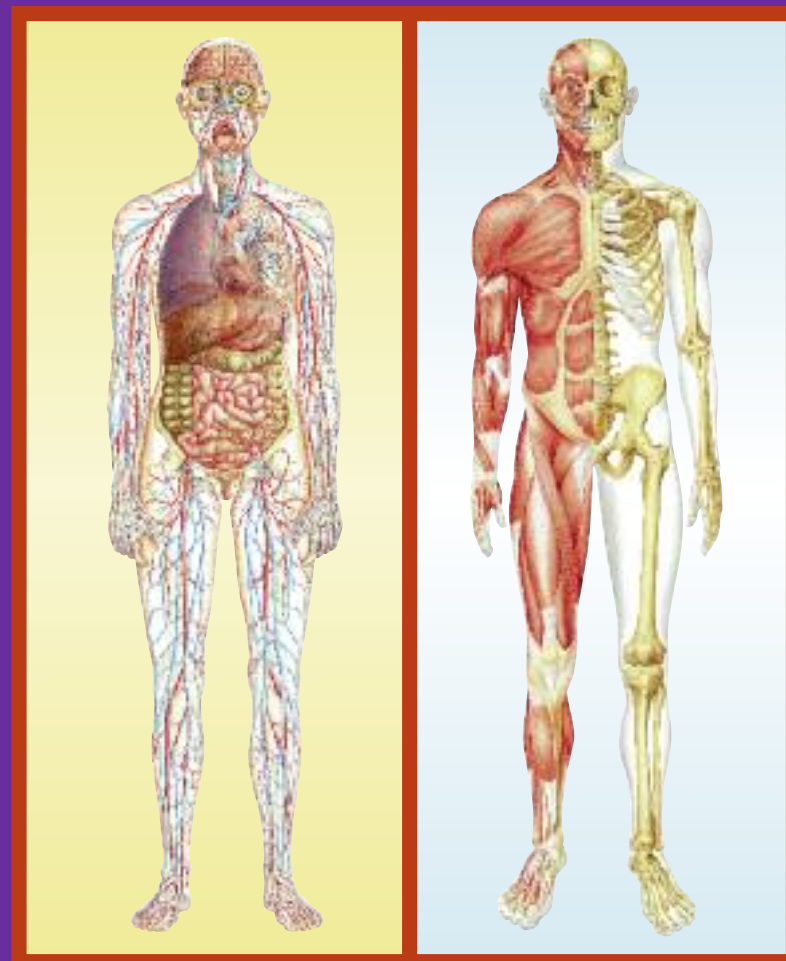


PANORAMAS HUMAN BODY



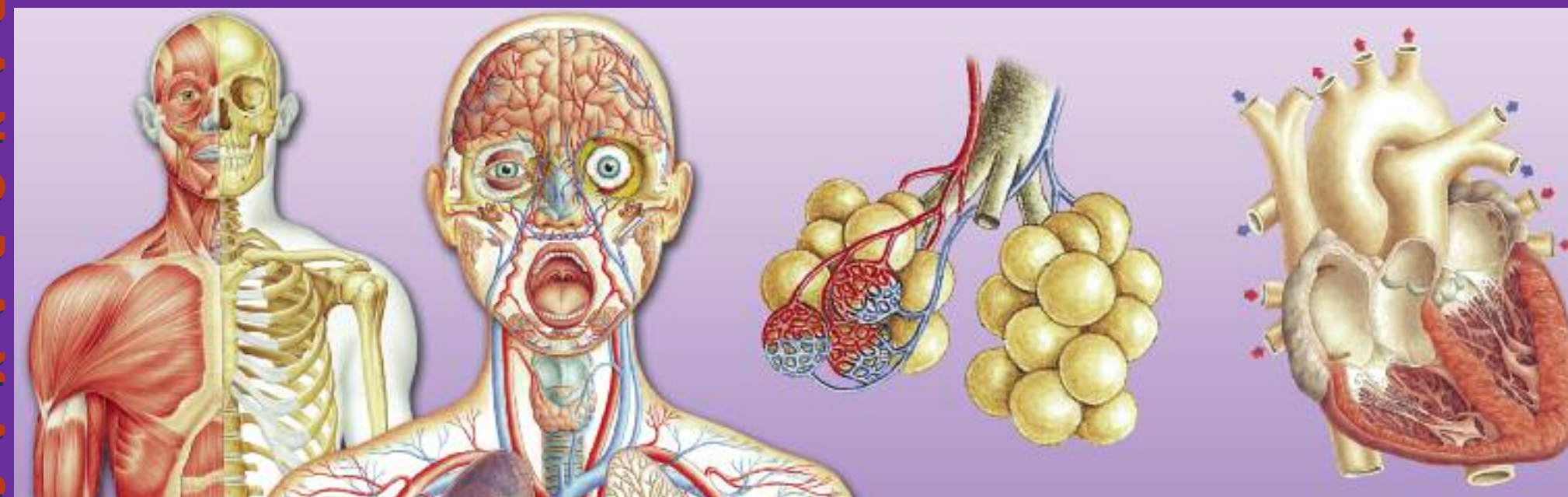
Open this book and see the human body unfold before your eyes! There are two giant panoramas inside, both more than three feet tall and illustrated in superb detail. One shows the internal organs and blood vessels, while the other presents the skeleton and muscles, a miracle of natural design.

BACK
PACK
BOOKS



PANORAMAS

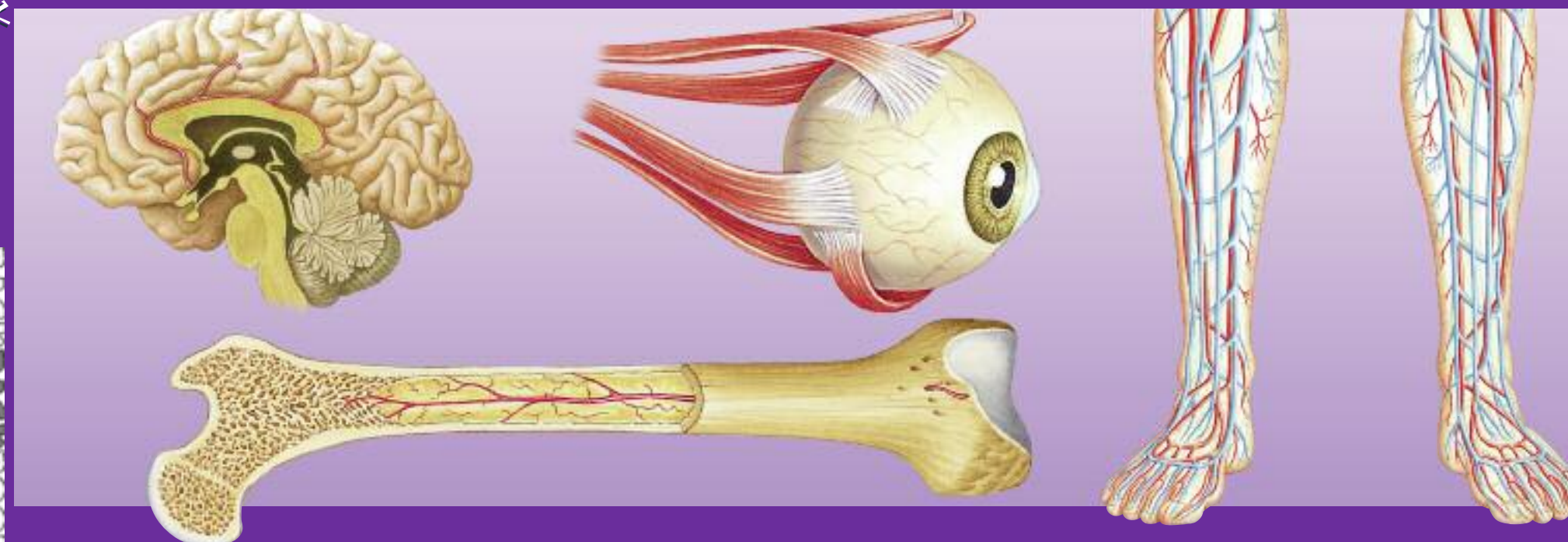
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HUMAN BODY

HUMAN BODY

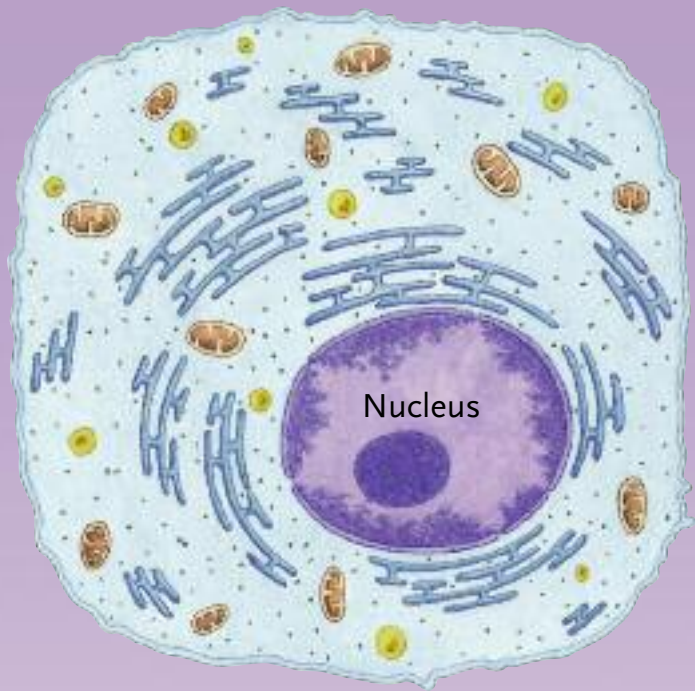
BACKPACK BOOKS



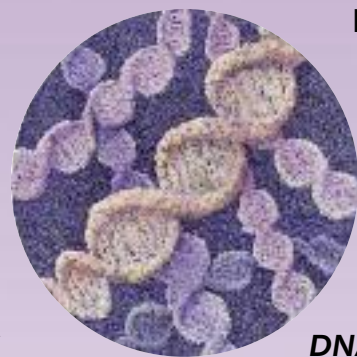
TWO FANTASTIC SCENES TO UNFOLD

PANORAMAS

HUMAN BODY

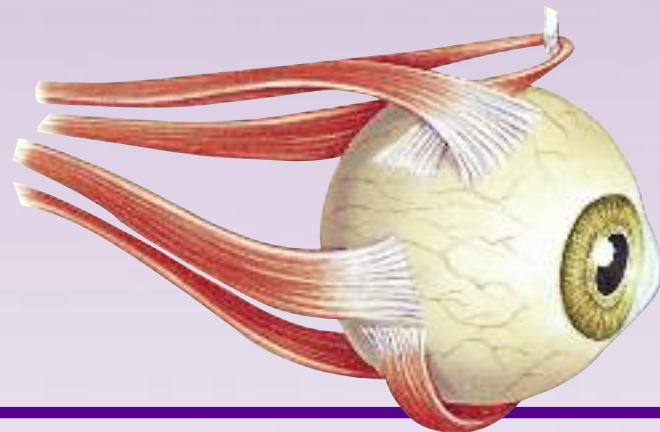


This is the thigh bone or femur (*right*). Its ball-shaped head fits into the socket in the hip bone. Its lower end connects with the shin bone or tibia at the knee joint. Bones have a hard outer layer of compact bone. Inside, there is light, but strong, spongy bone. The hollow centre is filled by jelly-like marrow.

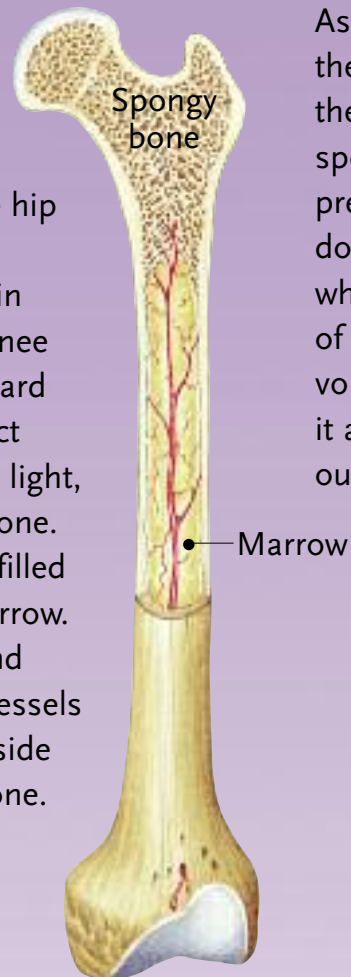


DNA

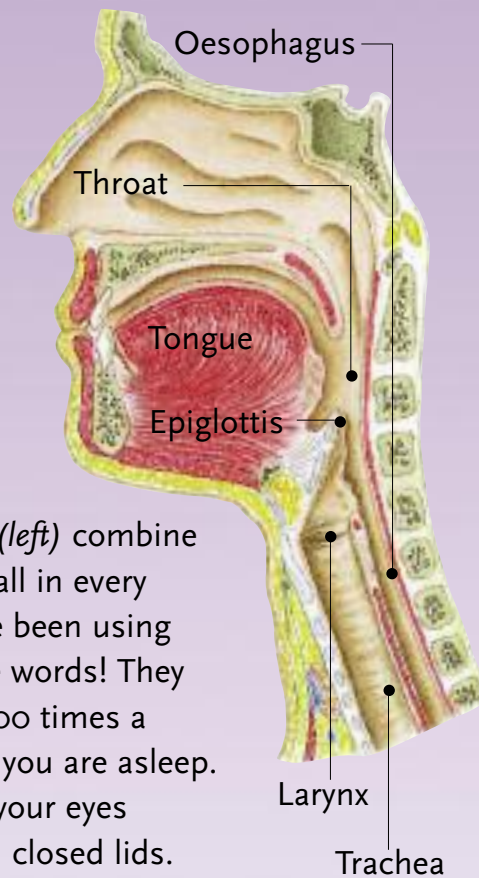
Your body is made up of microscopic “building blocks” called cells. There are more than 75 million million of them. You have more than 200 different kinds; for example, blood cells (*see page 6*), brain cells, nerve cells, and so on. A typical cell (*above*) is like a bag of jelly containing various working parts. Coiled up inside the nucleus are long strands of a substance called DNA. This contains your genes, a kind of “instruction manual” for the creation of



Nerves and blood vessels run inside the bone.

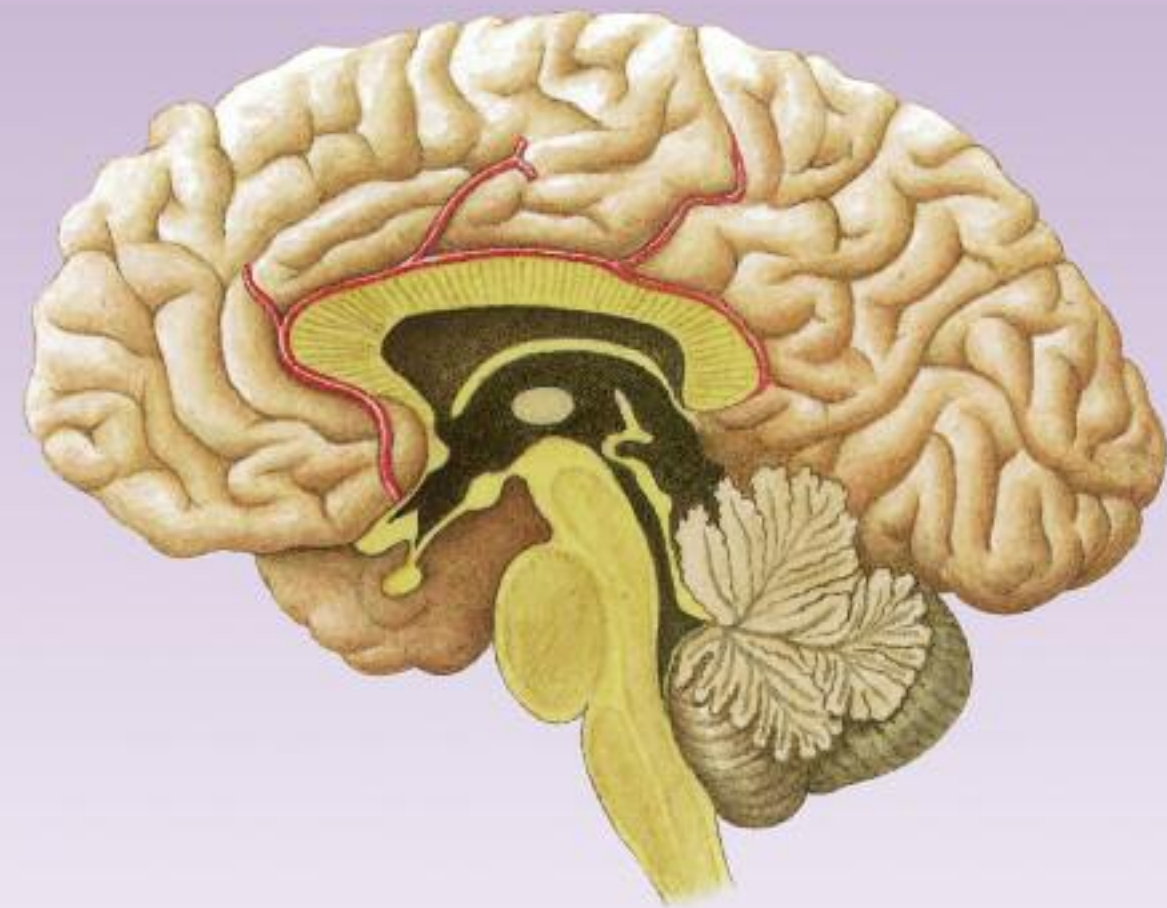


As well as a passage for food, the throat (*below*) lets air reach the lungs and allows you to speak. A flap called the epiglottis prevents food from slipping down the trachea by closing when you eat or drink. At the top of the trachea is your larynx or voice box. Two straps lie across it and vibrate when you breathe out, producing sounds.



Six small muscles (*left*) combine to move your eyeball in every direction. You have been using them to read these words! They move about 100,000 times a day—mostly while you are asleep. When you dream, your eyes flicker away behind closed lids.

PANORAMAS HUMAN BODY



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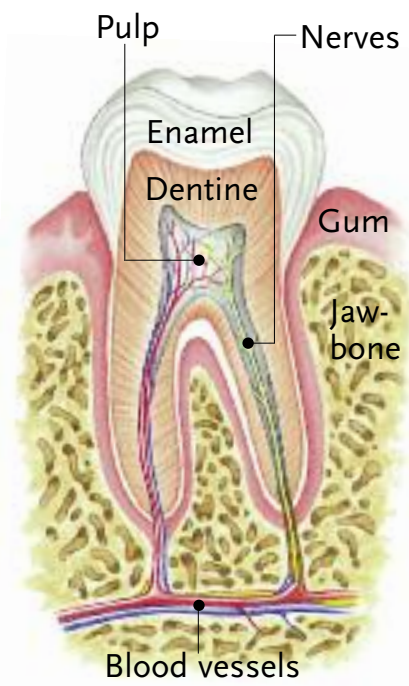
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The Skeleton and Muscles
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- 22 Glossary and Index



TEETH

Beneath the gums, deep roots firmly anchor your teeth to the jawbone. Teeth are made of a substance called dentine, cased in a tough layer of enamel. Inside there is a cavity containing a soft tissue called pulp and a cluster of tiny nerves and blood vessels.

4 FATS AND CARBOHYDRATES

Fats are found in meat, vegetable oil, pies, cheese and avocados. Carbohydrates include starches and sugars found in bread, pasta, potatoes, rice and other cereals. During digestion, starch turns into glucose. This substance gives your body energy.

CARBOHYDRATES

FATS

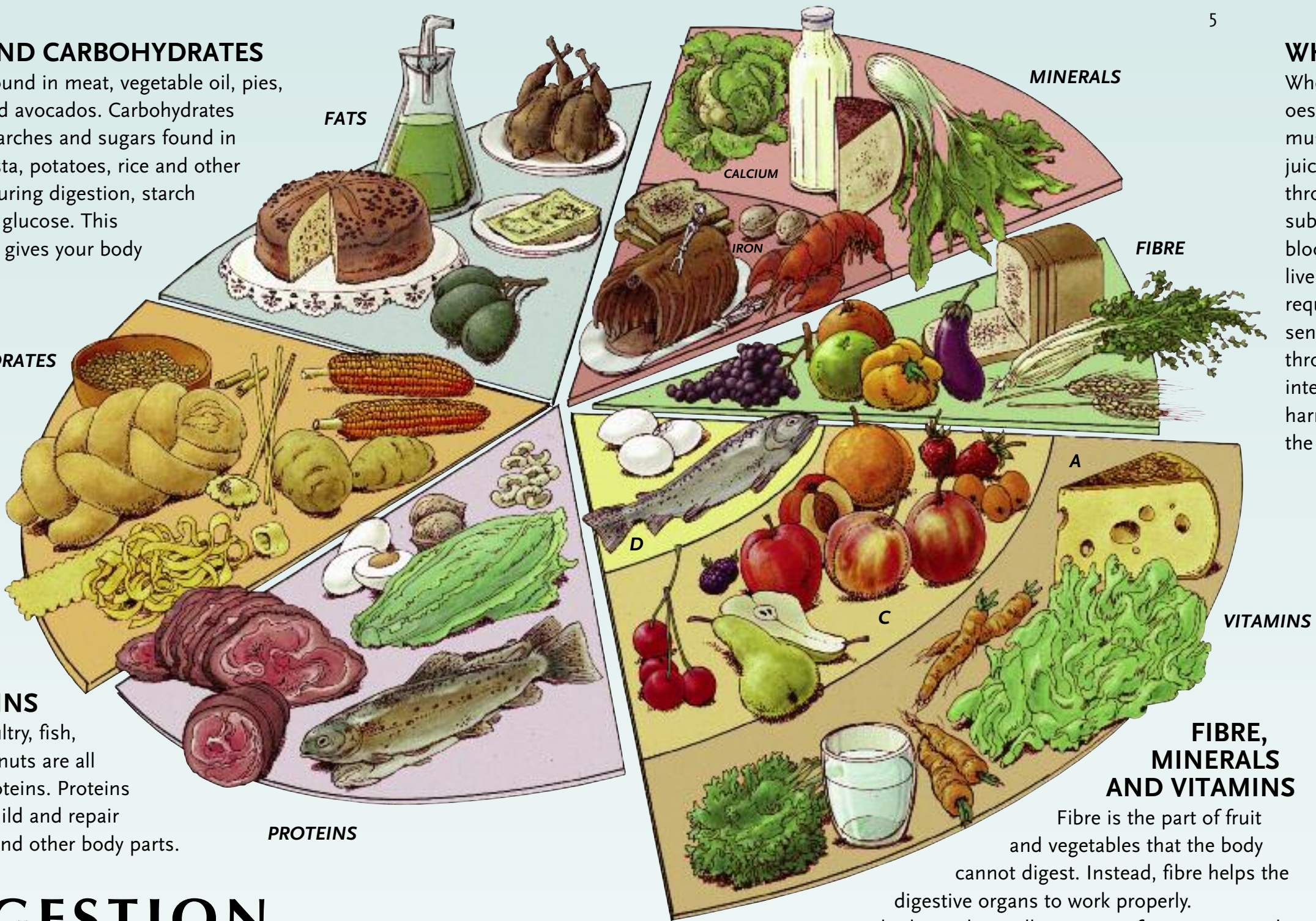
PROTEINS

Meat, poultry, fish, eggs and nuts are all rich in proteins. Proteins help to build and repair muscles and other body parts.

PROTEINS

DIGESTION

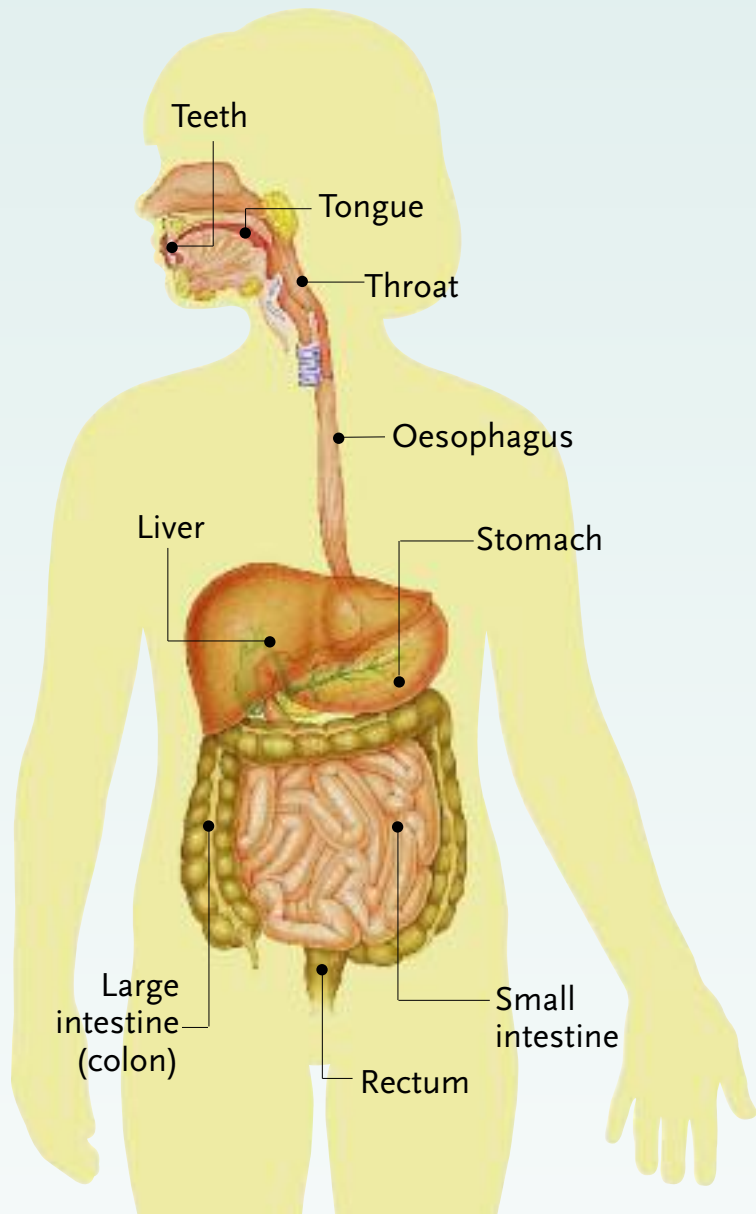
WHEN you eat, your body breaks down food into nutrients, a process called digestion. Proteins, fats, carbohydrates, minerals and vitamins are all nutrients the body needs. Different foods are rich in certain nutrients.



5

WHAT HAPPENS TO YOUR FOOD?

When you swallow your food, it is squeezed down the oesophagus to your stomach, a stretchy bag of muscle. Here, food is churned up and mixed with juices. The soft, gooey mixture is then squeezed through to the small intestine. Here the useful substances in your food, the nutrients, pass into the blood. All blood from the intestine passes through the liver, which stores the nutrients, releasing them when required. It also removes unwanted substances and sends them to the kidneys, which gets rid of them through your urine. When the food reaches the large intestine, or colon, all that is left is plant fibre, harmless bacteria and water. Solid waste collects in the rectum, while water is taken back into the blood.



BLOOD

SEEN UNDER a powerful microscope, blood is made up of billions of tiny cells, floating around in a yellowish, watery liquid called plasma. There are different kinds of blood cell. One tiny drop of blood the size of a pinhead contains about 5 million red blood cells, 9000 white cells, and about 250,000 fragments of cells, called platelets. Nutrients (see page 4) are dissolved in the plasma.



RED BLOOD CELL

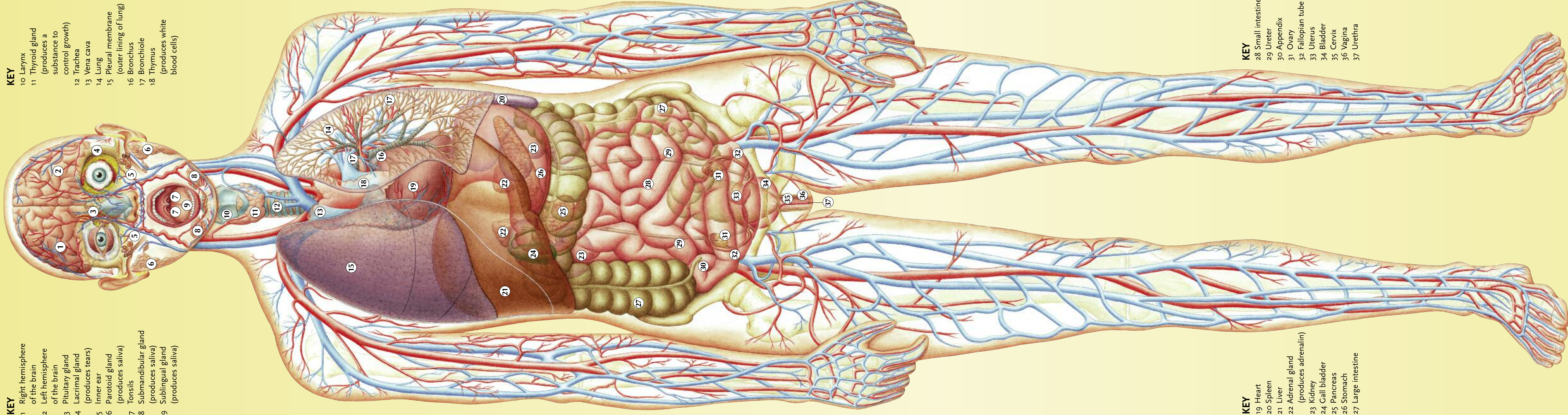
WHITE BLOOD CELL

PLATELETS
(STARTING TO
CLOT)

BLOOD CELLS

This illustration is a greatly magnified view of blood cells. Red cells carry oxygen from the lungs to all parts of the body. They are doughnut-shaped “sacks” of haemoglobin, a substance that combines very readily with oxygen. White cells are like a small army, ready to defend the body against invading bacteria and viruses. Different types of white cells work together to do this: T-cells identify the invaders, B-cells make deadly substances called antibodies that surround the invaders, while macrophages engulf and destroy them.

Platelets help make the blood clot when a blood vessel is damaged and so prevent it leaking out of the body.



KEY

- 1 Right hemisphere of the brain
- 2 Left hemisphere of the brain
- 3 Pituitary gland
- 4 Lacrimal gland (produces tears)
- 5 Inner ear
- 6 Parotid gland (produces saliva)
- 7 Tonsils
- 8 Submandibular gland (produces saliva)
- 9 Sublingual gland (produces saliva)

KEY

- 10 Larynx
- 11 Thyroid gland (produces a substance to control growth)
- 12 Trachea
- 13 Vena cava
- 14 Lung
- 15 Pleural membrane (outer lining of lung)
- 16 Bronchus
- 17 Bronchiole
- 18 Thymus (produces white blood cells)

KEY

- 19 Heart
- 20 Spleen
- 21 Liver
- 22 Adrenal gland (produces adrenalin)
- 23 Kidney
- 24 Gall bladder
- 25 Pancreas
- 26 Stomach
- 27 Large intestine

KEY

- 28 Small intestine
- 29 Ureter
- 30 Appendix
- 31 Ovary
- 32 Fallopian tube
- 33 Uterus
- 34 Bladder
- 35 Cervix
- 36 Vagina
- 37 Urethra

INSIDE THE HUMAN BODY

The Internal Organs

THE HUMAN BODY is the most studied object in all of science. Yet every year we learn even more about its most detailed structures and its innermost workings. Even in ancient times people have known basic facts—for example, that there are 206 bones in its skeleton. Since the invention of the microscope nearly 400 years ago, people have studied the body's billions of tiny building blocks, known as cells. In more recent years we have learned about the instructions for making the body—its genes.

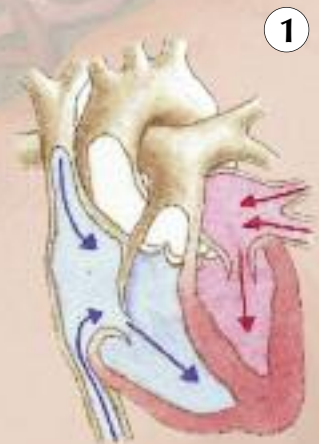
The body's main parts, like the brain, heart, lungs and stomach are called organs. Different groups of organs work together as systems. Each system has a vital job to keep the whole body alive and healthy. For example, the heart, the body-wide network of tubes called blood vessels, and the blood itself, together form the circulatory system. This carries essential nutrients and oxygen to all body parts and collects waste materials for disposal. There are about a dozen major systems, including the digestive and breathing systems.

HEART AND LUNGS

ALL the muscles and tissues that make up the body must be continually supplied with food and oxygen. This job is carried out by the blood system.

The heart pumps the blood around the body. About the size of your fist, it is a very strong organ, made entirely of muscle. It beats more than two billion

times during the average life span of a person and pumps about 340 litres of blood every hour—enough to fill a car's petrol tank every seven minutes! You can feel its pumping action by placing your fingers on the inside of your wrist or the side of your neck, both points where a main artery lies close to the surface.



1

THE HEART

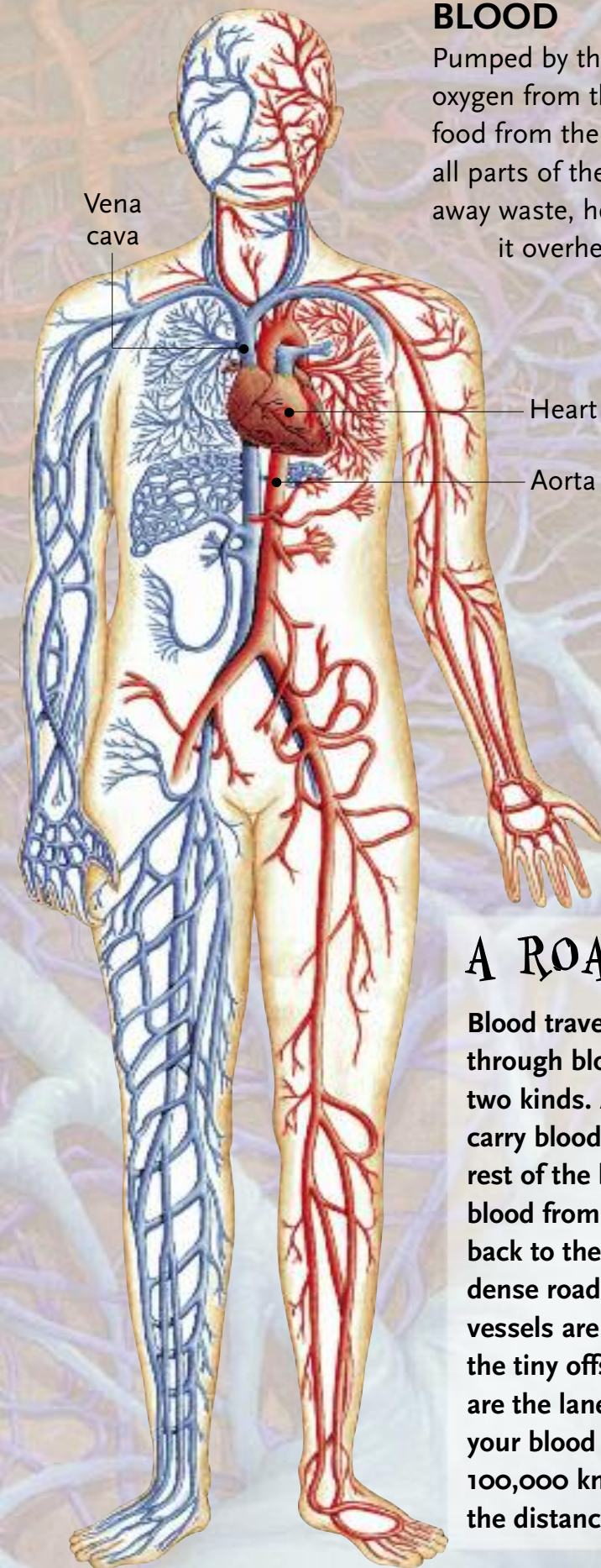
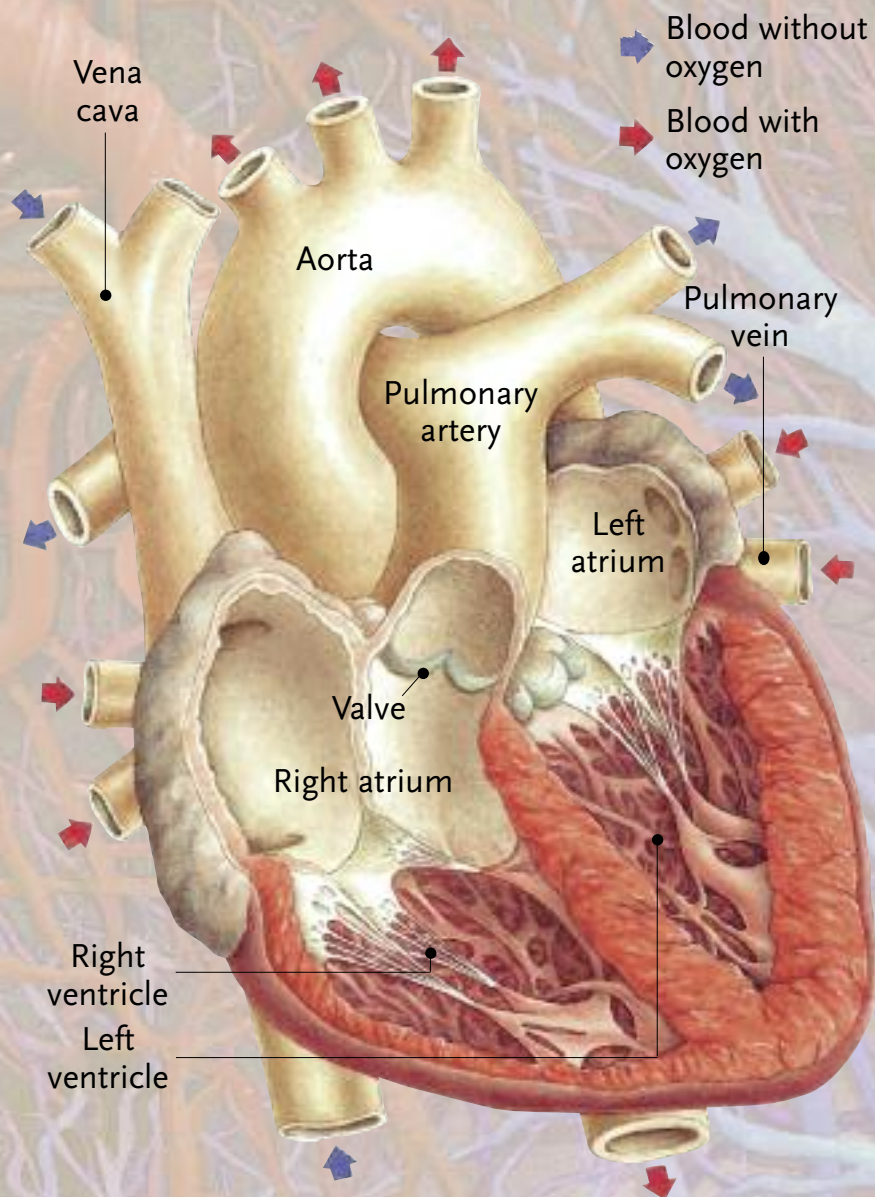
The heart has four chambers (left and right atriums, left and right ventricles). Flaps, called valves, slam shut to prevent blood leaking back once it has entered each chamber (this is the heartbeat you can hear in someone's chest).

When the heart muscles relax, blood flows in (1). Fresh blood enters via the pulmonary vein from the lungs (shown in red), while blood exhausted of oxygen arrives along the vena cava from the rest of the body (shown in blue). When full of blood, the heart then squeezes inwards and the blood is pushed out (2).

The exhausted blood travels along the pulmonary artery to the lungs to be refilled with oxygen. Meanwhile, the fresh blood passes through the aorta to the rest of the body.



2



BLOOD

Pumped by the heart, blood collects oxygen from the lungs and dissolved food from the liver and delivers it to all parts of the body. It also clears away waste, helps cool the body when it overheats, clots when the skin is damaged and protects against invading bacteria and viruses.

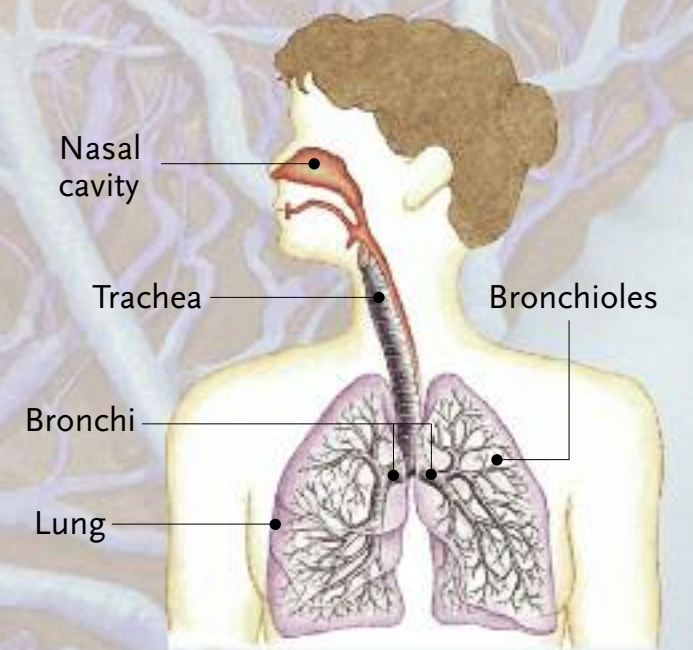


ARTERY

VEIN

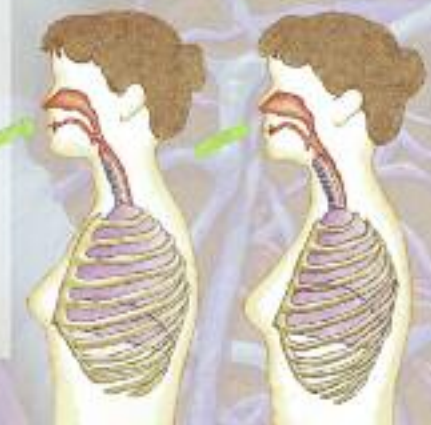
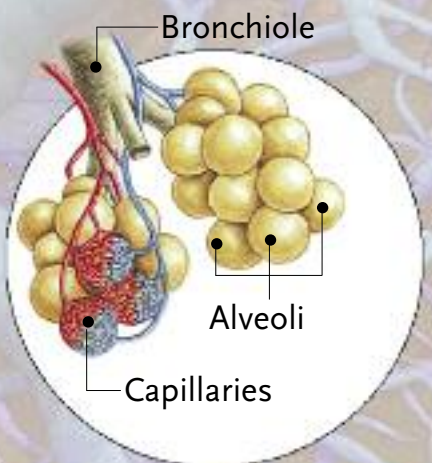
A ROAD NETWORK

Blood travels around the body through blood vessels. There are two kinds. Arteries (shown in red) carry blood from the heart to the rest of the body. Veins (blue) carry blood from the rest of the body back to the heart. They are like a dense road network. The main vessels are like motorways, while the tiny offshoots, the capillaries, are the lanes and tracks. Altogether, your blood vessels are about 100,000 km long—more than twice the distance around the world!



THE LUNGS

When you breathe in, oxygen passes to the lungs via your trachea. This splits into two bronchi—one for each lung—and each divides into smaller bronchioles, which lead to millions of tiny air sacs called alveoli. Capillaries link the alveoli to blood vessels from the heart. The oxygen replenishes the blood arriving from the heart. Meanwhile, the waste gas carbon dioxide passes in the opposite direction. When you breathe out, it makes the return journey along the bronchioles to the trachea and out into the open air.



To breathe in, the rib cage expands, making the lungs bigger. Air is sucked in to fill the space. To breathe out, the lungs return to their former size, pushing out the air.

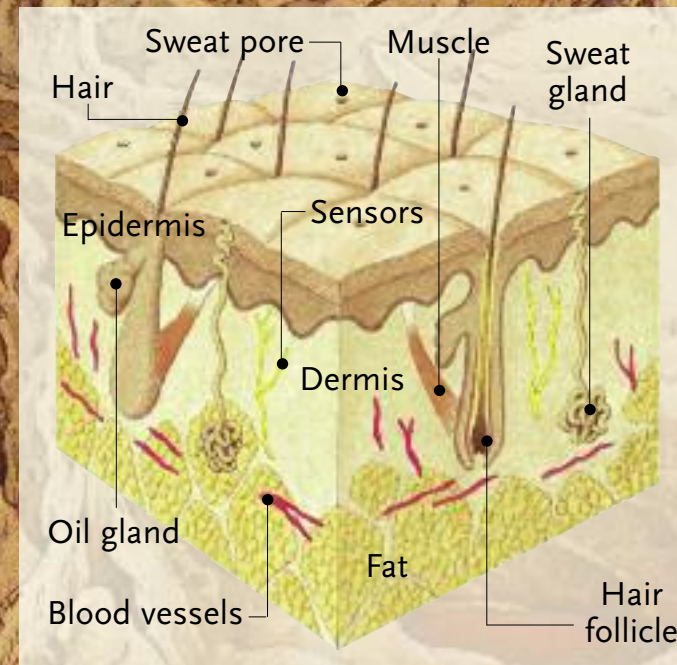
SKIN AND HAIR

MORE THAN just an outer layer around our bodies, the skin is the body's largest organ. It has important functions of its own. It is waterproof and protects you from the sun's harmful rays. It also helps control your body temperature and the nerve endings within it are extremely sensitive to touch and pain.

Hair is made from keratin, the same substance that forms fingernails and the skin's outer surface. The visible part, the shaft, is dead tissue. The live part is at the base, deep inside a pit in your skin.

SKIN IN CLOSE-UP

This illustration shows a greatly magnified view of your skin and hair. The outer layer of skin is always renewing itself as the dead surface flakes away.



A PIECE OF SKIN

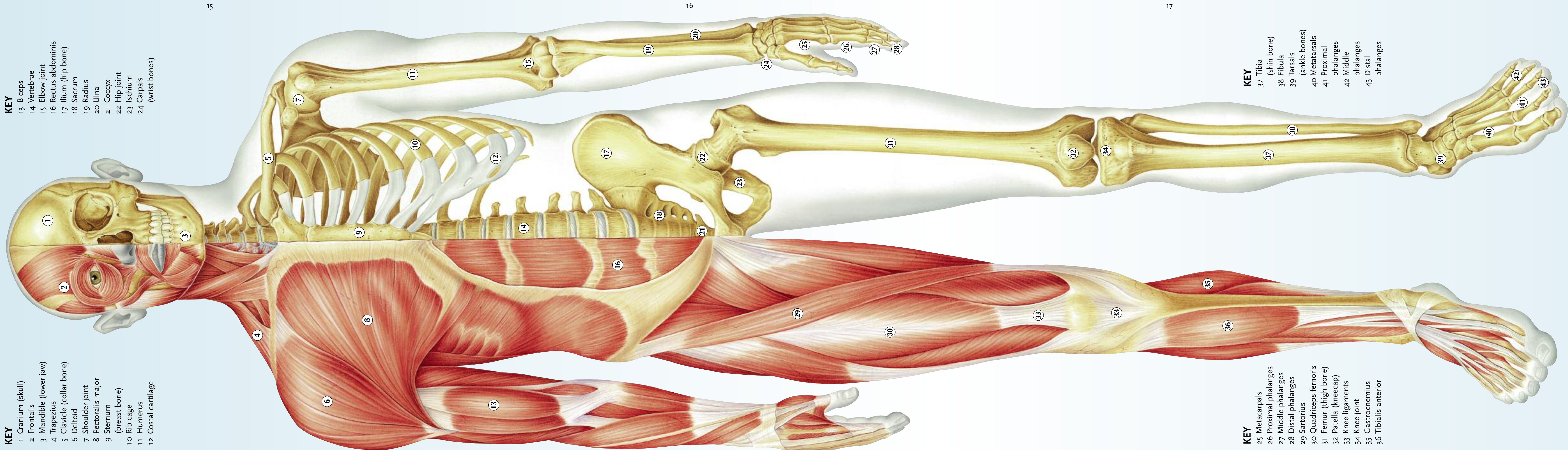
The skin's outer protective layer, the epidermis, consists mostly of dead cells. These are constantly flaking off and being replaced from beneath (the specks of dust you sometimes see floating around a room are mostly skin flakes). The underlying layer, the dermis, contains blood vessels, sensors, hair follicles (roots) and oil and sweat glands. The hair and epidermis are kept moist by oil from the oil glands. When you are cold or afraid, tiny muscles contract, making the hair stand on end and bunching the skin into "goose pimples".

KEY

- 1 Cranium (skull)
- 2 Frontalis
- 3 Mandible (lower jaw)
- 4 Trapezius
- 5 Clavicle (collar bone)
- 6 Deltoid
- 7 Shoulder joint
- 8 Pectoralis major
- 9 Sternum (breast bone)
- 10 Rib cage
- 11 Humerus
- 12 Costal cartilage

KEY

- 13 Biceps
- 14 Vertebrae
- 15 Elbow joint
- 16 Rectus abdominis
- 17 Ilium (hip bone)
- 18 Sacrum
- 19 Radius
- 20 Ulna
- 21 Coccyx
- 22 Hip joint
- 23 Ischium
- 24 Carpals (wrist bones)



KEY

- 25 Metacarpals
- 26 Proximal phalanges
- 27 Middle phalanges
- 28 Distal phalanges
- 29 Sartorius
- 30 Quadriceps femoris
- 31 Femur (thigh bone)
- 32 Patella (kneecap)
- 33 Knee ligaments
- 34 Knee joint
- 35 Gastrocnemius
- 36 Tibialis anterior

KEY

- 37 Tibia (shin bone)
- 38 Fibula
- 39 Tarsals (ankle bones)
- 40 Metatarsals
- 41 Proximal phalanges
- 42 Middle phalanges
- 43 Distal phalanges

INSIDE THE HUMAN BODY

The Skeleton and Muscles

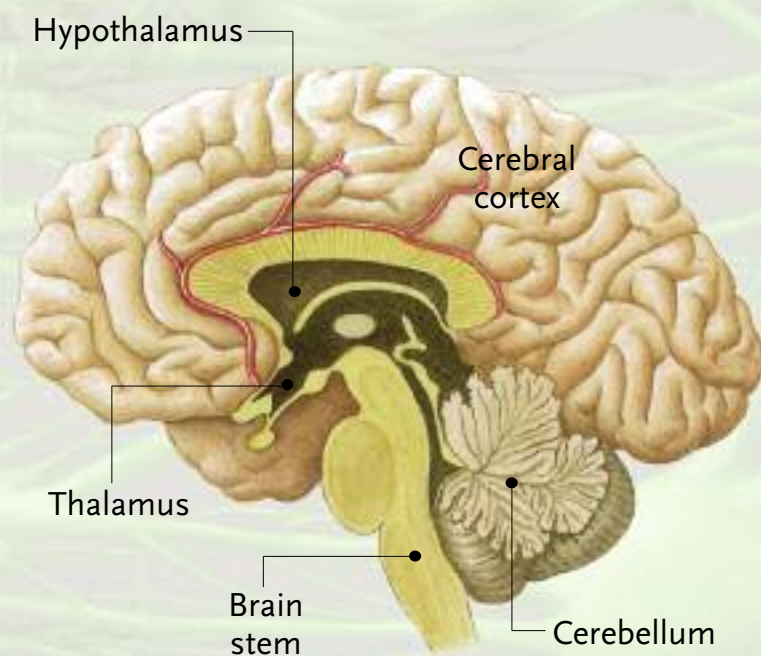
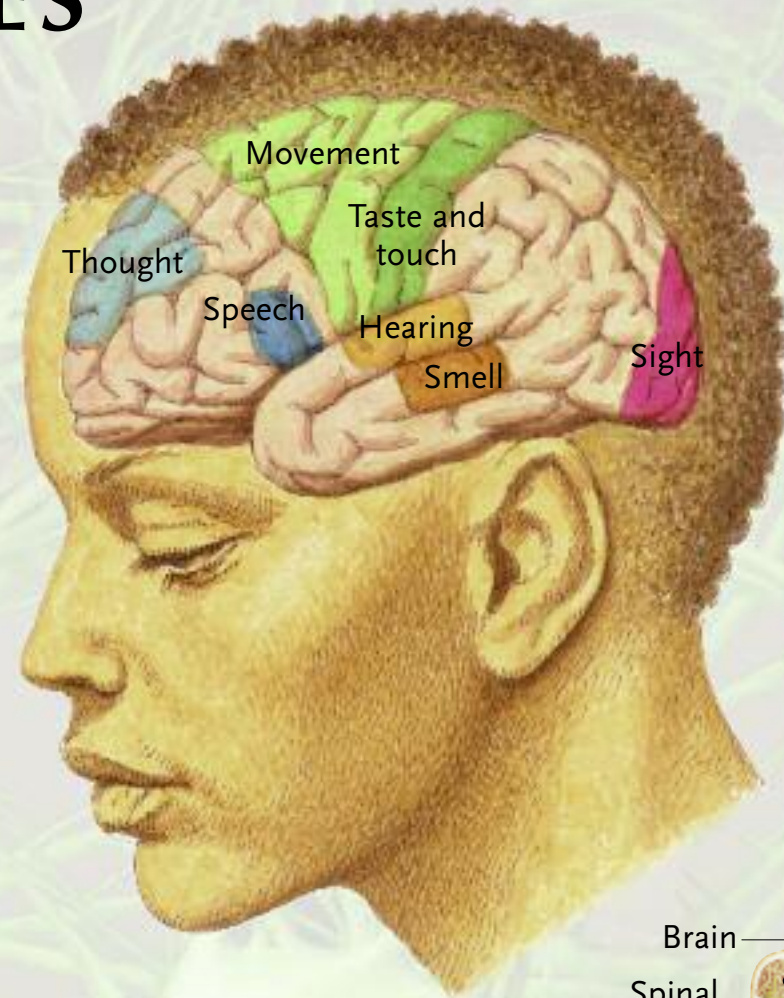
THE SKELETON inside your body is made up of living cells, just like all the other parts. It has the important job of supporting the body and protecting your vital organs. Every bone in the skeleton, together with the joints between them, is perfectly designed for its purpose. The skull and rib cage, for example, surround and protect vital organs such as the brain, heart and lungs. In the hand, the intricate structure of bones (27 in all) and joints allows us to perform all kinds of tasks requiring both strength and dexterity.

If our bodies were supported only by bones, we would be continually collapsing in a heap! Fortunately, we have muscles to keep us upright. They also allow us to move. Muscles are attached to bones by tough cords called tendons. When your muscles contract, they pull the tendons, causing the bones to move. Many muscles, including arm muscles and those that control breathing, are called voluntary muscles: we can control them at will. Other muscles, such as for example, the one that moves food through the intestine, are involuntary.

BRAIN AND SENSES

EVERY THOUGHT and idea happens inside your brain. It constantly receives information in the form of nerve signals, which it analyzes and acts upon. It then issues instructions, deciding, for example, on your breathing rate, how you think and move, and many other tasks.

Most of the brain is made up of the cerebral cortex. Different parts have different jobs. Signals from the eyes, for example, are dealt with at the lower rear of the brain, while the front of the brain handles movement and thought. The centres that control the various muscles in the body are called the motor centres.

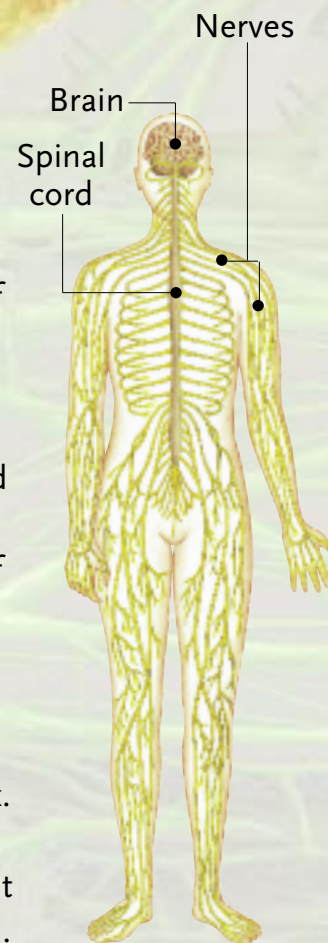


INSIDE THE BRAIN

Deeper inside the brain are other parts. The brain stem monitors heartbeat, breathing, blood pressure and other activities. The cerebellum co-ordinates the muscles. The hypothalamus controls body temperature, hunger and other automatic functions. The thalamus directs signals between the cerebral cortex and the spinal cord.

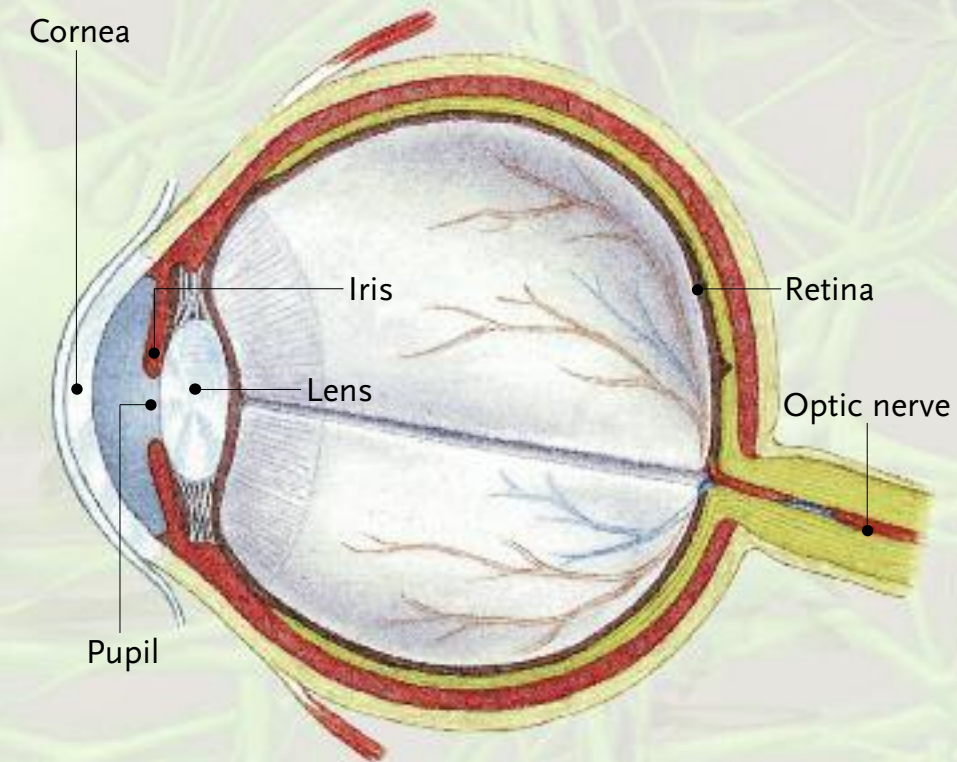
NERVES

Nerves are made up of nerve cells. Each one has thin, spidery parts called dendrites and a long wiry section called an axon. They connect the brain to all parts of the body via the spinal cord, a thick bundle of nerves bunched together and running the length of your back. The nerves carry tiny electric signals at about 100 metres per second.



SIGHT

The eye works just like an expertly designed camera. Light enters the eye through a transparent domed window called the cornea. It then passes through an opening, called the pupil, in the iris, the eye's coloured part. The iris is



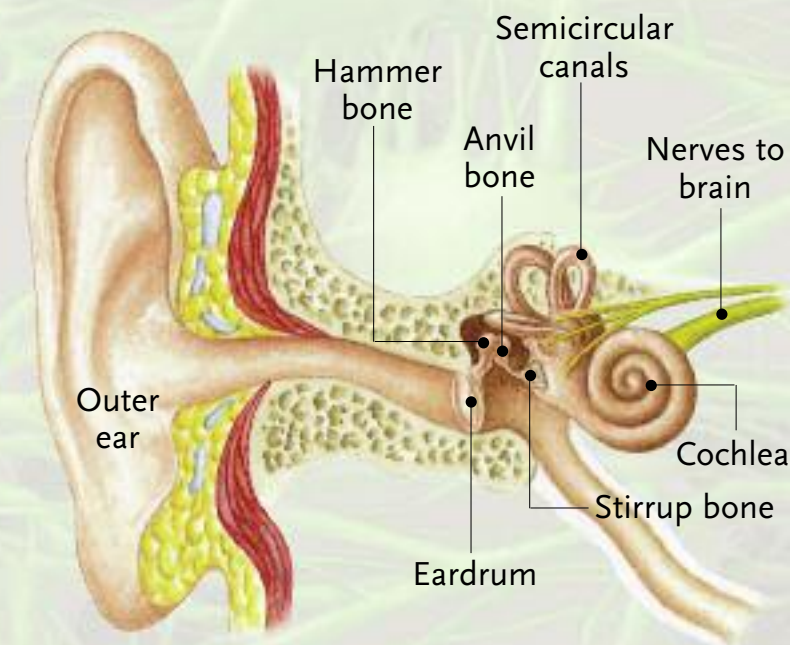
a ring of muscle that controls the size of the pupil, and so the amount of light that is allowed to enter the eye. Behind the iris there is a soft, elastic lens which focuses an image exactly on to the retina. From here, signals are sent along the optic nerve to the brain.

HEARING

The outer ear surrounds an opening in the side of your head. Inside are the workings of your inner ear. Sounds travel along a tube and strike the eardrum, a thin piece of skin. They cause it to vibrate. The vibrations set in motion three tiny bones—the hammer, anvil and stirrup. The stirrup sends the vibrations to the cochlea, a

coiled tube shaped like a snail's shell. The vibrations ripple through fluid inside the cochlea. Tiny hairs pick up the ripples and produce nerve signals which travel to the brain.

Three semicircular canals, set at different angles in the inner ear, help you to balance. Nerves pick up the flow of liquid within them so the brain can work out the direction of movement.



TASTE BUDS

The tongue's upper surface is covered with hundreds of pimple-like lumps, called papillae. Scattered between the papillae are about 8000 taste buds. They can detect four basic tastes—sweet, sour, salty and bitter. Different parts of the tongue respond to different flavours.

GLOSSARY

ALVEOLI Tiny air sacs in the lungs where oxygen is taken up by the blood.

ARTERY A tube that carries blood away from the heart.

CAPILLARIES The smallest blood vessels.

CARBOHYDRATES Foods like sugars and starches which provide energy for the body.

CARTILAGE A material that provides cushioning layers between bones in joints.

CELL A tiny “building block” from which all the tissues in the human body are made up.

DNA A substance whose structure contains genes. DNA is short for **deoxyribonucleic acid**.

GENES The instructions that control the way your cells are built, and so determine all your looks and characteristics.

INTESTINE The tube linking the stomach to the anus. The small intestine takes in nutrients from digested food. The colon, or large intestine, leads waste away to the rectum.

LIGAMENT A strong fibrous strap that holds bones together at a joint.

OESOPHAGUS The tube through which food passes from the mouth to the stomach.

ORGAN A structure made of different kinds of cells that does a particular job in the body. The brain, stomach and skin are all organs.

OVARY The female reproductive organ that produces eggs.

PANCREAS An organ that produces digestive juices and releases them into the intestine.

PROTEIN A type of food that provides the materials (amino acids) for building cells.

RETINA The layer of light-sensitive cells in the back of the eye.

SPINAL CORD The thick bunch of nerves that runs from the brain down the back of the body through a tunnel formed by the vertebrae.

TENDON A strong fibrous cord, also known as a sinew, that attaches a muscle to a bone.

TRACHEA The tube, also known as the windpipe, that connects the lungs to the mouth and nose.

URETER The tube through which urine passes from the kidneys to the bladder.

URETHRA The tube through which urine passes from the bladder to outside the body.

UTERUS Also called the womb, an organ inside which the fertilized egg develops into an embryo and eventually a baby.

VEIN A tube that carries blood to the heart.

VERTEBRA One of a chain of bones that make up the spinal column or backbone.

VITAMIN An essential chemical that the body needs to function properly.

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