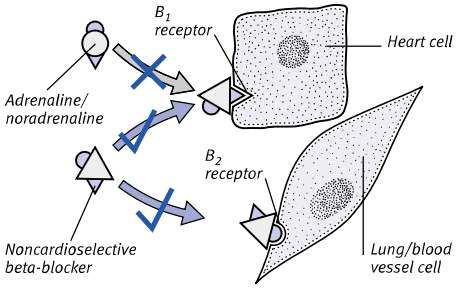
Normal
Adrenaline (epinephrine) and noradrenaline (norepinephrine) can be released either from the adrenal gland or from sympathetic nerve endings. They bind to $beta_1$ and $beta_2$ receptors in tissues around the body.



Cardioselective beta-blockers
Cardioselective beta-blockers occupy predominantly B_1 receptors, preventing adrenaline and noradrenaline from binding to them. This reduces the stimulating action of adrenaline and noradrenaline on heart tissue. Cardioselective beta-blockers do not block B_2 receptors, thereby allowing adrenaline (epinephrine)/noradrenaline (norepinephrine) to act on other tissues around the body.



Noncardioselective beta-blockers
Noncardioselective beta-blockers occupy both B_1 and B_2 receptors, reducing the stimulating action of adrenaline (epinephrine) and noradrenaline (norepinephrine) on tissues around the body.



Other types of beta-blocker, such as oxprenolol, propranolol, and timolol, may be given to prevent *migraine* attacks by acting on blood vessels in the head. They are also used to reduce the physical symptoms of *anxiety* and to control the symptoms of *thyrotoxicosis* (an overactive thyroid gland). Beta-blockers such as timolol are sometimes given in the form of eye-drops to treat *glaucoma*; they work by lowering the fluid pressure within the eyeball. (See also the illustrated box.)

POSSIBLE ADVERSE EFFECTS

Beta-blocker drugs may reduce an individual's capacity for strenuous exercise. They may worsen the symptoms of *asthma*, *bronchitis*, or other forms of lung disease. They may also reduce the flow of blood to the limbs, causing cold hands and feet. In addition, sleep disturbance and depression can be side effects of beta-blockers. Anyone taking beta-blockers should not suddenly stop; a severe recurrence of previous symptoms and a significant rise in blood pressure may result.

betahistine

A drug that is used in the treatment of the inner-ear disorder *Ménière's disease*. Betahistine reduces the frequency and severity of the characteristic attacks of nausea and vertigo.

beta interferon

A type of *interferon* (a protein produced naturally by body cells) sometimes used in the treatment of *multiple sclerosis*.

beta-lactam antibiotics

A group of *antibiotic drugs* that includes the penicillins and the cephalosporins. Beta-lactam antibiotics work by altering chemical activity in bacteria, thereby killing them.

beta-lactamase

An enzyme, also known as *lactamase*, that inactivates antibiotic drugs such as penicillins. Bacteria that are able to produce this enzyme are therefore resistant to treatment with these kinds of antibiotic drugs.

betamethasone

A *corticosteroid drug* that is used in the treatment of inflammation. Betamethasone is applied to the skin as a cream to treat contact *dermatitis* and *eczema*. The drug is also prescribed as nasal spray to treat allergic *rhinitis* (hay fever) and is taken by mouth to treat some cases of *asthma* and *arthritis*.

Adverse effects of betamethasone are unlikely with short-term use. However, prolonged topical use of the drug can cause thinning of the skin and may aggravate any infection that has developed. Taken orally over a prolonged period or in high doses, betamethasone can cause adverse effects typical of other corticosteroid drugs.

betel nut

The seed of the tropical palm *Areca catechu*, which, when chewed, acts as a stimulant and digestant. Betel nut is commonly used throughout India and Southeast Asia.

Betnovate

A brand name for the corticosteroid drug *betamethasone*, which is used in topical preparations.

bezafibrate

A *lipid-lowering drug* used to reduce blood cholesterol levels.

bezoar

A ball of food and mucus, vegetable fibre, hair, or other indigestible material in the stomach. Trichobezoars, which are composed of hair, may form in the stomachs of children or emotionally disturbed adults who nibble at, or pull out and swallow, their hair.

Symptoms include loss of appetite, constipation, nausea and vomiting, and abdominal pain. If trichobezoars pass into the intestines, they may cause a blockage (see *intestine, obstruction of*). Bezoars can be removed by *endoscopy* (a procedure in which a flexible viewing tube is passed down the digestive tract) or by conventional surgery.

bi-

A prefix meaning two or twice, as in bilateral (two-sided).

bicarbonate of soda

See *sodium bicarbonate*.

biceps muscle

The name that is given to any muscle that originates as two separate parts, which then fuse. The term biceps muscle is commonly used to refer to the biceps brachii muscle of the upper arm, which bends the arm at the elbow and rotates the forearm. Another example of a biceps muscle is the biceps femoris muscle, located at the back of the thigh, which bends the leg at the knee and extends the thigh.

bicornuate uterus

The term that is used to describe an abnormally shaped uterus (womb) that divides into two halves in its upper part. Bicornuate literally means "having two horns".

bicuspid

A term meaning to have two cusps (curved, pointed structures). Bicuspid describes certain *heart valves* and is used as an alternative name for a premolar tooth (see *teeth*).

bifocal

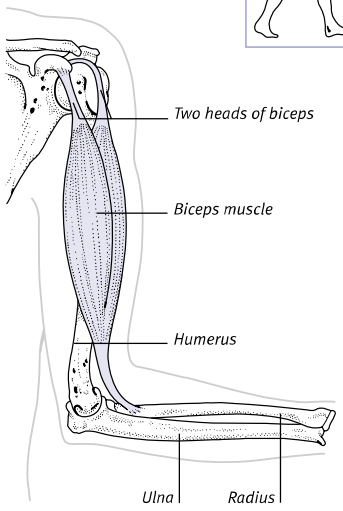
A spectacle lens with two different focal lengths. Glasses that have bifocal lenses make corrections both for close and for distant vision. (See also *myopia; hypermetropia*.)

biguanides

Oral hypoglycaemic drugs (see *hypoglycaemics, oral*) used in the treatment of type 2 (non-insulin-dependent) *diabetes mellitus*. Metformin, which is the only available type of biguanide drug, reduces the production of glucose

LOCATION OF BICEPS

There are four biceps muscles in the body: one in each upper arm and one on the back of each thigh.



(sugar) in the liver and also increases the uptake of glucose by the body's cells. (See also *antidiabetic drugs*.)

bilateral

A term that means affecting both sides of the body, or affecting both organs if they are paired (for example, both ears in bilateral deafness).

bile

A greenish-brown alkaline liquid that is secreted by the *liver*. Bile carries away waste products formed in the liver and also helps to break down fats in the small intestine for digestion.

The waste products in bile include the pigments *bilirubin* and biliverdin, which give bile its greenish-brown colour; bile salts, which aid in the breakdown and absorption of fats; and *cholesterol*. Bile passes out of the liver through the *bile ducts* and is then concentrated and stored in the gallbladder. After a meal, bile is expelled and enters the duodenum (the first section of the small intestine) via the common bile duct. Most of the bile salts are later reabsorbed into the bloodstream to be recycled by the liver into bile. Bile pigments are excreted in the faeces. (See also *biliary system*; *colestyramine*.)

bile duct

Any of the ducts through which *bile* is carried from the *liver* to the gallbladder and then on to the duodenum (the first section of the small intestine).

The bile duct system forms a network of tubular canals. Canaliculi (small canals) surround the liver cells and collect the bile. The canaliculi join together to form ducts of increasing size. The ducts emerge from the liver as the two hepatic ducts, which join within or just outside the liver to form the common hepatic duct. The cystic duct branches off to the gallbladder; from this point the common hepatic duct becomes the common bile duct and leads into the duodenum. (See also *biliary system*.)

bile duct cancer

See *cholangiocarcinoma*.

bile duct obstruction

A blockage or constriction of a bile duct (see *biliary system*). Obstruction of a bile duct results in the accumulation of bile in the liver (*cholestasis*) and *jaundice* (yellowing of the skin and the whites of the eyes) due to a buildup of *bilirubin* (bile pigment) in the blood. Prolonged obstruction of the bile duct can lead to secondary *biliary cirrhosis*, which is a serious form of liver disease.

CAUSES

The most common cause of bile duct obstruction is *gallstones*. Other causes include a tumour affecting the pancreas (see *pancreas, cancer of*) and cancer that has spread from elsewhere in the body. *Cholangiocarcinoma* (cancer of the bile ducts) is a rare cause of a blockage. Bile duct obstruction is known to be a rare side effect of certain drugs. It may also be caused by *cholangitis* (inflammation of the bile ducts), trauma (such as injury during surgery), and, rarely, by *flukes* or worms.

SYMPTOMS

Bile duct obstruction causes "obstructive" jaundice, which is characterized by pale-coloured faeces, dark urine, and a yellow skin colour. There may also be itching. Other symptoms of bile duct obstruction depend on the cause of the blockage; for example, there may be abdominal pain (with gallstones) or weight loss (with cancer).

TREATMENT

Treatment depends on the cause, but surgery is sometimes necessary. Gallstones may be removed by means of *ERCP* (an X-ray procedure that uses a viewing tube called an endoscope with instruments attached to it).

bilharzia

Another name for the tropical parasitic disease *schistosomiasis*.

biliary atresia

A rare *congenital* disorder in which some or all of the *bile ducts* fail to develop or develop abnormally. As a result, *bile* is unable to drain from the liver (see *cholestasis*). Unless the atresia can be treated, secondary *biliary cirrhosis* (a serious liver disorder) will develop and may prove fatal. Symptoms include *jaundice*, usually beginning a week after birth, and the passing of dark urine and pale faeces. Treatment is by surgery to bypass the ducts. If this fails, or if the jaundice recurs, a *liver transplant* is required.

biliary cirrhosis

An uncommon form of liver *cirrhosis* that results from problems with the bile ducts. There are two types of biliary cirrhosis. One is an *autoimmune disorder* and is known as primary biliary cirrhosis. Secondary biliary cirrhosis occurs as a result of a longstanding blockage. In both types of the condition, liver function is impaired due to *cholestasis* (accumulation of bile in the liver).

Primary biliary cirrhosis principally affects middle-aged women and seems to be linked with a malfunction of the *immune system*. In this disorder, the bile ducts within the liver become inflamed and are destroyed. Symptoms include itching, *jaundice* (a yellowish discoloration of the skin and the whites of the eyes), an enlarged liver, and sometimes abdominal pain, fatty diarrhoea, and *xanthomatosis* (deposits of fatty material under the skin). *Osteoporosis* may also develop. Symptoms of liver cirrhosis and *liver failure* may occur after a few years. Drugs can be used to minimize complications and to relieve symptoms such as itching, but a *liver transplant* is the only cure.

Secondary biliary cirrhosis results from prolonged *bile duct obstruction* or *biliary atresia* (abnormal bile ducts). Symptoms and signs include abdominal pain and tenderness, liver enlargement, fevers and chills, and sometimes blood abnormalities. Treatment is the same as for bile duct obstruction.

biliary colic

A severe pain in the upper right quadrant of the abdomen that is usually caused by the gallbladder's attempts to expel *gallstones* or by the movement of a stone in the *bile ducts*. The pain may be felt in the right shoulder (see *referred pain*) or may penetrate to the centre of the back. Episodes of biliary colic often last for several hours and may recur, particularly after meals.

Injections of an *analgesic drug* and *antispasmodic drug* may be given to relieve the colic. Tests such as *cholecystography* or *ultrasound scanning* can confirm the presence of gallstones, in which case *cholecystectomy* (surgical removal of the gallbladder) may be performed.

biliary system

The organs and ducts in which *bile* is formed, concentrated, and carried from the *liver* to the duodenum (the first part of the small intestine). Bile is secreted by liver cells and collected by a network of *bile ducts* that carry the bile out of the liver via the hepatic duct. The cystic duct branches off the hepatic duct and leads to the gallbladder, where the bile is concentrated and stored. Beyond this

junction, the hepatic duct becomes the common bile duct, which opens into the duodenum at a controlled orifice known as the ampulla of Vater. The presence of fat in the duodenum following a meal prompts the secretion of a hormone that opens the ampulla of Vater. This causes contraction of the gallbladder, which squeezes stored bile into the duodenum.

The main disorders affecting the biliary system are *gallstones*, congenital *biliary atresia* and *bile duct obstruction*. (See also *gallbladder, disorders of*.)

biliousness

A condition in which bile is brought up to the mouth from the stomach. Biliousness is also used as a nonmedical term for nausea and vomiting.

bilirubin

The main pigment in *bile*. Bilirubin is produced by the breakdown of *haemoglobin*, the pigment in red blood cells. Very high levels of bilirubin cause the yellow pigmentation of *jaundice*. Products formed from the breakdown of bilirubin make faeces brown.

Billings' method

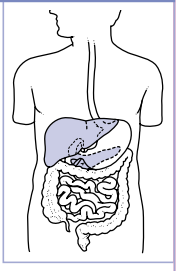
A technique (also known as the mucus inspection method) in which a woman notes changes in the characteristics of mucus produced by her cervix. The technique is employed to predict ovulation for the purposes of *contraception* or *family planning*.

Billroth's operation

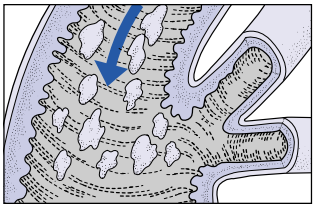
A type of partial *gastrectomy* in which the lower part of the stomach is surgically removed. Previously used in the treatment of *peptic ulcers*, the operation

FUNCTION OF THE **BILIARY SYSTEM**

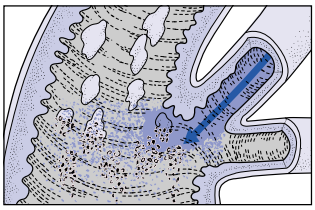
The biliary system consists of the bile ducts leading from the liver and gallbladder, the gallbladder itself, and associated structures. The system drains waste products from the liver into the duodenum and aids the process of fat digestion through controlled release of fat-emulsifying agents (contained in bile).



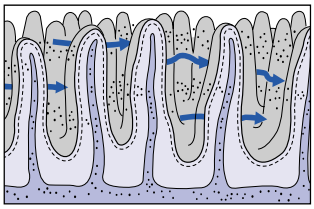
FAT DIGESTION



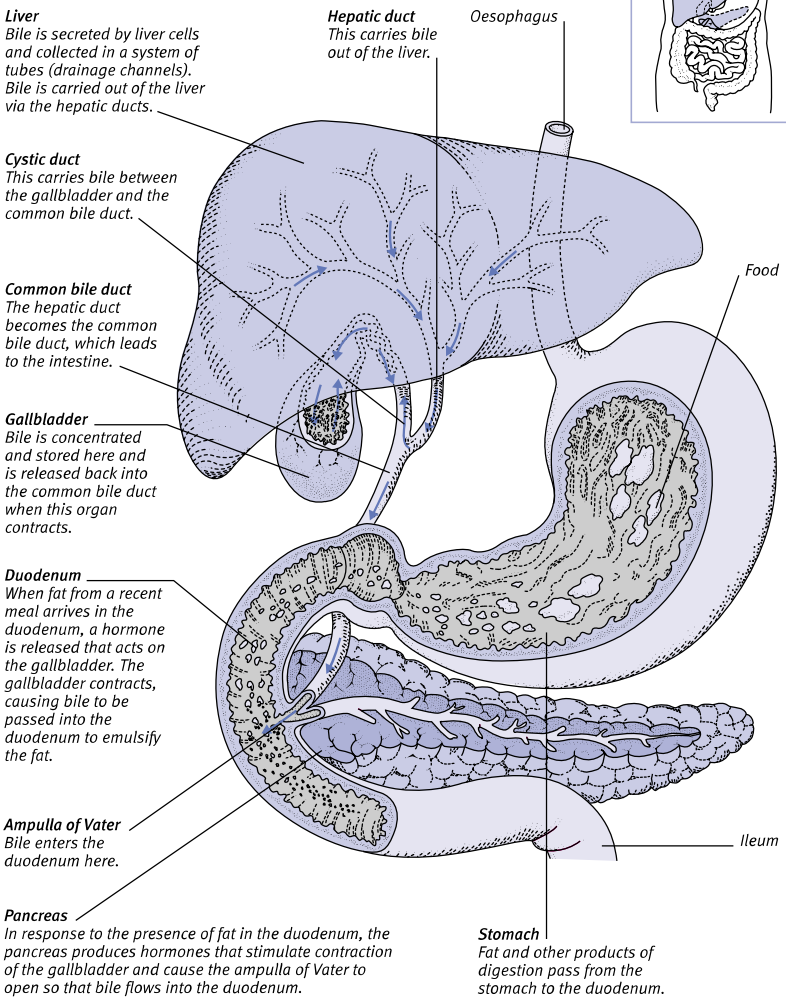
1 Dietary fat passes from the stomach to the duodenum in the form of large droplets.



2 Bile released into the duodenum contains salts that disperse the fat into smaller droplets.



3 The fats are now more easily broken down by lipase, an enzyme made by the pancreas, and absorbed through the intestinal lining.



is now rarely performed due to the introduction of newer, less invasive treatment, often using *antibiotic drugs*.

Binet test

The first *intelligence test* that attempted to measure higher mental functions rather than more primitive abilities. The Binet test was devised in 1905.

binge–purge syndrome

An alternative term for the eating disorder *bulimia*.

bio-

A prefix describing a relationship to life, as in biology, the science of life.

bioavailability

The proportion of a drug that reaches the target organs and tissues, usually expressed as a percentage of the dose administered. Intravenous administration of a drug results in 100 per cent bioavailability because the drug is injected directly into the bloodstream. Drugs taken orally have a much lower bioavailability. Preparations that have equal bioavailabilities are described as bioequivalent. (See also *drug*.)

biochemistry

A science that studies the chemistry of living organisms, including human beings. The human body is made up of millions of cells that require nutrients and energy, and which grow, multiply, and die. The chemical processes that are involved in providing these cells with energy, eliminating their wastes, repairing damage, promoting cell growth, and causing both normal and abnormal cell division are all studied by biochemists, the specialists in the field.

Life is maintained by a huge number of chemical reactions that are carried out inside cells. These reactions link together in a complex way and together make up the *metabolism* of the body. The reactions that produce energy and break down food and body structures are termed catabolism; those that build up body structures and store food are termed anabolism. Overall regulation of these chemical processes is a principal function of *hormones* which are secreted into the bloodstream by the *endocrine glands*; regulation of individual reactions is carried out by *enzymes* (substances that promote biochemical reactions).

Certain vital chemical processes take place in every single cell in the body. Other, more specific, chemical processes are confined to specialized cells that make up the tissues of particular organs. For example, liver cells store and chemically modify the digestion products of food; kidney cells help to control the amounts of various substances (such as certain minerals) in the blood, as well as regulating the total amount of fluid in the body.

A constant interchange of substances occurs between the cell fluids and the blood and urine. Biochemists can learn a great deal about the chemical changes occurring inside the body's cells by regularly taking, and comparing, precise measurements of the various minerals, gases, enzymes, hormones, and proteins in the different fluids of the body.

Such biochemical tests may be used to make, or to confirm, a diagnosis, as well as to screen for a particular disease and to monitor its progress. The most commonly used biochemical tests are performed on *blood*; such tests include *liver function tests* and *kidney function tests*. Biochemical tests can also be performed on urine (see *urinalysis*) as well as on all other body fluids.

bioengineering

See *biomechanical engineering*.

biofeedback training

A technique in which a person uses information about a normally unconscious body function, such as blood pressure, to gain conscious control over that function. This training may help to treat stress-related conditions, including certain types of *hypertension* (high blood pressure), *anxiety*, and *migraine*.

HOW IT IS DONE

The doctor connects the patient to a recording instrument that can measure one of the unconscious body activities, such as blood pressure, heart rate, muscle tension, the quantity of sweat on the skin, brain waves, or stomach acidity. The patient receives information (feedback) on the changing levels of these activities from changes in the instrument's signals, for example a flashing light or sound changing tone.

After some experience with the technique, the person starts to become aware of how he or she is feeling whenever there is a change of signal. By using *relaxation techniques*, the person learns to change the signals by conscious control of the function. Once acquired, control can be exercised without the instrument.

biological clock

A popular term for the inherent timing mechanism that supposedly controls physiological processes and cycles in living organisms. (See also *biorhythms*.)

biology

The scientific study of all living organisms, including animals, plants, and microorganisms (single-celled organisms). Biology involves the study of the structure and functions of living organisms, their relationships with other organisms, and the ways in which they interact with their environment. (See also *biochemistry*; *microbiology*.)

biomechanical engineering

A discipline that applies engineering methods and principles to the body to explain how it functions and to treat disorders. Applications include the design of artificial joints and heart valves, pacemakers, and kidney dialysis machines.

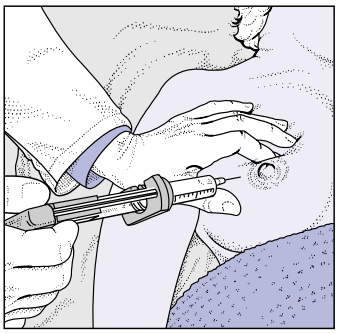
biopsy

A diagnostic test involving the removal of small amounts of tissue or cells from the body for microscopic examination. A biopsy is an accurate method of diagnosing many illnesses, including cancer. Microscopic examination of tissue (see *histology*) or of cells (see *cytology*) usually gives a correct diagnosis.

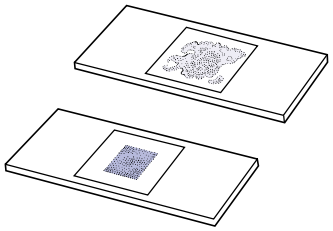
HOW IT IS DONE

There are several types of biopsy. In excisional biopsy, the whole abnormal area is removed for study. Incisional biopsy involves cutting away a small sample of skin or muscle for analysis. In a needle biopsy, a needle is inserted through the skin and into the organ or tumour to be investigated. Aspiration biopsy uses a needle and syringe to remove cells from a lump (see box). Guided biopsy uses *ultrasound scanning* or *CT scanning* to locate the area of tissue to be biopsied and follow the progress of the needle. In endoscopic biopsy, an *endoscope* (viewing tube) is passed into the organ to be investigated and an attachment is used to take a sample from the lining of accessible hollow structures such as the lungs, stomach, and bladder. In an open biopsy, a surgeon opens a body cavity to reveal a diseased organ or tumour and removes a sample. Prompt analysis, in some cases by *frozen section* (in which the tissue is frozen and thinly sliced), can enable the surgeon to decide whether to remove the entire diseased area immediately.

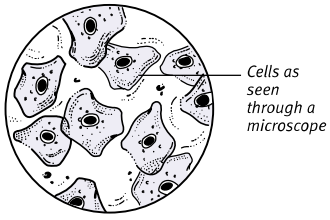
ASPIRATION **BIOPSY**



1 A fine needle attached to a syringe is inserted into the lump, and fluid or cells are sucked out to be examined under a microscope. The syringe can be held in a device that withdraws the plunger. Usually no anaesthetic is necessary, but local anaesthetic may be sometimes be used.



2 Before examination any fluid may be spun at high speed in a centrifuge and a small amount placed on a slide.



3 The cells are then fixed (preserved) and finally stained for viewing. The cytologist examines individual cells for abnormalities, paying particular attention to the size, shape, and structure of the nucleus.

OBTAINING RESULTS

Biopsy samples are analysed by *staining*; dyes are used to show up structures or identify constituents such as *antibodies* or *enzymes*. Tissue may be tested with specific antibodies in the investigation of infection and inflammation. In some cases, a tissue *culture* (cultivation of tissue cells in a growing medium) may be required. (See also *endometrial biopsy*; *excision*; *kidney biopsy*; *liver biopsy*.)

biorhythms

A term used to describe physiological functions that vary in a rhythmic way (for example, the menstrual cycle, which repeats approximately every 28 days in fertile women).

Most biorhythms are based on a daily, or circadian (24-hour), cycle. Our bodies are governed by an internal clock, which is itself regulated by *hormones* (chemicals released into the circulation by *endocrine glands*). Periods of sleepiness and wakefulness may be affected by the level of *melatonin* secreted by the pineal gland in the brain. Release of melatonin is stimulated by darkness and suppressed by light. Cortisol, a hormone that is secreted by the adrenal glands, also reflects sleeping and waking states, being low in the evening and high in the morning.

When the normal regular division between night and day is distorted by air travel to a distant time zone, the body's internal clock is disrupted and the result is *jet-lag*.

biosynthesis

The formation of chemical compounds by a living organism.

biotechnology

The use of living organisms such as *bacteria* in industry and science (for example, in drug production).

bioterrorism

The use of disease-causing organisms as an act of violence and intimidation. Examples of such organisms are *anthrax* spores and the *smallpox* virus.

biotin

A vitamin of the B complex (see *vitamin B complex*) that is essential for the breakdown of fats.

biphosphonate drugs

See *bisphosphonate drugs*.

bipolar disorder

An illness, commonly known as *manic–depressive illness*, that is characterized by swings in mood from severe depression to overexcitability and vice versa.

bird-fancier's lung

A form of allergic *alveolitis* (inflammation of the lungs) caused by inhalation of dust particles from bird droppings. The disease is also sometimes known as pigeon-fancier's lung.

birth

See *childbirth*.

birth canal

The passage through the pelvis, running from the cervix (the neck of the womb) to the vaginal opening, through which the baby passes during *childbirth*.

birth control

Limitation of the number of children born, either to an individual or within a population. *Family planning* allows men and women to choose if and when to have children; *contraception* can prevent unwanted pregnancies.

birth defects

Abnormalities that are obvious at birth or detectable early in infancy. Also called congenital defects, they encompass both minor abnormalities, such as *birthmarks*, and serious disorders such as *spina bifida* (failure of the spinal column to close properly). Birth defects may occur as the result of a variety of factors, but in most cases no obvious cause can be found.

CHROMOSOME DEFECTS

Some children are born with more or fewer than the normal 23 pairs of *chromosomes* (threadlike structures in the cell nuclei that carry the genetic information for normal development). *Down's syndrome*, a condition in which there is an extra copy of one of the chromosomes, is one of the most common *chromosomal abnormalities*.

GENETIC OR HEREDITARY DEFECTS

These may be inherited from one or both parents (see *gene*; *genetic disorders*). Genetic defects obvious at birth include *albinism* (lack of normal pigmentation in the skin, hair, and eyes) and *achondroplasia* (abnormally short stature).

DRUGS AND OTHER HARMFUL AGENTS

Certain drugs and chemicals (known as *teratogens*) can damage the fetus if the mother takes or is exposed to them during early pregnancy. Teratogenic drugs include *thalidomide* (now rarely prescribed) and *isotretinoin*, which is used in the treatment of severe *acne*. Alcohol can affect the development of the brain and face (see *fetal alcohol syndrome*).

IRRADIATION

Irradiation of the embryo at an early stage of development, for example, if a woman is X-rayed before she is aware of her pregnancy, can cause abnormalities.

INFECTIONS

If a woman contracts certain infections during pregnancy, there is a chance that

they may cause birth defects. For example, *rubella* (German measles) in early pregnancy can cause fetal abnormalities, including deafness, cataract (clouding of the lens of the eye), and heart disease. *Toxoplasmosis* (infection with a parasite found in cats' faeces), can also be passed on to the fetus, causing damage to the eyes, liver, and other organs.

OTHER COMMON DEFECTS

Abnormalities in the embryo's development can damage the brain and spinal cord, causing defects such as spina bifida and *hydrocephalus* (a buildup of fluid in the brain). In congenital heart disorders (see *heart disease, congenital*), there is a structural abnormality in the heart that may interfere with normal blood flow. C*left lip and palate* result from a failure of the two sides of the fetal face and palate to join completely.

DETECTION

Ultrasound scanning and blood tests during pregnancy can identify women at high risk of having a baby with a birth defect. Further tests such as c*horionic villus sampling*, *amniocentesis*, or *fetoscopy* may then be carried out.

PREVENTION

Some birth defects can be prevented, or the risks minimized; for example, by rubella immunization before pregnancy or avoiding teratogens during pregnancy.

birthing chair

A specially designed chair to support a woman during *childbirth*. In the opinion of many doctors, sitting, as opposed to lying down, can help to shorten labour.

birth injury

Damage sustained by a baby during *childbirth*. Minor injuries, such as bruising and swelling of the scalp during a vaginal delivery (see *cephalhaematoma*) are common. More serious injury can occur, particularly if the baby is large and has difficulty passing through the birth canal. A *breech delivery* may result in injury to nerves in the baby's shoulder, causing temporary paralysis in the arm. The face may be paralysed temporarily if the facial nerve is traumatized by forceps during delivery. Fractured bones are another hazard of difficult deliveries, but the bones usually heal easily. (See also *birth defects*; *brain damage*.)

birthmark

An area of discoloured skin that is present at birth, or appears very soon afterwards. Birthmarks include *moles*, freckles, and other types of melanocytic *naevi* (a variety of flat, brown to blue-grey skin patches), strawberry marks (bright red, usually protuberant areas), and port-wine stains (purple-red, flat, often large areas). The latter two are types of *haemangioma* (malformation of blood vessels). Strawberry marks often increase in size in the first year, but most disappear after the age of nine. Port-wine stains seldom fade, but some of them can be reduced by *laser treatment* during adulthood.

Birthmark
Strawberry marks, a common type of birthmark caused by malformation of blood vessels, are usually bright red, protuberant, and spongy.

birthpool

A pool of warm water in which a woman can sit to help relieve pain during labour (see *childbirth*).

birth, premature

See *prematurity*.

birth, preterm

See *preterm birth*.

birth rate

A measurement of the number of births in a particular year in relation to the size of the population.

birthweight

A baby's weight at birth, which usually ranges from 2.5 to 4.5 kg. Birthweight depends on a number of factors, including the size and ethnic origin of the parents. Baby boys weigh, on average, slightly more than baby girls. Babies who weigh less than 2.5 kg at birth are considered to be of low birthweight. Causes include *prematurity* and undernourishment in the uterus (because the mother had *pre-eclampsia*, for example). Abnormally high birthweight may be due to unrecognized or poorly controlled *diabetes mellitus* in the mother.

bisacodyl

A type of stimulant *laxative drug* that works by stimulating the intestinal wall into contracting, increasing the speed at which faecal matter passes through.

bisexuality

Sexual interest in members of both sexes that may or may not involve sexual activity.

bismuth

A metal, salts of which are used in tablets to treat *peptic ulcer* and in creams and suppositories to treat *haemorrhoids* (piles). Bismuth preparations taken by mouth may colour the faeces black. The tongue may darken and, occasionally, nausea and vomiting may occur.

bisphosphonate drugs

Drugs used to slow bone metabolism (for example, in *Paget's disease*) and to reduce the high calcium levels in the blood that are associated with destruction of bone by secondary cancerous growths. Bisphosphonate drugs may also be used in the prevention or treatment of *osteoporosis*.

bite

See *occlusion*.

bites, animal

Any injury inflicted by the mouthparts of an animal, which may range from the puncture wounds of bloodsucking insects to the massive injuries caused by shark or crocodile attacks. Teeth, especially those of carnivores, can inflict widespread mechanical injury. Severe injuries and lacerations to major blood vessels can lead to heavy blood loss and physiological *shock*. Serious infection may occur as a result of bacteria in the animal's mouth being transferred in the bite, and *tetanus* is a particular hazard. In countries where *rabies* is present, any mammal may potentially harbour the rabies virus and transmit it via a bite.

TREATMENT

Medical advice should be sought for all but minor injuries, and in all cases if there is a risk of rabies. The treatment usually includes cleaning and examination of the wound. The wound will usually be left open and dressed, rather than stitched, as closing it can encourage the multiplication of bacteria. Preventive *antibiotic drug* treatment and an anti-tetanus injection may also be given. Antirabies vaccine is given, together with

immunoglobulin, if there is any possibility that the animal could be infected with the rabies virus. (See also *bites, human*; *insect bites*; *snake bites*; *spider bites*; *venomous bites and stings*.)

bites, human

Wounds that are caused by one person biting another. Human bites rarely result in serious tissue damage or blood loss; but infection from any microorganisms in the mouth is likely, particularly if the bite is deep. For example, there is a risk of *tetanus* infection, and transmission of *hepatitis B*, *herpes simplex*, and *HIV* through a human bite is a theoretical hazard.

Bitot's spots

Grey, foamy patches that appear on the *conjunctiva* (the mucous membrane covering the front of the eye). Bitot's spots, which are made up of keratinized (horny) cells, are associated with *vitamin A* deficiency.

black death

The medieval name for bubonic *plague*, which in past epidemics killed 50 per cent of its victims. One feature of the disease is bleeding under the skin, causing bluish-black bruises, hence the name.

black eye

A dark discoloration of the skin around the eye, usually following an injury. The discoloration is due to blood collecting under the skin (see *bruise*). Because the skin around the eye is loose and thin, bruising is darker than on other parts of the body. A cold compress held over the eye can help to relieve the discomfort.

blackhead

Also called a comedo, a semi-solid, black-capped plug of keratin and sebum that blocks the outlet of a sebaceous (oil-forming) gland in the skin. Blackheads occur most commonly on the face, chest, shoulders, and back, and they are associated with increased sebaceous gland activity. They are one of the features of most types of *acne*.

blackout

A common term for loss of consciousness (see *fainting*).

black teeth

See *discoloured teeth*.

blackwater fever

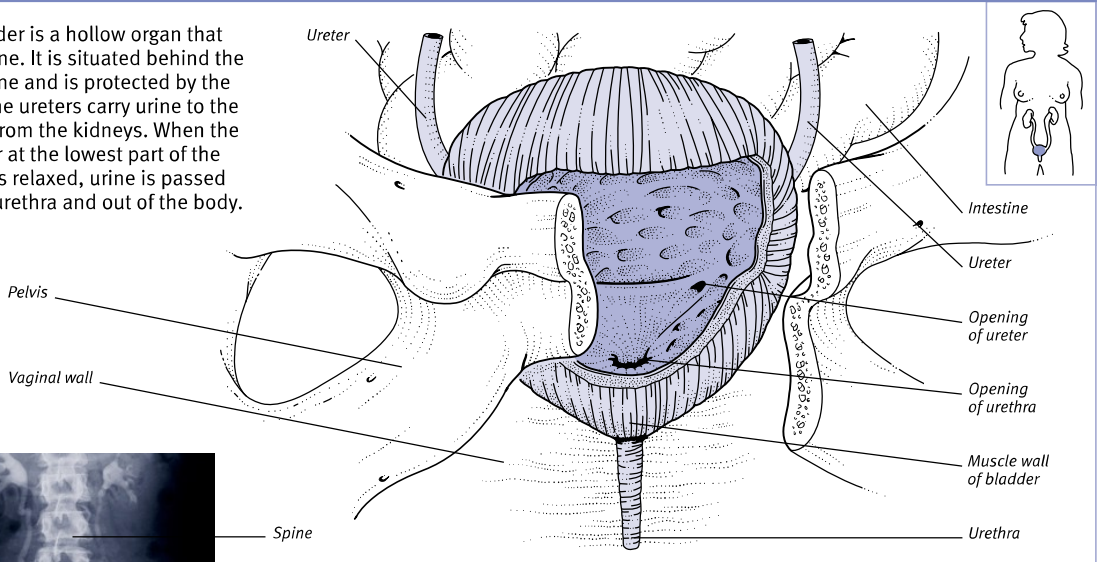
An occasional, life-threatening complication of falciparum *malaria* (the most dangerous form of malaria). Symptoms include loss of consciousness, fever, vomiting, and very dark urine (due to pigment from destroyed *red blood cells* being filtered into the urine).

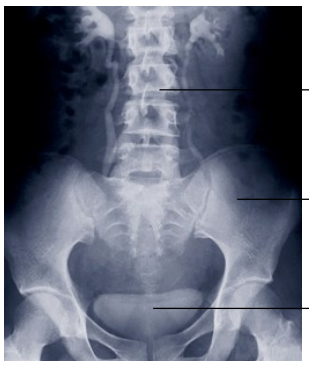
bladder

The hollow, muscular organ situated in the lower abdomen that acts as a reservoir for *urine*. The bladder lies within,

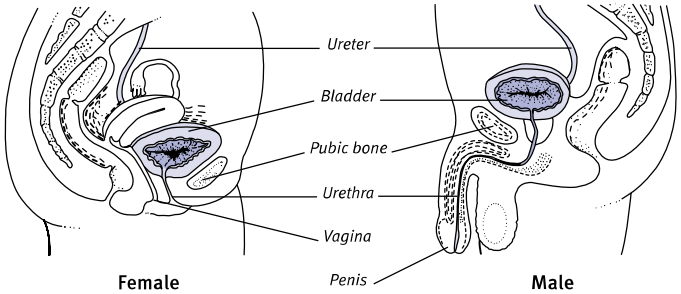
ANATOMY OF THE **BLADDER**

The bladder is a hollow organ that holds urine. It is situated behind the pubic bone and is protected by the pelvis. The ureters carry urine to the bladder from the kidneys. When the sphincter at the lowest part of the bladder is relaxed, urine is passed into the urethra and out of the body.





Intravenous urography
This special X-ray technique shows clearly the position of the bladder in the pelvis.



and is protected by, the *pelvis*. The average adult bladder can hold about 0.5 litres of urine before the need to pass urine is felt.

The bladder walls consist of muscle and an inner lining. Two tubes called *ureters* carry urine to the bladder from the kidneys. At the lowest point of the bladder is the opening into the *urethra* (outflow tube), known as the bladder neck. This is normally kept closed by a ring of muscle (the urethral sphincter).

FUNCTION

The bladder's function is to collect and store urine until it can be expelled from the body. Full control over bladder function takes several years to develop. In infants, emptying of the bladder is an entirely automatic, or *reflex*, reaction. When the bladder fills with urine and is stretched beyond a certain point, nerve signals are sent to the spinal cord. Signals from the spinal cord then cause the urethral sphincter to relax and the principal bladder muscle to contract, thereby expelling urine via the urethra.

Children develop complete bladder control at varying ages. Most are dry at night by the age of five years, but some take longer (see *enuresis, nocturnal*).

Defective bladder function, leading to problems such as incontinence (see *incontinence, urinary*) and *urinary retention*, can have a variety of causes. (See also *bladder disorders* box.)

bladder cancer

See *bladder tumours*.

bladder outflow obstruction

See *prostate, enlarged*; *urinary retention*.

bladder tumours

Growths originating in the inner lining of the bladder. *Papillomas* (small wart-like growths) often recur and eventually become cancerous. Other, more malignant, growths may extend not only into the bladder cavity, but also through the bladder wall to involve nearby organs, such as the colon, rectum, prostate gland, or uterus. Bladder cancer is more common in smokers and workers in the dye and rubber industries.

SYMPTOMS

Haematuria (blood in the urine) is the main symptom of bladder cancer. A tumour may obstruct the point at which a ureter enters the bladder, causing back pressure and pain in the kidney region, or the urethral exit, causing difficulty in passing, or retaining, urine.

DIAGNOSIS AND TREATMENT

Bladder tumours are diagnosed using *cystoscopy* (passage of a viewing tube up the urethra into the bladder) and biopsy (tissue sampling for microscopic analysis) of the abnormal area.

If they are small, the tumours can be treated by heat or removed surgically. Tumours tend to recur within the bladder, so regular follow-up cystoscopy is usually necessary. Bladder tumours that have spread through the bladder wall may be treated by *radiotherapy* or by the removal of part or all of the bladder.

Blalock shunt

A surgical procedure in which a connection is made between one of the two subclavian arteries (which normally deliver oxygen-rich blood to the neck and arms) and one of the pulmonary arteries (which carry blood from the right side of the heart to the lungs for oxygenation). The shunt may be used as a temporary treatment for congenital heart disorders, such as *tetralogy of Fallot*, in which oxygen-depleted blood is diverted back to the heart before it reaches the lungs. The shunt redirects the

DISORDERS OF THE **BLADDER**

The most important causes of bladder problems are infection, tumours, calculi (stones), and impairment of the bladder's nerve supply.

Infection

Bacterial infection of the bladder, which causes inflammation of the bladder wall (see *cystitis*), is particularly common in women. The short female urethra makes it relatively easy for bacteria to enter from outside the body. In men, infection is usually associated with obstruction of urine flow from the bladder by, for example an enlarged prostate gland (see *prostate, enlarged*) or bladder tumours.

Tumours

Bladder tumours may be cancerous or noncancerous and are more common in men than in women. They are usually painless in the early stages, the first symptoms being blood in the urine (see *haematuria*) or *urinary retention*, in which the bladder cannot be emptied. All bladder tumours need careful follow-up because, left untreated, noncancerous bladder tumours may become cancerous.

Calculi

Bladder stones (see *calculus, urinary tract*) are mostly caused by the crystallization of substances, such as calcium, in the urine. They mainly affect men and usually result from a longstanding urinary tract infection and/or incomplete emptying of the bladder.

Nerve impairment

Damage to the nerves controlling the bladder can prevent normal bladder function and lead either to incontinence (see *incontinence, urinary*) or to urinary retention. The most common cause is spinal-cord injury or tumours. Bladder control can be affected by nerve degeneration in conditions such as *diabetes mellitus*, *multiple sclerosis*, or *dementia*.

Other disorders

An unstable or *irritable bladder* is a common condition, particularly in women, in whom the bladder wall is especially sensitive to being stretched. Weakness of the muscles at the bladder neck, causing *stress incontinence*, is also common in women, particularly after childbirth. Tension or anxiety can cause frequent urination.

In children, delayed bladder control (see *enuresis, nocturnal*) is most often due to delayed maturation of the nervous system. Injury to the bladder is rare but may occur if the pelvis is fractured when the bladder is full.

INVESTIGATION

Various methods are used to investigate bladder disorders. Urinary tract infection is diagnosed by tests on a sample of urine. The bladder can be viewed directly by *cystoscopy* (insertion of a viewing tube). *Ultrasound scanning* is often performed, particularly if stones are suspected. X-ray procedures include micturating *cystourethrography*, which normally shows only the bladder and urethra, and intravenous *urography*, which shows the whole urinary tract except the urethra. *Urodynamics*, which may involve X-rays, are studies carried out to investigate bladder control problems. *Cystometry* measures bladder capacity in relation to pressure.

oxygen-depleted blood to the lungs. The improved blood oxygen levels allow the child to survive and grow until corrective surgery is possible.

bland diet

An easily digested diet that is free from possible irritants to the digestive tract, such as spicy foods and raw vegetable fibre. A bland diet is often advised following abdominal surgery or for people with gastrointestinal disorders.

blast cell

An immature *cell* that later develops into a specialized cell. For example, w*hite blood cells* begin as blast cells in the bone marrow and eventually form different types of mature white blood cells that are then released into the bloodstream. The presence of certain blast cells may indicate illness. For example, blast cells are found in the blood in acute leukaemia (see *leukaemia, acute*). (See also *stem cell*.)

blast injury

Tissue damage due to the effects of blast waves generated by an explosion. The eardrums and digestive tract are particularly at risk; the air within the ear and hollow parts of the gut transmits the waves in all directions, often resulting in severe damage.

blastocyst

A cell cluster that develops from a fertilized *ovum* and grows into an *embryo* (see *fertilization*).

blastomycosis

A type of *fungal infection* that can affect the lungs and other internal organs.

bleaching, dental

A cosmetic procedure for lightening certain types of *discoloured teeth*, including nonvital "dead" teeth. The surface of the affected tooth is painted with oxidizing agents and then exposed to ultraviolet light. A home procedure, consisting of trays loaded with bleaching material, is also available but is slower.

bleb

Another term for a *blister*.

bleeding

Loss of blood from the *circulatory system*, which may be caused by damage to the blood vessels or by a *bleeding disorder*. Bleeding may be visible (external) or concealed (internal). Rapid loss of more than 10 per cent of the blood volume can cause symptoms of *shock*, with fainting, pallor, and sweating.

The speed with which blood flows from a cut depends on the type of vessel damaged: blood usually oozes from a capillary, flows from a vein, and spurts from an artery. If an injury does not break open the skin, the blood collects around the damaged blood vessels just beneath the skin and forms a *bruise*.

Any lost blood that mixes with other body fluids such as sputum (phlegm) or urine will usually be noticed quite readily; bleeding from the lining of the digestive tract may make vomit or faeces appear darker than usual. Internal bleeding may not be discovered until severe *anaemia* develops.

bleeding disorders

A group of conditions characterized by bleeding in the absence of injury or by abnormally prolonged and excessive bleeding following injury. Bleeding disorders are the result of defects in the mechanisms by which bleeding is normally stopped: the coagulation of blood, the plugging of damaged blood vessels by platelets (the smallest type of blood cell), and the constriction of blood vessels (see *blood clotting*).

Defects in the coagulation system tend to cause deep bleeding into the gastrointestinal tract, muscles, and joint cavities. Defects of the platelets or blood vessels usually cause superficial bleeding into the skin, the gums, or the lining of the intestine or the urinary tract.

COAGULATION DEFECTS

These disorders are usually due to a deficiency of or abnormality in the *enzymes* (coagulation factors) that are involved in blood clotting. Clot formation is very slow and the clots are weak and do not seal blood vessels securely. Coagulation defects may be *congenital* (present at birth) or may be acquired later in life.

Congenital The main congenital coagulation defects are *haemophilia*, *Christmas disease*, and *von Willebrand's disease*. In all of these, one coagulation factor is either absent from the blood or present only in small amounts. Haemophilia and Christmas disease are similar disorders, resulting from deficiencies of two different coagulation factors: factor VIII and factor IX respectively. Inheritance of these disorders is sex-linked (see *genetic disorders*) and normally only males are affected. Von Willebrand's disease is an inherited disorder in which there is a platelet and a factor VIII defect; it affects both sexes about equally.

Individuals with one of these disorders may suffer from bruising, internal bleeding, abnormally heavy menstrual periods, and excessive bleeding from wounds. In severe cases, there may be recurrent bleeding into joints, such as the knee.

Acquired Acquired defects of blood coagulation factors may develop at any age due to severe liver disease, digestive system disorders that prevent the absorption of *vitamin K* (which is needed to make certain coagulation factors), or the use of *anticoagulant drugs*.

Disseminated intravascular coagulation (DIC) is an acquired disorder that is complex and serious. It may be the result of an underlying infection or of a cancerous tumour. In this condition, platelets accumulate and clots develop within small blood vessels; coagulation factors are used up faster than they are able to be replaced, and severe bleeding may result.

Tests and treatment Coagulation disorders are investigated by *blood-clotting tests*. If such a disorder is severe, it is treated by replacing the missing factor. Factors are extracted from fresh blood or from fresh frozen plasma, or genetically engineered factors may be used. Paradoxically, anticoagulants are sometimes used to suppress excess clotting activity in DIC, which results in a reduction in bleeding.

PLATELET DEFECTS

Bleeding may occur if there are too few platelets in the blood, a condition called *thrombocytopenia*. The main feature of this disorder is surface bleeding into the skin and gums, and there are multiple small bruises.

Occasionally, the platelets are present in normal numbers but function abnormally, causing bleeding. Platelet defects may be inherited, they may be associated with the use of certain drugs (including *aspirin*), or arise as a complication of certain bone marrow disorders such as *leukaemia*. Platelets can be destroyed by *autoimmune disorders* that may have been triggered by an infection or by drug treatment.

Platelet defects are investigated by blood tests. Bleeding due to a lack of platelets may be treated with intravenous platelet transfusions. In some cases, oral *corticosteroid drugs* are prescribed.

BLOOD VESSEL DEFECTS

In rare cases, abnormal bleeding is the result of a blood-vessel defect or *scurvy* (a disorder that is caused by a deficiency of *vitamin C*). Elderly people and patients on long-term courses of *corticosteroid drugs* may suffer mild abnormal bruising due to loss of skin support to the smallest blood vessels. Treatment is rarely required in these cases.

bleeding, dysfunctional uterine

Abnormal bleeding from the *uterus* (womb) with no obvious cause. (See also *menorrhagia*).

bleeding gums

See *gingivitis*.

bleeding, occult

Bleeding that is not obvious to the naked eye (such as that which occurs within the intestine) and that may be detected only by tests. (See also *occult blood, faecal*).

bleeding time

An assessment of the functioning of platelets (the tiny cell fragments within the blood that play a vital role in *blood clotting*) by measuring the speed at which they form plugs to stem bleeding from damaged blood vessels. Two small cuts are made in the forearm and the time taken for the bleeding from these cuts to stop is recorded.

blepharitis

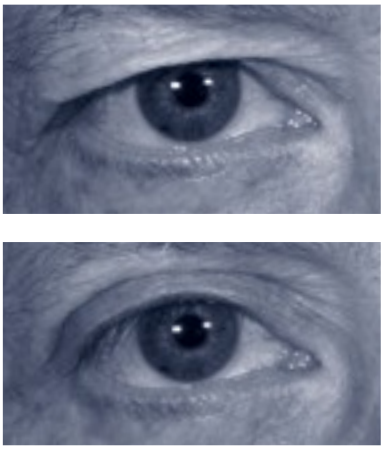
Inflammation of the eyelids, with redness, irritation, and scaly skin at the lid margins. Blepharitis may cause burning and discomfort in the eyes and flakes or crusts on the lashes. The condition is common, tends to recur, and is sometimes associated with dandruff of the scalp or *eczema*. Severe blepharitis may lead to *corneal ulcers*. In many cases, treatment of associated dandruff with an antifungal shampoo will result in improvement of the blepharitis.

blepharoplasty

A cosmetic operation to remove drooping, wrinkled skin from the upper and/or lower eyelids. Blepharoplasty is usually performed under local anaesthetic (see *anaesthesia, local*).

blepharospasm

Prolonged, involuntary contraction of one of the muscles controlling the eyelids, causing them to close. It may be due to *photophobia* (abnormal sensitivity of the eyes to light), to damage to the *cornea* (the transparent dome that forms the front part of the eyeball), or to *dystonia* (abnormal muscle rigidity), for which *botulinum toxin* (a muscle relaxant) treatment is highly effective.



Appearance before (top) and after (bottom) Blepharoplasty involves the removal of a crescent-shaped section of skin and underlying fat from each eyelid.

blind loop syndrome

A condition in which a redundant area or dead end (blind loop) in the small intestine becomes colonized with bacteria. The bacteria break down bile salts, which are necessary for the absorption of fat and certain vitamins. This results in poor absorption of fats and abnormal faeces. Blind loop syndrome may result from surgery or a *stricture* (narrowing) in the intestine as a result of a disorder such as *Crohn's disease*. It is characterized by *steatorrhoea* (pale yellow, foul-smelling, fatty, bulky faeces that are difficult to flush away), tiredness, and weight loss. *Antibiotic drug* treatment is usually effective, but the condition may recur if the underlying abnormality cannot be corrected.

blindness

Inability to see. Definitions of blindness and partial sight vary. In the UK, blindness is defined as a corrected *visual acuity* of 3/60 or less, or a *visual field* of no more than 20 degrees, in the better eye.

CAUSES

Loss of vision may result from injury to, or disease or degeneration of, the eyeball; the optic nerve or the nerve pathways that connect the eye to the brain; or the brain itself.

Eyeball Normal vision depends on an uninterrupted passage of light from the front of the eye to the light-sensitive retina at the back. Anything that prevents light from reaching the retina can cause blindness.

Various disorders can lead to the clouding of the cornea at the front of the eye. These disorders include *Sjögren's syndrome* (in which the eyes become excessively dry), *vitamin A* deficiency, chemical damage, infections, and injury. *Corneal ulcers*, which most commonly develop after severe infections, can cause blindness due to scarring of the cornea. *Uveitis* (inflammation of the iris, ciliary body, or choroid), can also cause loss of vision.

Cataract (cloudiness of the lens) is another common cause of blindness. It is usually the result of the lens becoming less transparent in old age, but is occasionally present from birth or develops in childhood.

Diabetes mellitus, *hypertension* (high blood pressure), or injury can all cause bleeding into the cavity of the eyeball and a subsequent loss of vision. Bleeding into the fluid in front of the lens (see *hyphaema*) or behind the lens (see *vitreous haemorrhage*) can also result in loss of vision.

Disorders of the retina that may result in blindness include age-related *macular degeneration* (degeneration of the central area of the retina, which occurs in old age); *retinopathy* due to diabetes or to hypertension; *retinal artery occlusion* or *retinal vein occlusion* (blockage of the blood flow to and from the retina); *retinal detachment*; certain types of tumour, such as *retinoblastoma* and malignant melanoma affecting the eye (see *melanoma, malignant*); and *retinal haemorrhage* (bleeding into the retina), caused by diabetes, hypertension, vascular disease, or injury.

In *glaucoma*, excessive fluid pressure within the eyeball causes degeneration of nerve fibres at the front end of the optic nerve.

Nerve pathways The light energy that is received by the retina is transformed into nerve impulses that travel along the optic nerve and nerve pathways into the brain. Loss of vision may result if the conduction of these nerve impulses is impaired.

Reasons for damage to nerve pathways include pressure caused by a tumour in the orbit (the bony cavity that contains the eyeball); a reduced blood supply to

the optic nerve, which may be caused by diabetes mellitus, hypertension, a tumour, injury, or *temporal arteritis* (inflammation of arteries in the scalp); *optic neuritis* (inflammation of the optic nerve that may occur in *multiple sclerosis*); the toxic (poisonous) effects of certain chemicals; and certain nutritional deficiencies.

Brain Nerve impulses from the retina eventually arrive in a region of the *cerebrum* (the main mass of the brain) called the visual cortex. Blindness can result if there is pressure on the visual cortex from a *brain tumour* or a *brain haemorrhage*, or if the blood supply to the visual cortex has been reduced following a *stroke*.

DIAGNOSIS AND TREATMENT

It is frequently possible to detect the cause of blindness by direct examination of the eye, using such techniques as *ophthalmoscopy*, *slit-lamp examination*, and *tonometry*. The conduction of nerve impulses can be measured by means of *evoked responses*.

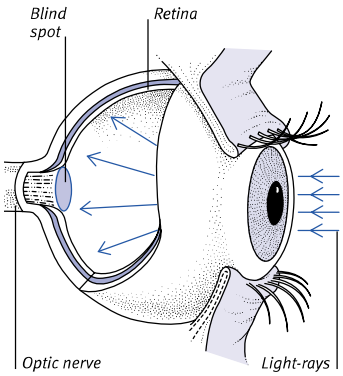
Treatment of blindness depends on the underlying cause. If the loss of vision cannot be corrected, the patient may then be registered as legally blind or partially sighted, and will become eligible for certain benefits and services. (See also *eye; vision, loss of*.)

blind spot

The small, oval-shaped area on the retina of the eye where the optic nerve leaves the eyeball. The area is not sensitive to light because it has no light receptors (nerve endings responsive to light). The blind spot can also be used to describe the part of the *visual field* in which objects cannot be detected.

LOCATION OF **BLIND SPOT**

The blind spot is a minute area on the retina that lacks light receptors and is therefore not light-sensitive.



blister

A collection of fluid beneath the outer layer of the skin that forms a raised area. The fluid is serum that has leaked from blood vessels in underlying skin layers after minor damage; it provides protection for the damaged tissue.

Common causes of blisters are *burns* and friction. Blisters may also occur in some skin diseases, including *eczema*, *epidermolysis bullosa, impetigo*, *erythema multiforme, pemphigus*, *pemphigoid*, and *dermatitis herpetiformis*, and in some types of *porphyria*. Small blisters develop in *chickenpox*, *herpes zoster* (shingles), and *herpes simplex*. Blisters are generally best left intact; large or unexplained blisters need medical attention.

bloating

Distension of the abdomen, commonly due to wind in the stomach or intestine (see *abdominal swelling*).

blocked nose

See *nasal congestion*; *nasal obstruction*.

blocking

The inability to express true feelings or thoughts, usually due to emotional or mental conflict. In Freudian-based *psychotherapy*, blocking is thought to result from the repression of painful emotions in early life. A very specific form of thought blocking occurs in *schizophrenia*: trains of thought are persistently interrupted involuntarily to be replaced by unrelated new ones.

blood

The red fluid that circulates in the body's veins, arteries, and capillaries. Blood is pumped by the heart via the arteries to the lungs and all other tissues and is then returned to the heart in veins (see *circulatory system*). Blood is the body's transport system and also plays an important role in the defence against infection. An average adult has about 5 litres of blood.

Almost half the blood's volume consists of *blood cells*, including red blood cells (erythrocytes), which carry oxygen to the tissues; white blood cells (leukocytes), which defend the body against infection; and platelets (thrombocytes), which are involved in *blood clotting*. The rest of the blood volume is made up of plasma, a watery, straw-coloured fluid containing proteins, sugars, fats, salts, and minerals.

Nutrients are transported in the bloodstream to the tissues after absorption from the intestinal tract or after release from storage depots such as the liver. Waste products, including *urea* and *bilirubin*, are carried in the plasma to the kidneys and liver respectively.

Plasma proteins include fibrinogen, which is involved in blood clotting; *immunoglobulins* (also called antibodies) and *complement*, which are part of the *immune system*; and *albumin*. Hormones are also transported in the blood to their target organs.

blood–brain barrier

A system of tight, impermeable junctions between the cells that form the walls of the capillaries (tiny blood vessels) within the *central nervous system*. The blood–brain barrier has a protective function; it allows only certain substances and drugs in the bloodstream to gain access to the central nervous system, especially to the brain.

blood cells

Cells, also called blood corpuscles, that are present in blood for most or part of their lifespan. They include red blood cells (which make up about 45 per cent of the volume of normal blood), white blood cells, and platelets. All blood cells are made in the bone marrow by a series of divisions from a single type of cell called a *stem cell*.

RED BLOOD CELLS

These cells are also known as RBCs, red blood corpuscles, or erythrocytes. They transport oxygen from the lungs to the tissues (see *respiration*).

Formation Red blood cells are formed from stem cells in the bone marrow by a process called erythropoiesis, which takes about five days. Their formation requires an adequate supply of nutrients, including iron, amino acids, and the vitamins B_{12} and folic acid. The rate at which RBCs are formed is influenced by a hormone called erythropoietin, which is produced by the kidneys.

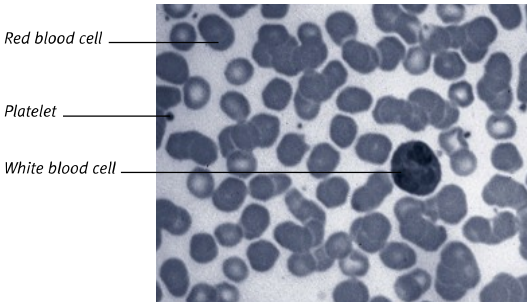
Immature red blood cells that have just been released into the bloodstream from the bone marrow are called reticulocytes; within two to four days, these develop into mature cells.

Structure and function In 1 ml of blood there are approximately 5 million red

B

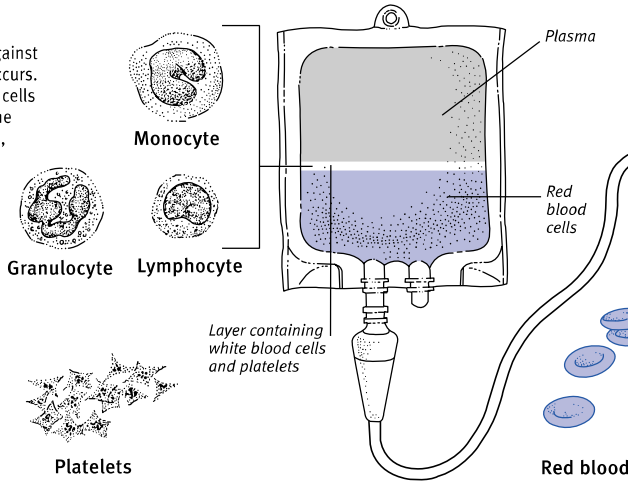
CONSTITUENTS OF **BLOOD**

Blood is pumped around the body in veins and arteries, transporting oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs. Blood also carries nutrients such as sugars, fats, and proteins that have been absorbed from the intestine and hormones produced by a variety of glands. Waste products that are released from cells are carried in the blood to be broken down in the liver or excreted from the kidneys.



Normal blood smear
This is the appearance of normal blood under a microscope. The dominant feature is the abundance of red blood cells, which make up almost half of the volume of blood. One white blood cell (a lymphocyte) can be clearly seen; the platelets are the tiny dark particles.

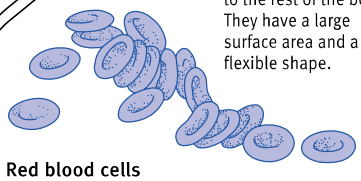
White blood cells
These cells protect the body against infection and fight it when it occurs. They are bigger than red blood cells but fewer in number. Each of the three main types (granulocytes, monocytes, and lymphocytes) plays a different role in dealing with infection.



Plasma
The fluid part of the blood that consists mostly of water. It carries substances such as proteins, fats, glucose, and salts.

Red blood cells
These disc-shaped cells are formed in the bone marrow and carry oxygen from the lungs to the rest of the body. They have a large surface area and a flexible shape.

Platelets
The smallest type of blood cell produced in the bone marrow. They play an important role in blood clotting.



blood cells, each of which is disc-shaped, about 0.0075 mm in diameter, and thicker around the edge than at the centre. This shape gives each cell a relatively large surface area, which helps it absorb and release oxygen molecules, and allows it to distort as it squeezes through narrow blood vessels. The surface structure of red blood cells varies slightly among individuals, and this provides the basis for classifying blood into groups (see *blood groups*).

RBCs are packed with large quantities of *haemoglobin*, a pigmented protein that contains iron. Haemoglobin binds (combines chemically) with oxygen to form oxyhaemoglobin, which carries oxygen to body tissues. Oxyhaemoglobin is responsible for the bright red coloration of oxygenated blood, which flows mainly through the arteries. Most venous blood is darker because it contains the unbound (deoxygenated) form of haemoglobin.

Every RBC also contains *enzymes* (substances that promote biochemical reactions), minerals, and sugars that provide energy for the cell's *metabolism* (chemical processes) and maintain its shape, structure, and elasticity.

Aging and destruction The normal lifespan of RBCs in the circulation is about 120 days. As they age, their internal chemical machinery wears out, they lose elasticity, and they become trapped in small blood vessels in the spleen and other organs; they are then destroyed by a type of white blood cell called a macrophage. Most of the components of haemoglobin molecules are reused, but some are broken down to form the waste product *bilirubin*.

Disorders Abnormalities can occur in the rate at which RBCs are produced or destroyed; in their numbers; and in their shape, size, and haemoglobin content, all of which may cause forms of *anaemia* and *polycythaemia* (see *blood* disorders box).

WHITE BLOOD CELLS

These are also called WBCs, white blood corpuscles, or leukocytes. They protect the body against infection and fight infection when it occurs. White blood cells are bigger than red blood cells (up to 0.015 mm in diameter) but are far less numerous (about 7,500 per ml of blood). They generally spend a shorter part of their lifespan than red blood cells in the blood itself. The three main types of WBC are granulocytes (also called polymorphonuclear leukocytes), monocytes, and *lymphocytes*.

Granulocytes Granulocytes are further classified as neutrophils, eosinophils, or basophils, each type having a specific role. The most important are neutrophils, which isolate and destroy invading bacteria. Neutrophils remain in the blood for only about six to nine hours before moving through blood-vessel walls into tissues. Eosinophils play a part in allergic reactions and increase in numbers in response to certain parasitic infections. Basophils are involved in inflammatory and allergic reactions.

Monocytes These cells also play an important role in the *immune system*.

DISORDERS OF THE **BLOOD**

Abnormalities can occur in any of the components of blood: in red blood cells, white blood cells, platelets, and the numerous constituents of plasma.

There are various types of *anaemia* (a reduced level of the oxygen-carrying pigment haemoglobin in the blood), which is by far the most common blood disorder. Some abnormalities of the blood are inherited; others may be the result of various diseases, such as cancer, or be caused by poisoning by infective organisms, toxins, or drugs.

Genetic disorders

Some blood disorders are inherited (genetic) and are present from birth (congenital). Such disorders include *sickle cell anaemia* and *thalassaemia*, in which the red blood cells are abnormally fragile, and *haemophilia*, in which there is a deficiency of one of the blood clotting factors.

Sickle-cell anaemia
This electron micrograph shows a red blood cell deformed by sickle-cell anaemia (left). On the right is another red cell that has started to sickle.

Nutritional disorders

Heavy or persistent blood loss, most commonly as a result of menstruation, may mean that iron (an essential component of the red cell pigment haemoglobin) is lost faster than it can be replaced in the diet (see *anaemia, iron-deficiency*). Deficiencies of the vitamins B_{12} or folic acid interfere with the production of red blood cells in bone marrow and give rise to abnormally large, deformed red blood cells (see *blood, anaemia, megaloblastic*).

Cancer

There are various types of bone marrow cancer, all of which affect the blood. *Leukaemia* causes an overgrowth of abnormal white blood cells and destroys healthy bone marrow. In *polycythaemia,* too many red blood cells are produced. Another bone marrow cancer, *multiple myeloma*, can cause an excess of certain proteins in the blood plasma. Secondary deposits that have spread from cancers elsewhere in the body may also involve the bone marrow.

Clotting disorders

Defects in the blood platelets and in blood clotting mechanisms may lead to *bleeding disorders*, such as haemophilia and *disseminated intravascular coagulation (DIC)*. Liver disease may cause deficiencies of some clotting factors. Unwanted clot formation (see *thrombosis*) may have any of a variety of causes, such as a mutation in the gene that controls production of a clotting factor (see *factor V*, for example) or use of oral contraceptives. People with *Hughes' syndrome* are also at increased risk of thrombosis.

Other disorders

Blood poisoning may be caused by the multiplication of bacteria in the blood (see *septicaemia*) or by the toxins released by bacteria (see *toxaemia*). Poisoning can also be caused by toxins such as carbon monoxide and lead.

Some drugs can cause blood abnormalities. For example, thiazide *diuretic drugs* may depress the production of white blood cells and/or platelets; *methotrexate* may interfere with red cell production; and too high a dose of *anticoagulant drugs* can cause abnormal bleeding.

Albumin, which is an important protein in blood plasma, may become deficient as a result of either liver or kidney disease.

INVESTIGATION

Blood disorders are investigated principally by various blood tests, such as *blood count*, *blood film*, and *blood-clotting tests*. Levels of vitamins and minerals, such as iron, may also be measured. In some cases, a bone marrow *biopsy* may also be required.

They circulate in the bloodstream for about one to three days.

Lymphocytes Lymphocytes are usually formed in the lymph nodes, rather than in the bone marrow. They play an important role in the immune system, roving throughout the body between the bloodstream, the lymph nodes, and the channels between lymph nodes. Lymphocyte cells may survive for anywhere between three months and ten years.

There are two principal types of lymphocyte: T-lymphocytes (or T-cells) and B-lymphocytes (or B-cells). T-lymphocytes are responsible for delayed hypersensitivity reactions (see *allergy*) and are also involved in protection against cancer. T-lymphocytes manufacture chemicals, called lymphokines, which affect the functioning of other cells. T-lymphocytes can be classified according to their surface marker proteins. For example, T-lymphocytes with CD4 surface marker proteins are particularly important in monitoring HIV infection. In addition, T-lymphocytes moderate the activity of B-lymphocytes, which form the antibodies that can act to prevent a second attack of certain infectious diseases.

Disorders The *leukaemias* are *blood disorders* in which there is uncontrolled overproduction of white blood cells in the bone marrow. Other disorders arise when white blood cells are not produced in sufficient numbers.

PLATELETS

Platelets, which are also called thrombocytes, are the smallest type of blood cell (0.002 mm to 0.003 mm in diameter). There are about 250,000 of them per cubic mm of blood. Like other blood cells, they originate in the bone marrow. Platelets survive in the blood for about nine days.

Function Platelets circulate in the blood in an inactive state until brought into action by certain circumstances, when they begin to stick to blood-vessel walls and to each other. These activities play an important part in *blood clotting*, which helps wounds to heal. However, the accumulation of platelets can, occasionally, lead to the formation of clots in blood vessels (see *thrombosis*).

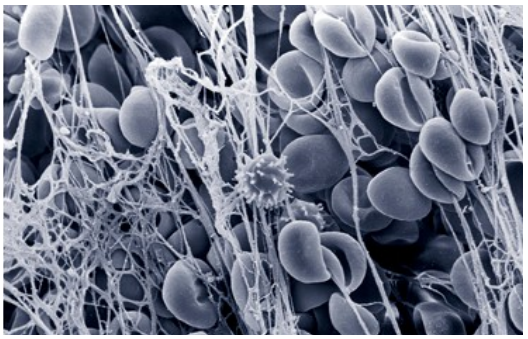
BLOOD CELLS IN DIAGNOSIS

The numbers, shapes, and appearance of the various types of blood cell are of great value in the diagnosis of disease (see *blood count; blood film*).

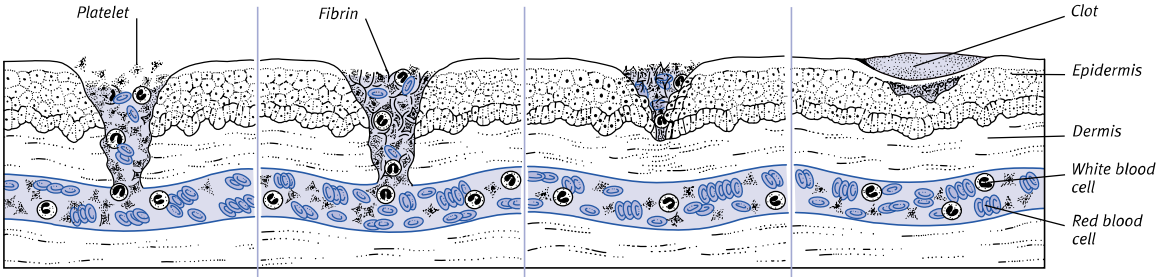
B

HOW **BLOOD** CLOTS

Clotting describes the solidification of blood anywhere in the body. Clotting occurs almost immediately at the site of a cut and helps to limit blood loss by sealing damaged blood vessels. However, if abnormal clotting occurs in major blood vessels, a heart attack, stroke, or other disorder may occur. The clotting process has two main parts – platelet activation and the formation of fibrin filaments.



Red blood cells enmeshed in fibrin filaments
Fibrin is formed by a chemical change from a soluble protein, fibrinogen, which is present in the blood. The fibrin molecules aggregate to form long filaments, which enmesh blood cells (see left) to form a solid clot. The conversion of fibrinogen to fibrin is the last step of the "coagulation cascade", a series of reactions in the blood that are triggered by injury to the tissues and activation of platelets.



1 Platelets are activated by coming into contact with damaged blood vessel walls, where they become sticky and then clump at the site of injury and adhere to the damaged blood-vessel wall.

2 Chemicals released by the platelets and damaged tissues stimulate coagulation factors within the blood to form filaments of fibrin at the site of injury.

3 The fibrin filaments enmesh the platelets along with red and white blood cells.

4 Once the cut blood vessel is plugged by the mass of fibrin, platelets, and red and white blood cells, the fibrin filaments contract to form a solid clot.

blood clot

See *thrombus*.

blood clotting

The process of blood solidification. Blood clotting is important in stemming bleeding from damaged blood vessels. However, blood clots can also form inside major blood vessels, leading to a *myocardial infarction* (heart attack) or to a *stroke* (see *thrombosis*).

CLOTTING MECHANISM

When a blood vessel is damaged, it constricts immediately to reduce blood flow to the area. The damage sets off a series of chemical reactions, leading to the formation of a clot to seal the injury. First, platelets around the injury site are activated, becoming sticky and adhering to the blood-vessel wall. The activated platelets then release chemicals that, in turn, activate coagulation factors. These factors, together with *vitamin K*, act on fibrinogen, a substance found in blood, converting it to fibrin. Strands of fibrin form a kind of meshwork, which traps red blood cells to form a clot.

ANTICLOTTING MECHANISMS

There are several anticlotting mechanisms that prevent the formation of unwanted blood clots. These mechanisms include prostacyclin (a *prostaglandin*), which prevents platelet aggregation (the first stage of blood clotting), and plasmin, which breaks down fibrin (see *fibrinolysis*). Blood flow washes away active coagulation factors; and the liver deactivates excess coagulation factors.

CLOTTING DEFECTS

Defects in blood clotting may result in *bleeding disorders*. Excessive clotting, or thrombosis, may be due to an inherited increase or defect in a coagulation factor (see *factor V*); the use of oral contraceptives; a decrease in the level of enzymes that inhibit coagulation; or sluggish blood flow through a particular area. Treatment is usually with *anticoagulant drugs* such as heparin or warfarin.

blood-clotting tests

Laboratory tests used to screen for and diagnose *bleeding disorders*. Such disorders usually result from deficiencies or abnormalities of blood coagulation factors or of platelets (see *blood clotting*). The tests are also used to monitor treatment with *anticoagulant drugs*; excessive doses of these drugs could cause bleeding. (See also *international normalized ratio*.)

blood count

A test, also called full blood count, that measures the *haemoglobin* concentration and the numbers of red blood cells, white blood cells, and platelets in 1 cu. mm of blood. The proportion of various white blood cells is measured and the size and shape of the red and white cells is also noted.

A blood count is the most commonly performed blood test and is important for diagnosing *anaemia* or confirming the presence of an infection to which cells in the blood have responded. It is also used to diagnose disorders such as *leukaemia* and *thrombocytopenia* (abnormally low platelet levels).

About 1 to 2 ml of blood is required for a blood count, which is usually performed by an automatic analyser.

blood culture

A laboratory test performed on a sample of *blood* to determine the presence of microorganisms such as bacteria. (See also *culture*.)

blood donation

The process of giving blood for use in *blood transfusion*. Blood donors give up to 500 ml of blood (about one-tenth of total blood volume), usually about twice a year. Donated blood is routinely tested for a range of infectious agents, such as *hepatitis B* and *hepatitis C*, and antibodies to *HIV*. After being classified into *blood groups*, the blood is stored in a blood bank, either whole or separated into its components (see *blood products*).

Apheresis is a specific type of blood donation in which only a particular component of blood (such as plasma, platelets, or white blood cells) is withdrawn from the donor.

blood film

A test that involves smearing a drop of blood on to a glass slide for examination under a microscope. The blood film is stained with dyes to make the blood cells show up clearly.

The test allows the shape and appearance of blood cells to be checked for any abnormality, for example the sickle-shaped red blood cells characteristic of *sickle cell anaemia*. The relative proportions of the different types of white blood cells can also be counted. This examination, known as a differential white cell count, may be helpful in diagnosing infection or *leukaemia*. Blood films are also used in diagnosing infections in which the parasites can be seen inside the red blood cells; an example of such an infection is *malaria*.

Blood film tests are usually carried out together with a full *blood count*.

blood gases

Measurement of the concentrations of oxygen and carbon dioxide in the blood. The acidity–alkalinity (pH) and bicarbonate levels are also measured. The test is carried out on a sample of blood that has been taken from an artery, usually at the wrist or the groin. It is useful in diagnosing and monitoring *respiratory failure*. Bicarbonate and acidity reflect the *acid–base balance* of the body, which may be disturbed in conditions such as diabetic ketoacidosis, aspirin poisoning, *hyperventilation* (overbreathing), or repeated vomiting. Blood oxygen can also be monitored continuously without the need to take blood samples by using an *oximeter*.

blood glucose

The level of *glucose* in the blood. Abnormally high blood glucose (sometimes called blood sugar) levels may be an indication of *diabetes mellitus*. (See also *hyperglycaemia; hypoglycaemia*.)

blood glucose monitoring

A method of analysing a person's blood *glucose* (sugar) levels that requires only a drop of blood taken from a pinprick on the fingertip. The blood is applied to a test strip, which has an area impregnated with a chemical that reacts with the glucose in the blood sample. The glucose level is shown either by a visible colour change on the strip or by placing the strip in a digital meter. People with *diabetes mellitus* must perform regular blood glucose monitoring tests to monitor their blood glucose control. (See also *hyperglycaemia*; *hypoglycaemia*.)

blood groups

Systems of classifying blood according to the different *antigens* (marker proteins) on the surface of *red blood cells* (RBCs) and the *antibodies* in the blood plasma. The antigens affect the ability of the RBCs to provoke an *immune response*. The two principal blood grouping systems used are the ABO system and the rhesus system.

ABO GROUPS

In this system, the presence or absence of two types of antigen (A and B) on the surface of the red blood cells determines a person's blood group. People with the A antigen (blood group A) have anti-B antibodies; people with the B antigen (blood group B) have anti-A antibodies; those with both antigens (blood group AB) have neither type of antibody; and those with neither antigen (blood group O) have both types of antibody.

RHESUS FACTORS

The rhesus system involves several antigens, the most important of which is called factor D. People with this factor are Rh-positive; those without it are Rh-negative. The importance of the Rh group relates mainly to pregnancy in Rh-negative women because, if the baby is Rh-positive, the mother may form antibodies against the baby's blood (see *rhesus incompatibility*).

USES

Blood group typing is essential for safe *blood transfusion*. The ABO and rhesus groups are used to categorize blood stored in blood banks, so that donor blood that is compatible with that of the patient can be selected before transfusion takes place.

Because a person's blood group is inherited, identification of blood group may be used in paternity testing. Genetic analysis allows identification of the blood of a criminal suspect with virtual certainty (see *genetic fingerprinting*).

BLOOD GROUP COMPATIBILITY

Group A is compatible with A and O, and group B with B and O. Group AB is compatible with all groups, but O is compatible with no other group.

		Donor blood group			
		A	B	AB	O
Recipient blood group	A	○	●	●	○
	B	●	○	●	○
	AB	○	○	○	○
	O	●	●	●	○

Key ○ Compatible ● Incompatible

blood level

The concentration of a given substance in the blood plasma or serum that may be measured by *blood tests*.

blood loss

See *bleeding*.

blood poisoning

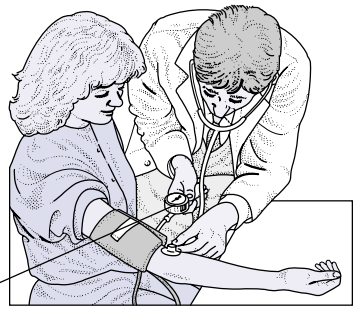
A common name for *septicaemia* with *toxaemia*, a life-threatening illness that is caused by multiplication of bacteria and formation of toxins in the bloodstream. Septicaemia may occur as a complication of an infection in an organ or tissue. In some infective conditions, *septic shock* may be caused by toxins that are released by bacteria. Treatment for blood poisoning is with *antibiotic drugs* and intensive therapy for shock. (See also *bacteraemia*.)

blood pressure

The pressure exerted by the flow of blood through the main arteries. The pressure at two different phases is measured. Systolic, the higher pressure, is

MEASURING BLOOD PRESSURE

Blood pressure measurement is a routine part of a physical examination. A sphygmomanometer measures blood pressure as systolic (the top figure), when the heart contracts, and diastolic, when the heart relaxes. An inflatable cuff attached to the sphygmomanometer is wrapped around the upper arm and deflated while a doctor listens to the blood flow through an artery, using a stethoscope.



created by the contraction of the ventricles of the *heart*. Diastolic, the lower pressure, is recorded during relaxation of the ventricles between heartbeats; it reflects the resistance of all the small arteries in the body and the load against which the heart must work. The pressure wave that is transmitted along the arteries with each heartbeat is easily felt as the *pulse*.

Blood pressure is measured using a *sphygmomanometer* and is expressed as millimetres of mercury (mmHg). Blood pressure varies with age, between individuals, and at different times in the same individual. A healthy young adult usually has a blood pressure reading, at rest, of about 120/80 (120 mmHg systolic and 80 mmHg diastolic pressure). A sustained level of high blood pressure is called *hypertension*; abnormally low pressure is termed *hypotension*.

blood products

Donated blood (see *blood donation*) that is separated into its components: red cells, white cells, platelets, and plasma. Each blood product has a specific lifespan and use in *blood transfusion*. Packed red cells (blood that has most of the plasma removed) are used to treat individuals with some forms of chronic *anaemia* and babies with *haemolytic disease of the newborn*. Washed red cells (with white blood cells and/or plasma proteins removed) are used when a person requires repeated transfusions since there is less risk of an *allergy* to any of the blood components developing.

Platelets may be given through transfusions for those people who have blood-clotting disorders. Patients who have life-threatening infections may be treated with granulocytes, a type of white blood cell. Fresh frozen plasma is used to correct many types of *bleeding disorder* because plasma contains all the clotting factors. Plasma substitutes may be used to treat *shock* that has occurred as a result of severe blood loss, until sufficient compatible whole blood becomes available. Purified albumin preparations are used for people who have *nephrotic syndrome* and chronic liver disease.

Concentrates of blood clotting factors VIII and IX are used in the treatment of the conditions *haemophilia* and *Christmas disease*. *Immunoglobulins* (also called antibodies), which are extracted from blood plasma, can be given by injection (see *immunoglobulin injection*) to protect those people who are unable to produce their own antibodies or have already been exposed to an infectious agent. Immunoglobulins may also be given to provide short-term protection against *hepatitis A*. Immunoglobulins are given in large doses to treat certain *autoimmune disorders*.

blood smear

See *blood film*.

blood sugar

See *blood glucose*.

blood test, haematological

Analysis of a sample of blood to provide information about its cells and proteins and the chemicals, gases, antigens, and antibodies it contains. Haematological blood tests are used to check respiratory function, the immune system, the metabolism, hormonal balance, and the health of the major organs. The tests look at the numbers, appearance, shape, and size, of blood cells and assess the function of clotting factors in the blood.

TYPES

Important haematological blood tests are *blood count* and *blood group* tests if a blood transfusion is needed. Biochemical tests measure chemicals in the blood (see *acid–base balance*; *kidney function tests*; and *liver function tests*). Microbiological tests (see *immunoassay*) look for microorganisms that are in the blood, such as in septicaemia. Immunological tests also look for antibodies in the blood, which may confirm immunity to an infection.

blood transfusion

The infusion of large volumes of blood or of *blood products* directly into the bloodstream to remedy severe blood loss or to correct chronic *anaemia*. In an exchange blood transfusion, nearly all of the recipient's blood is replaced by donor blood.

HOW IT IS DONE

Before a transfusion, a sample of the recipient's blood is taken to identify his or her *blood group*, which is then matched with suitable donor blood. The donor blood is transfused into an arm vein through a plastic cannula (a tube with a smooth tip). Usually, each unit (about 500 ml) of blood is given over one to four hours; in an emergency, 500 ml may be given within a couple of minutes. The blood pressure, body temperature, and pulse of the patient are monitored during the procedure.

COMPLICATIONS

If mismatched blood is accidentally introduced into the circulation, antibodies in the recipient's blood may cause the donor cells to burst, leading to *shock* or *kidney failure*. Less severe reactions can produce fever, chills, or a rash. Reactions can also occur as the result of an allergy to a particular component of the transfused blood.

The risk of infection is extremely small. All blood used for transfusion is carefully screened for a number of infectious agents, including *HIV* (the *AIDS* virus) and *hepatitis B* and *hepatitis C*.

In elderly or in severely anaemic patients, blood transfusion can overload the circulation, leading to heart failure. In patients with chronic anaemia who need regular transfusions over the course of many years, excess iron may accumulate (a condition called haemosiderosis) and damage organs such as the heart, liver, and pancreas. Treatment with the drug *desferrioxamine* to remove excess iron may be needed in this case.

blood transfusion, autologous

The use of a person's own blood, which had been donated at an earlier time, for *blood transfusion*. Autologous transfusion eliminates the slight but serious risk of contracting an infectious illness from contaminated blood. Another advantage is that there is no risk of a reaction occurring as a result of incompatibility between donor and recipient blood.

Up to 2.5 litres of a person's blood can be removed and stored in several sessions up to three days before planned surgery. There must be at least four days between each session. Blood may also be taken during surgery. The blood is filtered and returned to the body.

blood transfusion, incompatible

A *blood transfusion* in which the recipient's blood and the donor's blood are mismatched. As a result, *antibodies* that are present in the recipient's circulation lead to destruction of the transfused *red blood cells*. This can have serious consequences, including *kidney failure* and occasionally even death. Careful cross-matching of blood in the laboratory make incompatible transfusions rare.

blood vessels

A general term for arteries, veins, and capillaries (see *circulatory system*).

Bloom's syndrome

A *genetic disorder* that is most commonly found among people of East European Jewish descent. Physical characteristics of the syndrome include short stature, a butterfly-shaped red rash on the face, and *photosensitivity* (an abnormal reaction to sunlight). Individuals with Bloom's syndrome may also be at increased risk of certain cancers, such as *leukaemia*.

blue baby

An infant with a cyanotic (bluish) complexion, especially visible on the lips and tongue, caused by a relative lack of oxygen in the blood. This is usually due to a structural defect of the heart or the major arteries leaving the heart. Such defects may need to be corrected surgically (see *heart disease, congenital*).

blue bloater

An outdated term to describe a person with bluish lips and tongue and *oedema* (a buildup of fluid in the tissues). The cause is long-term lung damage that has led to heart failure (see *pulmonary disease, chronic obstructive*).

blue naevus

A type of *naevus* (skin blemish) with a dark blue or black coloration and a clearly defined border. Blue naevi are noncancerous and they are made up of a collection of pigment-producing cells called *melanocytes*.

blurred vision

Indistinct, or fuzzy, visual images. Blurred vision, which should not be confused with *double vision* (diplopia), can occur in one eye or both, for episodes of varying lengths of time, and can develop gradually or suddenly. The usual cause of longstanding blurred vision is a refractive error such as *astigmatism* (unequal curvature of the front of the eye), *hypermetropia* (longsightedness), or *myopia* (shortsightedness), all of which can be corrected by glasses or contact lenses. After the age of 40, *presbyopia* (reduced ability to focus on near objects) becomes more common.

Vision may also be blurred or impaired as a result of damage, disease, or abnormalities of parts of the eye or its connections to the brain. Blurred vision as a result of disease is most commonly caused by *cataract* or *retinopathy*.

blushing

Brief reddening of the face, and sometimes the neck, caused by widening of the blood vessels close to the skin's surface. Blushing is often an involuntary reaction to embarrassment. In some women, blushing is a feature of the *hot flushes* that occur during the *menopause*. Flushing of the face also occurs in association with *carcinoid syndrome*.

B-lymphocyte

A type of *white blood cell*, also referred to as a B-cell. B-lymphocytes play a vital part in the *immune system*, the body's natural defence mechanism, by producing *antibodies* (special proteins) to find and destroy harmful microorganisms.

BMI

The abbreviation for *body mass index*.

BMR

The abbreviation for *basal metabolic rate*.

BM-test 1–44

A brand-named *blood glucose monitoring* test strip for analysing the blood glucose level in *diabetes mellitus*. The strip is sensitive to blood glucose levels ranging from 1 mmol to 44 mmol.

body contour surgery

Surgery that is performed to remove excess fat, skin, or both, from various parts of the body, especially from the abdomen, the thighs, and the buttocks. One of the most commonly used operations is abdominal wall reduction, also called abdominoplasty, which involves removing excess skin and fat from the abdominal area.

To miminize scarring, a less invasive procedure, such as suction lipectomy (liposuction), may be performed. In this operation, a rigid hollow tube is inserted through a small incision in the skin and is used to break up large areas of fat. The fat can then be sucked out through the instrument.

All body contour surgery carries a risk of complications, including wound infection. Minor irregularities and some dimpling of the skin commonly occur following liposuction.

body dysmorphic disorder

A psychiatric disorder in which a person suffers intense anxiety about an imagined defect in part of his or her body.

body image

A person's perception of the different parts of his or her own body.

body mass index (BMI)

An indicator of healthy body weight. BMI is calculated by dividing weight in kilograms by the square of height in metres. The normal range is 20 to 25.

body odour

The smell caused by the action of *bacteria* on sweat. It is most noticeable in the armpits and around the genital area, where the *apocrine glands* contain proteins and fatty materials favourable to bacterial growth.

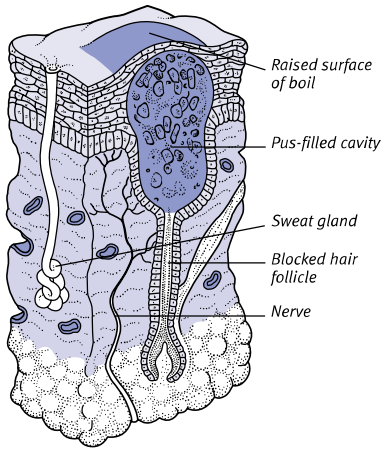
body temperature

See *temperature*.

boil

An inflamed, pus-filled area of skin, usually an infected hair follicle. A more severe and extensive form of boil involving several hair follicles is known as a *carbuncle*. The usual cause of a boil is infection with the bacterium STAPHYLOCOCCUS AUREUS. Recurrent boils may occur in people with known or unrecognized *diabetes mellitus* or in those with other conditions in which general resistance to infection is impaired.

Treatment sometimes involves *antibiotic drugs*. However, a boil that is opened surgically to release the pus usually heals rapidly without the need for drug treatment.



Cross-section of a boil
Following bacterial infection of the hair follicle, there is a buildup of pus, and a raised tender lump appears on the surface of the skin.

bolus

A soft mass of chewed food that is produced by the action of the tongue, the teeth, and the saliva to facilitate swallowing of the food. The term bolus is also used to describe a single dose of a drug that is rapidly injected into a vein.

bonding

The reciprocal process by which a strong tie, both psychological and emotional, is established between a parent and a newborn child. The process of bonding may be delayed if a baby is premature or ill and has to be separated from his or her parents immediately after birth (for example, by being placed in an incubator).

The bonding process
By the maintenance of close physical contact, bonding gradually becomes established.

bonding, dental

Techniques that use plastic resins and acrylic or porcelain veneers to repair, restore, or cosmetically improve the *teeth*. Dental bonding may sometimes be used as an alternative to crowning (see *crown, dental*) and can also be used to protect the teeth.

bone

The structural material of the *skeleton* that provides a rigid framework for the muscles and protects certain organs of the body. In combination with the joints and the muscles, the bones form the locomotor system.

STRUCTURE

Bone consists of several layers. The surface has a thin covering known as the periosteum, a membrane that contains a network of blood vessels and nerves. Beneath the periosteum is an inner shell of hard (also called compact or cortical) bone composed of columns of bone cells (osteoclasts and osteoblasts). Each column has a central hollow (haversian canal) that is important for the nutrition, growth, and repair of the bone. The direction of the haversian canals corresponds with the mechanical forces acting on the bone.

Inside the hard shell, bone has a central meshlike structure (which is known as spongy, cancellous, or trabecular bone). The cavity in the centre of certain bones, and the spaces in spongy bone, contain *bone marrow*, in which the red blood cells, platelets, and most of the white blood cells are formed.

GROWTH

Bone is continuously reabsorbed by osteoclasts and replaced by osteoblasts. The osteoblasts encourage deposition of calcium phosphate on the protein framework of the bone; the osteoclasts remove it. The actions of these cells are controlled by growth hormone, secreted by the pituitary gland, the sex hormones oestrogen and testosterone, the adrenal hormones, the thyroid hormone thyrocalcitonin, and parathyroid hormone. These hormones also work to maintain the level of calcium in the blood.

Most bones begin to develop in the embryo during the fifth or sixth week of pregnancy, at which time they take the form of *cartilage*. This cartilage begins to be replaced by hard bone, in a process known as *ossification*, at around the seventh or eighth week of pregnancy; this process is not complete until early adult life. At birth, many bones consist mainly of cartilage, which ossifies later in life. The *epiphyses* (the growing ends of the long bones) are separated from the bone shaft (*diaphysis*) by the epiphyseal plate. Some bones in the body, such as certain skull bones, do not develop from cartilage, and these are known as membranous bones.

bone abscess

A localized collection of pus in a bone (see *osteomyelitis*).

bone age

A measure of skeletal maturity used to assess physical development in children. *X-rays*, which show how much bones have grown in a particular body area, are used to determine bone age. (See also *age*.)

bone cancer

Malignant growth in bone. Bone cancer may originate in the bone itself (primary bone cancer) or, more commonly, may occur as a result of cancer spreading from elsewhere in the body (secondary, or metastatic, bone cancer).

PRIMARY BONE CANCER

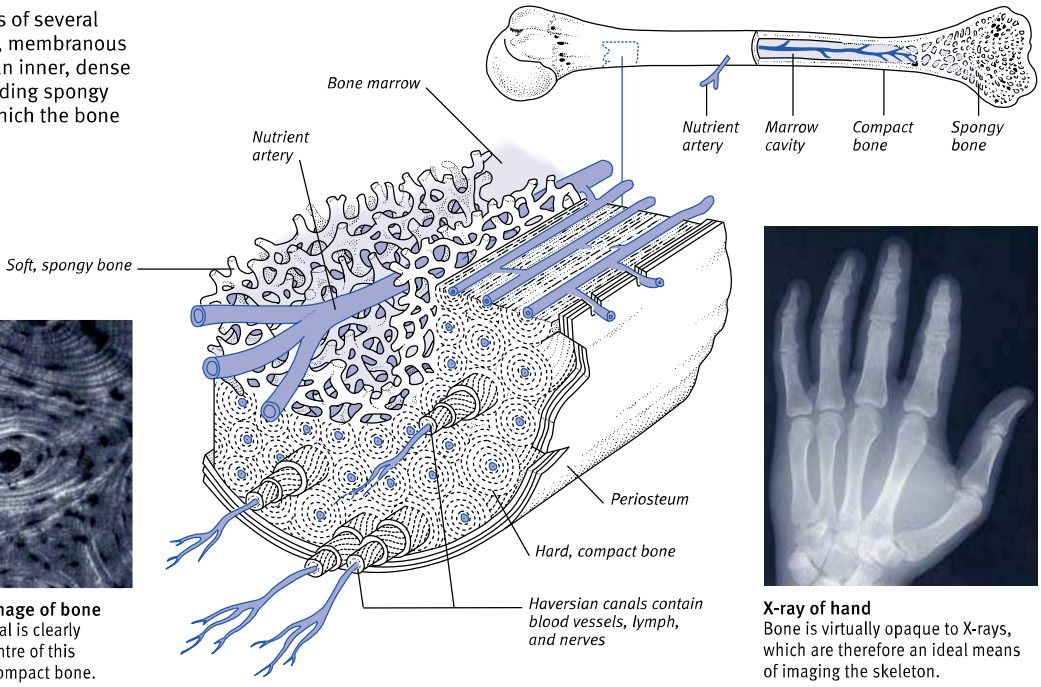
Cancers that originate in the bone are rare; the type of primary bone cancer that occurs most often is *osteosarcoma*. Other types include *chondrosarcoma* and *fibrosarcoma*. Cancers can also start in the bone marrow, but these are not usually considered to be bone cancers (see *multiple myeloma* and *leukaemia*). The treatment of primary bone cancer will depend on the extent to which the disease has spread. If it remains confined to bone, it may be possible to remove the cancer and fill the defect with a *bone graft*. In other cases, amputation may be recommended. *Radiotherapy* or *chemotherapy*, or both, may also be needed.

SECONDARY BONE CANCERS

The cancers that spread most readily to form secondary bone cancer are those of the breast, lung, prostate, thyroid, and kidney. These bone metastases occur commonly in the spine, pelvis, ribs, and skull. Pain is usually the main symptom. Affected bones are abnormally fragile and may fracture easily. Bone cancer that affects the spine may cause collapse or crushing of vertebrae, damaging the

STRUCTURE OF **BONE**

Bone consists of several layers: a thin, membranous surface and an inner, dense shell surrounding spongy material in which the bone marrow lies.



Microscopic image of bone
A Haversian canal is clearly visible in the centre of this micrograph of compact bone.

X-ray of hand
Bone is virtually opaque to X-rays, which are therefore an ideal means of imaging the skeleton.

spinal cord and causing weakness or paralysis of one or more limbs.

Secondary bone cancers from the breast and prostate gland may respond to treatment with *hormone antagonists*. In other cases, local treatment with radiotherapy is often effective in relieving pain caused by the tumour.

bone conduction

A method of transmitting sound that is tested during investigation into the cause of impaired *hearing*.

A vibrating tuning fork is held next to the ear. The base of the fork is then placed against the bone behind the ear. If the deafness is the result of an outer- or middle-ear problem (conductive deafness), the sound will be heard better when the tuning fork is held behind the ear. The bone transmits sound directly to the inner ear, bypassing the outer and middle ear. (See also *deafness; hearing tests*.)

bone cyst

An abnormal cavity in a bone. Bone cysts typically develop at one end of a long bone and may be discovered only by chance after a fracture at the site of the cyst. Minor surgery to scrape out the cyst and fill the cavity with bone chips usually cures the condition; many small cysts do not actually require treatment.

bone density

The compactness of *bone* tissue in relation to its volume. A decrease in bone density is a normal part of aging. However, excessive loss of bone density (see *osteoporosis*) can lead to *fractures*. An increase in bone density (see *osteosclerosis*) occurs in some disorders, such as *osteopetrosis* and *Paget's disease*. Bone density is measured by *densitometry*, a technique that uses low-dose X-rays.

bone graft

A surgical operation in which small pieces of bone are taken from one part of the body in order to repair or replace abnormal or missing bone elsewhere. The bone graft eventually dies, but it acts as a scaffold upon which strong new bone grows.

Bone is most commonly taken from the iliac crests (upper parts of the hipbones). They contain a large amount of inner, spongy bone, which is very useful for getting grafts to "take". Other common sources are the ribs (for curved bone) and the ulna in the forearm.

bone imaging

Techniques for providing pictures that show the structure or function of bones. *X-ray* images are commonly used for diagnosing fractures and injuries. More detailed information is provided by *tomography*, *CT scanning*, or *MRI*, which can show tumours, infections, and the effects of diseased bone on the surrounding tissues. *Radionuclide scanning* detects areas in the skeleton in which there is high bone-cell activity. This type of scanning is used mainly to determine whether cancer has spread to the bones.

bone marrow

The soft fatty tissue found in bone cavities; it may be red or yellow. Red bone marrow is present in all bones at birth and is the factory for most *blood cells*. During the teens, red bone marrow is gradually replaced in some bones by less active yellow marrow. In adults, red marrow is confined principally to the spine, sternum, (breastbone), pelvis (hip bones), ribs, scapulae (shoulderblades), clavicles (collarbones), and skull bones.

Stem cells within the red marrow are stimulated to form blood cells by the hormone erythropoietin. Yellow marrow is composed mainly of connective

B

DISORDERS OF BONE

Bone is affected by the same types of disorders as other body tissues, but its hard, rigid structure makes for extra complications. If a bone receives a direct blow or suffers from repeated stress, it may *fracture*. If it becomes infected (due to *osteomyelitis* or a *bone abscess*, for example), the resulting inflammation may interfere with the blood supply, leading to death of part of the bone.

Genetic disorders
Several inherited conditions may affect bone growth; these include *achondroplasia* and *osteogenesis imperfecta*. Such disorders often result in short stature.

Nutritional disorders
Lack of calcium and vitamin D in the diet may result in *rickets* in children and *osteomalacia* in adults; in both conditions the bones become soft and lose their shape.

Hormonal disorders
If the pituitary gland produces excess growth hormone before puberty, this results in excessive growth of the bones and other organs, leading to *gigantism*. Excess parathyroid hormone may lead to *bone cysts*. *Osteoporosis* (loss of bone density) is common in women following the menopause, when oestrogen levels fall.

Tumours
Several different types of cancerous and noncancerous growth can arise from bone (see *bone cancer* and *bone tumour*). In addition, the bones are a common site for secondary tumours (metastases) that have spread from cancerous tumours elsewhere in the body.

Other disorders
Paget's disease involves thickening of some areas of the bones, while other areas become spongy.

INVESTIGATION

Bone disorders are investigated using imaging techniques such as *X-rays, CT scanning, radionuclide scanning,* and *densitometry;* by *biopsy;* and *blood tests.*

tissue and fat. If the body needs to increase its rate of blood formation, some of the yellow marrow will be replaced by red. Sometimes marrow fails to produce sufficient numbers of normal blood cells, as occurs in aplastic anaemia (see *anaemia, aplastic*) or when marrow has been displaced by tumour cells. In other cases, marrow may overproduce certain blood cells, as occurs in *polycythaemia* and *leukaemia*.

bone marrow biopsy

A procedure to obtain a sample of cells from the bone marrow (an aspiration biopsy) or a small core of bone with marrow inside (a trephine biopsy). The sample is usually taken, under local *anaesthesia*, from the sternum (breastbone) or iliac crests (upper part of the hip-bones). Microscopic examination gives information on the development of the blood components and on the presence of cells foreign to the marrow. It is useful in the diagnosis of many blood disorders, including *leukaemia* and *anaemia*. It can also show whether bone marrow has been invaded by *lymphoma* or cells from other tumours.

bone marrow transplant

The technique of using normal red *bone marrow* to replace cancerous, defective, or diseased bone marrow in a patient. In allogeneic bone marrow transplantation (BMT), healthy marrow is taken from a donor with a very similar tissue-type to the recipient's (often a brother or sister). In autologous BMT, the patient's own healthy bone marrow is harvested while his or her disease is in remission and is reinfused at a later time. Generally, BMT is used only in the treatment of serious, potentially life-threatening blood and immune system disorders, including aplastic anaemia (see *anaemia, aplastic*), *sickle cell anaemia*, and *leukaemia*.

An alternative treatment is *stem-cell* transplantation, in which cells from the umbilical cord of a newborn baby or the bloodstream of an adult are transplanted instead of bone marrow.

HOW IT IS DONE
Before transplantation, all of the recipient's bone marrow is destroyed with *cytotoxic drugs* or radiation in order to prevent rejection of the donated cells and to kill any cancer cells present. The donor bone marrow is transfused into the circulation from where cells find their way to the bone marrow cavities and start to grow.

In autologous BMT, the patient's bone marrow is stored by *cryopreservation* (freezing). Before being frozen, the marrow is usually treated to eliminate any undetected cancerous cells. If the patient's disease recurs, the stored bone marrow can then be reinfused.

COMPLICATIONS
The major risks with BMT are infection during the recovery period and rejection (known as *graft-versus-host disease*, or GVHD). *Immunosuppressant drugs* are used to prevent and treat rejection. The risk of GVHD may be reduced by removing the T-cells (see *T-lymphocyte*) from the marrow using monoclonal antibodies (see *antibody, monoclonal*) before it is reinfused. GVHD does not occur with autologous BMT or with stem-cell transplantation.

bone metastases

Cancerous *tumours* in bone, also known as secondary bone cancers, that have spread from a cancer in another part of the body (see *bone cancer*). The bones of the ribs, pelvis, skull, and spine are particularly affected.

bone pain

An unpleasant sensation (see *pain*) felt in a part of the skeleton (see *musculoskeletal pain*). Bone pain is frequently described as constant and gnawing, and it may disturb sleep. There are many possible causes of bone pain, including trauma of the bone (see *fracture*), infection (see *osteomyelitis*), disorders of the bone itself (such as *Paget's disease*), and *bone tumours*. (See also *osteoid osteoma*; *osteomalacia*; *sickle cell anaemia*.)

bone resorption

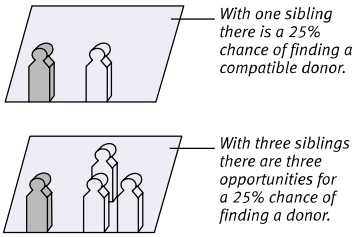
Loss of *bone* tissue. Bone resorption and the laying down of new bone tissue are continuous processes. With increasing age, resorption exceeds new bone formation, and the bone tissue gradually becomes thinner. However, in certain disorders (for example, *osteoporosis*), resorption takes place more rapidly and to a greater extent, causing weakening of bone and increased risk of *fractures*.

bone tumour

A bone swelling that may be cancerous (see *bone cancer*) or noncancerous. The most common type of noncancerous bone tumour is an *osteochondroma*.

PERFORMING A **BONE MARROW TRANSPLANT**

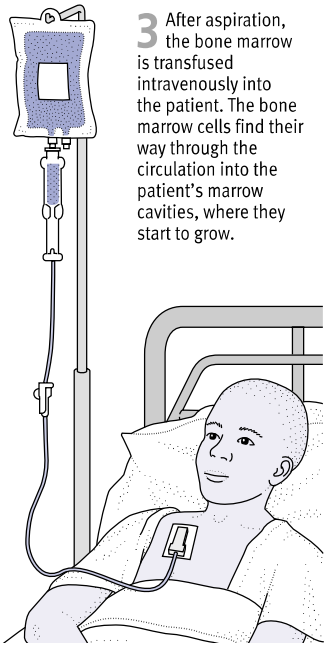
Normal bone marrow is used to replace malignant or defective marrow. In the allogeneic procedure, healthy marrow is taken from a donor. In the autologous procedure, the patient's own healthy marrow is used.



Finding a donor
The more siblings one has, the greater the chance of finding a donor. With three or more siblings, the chances are good.

1 Before transplantation, all the recipient's bone marrow is destroyed by treatment with drugs or radiation. Destroying the marrow kills any cancer cells.

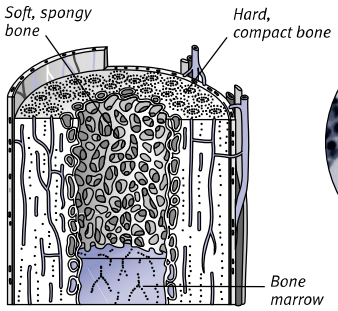
2 Using general anaesthesia, bone marrow is aspirated from the donor's iliac crests and/or sternum. Up to one litre is removed. The transplanted marrow grows quickly to occupy the bone spaces.

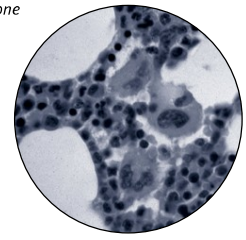


3 After aspiration, the bone marrow is transfused intravenously into the patient. The bone marrow cells find their way through the circulation into the patient's marrow cavities, where they start to grow.

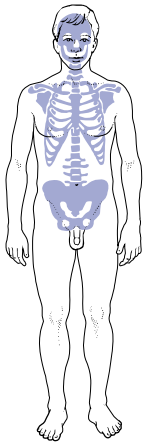
SITES OF BONE MARROW

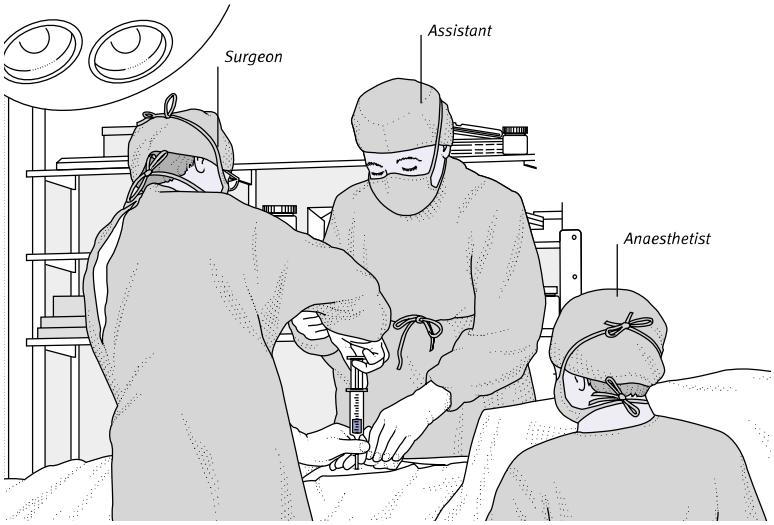
Red or yellow in colour, bone marrow is a soft, fatty tissue found in the cavities of bones. In newborn babies, red bone marrow is present in all bones; during the teen years, most is replaced by yellow marrow. The marrow used for transplants is red.





Bone marrow seen under the microscope

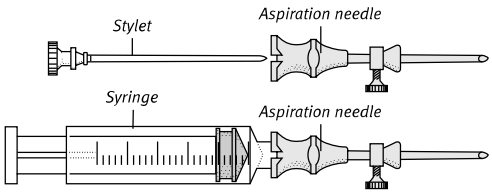


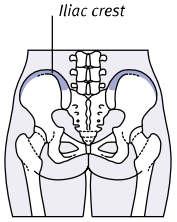


DONOR ASPIRATION

With the donor lying face down, a hollow aspiration needle, which has a stylet (a thin, sharp lance) within it, is introduced into the bone (iliac crests).

The stylet is then removed. Bone marrow is sucked out through the cortex into a syringe connected to the needle.





B

Other types of bone tumour are *osteoma* and chondroma (see *chondromatosis*). Treatment is needed only if the tumour becomes large or causes symptoms by pressing on other structures. In such cases, it can be removed by surgery. Osteoclastoma (also called a giant cell tumour), which usually occurs in the arm or leg of a young adult, is tender and painful and has to be removed.

booster

A follow-up dose of *vaccine*, given to reinforce or prolong immunity after an initial course of *immunization*.

borborygmi

The medical name for *bowel sounds* that are audible without a stethoscope.

borderline personality disorder

A personality disorder that falls between neurotic and psychotic levels. Mood changes are often rapid and inappropriate. Angry outbursts are common, as are impulsive, self-damaging acts such as gambling or suicide attempts.

Bordetella pertussis

A species of *bacteria* that may infect the human respiratory tract and is responsible for causing *whooping cough*.

Bornholm disease

One of the various names for epidemic *pleurodynia*, an infectious viral disease that is characterized by severe chest pains and fever.

Borrelia

A genus of spiral-shaped *bacteria* transmitted through tick bites (see *ticks and disease*). BORRELIA species cause *relapsing fever* (an infectious disease characterized by recurrent bouts of fever) and also *Lyme disease*.

bottle-feeding

Infant feeding using a milk preparation usually based on modified cow's milk. This formula milk contains similar proportions of protein, fat, lactose (milk sugar), and minerals to those in human milk, but it lacks the protective antibodies that are present in breast milk. Vitamins are added.

In some cases, medical problems in the mother or child may make *breast-feeding* impossible or undesirable, in which case bottle-feeding is recommended. However, bottle-fed babies are at higher risk of gastrointestinal infections than breast-fed babies and may be more likely to develop allergic disorders. (See also *feeding*, *infant*.)

Botox

A brand name for the drug *botulinum toxin*, which is used to treat muscle spasm in conditions such as *cerebral palsy*. Botox is also used for cosmetic reasons to reduce the appearance of wrinkles in the skin.

botulinum toxin

A potentially lethal toxin produced by the bacterium CLOSTRIDIUM BOTULINUM (see *botulism*). In tiny doses, botulinum toxin is used as a *muscle-relaxant drug* to control muscle spasms in some disorders (see *blepharospasm*; *facial spasm*). It is also increasingly used for cosmetic purposes; when injected into facial muscles, botulinum toxin temporarily reduces wrinkles.

botulism

A rare but serious form of poisoning caused by eating improperly canned or preserved food contaminated with a toxin produced by the bacterium CLOSTRIDIUM BOTULINUM. The toxin causes progressive muscular paralysis as well as other disturbances of the central and peripheral nervous system. CLOSTRIDIUM BOTULINUM produces spores that resist boiling, salting, smoking, and some forms of pickling. These spores, which multiply only in the absence of air, thrive in canned or poorly preserved food. Ingestion of even minute amounts of toxin can lead to severe poisoning.

SYMPTOMS

The symptoms of botulism first occur within 8 to 36 hours of ingesting contaminated food. They include difficulty in swallowing and speaking; nausea and vomiting; and double vision. Prompt treatment is vital.

In infants, the toxin can form within the body after the ingestion of foods contaminated with the bacterium, such as honey. (See also *food poisoning*.)

Bouchard's node

A bony swelling that forms on the joint in the middle of the finger in a person suffering from *osteoarthritis*. (See also *Heberden's node*.)

bougie

A rod-shaped instrument used for insertion into tubular organs, such as the urethra, during investigations or treatment. It may also be used to stretch a narrowed area. There are various types of bougie; they can be either hollow or solid, and most are slightly flexible.

bovine spongiform encephalopathy (BSE)

A neurological disorder in cattle that can be transmitted to humans through the consumption of infected meat, causing *Creutzfeldt–Jakob disease*. (See also *encephalopathy*.)

bowel

A common name for the large and/or small *intestines*.

bowel disorders

Any disorder that affects the *intestine*. Common bowel disorders are *inflammatory bowel disease* and *irritable bowel syndrome (IBS)*. (See also *intestine* disorders box; *intestine, cancer of*; *intestine, obstruction of*; *intestine, tumours of*.)

bowel movements, abnormal

See *faeces, abnormal*.

bowel sounds

Sounds made by the passage of air and fluid through the *intestine*. Absent or abnormal bowel sounds may indicate a disorder. Those that are audible without a stethoscope are known as borborygmi and are a normal part of the digestive process, but they may be exaggerated by anxiety and some intestinal disorders.

Bowen's disease

A rare skin disorder that is characterized by the formation of a flat patch of red, scaly skin, most commonly on the face or the hands. Bowen's disease may become cancerous.

Treatment involves surgical removal of the diseased skin, or its destruction by freezing or *cauterization*.

bowleg

An outward curving of bones in the legs that results in wide separation of the knees when the feet are together. Bowlegs are common in very young children, and they are a normal part of development. In most cases, the curve straightens as the child grows. If the bowing is severe, is on one side only, or persists beyond the age of three, a doctor should be consulted. Surgery may be needed. Rarely, leg deformity is a result of bone disease, particularly *rickets* (a vitamin D deficiency) in children.

Bowman's capsule

A cup-shaped membrane within the kidney's *nephron* containing a *glomerulus* (a cluster of tiny blood vessels called capillaries). Here, blood is filtered into the kidney tubule.

BP

The abbreviation for *blood pressure*.

brace, dental

See *orthodontic appliances*.

brace, orthopaedic

An appliance worn to support part of the body or hold it in a fixed position. A brace may be used to correct or halt the development of a deformity, to aid mobility, or to relieve pain. (See also *caliper splint*; *corset*; *splint*.)

brachial artery

The *artery* that runs down the inner side of the upper arm, between the armpit and the elbow.

brachialgia

Pain or stiffness in the arm that is often accompanied by pain, tingling and/or numbness of the hands or fingers, and weak hand grip. It may be a symptom of underlying disorders such as *frozen shoulder* or nerve compression from *cervical osteoarthritis*.

brachial plexus

A group of large nerve trunks formed from nerve roots of the lower part of the cervical spine (in the neck) and upper part of the thoracic spine (in the chest). These nerve trunks divide into the musculocutaneous, axillary, median, ulnar, and radial nerves, which control muscles in and receive sensation from the arm and the hand. Injuries to the brachial plexus can cause loss of movement and sensation in the arm.

In severe injuries, there may be damage to both the upper and the lower nerve roots of the brachial plexus, producing complete paralysis of the arm. The paralysis may be temporary if the stretching was not severe enough to tear nerve fibres. It may be possible to repair nerve roots that have been torn by nerve grafting, which is a *microsurgery* procedure, but if a nerve root has become separated from the spinal cord, surgical repair will not be successful. Apart from injuries, the brachial plexus may be compressed by the presence of a *cervical rib* (extra rib).

brachytherapy

A type of *radiotherapy*.

bradycardia

An abnormally slow heart rate. Most people have a heart rate of between 60 and 100 beats per minute. Many athletes and healthy people who exercise regularly and vigorously have slower rates. In others, bradycardia may indicate an underlying disorder such as *hypothyroidism* or *heart block*. Bradycardia may also occur as a result of taking *beta-blocker drugs*. Profound or sudden bradycardia may cause a drop in blood pressure that results in fainting (see *vasovagal attack*).

bradykinin

A *polypeptide* (protein molecule) that forms naturally in the blood as part of the inflammatory process. Bradykinin is a powerful vasodilator (it causes the widening of blood vessels). Bradykinin also allows fluid to leak from the blood vessels; stimulates pain receptors; and causes contraction of the smooth muscle in internal organs such as the lungs or intestines.

Braille

A system of embossed dots, now accepted for all written languages, that enables blind people to read and write. The system is based on six raised dots, which can be combined in different ways to form symbols.

There are two types of Braille. In grade I, each symbol represents an individual letter or punctuation mark. In grade II, which is the more widely used, symbols represent common letter combinations or words.

brain

The major organ of the *nervous system*, located in the *cranium* (skull). The brain receives, sorts, and interprets sensations from the nerves that extend from the *central nervous system* (brain and spinal cord) to the rest of the body; it initiates and coordinates nerve signals involved in activities such as speech, movement, thought, and emotion.

An adult brain weighs about 1.4 kg and has three main structures: the *brainstem*; the *cerebellum*; and the largest part, the *cerebrum*, which consists of left and right hemispheres.

CEREBRUM

Each hemisphere in the cerebrum has an outer layer called the cortex, consisting of grey matter, which is rich in nerve-cell bodies and is the main region in the brain for conscious thought, sensation, and movement. Beneath the cortex are tracts of nerve fibres called white matter, and, deeper within the hemispheres, are the *basal ganglia* (paired nerve cell clusters). The surface of each of the hemispheres is divided by fissures (sulci) and folds (gyri) into distinct lobes (occipital, frontal, parietal, and temporal lobes), named after the skull bones that overlie them. A thick band of nerve fibres called the corpus callosum connects the hemispheres.

The cerebrum encloses a central group of structures including the *thalami* and the *hypothalamus*, which has close connections with the *pituitary gland*. Encircling the thalami is a complex of nerve centres called the *limbic system*. These structures act as links between parts of the cerebrum and the brainstem lying beneath the thalami.

BRAINSTEM AND CEREBELLUM

The brainstem is concerned mainly with the control of vital functions such as breathing and blood pressure. The cerebellum at the back of the brain controls balance, posture, and muscular coordination. Both of these regions operate at a subconscious level.

MENINGES AND CEREBROSPINAL FLUID

The brain and spinal cord are encased in three layers of membranes known as *meninges*. *Cerebrospinal fluid* circulates between these membrane layers and within the four main brain cavities, which are known as *ventricles*. This fluid helps to nourish and cushion the brain.

BLOOD SUPPLY

The brain as a whole has an extensive blood supply. Blood comes from a circle of arteries fed by the internal *carotid arteries* (which run up each side of the front of the neck to enter the base of the skull) and from two vertebral arteries that run parallel to the spinal cord. The brain receives about 20 per cent of the blood from the heart's output.

brain abscess

A collection of pus, surrounded by inflamed tissues, within the brain or on its surface. The most common sites are the frontal and temporal lobes of the *cerebrum* in the forebrain.

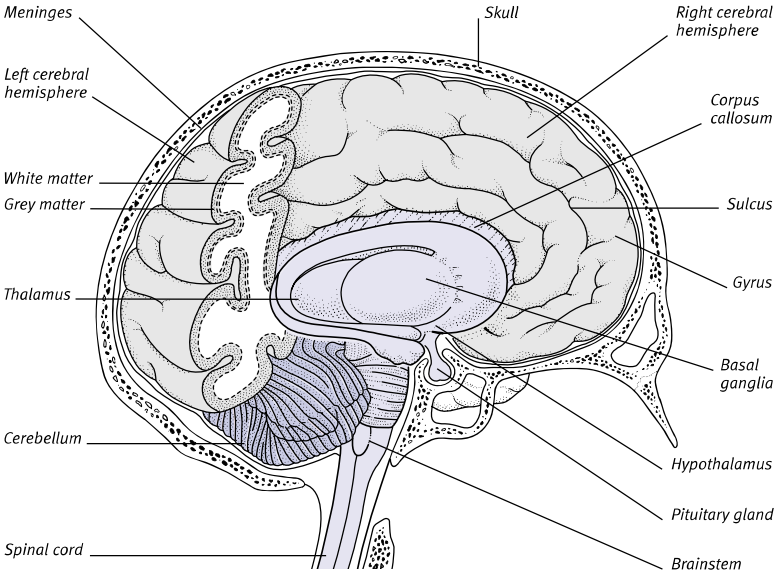
Brain abscesses may occur after a head injury, but most cases result from the spread of infection from elsewhere in the body, such as the middle ear or the sinuses. Another cause of a brain

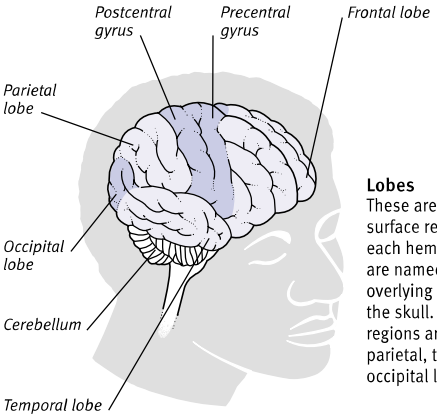
B

STRUCTURE OF THE **BRAIN**

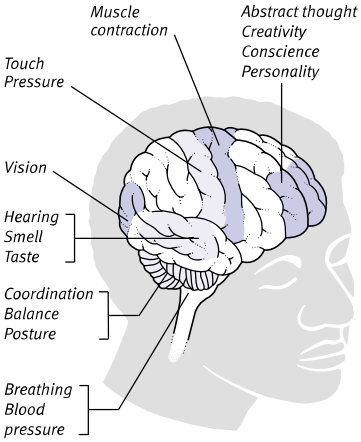
The brain has three main parts: the brainstem (an extension of the spinal cord), the cerebellum, and the cerebrum, much of which consists of the two large cerebral hemispheres. Each hemisphere consists of an outer layer, or cortex, which is rich in nerve cells and called grey matter, and inner areas rich in nerve fibres, called white matter. The surface of each hemisphere is thrown into folds called gyri, separated by fissures called sulci. The two hemispheres are linked by a thick band of nerve fibres, the corpus callosum. Deep within the forebrain are various central structures, which include the thalamus, hypothalamus, basal ganglia, and pituitary gland.

The brain has the consistency of jelly and, in adults, weighs about 1.4 kg. It is protected by membranous coverings (known as meninges) within the skull.



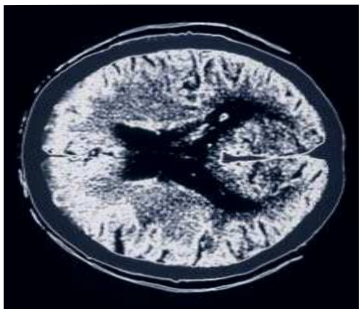


Lobes
These are broad surface regions of each hemisphere that are named after the overlying bones of the skull. The four main regions are the frontal, parietal, temporal, and occipital lobes.

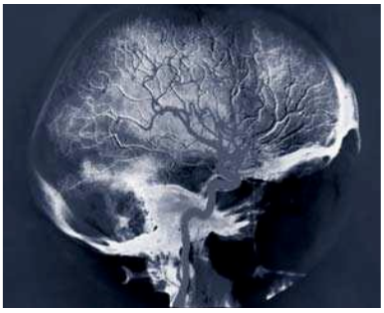


Special areas
Some areas of the brain are associated with specific functions – for example, the occipital lobe with vision and the cerebellum with balance and coordination. Touch and pressure sensation is perceived within the postcentral gyrus. Muscle movements are controlled from the precentral gyrus; speech is controlled from an area in the frontal lobe of the dominant hemisphere.

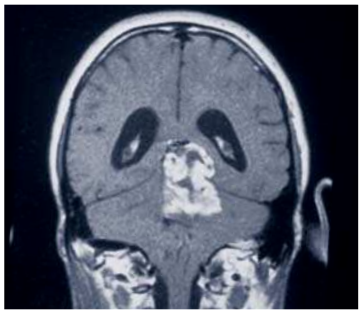
IMAGING THE BRAIN



CT scanning
CT scans produce images as "slices" through the head. The scan above shows bleeding into the brain tissue (a cerebral haemorrhage).



Angiography
This technique makes blood vessels clearly visible. The angiogram above shows the carotid artery and its branches.



Magnetic resonance imaging
MRI produces three-dimensional or cross-sectional images. This MRI shows a tumour (the white area to the right of centre) in the cerebellum.

abscess is an infection following a penetrating brain injury. Multiple brain abscesses may occur as a result of blood-borne infection, most commonly in patients with a heart-valve infection (see *endocarditis*).

Symptoms of a brain abscess include headache, drowsiness, vomiting, visual disturbances, fever, and seizures. There may also be other symptoms, such as speech disturbances, that are due to local pressure. Treatment is with *antibiotic drugs* and surgery. A *craniotomy* may be needed to open and drain the abscess. Untreated, brain abscesses can cause permanent damage and can be fatal. Despite treatment, scarring can cause *epilepsy* in some cases.

brain contusion

Bruising of the brain accompanied by loss of consciousness, which occurs as the result of an injury. (See also *brain damage*; *concussion*.)

brain damage

Degeneration or death of nerve cells and tracts within the brain that may be localized to a particular area of the brain or may be diffuse.

DIFFUSE DAMAGE

One of the most common causes of diffuse brain damage is prolonged cerebral *hypoxia* (an insufficient supply of oxygen to the brain), which may occur in a baby during a difficult birth. Other causes of diffuse damage to the brain tissue include *cardiac arrest* (cessation of the heartbeat), *respiratory arrest* (cessation of breathing), drowning, certain types of poisoning, and *status epilepticus* (prolonged seizures). Diffuse damage may also occur gradually as a result of exposure to environmental pollutants, such as lead or mercury compounds (see *Minamata disease*), or if nerve-cell poisons build up in the brain, as occurs in untreated *phenylketonuria*. Other possible causes of diffuse brain damage include brain infections such as *encephalitis*.

LOCALIZED DAMAGE

Localized brain damage may occur as the result of a *head injury*, *stroke* (damage to part of the brain caused by an interruption to its blood supply), *brain tumour*, or *brain abscess*. At birth, a raised blood level of bilirubin (see *haemolytic disease of the newborn*) can cause local damage to the *basal ganglia* deep within the brain. This leads to a condition called *kernicterus*. Brain damage that occurs before, during, or after birth may result in *cerebral palsy*.

OUTCOME

Diffuse damage to the brain may result in *learning difficulties* and severe physical disability. Localized brain damage may cause specific deficits in brain function, such as disturbances of movement or speech (see *speech disorders*). Nerve cells and tracts in the brain and spinal cord cannot repair themselves once they have been damaged, but some return of function may be possible with training, as patients learn to use other parts of the brain. (See also *Structure of the brain* box.)

brain death

The irreversible cessation of all functions of the brain, including those of the brainstem. (See also *death*.)

brain failure

See *brain syndrome, organic*.

brain haemorrhage

Bleeding within or around the brain caused either by injury or by the spontaneous rupture of a blood vessel. There

DISORDERS OF THE **BRAIN**

Defects and disorders of the brain have numerous causes, including infection, injury, *brain tumour*, or a lack of blood or oxygen (see *hypoxia*). Brain cells destroyed by injury or disease cannot be replaced, so any resulting loss in function can be difficult to reverse.

Because the brain is encased within the skull, any space-occupying tumour, *brain abscess*, or *haematoma* (large blood clot) creates raised pressure, which can impair the function of the whole brain.

Brain disorders that are localized in a small region may affect a specific function, such as speech (see *aphasia*). However, more often, damage is more diffuse and the symptoms can be varied and numerous.

The brain may also be damaged by a blow to the head (see *head injury*).

Congenital defects

Some brain disorders are congenital (present from birth) due to genetic or chromosomal disorders, as in *Down's syndrome*. Structural defects during fetal development include *hydrocephalus* (water on the brain) and *anencephaly* (congenital absence of the brain).

Impaired blood and oxygen supply

Brain cells can survive only a few minutes without oxygen. A reduced supply may occur at birth, causing *cerebral palsy*. Later in life, choking or arrest of breathing and heartbeat can cause hypoxia (oxygen lack).

From middle age onwards, *cerebrovascular disease*, which impairs the blood supply to one or more regions of the brain, is the most important cause of brain disorders. If an artery within the brain becomes blocked or ruptures, leading to haemorrhage, the result is a *stroke*.

Infection

Encephalitis (infection within the brain) may be due to a virus. *Meningitis* (infection of the membranes surrounding the brain) is generally due to bacterial infection.

Creutzfeldt–Jakob disease is a rare, fatal brain disease associated with an infective agent called a prion, which, in some cases, has been linked with *bovine spongiform encephalopathy* (BSE), a disease in cattle.

Degenerative disorders

Multiple sclerosis is a progressive disease of the brain and spinal cord. Degenerative brain diseases include *Alzheimer's disease* and *Parkinson's disease*.

Other disorders

Emotional or behavioural disorders are often called psychiatric illnesses, but the distinction between these and neurological disorders is unclear. In many illnesses, such as *depression* and *schizophrenia*, there may be an underlying disturbance of brain chemistry.

INVESTIGATION

Procedures used to investigate brain disorders and function include tests of reflexes and of mental and physical abilities. Electrical activity may be measured with an *EEG*. Physical abnormalities can be found using *brain imaging* techniques such as *angiography*, *CT scanning*, or *MRI*.

are four possible types of brain haemorrhage: *subdural*, *extradural*, *subarachnoid*, and *intracerebral* (see the illustrated box). Extradural and subdural haemorrhages are usually caused by a blow to the head (see *head injury*). Subarachnoid and intracerebral haemorrhages tend to occur spontaneously due to rupture of *aneurysms* or small blood vessels in the brain.

brain imaging

Techniques that can provide pictures of the brain. Brain imaging techniques are used to detect injury or disease of the brain and include *X-rays*, *angiography*, *CT scanning*, *MRI* (magnetic resonance imaging), *PET* (positron emission tomography) scanning, and *SPECT* (single photon emission CT).

INVESTIGATION OF BRAIN STRUCTURE

CT scanning gives images of the brain substance; it provides clear pictures of the ventricles (fluid-filled cavities) and can reveal tumours, blood clots, strokes, *aneurysms*, and abscesses.

MRI (magnetic resonance imaging) produces very detailed images of the brain's structure. This technique is also used to detect patches of abnormal brain tissue, as seen in *multiple sclerosis*.

Angiography involves the injection of a contrast medium that shows up the blood vessels in the brain on *X-ray*. It is used to investigate aneurysms and other circulatory disorders.

INVESTIGATION OF BRAIN FUNCTION

PET and SPECT scanning are specialized forms of *radionuclide scanning* that use small amounts of radioactive material to provide information about brain function as well as structure. They enable blood flow and metabolic activity in the brain to be measured.

Functional magnetic resonance imaging (fMRI) can be used to determine which parts of the brain are activated by different sensations or activities, such as sight or movement of the fingers. This technique is used to assess how the brain is working.

Ultrasound scanning, through the fontanelles (holes where the skull bones have yet to fuse), can detect bleeding in the brain only in premature or very young babies; ultrasound waves cannot penetrate the bones of a mature skull.

brainstem

A stalk of nerve tissue that forms the lowest part of the brain and links with the spinal cord. The brainstem acts partly as a highway for messages travelling between other parts of the brain and spinal cord. It also connects with 10 of the 12 pairs of *cranial nerves* (which emerge directly from the underside of the brain) and controls basic functions such as breathing, vomiting, and eye reflexes. Brainstem activities are below the level of consciousness, and they operate mainly on an automatic basis.

STRUCTURE

The brainstem is composed of three main parts: the midbrain, pons, and medulla. Attached to the back of the brainstem is a separate part of the brain, the *cerebellum*, which is concerned with balance and coordinated movement. Running longitudinally through the middle of the brainstem is a canal; this widens in the pons and medulla to form the fourth ventricle (cavity) of the brain, which contains the circulating *cerebrospinal fluid*.

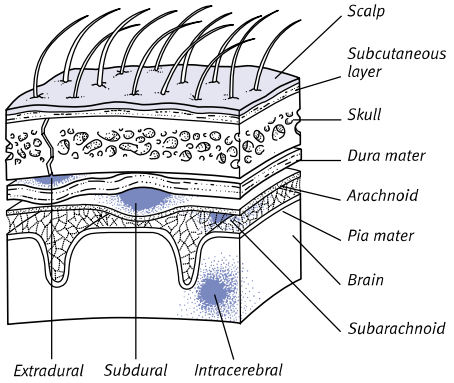
Midbrain The midbrain is the smallest section of the brainstem. This part contains the nuclei (nerve-cell centres) of the third and fourth cranial nerves, which control eye movements and the size and reactions of the pupil. It also contains cell groups, such as the substantia nigra, involved in smooth coordination of limb movements.

Pons The pons contains thick bundles of nerve fibres that connect with the *cerebellum*. It also houses the nuclei for the fifth to eighth cranial nerves, and relays sensory information from the ear, face, and teeth, as well as the signals that move the jaw, adjust facial expressions, and produce some eye movements.

Medulla The medulla resembles a thick extension of the spinal cord. It contains the nuclei of the ninth to 12th cranial nerves. by which it receives and relays taste sensations from the tongue and

SITES OF **BRAIN HAEMORRHAGE**

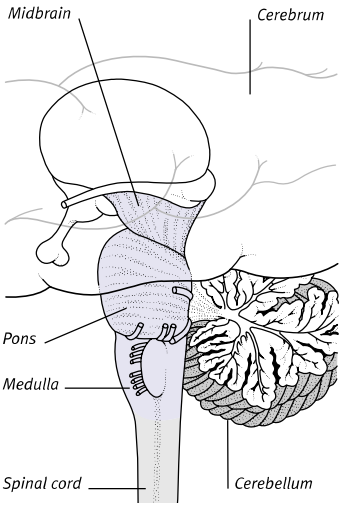
Haemorrhages within the skull fall into four main categories – extradural, subdural, subarachnoid, and intracerebral – according to the site of the bleeding in relation to the brain and its protective coverings (the meninges). The causes and effects of the bleeding and the outlook for the patient vary depending on which category the haemorrhage falls into.



Intracerebral haemorrhage
This CT scan shows bleeding in the brain tissue (cerebral haemorrhage).

LOCATION OF THE **BRAINSTEM**

The brainstem is a 7.5 cm-long stalk of nerve cells and fibres that joins the upper spinal cord to the rest of the brain.



relays signals to muscles involved in speech and in tongue and neck movements. The medulla also contains the "vital centres" (groups of nerve cells that regulate the heartbeat, breathing, blood pressure, and digestion (information on which is relayed via the 10th cranial nerve (see *vagus nerve*).

Reticular formation Throughout the brainstem are numerous nerve-cell groups known collectively as the reticular formation. This network alerts the higher brain centres to sensory stimuli that may require a conscious response. Our sleep/wake cycle is controlled by the reticular formation.

DISORDERS

The brainstem is susceptible to the same disorders that afflict the rest of the central nervous system (see *brain, disorders of*). Damage to the medulla's vital centres is rapidly fatal; damage to the reticular formation may cause *coma*. Damage to specific cranial nerve nuclei can sometimes lead to specific effects. For example, damage to the seventh cranial nerve (the facial nerve) leads to *facial palsy*. Degeneration of the substantia nigra in the midbrain is thought to be a cause of *Parkinson's disease*.

brain syndrome, organic

Disorder of consciousness, intellect, or mental functioning that is of organic (physical), as opposed to psychiatric, origin. Possible causes include degenerative diseases, most notably *Alzheimer's disease*; infections; certain drugs; or the effects of injury, *stroke*, or tumour.

SYMPTOMS

Symptoms of acute organic brain syndrome range from mild confusion to stupor or *coma*. They may also include disorientation, memory loss, hallucinations, and delusions (see *delirium*). In the chronic form, there is a progressive decline in intellect, memory, and behaviour (see *dementia*). Treatment is more likely to be successful with the acute form. In chronic cases, irreversible brain damage may already have occurred. (See also *psychosis*.)

brain tumour

An abnormal growth in or on the brain. Although they are not always cancerous, all brain tumours are serious due to the buildup of pressure they cause within the brain and the compression of adjoining brain areas, both of which may occur as the tumour grows and expands. Expansion of a brain tumour within the rigid skull may also result in damage to the normal tissue that surrounds the tumour.

TYPES

Brain tumours may be primary growths arising directly from tissues within the skull or metastases (secondary growths) that have spread via the bloodstream from cancerous tumours elsewhere in the body, particularly from those in the lung or breast.

The cause of primary brain tumours is not known. About 60 per cent are *gliomas* (which are frequently cancerous), and arise from the brain tissue. Other primary tumours include *meningiomas*, which arise from the meningeal membranes covering the brain; *acoustic neuromas*, which arise from the acoustic nerve; and *pituitary tumours*, which arise from the tissue of the pituitary gland. Most of these tumours are noncancerous, but their relatively large size can cause local tissue damage.

Some types of primary brain tumour affect mainly children. These include two types of glioma called *medulloblastoma* and cerebellar *astrocytoma*. Primary brain tumours virtually never spread (metastasize) outside the central nervous system.

Secondary growths (metastases) are always cancerous and may be found in more than one organ.

SYMPTOMS

Compression of brain tissue or nerve tracts near the tumour may cause muscle weakness, loss of vision, or other sensory disturbances, speech difficulties, and epileptic seizures.

The presence of a growing tumour can increase pressure within the skull, causing headache, visual disturbances, vomiting, and impaired mental functioning. *Hydrocephalus* (excess fluid in the brain) may occur if the circulation of cerebrospinal fluid is obstructed by the tumour.

DIAGNOSIS AND TREATMENT

Many different *brain imaging* techniques may be used to locate the site of a brain tumour and to establish its size and the extent of its spread.

In some cases, complete removal of a brain tumour may be possible using guidance from MRI scanning during surgery. In such cases, the patient may be cured. However, many cancerous growths are inaccessible or too extensive for removal. In cases where a tumour cannot be completely removed, as much as possible of it will be cut away to relieve pressure.

For primary and secondary tumours, *radiotherapy* or *anticancer drugs* may also be given. *Corticosteroid drugs* are often prescribed temporarily to reduce the size of a tumour and any associated swelling of brain tissues.

bran

The fibrous outer covering of grain that cannot be digested. The fibre is used as a bulk-forming *laxative* to prevent constipation (see *fibre, dietary*).

branchial disorders

Disorders due to abnormal development, in an embryo, of the branchial arches (paired segmented ridges of tissue in each side of the throat). Such disorders include branchial cyst and branchial *fistula*.

A branchial cyst is a soft swelling, containing fluid that may be either clear or puslike, that appears on the side of the neck in early adulthood. Treatment of a branchial cyst is usually with surgical removal.

A branchial fistula occurs between the back of the throat and the external surface of the neck, where it appears as a small hole, usually noted at birth. A hole in the neck that does not extend to the back of the throat is a branchial cleft sinus. A branchial fistula or cleft sinus may discharge mucus or pus and may be removed surgically.

brash, water

See *waterbrash*.

Braxton Hicks' contractions

Short relatively painless contractions of the uterus during pregnancy. They may be felt in late pregnancy and are sometimes mistaken for labour pains.

BRCA 1 and BRCA 2

Two of the abnormal *genes* that are thought to be responsible for inherited *breast cancer*. Women with these genes may also have an increased risk of ovarian cancer (see *ovary, cancer of*).

breakbone fever

A tropical viral illness, which is also called *dengue*, that is spread by mosquitoes. The symptoms include high fever and severe joint and muscle pain.

breakthrough bleeding

Bleeding or staining ("spotting") from the vagina between menstrual periods in women taking an oral contraceptive.

The bleeding is most common during the first few months of taking the pill and is caused by incomplete suppression of the monthly buildup of the *endometrium* (lining of the uterus). (See also *vaginal bleeding*.)

breast

Either of the two mammary glands, which, in women, provide milk to nourish a baby and are secondary *sexual characteristics*. The male breast is an immature version of the female breast.

DEVELOPMENT AND STRUCTURE

At puberty, a girl's breasts begin to develop: the areola (the circular area of pigmented skin around the nipple) swells and the nipple enlarges. This is followed by an increase in glandular tissue and fat.

The adult female breast consists of between 15 and 20 lobes of milk-secreting glands embedded in fatty tissue. The ducts of these glands have their outlet in the nipple. The areolar skin contains sweat glands, sebaceous glands, and hair follicles. Bands of fine ligaments determine the breast's height and shape.

The size, shape, and general appearance of a woman's breasts may vary throughout the menstrual cycle, during pregnancy and lactation, and following the menopause.

BREAST FUNCTION

During pregnancy, the hormones *oestrogen* and *progesterone*, which are secreted by the ovaries and placenta, cause the milk-producing glands in the breasts to develop and to become active. These two hormones also cause the nipples to enlarge.

Just before and immediately after childbirth, the glands in the breast produce a watery fluid known as *colostrum*. The production of this fluid is replaced by milk production a few days later. Milk production and release are stimulated by the hormone *prolactin*.

breast abscess

A collection of pus in the mammary gland, usually in a woman who is lactating (producing milk). Breast abscesses develop if acute *mastitis* (inflammation of the breast) is not treated promptly and occur most commonly during the month after a woman's first delivery.

The initial symptoms of a breast abscess are the same as those of acute mastitis. The abscess develops in one area, which becomes very firm, red, and extremely painful. Treatment involves *antibiotic drugs* and repeated *aspiration* (withdrawal by suction) of the pus using a needle and syringe. In rare cases, surgical drainage may be needed.

breast awareness

A woman's familiarity with the appearance and feel of her breasts, which allows her to recognize both normal and abnormal changes. Doctors recommend that women develop "awareness" in order to improve the chances of detecting *breast cancer* at an early stage. (See also *breast self-examination*.)

breastbone

The common name for the *sternum*, the front part of the *thorax* (chest).

breast cancer

A cancerous tumour of the breast. Breast cancer is the most common type of cancer in nonsmoking women and the second most common type, after lung cancer, in women who smoke. One woman in every 12 who live to old age will develop breast cancer at some point in her life. Breast cancer can also rarely develop in men. The advancement of techniques for early diagnosis and treatment of breast cancer has improved overall survival rates.

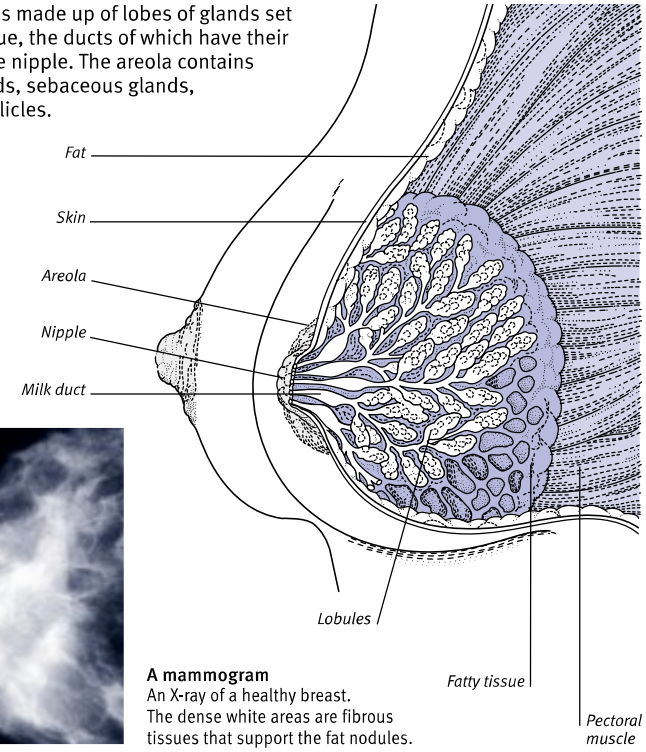
CAUSES

Current theories regarding the causes of breast cancer are focused on hormonal and genetic influences. However, the principal risk factor is age, with a woman's chances of developing the disease doubling every ten years of her life.

The incidence of breast cancer is known to be raised in women whose menstrual periods began at an early age and in those whose *menopause* was late to commence. The risk is also higher in women who did not have children or those who had their first child late in life. Women whose mothers or sisters have had breast cancer are also at an increased risk. Diet may also play a part; breast cancer is more common in countries in which the typical diet contains a lot of fat. Studies have shown that *hormone replacement therapy (HRT)* slightly increases the chances of developing breast cancer; the risk increases with the length of time that HRT has been taken.

THE FEMALE BREAST

The breast is made up of lobes of glands set in fatty tissue, the ducts of which have their outlet at the nipple. The areola contains sweat glands, sebaceous glands, and hair follicles.



A mammogram
An X-ray of a healthy breast. The dense white areas are fibrous tissues that support the fat nodules.

DISORDERS OF THE **BREAST**

Disorders of the breast are mostly minor and respond to treatment. Problems are most commonly caused by infection, hormonal changes, and tumours.

Infection

Mastitis (bacterial infection of breast tissue) often occurs with breast-feeding, usually due to a blocked milk duct. Untreated, it may lead to a *breast abscess*.

Hormonal changes

Breast pain and tenderness is common just before menstruation or when a woman is taking hormones. Before menstruation, breasts may increase in size and become lumpy. Such lumps shrink when menstruation is over. Hormonal disorders may, rarely, cause *galactorrhoea* (abnormal production of milk). In men, *gynaecomastia* (abnormal breast development) may occur as a result of hormonal disturbance or treatment with certain drugs.

Tumours

The majority of *breast lumps* are non-cancerous tumours, such as *cysts* (fluid-filled sacs) and *fibroadenomas* (thickened areas of milk-producing tissue). More rarely, *breast cancer* may occur.

INVESTIGATION

Disorders of the breast may be discovered during *breast self-examination* or physical examination by a doctor. Special investigations for the breast include *biopsy* (removal of a small sample of tissue for analysis) and *mammography*.

Breast cancer in women under the age of 50 may be linked to genetic factors and various genes, including *BRCA 1 and BRCA 2*, have been identified. These genes seem to account for some of the breast cancers that occur within families. Women with one or more relatives who have developed the disease in their 30s or 40s may wish to seek specialist genetic advice.

SYMPTOMS AND SIGNS

The first sign of breast cancer is often a painless lump. However, it is important to note that nine out of ten breast lumps are not cancerous. Other symptoms of breast cancer may include a dark discharge from the nipple, retraction (indentation) of the nipple, and an area of dimpled, creased skin over the lump. In the majority of cases, only one breast is affected.

An abnormality may sometimes be detected during a routine *mammography*, which is offered every three years to all women between the ages of 50 and 65.

INVESTIGATION AND TREATMENT

If a lump is detected in the breast, an imaging procedure, such as mammography or *ultrasound scanning*, will be carried out. Cells will then be collected from the lump by needle *aspiration* (withdrawal by suction) or *biopsy* (surgical removal of a small sample of tissue for analysis).

A small cancerous tumour that is not thought to have spread outside the breast is removed surgically, along with a surrounding margin of normal tissue. *Lymph nodes* in the armpit are usually removed at the same time. Larger cancers may require *mastectomy* (surgical removal of the whole breast). Surgery can be combined with or followed by *mammoplasty* (breast reconstruction) to help reduce the psychosexual impact of the disease.

Any further treatment depends on the size of the tumour; whether or not there is evidence of spread to the lymph nodes; and the sensitivity of the tumour cells to hormones, which is assessed in the laboratory using a technique known as oestrogen receptor testing. The woman's age and whether or not she has gone through the menopause are also significant factors in determining appropriate treatment.

After surgery, most women have a course of *radiotherapy* to any remaining breast tissue and to the armpit, and/or *chemotherapy* (treatment with *anticancer drugs*). *Tamoxifen*, an oral anti-oestrogen drug, is commonly prescribed for five years following surgery for breast cancer to reduce the risk of recurrence. Women who are approaching the menopause may be offered treatment to bring on an early menopause if the tumour is oestrogen-sensitive.

Secondary tumours in other parts of the body, which may be present at the time of the initial diagnosis or may develop years after apparently successful treatment, are treated with anticancer drugs and hormones.

OUTLOOK

A complete cure or years of good health can usually be expected after treatment for early breast cancer. Regular check-ups are required to detect recurrence or the development of a new cancer in the other breast. Mammograms should be performed periodically for this reason. If the cancer recurs, it can be controlled, sometimes for years, by drugs and/or radiotherapy. (See also *breast self-examination*.)

breast cyst

A fluid-filled lump that forms within the milk-producing tissue of the breast. Breast cysts most commonly affect women in their 30s and 40s, especially in the years leading up to the *menopause*. A lump can be diagnosed as a cyst by *ultrasound scanning*, a *mammography*, or by withdrawing fluid from it with a syringe and needle (see *aspiration*), which usually results in the lump disappearing. About half of all women with a breast cyst will develop future cysts. Any new breast lump should be seen by a doctor to confirm the diagnosis.

breast enlargement surgery

A type of *mammoplasty*.

breast-feeding

The natural method of infant feeding during the period between birth and weaning. Human milk contains the ideal balance of nutrients for a baby and provides valuable *antibodies* (proteins made by the immune system) against infections. For the first few days after birth, the breasts produce a watery fluid known as *colostrum*. Milk flow is stimulated by the baby's sucking and is usually established in three to four days.

Breast-feeding problems may occur as a result of engorged breasts and cracked nipples or if the baby has problems sucking; a breast-feeding advisor may be able to help with these difficulties. Breast-feeding can sometimes cause an infection (see *mastitis*) that leads to a *breast abscess*. In such cases, treatment with *antibiotic drugs* may mean that it is possible to continue breast-feeding.

breast implant

An artificial structure surgically introduced into the breast to increase its size (see *mammoplasty*).

B

breast lump

Any mass, swelling, or cyst that can be felt in the breast tissue. At least 90 per cent of lumps are noncancerous; the rest are cancerous (see *breast cancer*).

Many women have generally lumpy breasts, with the lumps more obvious before a period. Once known as *fibrocystic disease* or *fibroadenosis*, this is now considered to be a variation of normal. Lumpy breasts do not increase the risk of breast cancer, but any new or distinct lump should be medically assessed. In a young woman, a single lump is likely to be a noncancerous *fibroadenoma*. This growth is usually round, firm, and rubbery, causes no pain, and can be moved about beneath the skin. In an older woman, a lump is more likely to be a noncancerous, fluid-filled *breast cyst*.

Breast awareness and regular *breast self-examination* may help to detect any changes. Treatment depends on the cause and type of lump. Cysts can be drained in a simple outpatient procedure. Other lumps may need to be removed surgically.

breast pump

A device that is used to draw milk from overfull breasts during lactation (see *breast-feeding*). A breast pump may also be used to express milk for future use or to feed a baby who is unable to suckle.

breast reconstruction

See *mammoplasty*.

breast reduction

See *mammoplasty*.

breast self-examination

A visual and manual examination carried out by a woman to detect lumps and other changes in her breasts that might be a sign of early *breast cancer*.

To carry out self-examination, the breasts should be checked in a mirror for any dimpling of the skin, changes in the appearance of the nipples, or changes in breast size and shape. Then, placing one arm behind the head, and using small, circular movements, the breast should be gently but firmly pressed. The entire breast, armpit area, and nipple should be examined.

By performing regular self-examination, a woman is able to familiarize herself with the appearance and feel of her breasts (see *breast awareness*); any abnormal changes should be reported to a doctor without delay.

breast tenderness

Soreness or tenderness of the breasts, frequently accompanied by a feeling of fullness. Breast tenderness is extremely common. In most women it is cyclical, varying in severity in response to the hormonal changes of the menstrual cycle. The breasts are usually most tender before a period (see *premenstrual syndrome*). The condition tends to affect both breasts and may be aggravated by stress or caffeine. Breast tenderness may also be noncyclical, caused by muscle strain or *mastitis*. During lactation, it may be due to engorgement of the breasts with milk. Rarely, tenderness may be due to a *breast cyst* or to *breast cancer*. Examination by a doctor will exclude any underlying problems.

Women with large breasts are more likely to suffer from both cyclical and noncyclical breast tenderness.

Cyclical tenderness may be relieved by reduced caffeine intake, relaxation exercises for stress, a well-fitting bra, or weight loss to reduce breast size. If these measures do not work, hormonal treatment may be recommended.

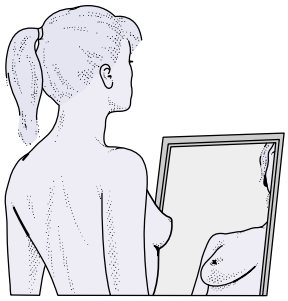
breath-holding attacks

Periods during which a toddler holds his or her breath, usually as an expression of pain, frustration, or anger. The child usually becomes red or even blue in the face after a few seconds, and may faint. Breathing quickly resumes as a natural reflex, ending the attack. Breath-holding does not cause damage and is usually outgrown.

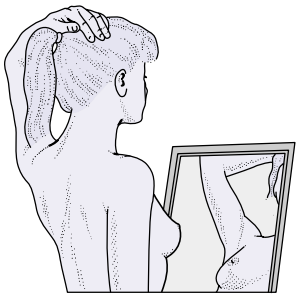
breathing

The process by which air passes into and out of the lungs to allow the blood to take up *oxygen* and dispose of *carbon*

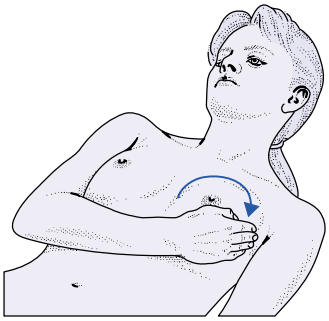
BREAST SELF-EXAMINATION



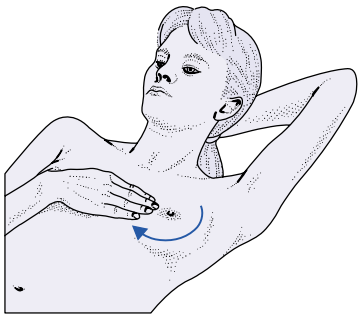
1 On a regular basis, examine your breasts in a mirror and become familiar with their general appearance. With your arms by your side, look at your breasts and be alert to any changes to the nipples or to the shape and size of the breasts.



2 Raise each arm in turn above your head, looking for changes in appearance. Turn from side to side, looking at the outline of the breasts for any changes. Examine the skin surface for peculiarities. Orange-peel texture could indicate the presence of a lump.



3 Lie on your back with a pillow under your shoulders and head, and one arm by your side. Using the flat of your other hand, and the pads of your fingers, work around the breast in firm, small circular movements.



4 Raise your arm above your head on one side and feel around the entire breast, including the nipple. Feel also along the top of the collarbone and into the armpit. Repeat the process for the other breast.

dioxide. Breathing is controlled by the respiratory centre in the *brainstem*. On inhalation, the diaphragm contracts and flattens. The intercostal muscles (between the ribs) contract and pull the ribcage up and out. The resulting increase in volume in the chest cavity causes the lungs to expand, and the reduced pressure draws air into the lungs. On exhalation, the chest muscles and diaphragm relax, causing the ribcage to sink and the lungs to contract, squeezing air out.

In normal, quiet breathing, less than a tenth of the air in the lungs passes out to be replaced by the same amount of fresh air (the tidal volume). This new air mixes with the stale air (the residual volume) already held in the lungs. The normal breathing rate for an adult at rest is 13 to 17 breaths per minute. (See also *respiration*.)

breathing difficulty

Laboured or distressed breathing that includes a change in the rate and depth of breathing or a feeling of breathlessness. Some degree of breathlessness is normal after exercise, particularly in unfit or overweight people. Breathlessness at rest is always abnormal and is usually due to disorders that affect the airways (see *asthma*), lungs (see *pulmonary disease, chronic obstructive*), or cardiovascular system (see *heart failure*). Severe anxiety can result in breathlessness, even when the lungs are normal (see *hyperventilation*). Damage to the breathing centre in the brainstem due to a *stroke* or *head injury* can affect breathing. This may also happen as a side effect of certain drugs. *Ventilator* assistance is sometimes needed.

At high altitudes, the lungs have to work harder in order to provide the body with sufficient oxygen (see *mountain sickness*). Breathlessness may occur in severe anaemia because abnormal or low levels of the oxygen-carrying pigment *haemoglobin* means that the lungs need to work harder to supply the body with oxygen. Breathing difficulty that intensifies on exertion may be caused by reduced circulation of blood through the lungs. This may be due to *heart failure* (reduced pumping efficiency of the heart), *pulmonary embolism* (blockage of blood vessels in the lungs by clots), or *pulmonary hypertension* (increased pressure in the arteries in the lungs).

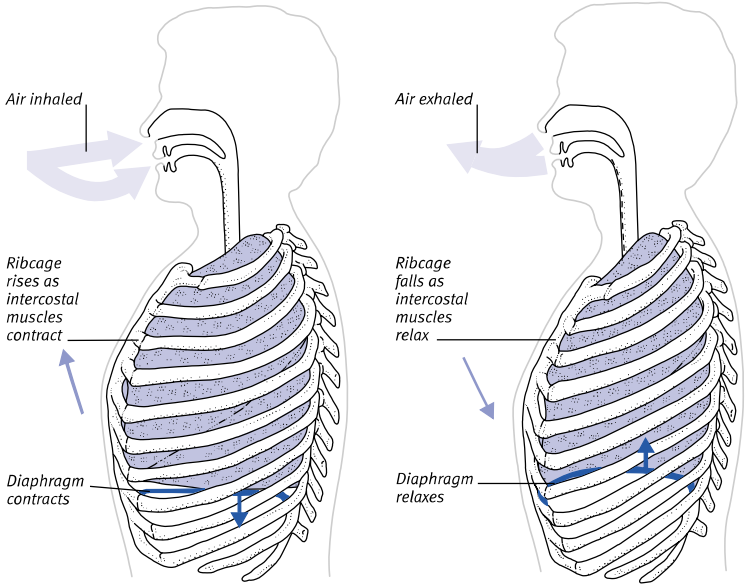
Breathing difficulty due to air-flow obstruction may be caused by chronic *bronchitis*, asthma, an allergic reaction, or *lung cancer*. Breathing difficulty may also be due to inefficient transfer of oxygen from the lungs into the bloodstream. Temporary damage to the lung tissue may be due to *pneumonia*, *pneumothorax* (collapsed lung), *pulmonary oedema* (fluid in the lung), or *pleural effusion* (fluid around the lung). Permanent lung damage may be due to *emphysema*, a condition in which the small air sacs in the lungs are destroyed.

Chest pain (for example, due to a broken rib) that is made worse by chest or lung movement can make normal breathing difficult and painful, as can *pleurisy* (inflammation of the membrane that lines the lungs and chest cavity). Pleurisy is associated with pain in the lower chest and often in the shoulder tip on the affected side.

Abnormalities of the skeletal structure of the thorax (chest), such as severe *scoliosis* or *kyphosis*, may cause difficulty in breathing by impairing the normal movements of the ribcage.

BREATHING

In an adult, inhalation and exhalation occur between 13 and 17 times a minute at rest and up to 80 times a minute during vigorous exertion. A normal, resting inhalation takes in about 400 ml of air; a deep breath, up to 4 litres.



Inhalation
Air is drawn into the lungs as the intercostal muscles (between the ribs) contract, causing the ribcage to rise, and the diaphragm contracts and flattens.

Exhalation
Air is expelled from the lungs as the intercostal muscles relax, causing the ribcage to fall, and the diaphragm relaxes and resumes its domed shape.

breathing exercises

Techniques for learning to control the rate and depth of breathing. They aim to teach people to inhale through the nose, while expanding the chest, and then to exhale fully through the mouth, while contracting the abdominal muscles. The exercises are used after chest surgery and for people with chronic obstructive pulmonary disease (see *pulmonary disease, chronic obstructive*), who often tend to have difficulty breathing effectively. Breathing exercises can also help people with *anxiety disorders* and may also help to relieve the symptoms of *asthma*.

In *yoga*, deep, rhythmic breathing is used to achieve a state of relaxation. During *childbirth*, breathing exercises can relax the mother and may also help to control the contractions of the uterus and reduce pain. (See also *physiotherapy*.)

breathing stoppage

The cessation of *breathing* (see *apnoea*). Breathing may be stopped by an *airway obstruction*, by damage to the brainstem

B

(for example, following a *stroke*), by *Cheyne–Stokes respiration*, and, in children, by *breath-holding attacks*.

breathlessness

A feeling of laboured breathing. Breathlessness is a normal response to exercise or exertion, but may also be caused by some underlying disorders (see *breathing difficulty*).

breath test

A procedure used to check for infection of the digestive tract by HELICOBACTER PYLORI, the bacterium associated with *peptic ulcers*. The test involves drinking a substance that can be broken down by the bacterium. The breakdown process produces a chemical that passes into the bloodstream and is then breathed out. A machine detects the substance's presence in the breath, confirming infection with the bacterium.

breech delivery

A birth in which the fetus presents buttocks first. Many fetuses lie in a breech position before week 32 of pregnancy, but most of them turn by week 36. The three per cent that do not turn may be in one of three types of breech presentation: in a complete breech, the fetus is curled up; in a frank breech, the fetus's legs are extended and the feet are close to the face; in a footling breech, one or both feet are positioned over the cervix. In many twin pregnancies, one twin is in a breech position.

A mother whose fetus is in a breech presentation may be offered a procedure to turn the fetus around after week 36 of pregnancy, because this usually makes birth easier. In some breech deliveries, a *caesarean section* may be recommended.

bridge, dental

False teeth attached to natural teeth on either side of a gap left by one or more missing teeth (see the illustrated box). Adhesive bridges, which are attached to, but do not damage, the teeth on either side of the gap are now available in certain situations. (See also *denture*.)

Bright's disease

An alternative name for the kidney disorder *glomerulonephritis*.

Briquet's syndrome

An alternative name for *somatization disorder*, a psychiatric illness.

brittle bones

Bones with an increased tendency to fracture. They are a feature of *osteoporosis* and may occur in people who are taking *corticosteroid drugs*, are immobile, or have certain hormonal disorders. In *osteomalacia*, the bones are soft and tend both to become deformed and to fracture. The inherited disorder *osteogenesis imperfecta* is a rare cause of brittle bones and frequent fractures and is usually detected in infancy.

brittle diabetes

A former term for type 1 (insulin-dependent) *diabetes mellitus* in which it is difficult to maintain blood sugar levels within an acceptable range.

Broca's area

An area of the cerebral cortex (the outer layer of the *brain*) that is responsible for speech origination. Damage to Broca's area may result in *aphasia* (complete loss of previously acquired language skills).

Brodmann areas

Areas of the cerebral cortex (outer layer of the *brain*), that are numbered one to 47. Each area contains nerve cells that correspond to specific functions, such as sight, hearing, and movement.

broken leg

See *femur, fracture of*; *fibula*; *tibia*.

broken nose

Fracture of the nasal bones or dislocation of the cartilage that forms the bridge of the nose (see *nose, broken*).

broken tooth

See *fracture, dental*.

broken veins

A term that is commonly used to refer to *telangiectasia*, in which small blood vessels under the surface of the skin enlarge and give the impression of being "broken".

bromides

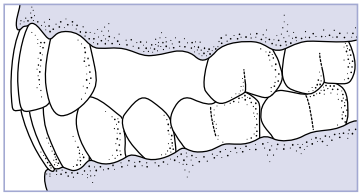
Substances formerly used as *sedative drugs* or as *anticonvulsant drugs* in the treatment of *epilepsy*. Bromides are no longer used due to their side effects, which include serious disturbance of brain function that may lead to *coma*.

bromocriptine

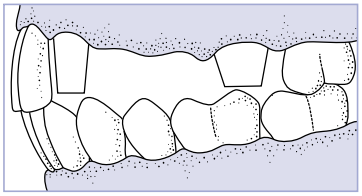
A drug used to suppress production of *prolactin* (a hormone) to treat conditions such as noncancerous pituitary tumours (see *prolactinomas*; *acromegaly*). Bromocriptine may also be used to suppress

FITTING A **BRIDGE**

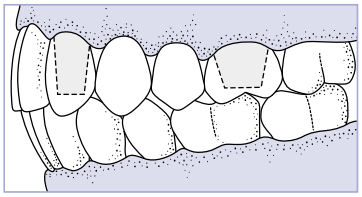
The most common type of bridge consists of one or more false teeth attached to a crown on each side of a gap. The natural teeth are shaped to receive the crowns, which are then cemented into place.



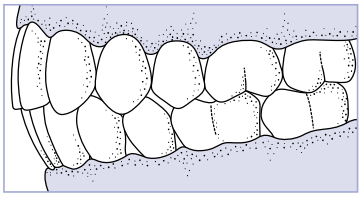
1 Two complete teeth are missing. A bridge of two false teeth and two crowns can be attached.



2 The two healthy teeth are shaped so that they can receive the crowns on either side of the gap.



3 The bridge, which is mounted on a cast-metal subframe (not shown), is cemented on to the healthy teeth on either side of the gap.



4 The finished bridge is in position, showing the new porcelain teeth; the metal base to which they are cemented is concealed.

milk production after childbirth and to treat *Parkinson's disease*. Side effects include nausea and vomiting; high doses may cause drowsiness and confusion.

bronchial asthma

See *asthma*.

bronchiectasis

A lung disorder in which one or more bronchi (air passages leading from the trachea) are abnormally widened and distorted, with damaged linings. Bronchiectasis commonly develops during childhood and was once associated with infections such as *measles* and *pertussis* (whooping cough). The condition may also be a complication of *cystic fibrosis*. Bronchiectasis results in pockets of long-term infection within the airways and the continuous production of large volumes of green or yellow sputum (phlegm). Extensive bronchiectasis may cause shortness of breath.

Symptoms are usually controlled with *antibiotic drugs* and *postural drainage*, a technique that clears secretions from the lungs. If the condition is confined to one area of lung, surgical removal of the damaged area may be recommended.

bronchiole

One of many small airways of the *lungs*. Bronchioles branch from larger airways (bronchi) and subdivide into progressively smaller tubes before reaching the alveoli (see *alveolus, pulmonary*), where gases are exchanged.

bronchiolitis

An acute viral infection of the lungs, mainly affecting babies and young children, in which the bronchioles (the airways branching off the bronchi) become inflamed. A common cause is the respiratory syncytial virus (RSV).

Symptoms of bronchiolitis include rapid breathing, a cough, and fever. No treatment may be necessary but, in severe cases, hospital admission is necessary so that *oxygen therapy* can be given. If treatment is prompt, recovery is usually within a few days. *Antibiotic drugs* may be given to prevent a secondary bacterial infection.

bronchitis

A disorder in which the bronchi, the large air passages to the lungs, are inflamed. Bronchitis results in a cough that may produce considerable quantities of sputum (phlegm) and may be acute or chronic. Both types are more common in smokers and in areas with high atmospheric pollution. (See also *bronchitis, acute*; *bronchitis, chronic*.)

bronchitis, acute

A form of *bronchitis*, usually due to a viral infection, that develops suddenly but often clears up within a few days. Bacterial infection of the airways may be a complication. Smokers, babies, the elderly, and people with lung disease are particularly susceptible. Symptoms include wheezing, shortness of breath, and a cough producing yellow or green sputum. There may also be pain behind the sternum (breastbone) and fever.

Symptoms may be relieved by drinking plenty of fluids and inhaling steam or using a humidifier. Most cases clear up without further treatment, but acute bronchitis may be serious in people who already have lung damage.

bronchitis, chronic

Smoking-induced inflammation of the airways associated with *emphysema*, in which the air sacs in the lungs are destroyed. The combination of chronic bronchitis and emphysema is known as chronic obstructive pulmonary disease (see *pulmonary disease, chronic obstructive*). Symptoms include a productive cough and progressive breathlessness.

bronchoconstrictor

A substance that causes narrowing of the airways. Bronchoconstrictors, such as *histamine*, are released during an allergic reaction (see *allergy*) and may provoke an *asthma* attack. The effect can be reversed by a *bronchodilator drug*.

bronchodilator drugs

COMMON DRUGS

SYMPATHOMIMETICS • Bambuterol • Eformoterol • Ephedrine • Epinephrine • Fenoterol • Salbutamol • Salmeterol • Terbutaline

ANTICHOLINERGICS • Ipratropium bromide • Oxitropium

XANTHINES • Aminophylline • Theophylline

Drugs that widen the bronchioles (small airways in the lungs) to improve air flow and breathing. They are especially used to treat *asthma* and chronic obstructive pulmonary disease (see *pulmonary disease, chronic obstructive*), in which the lungs are inflamed and damaged.

TYPES

There are three main types of bronchodilator drug. Sympathomimetics (such as *salbutamol*) are used primarily for the rapid relief of *breathing difficulty*. *Anticholinergics* (such as ipratropium) and xanthines (such as *aminophylline*) are more frequently used for the long-term prevention of attacks of breathing difficulty. Bronchodilators can be given by *inhaler*, in tablet form, or, in severe cases, by *nebulizer* or injection.

SIDE EFFECTS

The main side effects of sympathomimetics are palpitations and trembling. Anticholinergics may cause dry mouth, blurred vision, and, rarely, difficulty in passing urine. Xanthines may cause headaches, nausea, and palpitations.

bronchography

An *X-ray* procedure used for examining the bronchi, which are the two main air passages of the lungs. Once used to diagnose *bronchiectasis* (widening and distortion of the bronchi), this method has now been largely replaced by other imaging techniques, especially *CT scanning*, and by *bronchoscopy*.

bronchopneumonia

The most common form of *pneumonia*. In bronchopneumonia, inflammation is spread throughout the lungs in small patches around the airways; in lobar pneumonia, it is confined to one lobe.

bronchoscopy

Examination of the bronchi, the main airways of the lungs (see *bronchus*), by means of an *endoscope* (viewing tube) known as a bronchoscope. Bronchoscopes may be rigid or flexible.

WHY IT IS DONE

Bronchoscopy is performed to inspect the bronchi for abnormalities, such as *lung cancer* and *tuberculosis*; to collect samples of mucus; to obtain cells; and to take *biopsy* samples from the airways or lungs. A bronchoscope with special attachments is used to carry out treatments such as removing inhaled foreign bodies, destroying abnormal growths, and sealing off damaged blood vessels. (See also *Bronchoscopy* box, overleaf.)

bronchospasm

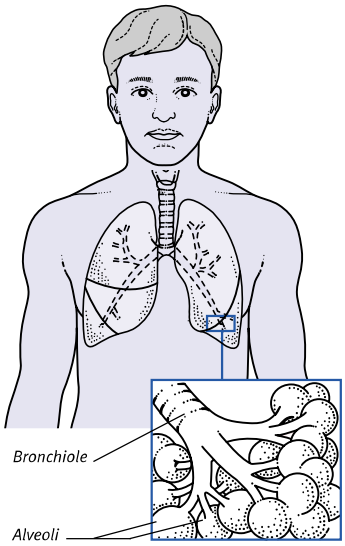
Temporary narrowing of the bronchi (the air passages to the lungs). Bronchospasm is caused by contraction of the muscles in the walls of the bronchi, by inflammation of the lining of the bronchi, or by a combination of both. Contraction may be triggered by the release of substances during an allergic

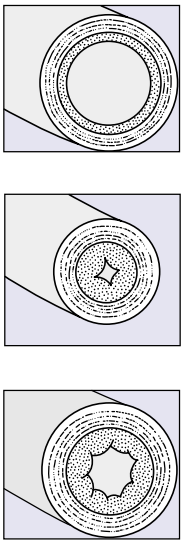
B

HOW **BRONCHODILATORS** WORK

When bronchioles become narrow following contraction of the muscle layer and swelling of the mucous lining, the passage of air is impeded. Bronchodilator drugs relax the muscles surrounding bronchioles by acting on the nerve signals that govern muscle activity.

Sympathomimetic and anticholinergic drugs interfere with nerve signals passed to the muscles through the autonomic nervous system. Sympathomimetics enhance the action of neurotransmitters that encourage muscle relaxation. Anticholinergics block the neurotransmitters that trigger muscle contraction. Xanthine drugs relax muscle in the bronchioles by a direct effect on the muscle fibres; however, their precise action is not fully understood.





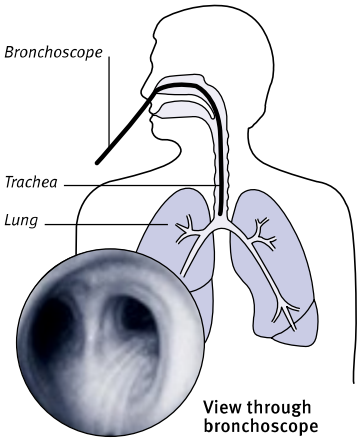
Normal bronchioles
The muscle surrounding the bronchioles is relaxed, leaving the airway open.

during an asthma attack
The muscle contracts and the lining swells, narrowing the airway.

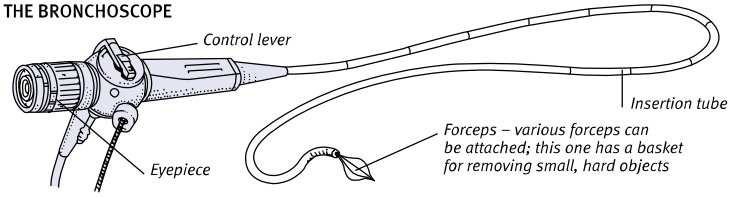
After drug treatment
The muscles relax, opening the airway, but the mucous lining remains swollen.

BRONCHOSCOPY

There are two kinds of bronchoscope. The rigid type is a hollow tube that is passed into the bronchi via the mouth and requires a general anaesthetic. The flexible, fibre-optic bronchoscope (a narrower tube formed from light-transmitting fibres) can be inserted through either the mouth or nose. It is used after giving only a mild sedative and/or local anaesthetic and it reaches farther into the lungs. Both types of bronchoscope can be fitted with forceps for taking tissue samples and the instrument also has attachments for performing laser therapy and cryosurgery. (See also *endoscopy*.)



THE BRONCHOSCOPE



reaction (see *allergy*). When the airways are narrowed, the air is reduced, causing wheezing or coughing.

Asthma is the most common cause of bronchospasm. Other possible causes include respiratory infection, chronic obstructive pulmonary disease (see *pulmonary disease, chronic obstructive*), in which the lungs are inflamed and damaged, *anaphylactic shock* (a potentially life-threatening hypersensitivity reaction), or allergic reaction to chemicals.

bronchus

A large air passage in a lung. Each lung has one main bronchus, originating at the end of the trachea (windpipe). This main bronchus divides into smaller branches known as segmental bronchi, which further divide into *bronchioles*.

bronchus, cancer of

See *lung cancer*.

bronze diabetes

An outdated term for *haemochromatosis*, a rare genetic disorder in which excess amounts of *iron* are deposited in tissues.

brown fat

A special type of fat found in infants and some animals. Located mainly between and around the shoulderblades, brown fat provides energy and helps infants to maintain a constant body temperature.

Brown–Sequard syndrome

A combination of symptoms associated with damage to a part of the *spinal cord*. There is loss of pain and temperature sensation on the opposite side of the body below the damage, and weakness and stiffness of muscles below the damage on the same side of the body.

brow presentation

A rare form of *malpresentation* in which the head of the fetus is bent slightly backwards and its brow lies against the

mother's cervix. Vaginal delivery is not possible if this presentation persists throughout labour, and a *caesarean section* is then required.

brucellosis

A rare bacterial infection, caused by various strains of BRUCELLA, which may be transmitted to humans from affected cattle, goats, and pigs. The infection may also be transmitted in unpasteurized dairy products.

Brucellosis causes high fever, sweating, poor appetite, joint aches, headache, backache, weakness, and depression. Rarely, severe untreated cases lead to *pneumonia* or *meningitis* (inflammation of the membranes surrounding the brain and spinal cord). In long-term brucellosis, bouts of the illness recur over months or years, and the depression can be severe. The disease is treated with *antibiotic drugs*.

bruise

A discoloured area under the skin caused by leakage of blood from damaged capillaries (tiny blood vessels). The blood initially appears blue or black; as the *haemoglobin* (the red pigment in blood) breaks down, the bruise turns a yellowish colour.

A bruise that does not fade after about week, that appears for no apparent reason, or that is severe after only minor injury, may indicate a *bleeding disorder*. (See also *black eye*; *purpura*.)

bruits

The sounds that are made in the heart, arteries, or veins when the blood circulation becomes turbulent or when it flows abnormally fast. This may happen when blood vessels widen (as in an *aneurysm*), when they become narrowed by disease (as in *arteriosclerosis*), or when heart valves are narrowed or damaged (as in *endocarditis*). Bruits can be heard by a doctor through a *stethoscope*. (See also *carotid bruit*.)

bruxism

Rhythmic grinding or clenching of the teeth that usually occurs during sleep. The main causes are emotional stress and minor discomfort when the teeth are brought together. Continued bruxism may wear away the teeth.

BSE

The abbreviation for *bovine spongiform encephalopathy*.

bubo

An inflamed and swollen *lymph node*, usually in the groin or armpit. Buboes usually occur as the result of a bacterial infection such as *plague* or a *sexually transmitted infection*.

bubonic plague

The most common form of *plague*, characterized by the development of a *bubo* (a swollen lymph node) in the groin or armpit.

buccal

A term that refers to the cheek or mouth. Buccal preparations of some drugs are available. Placed between the cheek and gum, they dissolve and are absorbed directly into the blood circulation.

buck teeth

Prominent upper incisors (front teeth) that protrude from the mouth. Orthodontic treatment of buck teeth involves repositioning the teeth with a removable brace (see *brace, dental*) or a fixed *orthodontic appliance*.

Budd–Chiari syndrome

A rare disorder in which the veins draining blood from the liver become blocked or narrowed. Blood accumulates in the liver, which swells. *Liver failure* and *portal hypertension* (raised pressure in the vein carrying blood to the liver) result.

Treatment is aimed at removing the cause of the obstruction, which may be a blood clot, pressure on the veins from a liver tumour, or a congenital (present from birth) abnormality of the veins. In most cases, treatment has only a limited effect and, unless a *liver transplant* can be carried out, the disease is generally fatal within two years.

budesonide

A *corticosteroid drug* used in the prevention of bronchial *asthma* attacks. Budesonide is administered using an *inhaler*. Adverse effects, which include hoarseness, throat irritation and, rarely, fungal infections, can be reduced by rinsing the mouth after administration.

Buerger's disease

A rare disorder, also known as thromboangiitis obliterans, in which the nerves, arteries, and veins in the legs, and sometimes the arms, become severely inflamed. The blood supply to the toes and fingers becomes cut off, eventually causing *gangrene* (tissue death). Buerger's disease is most common in men under the age of 45 who smoke heavily.

buffalo hump

A lump of fat under the skin on the back of the neck. A buffalo hump may develop following long-term treatment with high doses of *corticosteroid drugs* or as a result of *Cushing's syndrome*.

building-related illnesses

Another term for the group of symptoms known as *sick building syndrome*.

bulbar palsy

Weakness of the muscles involved in talking and swallowing, causing slurred speech, hoarseness, difficulty in swallowing, and choking on food and drink. Bulbar palsy may be caused by damage to the muscles' nerve supply, as in *motor neuron disease*, or disease of the muscles themselves, as in *muscular dystrophy*.

bulimia

A psychiatric illness that is characterized by bouts of overeating, usually followed by self-induced vomiting or excessive use of *laxatives*. Most people suffering from bulimia are girls or women between the ages of 15 and 30. In some cases, the symptoms coexist with those of *anorexia nervosa*.

Repeated vomiting can lead to dehydration and loss of potassium, causing weakness and cramps, and also causes tooth damage due to the gastric acid in vomit. Treatment of bulimia includes supervision and regulation of the person's eating habits, *psychotherapy*, and, in some cases, antidepressant drugs (*see selective serotonin reuptake inhibitors*).

bulk-forming agent

A type of *antidiarrhoeal drug* that absorbs water, making stools less liquid. Bulk-forming agents are also used as *laxatives*, stimulating bowel movement by softening faeces and increasing their bulk.

bulla

A large air- or fluid-filled bubble that is usually found in the lungs or skin. Lung bullae in young adults are usually *congenital* (present from birth). In later life, lung bullae develop in patients with *emphysema*, a disorder in which the air sacs in the lungs are gradually destroyed. Skin bullae are large, fluid-filled *blisters* with a variety of causes, including the bullous disease *pemphigus*.

bull-neck

Swelling of the neck caused by severely swollen *lymph glands*, often related to infections in the tonsils and throat. (See also *diphtheria*.)

bullous pemphigoid

An alternative term for *pemphigoid*, a skin disease in which large, tense blisters develop.

bumetanide

A powerful, short-acting loop *diuretic drug* used to treat *oedema* (accumulation of fluid in tissues) resulting from *heart failure*, *nephrotic syndrome* (damage to the kidney's filtering units), or *cirrhosis*. It may be given by injection for the emergency treatment of *pulmonary oedema* (fluid in the lungs). Side effects may include rash and muscle pain.

bundle

Also known as a fascicle, a cluster of nerve or muscle fibres.

bundle branch block

See *heart block*.

bunion

A thickened pad of tissue or a fluid-filled bursa (sac) overlying a deformed big-toe joint. The underlying cause is an abnormal outward projection of the big toe called a *hallux valgus*. Small bunions can usually be remedied by wearing well-fitting shoes and a special toe pad to straighten the big toe. Large bunions may require surgery to realign the joint and relieve the pressure.

HOW **BUNIONS** FORM

A bunion results from the rubbing of a shoe against an abnormal outward projection of the joint at the base of the big toe (a hallux valgus), leading to irritation and inflammation. The joint abnormality is often due to wearing narrow, pointed shoes with high heels, although it can also result from an inherited weakness in the joint.

Bunion
Valgus deformity of the joint between the first metatarsal bone and the adjoining phalanx.

buphthalmos

A large, prominent eyeball in an infant due to congenital *glaucoma* (increased pressure inside the eyeball). The condition is usually treated with surgery to reduce the pressure; otherwise, the child's sight is progressively damaged.

bupivacaine

A long-acting local anaesthetic (see *anaesthesia, local*) often used as a *nerve block* during *childbirth* and in *epidural anaesthesia* and *spinal anaesthesia*. Side effects are uncommon, but high doses may cause blood pressure to fall.

bupropion

Another name for *amfebutamone*, a drug used as an aid to stopping smoking.

Burkitt's lymphoma

A cancer of lymph tissues (see *lymphatic system*) characterized by tumours within the jaw and/or the abdomen. The condition almost exclusively affects children living in the low-lying, moist, tropical regions of Africa and New Guinea. *Anticancer drugs* or *radiotherapy* give a partial or complete cure in about 80 per cent of cases. (See also *lymphoma*.)

burns

Tissue damage caused by contact with heat, electricity, chemicals, or radiation. Burns are classified, according to the severity of skin damage, as first-, second-, or third-degree (or superficial, partial thickness, or full thickness).

FIRST-DEGREE BURNS

A first-degree burn causes reddening of the skin and affects only the epidermis, (topmost layer of skin). These type of burns usually heal quickly, but the damaged skin may peel away after a day or two. *Sunburn* is a common example of a first-degree burn.

SECOND-DEGREE BURNS

A second-degree burn extends into, and damages, the dermis (deep layer of skin), sometimes causing the formation of blisters. Because some of the dermis is left to recover, these type of burns usually heal without leaving scars, unless they are very deep.

THIRD-DEGREE BURNS

A third-degree burn destroys the full skin thickness and may extend to the muscle layer beneath the skin. The affected area will look white or charred; if the burn is very deep, muscles and bones may be exposed. Even if very localized, third-degree burns will need specialist treatment and possibly skin grafts to prevent scarring.

ELECTRICAL BURNS

Electrical burns can cause extensive tissue damage with minimal external skin damage. The electric current may cause heart damage.

EFFECTS AND COMPLICATIONS

Extensive first-degree burns (such as sunburn) cause pain, restlessness, fever, and headache, but are not life-threatening. A second- or third-degree burn that affects more than ten per cent of the body surface causes *shock*, with lowered blood pressure and a rapid pulse, due to massive fluid loss from the burned area. Shock may be fatal if this fluid is not replaced intravenously.

When the skin is burned it can no longer protect the body from contamination by airborne bacteria. The infection of extensive burns may cause fatal complications if effective treatment with *antibiotic drugs* is not available.

Victims who have inhaled smoke may develop inflammation of the lungs and may need specialist care for burns of the eyes and respiratory passages.

TREATMENT

A burn is covered with a non-stick dressing to keep the area moist. *Analgesic drugs* are given if necessary and antibiotics are prescribed if there is any infection. For extensive second-degree burns, which may be slow to heal or carry a high risk of infection, a topical antibacterial agent, such as silver sulphadiazine, is used. Third-degree burns always require *skin grafts*, which are used early to minimize scarring. Extensive burns may require *plastic surgery*.

burping

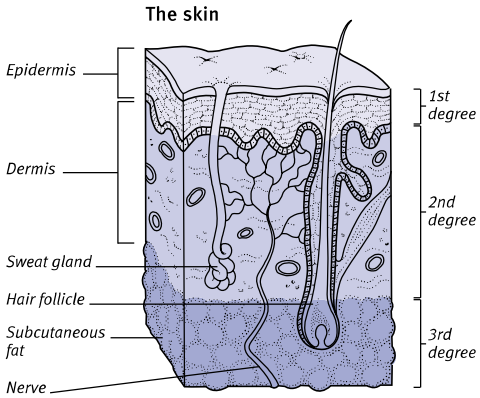
Another term for *belching*.

burr hole

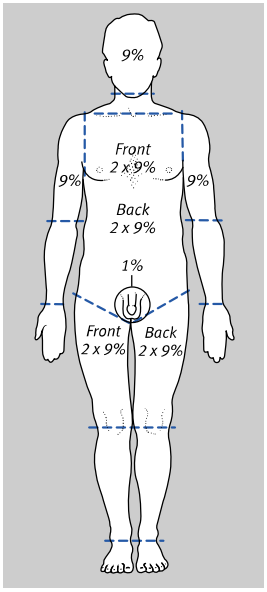
A hole made in the skull by a special drill with a rounded tip (burr). The hole relieves pressure on the brain that often results from bleeding inside the skull, usually due to a *head injury*. Burr holes may be part of a *craniotomy* (in which a section of skull is removed for access to the brain) and may be life-saving.

BURNS

Superficial burns cause the skin to redden and peel but, unless extensive, need no treatment. Burns that blister usually heal well but can be fatal if they affect a large area of the body. Burns that extend beyond the skin layers may damage fat, nerves, and muscle; and healing is slow because they are likely to require skin grafting.



Degrees of burns
Burns are divided into three categories. First-degree (or superficial) burns affect the epidermis and the skin may peel; second-degree (or partial thickness) burns cause blisters; third-degree (or full thickness) burns destroy the whole of the skin's thickness and require special treatment.



Skin surface area
For assessment of burns, the body is divided roughly into nine per cent areas. This varies slightly In young children because the head is larger in relation to the body.

bursa

A fluid-filled sac that acts as a cushion at a pressure point, often where a tendon or muscle crosses bone or other muscles. The important bursae are found around the knee, elbow, and shoulder joints.

bursitis

Inflammation of a *bursa* (a fluid-filled sac) causing pain and swelling. Bursitis may result from pressure, friction, or injury to the membrane surrounding a joint, or to infection. Prepatellar bursitis (also known as housemaid's knee), for example, is the result of prolonged kneeling on a hard surface. Treatment is by avoiding further pressure and by taking *nonsteroidal anti-inflammatory drugs*. *Antibiotic drugs* may be necessary if the bursa is infected.

Pre-patellar bursitis
This condition, which is caused by inflammation of a bursa, produces a fluid-filled swelling in front of the kneecap.

buserelin

A synthetic form of the hormone *gonadorelin* that is used to treat *endometriosis* (a disease of the lining of the uterus), infertility, and cancer of the prostate.

butterfly rash

A skin eruption, also called a butterfly patch, that is characteristic of systemic *lupus erythematosus* (see *rash*).

buzzer and pad system

A device used to treat bedwetting (see *enuresis, nocturnal*). A pad that detects moisture is placed in the bed and is attached to a buzzer that sounds when the pad becomes wet with urine. The person is woken up as soon as he or she starts to pass urine and gradually learns to wake up before starting to pass urine.

bypass operations

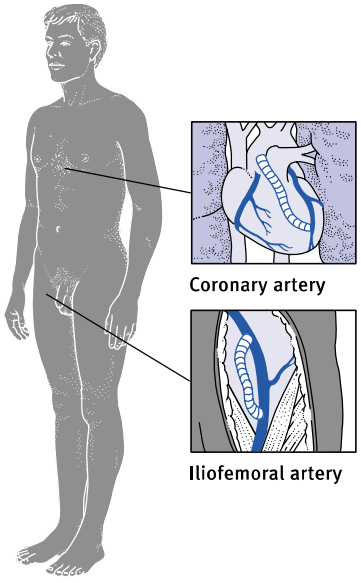
Surgical procedures that are used to bypass blockages or narrowing. The term bypass usually refers to operations on arteries, although blockages in the digestive system can also be treated with bypass operations.

The most common type of bypass operation is *coronary artery bypass*, which is used to treat *coronary artery disease*, (a condition in which the arteries have become blocked or narrowed by *atherosclerosis*). Obstructions can be bypassed by using sections of healthy artery or vein from elsewhere in the body or using tubing made from a synthetic material such as dacron.

Intestinal bypass operations are most often performed to treat cancer patients in whom the tumour is too extensive to be removed surgically. The blocked area is bypassed by joining the sections of bowel above and below the blockage.

byssinosis

A lung disease caused by the dust that is produced during the processing of flax, cotton, hemp, or sisal. Byssinosis causes a feeling of tightness in the chest and shortness of breath that may become chronic (of long duration) if exposure to the agent continues. *Bronchodilator drugs* and other drugs used to treat asthma can relieve the symptoms; good ventilation and equipment such as masks reduce the risk.



Common bypass locations
The coronary artery and the iliofemoral vessels are the most common locations for bypasses.

C

cachexia

A condition of severe weight loss and decline in health caused by a serious underlying disease, such as cancer or tuberculosis, or by starvation.

cadaver

A dead human body used as a source of transplant organs or for anatomical study and dissection.

cadmium poisoning

The toxic effects of cadmium, a tinlike metal. Poisoning as a result of inhalation of cadmium fumes is an industrial hazard, the effects of which depend on the duration and severity of exposure. Eating vegetables grown in cadmium-rich soil, or the consumption of food or drink stored in cadmium-lined containers, can also cause poisoning.

Short-term exposure to cadmium may lead to *pneumonitis* (inflammation of the lungs). Exposure over a long period can lead to urinary tract *calculi* (stones), *kidney failure*, or *emphysema* (a form of permanent lung damage).

caecum

The first section of the large intestine, joining the *ileum* (the end of the small intestine) to the ascending *colon*. The *appendix* projects from the caecum. (See also *digestive system*).

caesarean section

An operation to deliver a baby from the mother's uterus through a horizontal or, less commonly, a vertical incision in the abdomen. A caesarean section is performed if vaginal delivery would be difficult or dangerous for the mother or the baby. Increasingly, women who do not want to go through labour are also opting to have the operation.

A caesarean section may be performed using either an *epidural anaesthesia* or general anaesthesia (see *anaesthesia, general*). The procedure for performing a caesarean section is shown in the illustrated box (see opposite page).

After the operation, the mother is given *analgesic drugs* (painkillers) as required. If there are no complications, she and the baby can usually leave hospital about a week after the operation.

café au lait spots

Coffee-coloured patches on the skin that may occur on any part of the body. Café au lait spots are usually oval in shape and may measure several centimetres across. Generally, the presence of a few of these spots is not significant. However, larger numbers of them may be a sign of *neurofibromatosis*, a hereditary disorder of the sheaths that surround nerve fibres.

caffeine

A *stimulant drug* that is found in coffee, tea, cocoa, and cola drinks. Caffeine reduces fatigue, improves concentration, makes the heart pump blood faster, and has a diuretic effect.

CAFFEINE LEVELS

The strength and preparation method determine exact amounts of caffeine present (in mg per cup).

Drink	Caffeine
Tea, weak	50mg
Tea, strong	80mg
Coffee, weak	80mg
Coffee, strong	200mg
Cocoa	10–17mg
Cola	43–75mg

Large quantities of caffeine may produce side effects such as agitation and tremors. A regular high intake may lead to increased *tolerance*, so that people need to increase their caffeine intake to obtain the equivalent stimulant effect. In people who consume large amounts of caffeine, withdrawal symptoms (see *withdrawal syndrome*), such as headaches and tiredness, may occur after a few hours without caffeine.

Caffeine may be used in some drug preparations, particularly in combination with *analgesic drugs* (painkillers) and with *ergotamine* in preventive treatments for migraine.

caisson disease

An alternative term for *decompression sickness*. It usually occurs when a person surfaces too quickly after a deep dive.

calamine

A preparation of zinc oxide and iron oxide that is applied to the skin as an ointment, lotion, or dusting powder to relieve irritation and itching. Calamine has a protective, cooling, and drying effect. It may be combined with a local anaesthetic (see *anaesthesia, local*), *corticosteroid drug*, or *antihistamine drug*.

calcaneal bursitis

Inflammation of the bursa (fluid-filled pad) that cushions the *calcaneus* and prevents friction at the back of the heel (see *bursitis*). The condition causes pain and swelling but usually clears up with rest and *anti-inflammatory drugs*.

calcaneus

The heel bone. The calcaneus is one of the tarsal bones and is the largest bone in the *foot*. The *Achilles tendon* runs between the back of the calcaneus and the calf muscles; it controls upward and downward movements of the foot.

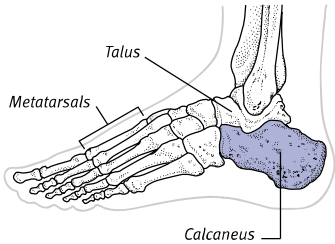
DISORDERS

The calcaneus may be fractured by a fall from a height on to the heel. Minor fractures do not usually cause problems and can be treated by placing the affected foot and leg in a *cast*. A more serious fracture, with compression of the bone, may cause permanent damage to the joints involved in turning the foot in and out, leading to pain and stiffness that are aggravated by walking.

The point at which the Achilles tendon joins the calcaneus may become strained by excessive or prolonged stress from the pull of the tendon (in some *running injuries*, for example). In children, this area may be inflamed and painful (see *osteochondrosis*) because the bone is still growing.

LOCATION OF THE CALCANEUS

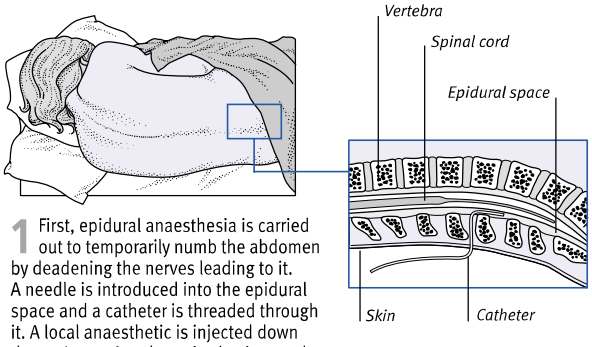
The calcaneus is the largest of the tarsal bones. It projects backwards beyond the leg bones.



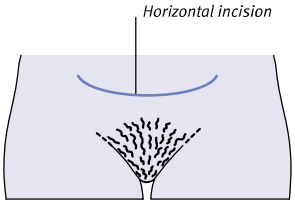
PROCEDURE FOR A **CAESAREAN SECTION**

A caesarean section allows delivery of a baby through a horizontal or vertical cut in the abdominal and uterine walls. The mother is given epidural anaesthesia, so that she remains conscious during the procedure, or general anaesthesia.

HOW IT IS DONE



1 First, epidural anaesthesia is carried out to temporarily numb the abdomen by deadening the nerves leading to it. A needle is introduced into the epidural space and a catheter is threaded through it. A local anaesthetic is injected down the *catheter*. A catheter is also inserted into the bladder to empty it.



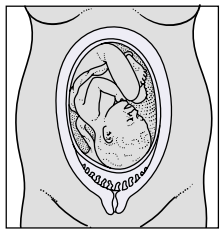
2 The abdomen is then opened, usually through a horizontal incision made just above the pubic bone. This type of cut heals most effectively. The resulting scar is hardly noticeable and comes below the "bikini line".

WHY IT IS DONE

A caesarean can be elective (planned) in cases of breech presentation; placenta praevia (where the placenta is lying close to or across the cervix); the mother's ill health; or, most commonly, if there were problems in previous caesareans that still exist (such as the mother having a small pelvis). Elective caesarean is sometimes requested by the parents for social reasons.

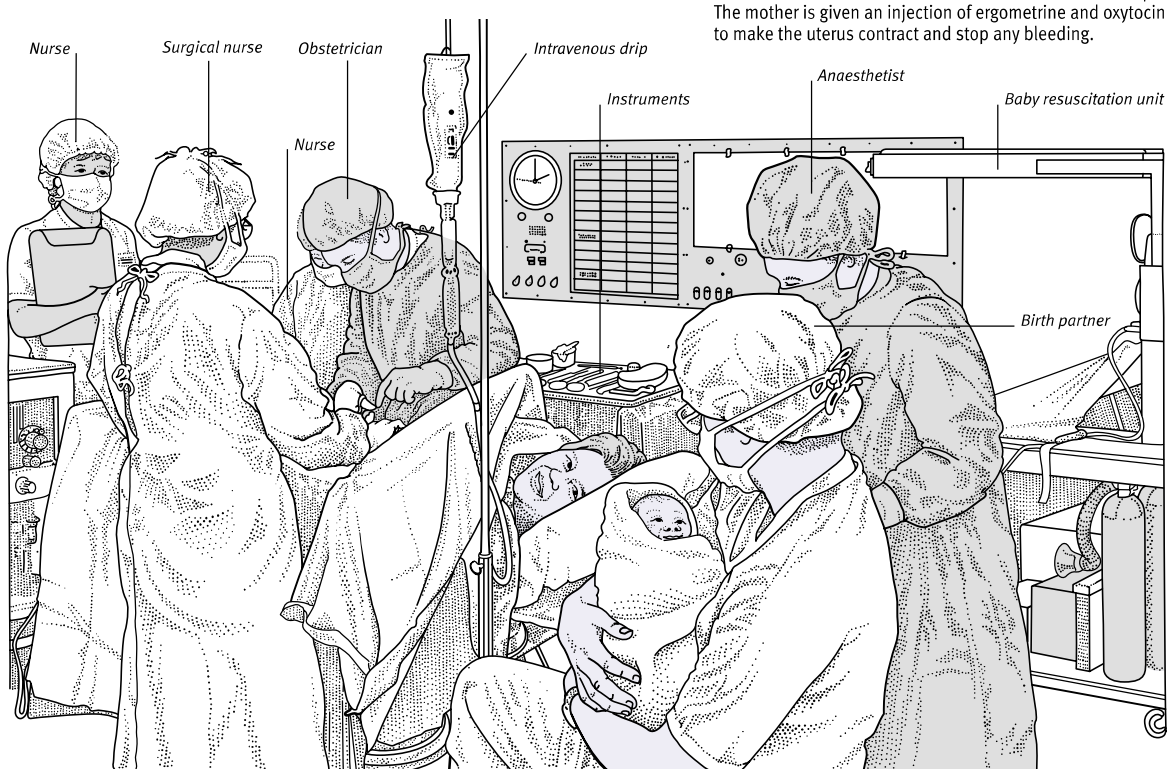
An emergency caesarean is needed in cases of *fetal distress* (lack of oxygen); unsuccessful induction of labour; or bleeding (such as in placental abruption (premature separation) or placenta praevia).

Breech presentation



Placenta praevia

3 The amniotic fluid is drained off by suction. The baby is delivered through an incision in the lower part of the uterus. The umbilical cord is cut and the afterbirth removed. The incisions in the uterus and abdomen are then sewn up. The mother is given an injection of ergometrine and oxytocin to make the uterus contract and stop any bleeding.



The tendons of the sole of the foot are fixed under the calcaneus, and the associated muscles are important in supporting the arches of the foot. Inflammation around these tendons (as occurs in plantar *fasciitis*) causes pain and tenderness under the heel when standing or walking. A calcaneal spur (a bony protrusion) occurs in some people with plantar fasciitis and also, occasionally, in those with healthy feet.

calciferol

A former name for vitamin D_2. This vitamin is now more commonly known as ergocalciferol (see *vitamin D*).

calcification

The deposition of *calcium* salts in body tissues. Calcification is part of the normal processes of bone and teeth formation and the healing of fractures. It also occurs in injured muscles, in arteries affected by *atherosclerosis,* and when blood calcium levels are raised by disorders of the *parathyroid glands*.

calcification, dental

The deposition of *calcium* salts in developing teeth. Primary teeth (see *eruption of teeth*) begin to calcify in a fetus at between three and six months gestation. Calcification of permanent teeth (other than the wisdom teeth) begins between birth and four years.

Certain tooth conditions can cause abnormal calcification. In amelogenesis imperfecta, an enamel disorder (see *hypoplasia, enamel*), teeth have a thin, grooved covering due to incomplete calcification. Another cause is absorption of high levels of fluoride (see *fluorosis*) and drugs, such as *tetracycline*, that are taken in pregnancy.

calcinosis

The abnormal deposition of *calcium* salts in the skin, muscles, or *connective tissues,* forming *nodules*. Calcinosis occurs in connective tissue disorders such as *scleroderma*. (See also *calcification*.)

calcipotriol

A derivative of *vitamin D* that is used in topical treatments for the skin condition *psoriasis*.

calcitonin

A *hormone* produced by the *thyroid gland* that helps to control blood *calcium* levels by slowing the rate at which calcium is lost from the bones.

WHY IT IS USED

A synthetic form of calcitonin used in the treatment of *Paget's disease*, in which the bones grow abnormally and become deformed, causing pain and an increased risk of fracture. Injections of calcitonin can generally halt abnormal bone formation in about a week and can relieve pain within a few months.

Calcitonin is also used in the treatment of *hypercalcaemia* (abnormally high levels of calcium in the blood), which may be caused by overactivity of the *parathyroid glands* or by *bone cancer*. It helps to relieve the nausea and vomiting that result from hypercalcaemia by rapidly reducing the level of calcium circulating in the blood.

SIDE EFFECTS

Calcitonin causes minimal side effects. Gastrointestinal reactions, such as nausea, vomiting, and diarrhoea, usually diminish with continued use.

calcium

The body's most abundant mineral, calcium is essential for cell function, muscle contraction, the transmission of nerve impulses from nerve endings to muscle fibres, and for *blood clotting*. Calcium phosphate is the hard, basic constituent of teeth and bones. Dietary sources of calcium include dairy products, eggs, and green, leafy vegetables.

CONTROL OF CALCIUM LEVELS

Vitamin D and certain hormones help to control the overall amount of calcium in the body. They act by regulating the amount of calcium that is absorbed from food and the amount filtered out from the blood by the kidneys and excreted in the urine.

The levels of calcium in the blood are controlled by the actions of two hormones: parathyroid hormone, which is produced by the *parathyroid glands*, and *calcitonin*, which is produced by the thyroid gland. When the level of calcium in the blood falls to a low level, the parathyroid glands release more parathyroid hormone, which raises the blood calcium level by helping to release calcium from the enormous reservoir in the bones. When the blood calcium level rises significantly, the thyroid gland releases more calcitonin. This hormone counteracts the effects of parathyroid hormone, thereby lowering the level of calcium in the blood.

DISORDERS OF CALCIUM METABOLISM

Abnormally high levels of calcium in the blood (*hypercalcaemia*) or abnormally low levels (*hypocalcaemia*) may seriously disrupt cell function, particularly in muscles and nerves. (See also *mineral supplements*.)

calcium carbonate

A *calcium* salt used in some *antacid drugs*, which can be taken for the treatment of indigestion.

calcium channel blockers

COMMON DRUGS

•Amlodipine •Diltiazem •Felodipine •Isradipine •Lacidipine •Lercanidipine •Nicardipine •Nifedipine •Verapamil

Drugs used in the treatment of *angina pectoris* (chest pain due to impaired blood supply to the heart muscle), *hypertension* (high blood pressure), and certain types of cardiac *arrhythmia* (irregular heartbeat).

HOW THEY WORK

Calcium channel blockers work by interfering with the movement of *calcium* across the membranes of muscle cells in blood vessels and in the heart muscle itself. This action decreases the work of the heart in pumping blood, reduces the pressure of blood flow through the body, and improves blood circulation through the heart muscle.

The drugs also slow the passage of nerve impulses through the heart's internal conduction system, which helps to correct certain types of arrhythmia.

SIDE EFFECTS

The side effects of calcium channel blockers are mainly related to their action of increasing the blood flow through tissues. These effects include headaches, swollen ankles, flushing, and dizziness. Adverse effects tend to diminish with continued treatment.

calculus

A hard deposit in the body. Calculus may form on the surface of the teeth (see *calculus, dental*). Alternatively, it may be a small, hard, crystalline mass that forms in a body cavity from certain substances in fluids such as bile, urine, or saliva. Such calculi (also called stones) can occur in the gallbladder and bile ducts (see *gallstones*), kidneys, ureters, bladder (see *calculus, urinary tract*), or in the salivary ducts.

Although some calculi do not cause any symptoms, some can cause severe pain, in which case they may need to be dissolved, shattered, or surgically removed from the body cavity.

calculus, dental

A hard, crust-like deposit, also called tartar, found on the crowns and roots of the teeth. Calculus forms when mineral salts in saliva are deposited in existing *plaque*, a coating of mucus and debris that forms on the teeth.

TYPES

There are two types of dental calculus. Supragingival calculus is a yellowish or white deposit that forms above the gum margin, on the crowns of teeth in areas close to the openings of *salivary gland* ducts. Subgingival calculus forms below the gum margin, is more evenly distributed around all the teeth, and is brown or black.

Both types of calculus are hard and are therefore difficult to remove; the subgingival variety may be more difficult to remove because of its location and degree of calcification.

EFFECTS AND TREATMENT

The toxins present in calculus can lead to gum inflammation (see *gingivitis*), which may progress to destruction of the supporting tissues (see *periodontitis*). Calculus should be removed on a regular basis by professional *scaling*. Careful attention to *oral hygiene* may reduce the recurrence of dental calculus.

calculus, urinary tract

A stone in the kidneys, ureters, or bladder that is formed from crystallized substances in the urine.

TYPES AND CAUSES

Kidney and ureteral stones Most stones that form in the kidneys and ureters are composed of calcium oxalate or other salts crystallized from the urine. These stones may be associated with a diet that is rich in oxalates (which are found, for example, in leafy vegetables and tea); high levels of *calcium* in the blood due to *hyperparathyroidism* (overactivity of the parathyroid glands); or chronic dehydration.

Other types of kidney or ureteral stone are associated with *gout* and certain cancers. Stones that develop in these locations due to chronic *urinary tract infection* are termed "infective". Kidney stones that fill the entire network of urine-collecting ducts at the top of the ureter are called "staghorn" calculi, due to their shape.

Bladder stones In developing countries, bladder stones usually occur as a result of dietary deficiencies. In developed countries, they are usually caused by an obstruction to urine flow from the bladder and/or a longstanding urinary tract infection. The composition of the stones is related to the acidity or alkalinity of the urine.

SYMPTOMS

The most common symptom of a stone in the kidney or ureter is *renal colic*, a severe pain in the back, under the ribs, that often spreads into the groin. This pain may be accompanied by nausea and vomiting. There may also be *haematuria* (blood in the urine). A bladder stone usually causes difficulty in passing urine.

DIAGNOSIS AND TREATMENT

Investigation of a suspected calculus usually starts with microscopic examination of the urine, which may reveal red blood cells and the presence of crystals. The degree of acidity or alkalinity of the urine may reflect the type of stone involved. The site of a stone can usually be confirmed by intravenous *urography*. Some stones, particularly those containing calcium, are visible on a plain abdominal X-ray.

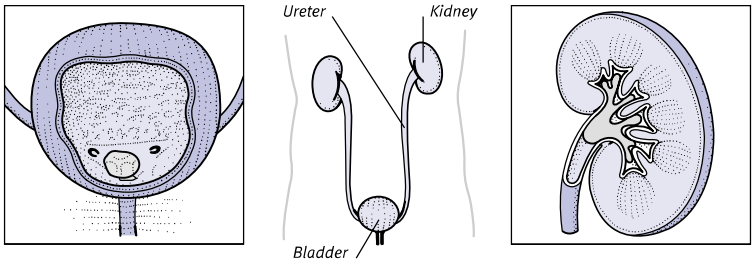
Renal colic is treated with bed rest and an *analgesic drug* (painkiller). With an adequate fluid intake, small stones are usually passed in the urine without causing problems. The first line of treatment for larger stones in the urinary tract is often *lithotripsy*, a procedure that uses ultrasonic waves or shock waves to disintegrate the stones. Alternatively, *cystoscopy* can be used to crush and remove stones in the bladder and lower ureter. In some cases, surgery may be needed to remove the stones.

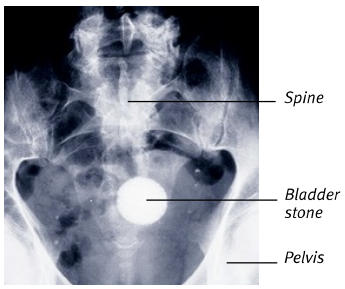
calendar method

A method of *contraception,* also called the rhythm method, based on abstaining from sexual intercourse around the

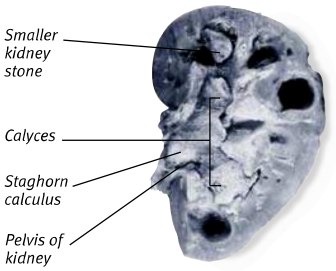
URINARY TRACT CALCULI

Calculi form in the urinary tract when certain substances in the urine become overly concentrated. The substances form crystals, which grow into stones. Some stones may be associated with recurrent episodes of *urinary tract infection*. Symptoms vary according to the site of the stone. Small stones may be passed in the urine and cause no symptoms. Some stones, however, may lodge in a ureter, causing *renal colic* (a sudden, severe pain in the small of the back that moves towards the groin) and haematuria (blood in the urine). In the bladder, stones may settle over the outlet, which can cause difficulty in passing urine, a poor flow rate, and dribbling. Any obstruction to urine flow may result in rapid kidney damage and acute, severe infection (*pyelonephritis*).





X-ray of a bladder stone
A large bladder stone, such as the one that can be clearly seen in this X-ray, can make the passing of urine both difficult and painful.



Staghorn calculus
Here, a staghorn calculus has filled the entire pelvis and calyces of the kidney, producing a cast of them. A smaller stone has formed in the medulla (central area).

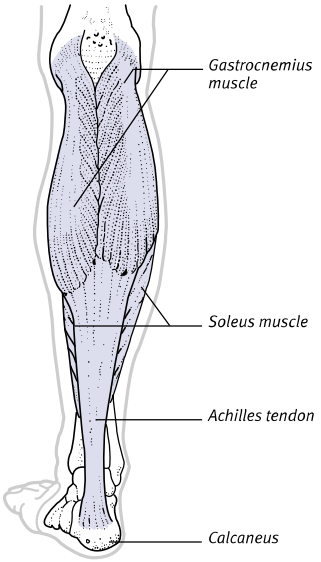
time of *ovulation* (the release of an egg from a woman's ovary). This time is calculated on the basis of the length of her previous menstrual cycles. The calendar method is unreliable because a woman's menstrual cycle may vary. There are now more scientific and effective contraceptive methods of this type (see *contraception, natural methods*).

calf muscles

The muscles extending from the back of the knee to the heel. The gastrocnemius muscle starts behind the knee and forms the bulky part of the calf; beneath it lies the soleus muscle which starts at the back of the *tibia* (shin). These two muscles join to form the *Achilles tendon*, which connects them to the heel. Contraction of the calf muscles pulls the heel up and is important in walking, running, and jumping.

LOCATION OF **CALF MUSCLES**

The gastrocnemius muscle and the soleus muscle at the back of the leg join to form the Achilles tendon.



calf pain

Various disorders may be responsible for pain in the calf. Common causes include *cramp*, muscle strain, and *sciatica* (inflammation of the sciatic nerve). More rarely, pain in the calf muscles may be due to blood clots in leg veins (see *thrombosis, deep vein*). This disorder is a particular risk if a person has been immobile for a long time – for example, after surgery or during a long journey by air. Another possible problem is *claudication* (cramping pain often due to narrowing of the arteries). In this last condition, pain is often caused by walking and relieved by rest.

caliper splint

An *orthopaedic* device that corrects or controls a deformed leg or supports a leg weakened by a muscular disorder, allowing an affected person to stand and walk. For example, a person who has lost the ability to flex the foot upward and, as a result, drags the toes on the ground with each step can be fitted with a splint that keeps the foot permanently at right angles to the leg, thereby allowing walking.

A caliper splint consists of one or two vertical metal rods attached to leather or metal rings that are worn around the affected limb. A splint extending just below the knee is sufficient to control the position of the ankle. Longer splints may be jointed to allow movement of the knee.

callosity

See *callus, skin*.

callus, bony

A diffuse growth of new, soft bone that forms as part of the healing process in a *fracture*. As healing continues, the callus is replaced by harder bone, and the original shape of the bone is restored.

callus, skin

An area of thickened skin, usually on the hands or feet, caused by regular or prolonged pressure or friction. A *corn* is a callus on a toe. If corns are painful, the thickened skin can be pared away by a chiropodist using a scalpel.

caloric test

A method of finding out whether the *labyrinth* in the inner ear is diseased. A caloric test may be performed as part of investigations into *vertigo* (dizziness) and hearing loss.

The outer-ear canal is briefly flooded with water of different temperatures, above and below normal body temperature. This flooding sets up convection currents in the semicircular canals in the inner ear. If the labyrinth is normal, *nystagmus* (rapid reflex flickering of the eyes) occurs for a predictable period. If the labyrinth is diseased, this response is either absent or reduced. The presence and duration of nystagmus may be observed directly or recorded electrically using *electronystagmography*.

calorie

A unit of energy. One calorie is the amount of energy that is needed to raise the temperature of 1 gram of water by 1°C. The term "calorie" is also used in medicine and *dietetics* to mean "kilocalorie", which is a larger unit of energy equal to 1,000 calories.

Normally, when a person's calorie intake matches the amount of energy expended, body weight remains constant. If intake exceeds expenditure, weight is usually gained; if expenditure exceeds intake, weight is usually lost. In general, fats contain more calories than proteins or carbohydrates.

Energy can also be measured in joules: 1 calorie equals 4.2 joules. (See also *calorimetry; diet and disease.*)

calorie requirements

See *energy requirements*.

calorimetry

The measurement of the *calorie* (energy) value of foods or the energy expenditure of a person. In direct calorimetry, a small measure of food is burned up inside a sealed container, which is immersed in water. The resultant rise in water temperature is used to calculate the calorie value.

Energy production in humans can be measured by oxygen uptake. Every litre of oxygen taken into the body produces 4.8 kilocalories of energy. The level of energy production is calculated by comparing the percentage of oxygen in air that is inhaled and exhaled.

Calpol

A brand name for paediatric preparations containing the *analgesic drug* (painkiller) *paracetamol*.

camouflaging preparations

Creams or powders that are applied to the skin to conceal skin disfigurements, such as *birthmarks* and scars.

Campbell de Morgan's spot

A small (1–3 mm), bright red, domed spot, also known as a cherry angioma, that appears on the trunk or limbs. A Campbell de Morgan's spot is a type of *haemangioma* (a noncancerous blemish). The spots are harmless. They are

caused by weakening of the walls of capillaries in the dermis (the inner layer of the skin). Campbell de Morgan's spots are common in adults, especially elderly people.

Campylobacter

A group of bacteria that are among the most common causes of gastrointestinal disorders. Campylobacter bacteria are harboured by animals and can be passed on to humans through contaminated food, especially in poultry, causing *food poisoning*. These bacteria also cause a form of *colitis*, an inflammatory disease of the colon.

canal

A narrow tubular passage or channel in the body, such as the *ear* canal, which leads from the outer to the middle ear, or the alimentary canal, which is part of the *digestive system*.

cancer

Any of a group of diseases that are characterized by the abnormal and unrestrained growth of cells in body organs or tissues. Cancerous tumours can form in any tissue in the body, but they most commonly develop in major organs, such as in the lungs, breasts, intestines, skin, stomach, or pancreas. Cancerous tumours can also develop in the nasal sinuses, the testes or ovaries, or the lips or tongue. Cancers may also develop in the tissues of the bone marrow that form blood cells (see *leukaemia*) and in the lymphatic system, the muscles, or the bones.

Cancers differ from benign (noncancerous) *neoplasms* (growths) in that they spread and infiltrate surrounding normal tissue. The tumours can cause blockages in hollow organs, such as within the digestive tract. They can also destroy nerves and erode bone. Cancer cells may also spread through the blood vessels or lymphatic system to other organs to form secondary tumours, known as metastases (see *metastasis*).

CAUSES

Tumour-forming cells develop when the *oncogenes* (genes controlling cell growth and multiplication) in a cell or cells undergo a series of changes. A small group of abnormal cells develop that divide more rapidly than normal, lack differentiation (they no longer perform their specialized task), and may escape the normal control of hormones and nerves.

Possible causes of cancer include environmental factors (such as sunlight and pollutants), alcohol consumption, dietary factors, and, most particularly, smoking, which is responsible for more cancers than any other agent. All of these factors may provoke critical changes within body cells in people who are already susceptible to developing cancer. Susceptibility to certain cancers may be inherited.

SYMPTOMS

Cancer symptoms depend on the site of the growth, the tissue of origin, and the extent of the tumour. They may be a direct feature of the growth (for example, lumps or skin changes) or may result from disruption of the function of a vital organ or blockage of a part of the body by the tumour. Unexplained weight loss is a feature of many different types of cancer.

DIAGNOSIS

Screening tests (see *cancer screening*) are increasingly being used to detect early signs of certain types of cancer in people who are thought to be at risk. Early detection of cancer optimizes the chance of a cure; for this reason, screening for breast cancer, cancer of the cervix, and intestinal cancer has reduced mortality from these tumours. Diagnosis of cancer after symptoms have appeared is based on a physical examination, and confirmed by *biopsy* (removal of a sample of abnormal tissue for microscopic analysis) and imaging tests.

There are four main types of procedure used to detect cancer: cytology (cell) tests, imaging techniques, chemical tests, and direct inspection.

TREATMENT AND OUTLOOK

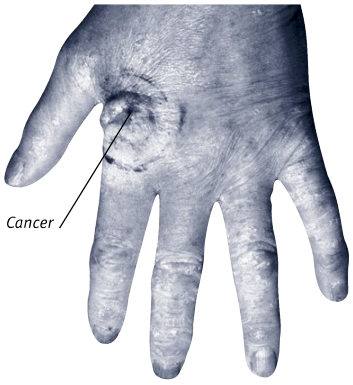
Many cancers are now curable, usually by combinations of surgery, *radiotherapy,* and *anticancer drugs*. For details of a specific type of cancer, refer to the article on that organ (for example, see *lung cancer; stomach cancer*).

cancerphobia

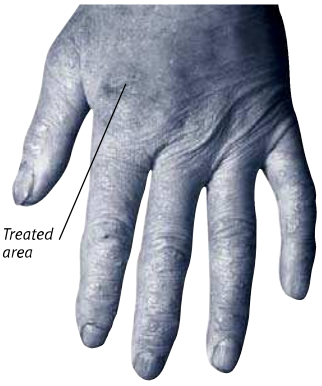
An intense fear of developing cancer, out of proportion to the actual risk, that significantly affects the life of the sufferer. An individual who has cancerphobia may become convinced that symptoms such as headaches, skin problems, constipation, or difficulty in swallowing, are signs of cancer. Patterns of behaviour that are typical of *obsessive–compulsive disorder* (such as prolonged washing rituals) may be adopted in an attempt to reduce the

TREATMENT OF CANCER

The treatment of many cancers is still primarily surgical. Excision of an early tumour will often give a complete cure. There may be small, undetectable metastases (secondary tumours) at the time of operation, so surgery is commonly combined with radiotherapy and anticancer drugs. The aim of these treatments is to suppress or arrest the rate of cell division in any tumour cells left after surgery. Anticancer drugs often have unpleasant side effects because it is sometimes difficult to direct specific drugs to their target, and normal cells and tissues may be disrupted along with the tumour cells.



Before radiotherapy
The photograph shows a skin cancer on the back of the hand before treatment.



After radiotherapy
This was the appearance a few weeks later, after a course of radiotherapy.

TESTS USED TO DETECT CANCER

Cytology tests	These tests reveal the presence of abnormal cells. One example is the *cervical smear test,* an investigation in which cells are scraped from the cervix (neck of the uterus) and examined microscopically to detect	potential or early cancer of the cervix. Another example is urine cytology, used to detect bladder cancer. Cells can also be removed from solid lumps; this procedure is often carried out on breast lumps.
Imaging techniques	Imaging tests can sometimes reveal changes in the appearance of tissue that are suggestive of cancer. One such test is a low-dose X-ray used in *mammography* to detect early breast cancer. Another is *ultrasound scanning;* for example, pelvic	ultrasound scans can detect cancer of the ovary. CT scanning and MRI provide detailed images of internal anatomy and are particularly useful for showing inaccessible areas, such as the brain and the back of the abdominal cavity.
Chemical tests	Tests on blood, urine, or faeces can show the presence of substances suggestive of cancer. For example, microscopic amounts of blood in the	faeces may be due to cancer of the colon; high blood levels of prostate specific antigen (PSA) are sometimes due to prostate cancer.
Viewing techniques	Viewing tests involve looking inside a hollow organ using an *endoscope* (a tube with a viewing lens). They are usually performed only when cancer is already suspected. Examples	include *colonoscopy, gastroscopy, cystoscopy,* and *laparoscopy* (viewing of the colon, stomach, bladder, and abdominal cavity, respectively).

risk of cancer. *Psychotherapy*, including *behaviour therapy*, may be of benefit. (See also *phobia*.)

cancer screening

Tests that are carried out to detect cancer before symptoms have developed. Cancer screening is used particularly for groups of people who are thought to be susceptible because of their age, occupation, lifestyle, or genetic predisposition. Early detection often increases the chance of a cure. Tests for cancers of the cervix (see *cervical smear test)*, breast (see *mammography*), bladder, and colon have proved effective in reducing mortality from these conditions.

cancrum

The medical term for canker or ulceration. It mainly refers to the mouth and lips, when the condition is known as cancrum oris. (See also *noma*.)

candidiasis

Infection by the fungus CANDIDA ALBICANS, also known as thrush or moniliasis. Candidiasis affects areas of mucous membrane in the body, most commonly the vagina and the inside of the mouth. In infants, candidiasis can occur in conjunction with *nappy rash*.

CAUSES

The fungus is normally present in the mouth and the vagina, but in some situations it may multiply excessively. Candidiasis may occur if *antibiotic drugs* destroy the harmless bacteria that control the growth of the fungus, or if the body's resistance to infection is lowered. Certain disorders, for example *diabetes mellitus*, and the hormonal changes that occur during pregnancy or with *oral contraceptives*, may also encourage growth of the fungus.

Candidiasis can be contracted by having sexual intercourse with an infected partner. The infection is far more common in women than in men.

SYMPTOMS

Symptoms of vaginal infection include a thick, white discharge, genital irritation, and discomfort on passing urine. Less commonly, the penis is infected, usually causing *balanitis* (inflammation of the head of the penis). Oral candidiasis produces sore, creamy-yellow, raised patches inside the mouth.

Candidiasis may spread from the genitals or mouth to other moist areas of the body. It may also affect the gastrointestinal tract, especially in people with impaired immune systems, such as those taking *immunosuppressant drugs* or who have HIV (the virus that leads to *AIDS*).

DIAGNOSIS AND TREATMENT

Candidiasis is diagnosed by examination of a sample taken from the white discharge or from patches.

The condition is treated topically with *antifungal drugs* such as clotrimazole or with oral antifungals. The drugs are given in the form of creams, vaginal pessaries, or throat lozenges. Treatment of candidiasis is usually successful, but the condition may recur.

Canesten cream

A brand name for the *antifungal drug* clotrimazole, used to treat fungal infections of the skin and genitals (for example, *candidiasis*).

canine tooth

See *teeth*.

cannabis

A preparation that is derived from the hemp plant CANNABIS SATIVA and usually used to produce euphoria and hallucinations (see *marijuana*).

cannula

A smooth, blunt-ended tube that is inserted into a blood vessel, lymphatic vessel, or body cavity, in order to introduce or withdraw fluids.

Cannulas are used for *blood transfusions* and *intravenous infusions* and for draining *pleural effusions* (fluid around the lungs). If necessary, a cannula may be left in place for several days if continuous testing of, or introduction of, fluids is required.

canthus

The anatomical term for the corner of the *eye* (the angle at which the upper and lower eyelids meet).

capacity, iron-binding

A measure of the level of transferrin, a protein that acts in addition to *haemoglobin* (the oxygen-carrying pigment in the blood) to bind and transport iron in the blood. Measuring iron-binding capacity may help to establish the cause of *anaemia* (a reduced level of haemoglobin in the blood).

Transferrin is formed mainly in the *liver*. The amount produced is determined by the amount of iron that is stored in the body. When iron stores are low, as occurs in iron-deficiency anaemia (see *anaemia, iron-deficiency*), more transferrin is produced to enable the blood to carry as much iron as possible. The level of transferrin and the iron-binding capacity of the blood are thereby raised, although the level of iron in the body is low.

capacity, vital

The maximum volume of air, usually around 4.5 litres, that can be expelled from the lungs following maximum inhalation. Vital capacity is measured as part of lung function tests (see *pulmonary function tests*).

cap, cervical

A flexible contraceptive device that is placed directly over the *cervix* to prevent sperm from entering it (see *contraception, barrier methods of*).

cap, duodenal

See *duodenal cap*.

Capgras' syndrome

The delusion (false belief) that a relative or friend has been replaced by an identical impostor. Capgras' syndrome, also known as the "illusion of doubles", is seen most frequently in patients with paranoid *schizophrenia* but can also occur in some organic brain disorders (see *brain syndrome, organic*) and *affective disorders*.

capillary

Any of the vessels that carry blood between the smallest arteries, or arterioles, and the smallest veins, or venules (see *circulatory system*). Capillaries form a fine network throughout the body's organs and tissues. Their thin walls are permeable; as a result, they allow blood and cells to exchange constituents such as oxygen, glucose, carbon dioxide, and water (see *respiration*).

Capillaries open and close to blood flow according to the requirements of different organs for oxygen and nutrients. For example, when a person is running, most of the capillaries in the leg muscles are open, but at rest many are closed. The opening and closing of skin capillaries helps to regulate *temperature*. The blood flow through each capillary is controlled by a tiny circle of muscle at its entrance.

DISORDERS

A direct blow to an area of the body may rupture the capillary walls, causing bleeding under the skin, which in turn results in swelling and bruising.

Capillaries become more fragile in elderly people, in people taking high doses of *corticosteroid drugs*, and in those suffering from *scurvy* (vitamin C deficiency). All such people have a tendency to develop *purpura* (small areas of bleeding under the skin which often appear as reddish-purple patches).

capillary haemangioma

See *haemangioma*.

Caplan's syndrome

A combination of *rheumatoid arthritis* and *pneumoconiosis* (a lung disorder that is caused by inhalation of certain mineral dusts). In Caplan's syndrome, large areas of fibrous (scar) tissue form in the lungs, often causing severe shortness of breath.

capping, dental

See *crown, dental*.

capsule

An anatomical structure enclosing an organ or body part. For example, the liver, kidneys, joints, and eye lenses are all enclosed in capsules.

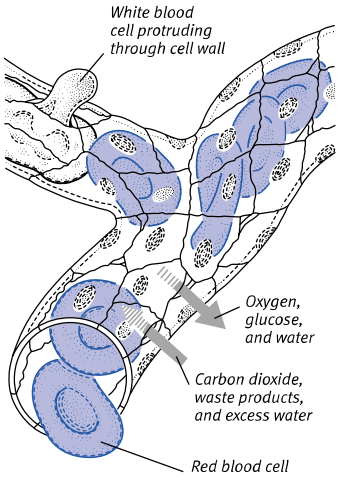
The term "capsule" is also used to describe a soluble, elongated shell, usually made of gelatine, which contains a drug to be taken by mouth. The coating of some capsules prevents potentially irritant drugs from being released into the stomach, or allows drugs to be released slowly to enable them to be taken less frequently.

capsulitis

Inflammation of a *capsule*, a structure that encloses an organ or joint. One example of capsulitis is *frozen shoulder*.

STRUCTURE OF CAPILLARIES

These minute blood vessels have thin, permeable walls, which allow the transfer of oxygen, glucose, and water from blood to tissues.



captopril

An *ACE inhibitor drug*. These drugs are used in the treatment of *hypertension* (high blood pressure), *heart failure*, and diabetic *nephropathy* (kidney damage).

caput

The Latin word for head. The term is commonly used of the caput succedaneum: a soft, temporary swelling in the scalp of newborn babies, which is caused by pressure during labour. The word "caput" was once also used to refer to the face, skull, and associated organs; to the origin of a muscle; or to any enlarged extremity, such as the caput femoris, the head of the femur (thigh bone).

carbamazepine

An *anticonvulsant drug* that is chemically related to the *tricyclic antidepressants*. Taken orally or as suppositories, carbamazepine reduces the frequency of seizures that are caused by abnormal nerve signals in the brain and is used mainly in the long-term treatment of *epilepsy*. The drug is also prescribed to relieve *neuralgia* (intermittent severe pain caused by nerve damage or irritation) and as a mood-stabilizing drug in the treatment of psychiatric disorders such as *mania*.

carbaryl

An insecticide used to treat head *lice* and *crab lice*. Carbaryl is applied topically as a liquid; however, it must not come into contact with the eyes or with areas of broken skin.

carbenoxolone

An *ulcer-healing drug* that is used to treat inflammation and ulceration of the oesophagus, but which has now largely been superseded by antibiotics and by proton pump inhibitors. A gel containing carbenoxolone is commonly used to relieve mouth ulcers.

carbimazole

A drug that is used to treat *hyperthyroidism* (overactivity of the thyroid gland). Carbimazole is slow to take effect, so *beta-blockers* may be given to relieve symptoms in the interim.

Long-term treatment with carbimazole may reduce the production of blood cells by the bone marrow, so regular blood counts are required. Side effects may include headaches, dizziness, joint pain, and nausea.

C

carbocisteine

A type of *mucolytic drug* that is used to thin sputum, making it easier to cough up. Carbocisteine may be helpful in chronic obstructive pulmonary disease (see *pulmonary disease, chronic obstructive*) and *cystic fibrosis*.

carbohydrates

A group of compounds, including starches (complex carbohydrates) and sugars (simple carbohydrates), that are composed of carbon, hydrogen, and oxygen and supply the body with its main source of energy.

TYPES AND SOURCES

Carbohydrates are found in fruits, cereals, and root vegetables. They fall into two main groups: available carbohydrates and unavailable carbohydrates.

The main available carbohydrates are starches and sugars, which are metabolized into glucose for the body's use. Unavailable carbohydrates include cellulose, which cannot be broken down by digestive *enzymes* and makes up the bulk of dietary fibre (see *fibre, dietary*).

CARBOHYDRATE METABOLISM

The different types of carbohydrates are processed by the body in different ways. Monosaccharides (also known as simple sugars), which include glucose (grape sugar), galactose (a milk sugar), and fructose (fruit sugar), can all be absorbed, unchanged, into the bloodstream, whereas disaccharides (also known as "double" sugars), including sucrose, maltose, and lactose (a milk sugar), need to be broken down into simple sugars before they are absorbed. Starches also have to be broken down into simple sugars before they can be absorbed by the body. This process is carried out by enzymes (chemical catalysts) in the digestive tract.

The simple sugars (mainly glucose) are then absorbed through the intestinal wall and into the bloodstream for distribution throughout the body. Some glucose is burned up immediately (see *metabolism*) in order to generate energy for cells that need a constant supply, such as brain cells and red blood cells. Galactose and fructose are converted to glucose in the liver to be used by body cells. Surplus glucose is transported to the liver, muscles, and fat cells where it is converted into *glycogen* and fat for storage.

When blood glucose levels are high, glucose storage is stimulated by *insulin*, a hormone that is secreted by the *pancreas*. When blood glucose levels become low, insulin secretion diminishes and *glucagon*, another hormone produced by the pancreas, stimulates the conversion of stored glycogen to glucose for release into the bloodstream. Fat cannot be converted to glucose, although it can be used as a fuel to conserve glucose.

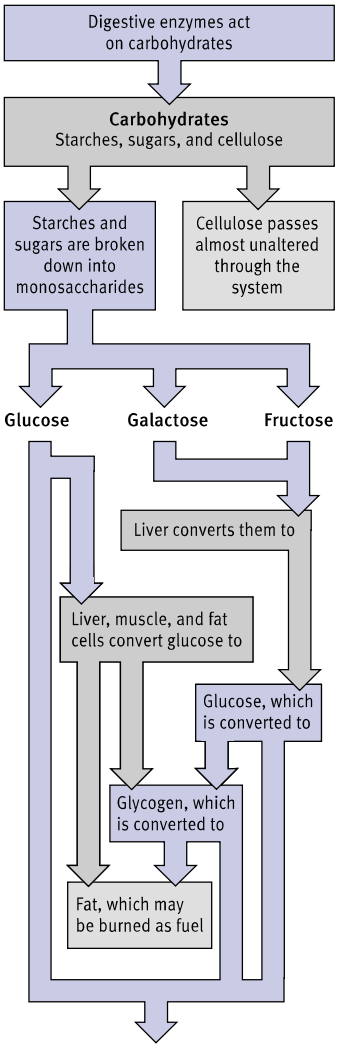
In the disorder *diabetes mellitus*, carbohydrate metabolism is disturbed by a deficiency of insulin.

TYPES OF CARBOHYDRATE

Monosaccharides are the simplest, consisting of a single saccharide molecule. Disaccharides consist of two linked saccharide molecules. Polysaccharides consist of a long chain of many saccharide molecules. Starch is an important carbohydrate and a major constituent in the diet.

- **Monosaccharides**
  glucose, galactose, fructose
- **Disaccharides**
  sucrose, lactose, maltose
- **Polysaccharides**
  starches, cellulose

CARBOHYDRATE METABOLISM



Glucose is absorbed into the bloodstream for distribution throughout the body or is used directly by body cells.

carbolic acid

See *phenol*.

carbon

A nonmetallic element that is present in all the fundamental molecules of living organisms, such as *proteins*, *fats*, and *carbohydrates*, and well as in some inorganic molecules, such as *carbon dioxide*, *carbon monoxide*, and *sodium bicarbonate*. Pure carbon is the major constituent of diamond, coal, charcoal, and graphite.

carbon dioxide (CO_2)

A colourless, odourless gas. Carbon dioxide consists of one carbon atom linked to two oxygen atoms and has the chemical formula CO_2. The gas is present in small amounts in the air and is an important by-product of *metabolism* in cells. It is produced by the breakdown of substances such as carbohydrates and fats to produce energy. It is then carried in the bloodstream to the lungs, where it is exhaled.

Carbon dioxide helps to control the rate of respiration: when a person exercises, CO_2 levels in the blood rise, causing the person to breathe more rapidly in order to expel carbon dioxide and to take in more *oxygen*.

Carbon dioxide that is compressed and cooled to -75°C becomes solid *dry ice*, which is used in *cryosurgery* (destruction of diseased tissues by freezing).

carbon monoxide (CO)

A colourless, odourless, poisonous gas. Carbon monoxide consists of one carbon atom linked to one oxygen atom and has the chemical formula CO. It

toxin is present in vehicle exhaust fumes and is produced by inefficient burning of coal, gas, or oil.

POISONING

Carbon monoxide is toxic because it binds with *haemoglobin* (the oxygen-carrying molecule in red blood cells), which prevents the blood from carrying oxygen to the body tissues. As a result, the tissues are deprived of oxygen, and asphyxiation occurs. The initial symptoms of acute high-level carbon monoxide poisoning include dizziness, headache, nausea, and faintness. Continued inhalation of the gas may lead to loss of consciousness, permanent brain damage, and even death. Low-level exposure to carbon monoxide over a period of time may cause fatigue, nausea, diarrhoea, abdominal pain, and general malaise.

carbon tetrachloride (CCl_4)

A colourless, poisonous, volatile chemical with a characteristic odour. Carbon tetrachloride consists of one carbon atom linked to four chlorine atoms and has the chemical formula CCl_4. Formerly used in domestic dry-cleaning fluids, its use is now restricted to industry.

Carbon tetrachloride is an extremely dangerous chemical, and it can cause dizziness, confusion, and liver and kidney damage if a significant amount of the chemical is inhaled or swallowed. (See also *household poisons*.)

carbuncle

A cluster of interconnected *boils* (painful, pus-filled, inflamed hair roots). Carbuncles are usually caused by infection with the bacterium *Staphylococcus aureus*. The back of the neck and the buttocks are the most common sites. The swellings mainly affect people with reduced immunity, particularly those with *diabetes mellitus*.

Treatment is usually with an *antibiotic drug*. In addition, the application of hot *compresses* may encourage the pus-filled heads of the boils to burst, which relieves pain. Occasionally, incision and drainage (together with removal of the core of the carbuncle) may be necessary if a carbuncle is persistent, and drainage and healing have not occurred spontaneously.

carcinogen

Any agent that is capable of causing *cancer*, such as tobacco smoke, high-energy *radiation*, or asbestos fibres.

CHEMICAL CARCINOGENS

Chemicals form the largest group of carcinogens. Major types include polycyclic aromatic hydrocarbons (PAHs), which occur in tobacco smoke, pitch, tar fumes, and soot. Exposure to PAHs may lead to cancer of the respiratory system or skin. In addition, certain aromatic amines used in the chemical and rubber industries may cause bladder cancer after prolonged exposure.

PHYSICAL CARCINOGENS

The best-known physical carcinogen is high-energy radiation, such as nuclear radiation and *X-rays*. Radiation may also come from *ultraviolet light*, for example in sunlight. Another known physical carcinogen is asbestos (see *asbestos-related diseases*).

Exposure to radiation may cause cancerous changes in cells, especially in cells that divide quickly; for example changes in the precursors of white blood cells in the bone marrow causes *leukaemia*. The level of risk depends on the dosage and duration of exposure to the carcinogen. Over many years, exposure to ultraviolet radiation in sunlight can cause skin cancer.

BIOLOGICAL CARCINOGENS

Only a few biological agents are known to cause cancer in humans. *Schistosoma haematobium*, one of the blood flukes responsible for the tropical disease *schistosomiasis*, can cause cancer of the bladder; and *Aspergillus flavus*, a fungus that produces the poison *aflatoxin* in stored peanuts and grain, is believed to cause liver cancer.

Viruses that are associated with cancer include some strains of the human papilloma virus, which are linked to cancer of the cervix; the hepatitis B and C viruses, which are linked to liver cancer; and some types of herpes virus, which are associated with *Kaposi's sarcoma* and *Burkitt's lymphoma*.

AVOIDANCE OF CARCINOGENS

In industry, known carcinogens may be banned. Alternatively, as in the nuclear industry and in hospital X-ray departments, they may be allowed only if their use is considered essential, if exposure to them is strictly limited, and if regular medical screening is provided for workers using them.

Outside industry, people are exposed to very few known, unavoidable, high-risk carcinogens. Any substance that could possibly be carcinogenic, such as a food additive, a cosmetic, or a chemical for use in drugs, must be carefully screened by an official body (such as the Medicines Control Agency, which assesses drugs in the UK) before it is allowed to be manufactured.

carcinogenesis

The development of a *cancer* caused by the action of *carcinogens* (factors that cause cancer) on normal cells.

Carcinogens are believed to alter the *DNA* in cells, particularly in *oncogenes* (genes that control the growth and division of cells). An altered cell divides abnormally fast, passing on the genetic changes to all of its offspring cells. Thus, a group of cells is established that is not affected by the body's normal restraints on growth.

carcinoid syndrome

A rare condition caused by an intestinal or lung tumour, called a carcinoid, which secretes excessive amounts of the hormone *serotonin* and often also other chemicals, such as *bradykinin*. Carcinoid syndrome is characterized by bouts of facial flushing, diarrhoea, and wheezing, but symptoms usually occur only if the tumour has spread to the liver or has arisen in a lung.

Carcinoid tumours in the intestine, lung, and, more rarely, the liver are sometimes removed surgically, but, in most cases, surgery is unlikely to be of benefit. In these circumstances, symptoms may be relieved by drugs such as *octreotide*, which often inhibits the growth of the tumour.

carcinoid tumour

A type of hormone-secreting cancerous tumour. Carcinoids most often occur in the small intestine or rectum but occasionally also develop in the lungs. (See also *carcinoid syndrome*.)

carcinoma

Any cancerous tumour (see *cancer*) that arises from cells in the covering surface layer or lining membrane of an organ. A carcinoma is distinguished from a *sarcoma*, which is a cancer arising in bone, muscle, or connective tissue. The most common cancers of the lungs, breast, stomach, skin, cervix, colon, and rectum are carcinomas.

carcinoma in situ

The earliest, usually curable, stage of a cancer. In this stage, the disease has not yet spread from the surface layer of cells in an organ or other tissue.

C

carcinomatosis

The presence of cancerous tissue in different sites of the body due to the spread of *cancer* cells from a primary (original) cancerous tumour.

SYMPTOMS

The symptoms of carcinomatosis may include weight loss, lack of energy, and various other problems depending on the sites of the metastases (secondary tumours). For example, metastases in the lungs may cause coughing and breathlessness; those that develop in the liver may cause jaundice.

DIAGNOSIS AND TREATMENT

A diagnosis of carcinomatosis may be confirmed by *X-rays* or by *radionuclide scanning* of the bones and lungs, by biochemical tests, or in the course of an operation. *Anticancer drugs* or *radiotherapy* may be given to destroy the metastases. The condition will not be improved by removing the primary tumour unless the tumour is producing a hormone that directly stimulates the growth of metastases.

cardiac aneurysm

Ballooning of an area of a ventricle (lower chamber) of the heart, usually as a result of damage following a *myocardial infarction* (heart attack). (See also *ventricular aneurysm*.)

cardiac arrest

A halt in the pumping action of the heart. Cardiac arrest occurs when the heart's rhythmic muscular contractions stop, and usually results from abnormal electrical activity. It causes sudden collapse, loss of consciousness, and the absence of pulse and breathing.

CAUSES

The most common cause of cardiac arrest is a *myocardial infarction* (heart attack). Other possible causes include *respiratory arrest*, *electrical injury*, loss of blood, *hypothermia*, drug overdose, and *anaphylactic shock* (an extremely severe type of allergic reaction).

DIAGNOSIS AND TREATMENT

The survival of the patient depends on prompt restoration of the heartbeat and the oxygen supply to the brain. *Cardiopulmonary resuscitation* may be used to maintain the circulation until the heartbeat resumes.

A diagnosis of cardiac arrest can only be confirmed by monitoring the electrical activity of the heart using *ECG*. This helps medical personnel distinguish between ventricular fibrillation (the rapid, uncoordinated contraction of individual heart muscle fibres) and asystole (the complete absence of heart muscle activity), which are the two abnormalities of heart rhythm that can lead to cardiac arrest.

Ventricular fibrillation may be corrected by *defibrillation* (the application of an electric shock to the heart). Asystole is more difficult to reverse but may respond to injection of *adrenaline* or to an electrical *pacemaker*.

OUTLOOK

In general, recovery after ventricular fibrillation is more likely than after a cardiac arrest triggered by asystole.

cardiac arrhythmia

See *arrhythmia, cardiac*.

cardiac asthma

Difficulty in breathing that is similar to asthma but is the result of *pulmonary oedema* (fluid on the lungs); the oedema, in turn, is due to *heart failure* (the inability of the heart to cope with its workload). Attacks of cardiac asthma usually occur at night. The disorder is not related to bronchial *asthma* and requires different treatment.

cardiac catheter

See *catheterization, cardiac*.

cardiac cycle

The sequence of events, lasting for less than a second, that make up each beat of the *heart*. A heartbeat has three phases: diastole, atrial systole, and ventricular systole. In diastole, the heart relaxes. During atrial systole, the *atria* (upper chambers of the heart) contract, and in ventricular systole, the *ventricles* (the heart's lower chambers) contract. The *sinoatrial node* (the heart's natural pacemaker) regulates the timing of the phases by sending electrical impulses to the atria and the ventricles.

cardiac dysrhythmia

See *dysrhythmia, cardiac*.

cardiac massage

Rhythmic compression of the heart. Cardiac massage is performed when the heart has stopped beating, in order to maintain blood circulation, especially to vital organs such as the brain. It involves repeatedly squeezing the heart to force blood out of it and into the circulatory system, then releasing the pressure on the heart so that it fills with blood again. Cardiac massage is continued until the heart resumes beating or the person is declared dead.

There are two main types: *external cardiac massage*, which involves pressing on the chest to squeeze the heart, and *internal cardiac massage*, when the exposed heart is massaged by hand. (See also *cardiopulmonary resuscitation*.)

cardiac muscle

See *muscle*.

cardiac neurosis

Excessive anxiety about the condition of the heart. Cardiac neurosis usually follows a *myocardial infarction* (heart attack) or heart surgery, but sometimes occurs when the person has had no previous heart trouble.

A person who has cardiac neurosis experiences symptoms that are typical of heart disease, such as breathlessness and chest pain, and may be reluctant to exercise or work for fear of having a heart attack. Medical investigation reveals no physical problem, however.

Psychotherapy may help an affected person to overcome the anxiety and resume a normal, active life.

cardiac oedema

An abnormal build-up of fluid in body tissues that is caused by *heart failure* (inability of the heart to cope with its workload). (See also *oedema*.)

cardiac output

The volume of blood pumped by the heart each minute. Cardiac output is a measure that is used to assess how efficiently the heart is working. At rest, a healthy adult's heart pumps between 2.5 and 4.5 litres of blood per minute. During exercise, however, this figure may rise to as much as 30 litres per minute. A low output during exercise may indicate damage to the heart muscle or major blood loss.

cardiac stress test

One of a group of tests used to assess the function of the *heart* in people who experience chest pain, breathlessness, or palpitations during exercise. A cardiac stress test establishes whether the patient has *coronary artery disease* (in which the blood supply to the heart muscle is impaired).

An *ECG* machine records the patterns of the heart's electrical activity while the heart is stressed. This is usually

achieved by the patient exercising on a treadmill or stationary bicycle. Specific changes in the electrical pattern as exercise levels increase indicate *angina pectoris* (chest pain due to impaired blood supply to the heart muscle).

Cardiac stress testing may also be used in conjunction with *radionuclide scanning* in order to identify damaged areas of heart muscle.

cardiology

The study of the function of the *heart* and the investigation, diagnosis, and medical treatment of disorders of the heart and blood vessels, such as *atherosclerosis* (fat deposits on the artery walls) and *hypertension* (high blood pressure).

Some disorders reduce the pumping efficiency of the heart. They include arrhythmias (abnormalities in the rate or rhythm of the heartbeat; see *arrhythmia, cardiac*), *coronary artery disease* (in which the blood supply to the heart muscle is impaired), *cardiomyopathy* (in which the heart muscle itself is abnormal), and *heart valve* disorders.

Some babies are born with structural defects of the heart and/or the major blood vessels that emerge from it (see *heart disease, congenital*). Diseases of the lungs and blood vessels can also have adverse effects on heart function.

Many people with heart problems are treated by their general practitioners, but some may be referred to a cardiologist (a heart specialist). Investigations may include tests such as *echocardiography* (viewing the structure and movement of the heart using ultrasound) and detailed interpretation of *ECGs* (electrocardiograms, which measure the electrical activity of the heart). If coronary artery disease is suspected, the cardiologist may perform coronary *angiography* (taking X-ray images of blood vessels) and possibly widen any blocked blood vessels (see *angioplasty, balloon*). A cardiologist may, in turn, refer a patient to a cardiovascular surgeon if surgical treatment is required.

cardiomegaly

Enlargement of the *heart*. This condition may take the form of *hypertrophy* (thickening) of the heart muscle or of dilatation (increase in volume) of one or more of the heart chambers.

CAUSES

Hypertrophy of the heart muscle occurs in conditions in which the heart has to work harder than normal to pump blood. These disorders include *hypertension* (high blood pressure), which causes the wall of the left ventricle to thicken; *pulmonary hypertension* (raised blood pressure in the lungs), in which the wall of the right ventricle thickens; and one type of *cardiomyopathy* (disease of the heart muscle), in which the walls of one or both ventricles may thicken.

Dilation of a heart chamber may be due to heart valve incompetence (failure of a valve to close properly after a contraction). In *aortic insufficiency*, failure of the aortic valve to close completely allows blood to flow back from the aorta into the left ventricle after each contraction, eventually enlarging the chamber.

SYMPTOMS

Symptoms of cardiomegaly may not occur until the heart has enlarged to the point where it cannot cope with additional stress (for example, as a result of exercise or infection). The heart's reduced pumping efficiency leads to *heart failure,* with symptoms of breathlessness and ankle swelling.

DIAGNOSIS AND TREATMENT

Cardiomegaly is diagnosed by a physical examination, *chest X-ray*, and *ECG* (measurement of the electrical activity of the heart). Treatment is directed at the underlying cause.

cardiomyopathy

Any disease of the heart muscle that weakens the force of cardiac contractions, thereby reducing the efficiency of blood circulation. Cardiomyopathies may be the result of infectious, metabolic, nutritional, toxic, autoimmune, or degenerative disorders. However, in many cases, the cause is unknown.

TYPES

There are three principal forms of the condition: hypertrophic, dilated, and restrictive cardiomyopathy.

Chest X-ray showing cardiomyopathy
The heart has become greatly enlarged as a result of the heart-muscle abnormality.

In hypertrophic cardiomyopathy, the heart muscle is abnormally thickened. This condition is usually inherited.

In dilated cardiomyopathy, which is often of unknown cause, *metabolism* (chemical activity) of the heart muscle cells is abnormal and the heart's walls tend to balloon out under pressure.

Restrictive cardiomyopathy is a condition in which the heart walls are unusually inflexible, so that the heart cannot fill sufficiently with blood. It is often caused by scarring of the endocardium (the inner lining of the heart) or by *amyloidosis* (infiltration of the muscle with a starchlike substance).

SYMPTOMS AND SIGNS

Symptoms of cardiomyopathy include fatigue, palpitations, and chest pain. Palpitations may be due to an abnormal heart rhythm such as *atrial fibrillation* (rapid, uncoordinated contractions of the upper chambers of the heart).

The condition may lead to *heart failure*, in which the pumping action of the heart becomes less efficient. Symptoms of heart failure include breathing difficulty and *oedema* (abnormal fluid accumulation in body tissues).

DIAGNOSIS

A *chest X-ray* may show enlargement of the heart, and *echocardiography* (an ultrasound technique for imaging the structure and movement of the heart) may show thickened heart muscle. A *biopsy* (small tissue sample removed for microscopic analysis) of heart muscle may reveal muscle cell abnormalities.

TREATMENT

Symptoms of cardiomyopathy may be treated with *diuretic drugs* to control heart failure and *antiarrhythmic drugs* to correct the abnormal heart rhythm. In many cases, heart muscle function deteriorates, and the only remaining option is a *heart transplant*.

cardiopulmonary bypass

The procedure by which the circulation of blood around the body is maintained while the heart is stopped during heart surgery. A *heart–lung machine* is used to maintain the supply of oxygenated blood to the body tissues.

cardiopulmonary resuscitation

The administration of life-saving measures to a person who has suffered a *cardiac arrest* (in which the heart stops pumping blood). A person in cardiac arrest shows no sign of breathing and has no detectable pulse or heartbeat.

Brain damage is likely if the brain is starved of blood, and therefore oxygen, for more than three to four minutes.

First, mouth-to-mouth resuscitation (see *rescue breathing*) is given in order to restart the casualty's breathing. If this step fails, repeated chest compressions, using the heel of the hand, are applied to the lower part of the breastbone (see *external cardiac massage*) until emergency medical help arrives. These measures are used alternately to restore blood circulation to the brain.

cardiotocography

See *fetal heart monitoring*.

cardiovascular

A term that means "pertaining to the heart and blood vessels".

cardiovascular disorders

Disorders of the heart (see *heart* disorders box), blood vessels, and blood circulation (see *arteries, disorders of*; *veins, disorders of*).

cardiovascular surgery

The branch of surgery that is concerned with the heart and blood vessels. Cardiovascular surgery can be divided into two main areas.

One area, sometimes called cardiothoracic surgery, includes operations to prevent or repair damage to the heart itself and to the major blood vessels within the chest cavity. Cardiothoracic surgery is used, for example, to help treat damage due to congenital heart disease (see *heart disease, congenital*) or a *myocardial infarction* (heart attack).

The second area, which is known as vascular surgery, is concerned with the treatment of blood vessels elsewhere in the body, such as in the legs. (See also *heart valve surgery*, *coronary artery bypass*, and *heart transplant*.)

cardioversion

An alternative name for *defibrillation*.

carditis

A general term for inflammation of any part of the heart or its linings. There are three types. *Myocarditis* (inflammation of the heart muscle) is usually caused by a viral infection. *Endocarditis* (inflammation of the internal lining of the heart) is usually due to a bacterial infection. *Pericarditis* (inflammation of the outer covering of the heart) is usually the result of a viral or bacterial infection but may be associated with a *myocardial infarction* (heart attack) or an autoimmune disorder, such as systemic *lupus erythematosus*.

caries, dental

The gradual erosion of enamel (the hard covering of a tooth) and dentine (the softer substance that lies beneath the enamel). This condition is more commonly known as tooth decay.

CAUSES

The main cause of dental caries is *plaque*, a sticky substance consisting of food deposits, saliva by-products, and bacteria that collects on the surface of teeth. The breakdown of food deposits by bacteria creates acid that eats into the enamel to form cavities. Left unchecked, decay spreads to the dentine, and as the cavity enlarges, bacteria may invade and destroy the pulp tissue at the core of the tooth.

SYMPTOMS

Initial decay usually occurs on the grinding surfaces of the back teeth and on areas around the gum line. In the early stages, dental caries does not usually cause any symptoms. Advanced decay causes toothache (see *pulpitis*), however, which may be aggravated by eating very sweet, hot, or cold food. Sometimes advanced decay can also cause halitosis (bad breath).

TREATMENT

Treatment consists of drilling away the area of decay and filling the cavity (see *filling, dental*). In advanced decay, it may be necessary to remove the infected pulp and replace it with a filling (see *root-canal treatment*) or to extract the tooth (see *extraction, dental*).

PREVENTION

The risk of dental caries occurring is reduced by cutting down on sugar consumption, practising good *oral hygiene*, and visiting the dentist regularly. Water *fluoridation* and the use of fluoride toothpaste also helps to prevent caries.

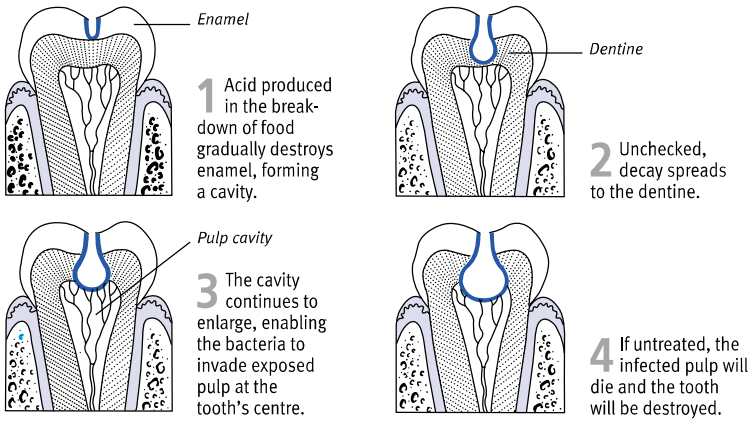
carminative

A medicine that relieves abdominal wind (*flatulence*). Carminatives are used in the treatment of *colic*.

CAUSES OF **CARIES** (TOOTH DECAY)

The primary cause of tooth decay is dental *plaque*, a sticky substance that forms on the teeth. Plaque consists of food remains, saliva by-products, and the bacteria that live in the mouth. The bacteria feed mainly on the fermentable carbohydrates (simple sugars and starches) in food, and, in breaking them down, create an acid that gradually destroys enamel, forming a cavity. If the process is not checked, the dentine is eroded next, enlarging the cavity and enabling the bacteria to invade the pulp at the centre of the tooth.

Micrograph of dental caries
The surface enamel of this decaying molar tooth is being broken down.



carotenaemia

A harmless condition in which blood levels of *carotene*, an orange pigment in certain vegetables, are very high as a result of excessive intake of these foods. Carotenaemia may cause temporary yellowing of the skin, especially on the palms and soles. Unlike *jaundice*, carotenaemia does not cause yellowing of the whites of the eyes.

carotene

A yellow or orange pigment found in carrots, tomatoes, and leafy green vegetables. The most important form of carotene is beta-carotene, an *antioxidant*. Beta-carotene is converted in the intestines into retinol (see *vitamin A*), which is essential for vision and healthy skin. Excessive intake of foods containing carotene may cause *carotenaemia* (temporary yellowing of the skin).

carotid artery

Any of the main arteries of the neck and head. There are two common carotid arteries (left and right), each of which divides into two main branches (internal and external).

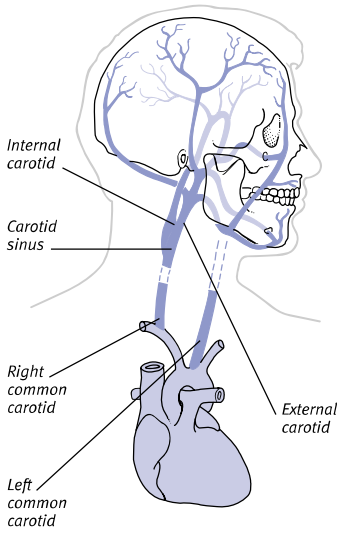
The left carotid artery arises from the *aorta* and runs up the neck on the left side of the *trachea* (windpipe). The right carotid artery arises from the subclavian artery (which branches off the aorta) and follows a similar route on the right side of the neck. Just above the level of the *larynx* (voicebox), each carotid artery divides to form an external carotid artery and an internal carotid artery.

The external arteries have multiple branches that supply most of the tissues in the face, scalp, mouth, and jaws. The internal arteries enter the skull to supply the brain and eyes. At the base of the brain, branches of the two internal carotids and the basilar artery join to form a ring of blood vessels called the circle of Willis. Narrowing of these vessels may be associated with *transient ischaemic attack (TIA)*; obstruction of them causes a *stroke*.

The carotid arteries have two specialized sensory regions in the neck: the carotid sinus, which monitors blood pressure, and the carotid body, which monitors the oxygen content of the blood and helps to regulate breathing. The carotid artery is one of the points at which the *pulse* can be measured. (See also *carotid bruit*; *carotid doppler scanning*; *carotid sinus syndrome*.)

LOCATION OF **CAROTID ARTERY**

The common carotid artery runs up each side of the neck and divides to form internal and external branches.



carotid bruit

An abnormal noise in a *carotid artery* (one of the major arteries supplying the neck and head), which is due to turbulent blood flow. A doctor can hear the noise with a stethoscope placed on the side of a person's neck, over the artery. A carotid bruit indicates narrowing (stenosis) of the artery, usually due to fatty deposits on the blood vessel lining (see *atherosclerosis*).

carotid doppler scanning

A method for assessing blood flow through the *carotid arteries* (the major arteries supplying the neck and head) by the use of *ultrasound scanning*. Carotid doppler scanning is used to investigate certain disorders, such as carotid artery stenosis (narrowing of the artery), *transient ischaemic attacks*, and *stroke*, that may be the result of narrowing of the common carotid arteries and their branches.

An ultrasound transducer is moved over each side of the neck in the area of the carotid arteries. The transducer emits ultrasound waves, which are reflected off the moving blood cells and blood-vessel walls to produce an image on a screen. This image reveals any narrowing of the arteries or turbulence in blood flow.

carotid sinus syndrome

A condition mainly affecting elderly people, in which the carotid sinus, a structure within the common *carotid artery* of the neck that regulates blood pressure, is overly sensitive.

The carotid sinus is a pocket in the artery at the point where the vessel divides to form two branches. It contains sensors that continually monitor blood pressure. When the blood pressure is raised, the sinus sends messages to the brain, which signals blood vessels to widen and the heart rate to slow, thus lowering the pressure.

In carotid sinus syndrome, the sinus reacts too readily: simply turning the neck suddenly or coughing can trigger the sensors. As a result, the brain slows the heart rate and lowers blood pressure excessively, causing the affected person to faint. This problem may be avoided by the insertion of a *pacemaker*, which will help to maintain a normal heart rate, overriding any inappropriate messages from the carotid sinus.

carpal tunnel syndrome

Numbness, tingling, and pain in the thumb, index finger, and middle fingers. Carpal tunnel syndrome is caused by compression of the *median nerve* at the wrist. The carpal tunnel, through which the nerve passes, is a narrow gap formed by the carpal bones of the wrist and a ligament that lies over them. The condition may affect one or both of the hands and is sometimes accompanied by weakness in the thumb. Symptoms may be worse at night.

CAUSES

Carpal tunnel syndrome is common among people who use computer keyboards, who make constant, repetitive hand movements. The condition also occurs without obvious cause in middle-aged women. In addition, it is quite common in pregnancy; in women who have begun using *oral contraceptives*; in those who suffer from *premenstrual syndrome*; and in men and women who suffer from *rheumatoid arthritis*, *myxoedema* (thickening and coarsening of the skin and other body tissues), and *acromegaly* (a condition in which there is abnormal enlargement of the skull, jaw, hands, feet, and internal organs).

TREATMENT

The condition often disappears without any treatment. Persistent symptoms may be treated by the injection of a *corticosteroid drug* under the ligament.

Alternatively, the ligament may be cut surgically in order to relieve pressure on the nerve.

carpopedal spasm

Involuntary contraction of muscles in the hands and feet. Carpopedal spasm is due to low levels of calcium in the blood. This problem, in turn, may be caused by *hyperventilation* (abnormally rapid breathing) or by disorders such as *hypoparathyroidism*.

carpus

The eight bones of the *wrist*.

carrier

A person who is able to pass on an infectious or inherited disease without actually suffering from it themselves.

car sickness

See *motion sickness*.

cartilage

A type of *connective tissue* (a material that holds body structures together) made up of varying amounts of the gel-like substance *collagen*. Cartilage is not as hard as *bone,* but it nevertheless forms an important structural component of various parts of the skeletal system, including the *joints*. Much of the fetal skeleton is formed entirely of cartilage. During childhood, the cartilage is gradually converted to bone by a process known as *ossification*.

TYPES

There are three main types of cartilage: hyaline cartilage, fibrocartilage, and elastic cartilage. Each type is composed of a different proportion of collagen and has a particular function.

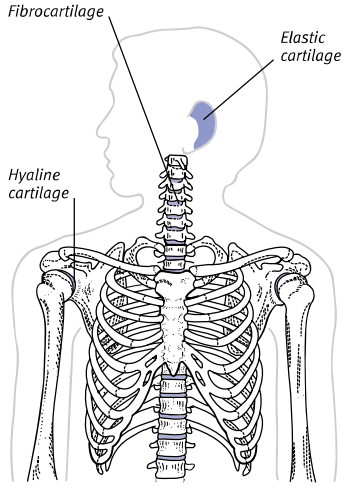
Hyaline cartilage is a tough, smooth tissue that lines the surfaces of joints, such as the knee, providing an almost frictionless layer over the bony parts of the joint. If the lining becomes worn (as occurs in *osteoarthritis*) or damaged, the movement of that joint may be painful or severely restricted.

Fibrocartilage contains a large proportion of collagen and is solid and strong. This type of cartilage makes up the discs that are situated between the bones of the spine (see *disc, intervertebral*). It also forms the shock-absorbing pads of tissue within joints.

Elastic cartilage is soft and rubbery. It is found in structures such as the outer ear and the *epiglottis*.

TYPES OF CARTILAGE

The three main types of cartilage have different amounts of collagen, vary in toughness and elasticity, and exist at different sites in the body.



caruncle

A general term for a small, fleshy swelling. Caruncles can be normal, such as the red, raised tissue in the inner corner of the eye. Some are abnormal, appearing as polyp-like growths; this type may be found, for example, at the opening of the urethra (the tube by which urine leaves the bladder).

Casal's necklace

A red rash forming a clearly defined ring around the neck. It is a symptom of *pellagra*, a disorder caused by lack of the B vitamin niacin in the diet.

cascara

A type of stimulant *laxative drug*, which can be used when rapid onset of action is needed. Cascara is now rarely used.

caseous abscess

An *abscess* (collection of pus) containing matter that resembles curds or cottage cheese. Caseous abscesses are most commonly due to *tuberculosis*.

cast

A rigid casing applied to a limb or other part of the body to hold a broken bone or dislocated joint in position as it heals. Most casts are made of bandages impregnated with resin or *plaster of Paris*, which are applied while wet and harden as they dry. Casts are removed using an electric saw that cuts through the cast but does not damage the skin.

castor oil

A colourless or yellow-tinged oil that is obtained from the leaves of the castor oil plant, RICINUS COMMUNIS. If taken orally, castor oil irritates the lining of the small intestine and has a powerful laxative action that completely empties the bowel. Zinc and castor oil are combined in a soothing ointment to treat conditions such as *nappy rash*.

castration

The surgical removal of the testes (see *orchidectomy*). The term "castration" is sometimes also used to refer to removal of the ovaries (see *oophorectomy*).

Castration is performed when the testes or ovaries are diseased. It may also be carried out in order to reduce the level of *testosterone* (a male sex hormone produced in the testes) or of *oestrogen* (a female sex hormone produced in the ovaries) in people who have certain types of *cancer* that are stimulated by these hormones.

Orchidectomy and oophorectomy are performed less frequently since the introduction of *gonadorelin* analogues, which are drugs that also act to reduce the amount of testosterone and oestrogen produced by the body.

catabolism

A chemical process by which constituents of food stored in the body (for example, fats) are broken down, releasing energy into the body cells (see *biochemistry; metabolism*).

catalepsy

A physical state in which the muscles of the face, body, and limbs stay in a semi-rigid, statuelike position for minutes, hours, or even days. Catalepsy sometimes occurs in people who have *schizophrenia* or *epilepsy* but may also be due to brain disease or certain drugs.

catalyst

A substance, such as an *enzyme*, that increases the rate of a chemical reaction without being permanently changed itself by that reaction.

cataplexy

A sudden loss of muscle tone, causing an involuntary collapse without loss of consciousness. Triggered by intense

emotion, particularly laughter, it occurs almost exclusively in sufferers of sleep disorders such as *narcolepsy*.

cataract

Loss of transparency of the *lens* of the *eye*, as a result of changes in its protein fibres. At an advanced stage, the front part of the lens becomes densely opaque, but the cataract never causes total blindness. A densely opalescent lens will still transmit light, but the clarity and detail of the image will be lost. Cataract usually occurs in both eyes, but in most cases one eye is more seriously affected than the other.

CAUSES

Almost everyone over 65 has some degree of cataract; the condition might be considered part of the normal aging process. Regular exposure to *ultraviolet light* increases the risk.

Other causes of cataract include an injury to the eye, particularly if a foreign body enters the lens. Cataract is also common in people with *diabetes mellitus* and may develop at an earlier age if blood sugar levels are not well controlled. Long-term use of *corticosteroid drugs* may contribute to cataract.

Congenital cataract may be due to an infection of the mother in early pregnancy, especially with *rubella* (German measles), or to the toxic effects of certain drugs in pregnancy. It may also be associated with *Down's syndrome* or the rare genetic disorder *galactosaemia*.

SYMPTOMS

Cataract is entirely painless and causes only visual symptoms. The onset of symptoms is almost imperceptible, although night driving may be affected in the early stages. There is slow, progressive loss of visual acuity (increasing blurring of vision). The person may become shortsighted and notice disturbances in colour perception.

TREATMENT

When vision has become significantly impaired, *cataract surgery* is performed to remove the lens and replace it with an implant. Provided the eye is otherwise healthy, cataract surgery generally gives excellent results.

cataract surgery

Removal of the *lens* from the eye. Cataract surgery is done to restore sight in people whose vision is impaired by a *cataract*. The lens is usually replaced with a plastic implant during the operation. Alternatively, for young people and those with other eye disorders, a contact lens or spectacle lens fitted after the operation may be preferable.

catarrh

Oversecretion of mucus by inflamed *mucous membranes* (see *rhinitis*), sinuses (see *sinusitus*) or air passages.

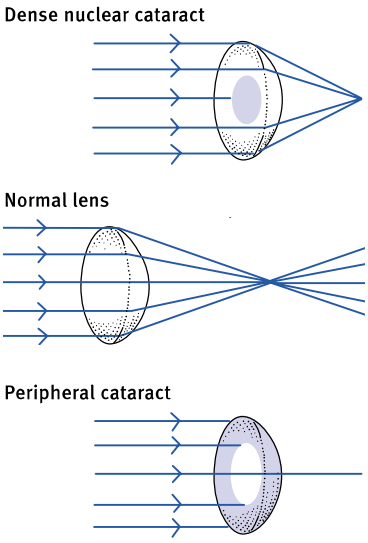
catatonia

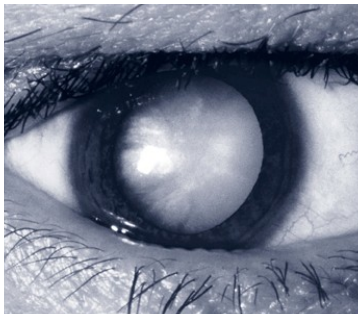
A state in which a person becomes mute or adopts a bizarre, rigid pose. The eyes usually remain open and the person may seem awake, but they make no voluntary movements. The state is seen in a rare form of *schizophrenia* and some types of brain disease.

C

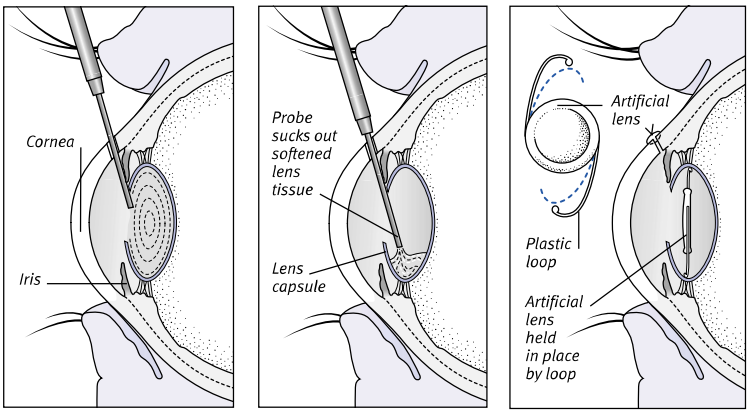
PROCEDURE FOR **CATARACT SURGERY**

In a normal, healthy lens there is no interference with the passage of light rays. Even when peripheral opacities develop, vision is not limited until the central zone is affected. Dense nuclear opacities, however, such as that shown on the right, cause deteriorating vision. The affected lens cannot be restored to its former transparency, hence the need for surgical replacement.





Appearance of cataract
In preparation for surgery, measurements are taken of the cornea and the eye's length to calculate the power of the lens implant that will be needed to restore vision fully. The operation may be performed using general or local anaesthesia; there is no pain in either case. Instruments of remarkable delicacy and precision are used for the procedure, usually with the help of microscope magnification.



1 An ultrasound probe is inserted into the lens capsule through a small incision in the cornea. The incision is made using a diamond tipped instrument.

2 The ultrasound probe softens the lens by emitting sound waves. It then sucks out the softened lens tissue. Only the front part of the lens capsule is removed.

3 An artificial lens is placed inside the lens capsule. The incision in the cornea is left to heal naturally, or it may be closed with a few surgical stitches.

C

catharthis

A word that means purification or cleansing. The term "catharsis" is used in medicine to refer to the process of cleaning out the bowels. In addition, the term was used by Sigmund Freud in *psychoanalytic theory* to describe the expression of previously repressed feelings and memories. Freud believed that the revival of "forgotten" memories and the expression of the emotions associated with them could bring relief from anxiety, tension, and a variety of other psychological symptoms.

cathartic

A term that means "having the power to purify or cleanse". A cathartic drug stimulates movement of the bowels (see *laxative drugs*).

catheter

A flexible tube that is inserted into the body to drain or introduce fluids or to carry out other functions. Catheters are commonly used to drain urine from the bladder (see *catheterization, urinary*). Other procedures using catheters may be performed in order to investigate the condition of the heart (see *catheterization, cardiac*), to widen obstructed blood vessels, or to control bleeding. (See also *balloon catheter*.)

catheterization, cardiac

A diagnostic procedure in which a fine, sterile *catheter* (flexible tube) is introduced into the heart through a vein or artery in the arm or leg. Cardiac catheterization is used to diagnose and assess the extent of congenital heart disease (see *heart disease, congenital*) and *coronary artery disease,* and to diagnose and treat some disorders of the heart valves (see *valvuloplasty*).

During the procedure, the pressure within the chambers of the heart may be measured, samples of blood and tissue may be taken for laboratory analysis, or a radiopaque dye (a substance that is opaque to X-rays) may be injected into the arteries in order for the cavities of the heart to be visible on an X-ray (see *angiography*).

The procedure causes little discomfort and is performed under local anaesthesia (see *anaesthesia, local*). A small incision is made in an artery or vein near the skin surface, and the catheter is introduced into the vessel. The tube is passed along the blood vessels and into the heart.

catheterization, urinary

The insertion of a sterile *catheter* (a flexible tube) into the *bladder* in order to drain urine from the body.

WHY IT IS DONE

Urinary catheterization is carried out when a person is unable to empty the bladder normally or is incontinent (see *incontinence, urinary*). The procedure is also performed during certain operations in which a full bladder might block the surgeon's view of surrounding organs; in bladder function tests such as *cystometry* and *cystourethrography*; and to monitor urine production in critically ill patients.

HOW IT IS DONE

There are two principal techniques: urethral catheterization (described in the illustrated box below), and suprapubic catheterization.

Suprapubic catheterization is used if it is not possible to pass a catheter up the urethra (for example, if the urethra is abnormally narrow). This form of catheterization involves the insertion of a catheter into the bladder directly through the abdominal wall, and this is carried out under local anaesthesia (see *anaesthesia, local*).

cation

An *ion* of positive charge. An example of a cation is the sodium ion in saline solution. (See also *electrolyte*.)

cation exchange resin

A type of drug used to remove excess *potassium* that has accumulated in the body because of *renal failure*.

CAT scanning

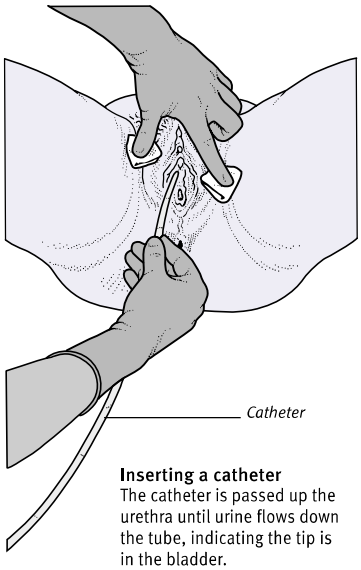
An abbreviation for computerized axial tomographic scanning, which is commonly known as *CT scanning*.

cat-scratch fever

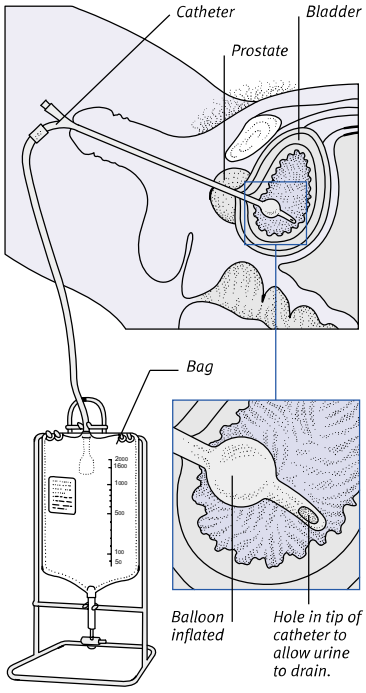
An uncommon disease that develops in people (mostly children) who have suffered a scratch or bite from a cat. The fever is due to infection with a bacterium called *Bartonella henselae*.

URETHRAL **CATHETERIZATION** OF THE BLADDER

A urinary catheter is usually passed into the bladder through the urethra. First, the doctor or nurse cleans the opening of the urethra with antiseptic solution to avoid introducing infection into the urinary tract. He or she then applies a local anaesthetic gel to the urethra. The procedure usually takes about 10 minutes.



Inserting a catheter
The catheter is passed up the urethra until urine flows down the tube, indicating the tip is in the bladder.



Self-retaining catheter
If the catheter is to remain in the bladder, a self-retaining type is used. This catheter has a balloon at its tip that can be inflated and filled with sterile water.

SYMPTOMS

The main symptom, appearing three to ten days after the bite or scratch, is a swollen *lymph node* near the affected area. The node may become painful and tender, and an infected blister may develop at the site of the injury. A fever, rash, and headache may occur.

DIAGNOSIS AND TREATMENT

Diagnosis of cat-scratch fever is confirmed by *biopsy* (removal of a small sample of tissue for microscopic analysis) of the swollen lymph node and by a skin test. *Analgesic drugs* (painkillers) may be used to relieve the fever and headache. In most cases, the illness clears up completely within two months.

cats, diseases from

Cats carry various parasites and infectious organisms that can be spread to humans. Some of these are specific to cats; others may also affect dogs.

SPECIFIC DISEASES

The most serious disease that can be contracted from an infected cat is *rabies*. Anyone who is bitten by a cat (or any other animal) in a country where rabies is present should seek medical advice without delay.

Cat-scratch fever is an uncommon illness that is caused by infection with the bacterium *Bartonella henselae* following a scratch or bite from a cat.

Cats commonly carry the *protozoan* (single-celled parasite) *Toxoplasma gondii*, which causes the disease *toxoplasmosis*. Infection with the parasite, which is usually from contact with a cat's faeces, is not generally serious, but it can have severe effects in pregnant women. Infections in early pregnancy can lead to *miscarriage* or severe malformation of the fetus. Later in pregnancy, infections can result in nervous system disorders in the fetus and may even lead to blindness in early childhood.

Cat faeces may also carry eggs of the cat roundworm, a possible cause of *toxocariasis*. Rarely, a larva from an ingested roundworm egg migrates to and lodges in an eye, causing deterioration of vision or blindness. Children who have been playing in sand or soil that has been contaminated by cat faeces are at risk of coming into contact with the worm eggs.

Other cat-related disorders in humans include *tinea* (fungal infections of the skin, hair, or nails), particularly ringworm, (ringlike fungal patches, often on the scalp), bites from cat fleas, and allergic reactions to dander (scales from animal skin, hair, or feathers) that may cause *asthma* or *urticaria* (nettle rash).

PREVENTION

Diseases from cats can be avoided by good hygiene, such as hand-washing, particularly after touching a cat. All pets should have regular worming and flea treatment and veterinary care if ill.

cauda equina

A "spray" of nerve roots resembling a horse's tail that descends from the lower *spinal cord* and occupies the lower third of the spinal canal.

caudal

This word is used to refer to the lower end of the *spine*. The word "caudal" means "of the tail".

caudal block

A type of *nerve block* in which a local anaesthetic is injected into the lower part of the spinal canal (the central space within the spine). Caudal block may be used to anaesthetize the buttocks and genitals as part of *obstetric* and gynaecological procedures.

cauliflower ear

Painful, swollen distortion of the pinna (ear flap) resulting from blows or friction that have caused bleeding in the soft *cartilage* of the ear.

Immediate treatment following an injury involves the use of ice-packs to reduce the swelling. In severe cases, a doctor may drain blood from the ear and apply a pressure bandage.

Example of cauliflower ear
Following injury to the ear, there has been bleeding into the soft cartilage. The ear flap has been deformed, with loss of the normal folds of skin.

causalgia

A persistent, burning pain, usually in an arm or leg. Causalgia most often occurs as a result of injury to a nerve by a deep cut, limb *fracture*, or gunshot wound. The skin overlying the painful area may be red and tender, or blue, cold, and clammy. The condition may be aggravated by light sensations, such as touch, or by emotional factors.

In some cases, treatment with *antidepressant drugs* or *anticonvulsant drugs* is effective. A few people benefit from *sympathectomy*, in which nerves supplying the affected area are severed.

caustic

Describes substances that have a burning or corrosive action on body tissues or a burning taste. An example is caustic soda, the common name for sodium hydroxide. Caustic agents such as silver nitrate are used to destroy warts.

cauterization

The application of a heated instrument to destroy tissues, stop bleeding, or promote healing. Cauterization may be used to treat conditions such as *haemorrhoids* (piles) and *cervical erosion*. It has been largely replaced by *electrocoagulation* (use of high-frequency electric current and, increasingly, laser to seal blood vessels).

Caverject preparations

A brand name for preparations of *alprostadil*, a *prostaglandin drug* used to treat impotence, normally by self-injection.

cavernous sinus thrombosis

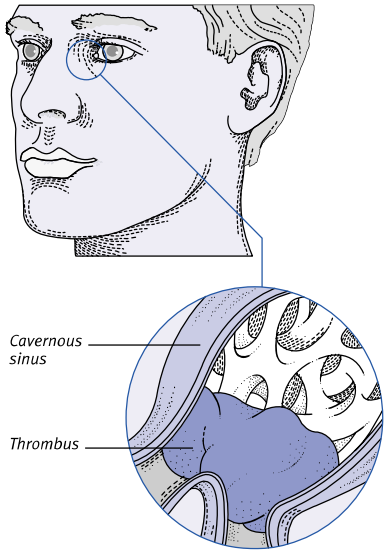
Blockage of a venous *sinus* (a channel for venous blood located deep inside the skull behind an eye socket) by a *thrombus* (an abnormal blood clot). Cavernous sinus thrombosis is usually a complication of a bacterial infection in an area drained by the veins entering the sinus. At first, only the veins behind one eye are affected, but within a few days the thrombosis may spread to the sinus behind the other eye.

CAUSES

Among the infections that can lead to cavernous sinus thrombosis are *cellulitis* (a severe skin infection) of the face, infections of the mouth, eye, or middle ear, *sinusitis* (infection of the air spaces of the facial skull), and *septicaemia* (infection in the bloodstream).

SYMPTOMS

Symptoms of cavernous sinus thrombosis include severe headache, high fever, pain and loss of sensation in and above the affected eye due to the pressure on the fifth cranial nerve, and *proptosis* (protrusion of the eyeball) due to swelling around and behind the eye. In some cases, vision may become blurred



Thrombus in cavernous sinus
The clot obstructs blood flow in the cavernous sinus, causing pressure behind the eye socket.

and eye movements may be paralysed due to pressure on the *optic nerve* and other cranial nerves.

TREATMENT

Treatment with *antibiotic drugs* and *anticoagulant drugs* can save vision. Left untreated, blindness will result, and the infection may eventually prove fatal.

cavity, abdominal

See *abdomen*.

cavity, dental

A hole in a tooth, commonly caused by dental caries (see *caries, dental*).

cavity, oral

See *mouth*.

cavity, pelvic

The area of the body that lies below the abdomen, framed by the pelvic bones and lower spine. The pelvic cavity contains the lower digestive and urinary organs, nearly all of the reproductive organs in females, and part of the reproductive system in males.

cavity, pleural

The space between the two layers of the *pleura* (membrane) that lines the chest wall and the outside of the lungs.

CD4 count

A blood test used to monitor *HIV infection* and *AIDS*. The procedure involves counting the number of CD4 *lymphocytes* (white blood cells responsible for fighting infection) in a blood sample. CD4 lymphocytes are destroyed by HIV, and reduced levels of these cells indicate the progression of HIV and the eventual development of AIDS.

cefaclor

A common antibiotic that belongs to the group of *cephalosporin drugs*.

cefadroxil

A *cephalosporin drug*, which is used to treat bacterial infections.

cefalexin

A *cephalosporin drug*, which is used to treat bacterial infections.

cefotaxime

A *cephalosporin drug*, which is used to treat bacterial infections.

cefuroxime

A *cephalosporin drug*, which is used to treat bacterial infections.

celecoxib

A COX-2 inhibitor drug (a type of *non-steroidal anti-inflammatory drug*) used to relieve the pain and inflammation of *rheumatoid arthritis* and *osteoarthritis*. Side effects of celecoxib include nausea and diarrhoea. Abdominal discomfort may also occur, but can be minimized by taking the drug with food.

cell

The basic structural unit of all living organisms. The human body comprises billions of cells, which are structurally and functionally integrated to perform the complex tasks necessary for life. In spite of variations in size and function, most of the cells have a similar form.

CELL MEMBRANE

Each cell is a microscopically small bag containing liquid cytoplasm. It is surrounded by a membrane that regulates the passage of useful substances (such as oxygen and nutrients) into the cell and waste materials (such as carbon dioxide) and manufactured substances (such as hormones) out of the cell. Some cells, such as those lining the small intestine, have microvilli, projections that increase the cells' surface area to facilitate absorption.

NUCLEUS

All cells, except red blood cells, have a *nucleus*. The nucleus controls all major cell activities by regulating the amount and types of *proteins* made in the cell. Inside the nucleus are *chromosomes*, which are made of the nucleic acid *DNA*. This acid contains the instructions for *protein synthesis*, which are carried into the cytoplasm by a type of *RNA* (another nucleic acid) and are decoded in particles called ribosomes. The nucleus also contains a spherical structure called the nucleolus, which plays a role in the production of ribosomes.

ORGANELLES

In the cytoplasm there are various tiny structures called organelles, each with a particular role. Energy is generated by *mitochondria* breaking down sugars and fatty acids. Substances that would damage the cell if they came into contact with the cytoplasm are contained in particles called lysosomes and peroxisomes. A system of membranes in the cytoplasm, called the endoplasmic reticulum, transports materials through the cell. Flattened sacs called the Golgi complex receive and process proteins from the endoplasmic reticulum.

Enzymes and hormones are secreted by vesicles (small saclike structures) at the cell surface. Some waste products and other materials are transported and stored in vacuoles (spaces created by the cytoplasm). The cytoplasm has a network of fine tubes (microtubules) and filaments (microfilaments) known as the cytoskeleton, which gives the cell a definite shape.

cell death

See *apoptosis*.

cell division

The processes by which cells multiply. *Mitosis* is the most common form of cell division, giving rise to daughter cells identical to the parent cells. *Meiosis* produces egg (see *ovum*) and *sperm* cells that differ from their parent cells in that they have only half the normal number of *chromosomes*.

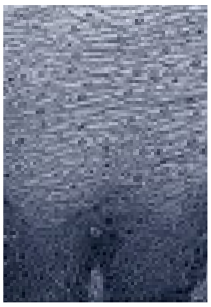
cellular immunity

The part of the body's defence mechanisms (see *immune system*) that attacks and destroys harmful cells directly rather than by using *antibodies* (proteins created to combat infection).

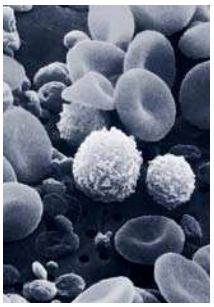
Lymphocytes (a type of white blood cell) mount a response against infectious organisms and other abnormal cells, such as cancer cells. There are two main types: T-lymphocytes, which provide cellular immunity, and B-lymphocytes,

CELL TYPES

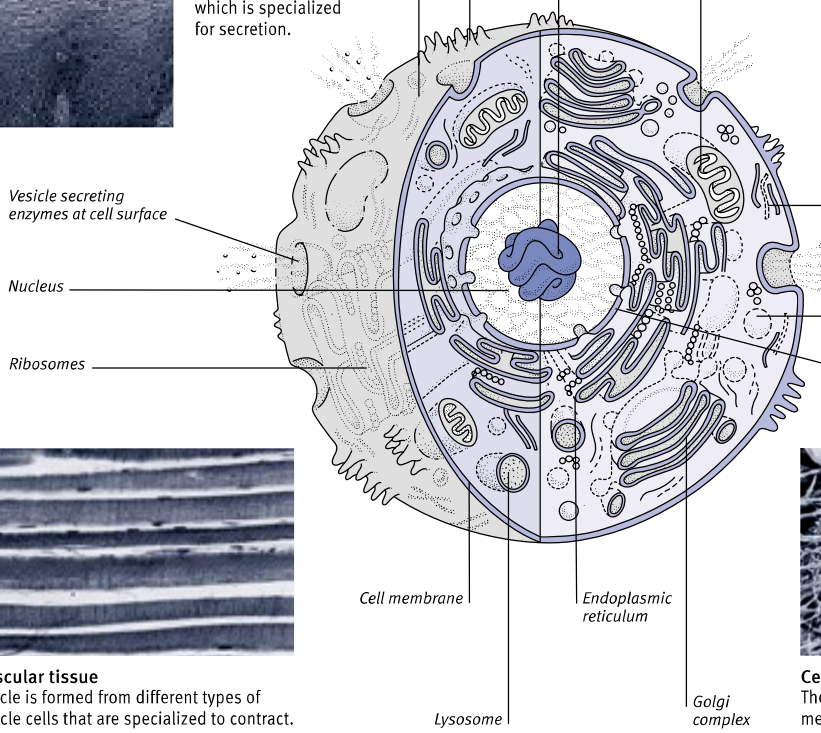
Despite their fundamental similarities in structure, the cells of the body are differentiated so that they can perform a variety of specific tasks, such as carrying oxygen (red blood cells), destroying invading microorganisms (white blood cells), and making hormones (secretory cells in glands). Some cells (nerve cells, for instance) cannot be replaced once they have been destroyed, while other cells (those that form toe- and fingernails, for instance) regrow and continue to function even after a person's death. There are four main types of cells, which are grouped according to their primary functions.



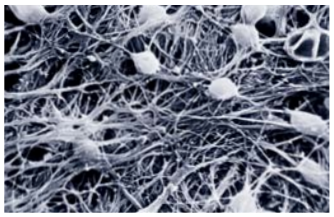
Epithelial cells
These make up the tissues that cover the outside of the body and line the digestive, respiratory, and urinary tracts. The epithelium includes glandular tissue, which is specialized for secretion.



Blood cells
Red and white blood cells, and platelets, circulate individually in the blood to carry nutrients and combat infection and injury.



Muscular tissue
Muscle is formed from different types of muscle cells that are specialized to contract.



Cells in the nervous tissue
These cells conduct electrochemical messages throughout the body.

which produce antibodies. T-lymphocytes recognize specific antigens (substances that the body identifies as foreign), including cancer cells and cells infected by viruses. One group of T-lymphocytes, known as killer T-cells, attach themselves to the abnormal cells and release toxic proteins that destroy them. (See also *humoral immunity*.)

cellular pathology

See *pathology, cellular*.

cellulite

The popular term for the subcutaneous fat that gives the skin a dimpled, or orange-peel, appearance, especially on the thighs and buttocks. Cellulite usually affects women rather than men and is often attributed to water retention.

cellulitis

A bacterial infection of the skin and the tissues beneath it, which usually affects the lower legs but can occur anywhere on the body. Cellulitis is most commonly caused by streptococci bacteria, which enter the skin via a wound.

SYMPTOMS

There may be fever and chills; and the affected area is hot, red and swollen. Cellulitis is more severe in people with reduced immunity, such as those who have an *immunodeficiency disorder*.

Untreated cellulitis at the site of a wound may progress to *bacteraemia* (bacterial infection of the blood) and *septicaemia* (blood poisoning). Facial infections may spread to the eye socket.

TREATMENT

Treatment of cellulitis is with an *antibiotic drug* such as a *penicillin* drug or *erythromycin*. (See also *erysipelas*.)

cellulose

A *carbohydrate* consisting of chains of glucose (a simple sugar). Cellulose is the main constituent of plant-cell walls. Because it cannot be digested, cellulose is an important source of dietary fibre (see *fibre, dietary*).