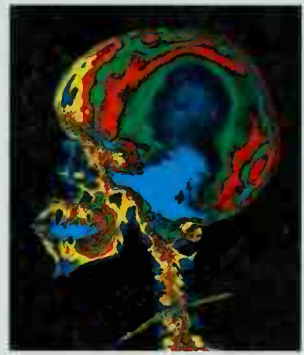
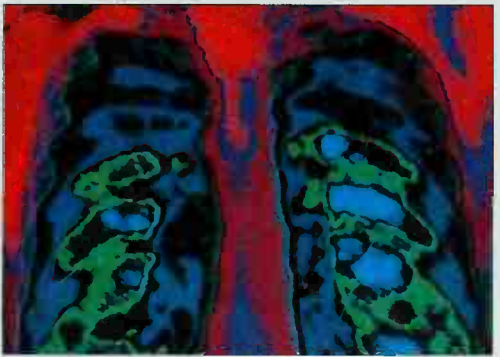


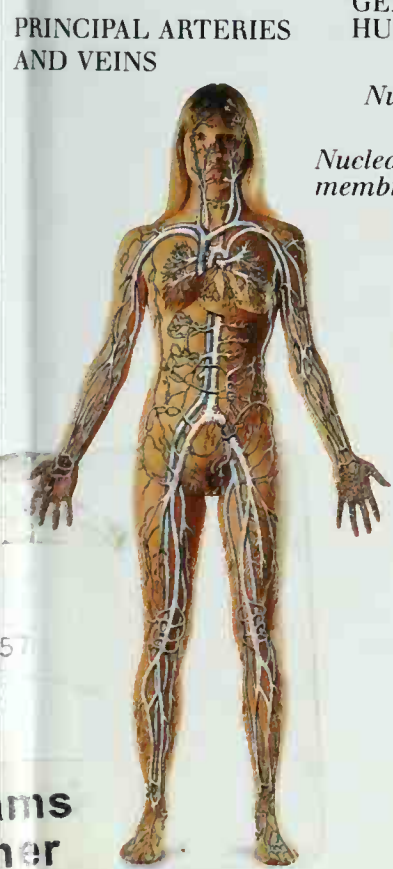
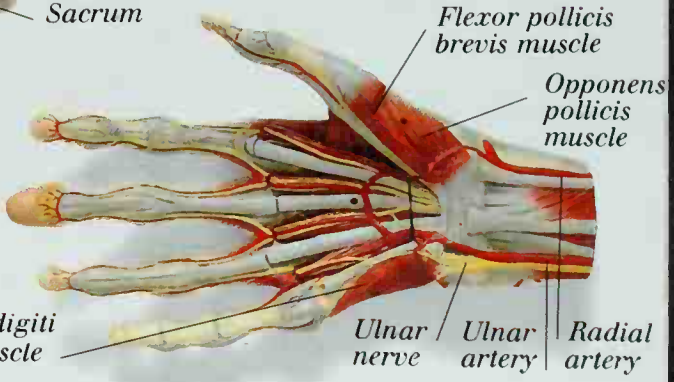
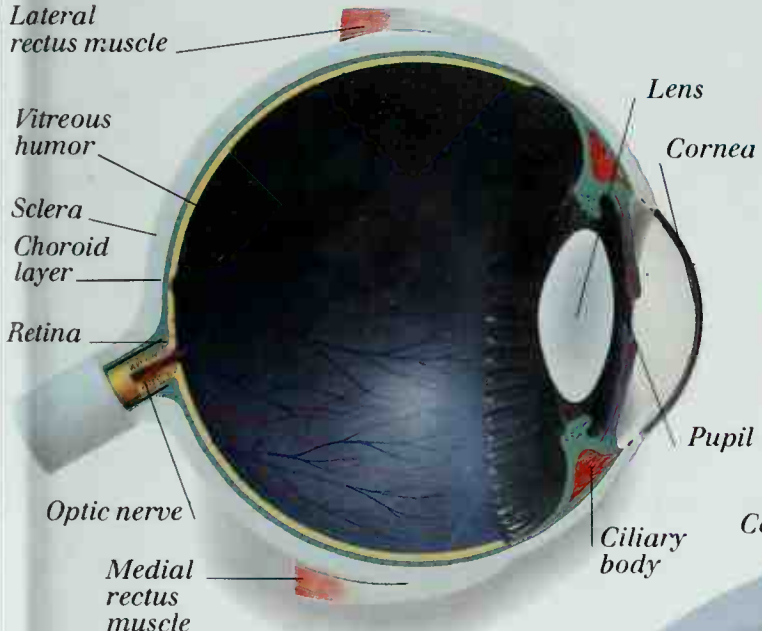
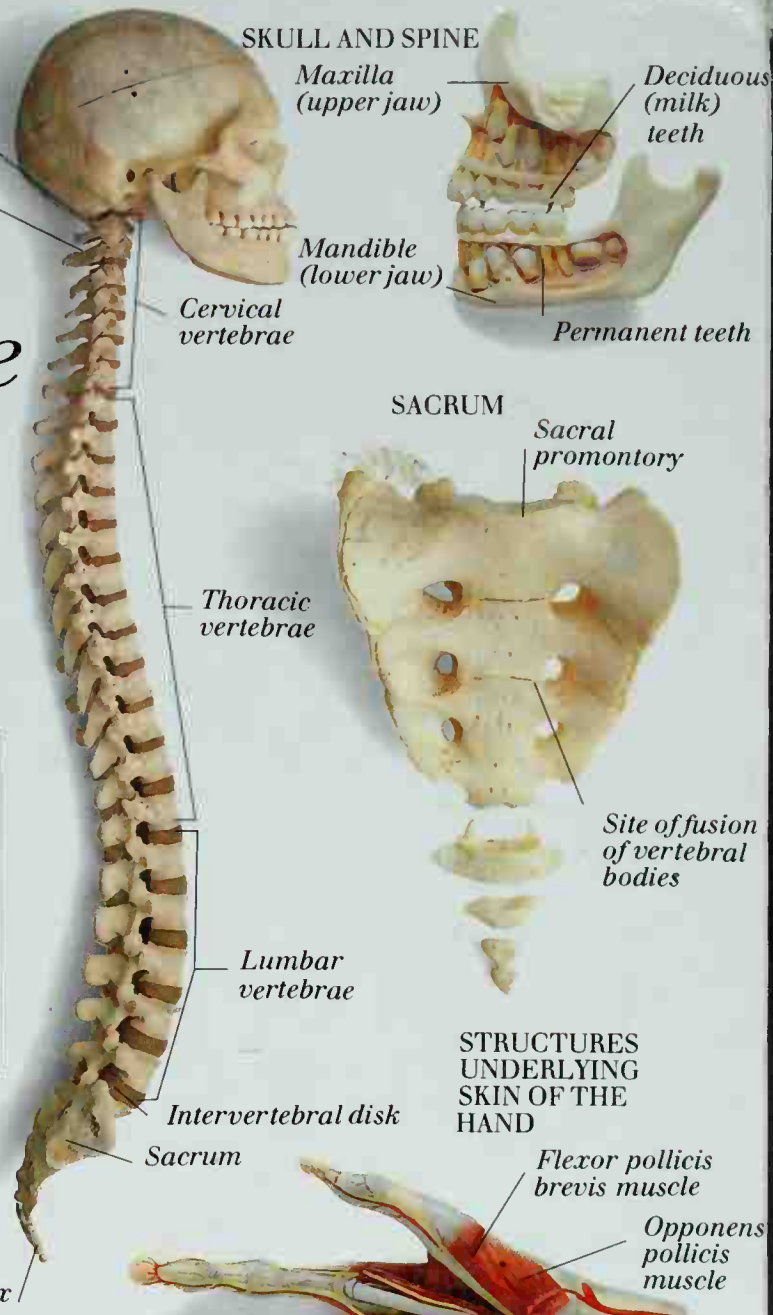
THE VISUAL DICTIONARY of the HUMAN BODY



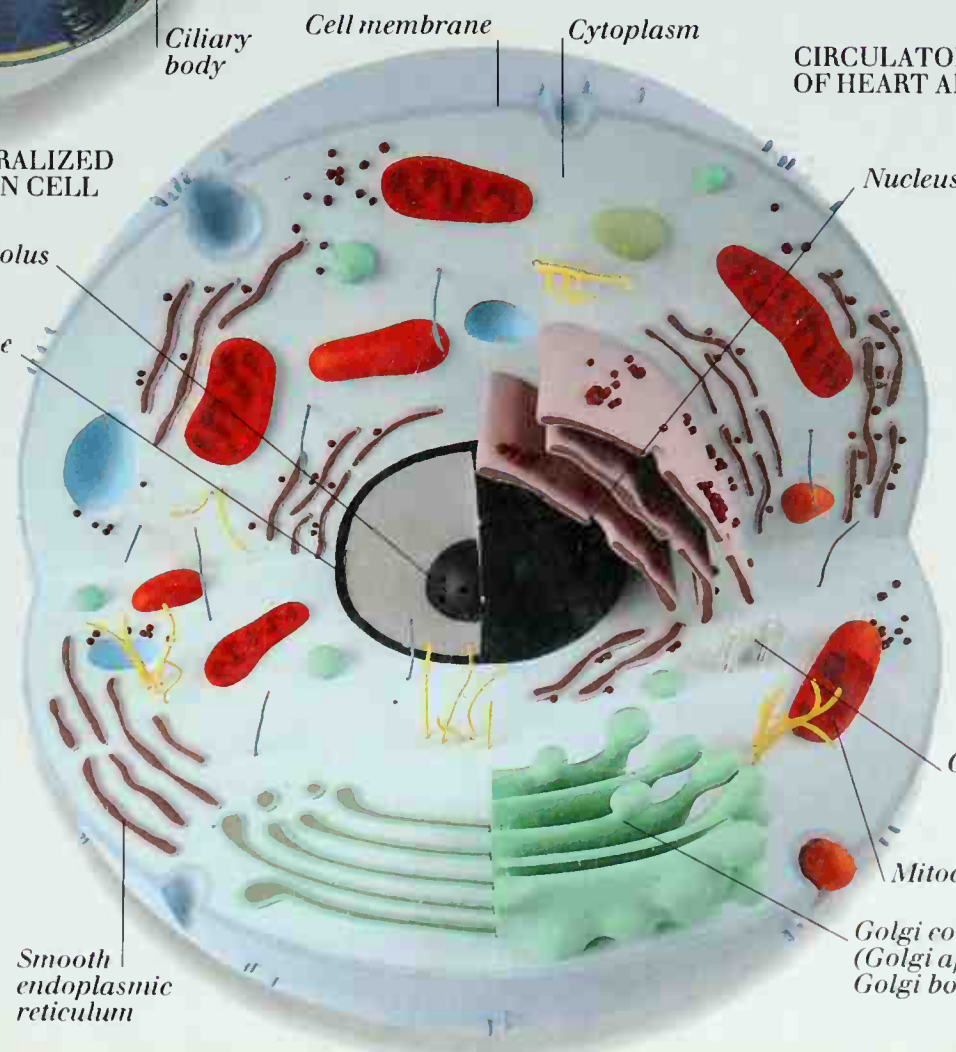
SCAN OF FEMALE SKULL



THERMOGRAM OF CHEST

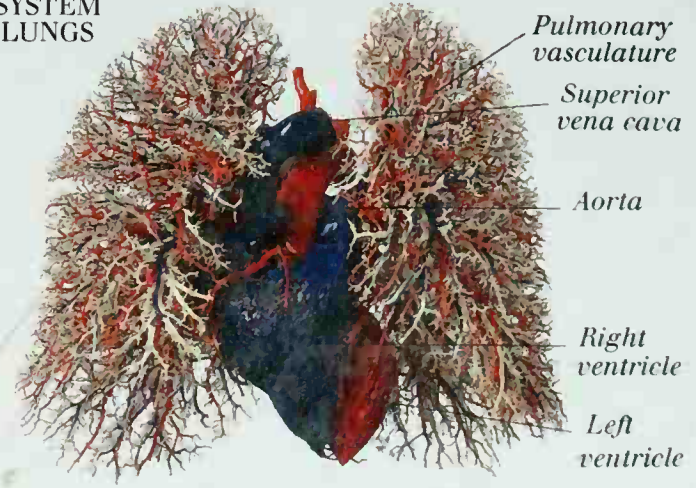


PRINCIPAL ARTERIES AND VEINS

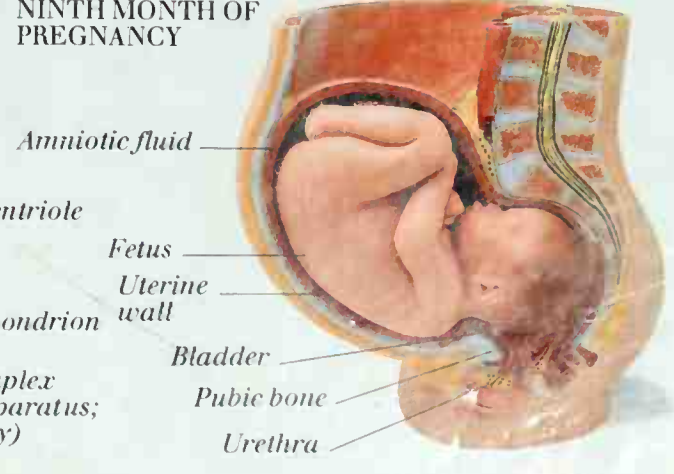


GENERALIZED HUMAN CELL

CIRCULATORY SYSTEM OF HEART AND LUNGS



NINTH MONTH OF PREGNANCY



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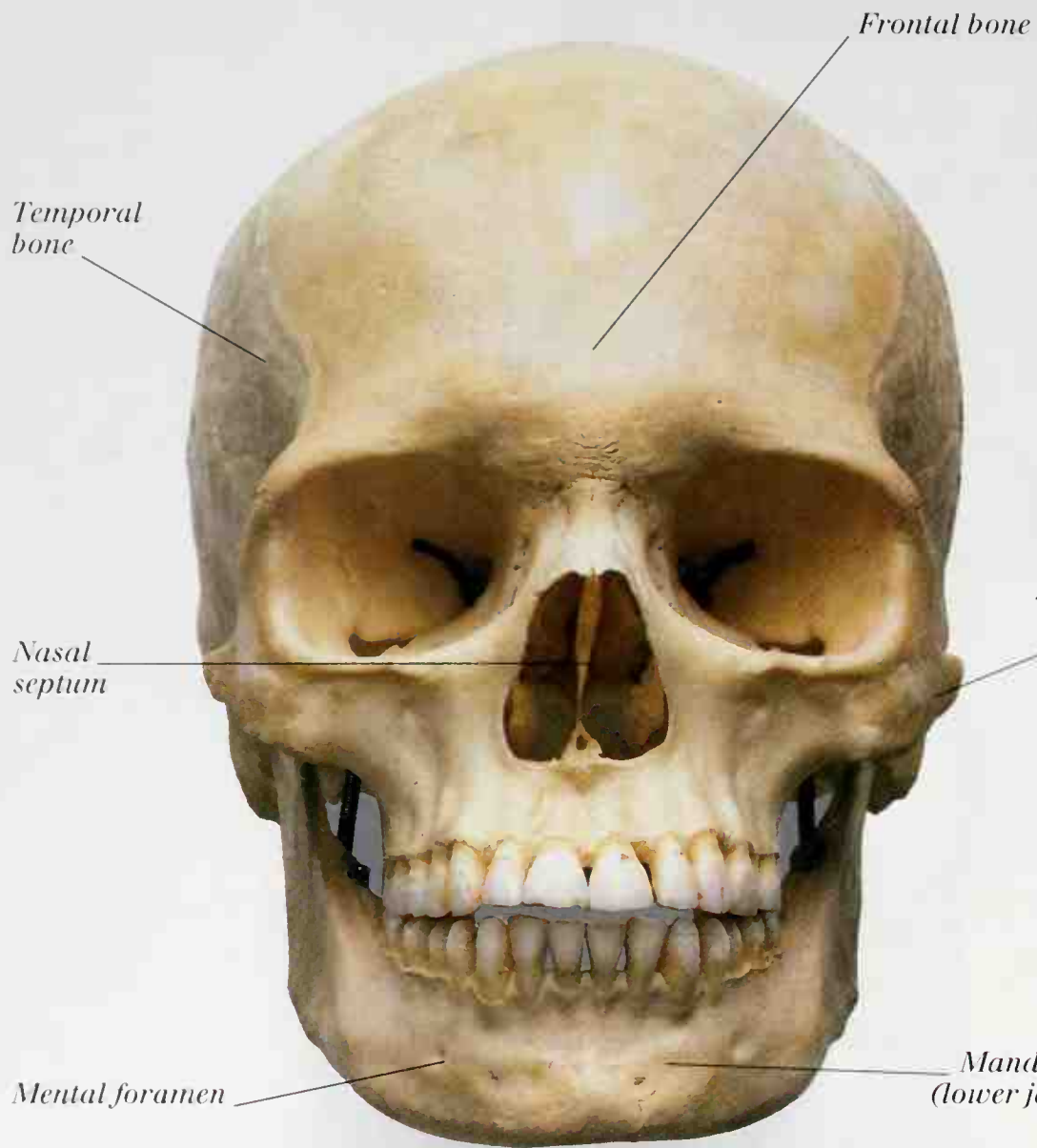


EYEWITNESS VISUAL DICTIONARIES

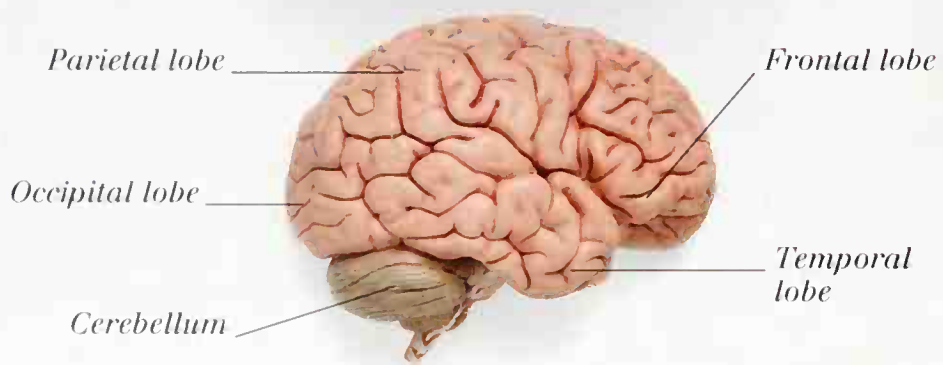
THE VISUAL
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BODY**



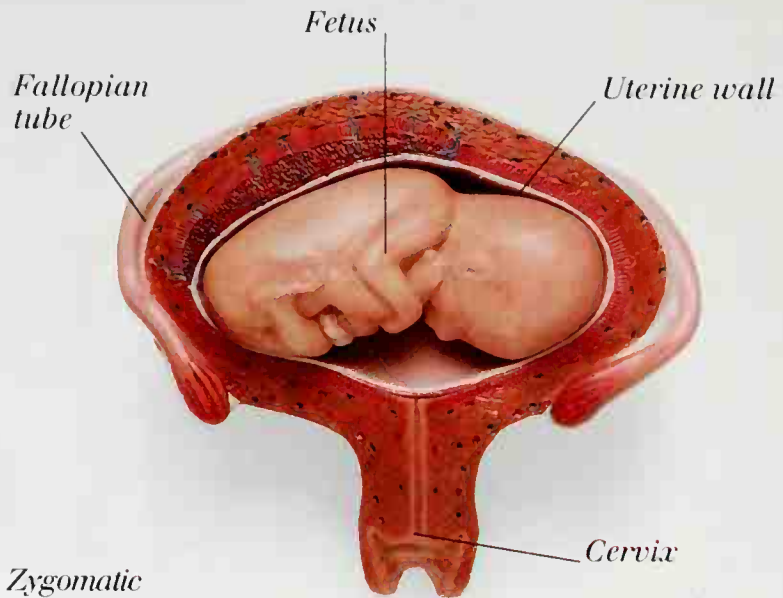
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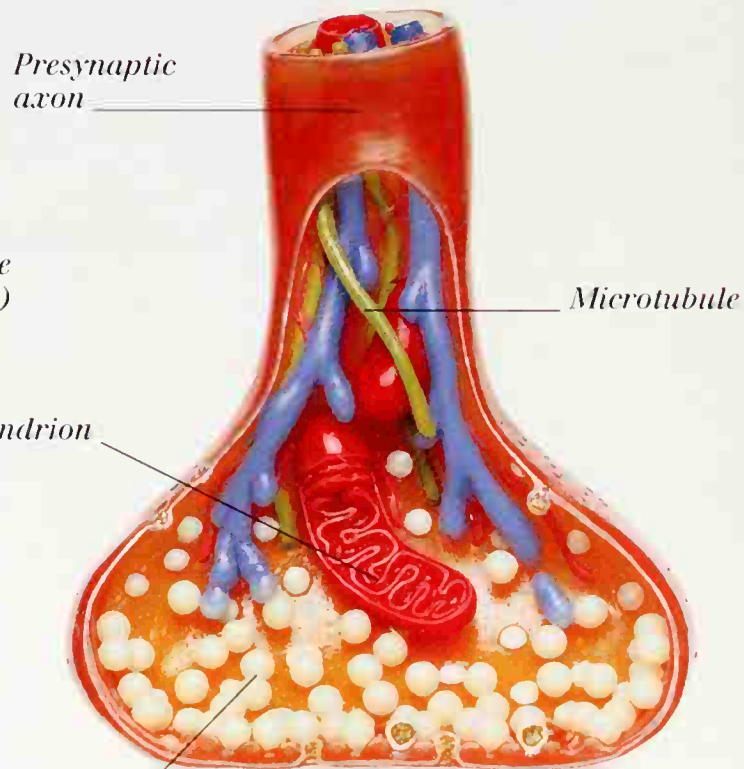
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EXTERNAL VIEW OF BRAIN



THE DEVELOPING FETUS



STRUCTURE OF A SYNAPTIC KNOB



EYEWITNESS VISUAL DICTIONARIES

THE VISUAL
DICTIONARY *of the*
HUMAN
BODY



SECTION THROUGH LEFT EYE



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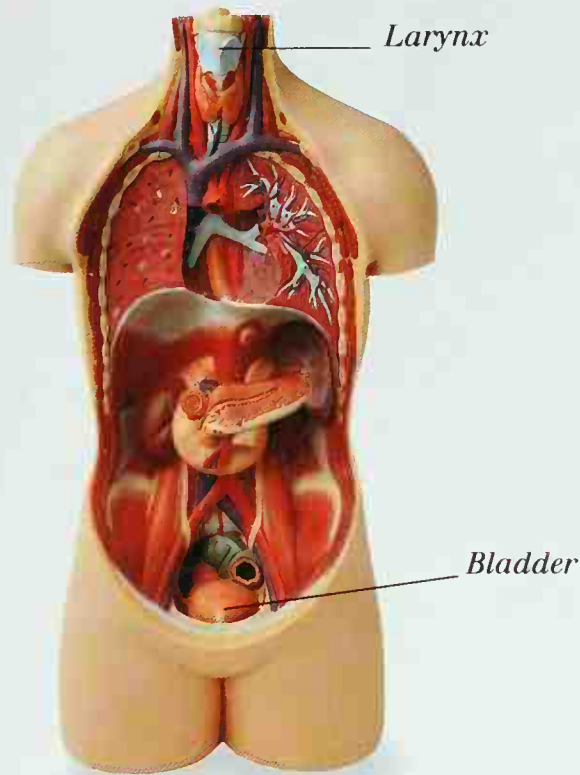
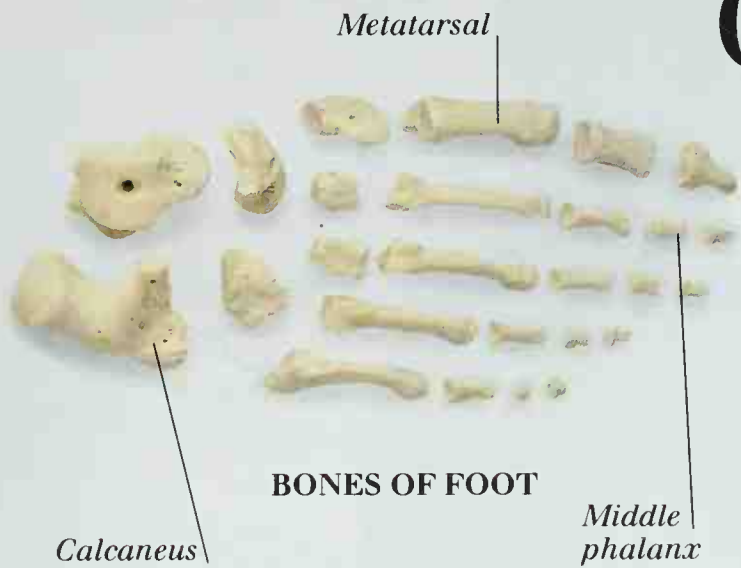
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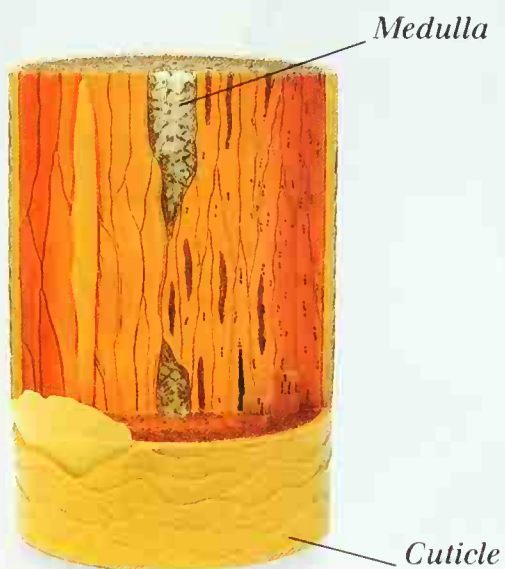
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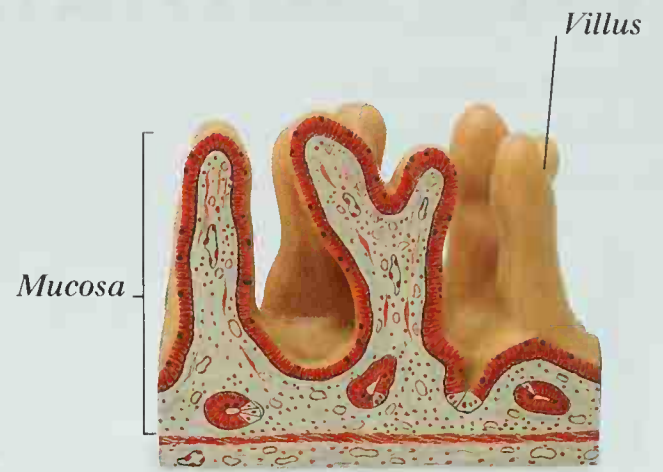
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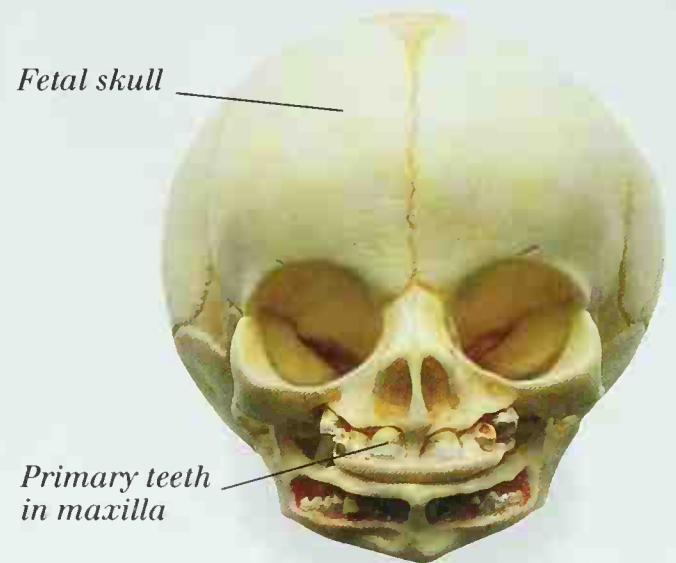
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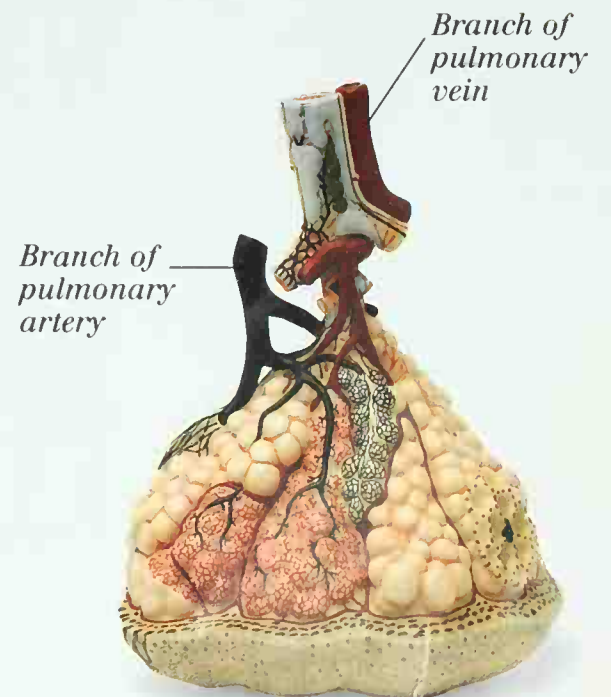
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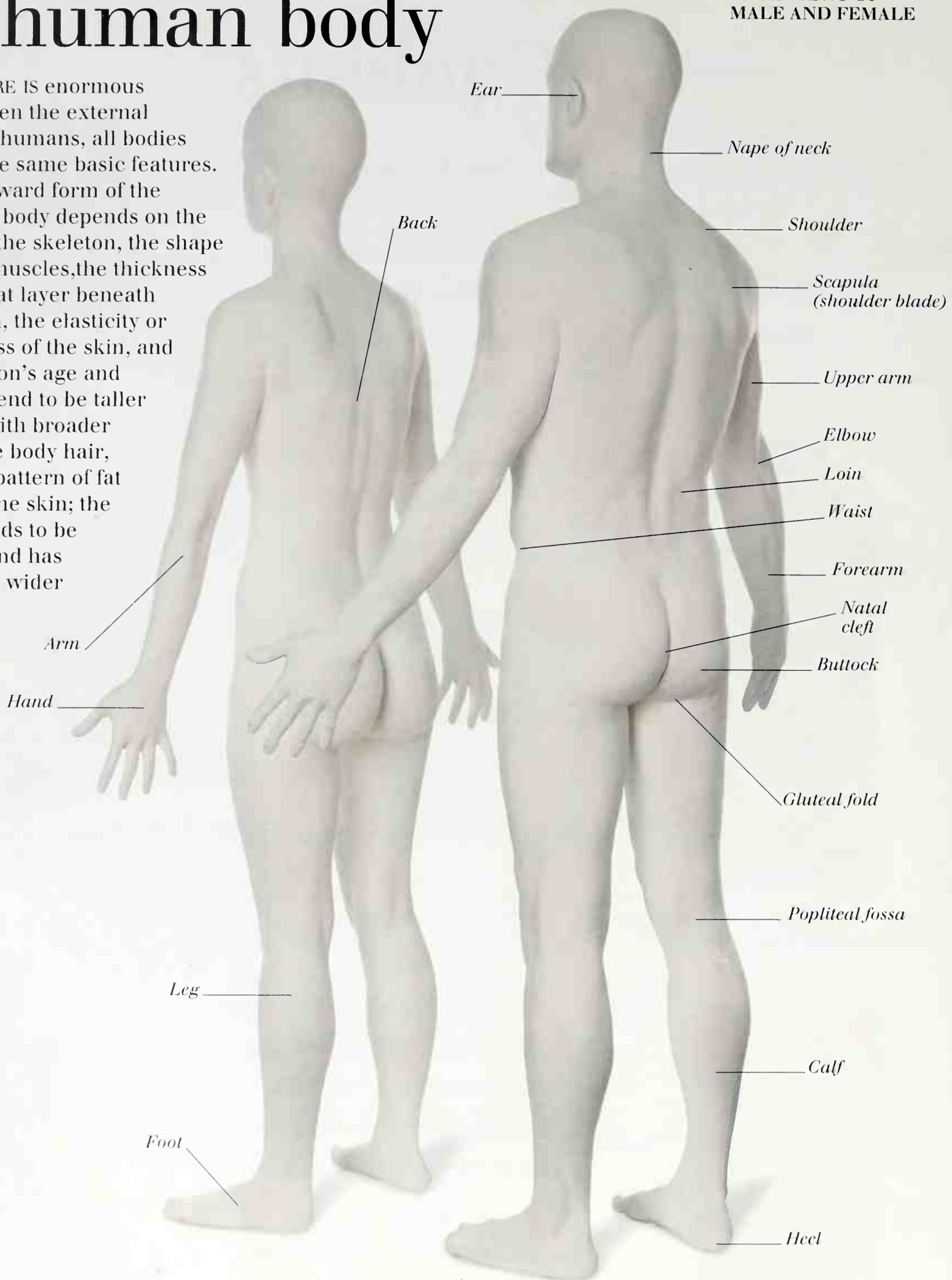
The human body

BACK VIEWS OF
MALE AND FEMALE

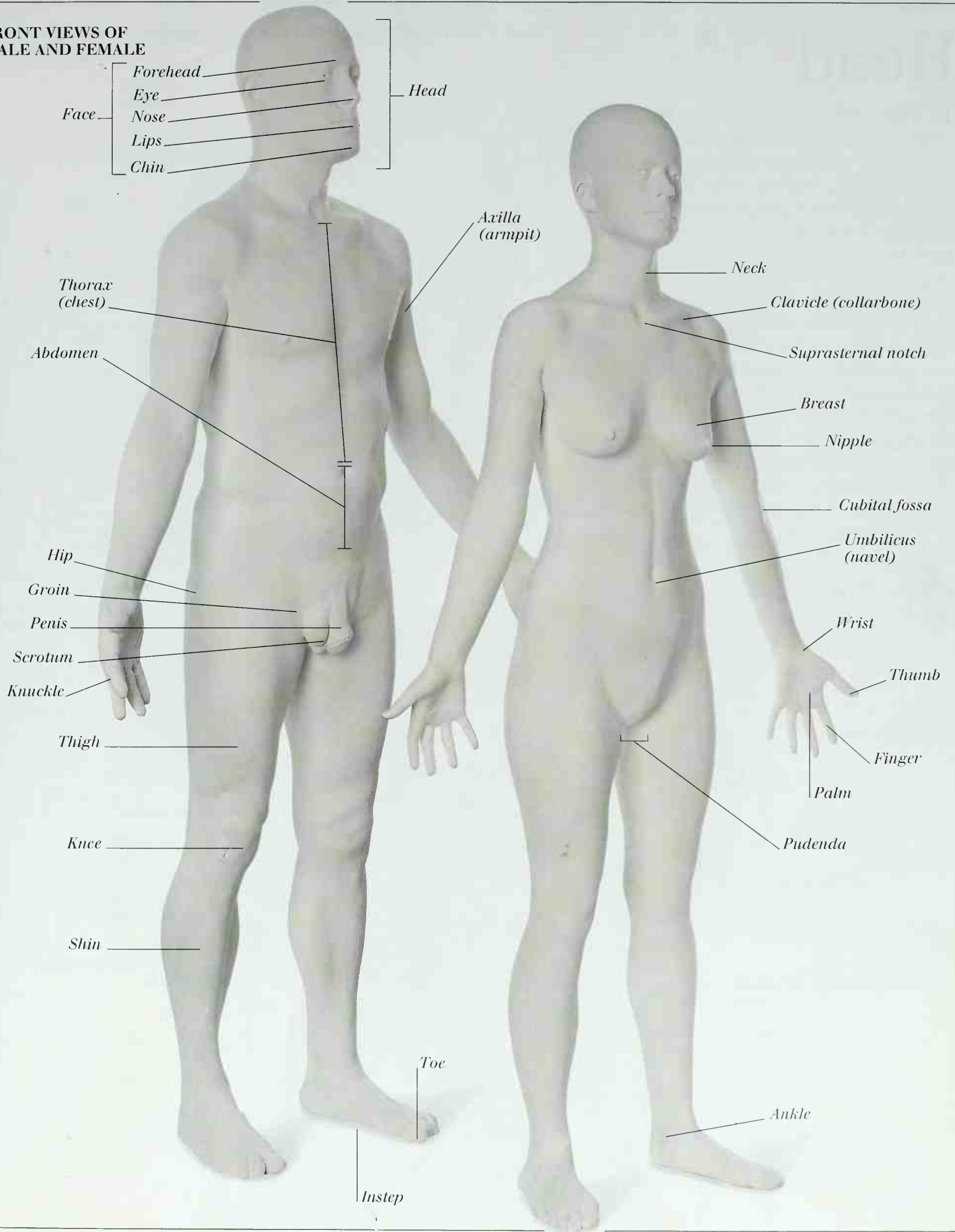
ALTHOUGH THERE IS ENORMOUS variation between the external appearances of humans, all bodies contain the same basic features.



The outward form of the human body depends on the size of the skeleton, the shape of the muscles, the thickness of the fat layer beneath the skin, the elasticity or sagginess of the skin, and the person's age and gender. Males tend to be taller than females, with broader shoulders, more body hair, and a different pattern of fat deposits under the skin; the female body tends to be less muscular and has a shallower and wider pelvis to allow for childbirth.



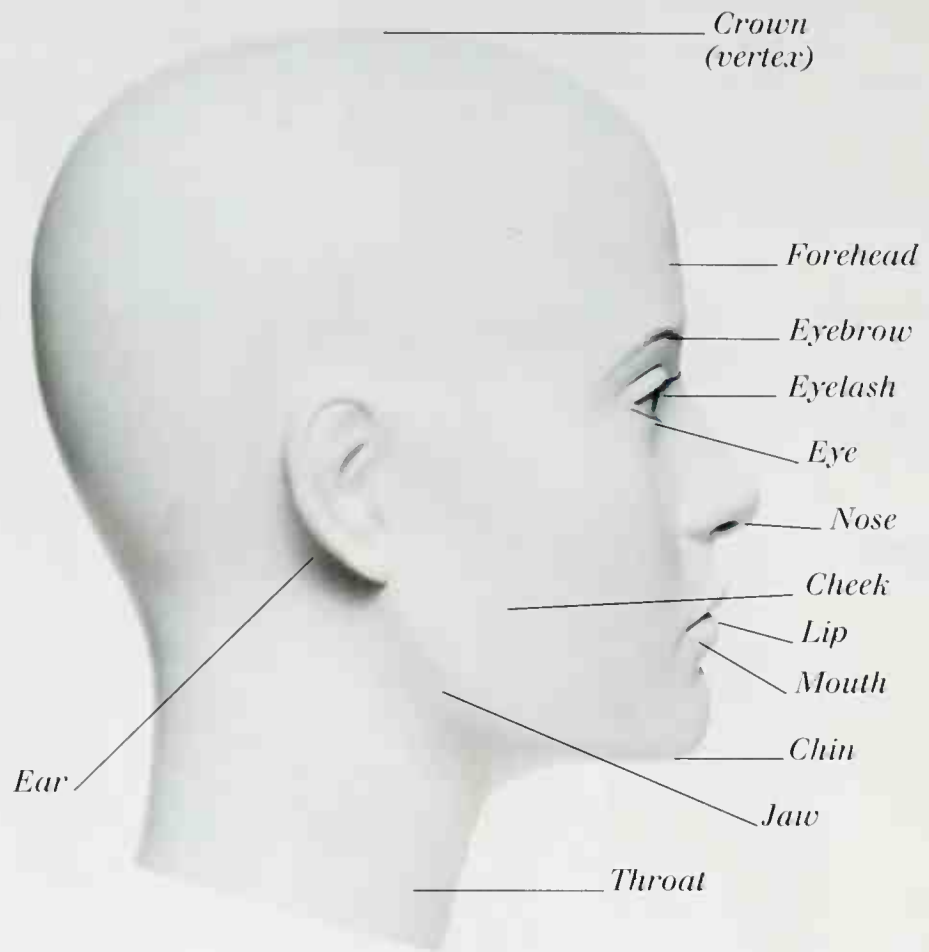
**FRONT VIEWS OF
MALE AND FEMALE**



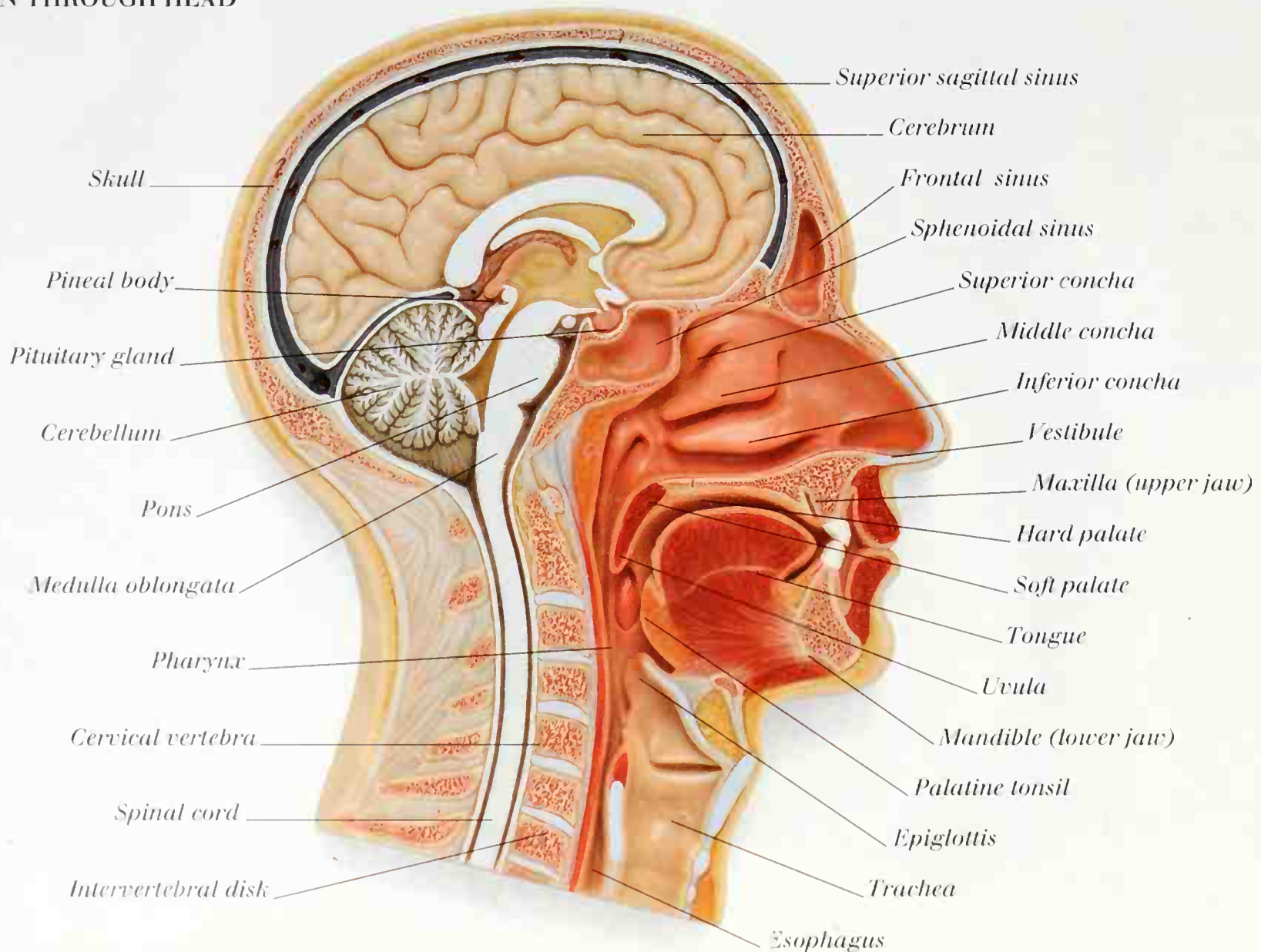
Head

SIDE VIEW OF EXTERNAL FEATURES OF HEAD

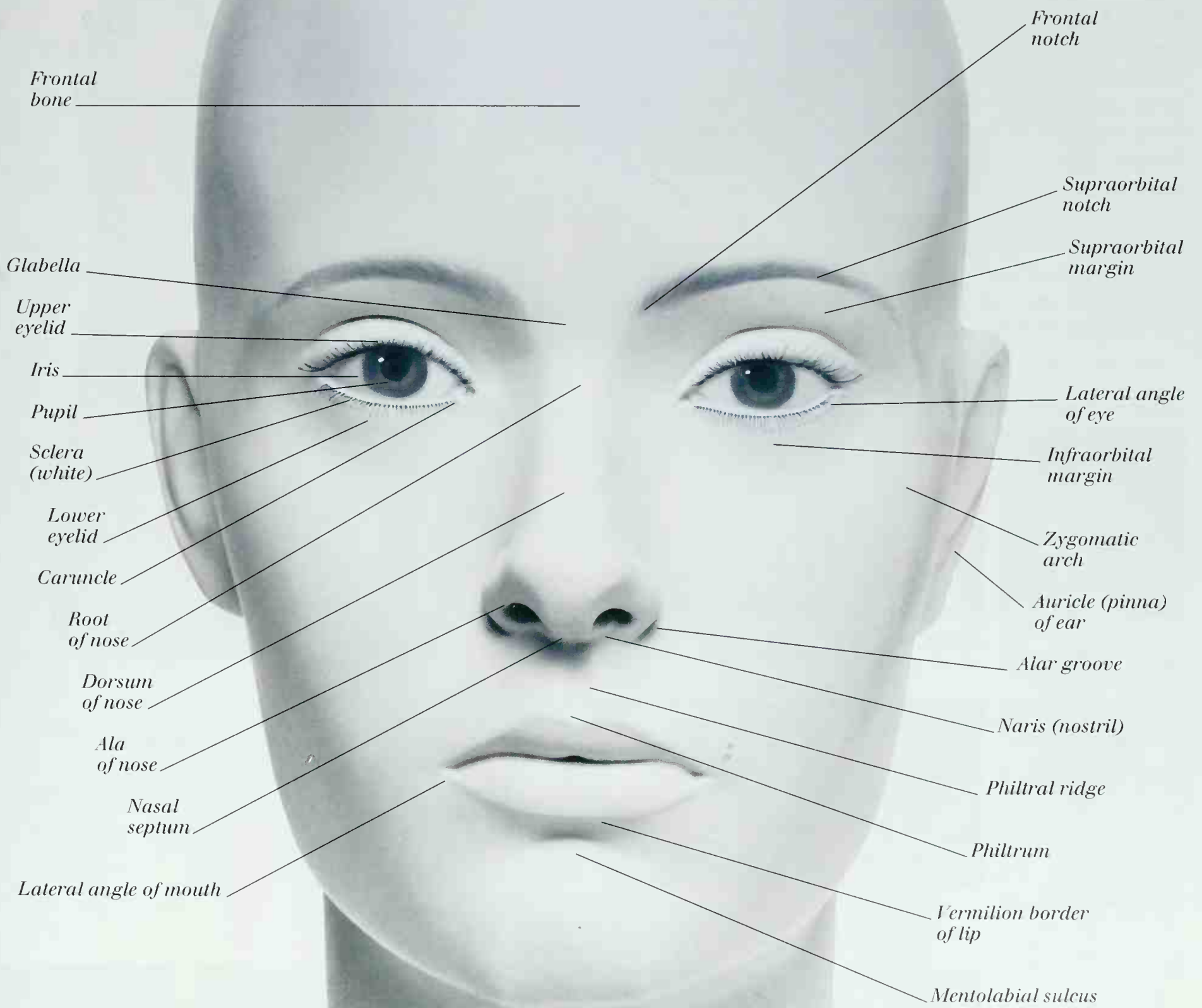
IN A NEWBORN BABY, the head accounts for one-quarter of the total body length; by adulthood, the proportion has reduced to one-eighth. Contained in the head are the body's main sense organs: eyes, ears, olfactory nerves that detect smells, and the taste buds of the tongue. Signals from these organs pass to the body's great coordination center: the brain, housed in the protective, bony dome of the skull. Hair on the head insulates against heat loss, and adult males also grow thick facial hair. The face has three important openings: two nostrils through which air passes, and the mouth, which takes in nourishment and helps form speech. Although all heads are basically similar, differences in the size, shape, and color of features produce an infinite variety of appearances.



SECTION THROUGH HEAD



**FRONT VIEW OF EXTERNAL
FEATURES OF HEAD**

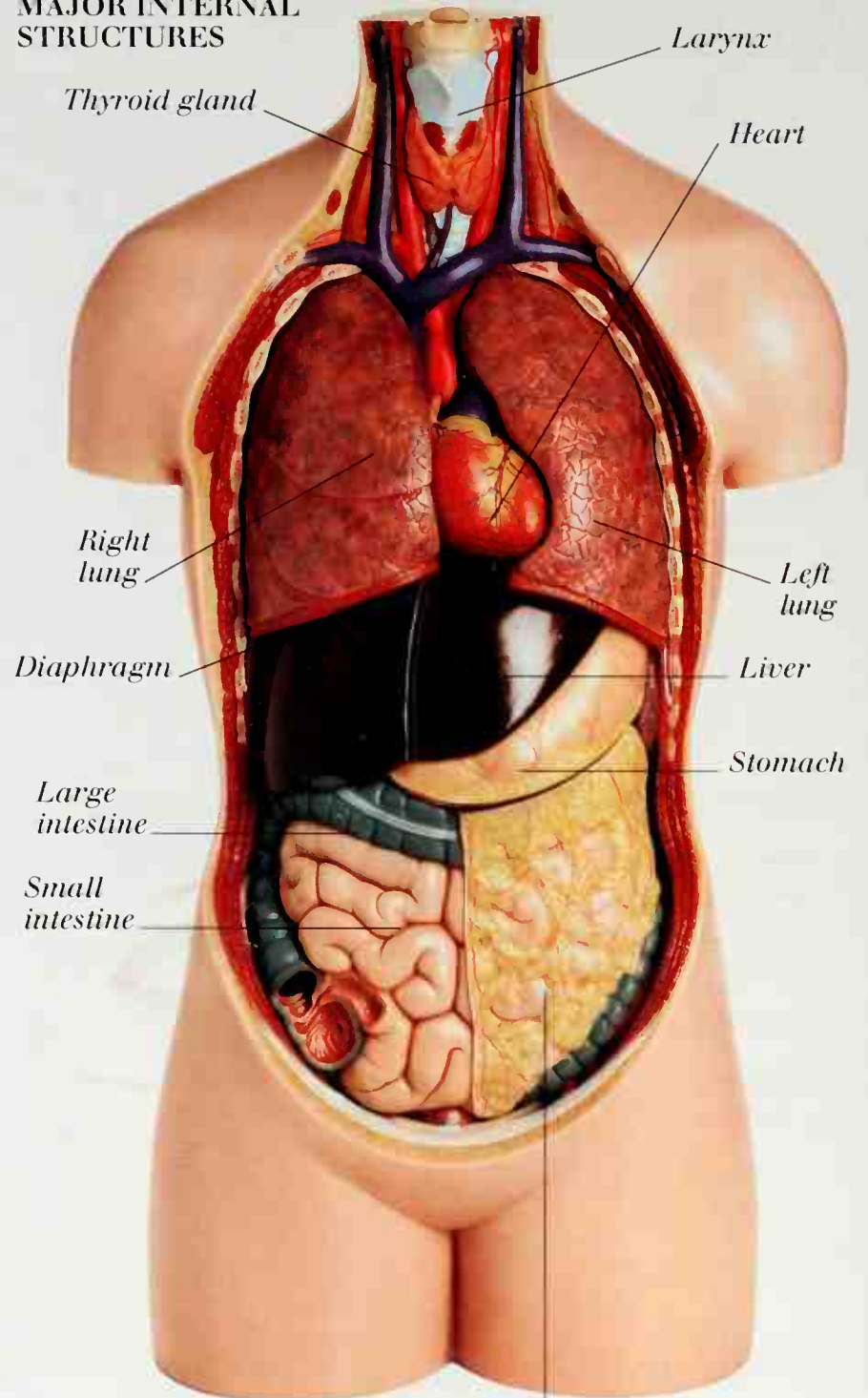


Body organs



ALL THE VITAL BODY ORGANS except for the brain are enclosed within the trunk or torso (the body apart from the head and limbs). The trunk contains two large cavities separated by a muscular sheet called the diaphragm. The upper cavity, known as the thorax or chest cavity, contains the heart and lungs. The lower cavity, called the abdominal cavity, contains the stomach, intestines, liver, and pancreas, which all play a role in digesting food. Also within the trunk are the kidneys and bladder, which are part of the urinary system, and the reproductive organs, which hold the seeds of new human life. Modern imaging techniques, such as contrast X-rays and different types of scans, make it possible to see and study body organs without the need to cut through their protective coverings of skin, fat, muscle, and bone.

MAJOR INTERNAL STRUCTURES



Greater omentum

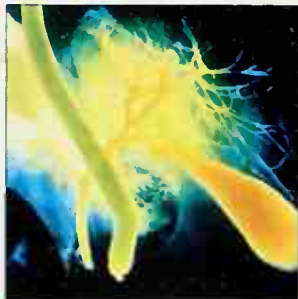
IMAGING THE BODY



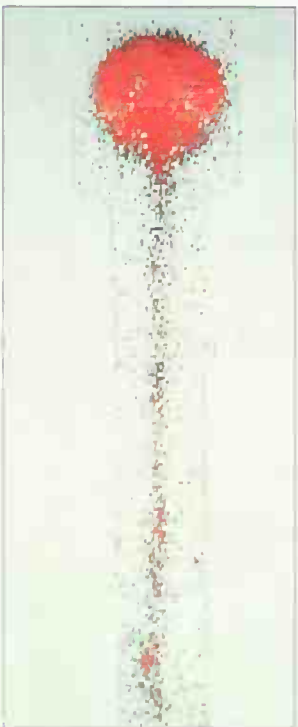
SCINTIGRAM OF HEART CHAMBERS



ANGIOGRAM OF RIGHT LUNG



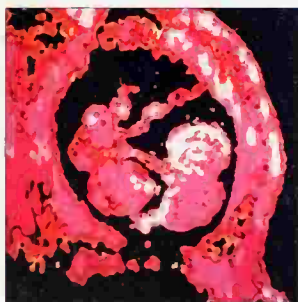
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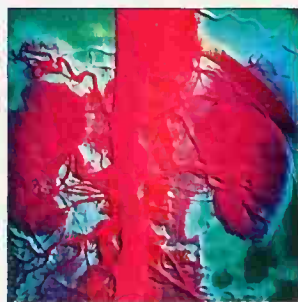
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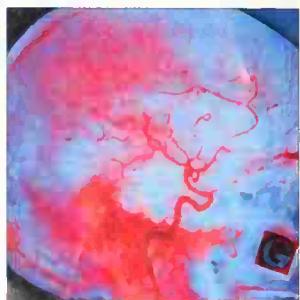
DOUBLE CONTRAST X-RAY OF COLON



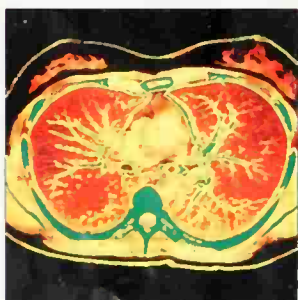
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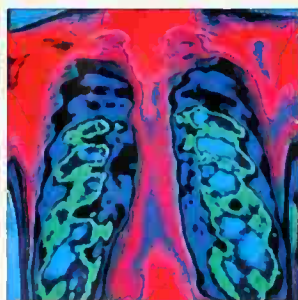
ANGIOGRAM OF KIDNEYS



ANGIOGRAM OF ARTERIES OF HEAD



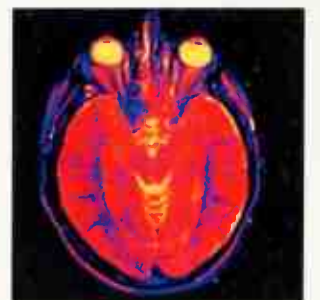
CT SCAN THROUGH FEMALE CHEST



THERMOGRAM OF CHEST REGION

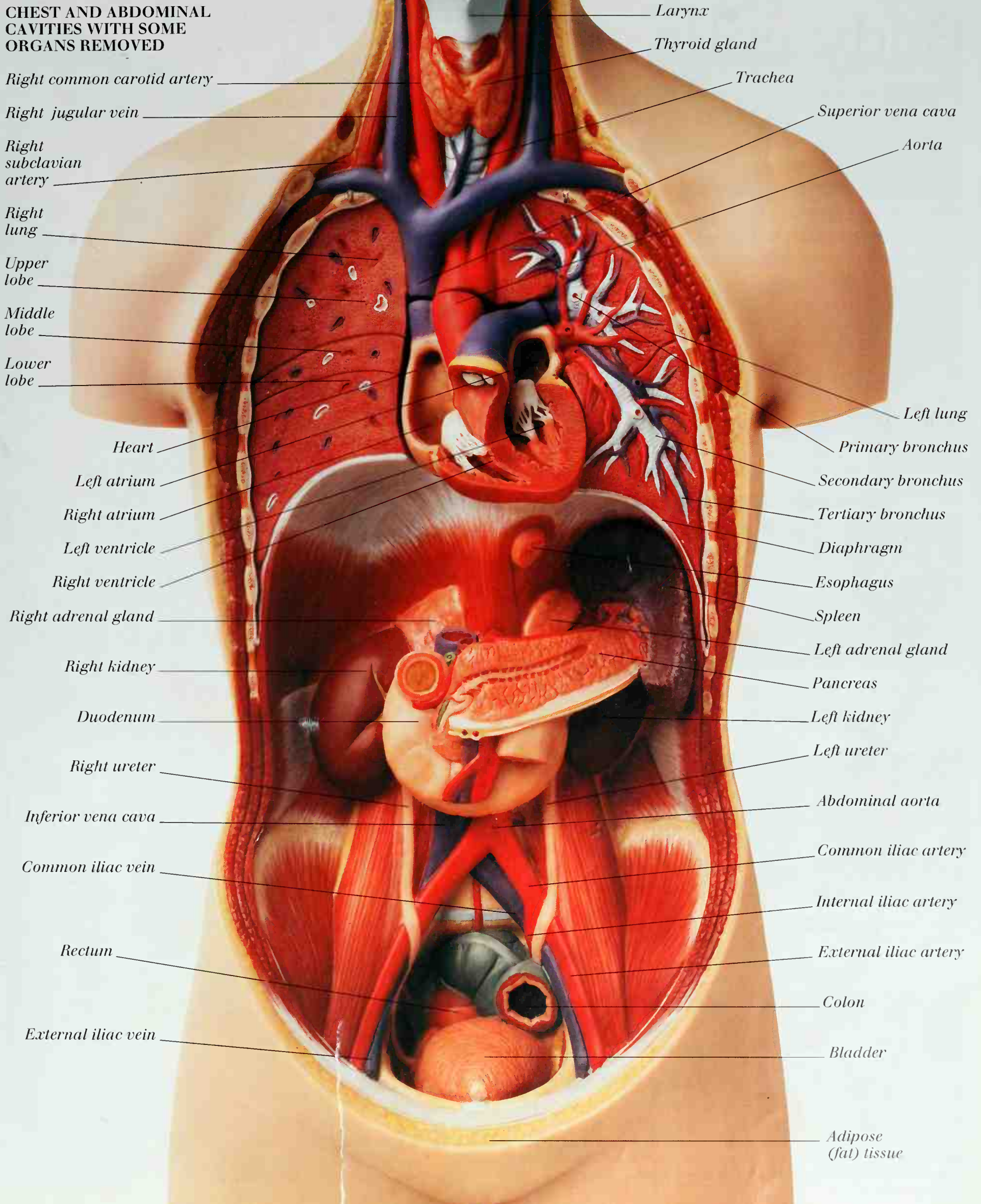


ANGIOGRAM OF ARTERIES OF HEART



MRI SCAN THROUGH HEAD AT EYE LEVEL

**CHEST AND ABDOMINAL
CAVITIES WITH SOME
ORGANS REMOVED**



Right common carotid artery

Right jugular vein

Right subclavian artery

Right lung

Upper lobe

Middle lobe

Lower lobe

Heart

Left atrium

Right atrium

Left ventricle

Right ventricle

Right adrenal gland

Right kidney

Duodenum

Right ureter

Inferior vena cava

Common iliac vein

Rectum

External iliac vein

Larynx

Thyroid gland

Trachea

Superior vena cava

Aorta

Left lung

Primary bronchus

Secondary bronchus

Tertiary bronchus

Diaphragm

Esophagus

Spleen

Left adrenal gland

Pancreas

Left kidney

Left ureter

Abdominal aorta

Common iliac artery

Internal iliac artery

External iliac artery

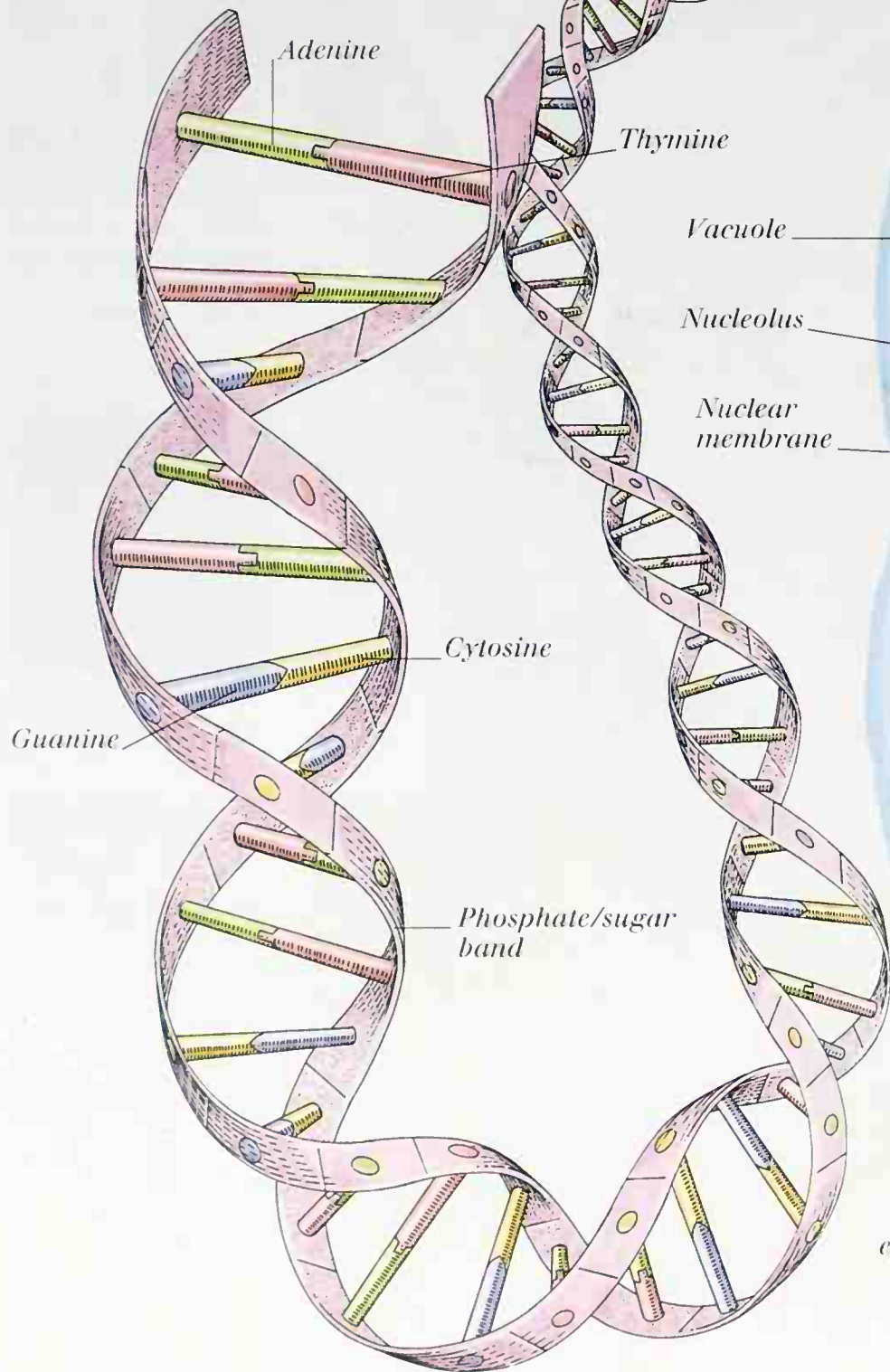
Colon

Bladder

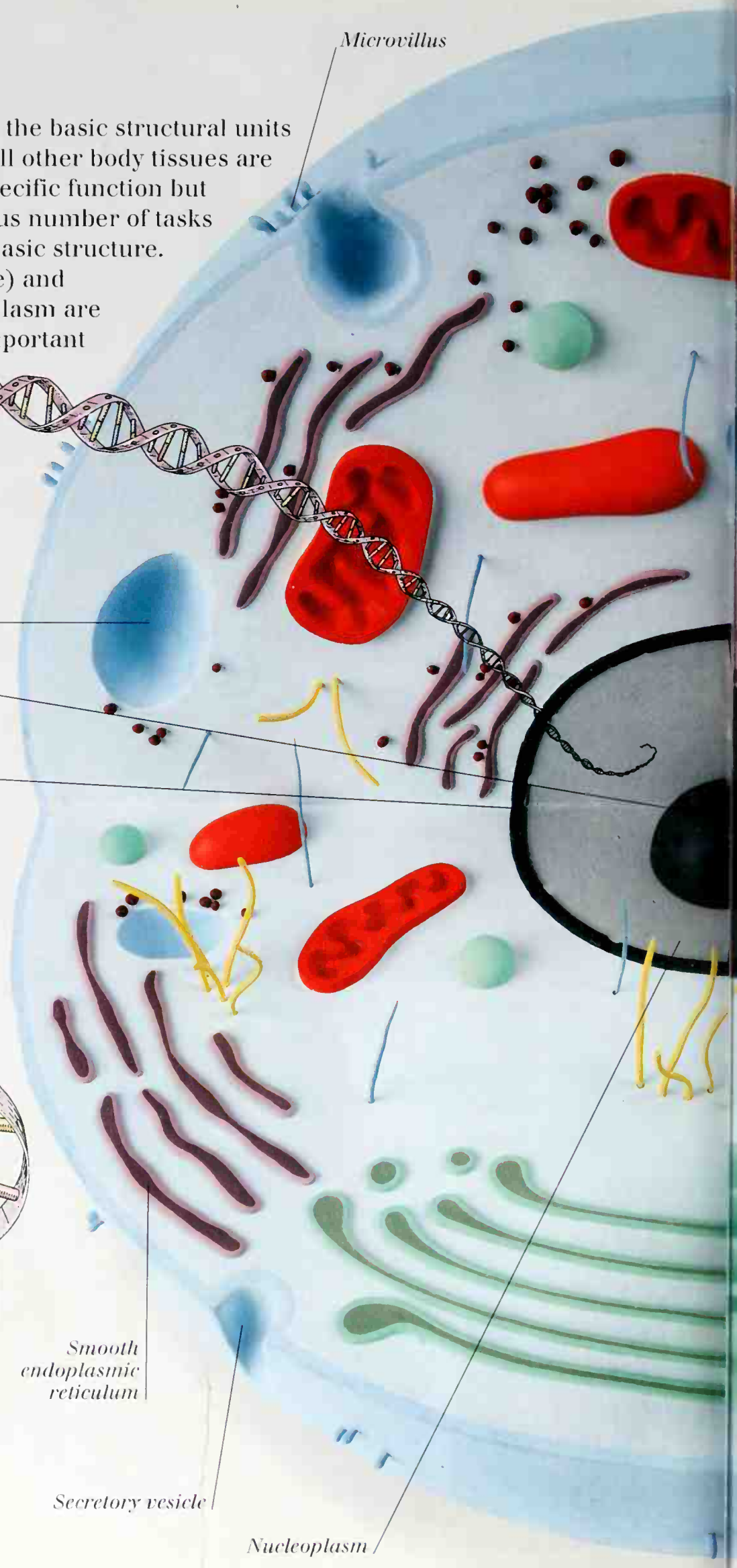
Adipose (fat) tissue

Body cells

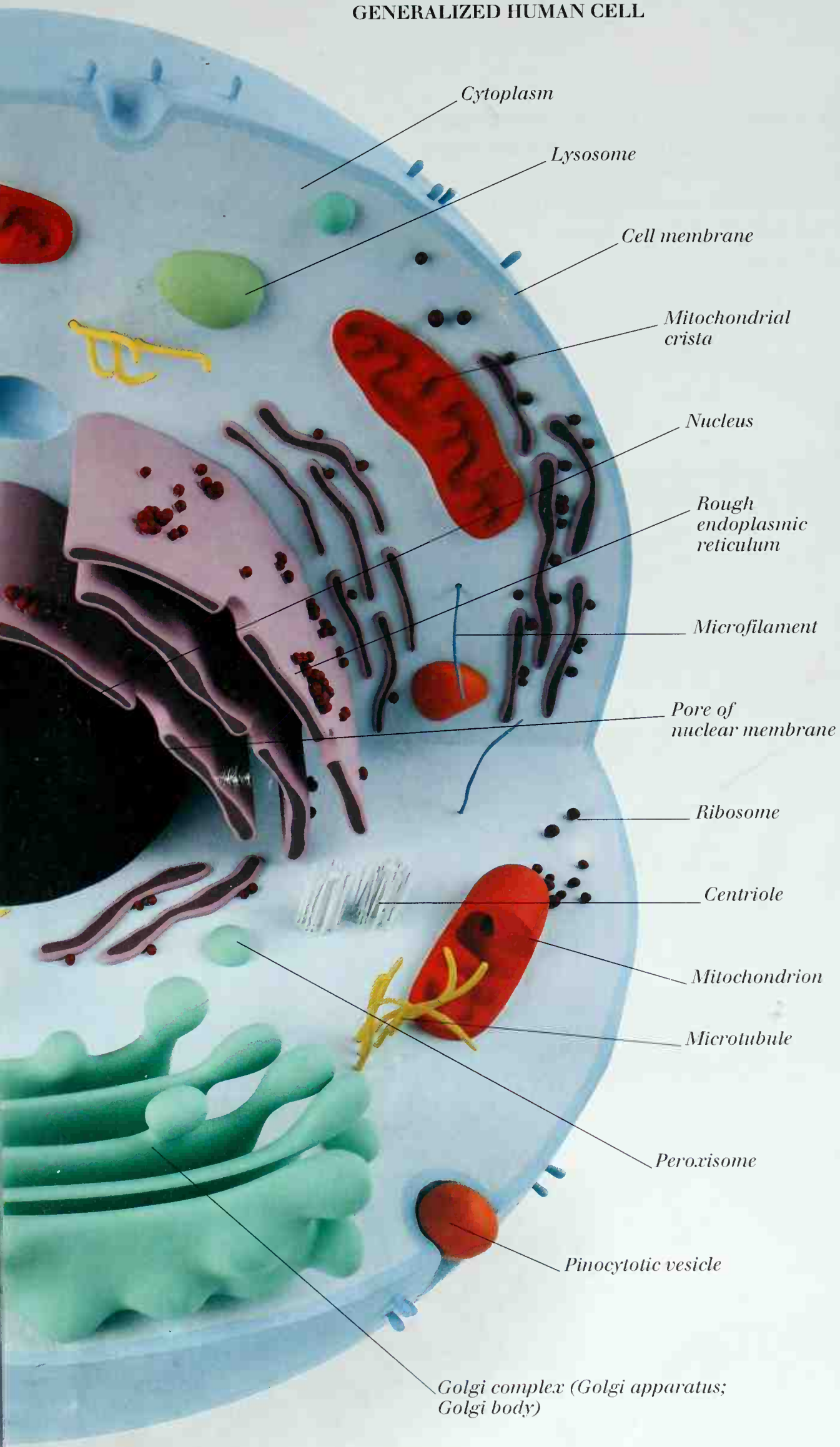
EVERYONE IS MADE UP OF BILLIONS OF CELLS, which are the basic structural units of the body. Bones, muscles, nerves, skin, blood, and all other body tissues are formed from different types of cells. Each cell has a specific function but works with other types of cells to perform the enormous number of tasks needed to sustain life. Most body cells have a similar basic structure. Each cell has an outer layer (called the cell membrane) and contains a fluid material (cytoplasm). Within the cytoplasm are many specialized structures (organelles). The most important organelle is the nucleus, which contains vital genetic material and acts as the cell's control center.



THE DOUBLE HELIX
Diagrammatic representation of DNA, which is structured like a spiral ladder. DNA contains all the vital genetic information and instruction codes necessary for the maintenance and continuation of life.



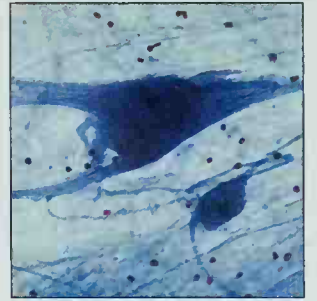
GENERALIZED HUMAN CELL



TYPES OF CELLS



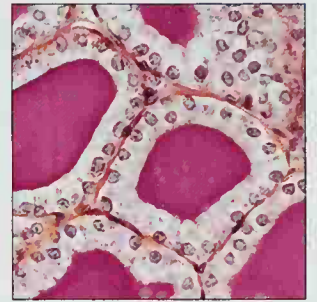
BONE-FORMING CELL



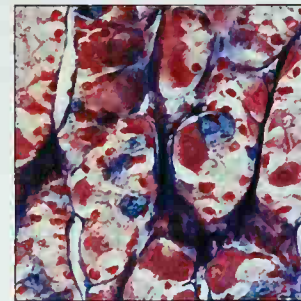
NERVE CELLS IN SPINAL CORD



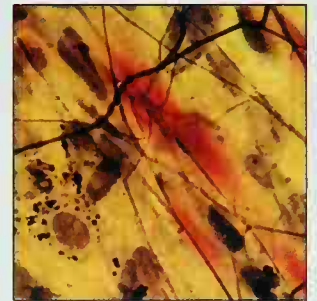
SPERM CELLS IN SEMEN



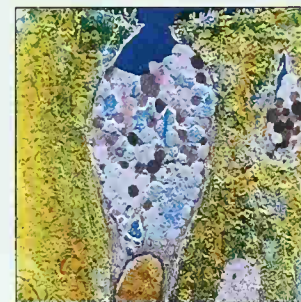
SECRETORY THYROID GLAND CELLS



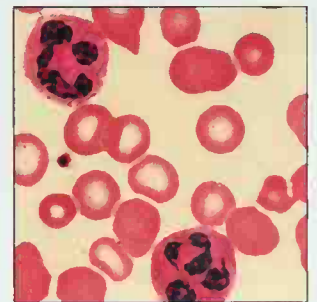
ACID-SECRETING STOMACH CELLS



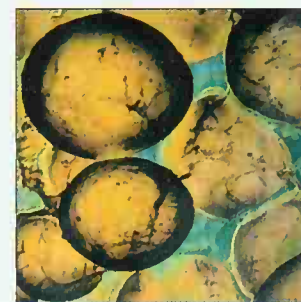
CONNECTIVE TISSUE CELLS



MUCUS-SECRETING DUODENAL CELLS



RED AND TWO WHITE BLOOD CELLS



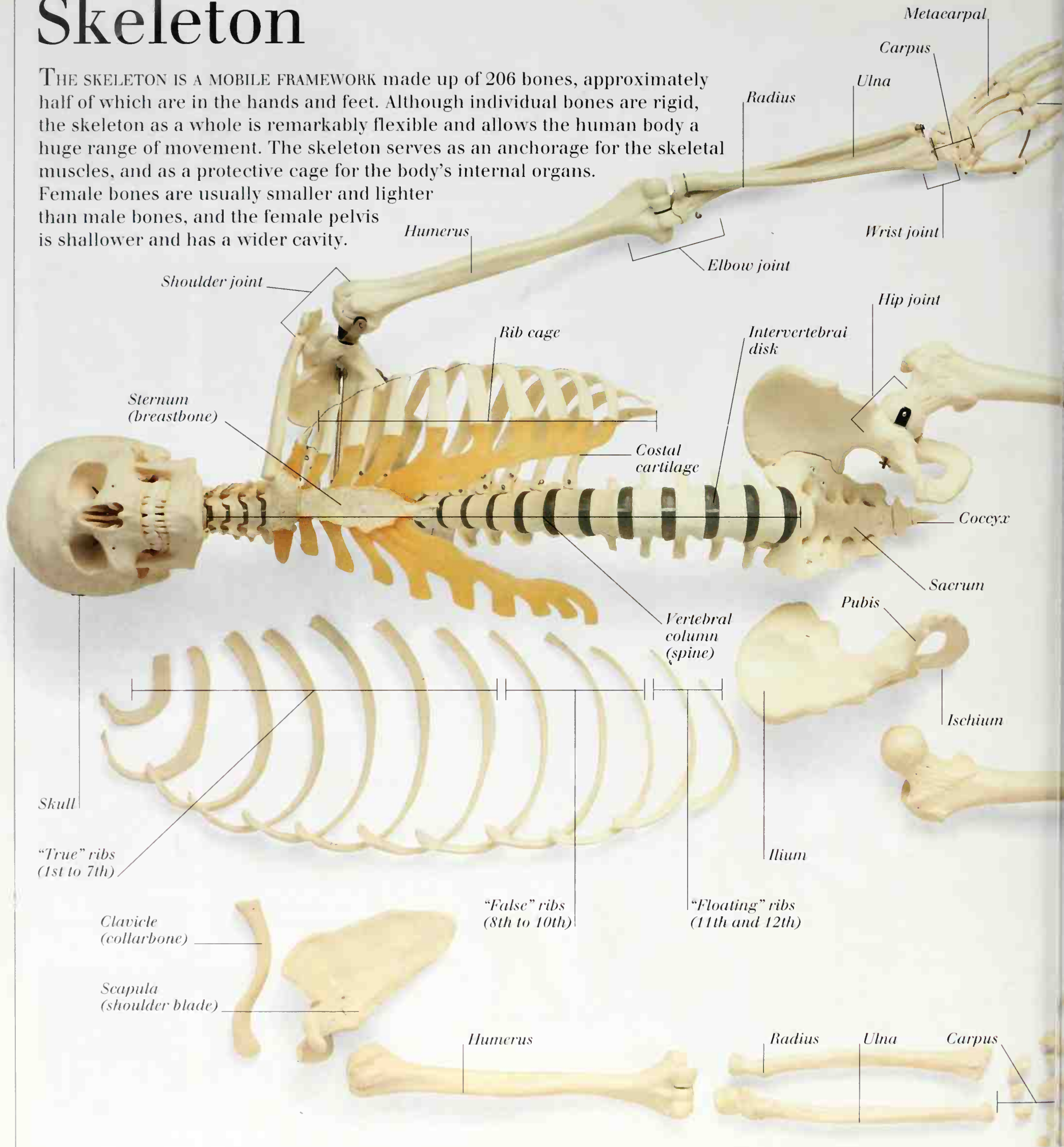
FAT CELLS IN ADIPOSE TISSUE



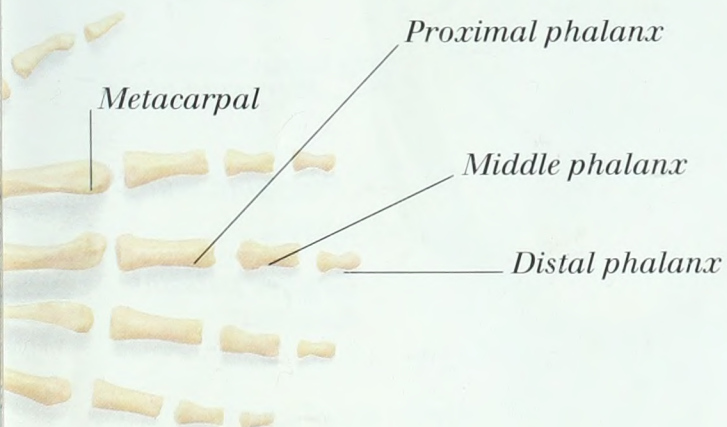
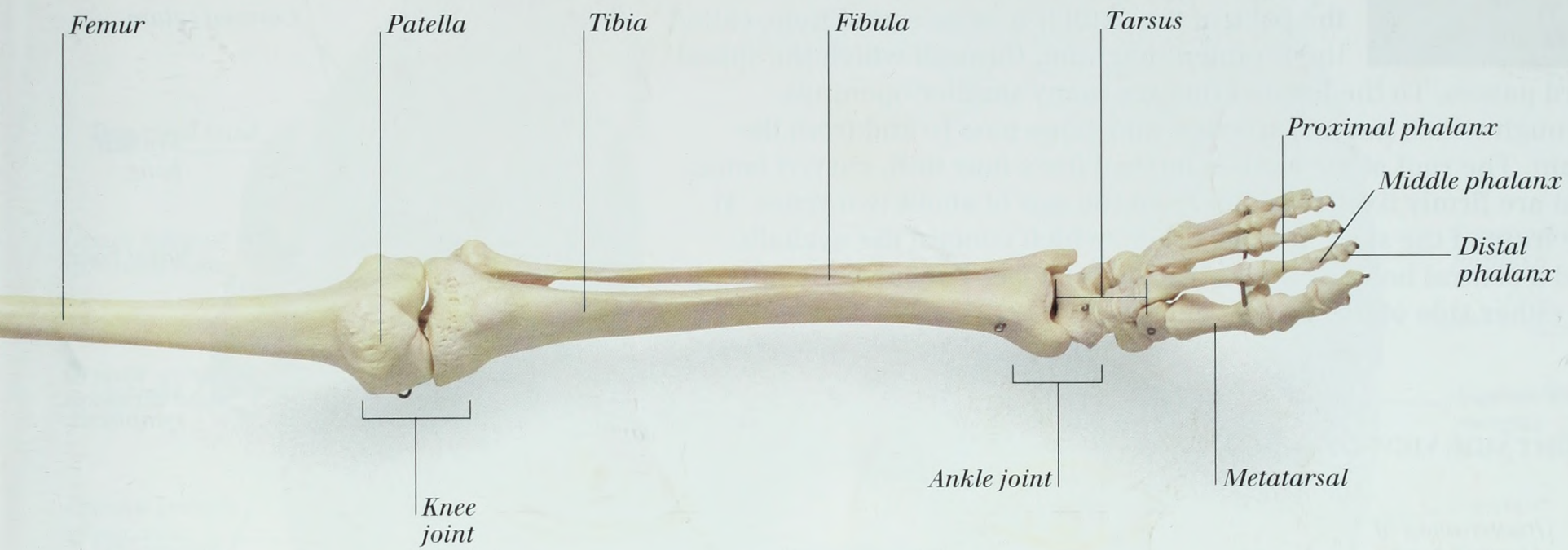
EPITHELIAL CELLS IN CHEEK

Skeleton

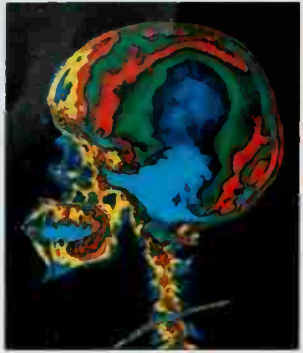
THE SKELETON IS A MOBILE FRAMEWORK made up of 206 bones, approximately half of which are in the hands and feet. Although individual bones are rigid, the skeleton as a whole is remarkably flexible and allows the human body a huge range of movement. The skeleton serves as an anchorage for the skeletal muscles, and as a protective cage for the body's internal organs. Female bones are usually smaller and lighter than male bones, and the female pelvis is shallower and has a wider cavity.



Distal phalanx
Middle phalanx
Proximal phalanx

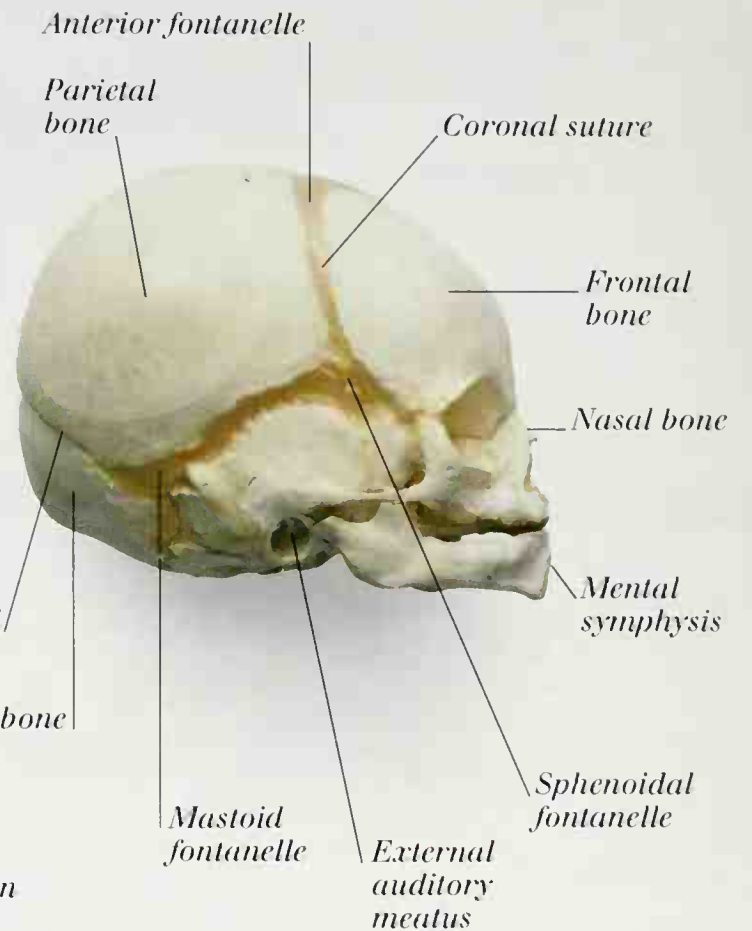


Skull

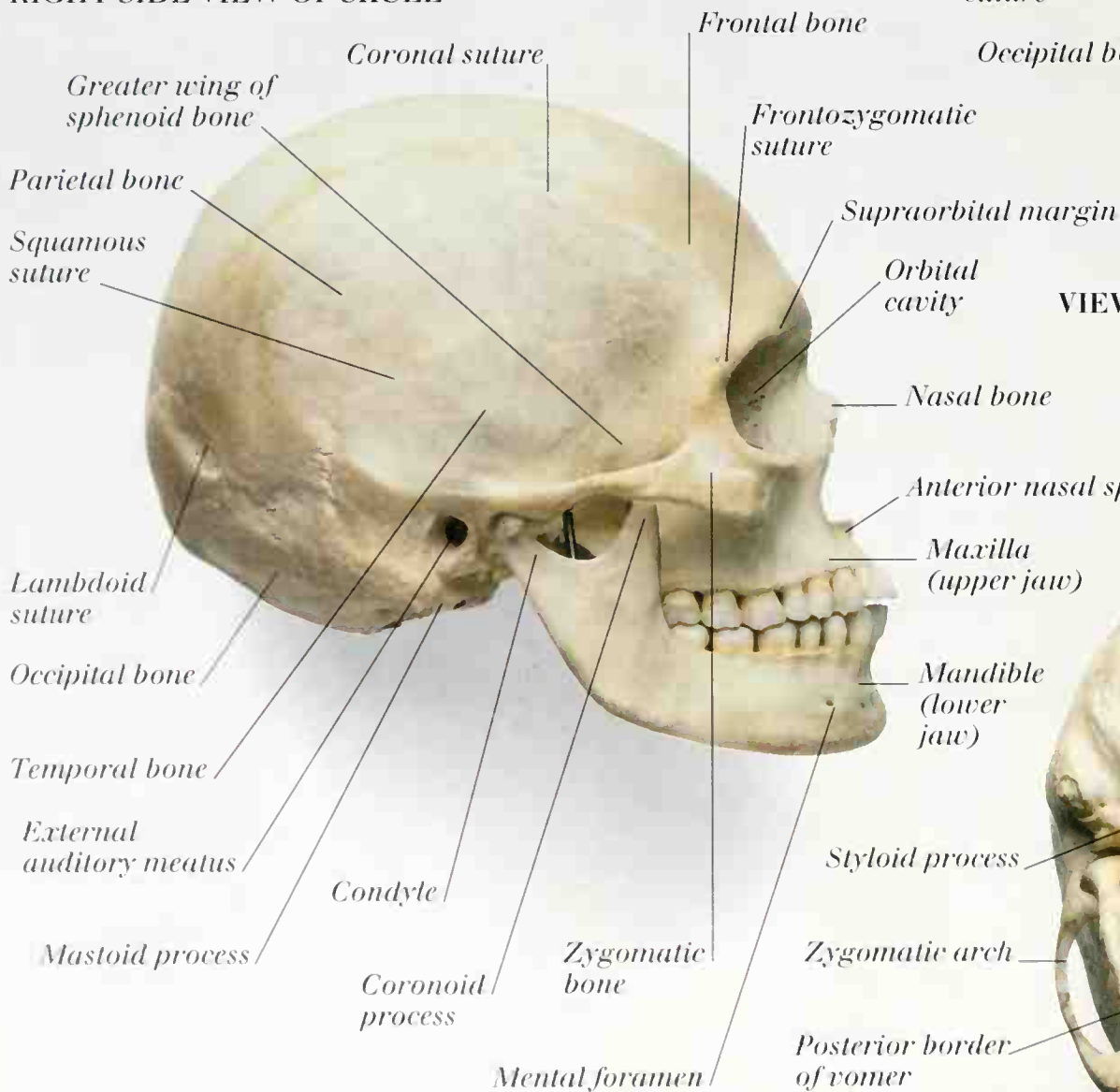


THE SKULL is the most complicated bony structure of the body—but every feature serves a purpose. Internally, the main hollow chamber of the skull has three levels that support the brain, with every bump and hollow corresponding to the shape of the brain. Underneath and toward the back of the skull is a large round hole, called the foramen magnum, through which the spinal cord passes. To the front of this are many smaller openings through which nerves, arteries, and veins pass to and from the brain. The roof of the skull is formed from four thin, curved bones that are firmly fixed together from the age of about two years. At the front of the skull are two orbits, which contain the eyeballs, and a central hole for the airway of the nose. The jawbone hinges on either side of the skull at ear level.

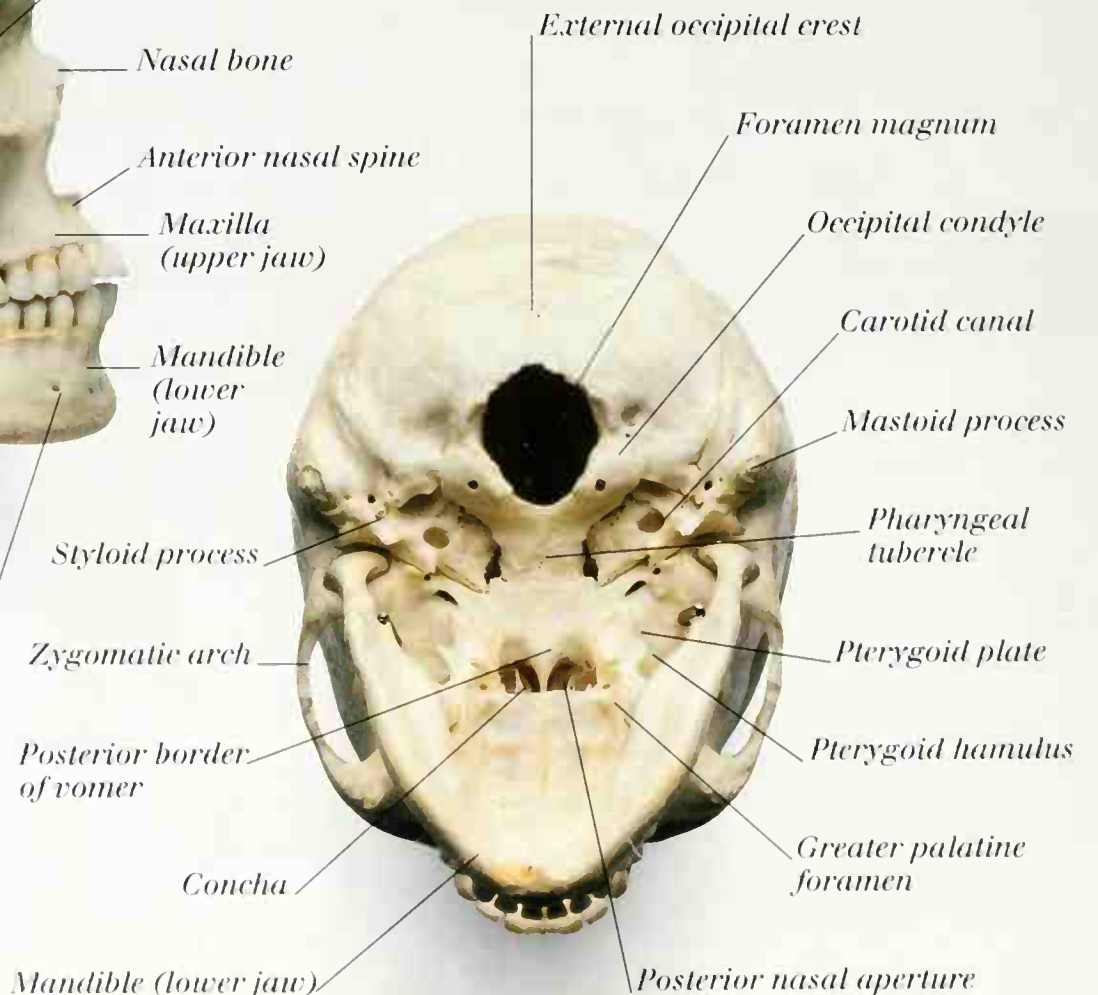
RIGHT SIDE VIEW OF A FETAL SKULL



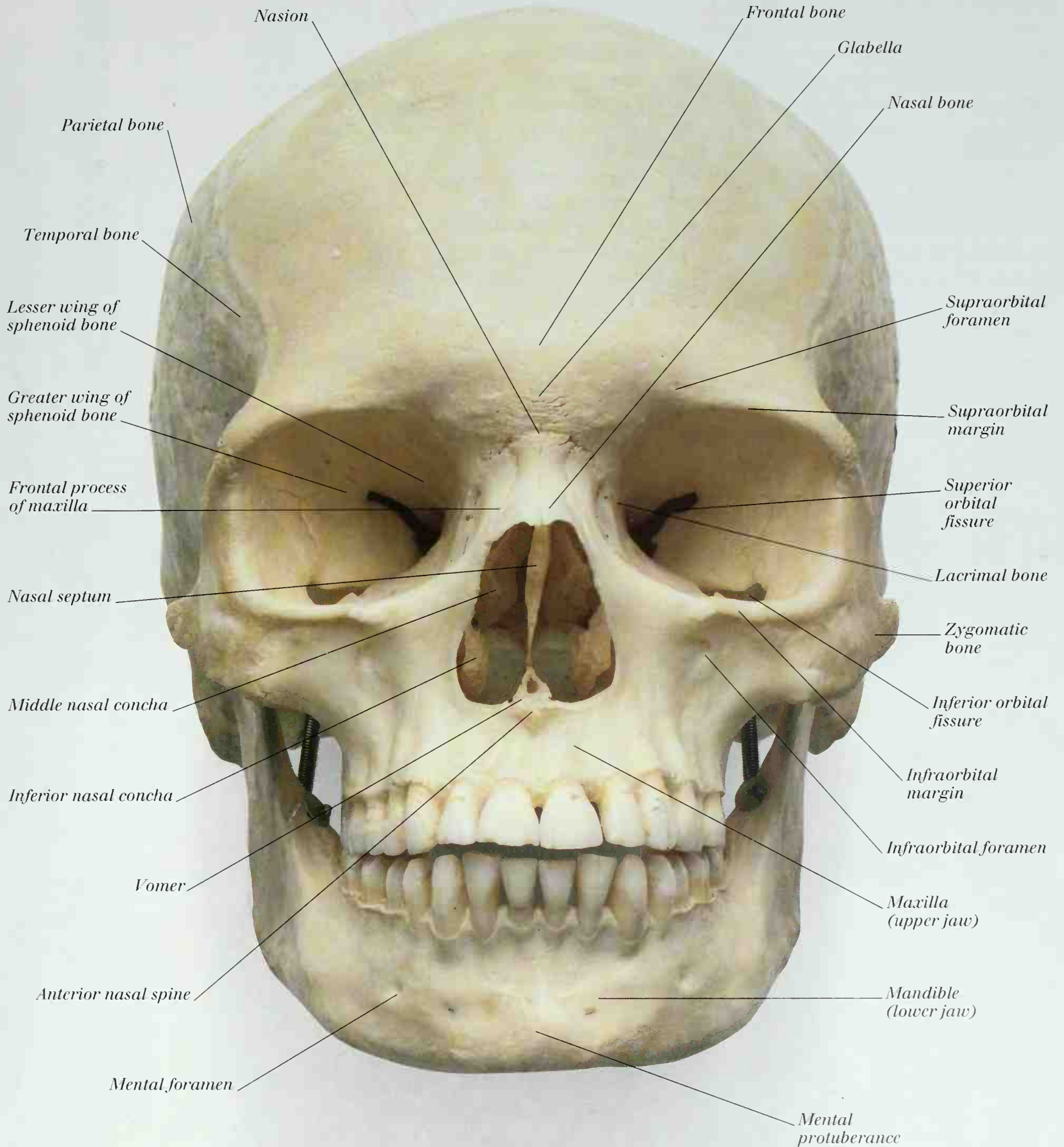
RIGHT SIDE VIEW OF SKULL



VIEW OF SKULL FROM BELOW



FRONT VIEW OF SKULL

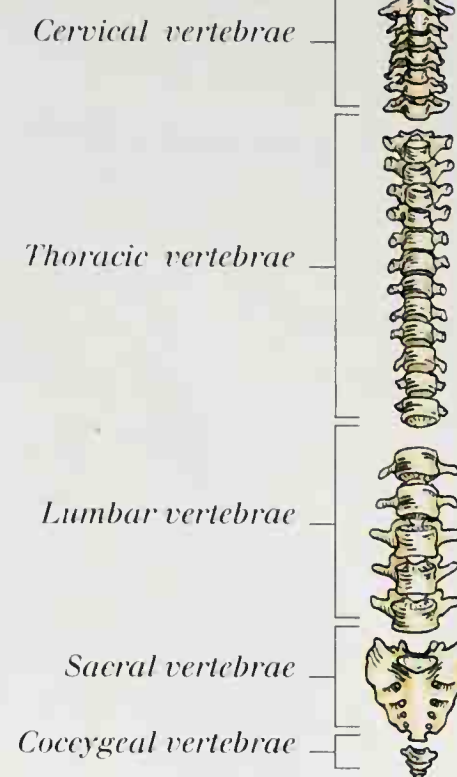


Spine

THE SPINE (OR SPINAL COLUMN) has two main functions: it serves as a protective surrounding for the delicate spinal cord and forms the supporting backbone of the skeleton. The spine consists of 24 separate, differently shaped bones (vertebrae) with a curved, triangular bone (the sacrum) at the bottom. The sacrum is made up of fused vertebrae; at its lower end is a small tail-like structure made up of tiny bones collectively called the coccyx. Between each pair of vertebrae is a disk of cartilage that cushions the bones during movement. The top two vertebrae differ in appearance from the others and work as a pair: the first, called the atlas, rotates around a stout vertical peg on the second, called the axis. This arrangement allows the skull to move freely up and down, and from side to side.

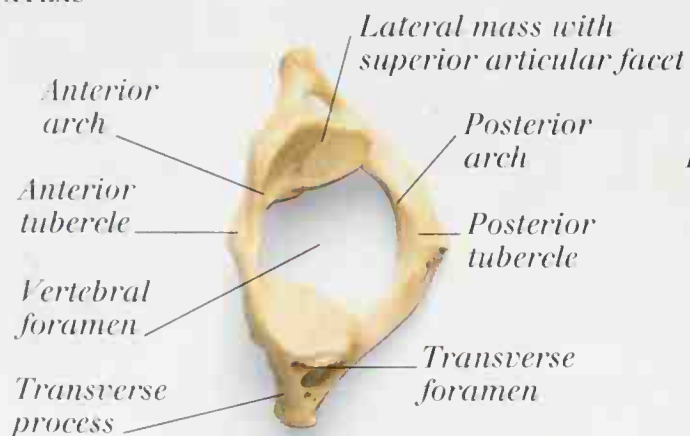
SPINE DIVIDED INTO VERTEBRAL SECTIONS

FRONTAL VIEW

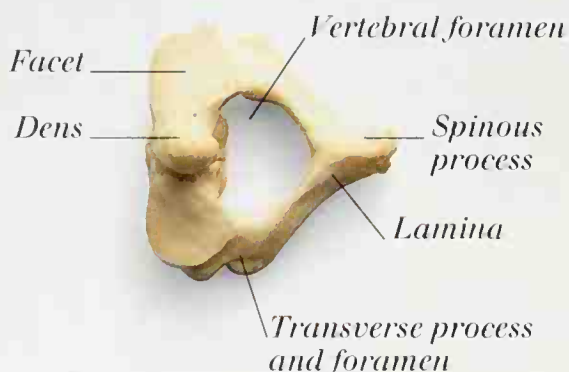


TYPES OF VERTEBRAE

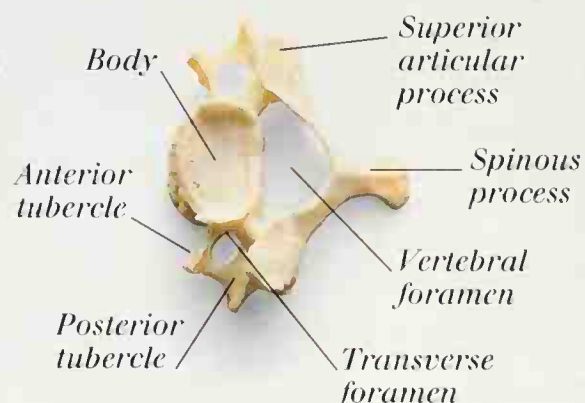
ATLAS



AXIS

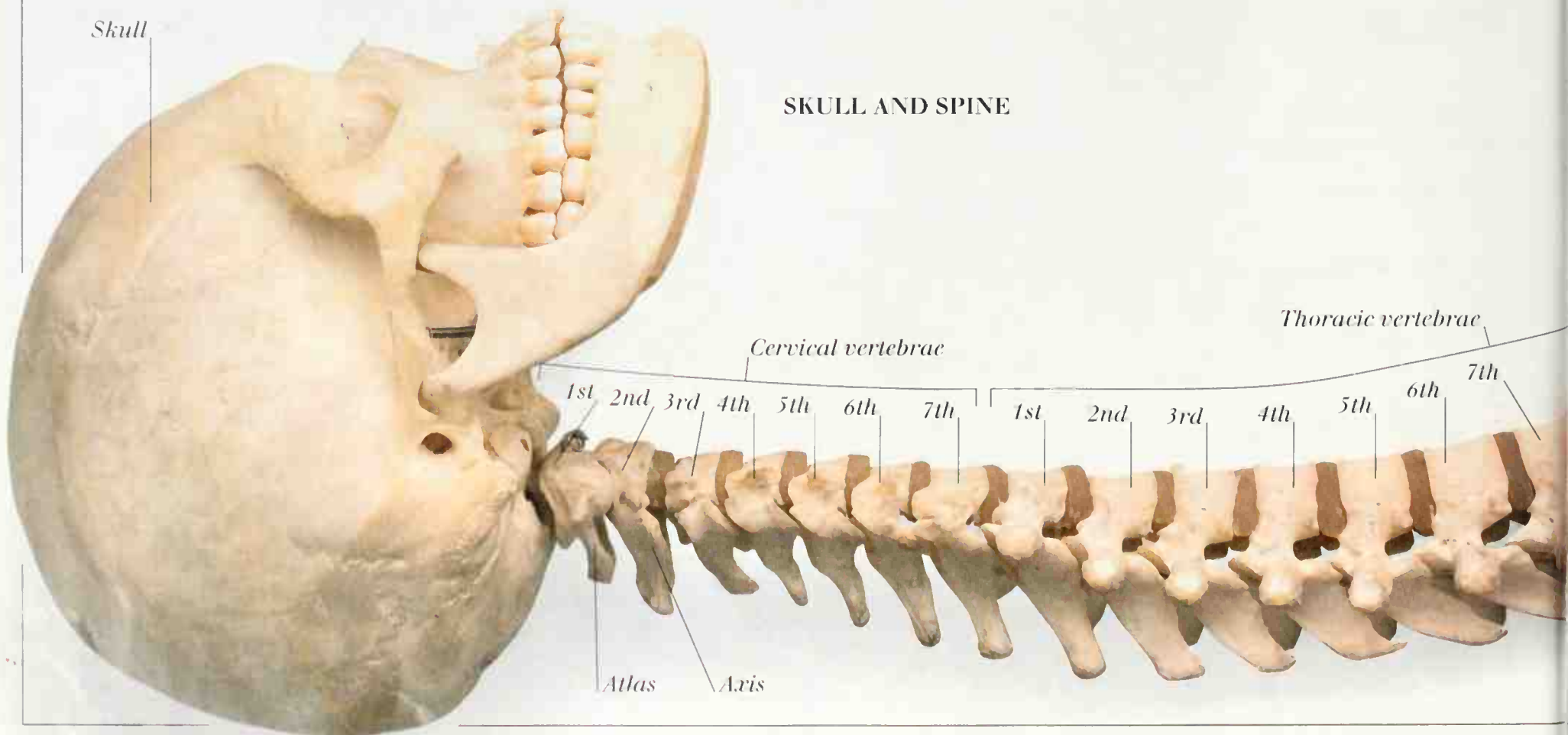


CERVICAL VERTEBRA



Skull

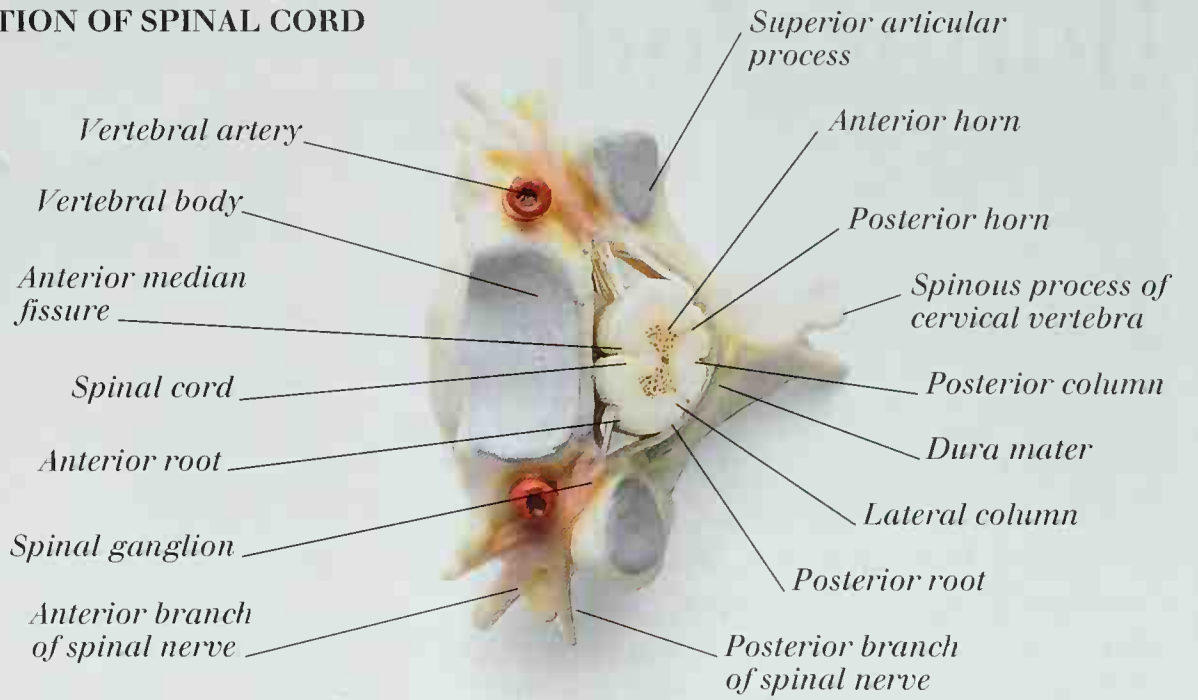
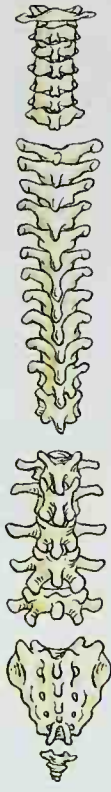
SKULL AND SPINE



RIGHT SIDE VIEW

BACK VIEW

CERVICAL VERTEBRA AND SECTION OF SPINAL CORD

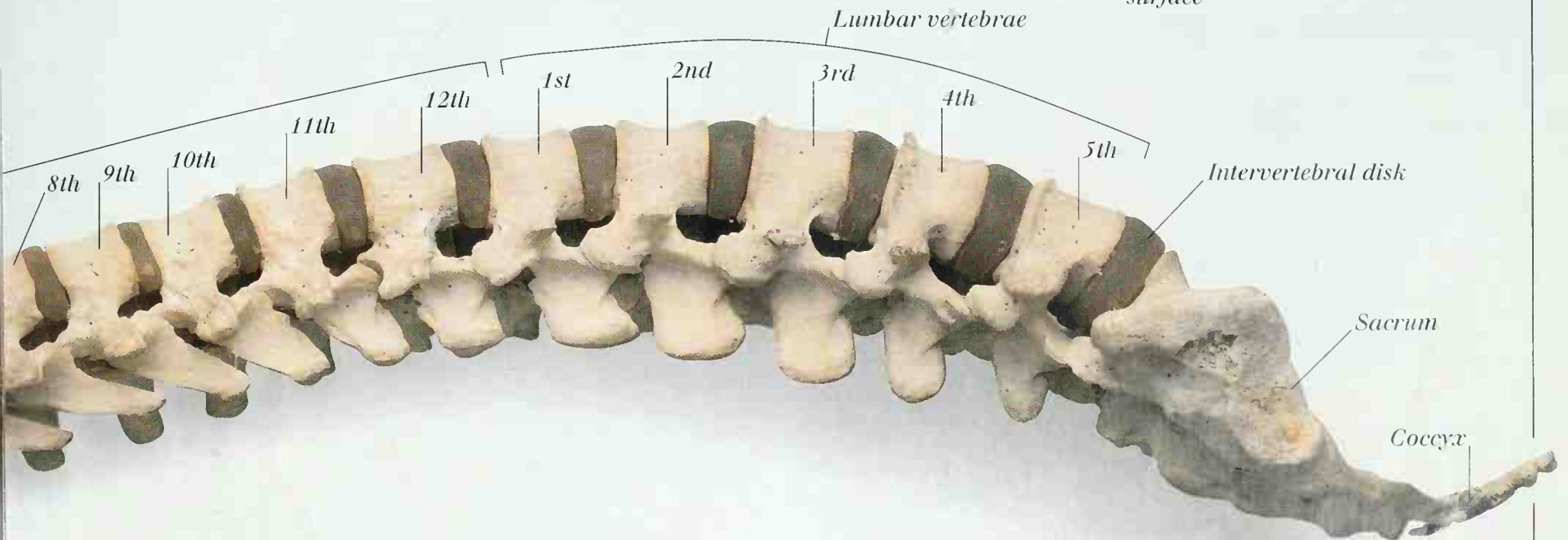
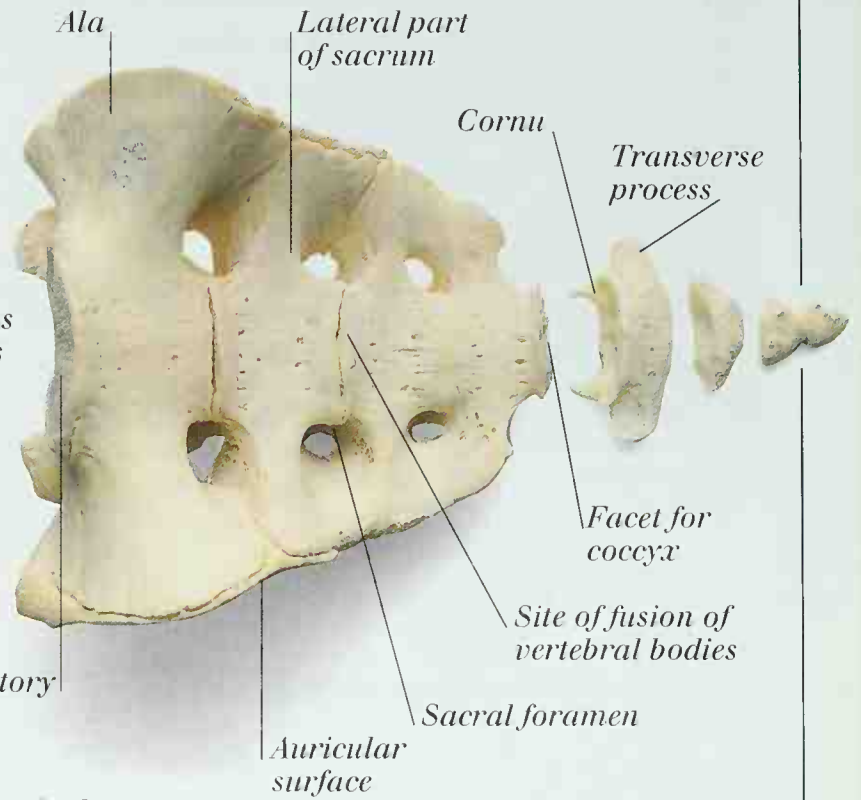
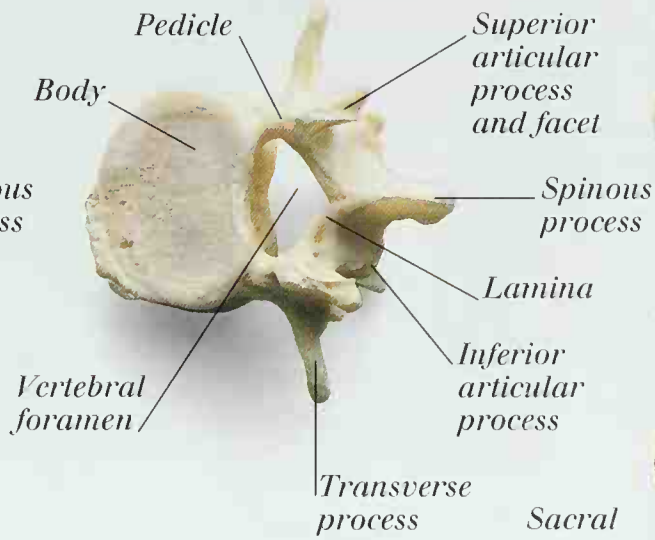
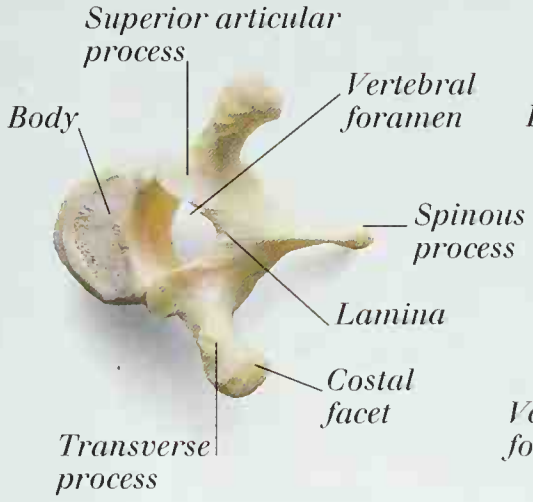


SACRUM

COCCYX

THORACIC VERTEBRA

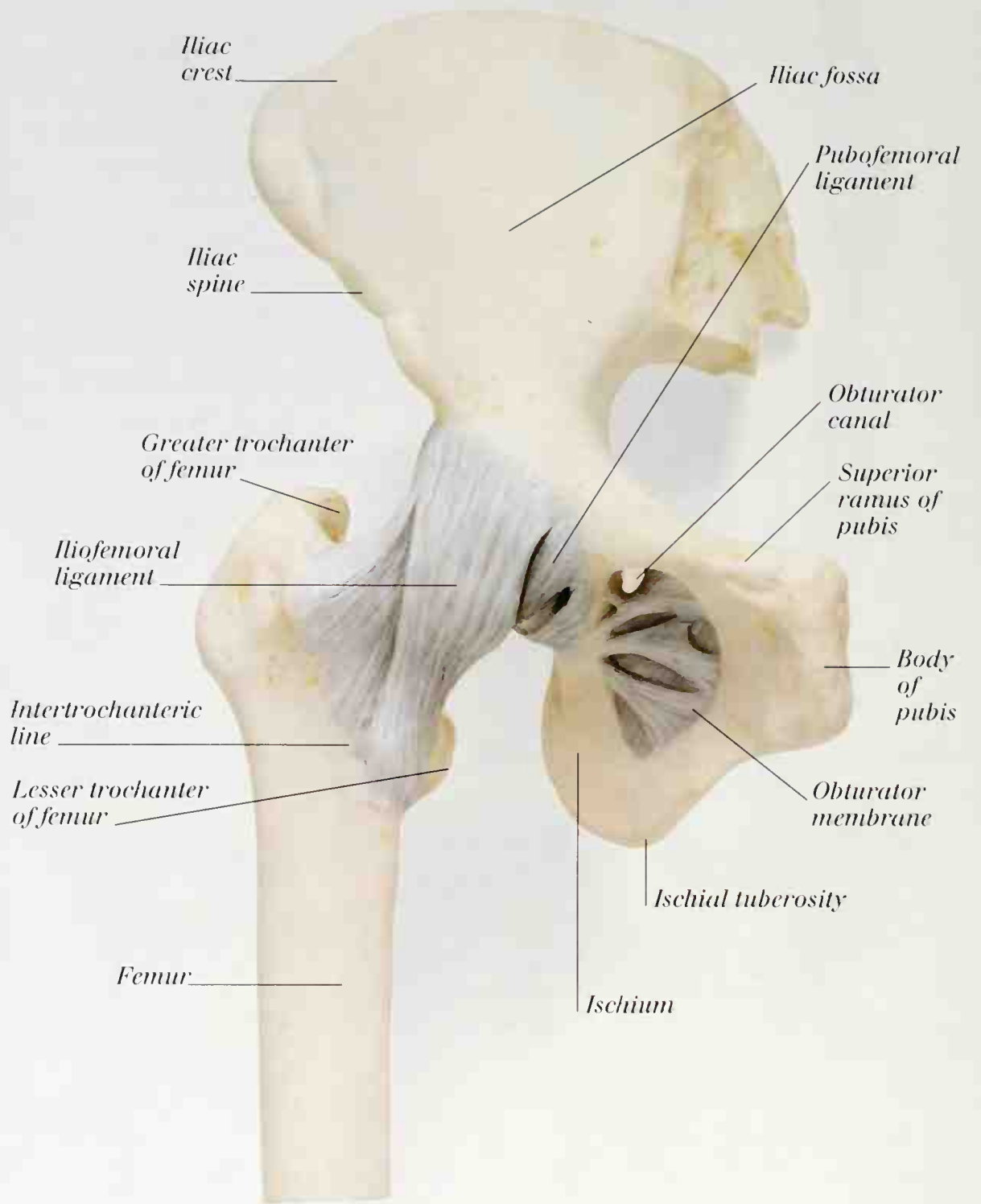
LUMBAR VERTEBRA



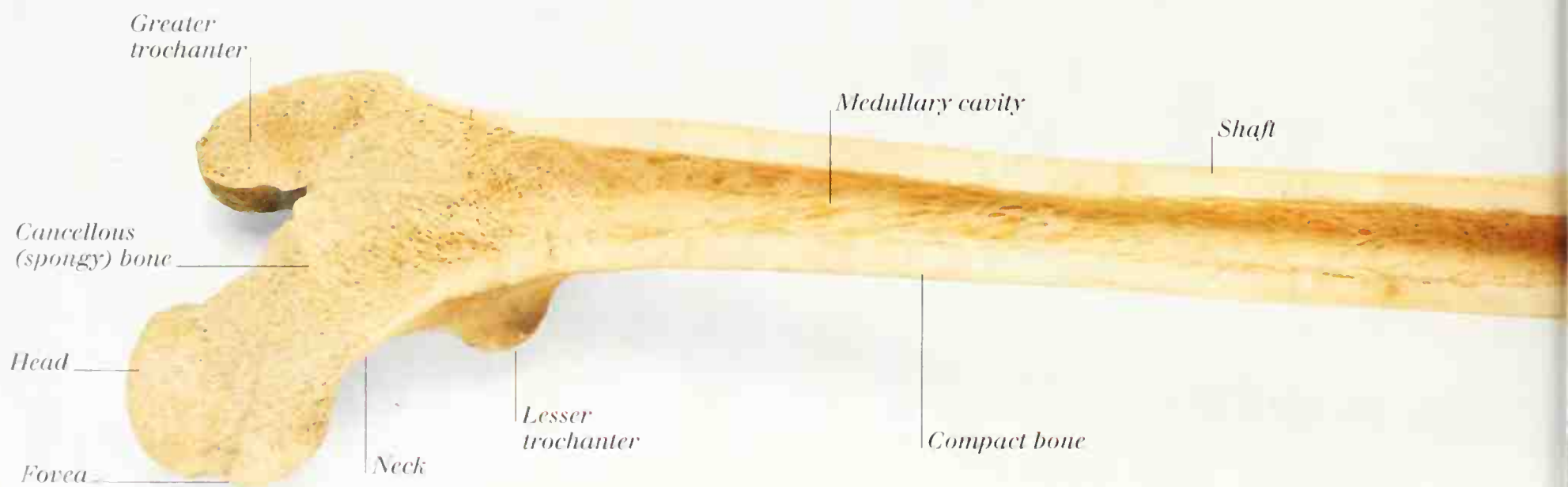
Bones and joints

BONES FORM the body's hard, strong skeletal framework. Each bone has a hard, compact exterior surrounding a spongy, lighter interior. The long bones of the arms and legs, such as the femur (thigh bone), have a central cavity containing bone marrow. Bones are composed chiefly of calcium, phosphorus, and a fibrous substance known as collagen. Bones meet at joints, which are of several different types. For example, the hip is a ball-and-socket joint that allows the femur a wide range of movement, whereas finger joints are simple hinge joints that allow only bending and straightening. Joints are held in place by bands of tissue called ligaments. Movement of joints is facilitated by the smooth hyaline cartilage that covers the bone ends and by the synovial membrane that lines and lubricates the joint.

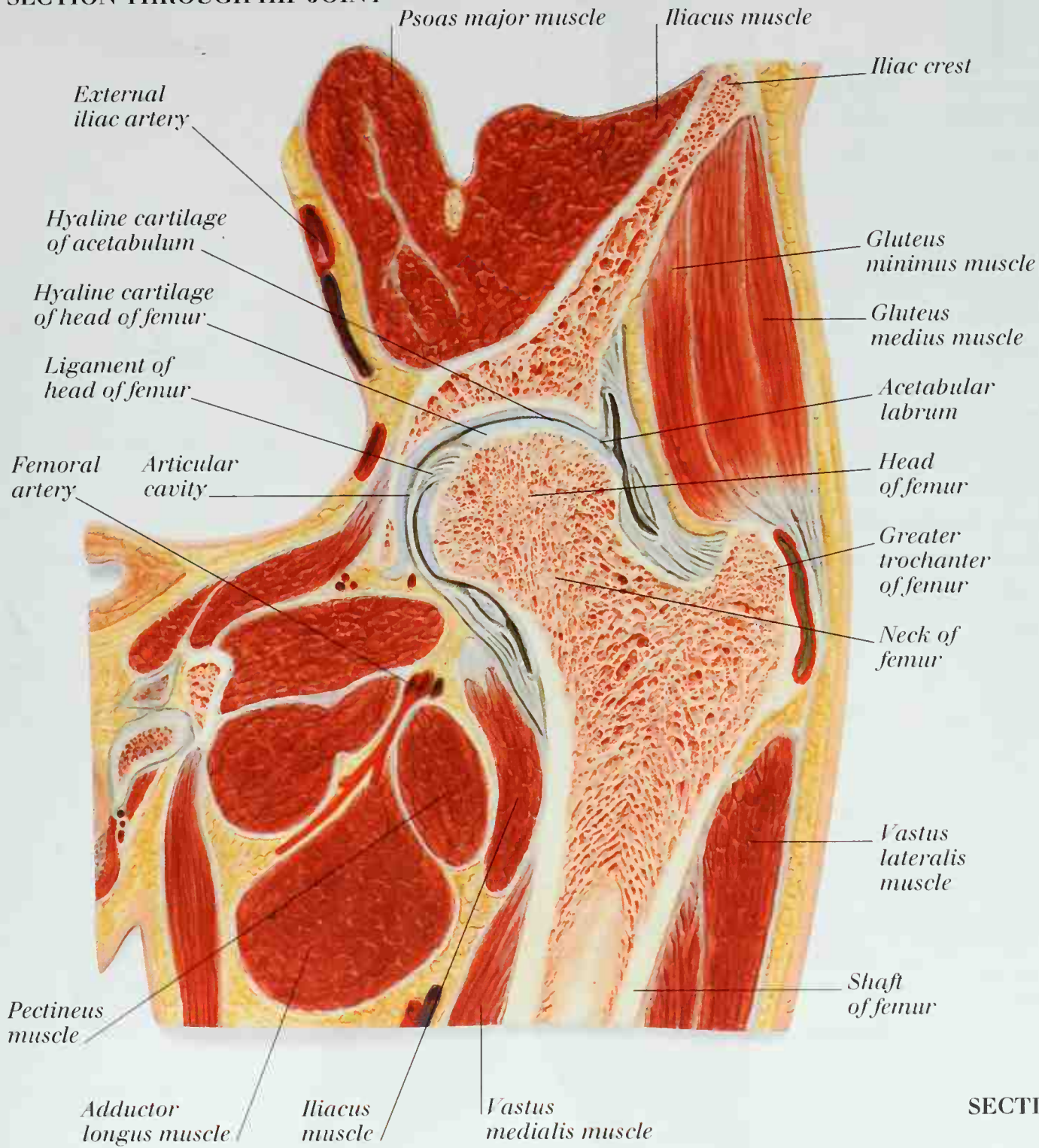
LIGAMENTS SURROUNDING HIP JOINT



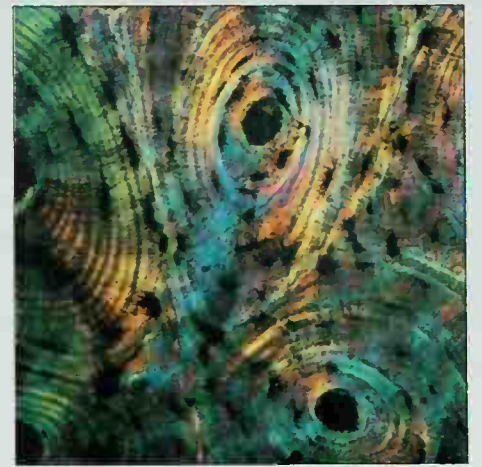
SECTION THROUGH LEFT FEMUR



SECTION THROUGH HIP JOINT

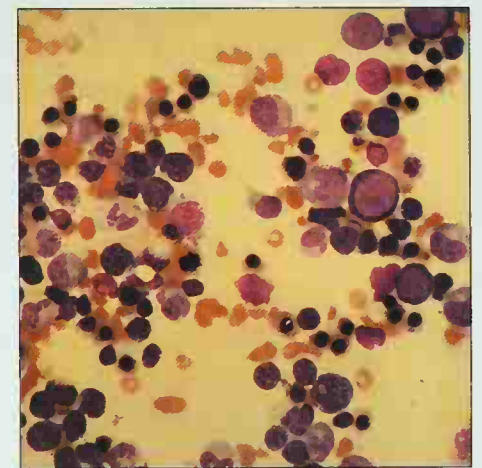


SECTION OF COMPACT BONE



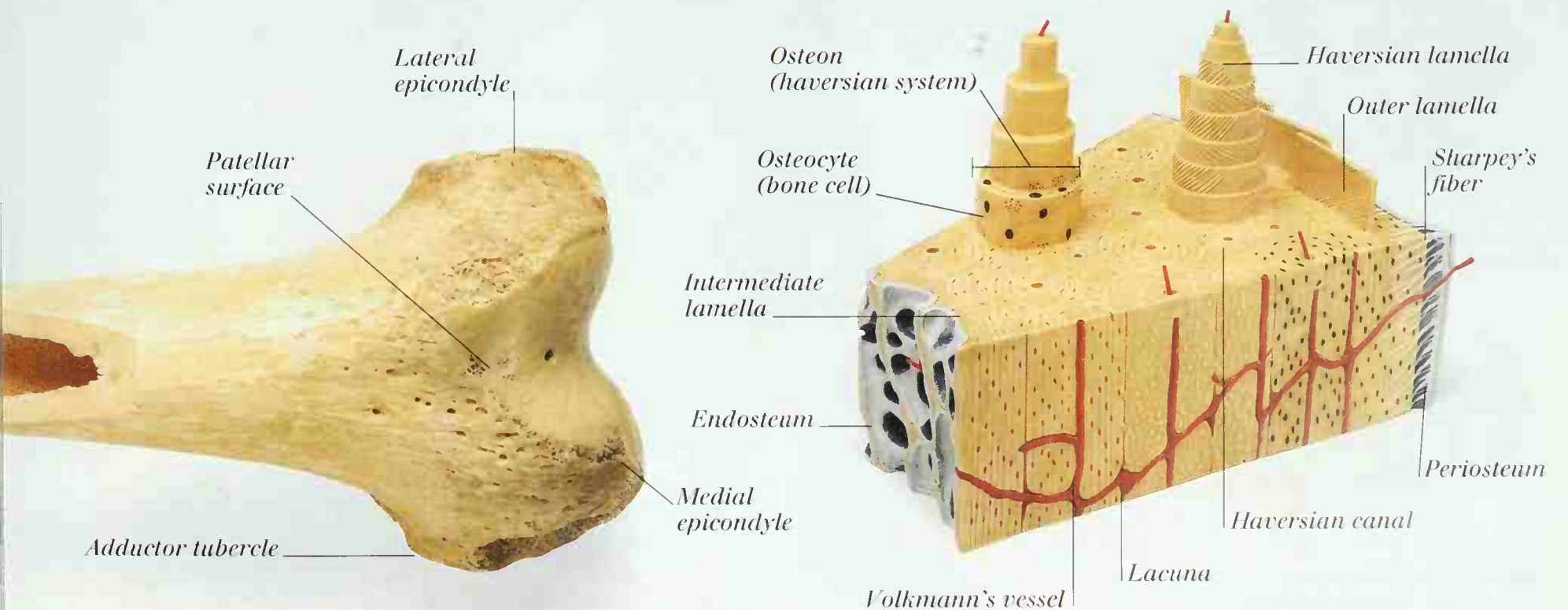
Parallel rows of concentric bony layers make up this strong material.

BONE MARROW CELLS



Composed mainly of red and white blood cells, marrow fills the cavities of bones.

SECTION THROUGH LONG BONE



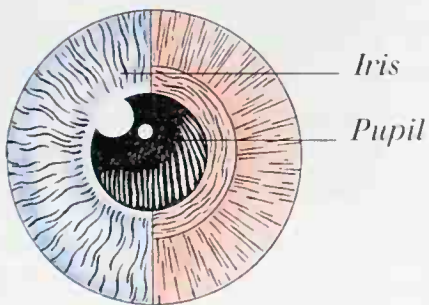
Muscles 1

SUPERFICIAL SKELETAL MUSCLES

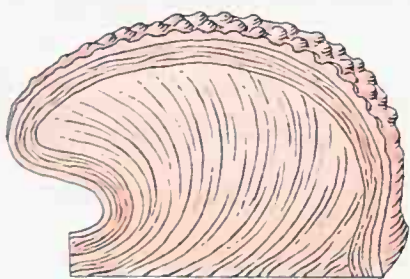
FRONT VIEW

THERE ARE THREE MAIN TYPES OF MUSCLE: skeletal muscle (also called voluntary muscle because it can be consciously controlled); smooth muscle (also called involuntary muscle because it is not under voluntary control); and the specialized muscle tissue of the heart. Humans have more than 600 skeletal muscles, which differ in size and shape according to the jobs they do. Skeletal muscles are attached either directly or indirectly (via tendons) to bones, and work in opposing pairs (one muscle in the pair contracts while the other relaxes) to produce body movements as diverse as walking, threading a needle, and an array of facial expressions. Smooth muscles occur in the walls of internal body organs and perform actions such as forcing food through the intestines, contracting the uterus (womb) in childbirth, and pumping blood through the blood vessels.

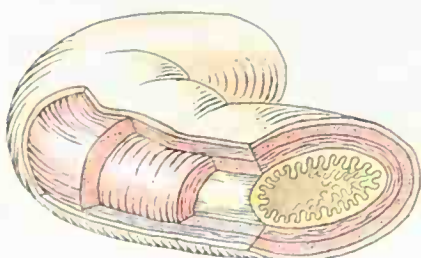
SOME OTHER MUSCLES IN THE BODY



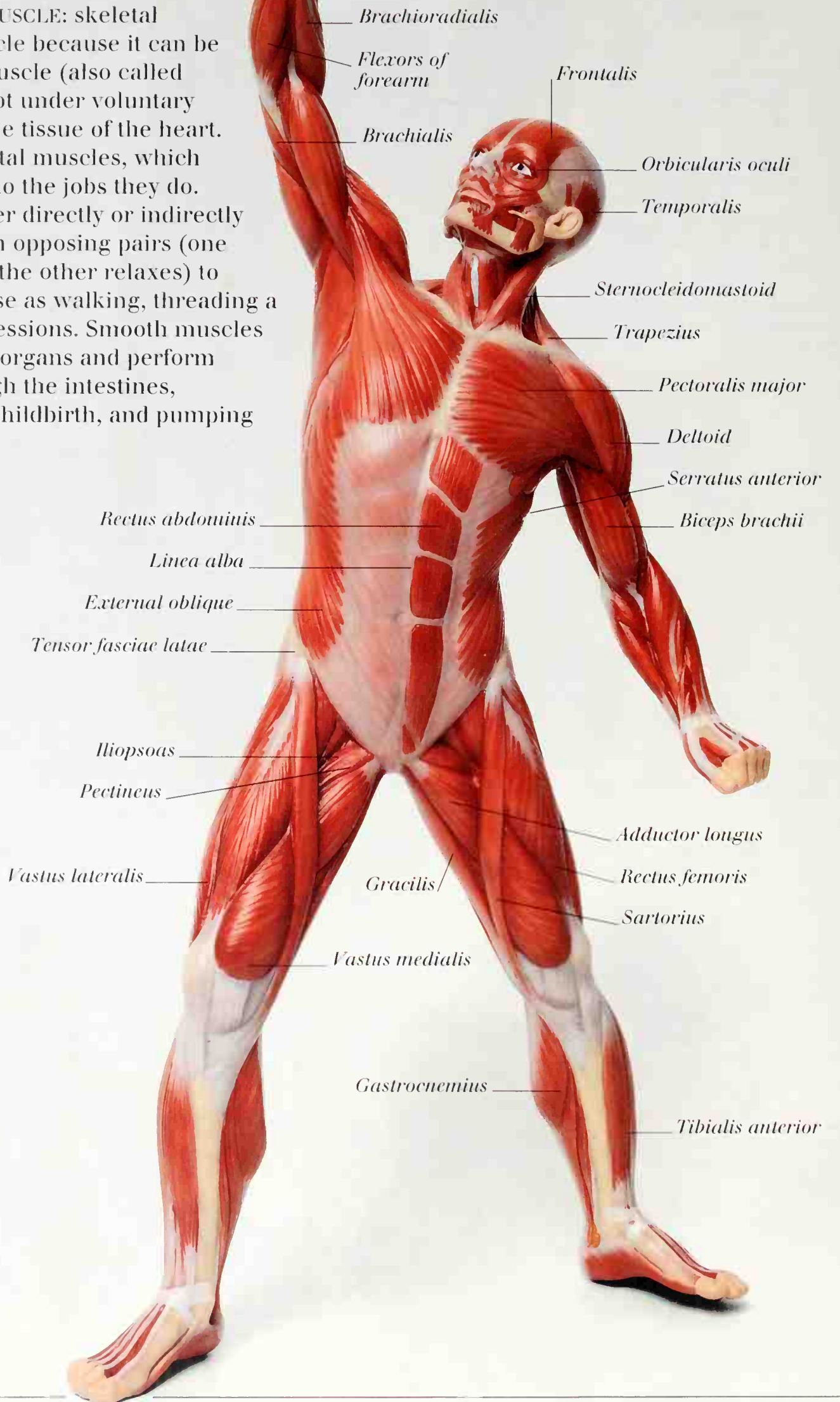
IRIS
The muscle fibers contract and dilate (expand) to alter pupil size.



TONGUE
Interlacing layers of muscle allow great mobility.



ILEUM
Opposing muscle layers transport semidigested food.



Brachioradialis

Flexors of forearm

Frontalis

Brachialis

Orbicularis oculi

Temporalis

Sternocleidomastoid

Trapezius

Pectoralis major

Deltoid

Serratus anterior

Biceps brachii

Rectus abdominis

Linea alba

External oblique

Tensor fasciae latae

Iliopsoas

Pectineus

Adductor longus

Rectus femoris

Sartorius

Vastus lateralis

Gracilis

Vastus medialis

Gastrocnemius

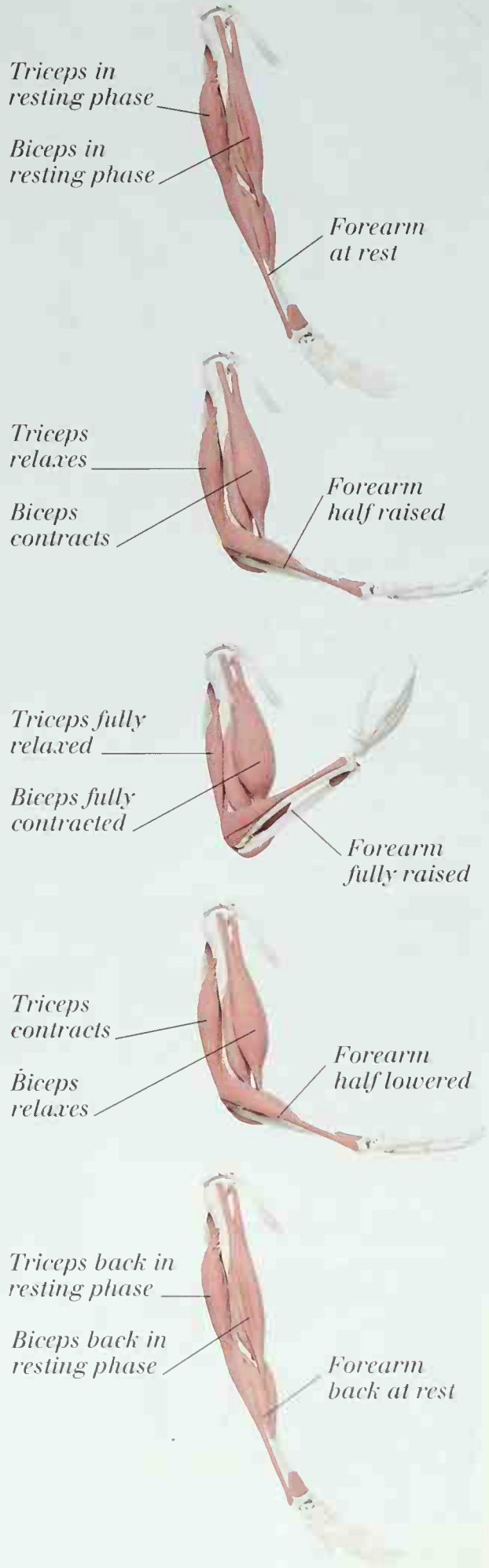
Tibialis anterior

BACK VIEW



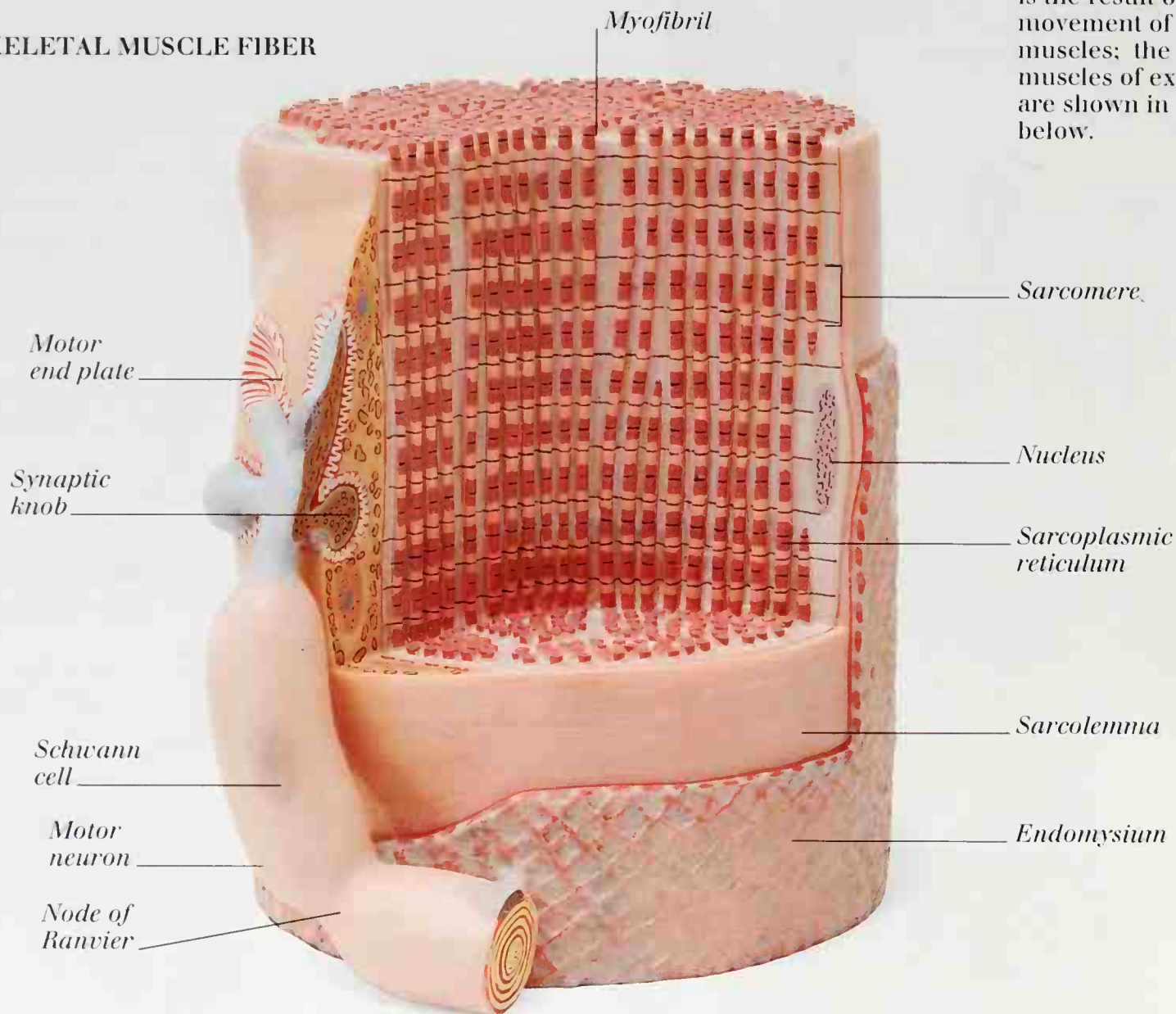
MOVEMENT OF THE FOREARM

Controlled movement of the limbs relies on coordinated relaxation and contraction of opposing muscles. To raise the forearm, the biceps (two-rooted muscle) contracts and shortens while the triceps (three-rooted muscle) relaxes; the reverse occurs when the forearm is lowered.



Muscles 2

SKELETAL MUSCLE FIBER



MUSCLES OF FACIAL EXPRESSION

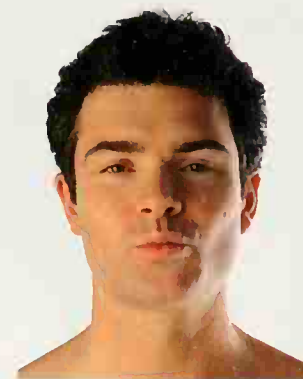
A single expression is the result of movement of many muscles; the main muscles of expression are shown in action below.



FRONTALIS

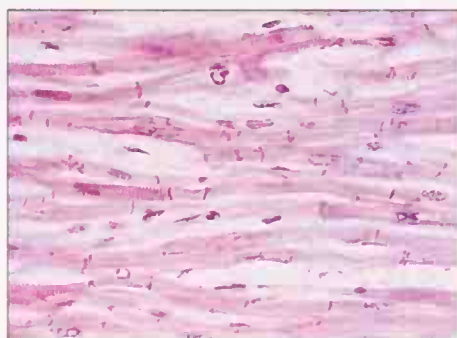


CORRUGATOR SUPERCILII

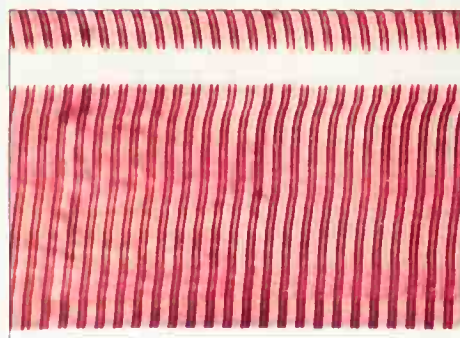


ORBICULARIS ORIS

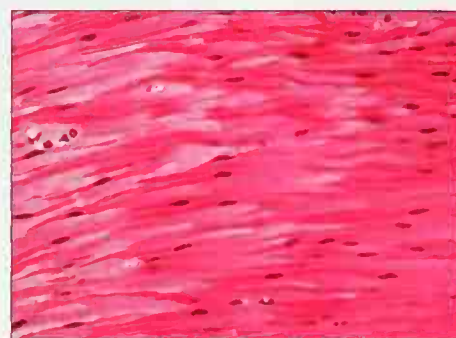
TYPES OF MUSCLE



CARDIAC MUSCLE



SKELETAL MUSCLE

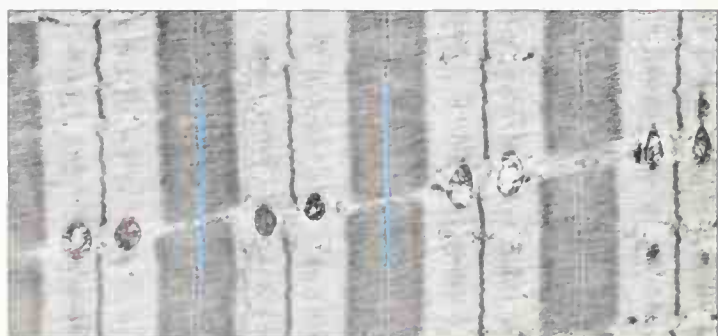


SMOOTH MUSCLE

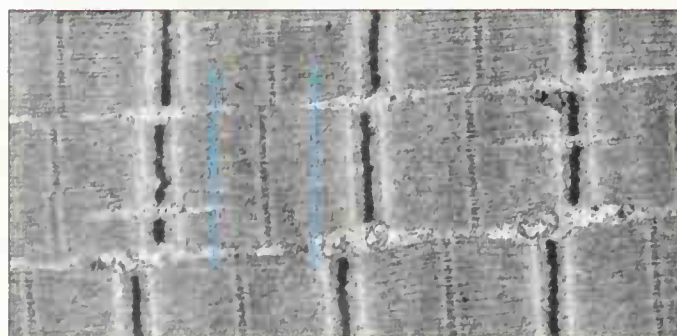


ZYGOMATICUS MAJOR

CONTRACTION OF SKELETAL MUSCLE



RELAXED STATE

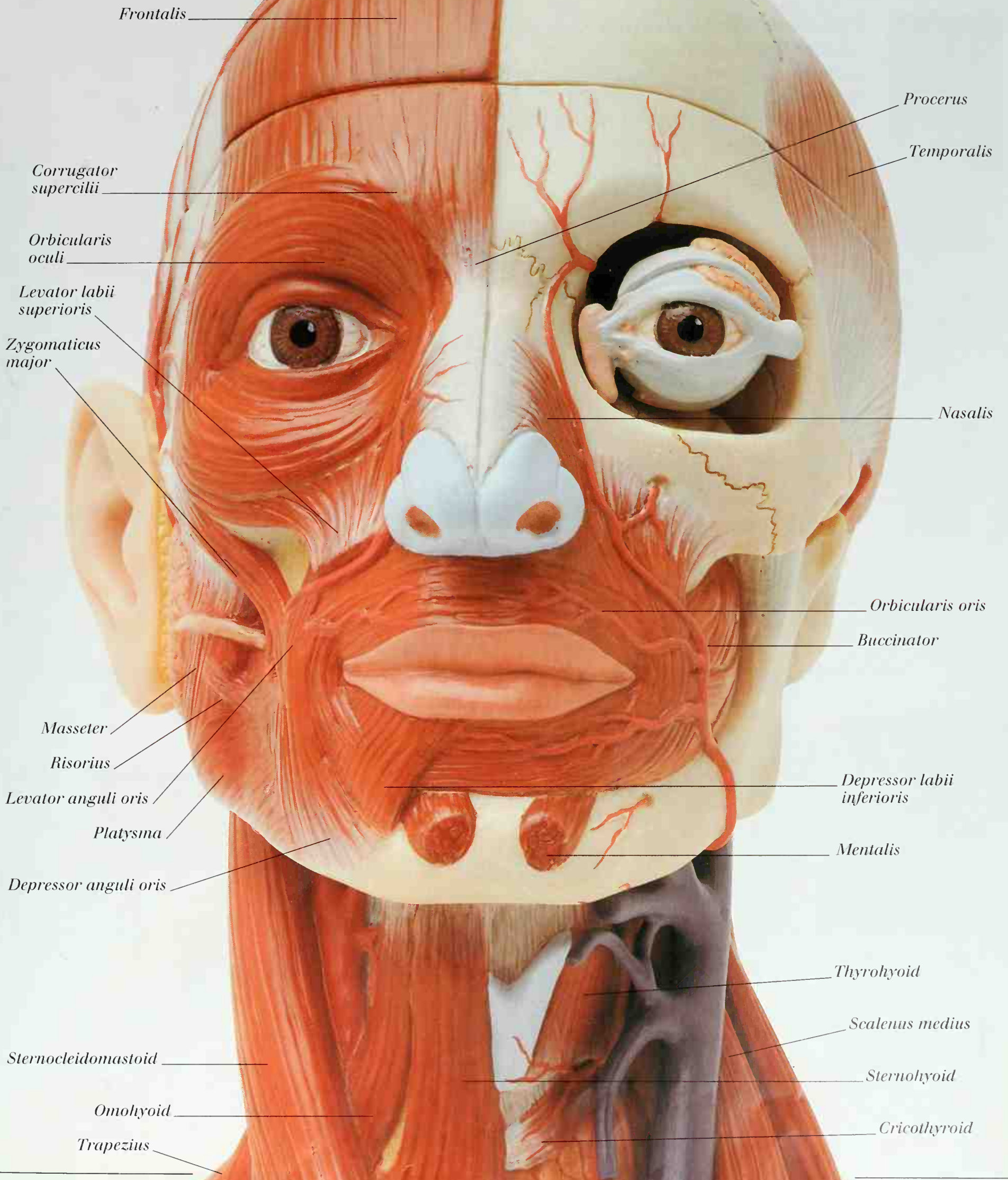


CONTRACTED STATE



DEPRESSOR ANGULI ORIS

**MUSCLES OF
HEAD AND NECK**



Hands



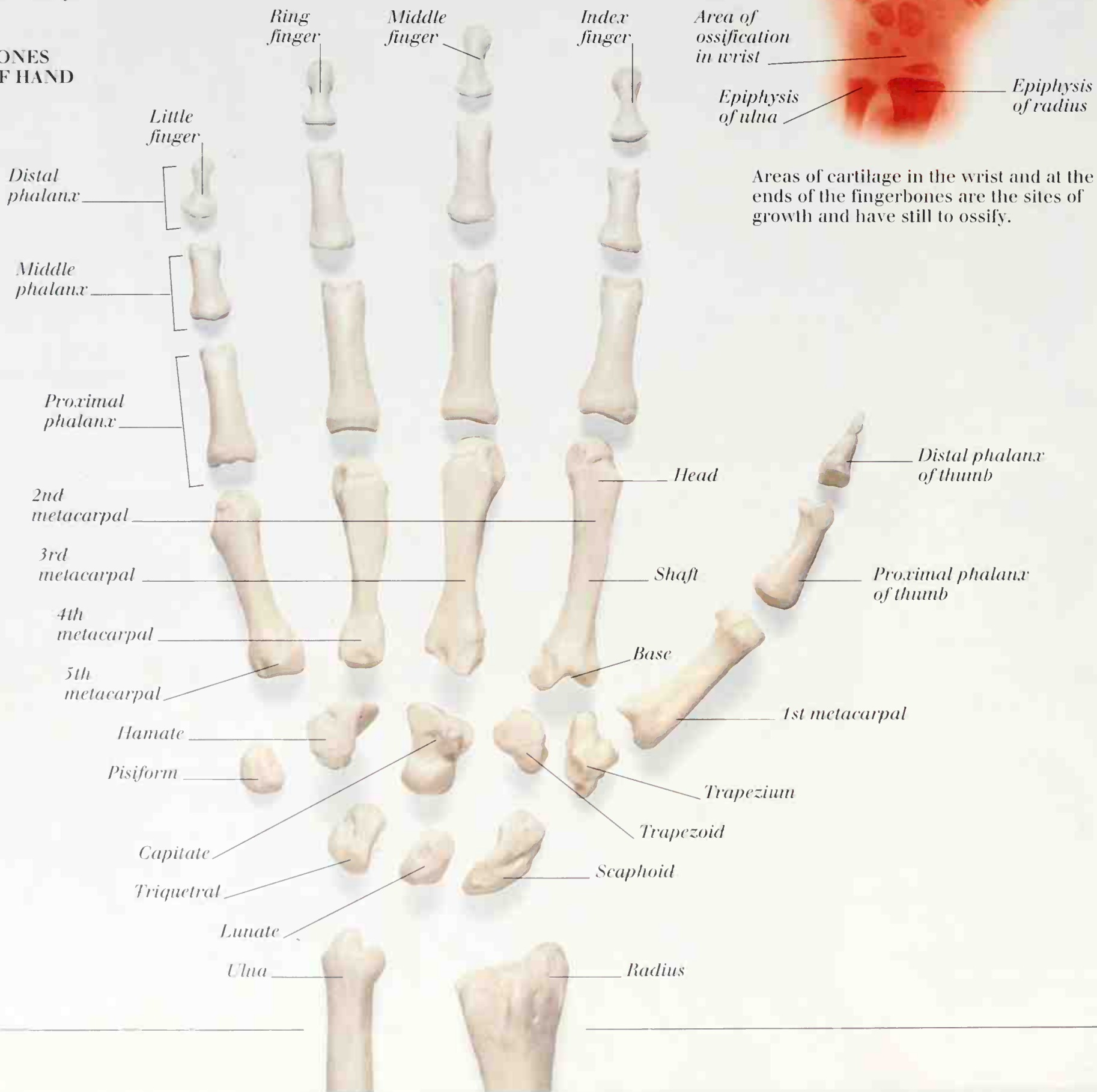
THE HUMAN HAND is an extremely versatile tool, capable of delicate manipulation as well as powerful gripping actions. The arrangement of its 27 small bones, moved by 37 skeletal muscles that are connected to the bones by tendons, allows a wide range of movements. In particular, it is our ability to bring the tips of our thumbs

and fingers together, combined with the extraordinary sensitivity of our fingertips due to their rich supply of nerve endings, that gives human hands their unique dexterity.

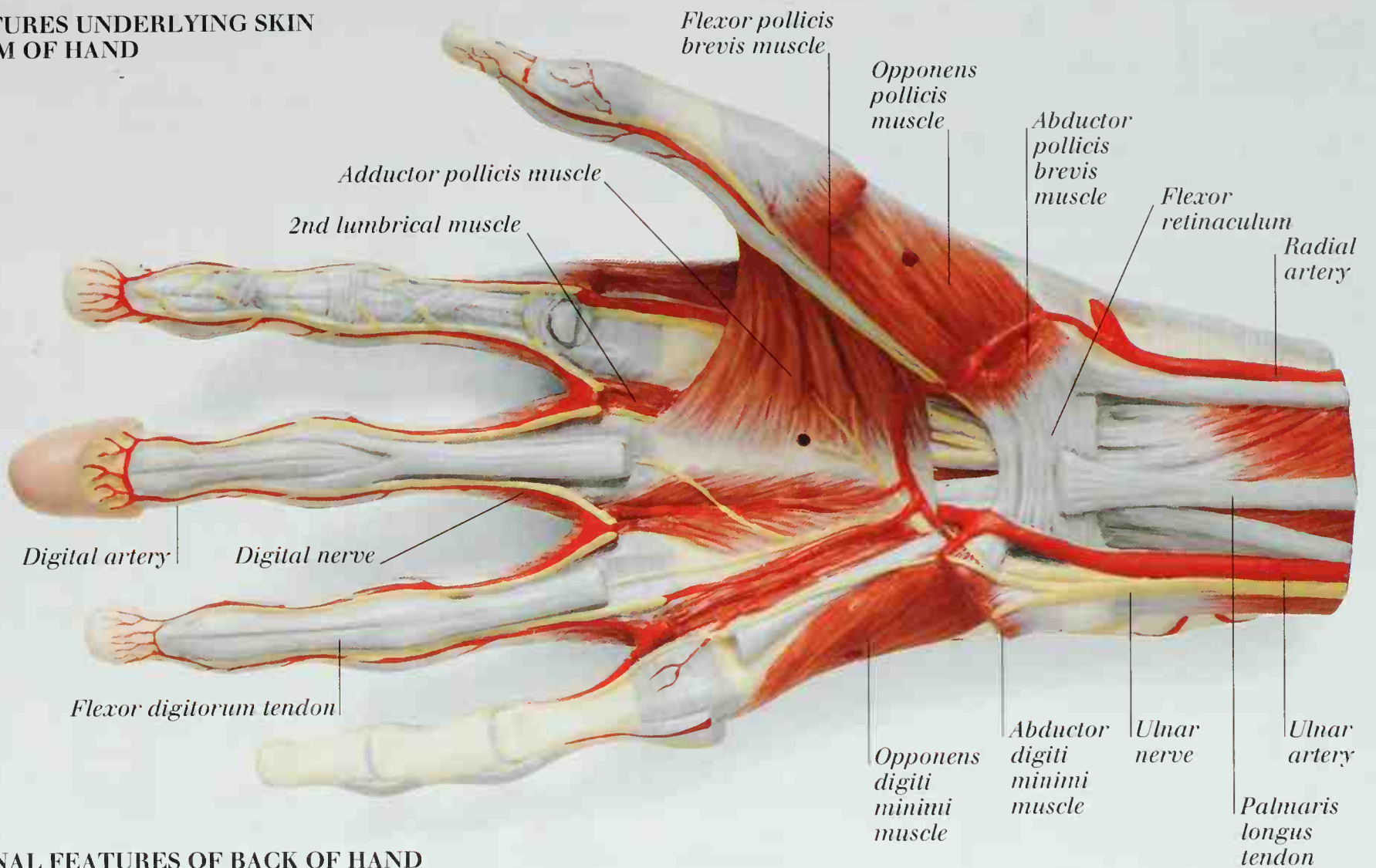
X-RAY OF LEFT HAND OF A YOUNG CHILD



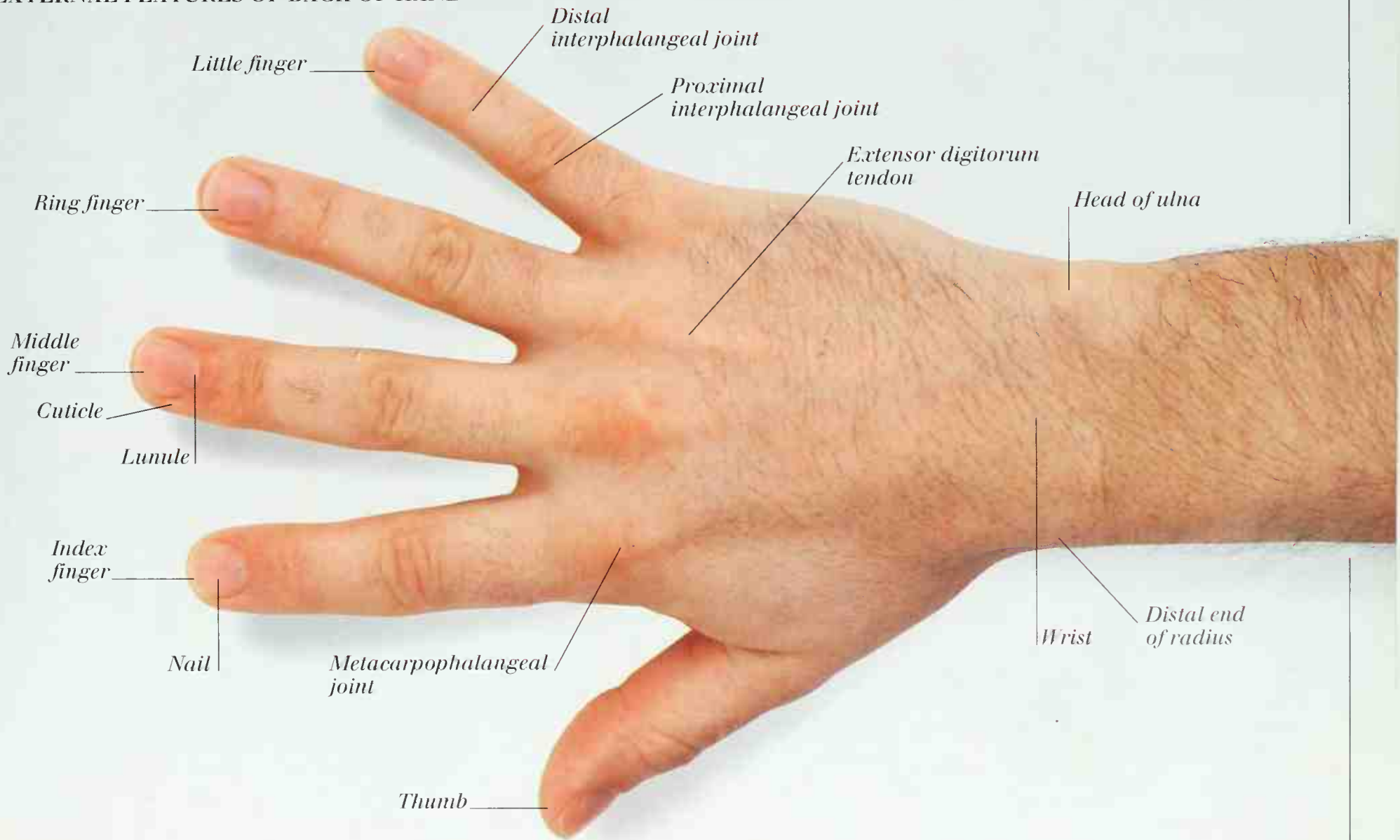
BONES OF HAND



STRUCTURES UNDERLYING SKIN OF PALM OF HAND



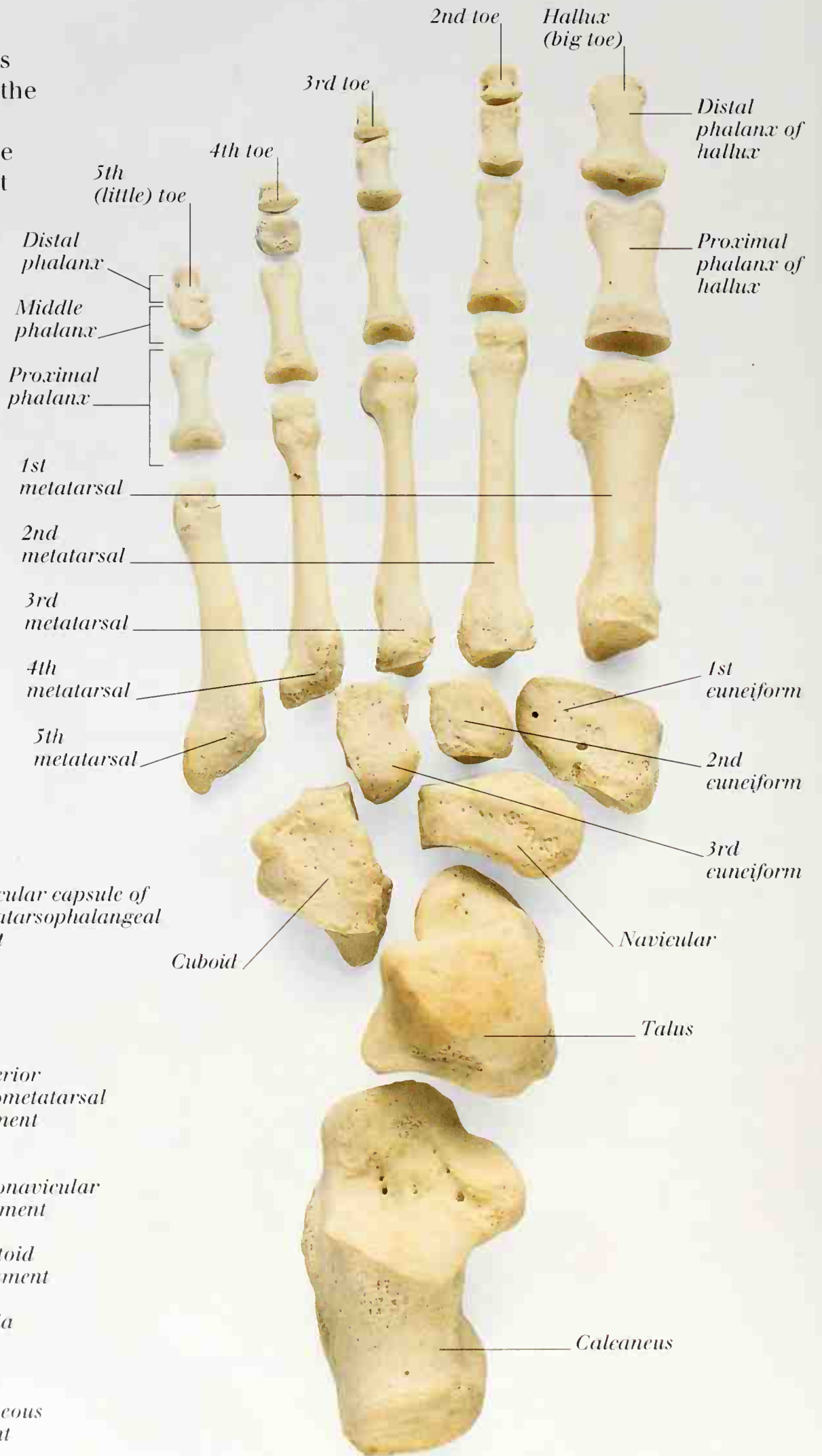
EXTERNAL FEATURES OF BACK OF HAND



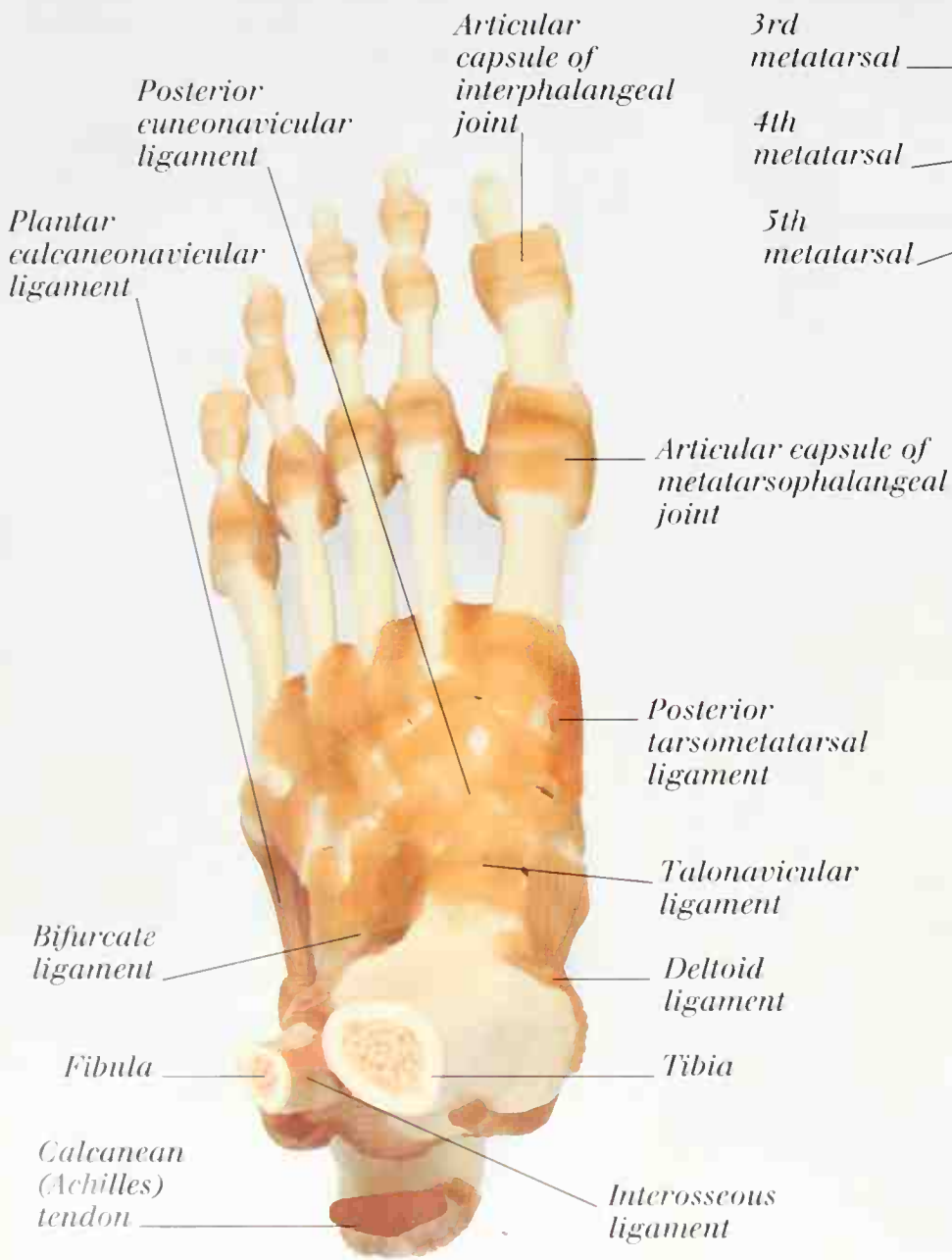
Feet

BONES OF FOOT

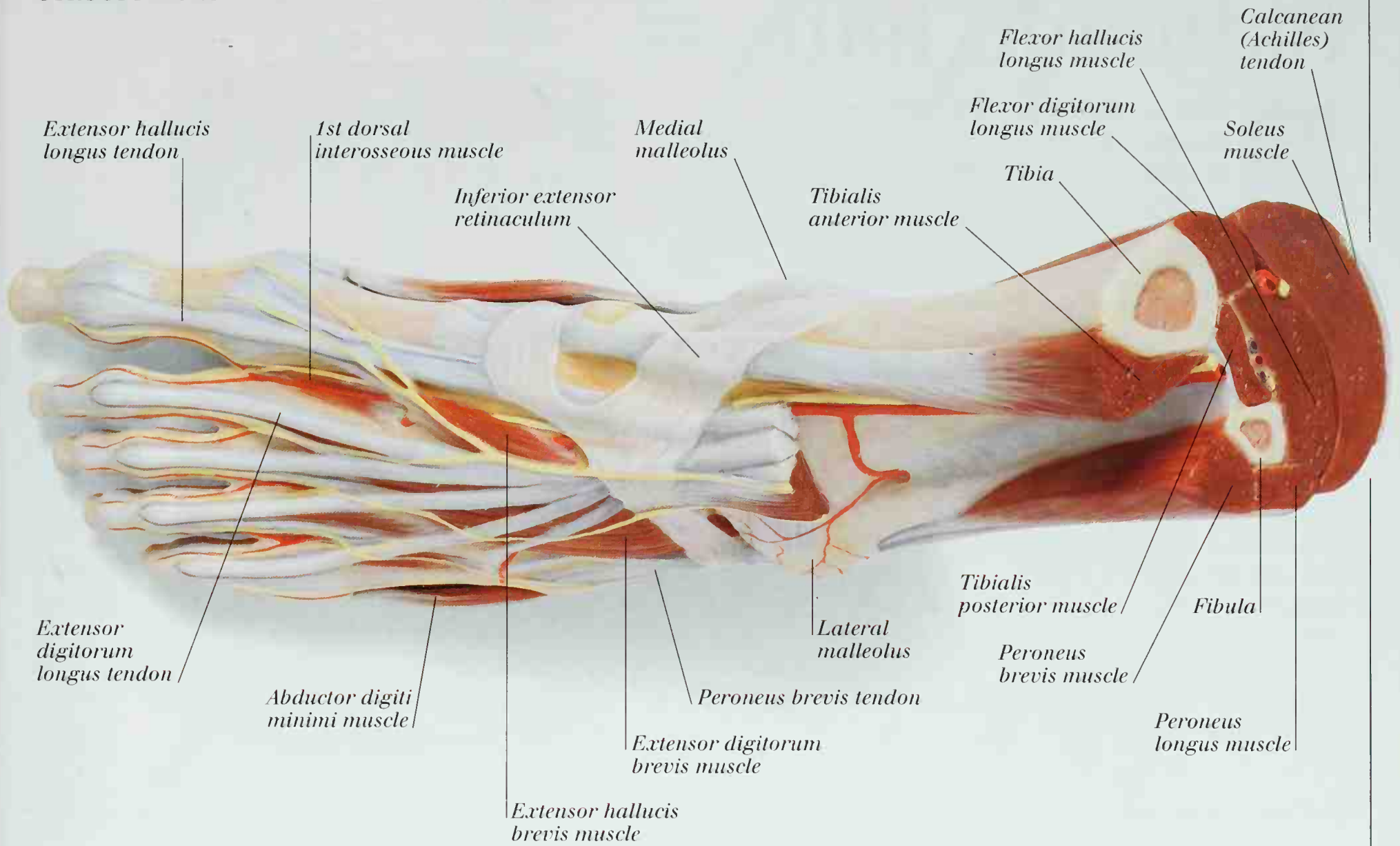
THE FEET AND TOES are essential elements in body movement. They bear and propel the weight of the body during walking and running, and also help to maintain balance during changes of body position. Each foot has 26 bones, more than 100 ligaments, and 33 muscles, some of which are attached to the lower leg. The heel pad and the arch of the foot act as shock absorbers, providing a cushion against the jolts that occur with every step.



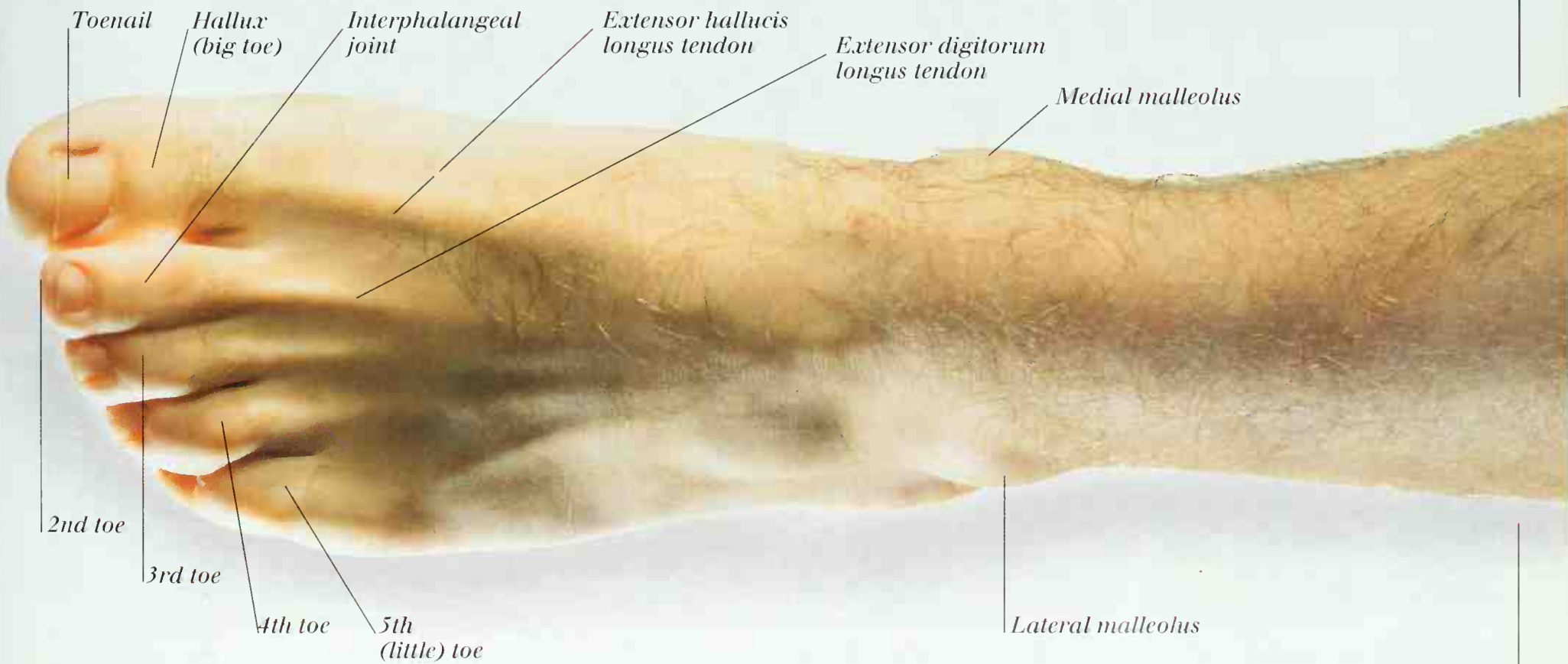
LIGAMENTS OF FOOT



STRUCTURES UNDERLYING SKIN OF FOOT



EXTERNAL FEATURES OF FOOT



Skin and hair

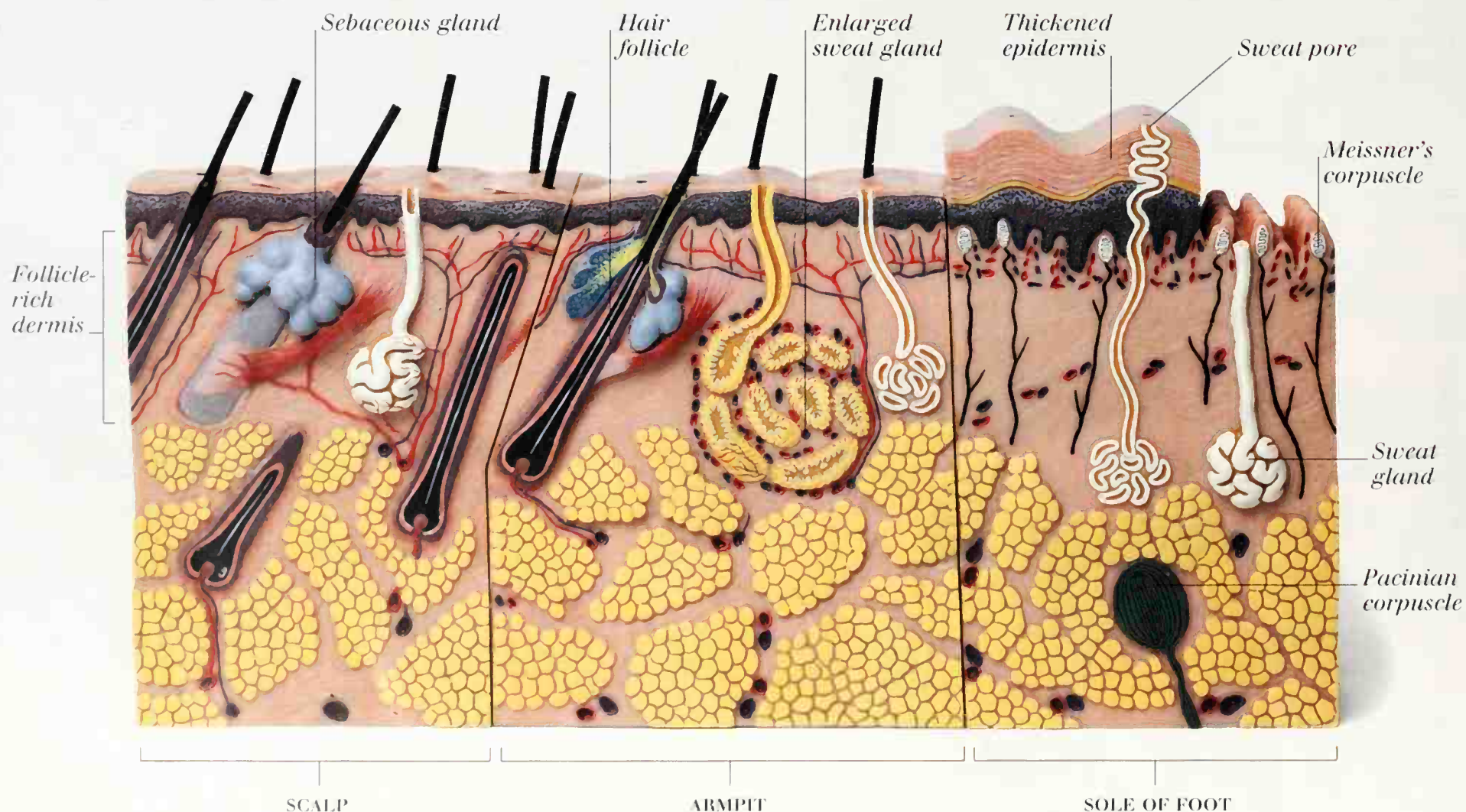


SKIN IS THE BODY'S LARGEST ORGAN, a waterproof barrier that protects the internal organs against infection, injury, and harmful sun rays. The skin is also an important sensory organ and helps to control body temperature. The outer layer of the skin, known as the epidermis, is coated with keratin, a tough, horny protein that is also the chief constituent of hair and nails. Dead cells are shed from the skin's surface and are replaced by new cells from the base of the epidermis, the region that also produces the skin pigment, melanin. The dermis contains most of the skin's living structures, and includes nerve endings, blood vessels, elastic fibers, sweat glands that cool the skin, and sebaceous glands that produce oil to keep the skin supple. Beneath the dermis lies the subcutaneous tissue (hypodermis), which is rich in fat and blood vessels. Hair shafts grow from hair follicles situated in the dermis and subcutaneous tissue. Hair grows on every part of the skin apart from the palms of the hands and soles of the feet.

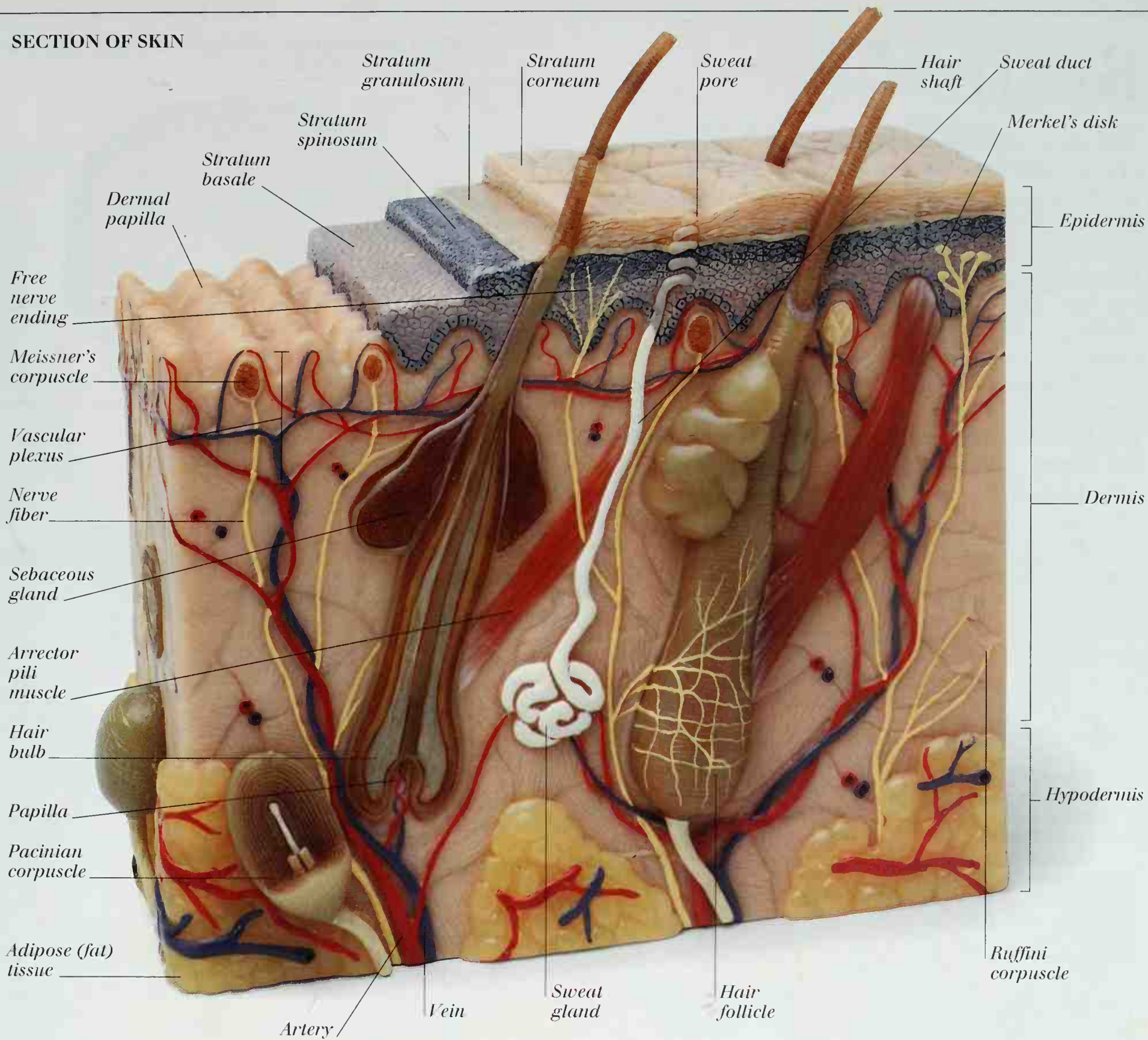
SECTION OF HAIR



SECTIONS OF DIFFERENT TYPES OF SKIN



SECTION OF SKIN



PHOTOMICROGRAPHS OF SKIN AND HAIR



SECTION OF SKIN
The flaky cells at the skin's surface are shed continuously.



SWEAT PORE
This allows loss of fluid as part of temperature control.



SKIN HAIR
Two hairs pushing through the outer layer of skin.

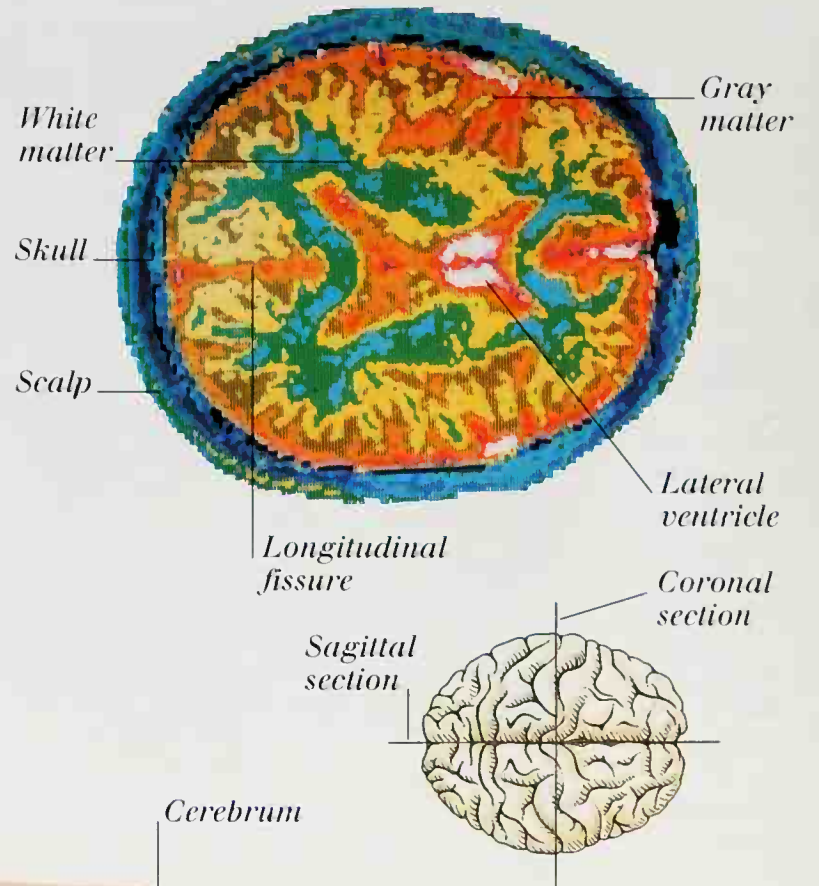


HEAD HAIR
The root and part of the shaft of a hair from the scalp.

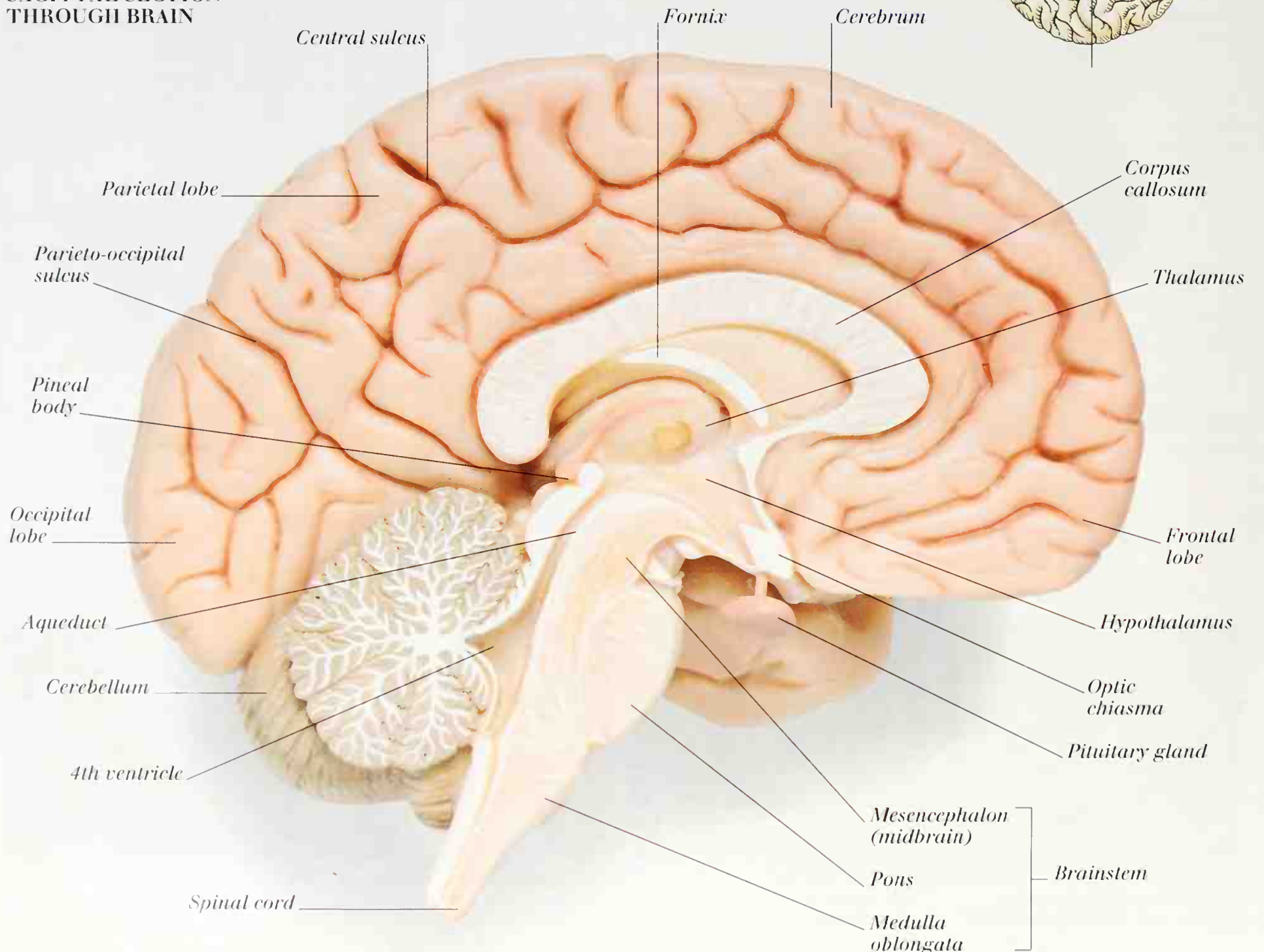
Brain

THE BRAIN IS THE MAJOR ORGAN of the central nervous system and the control center for all the body's voluntary and involuntary activities. It is also responsible for the complexities of thought, memory, emotion, and language. In adults, this complex organ is a mere 3 lb (1.4 kg) in weight, containing over 10 thousand million nerve cells. Three distinct regions can easily be seen—the brainstem, the cerebellum, and the large cerebrum. The brainstem controls vital body functions, such as breathing and digestion. The cerebellum's main functions are the maintenance of posture and the coordination of body movements. The cerebrum, which consists of the right and left cerebral hemispheres joined by the corpus callosum, is the site of most conscious and intelligent activities.

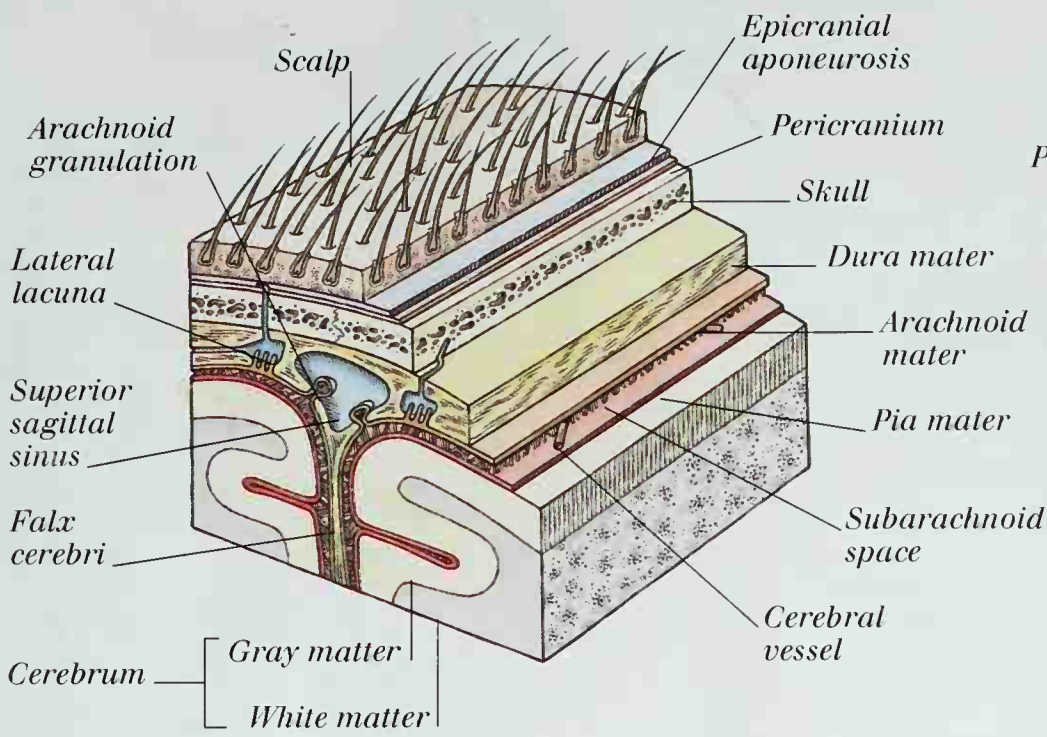
MRI SCAN OF TRANSVERSE SECTION THROUGH BRAIN



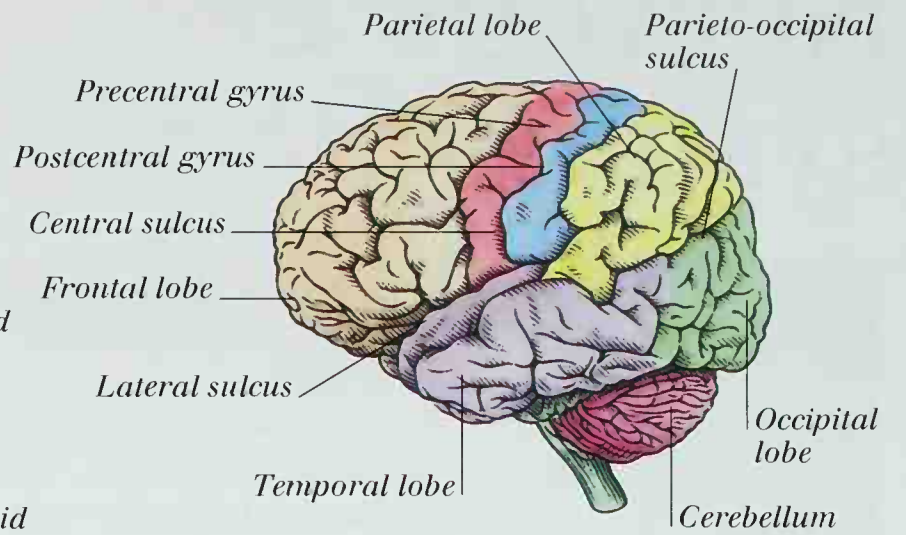
SAGITTAL SECTION THROUGH BRAIN



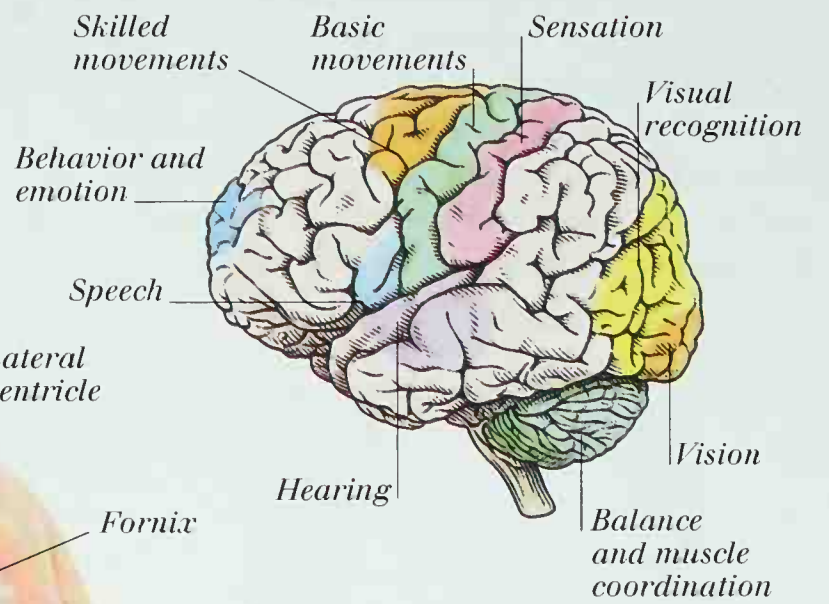
SECTION THROUGH SKULL AND BRAIN



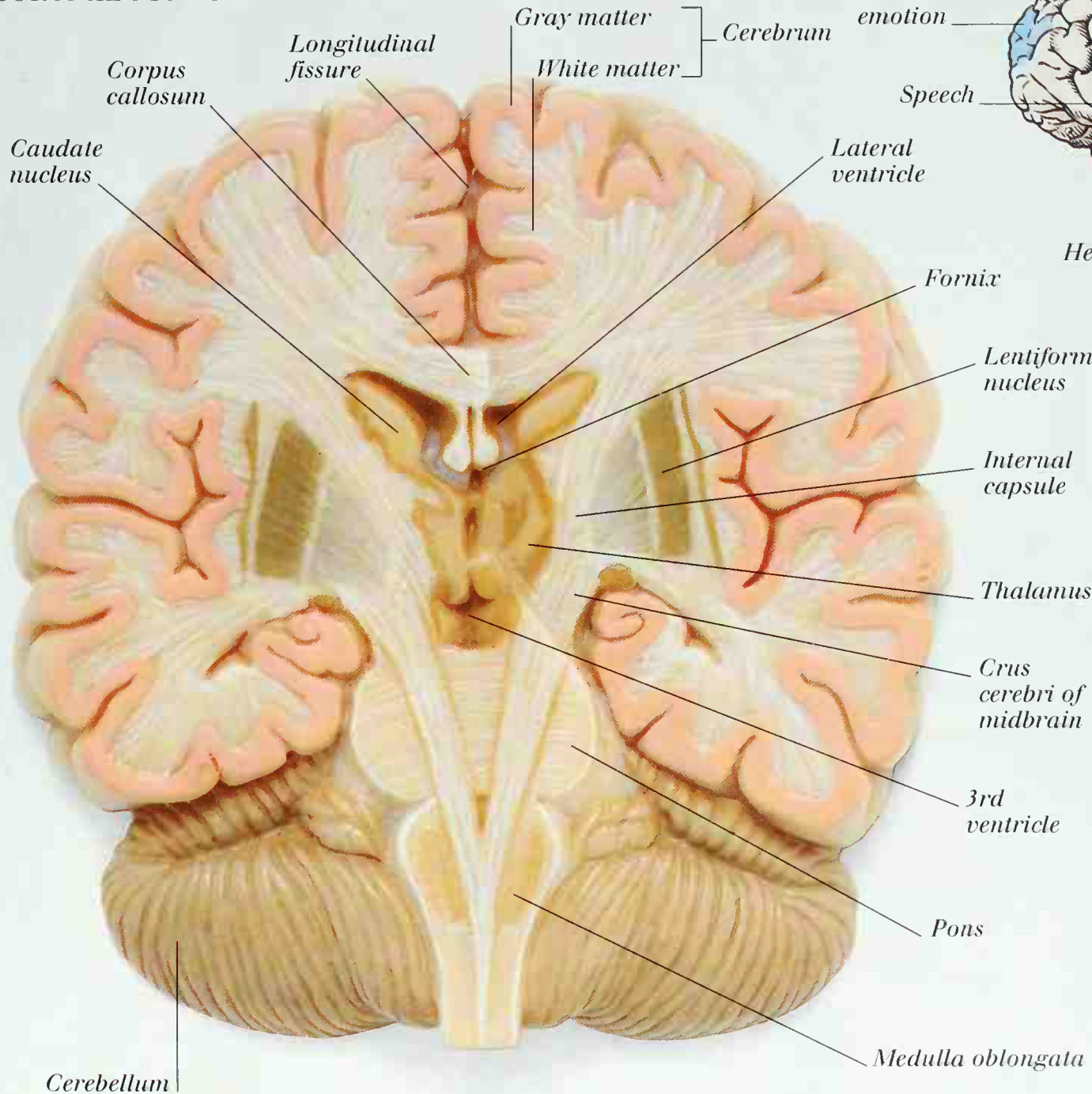
EXTERNAL ANATOMY OF BRAIN



SPECIFIC ROLES OF AREAS OF CEREBRUM



CORONAL SECTION THROUGH BRAIN

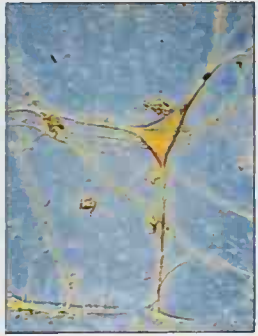


NERVE CELLS IN BRAIN



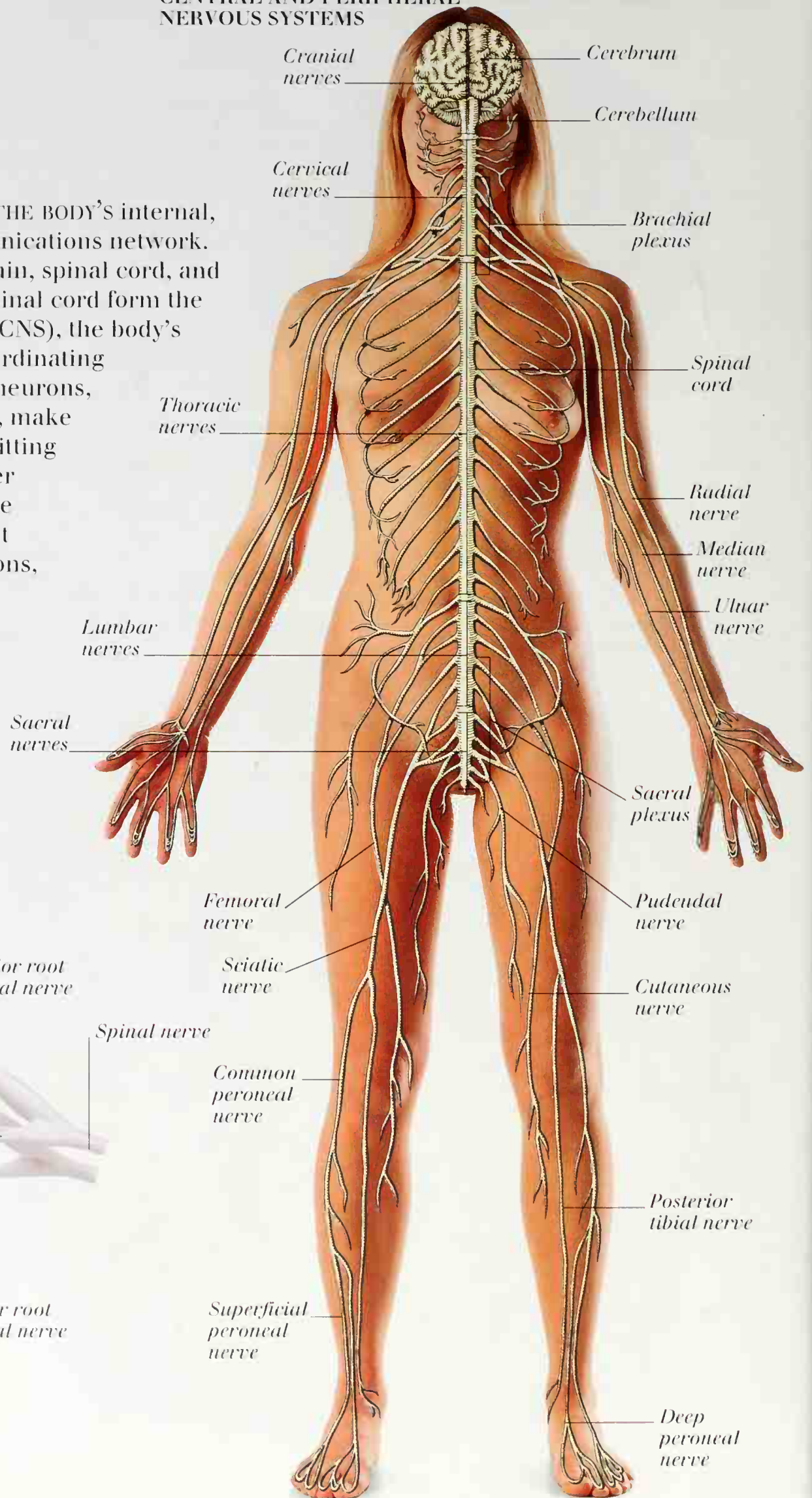
The dark cells are Purkinje cells, which are among the largest nerve cells in the body.

Nervous system

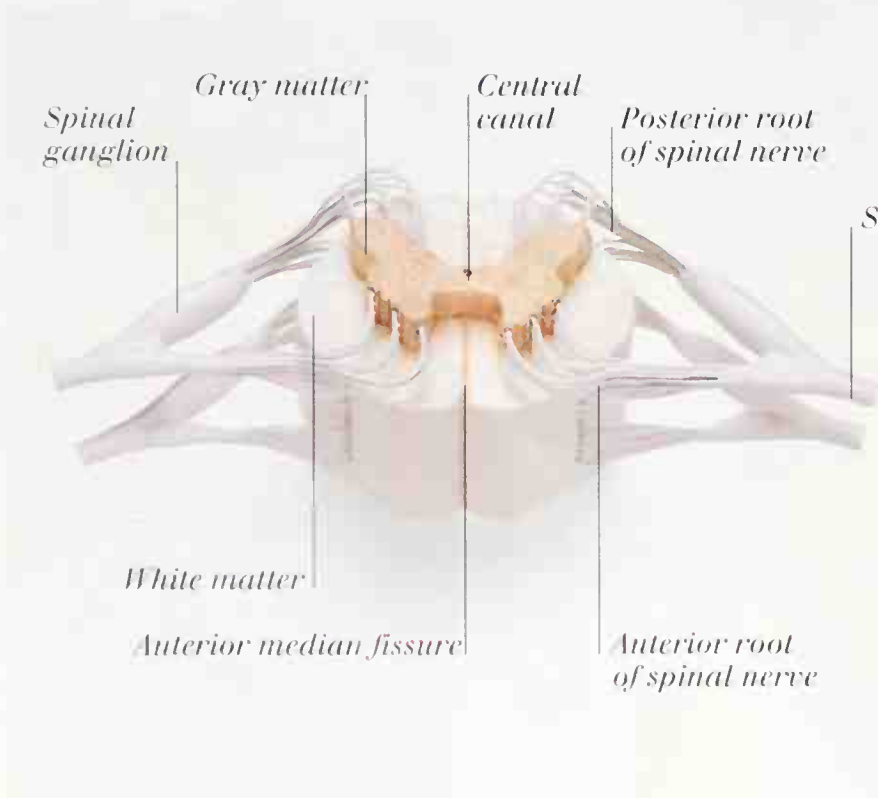


THE NERVOUS SYSTEM IS THE BODY'S internal, electrochemical, communications network. Its main parts are the brain, spinal cord, and nerves. The brain and spinal cord form the central nervous system (CNS), the body's chief controlling and coordinating centers. Billions of long neurons, many grouped as nerves, make up the peripheral nervous system, transmitting nerve impulses between the CNS and other regions of the body. Each neuron has three parts: a cell body, branching dendrites that receive chemical signals from other neurons, and a tube-like axon that conveys these signals as electrical impulses.

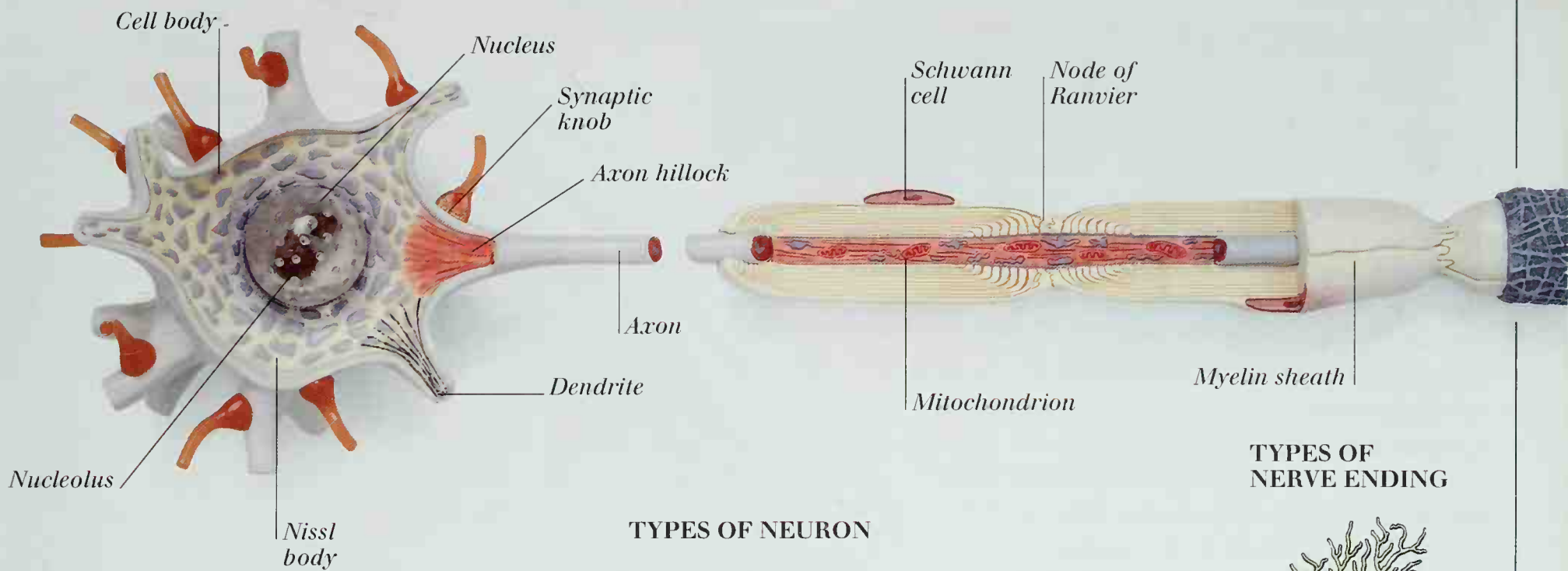
CENTRAL AND PERIPHERAL NERVOUS SYSTEMS



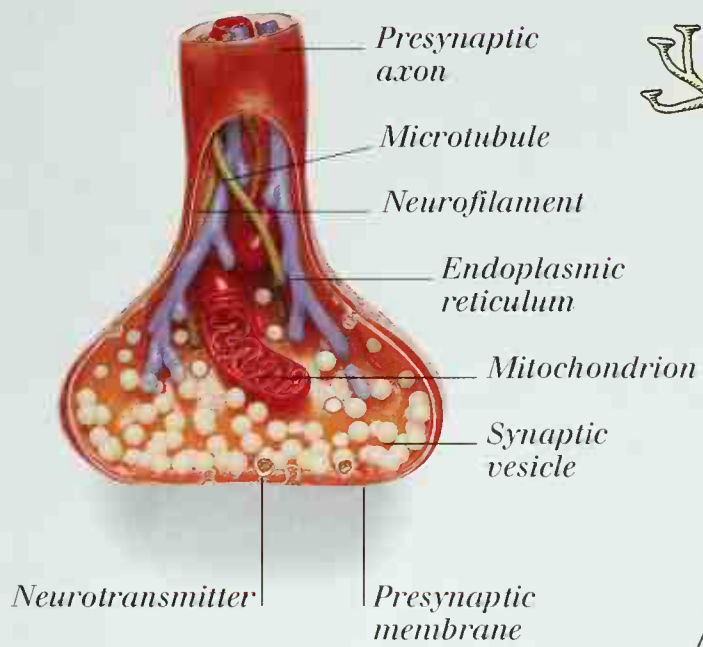
SECTION THROUGH SPINAL CORD



STRUCTURE OF A MOTOR NEURON



STRUCTURE OF A SYNAPTIC KNOB

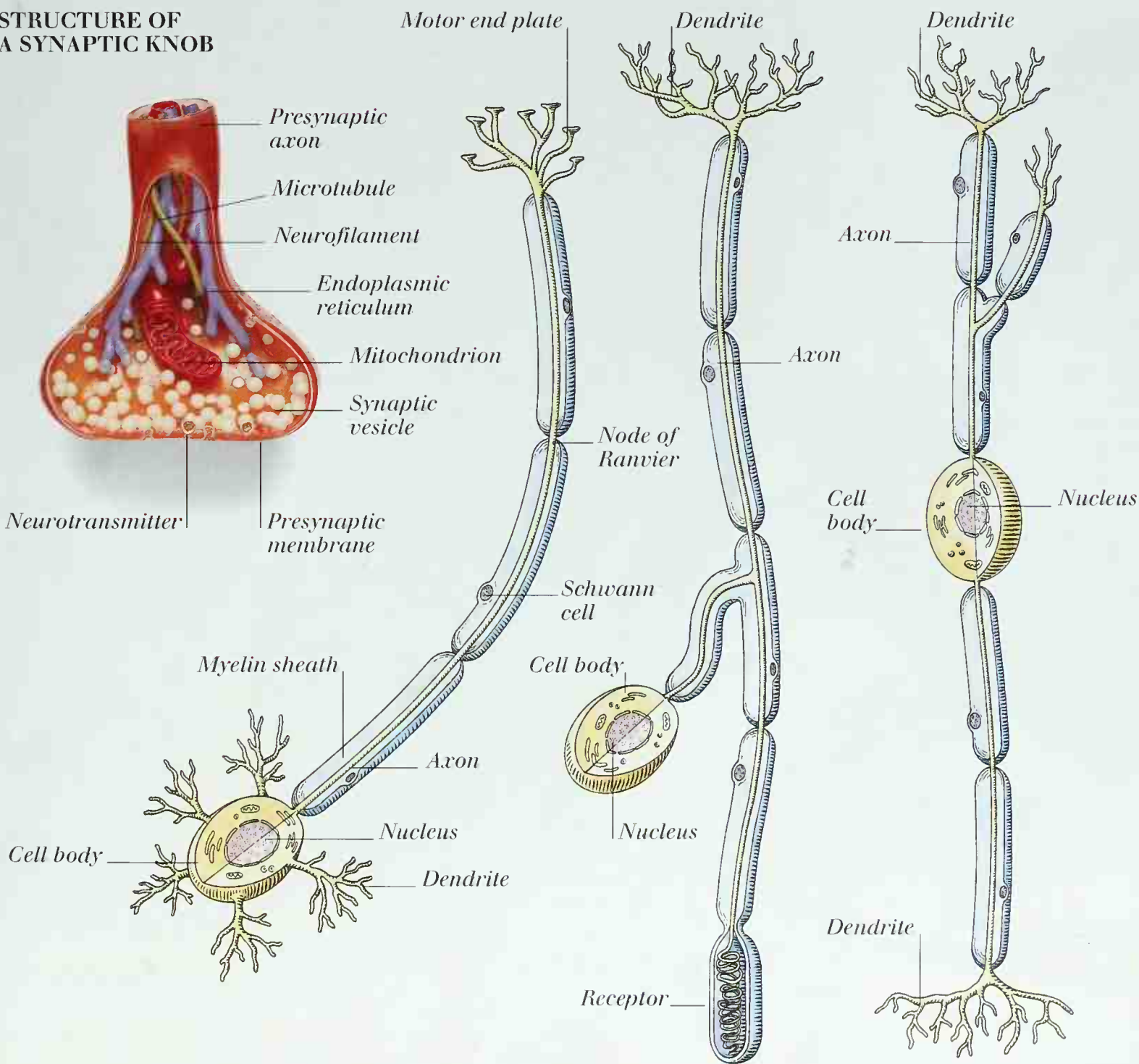


TYPES OF NEURON

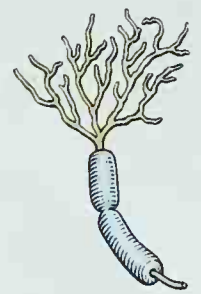
MULTIPOLAR

UNIPOLAR

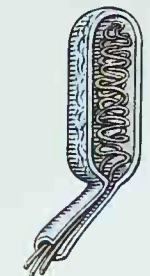
BIPOLAR



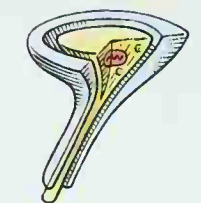
TYPES OF NERVE ENDING



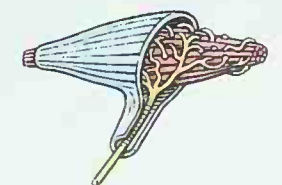
FREE NERVE ENDING



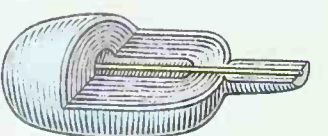
MEISSNER'S CORPUSCLE



MERKEL'S DISK



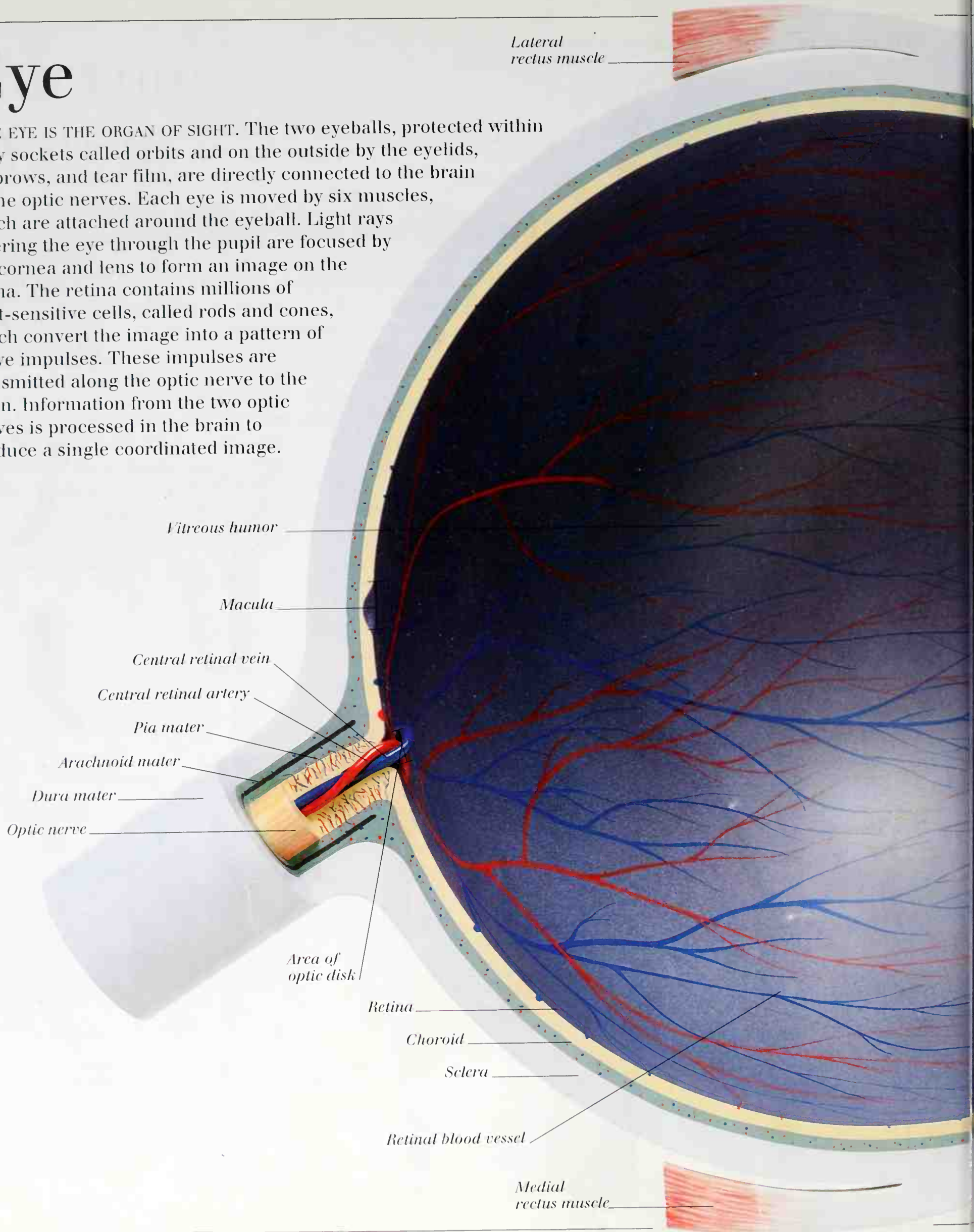
RUFFINI CORPUSCLE



PACINIAN CORPUSCLE

Eye

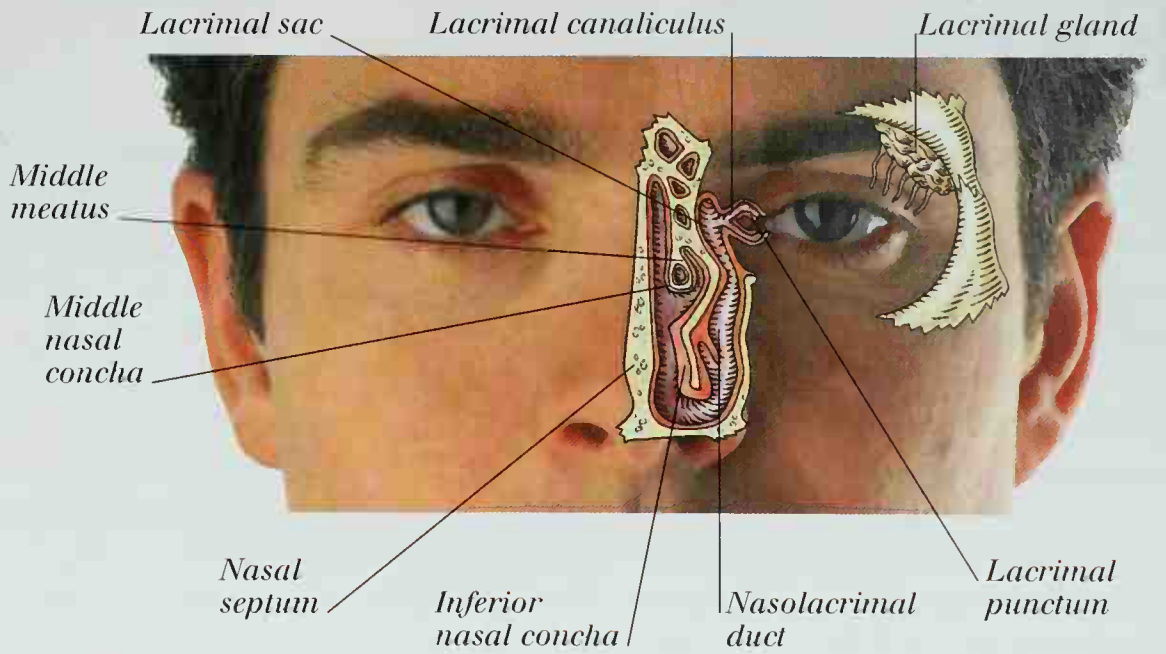
THE EYE IS THE ORGAN OF SIGHT. The two eyeballs, protected within bony sockets called orbits and on the outside by the eyelids, eyebrows, and tear film, are directly connected to the brain by the optic nerves. Each eye is moved by six muscles, which are attached around the eyeball. Light rays entering the eye through the pupil are focused by the cornea and lens to form an image on the retina. The retina contains millions of light-sensitive cells, called rods and cones, which convert the image into a pattern of nerve impulses. These impulses are transmitted along the optic nerve to the brain. Information from the two optic nerves is processed in the brain to produce a single coordinated image.



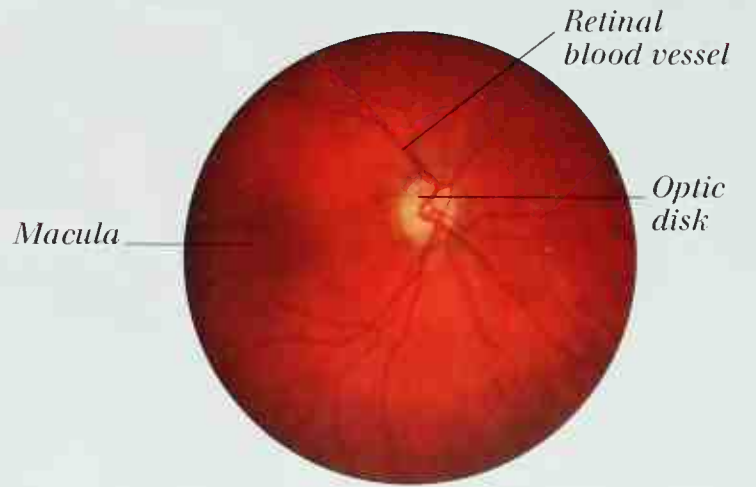
SECTION THROUGH LEFT EYE



LACRIMAL (TEAR-PRODUCING) APPARATUS

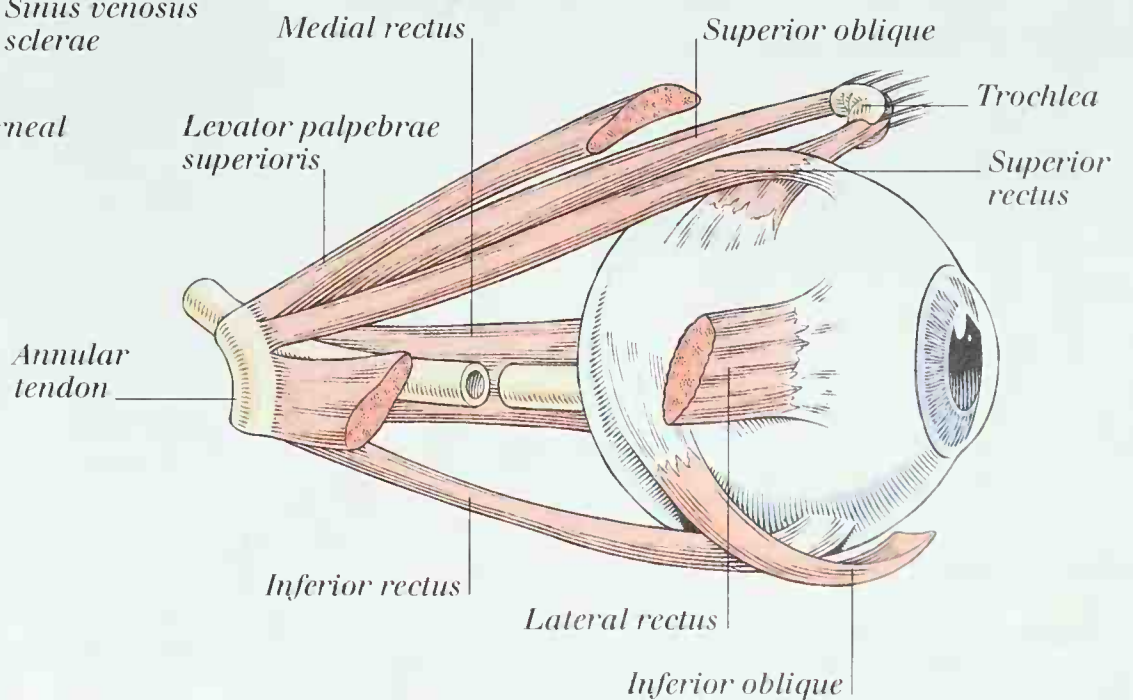


OPHTHALMOSCOPIC VIEW OF RETINA



The blind spot, where the optic nerve leaves the eye, can be clearly seen as a light circular area toward the center of the image.

MUSCLES SURROUNDING RIGHT EYE

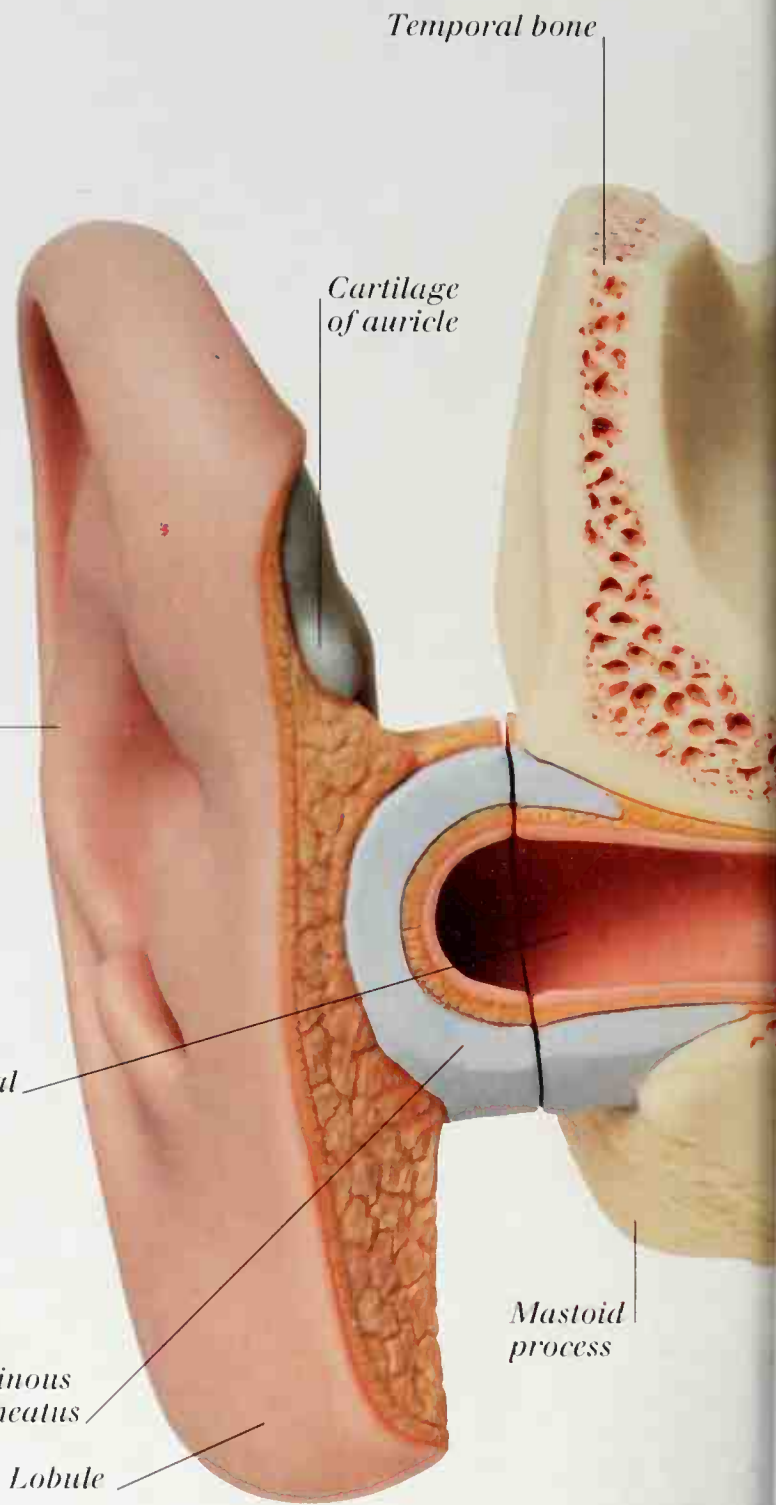
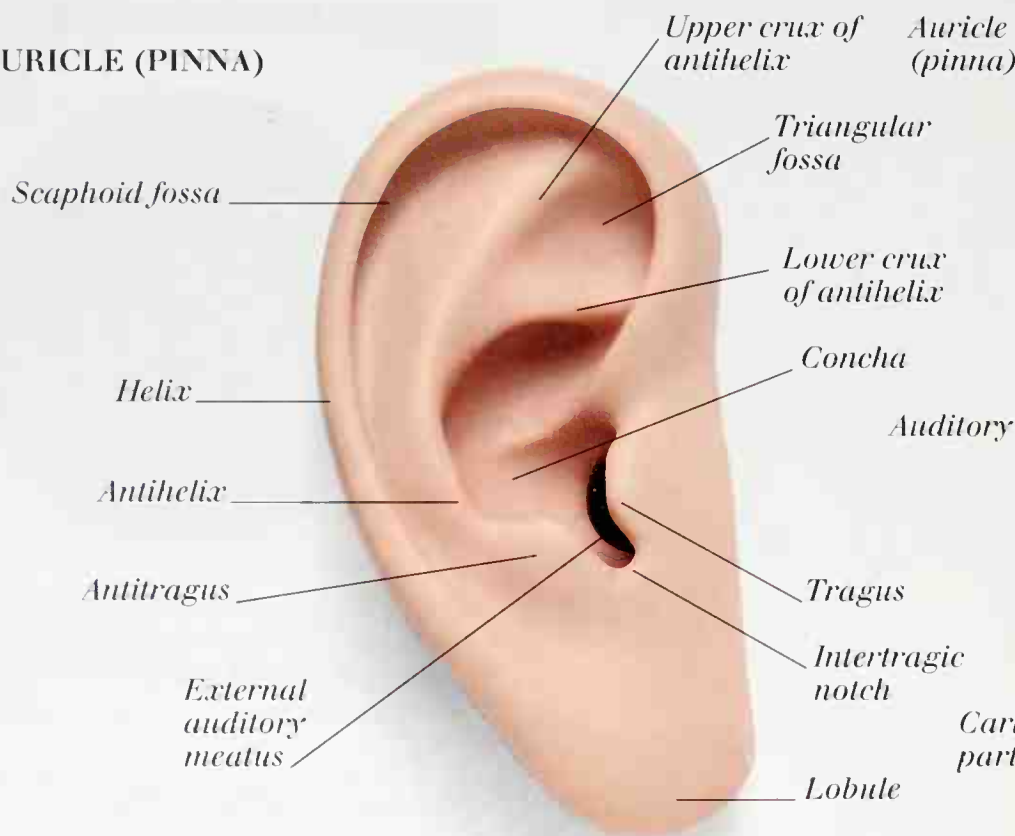


Ear

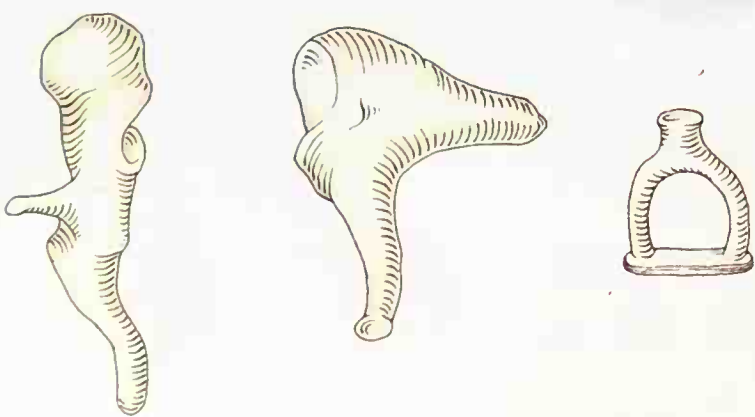
STRUCTURE OF EAR

THE EAR IS THE ORGAN OF HEARING AND BALANCE. The outer ear consists of a flap called the auricle or pinna and the auditory canal. The main functional parts—the middle and inner ears—are enclosed within the skull. The middle ear consists of three tiny bones, known as auditory ossicles, and the eustachian tube, which links the ear to the back of the nose. The inner ear consists of the spiral-shaped cochlea, and also the semicircular canals and the vestibule, which are the organs of balance. Sound waves entering the ear travel through the auditory canal to the tympanic membrane (eardrum), where they are converted to vibrations that are transmitted via the ossicles to the cochlea. Here, the vibrations are converted by millions of microscopic hairs into electrical nerve signals to be interpreted by the brain.

RIGHT AURICLE (PINNA)



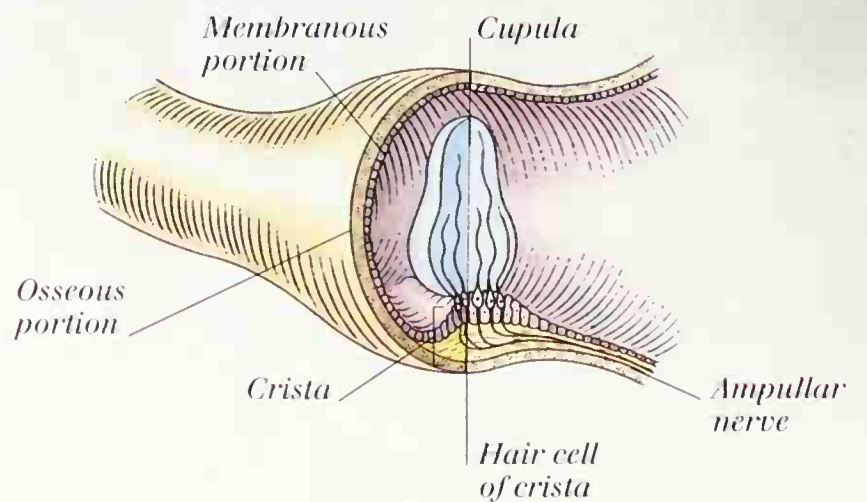
OSSICLES OF MIDDLE EAR



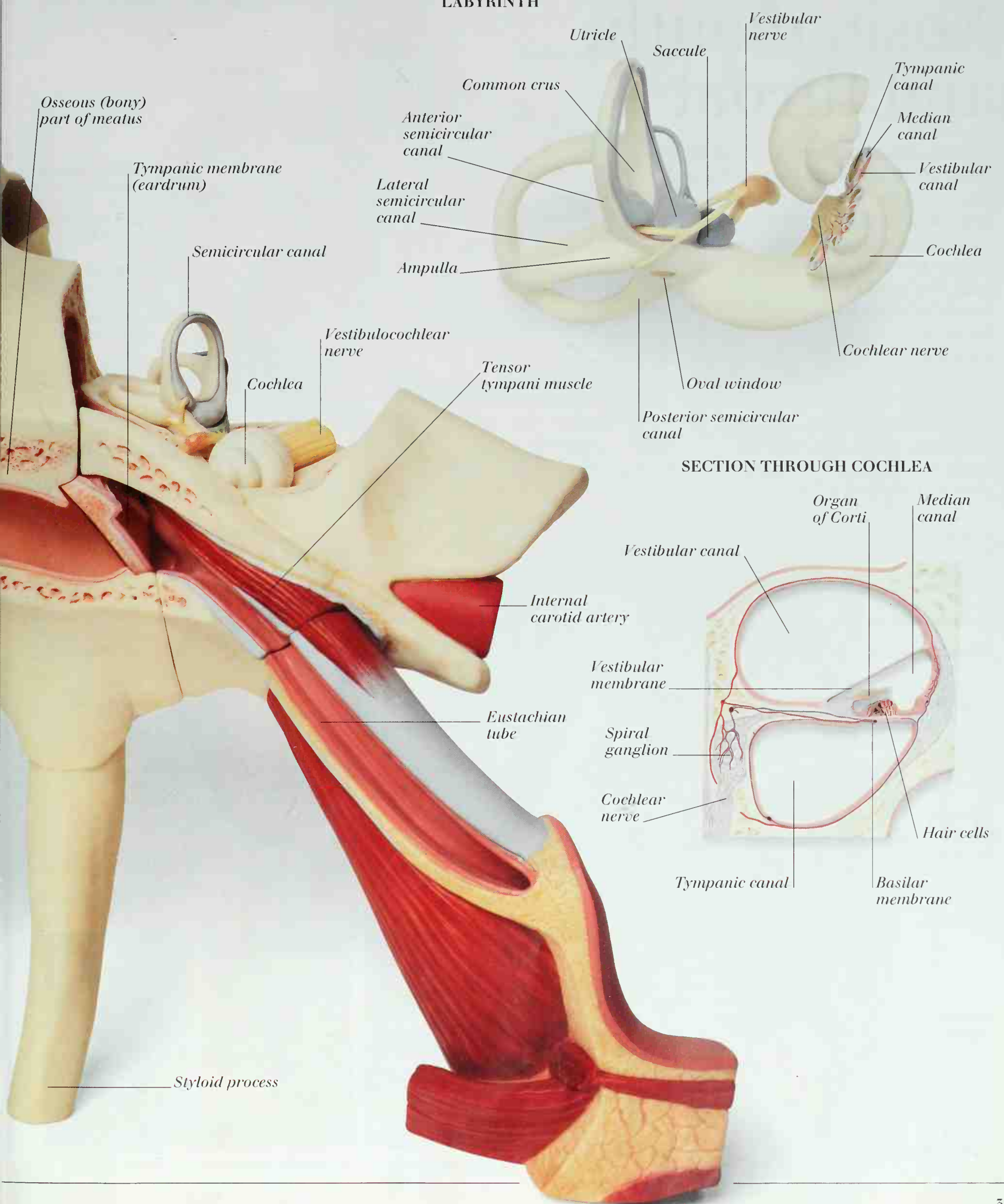
MALLEUS (HAMMER) INCUS (ANVIL) STAPES (STIRRUP)

These three tiny bones connect to form a bridge between the tympanic membrane and the oval window. With a system of membranes they convey sound vibrations to the inner ear.

INTERNAL STRUCTURE OF AMPULLA



LABYRINTH

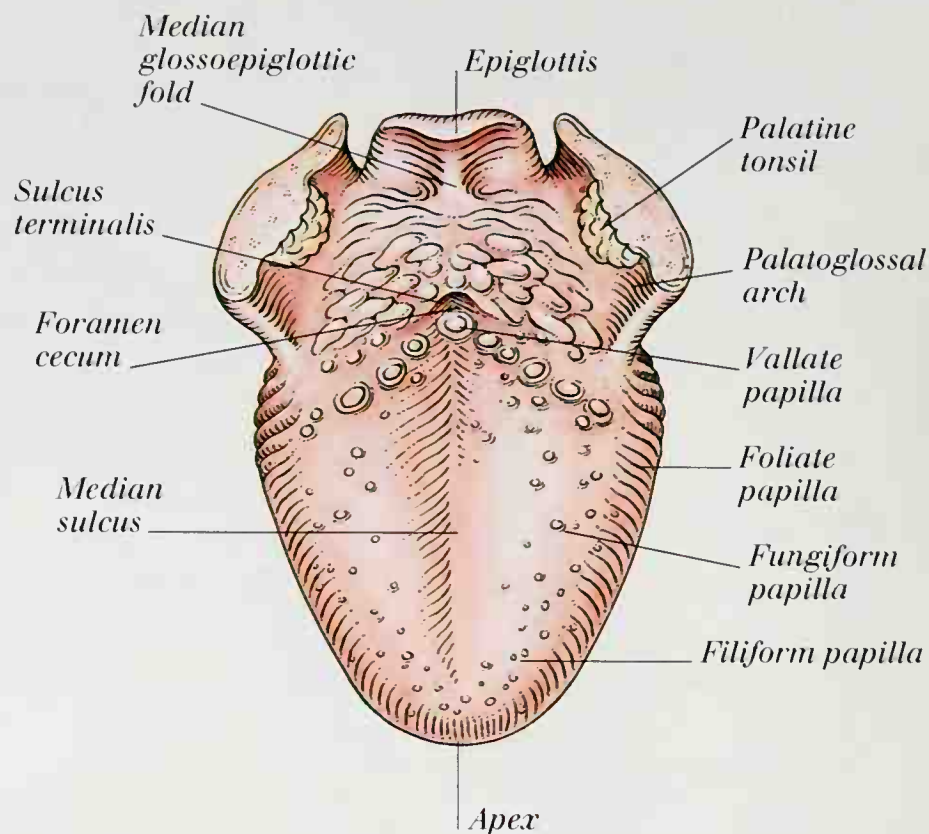


SECTION THROUGH COCHLEA

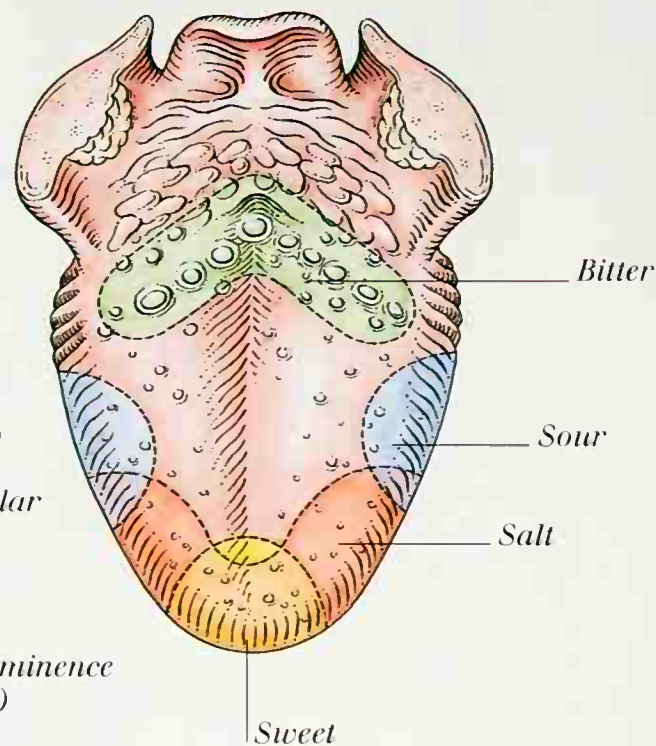
Nose, mouth, and throat

WITH EVERY BREATH, air passes through the nasal cavity down the pharynx (throat), larynx ("voice box"), and trachea (windpipe) to the lungs. The nasal cavity warms and moistens air, and the tiny layers in its lining protect the airway against damage by foreign bodies. During swallowing, the tongue moves up and back, the larynx rises, the epiglottis closes off the entrance to the trachea, and the soft palate separates the nasal cavity from the pharynx. Saliva, secreted from three pairs of salivary glands, lubricates food to make swallowing easier; it also begins the chemical breakdown of food, and helps to produce taste. The senses of taste and smell are closely linked. Both depend on the detection of dissolved molecules by sensory receptors in the olfactory nerve endings of the nose and in the taste buds of the tongue.

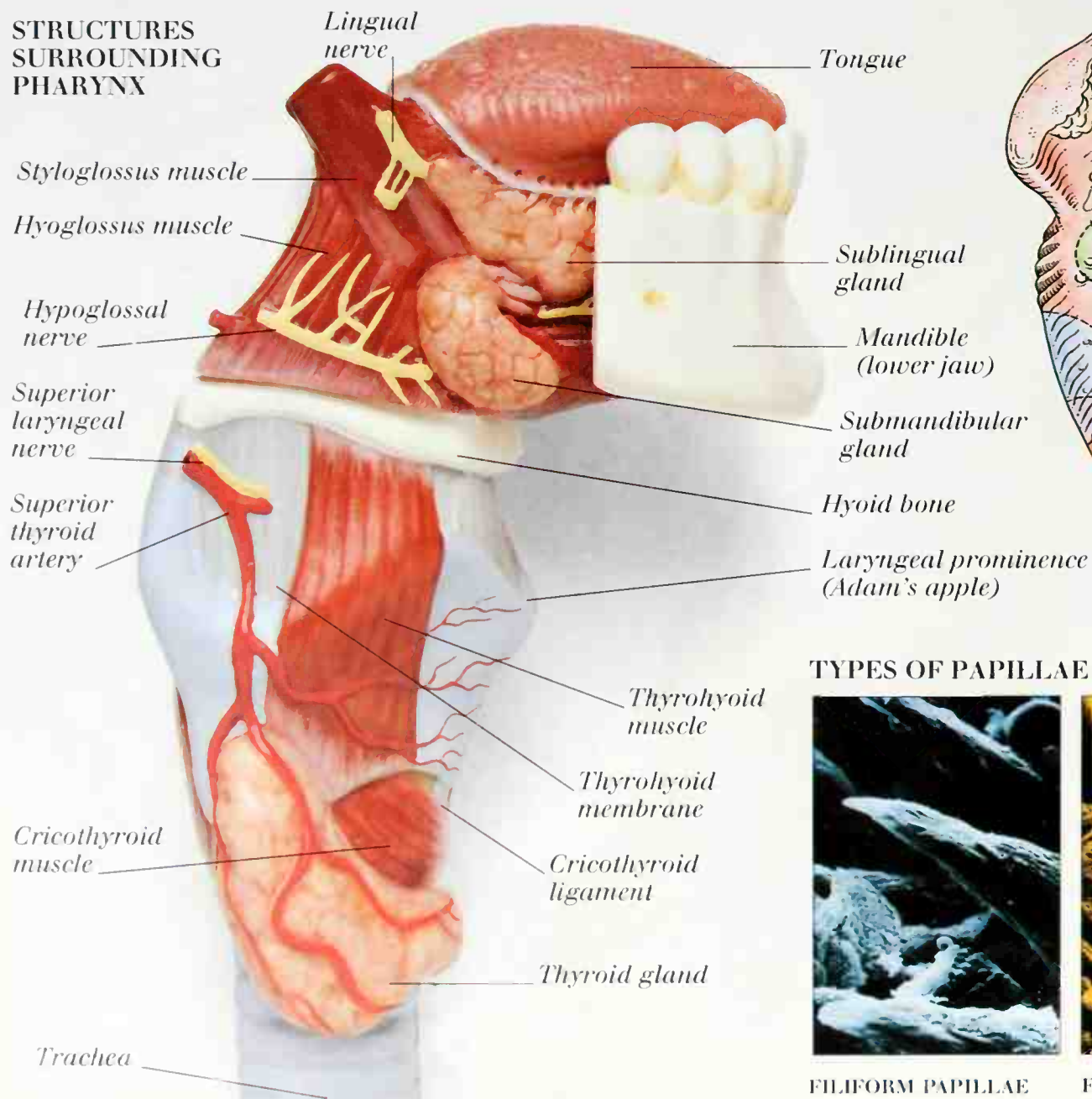
STRUCTURE OF TONGUE



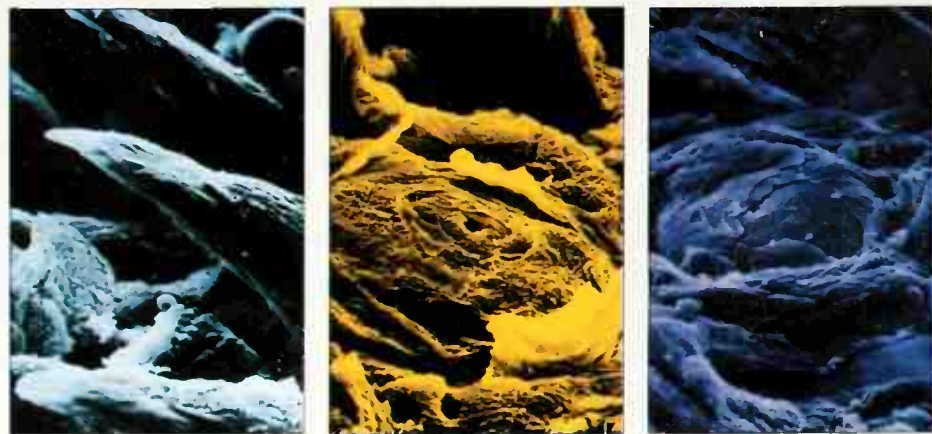
TASTE AREAS ON TONGUE



STRUCTURES SURROUNDING PHARYNX



TYPES OF PAPILLAE

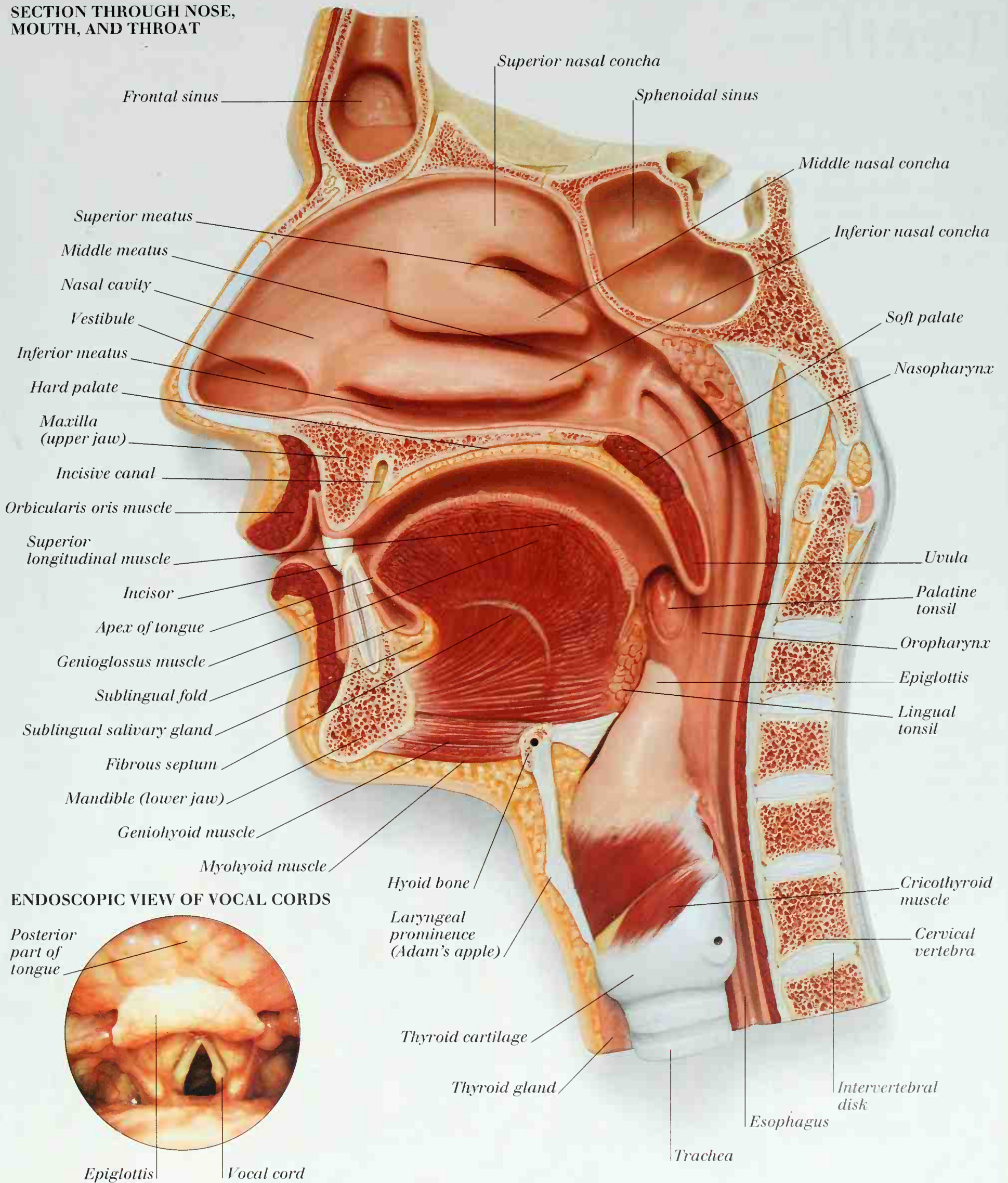


FILIFORM PAPILLAE

FUNGIFORM PAPILLAE

VALLATE PAPILLAE

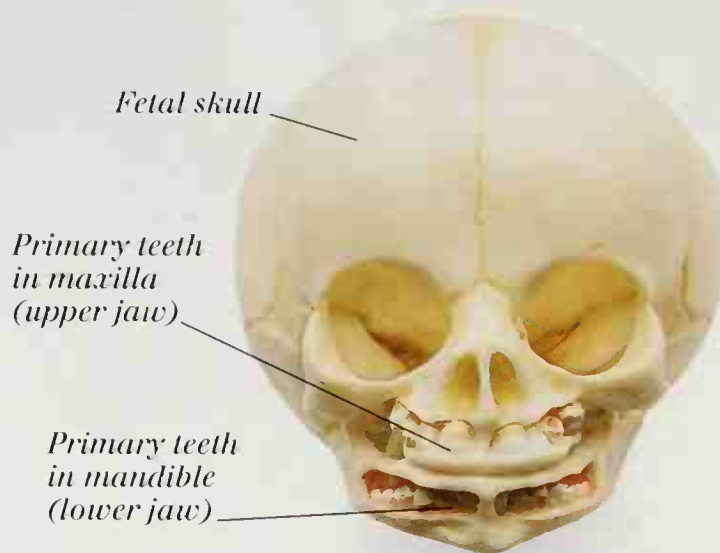
**SECTION THROUGH NOSE,
MOUTH, AND THROAT**



Teeth

THE 20 PRIMARY TEETH (also called deciduous or milk teeth) usually begin to erupt when a baby is about six months old. They start to be replaced by the permanent teeth when the child is about six years old. By the age of 20, most adults have a full set of 32 teeth although the third molars (commonly called wisdom teeth) may never erupt. While teeth help people to speak clearly and give shape to the face, their main function is the chewing of food. Incisors and canines shear and tear the food into pieces; premolars and molars crush and grind it further. Although tooth enamel is the hardest substance in the body, it tends to be eroded and destroyed by acid produced in the mouth during the breakdown of food.

DEVELOPMENT OF TEETH IN A FETUS



FETAL JAWS

By the sixth week of embryonic development areas of thickening occur in each jaw; these areas give rise to tooth buds. By the time the fetus is six months old, enamel has formed on the tooth buds.

DEVELOPMENT OF JAW AND TEETH



A NEWBORN BABY'S JAWS

The primary teeth can be seen developing in the jawbones; they begin to erupt around the age of six months.

A FIVE-YEAR-OLD CHILD'S TEETH

There is a full set of 20 erupted primary teeth; the permanent teeth can be seen developing in the upper and lower jaws.

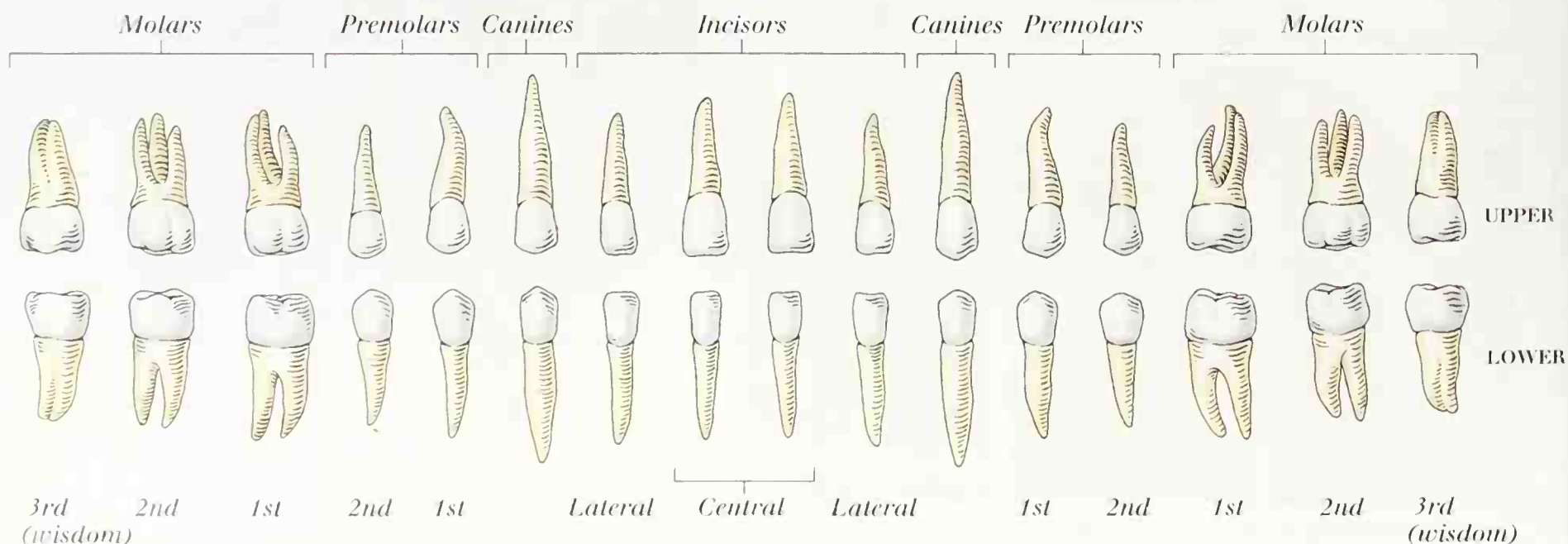
A NINE-YEAR-OLD CHILD'S TEETH

Most of the teeth are primary teeth but the permanent incisors and first molars have now emerged.

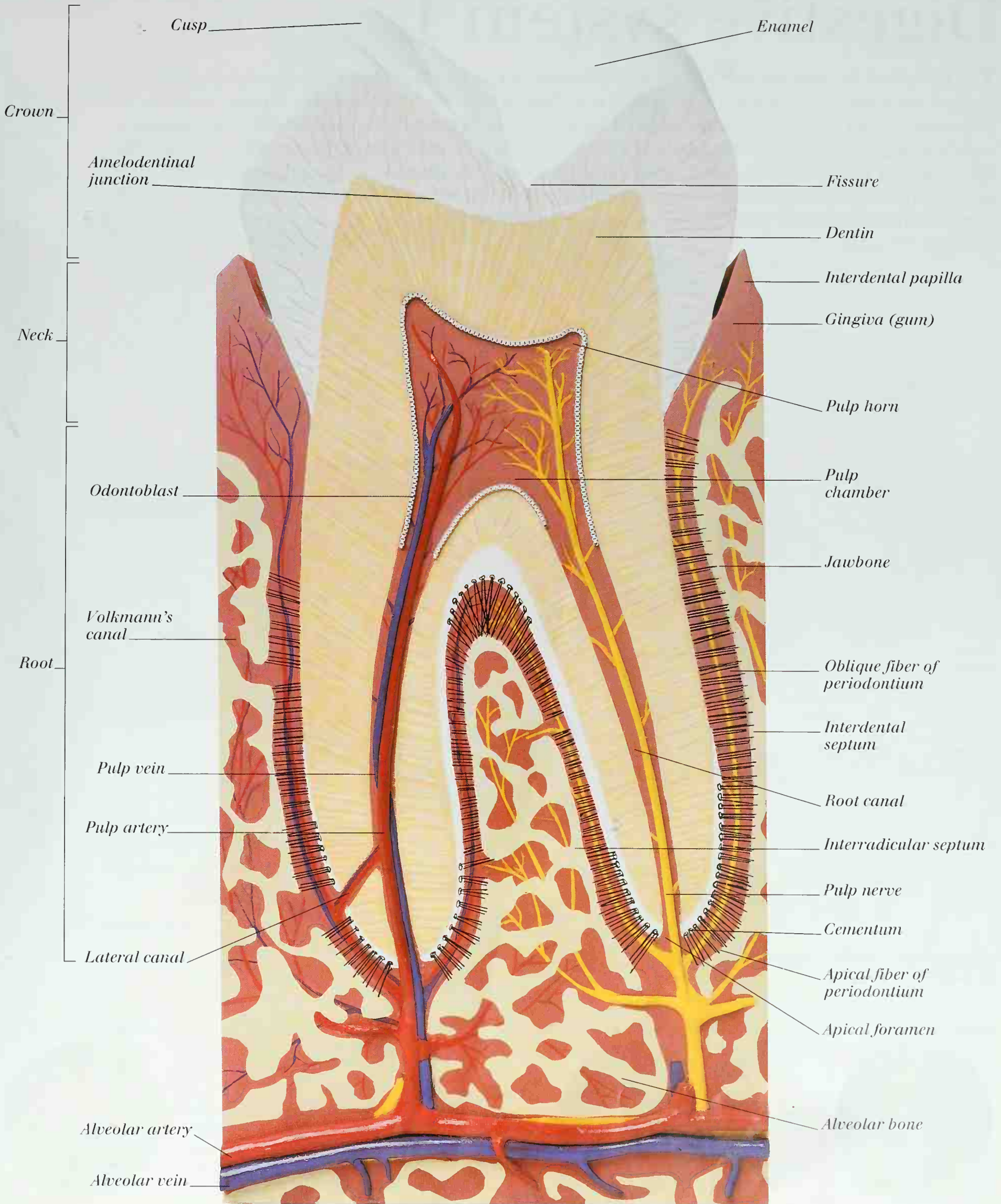
AN ADULT'S TEETH

By the age of 20, the full set of 32 permanent teeth (including the wisdom teeth) should be in position.

THE PERMANENT TEETH

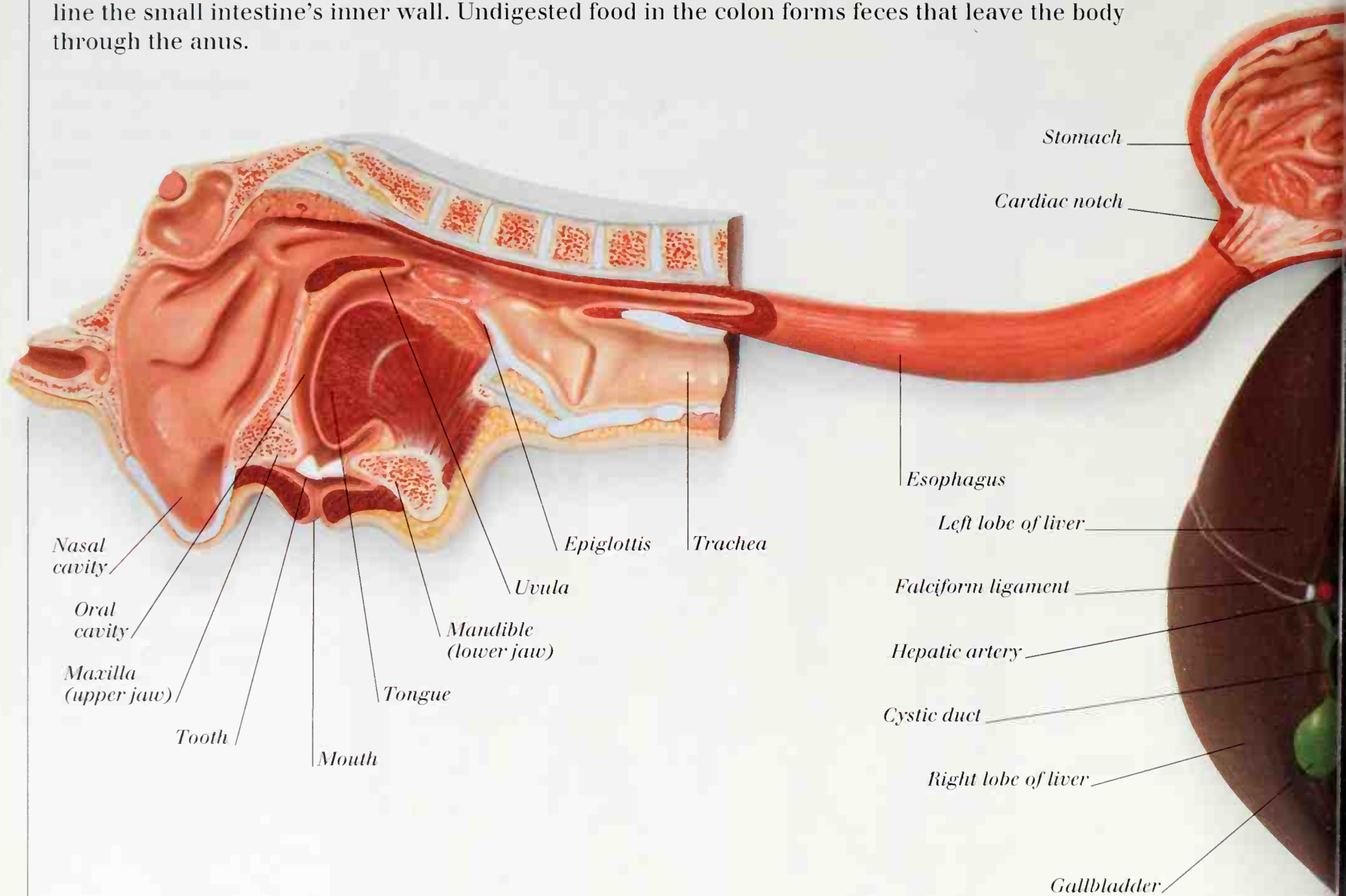


STRUCTURE OF A TOOTH



Digestive system 1

THE DIGESTIVE SYSTEM BREAKS DOWN FOOD into particles so tiny that blood can take nourishment to all parts of the body. The system's main part is a 30-foot (9 m) tube from mouth to rectum; muscles in this alimentary canal force food along. Chewed food first travels through the esophagus to the stomach, which churns and liquidizes food before it passes through the duodenum, jejunum, and ileum—the three parts of the long, convoluted small intestine. Here, digestive juices from the gallbladder and pancreas break down food particles; many filter out into the blood through tiny fingerlike villi that line the small intestine's inner wall. Undigested food in the colon forms feces that leave the body through the anus.

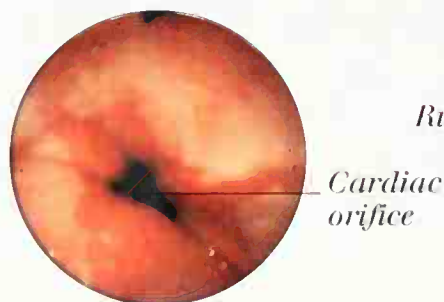


ENDOSCOPIC VIEWS INSIDE ALIMENTARY CANAL

ESOPHAGUS



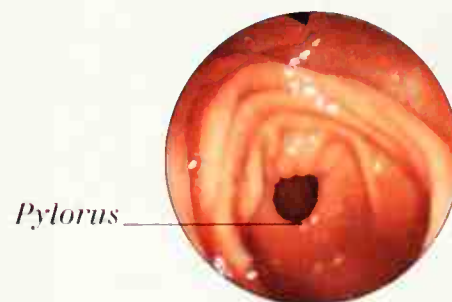
STOMACH ENTRANCE



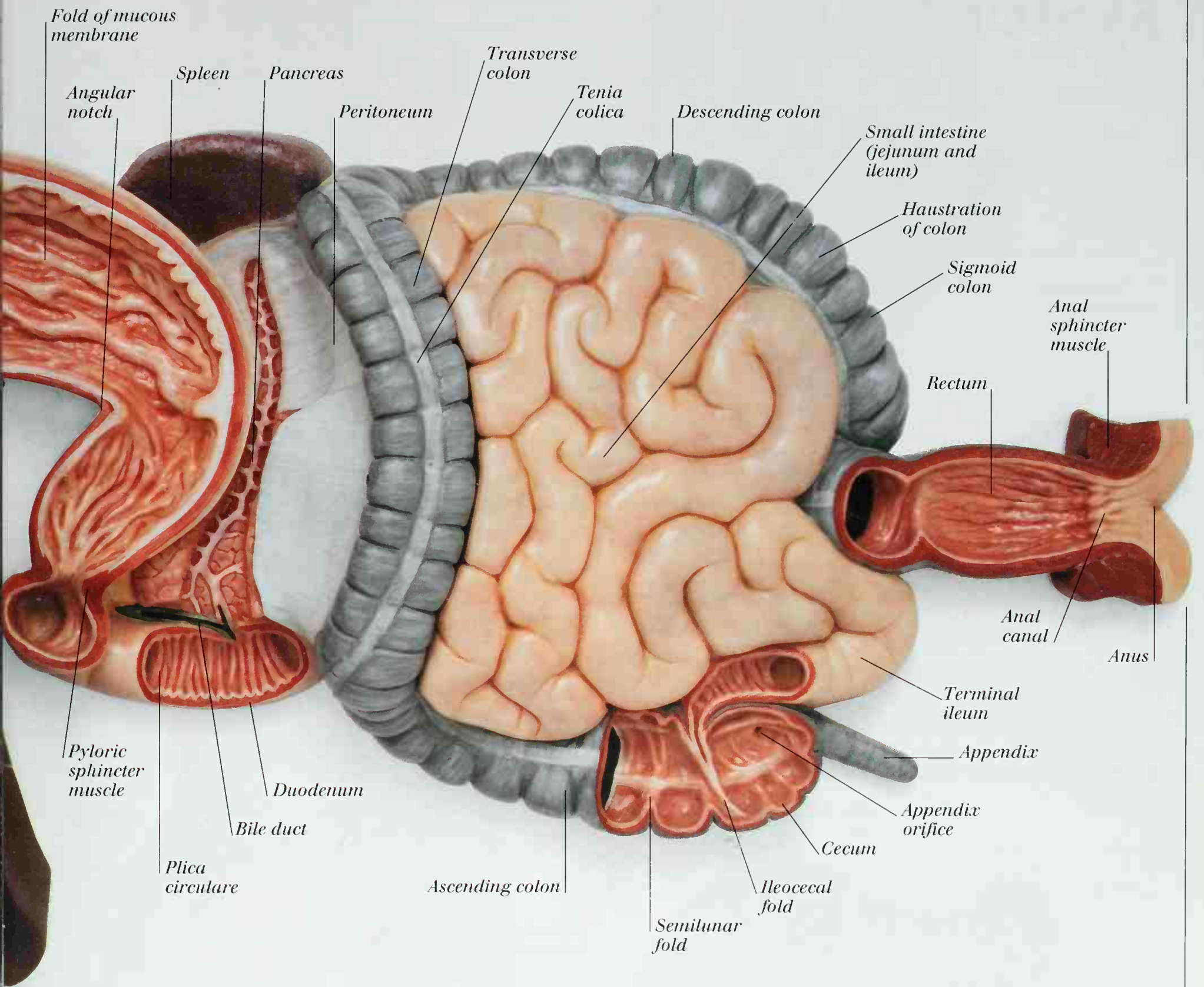
STOMACH



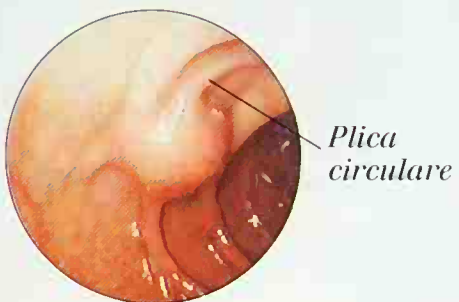
STOMACH EXIT



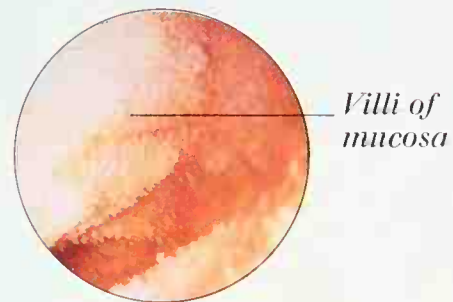
ALIMENTARY CANAL



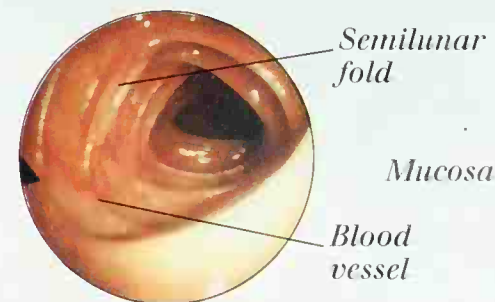
DUODENUM



ILEUM



COLON

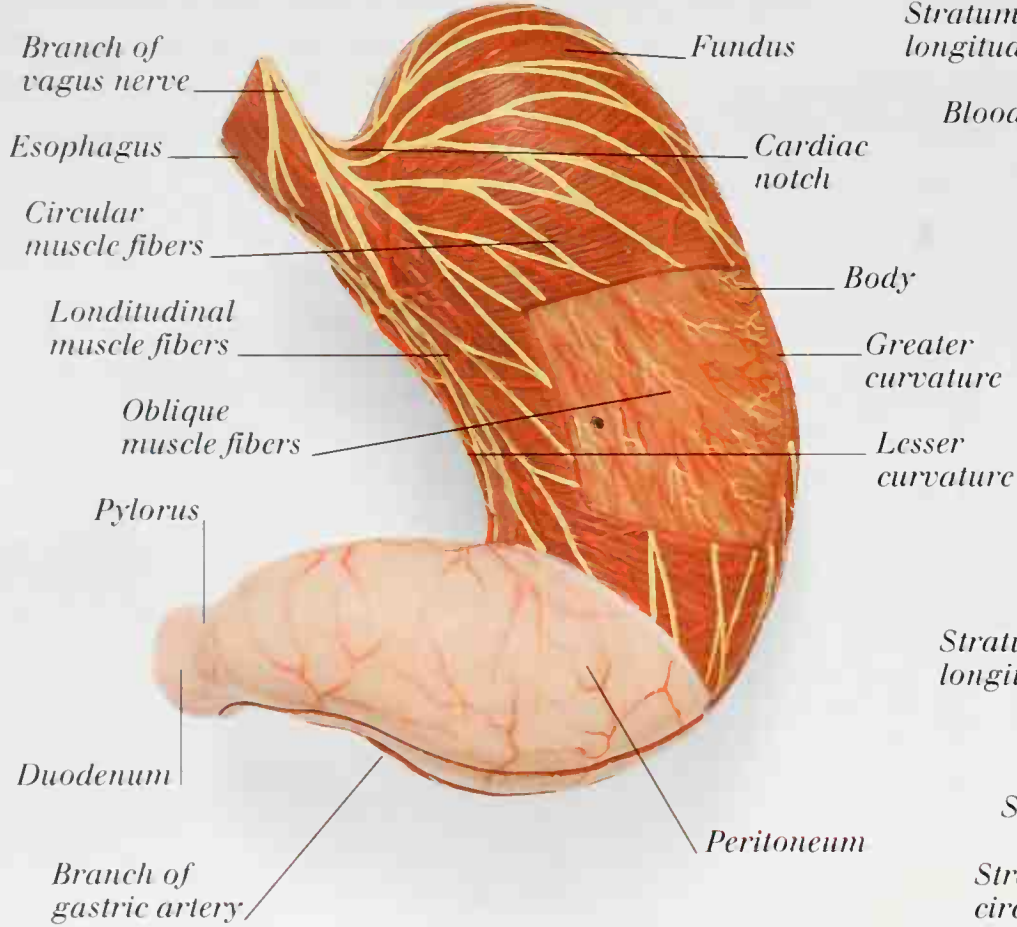


RECTUM

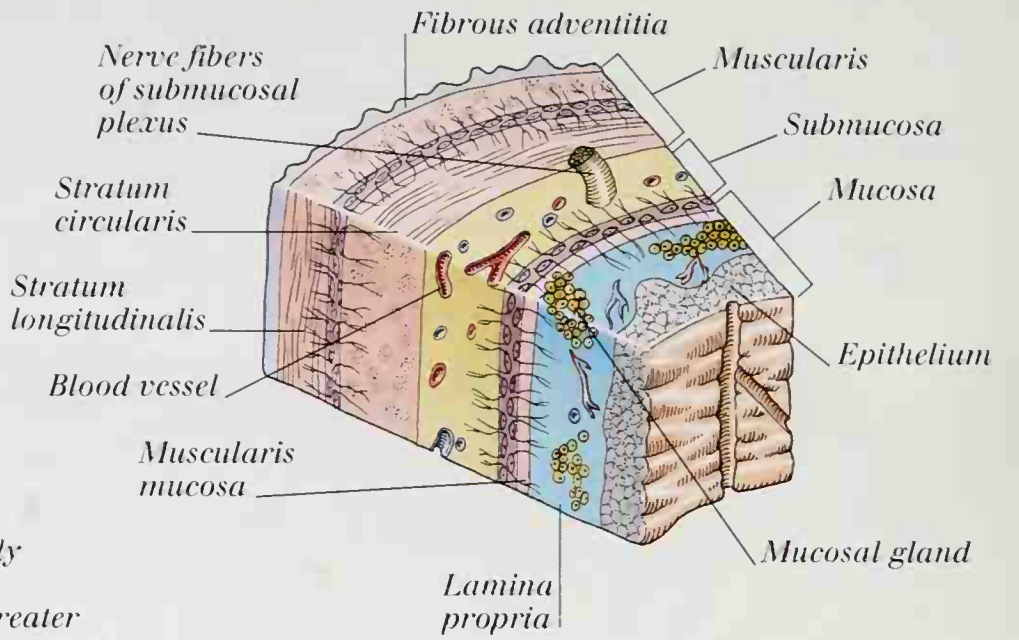


Digestive system 2

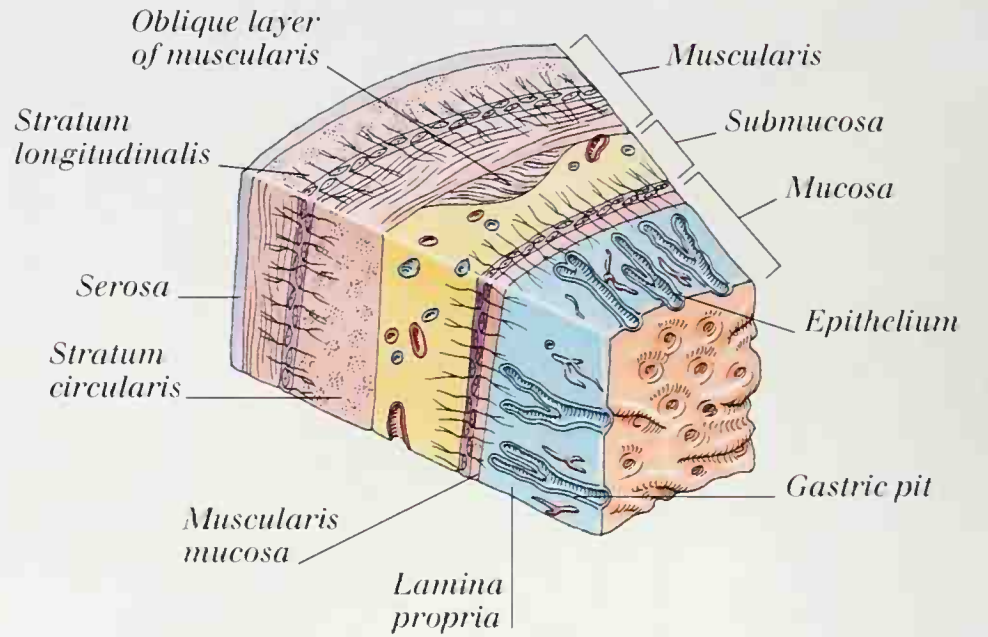
EXTERNAL ANATOMY OF STOMACH



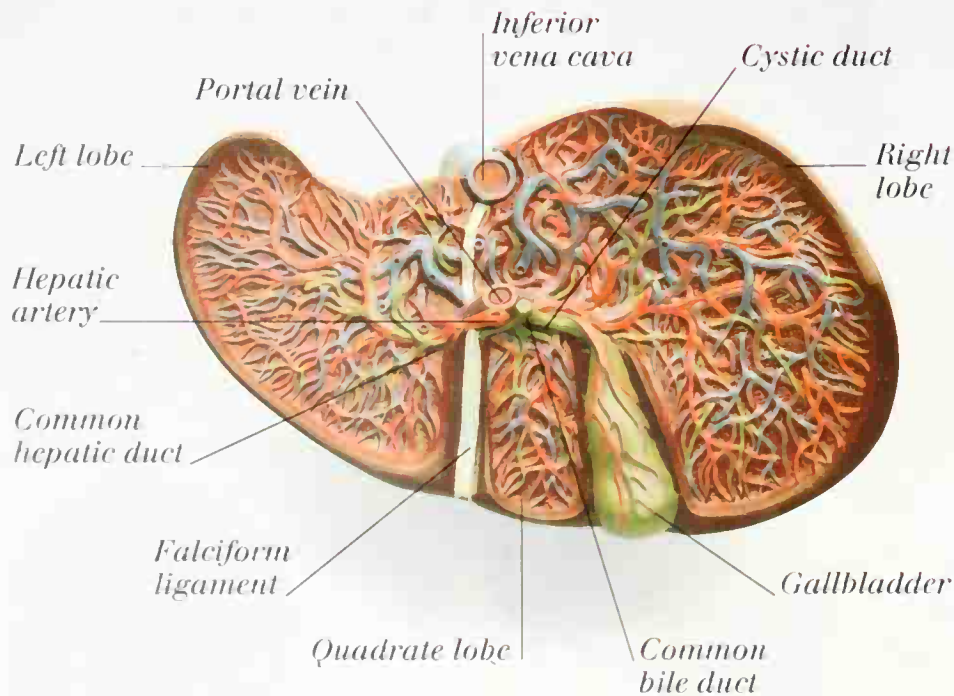
STRUCTURE OF ALIMENTARY CANAL SECTION OF ESOPHAGEAL WALL



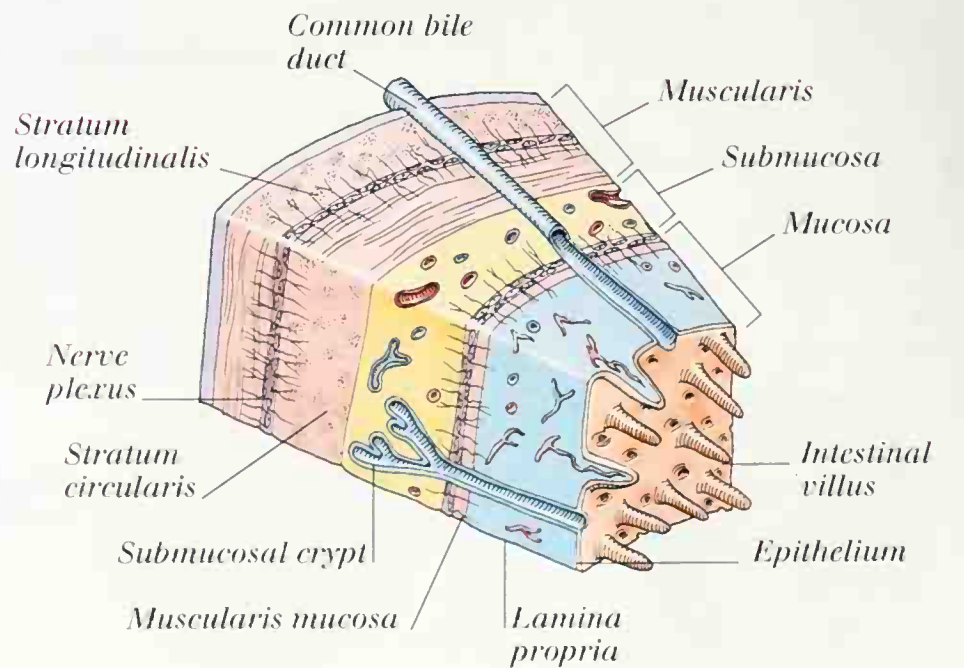
SECTION OF STOMACH WALL

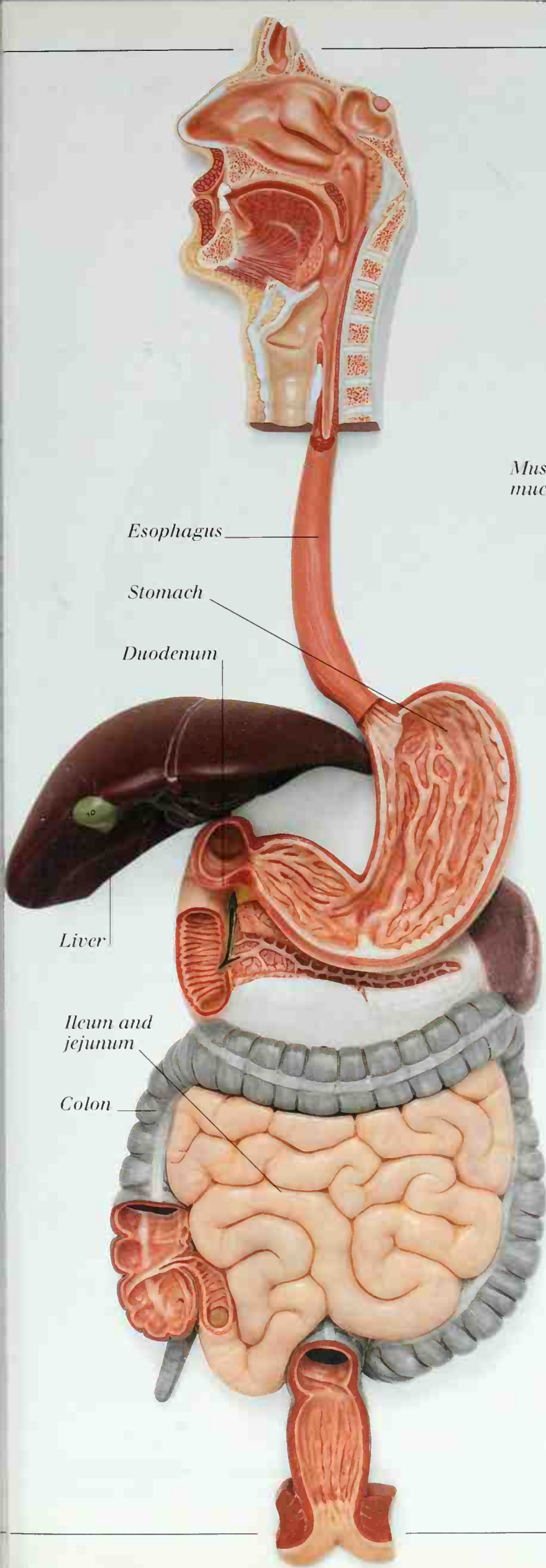


SECTION THROUGH LIVER

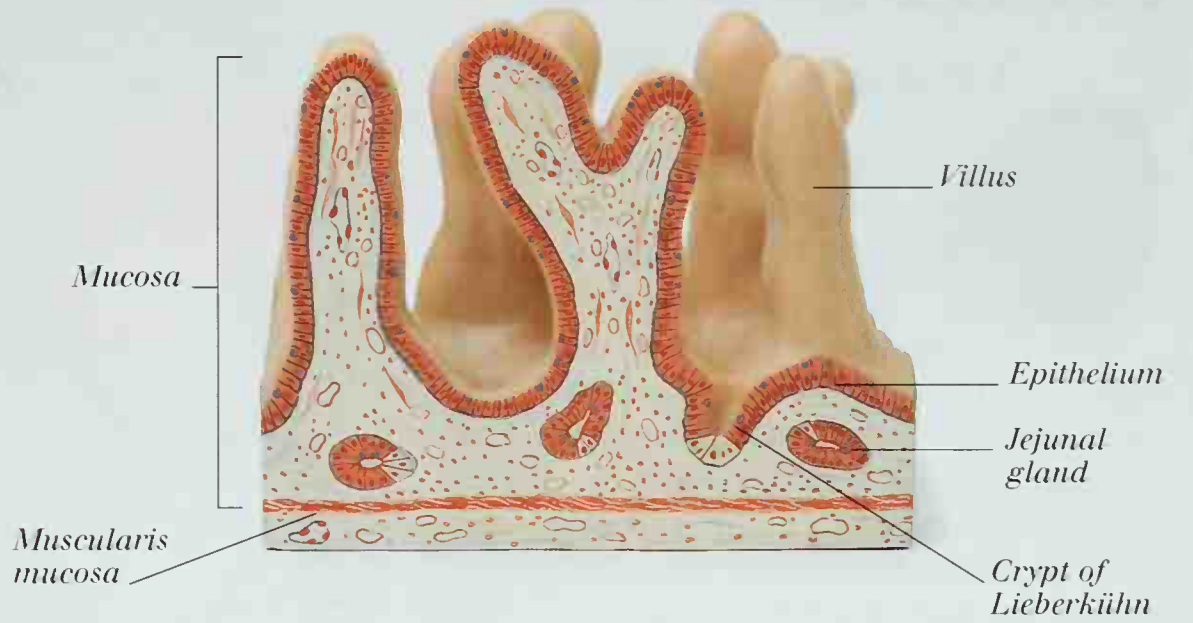


SECTION OF DUODENAL WALL

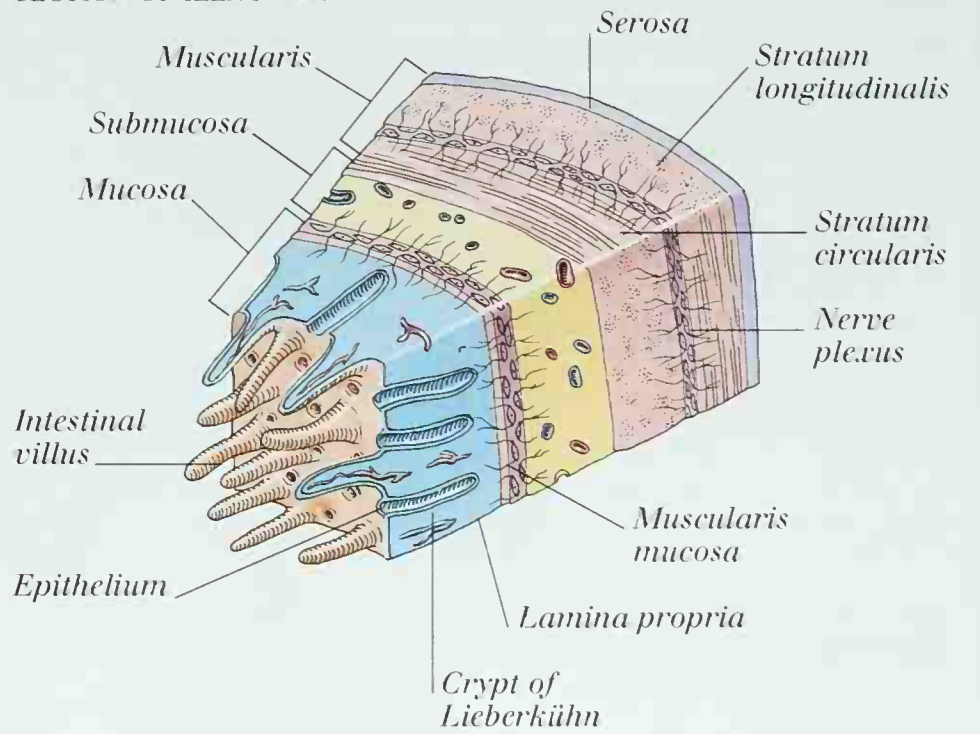




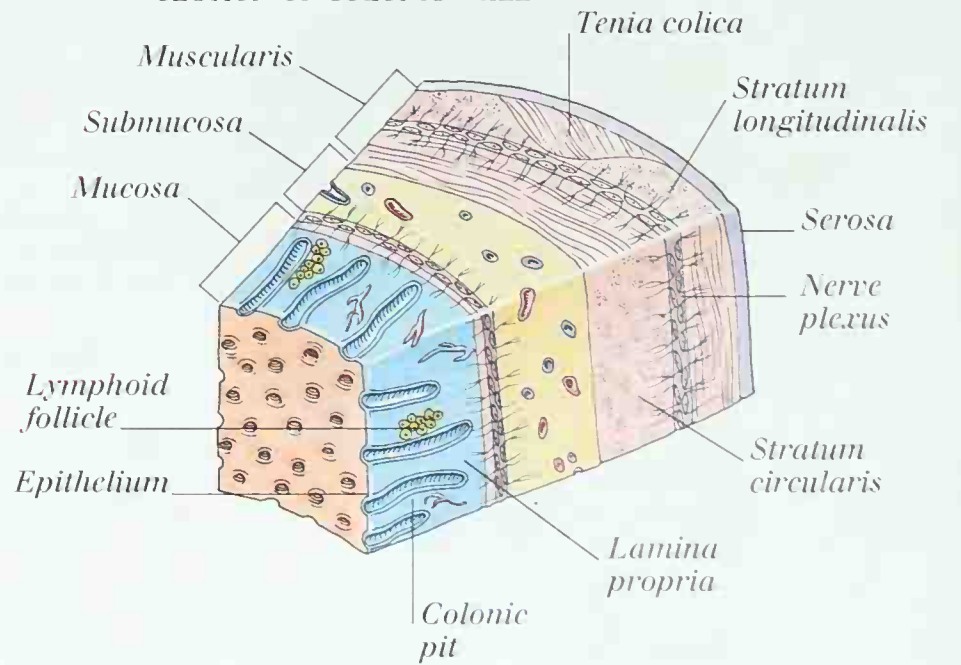
INTERNAL SURFACE OF JEJUNUM



SECTION OF ILEAL WALL

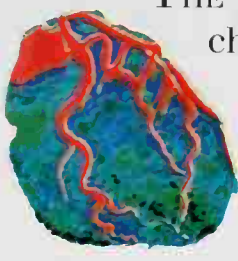


SECTION OF COLONIC WALL



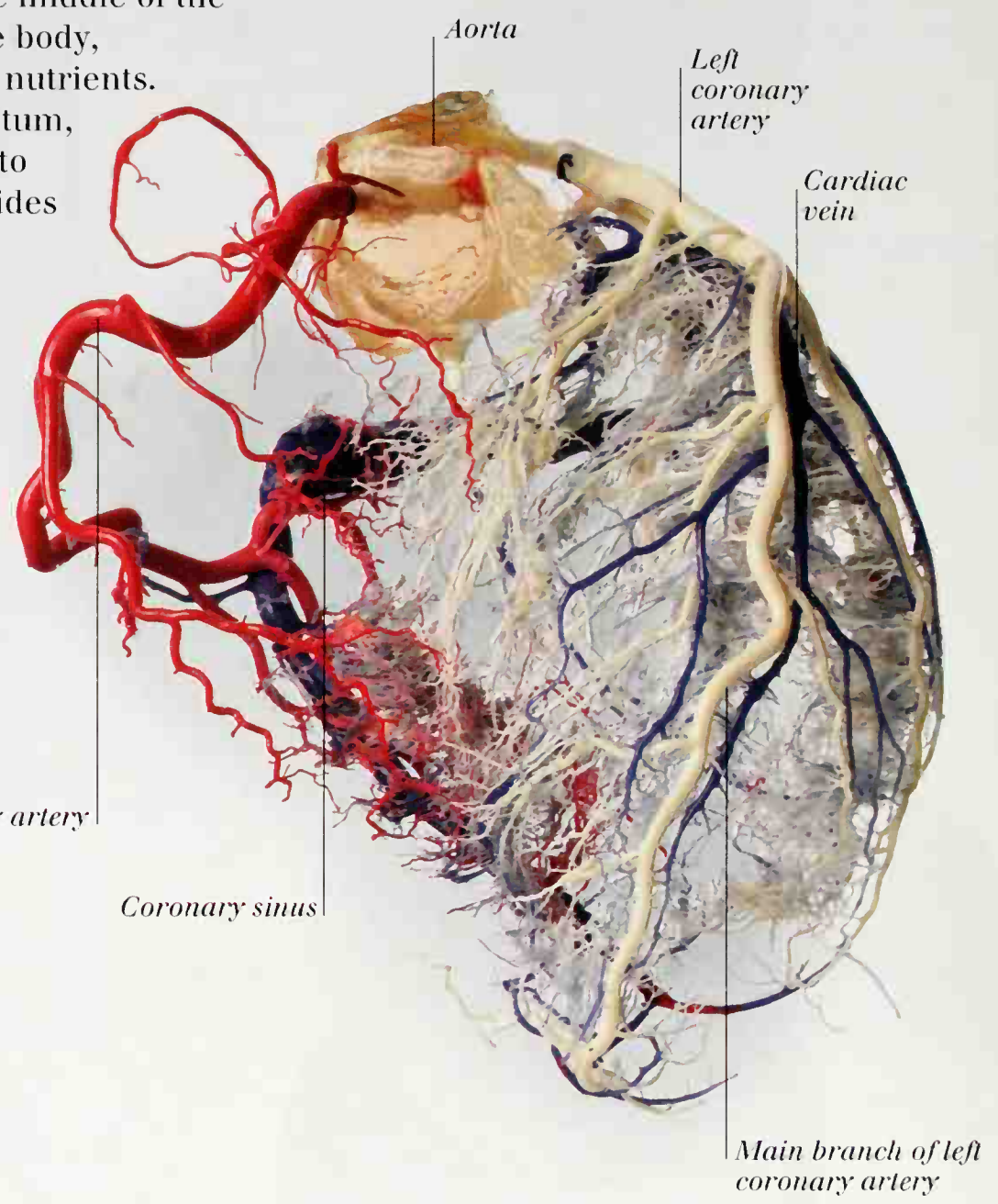
Heart

ARTERIES AND VEINS SURROUNDING HEART

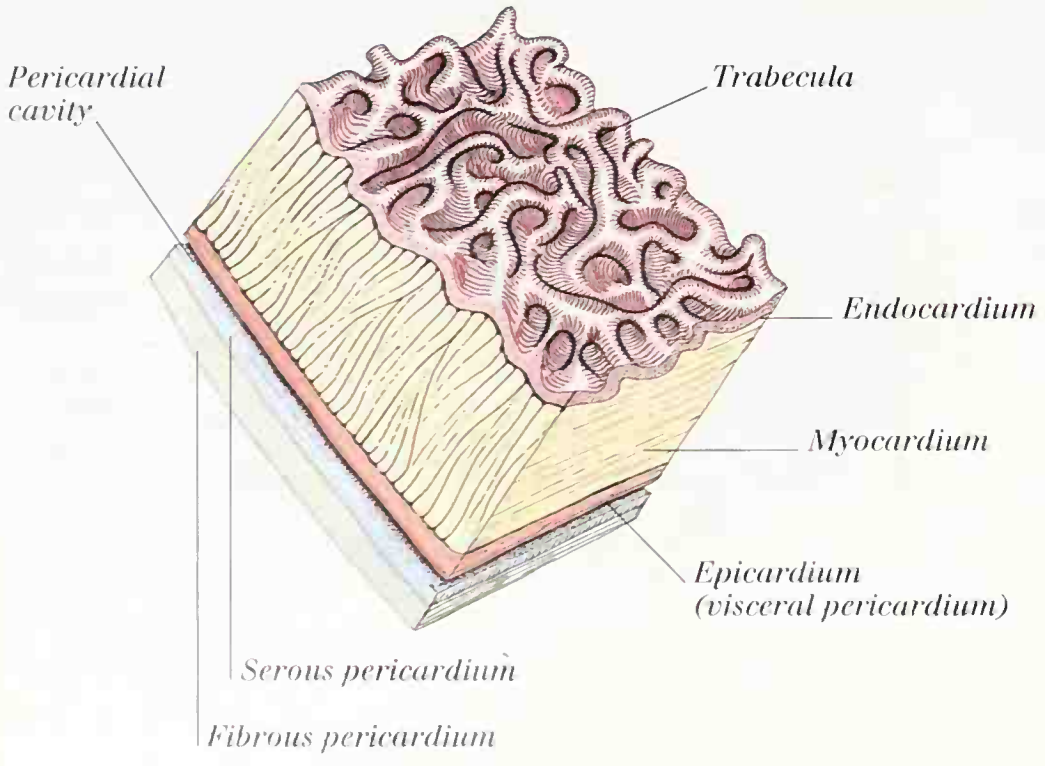


THE HEART IS A HOLLOW MUSCLE in the middle of the chest that pumps blood around the body, supplying cells with oxygen and nutrients.

A muscular wall, called the septum, divides the heart lengthwise into left and right sides. A valve divides each side into two chambers: an upper atrium and a lower ventricle. When the heart muscle contracts, it squeezes blood through the atria and then through the ventricles. Oxygenated blood from the lungs flows from the pulmonary veins into the left atrium, through the left ventricle, and then out via the aorta to all parts of the body. Deoxygenated blood returning from the body flows from the vena cava into the right atrium, through the right ventricle, and then out via the pulmonary artery to the lungs for reoxygenation. At rest the heart beats between 60 and 80 times a minute; during exercise or at times of stress or excitement the rate may increase to 200 beats a minute.

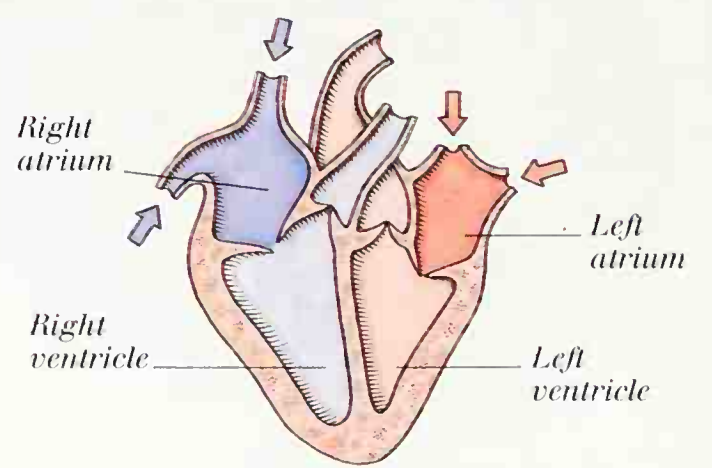


SECTION THROUGH HEART WALL



HEARTBEAT SEQUENCE

ATRIAL DIASTOLE



Deoxygenated blood enters the right atrium while the left atrium receives oxygenated blood.

STRUCTURE OF HEART

Brachiocephalic trunk

Left subclavian artery

Left common carotid artery

Superior vena cava

Ascending aorta

Left pulmonary vein

Right pulmonary artery

Pulmonary trunk

Fossa ovalis

Pulmonary semilunar valve

Coronary artery

Right pulmonary vein

Right atrium

Chordae tendineae

Opening of inferior vena cava

Muscular part of interventricular septum

Branch of coronary artery

Left ventricle

Tricuspid valve

Papillary muscle

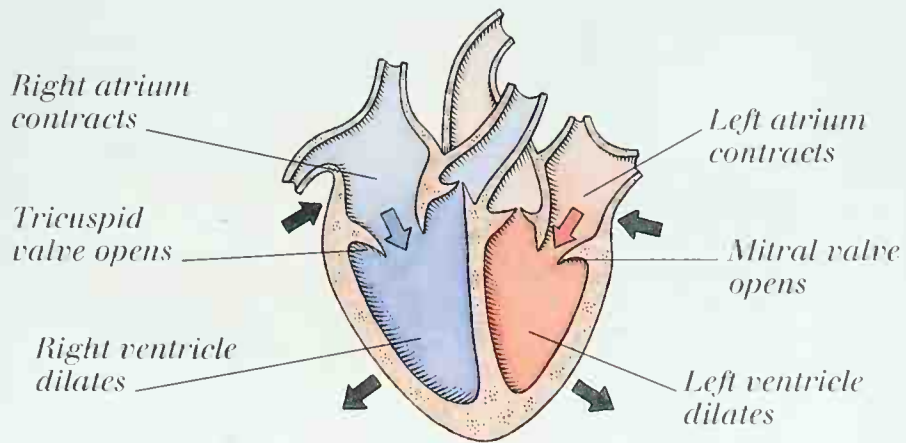
Chordae tendineae

Myocardium of left ventricle

Right ventricle

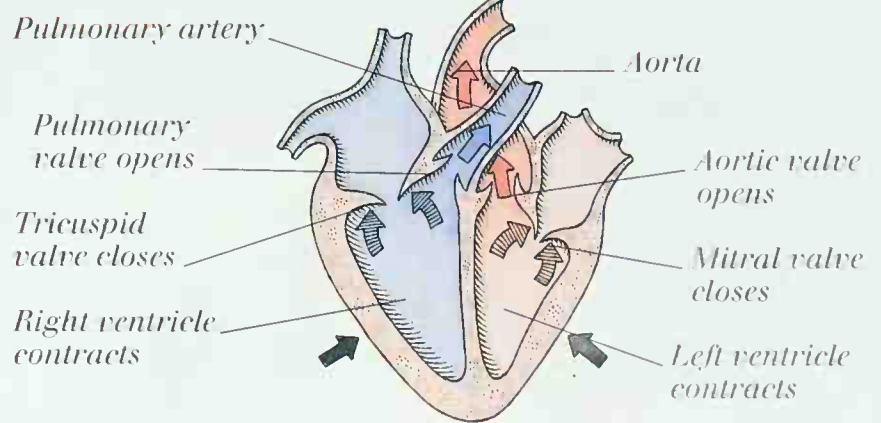
Trabecula

ATRIAL SYSTOLE (VENTRICULAR DIASTOLE)



Left and right atria contract, forcing blood into the relaxed ventricles.

VENTRICULAR SYSTOLE



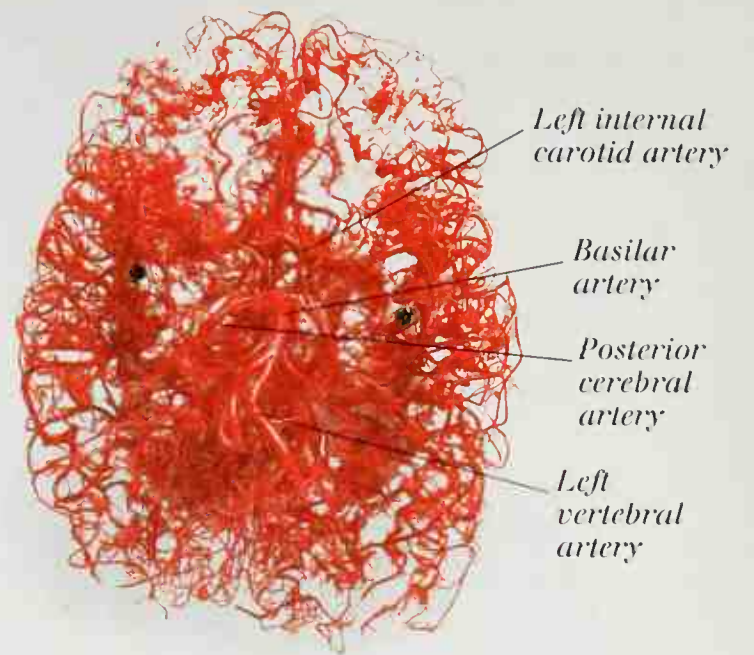
Ventricles contract and force blood to the lungs for oxygenation and via the aorta to the rest of the body.

Circulatory system

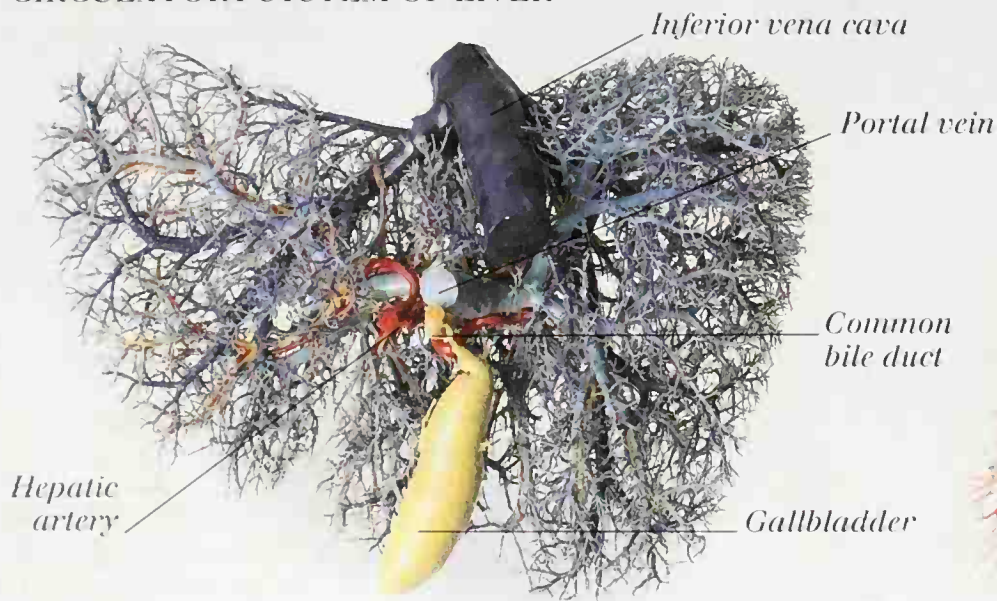


THE CIRCULATORY SYSTEM consists of the heart and blood vessels, which together maintain a continuous flow of blood around the body. The heart pumps oxygen-rich blood from the lungs to all parts of the body through a network of tubes called arteries, and smaller branches called arterioles. Blood returns to the heart via small vessels called venules, which lead in turn into larger tubes called veins. Arterioles and venules are linked by a network of tiny vessels called capillaries, where the exchange of oxygen and carbon dioxide between blood and body cells takes place. Blood has four main components: red blood cells, white blood cells, platelets, and liquid plasma.

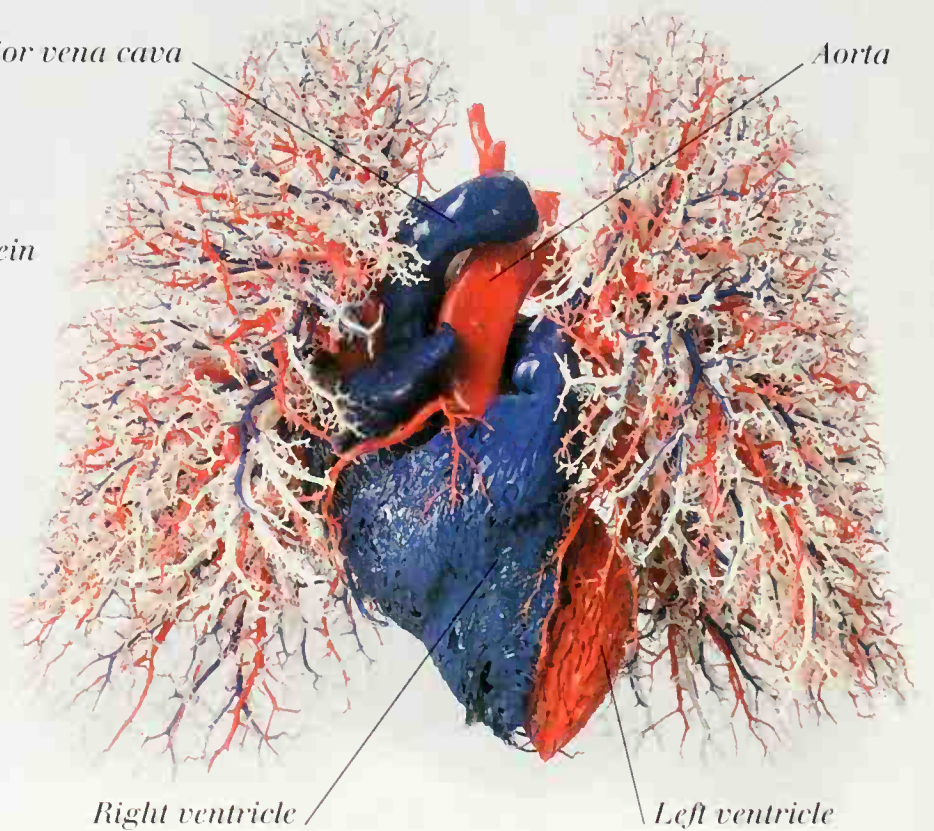
ARTERIAL SYSTEM OF BRAIN



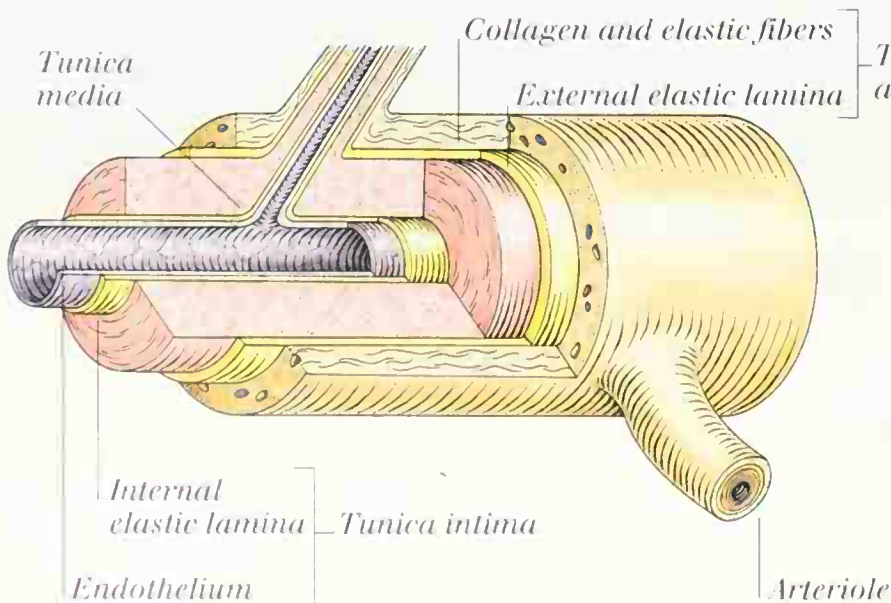
CIRCULATORY SYSTEM OF LIVER



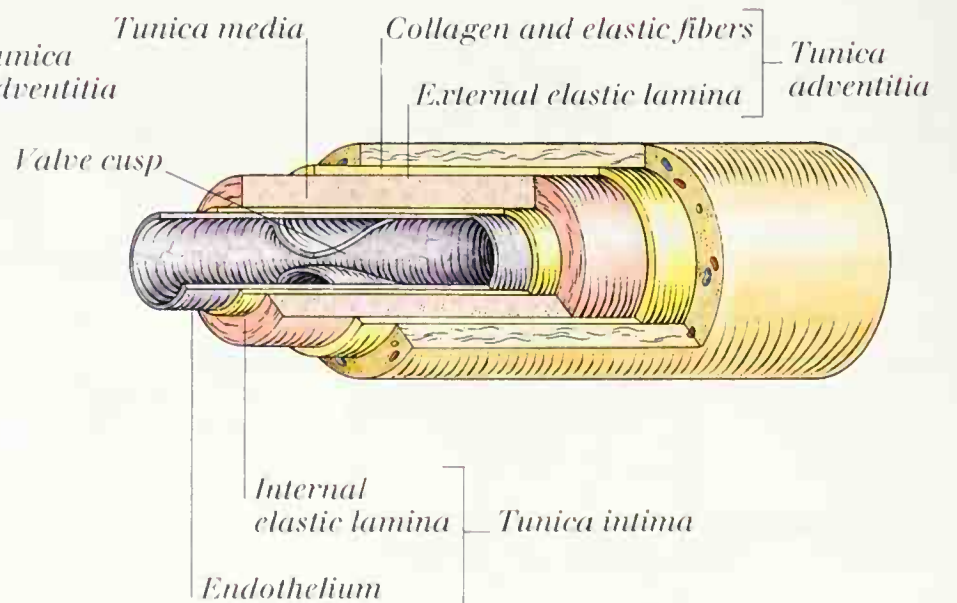
CIRCULATORY SYSTEM OF HEART AND LUNGS



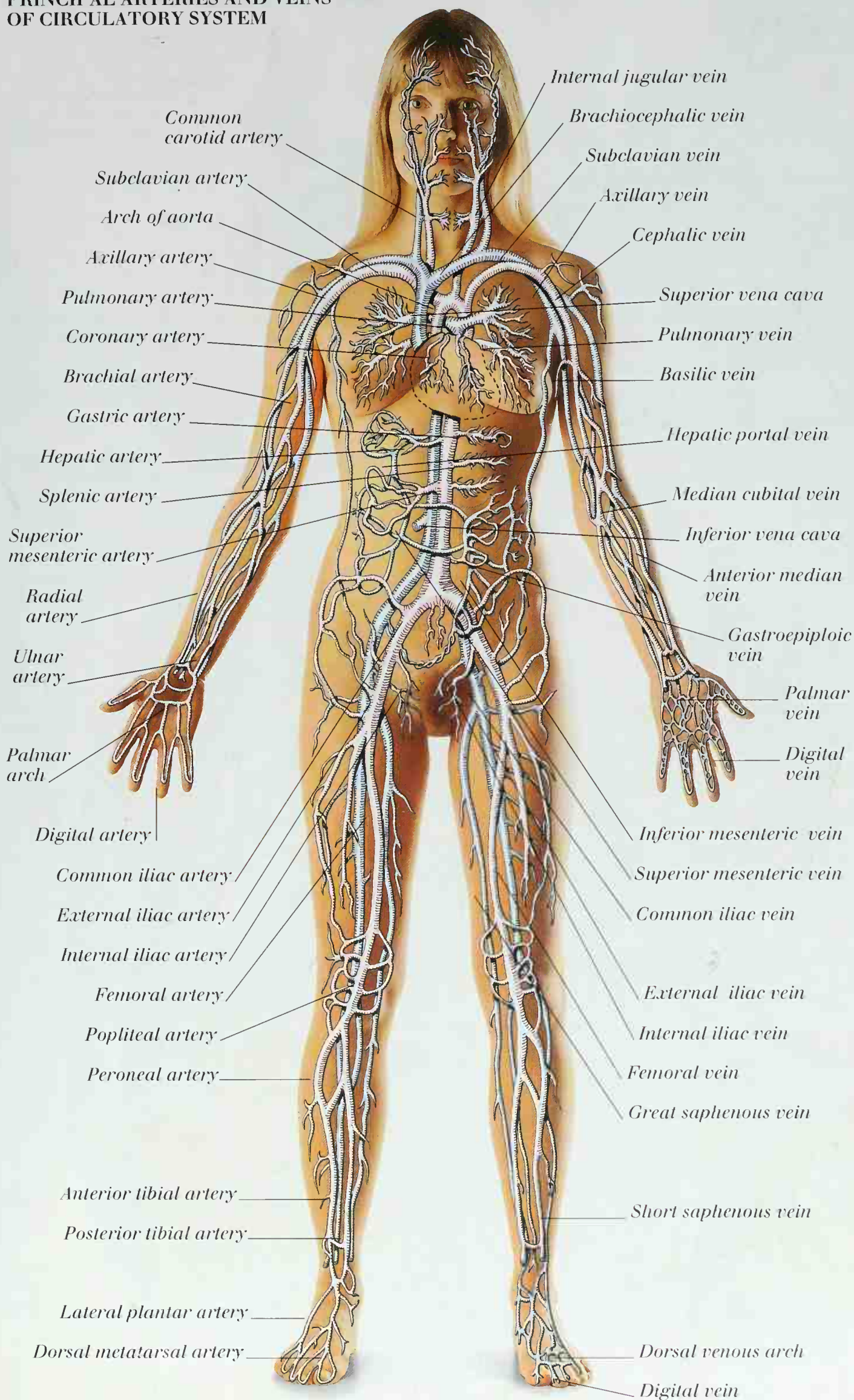
SECTION OF MAIN ARTERY



SECTION OF MAIN VEIN



PRINCIPAL ARTERIES AND VEINS OF CIRCULATORY SYSTEM



TYPES OF BLOOD CELLS



RED BLOOD CELLS
 These cells are biconcave in shape to maximize their oxygen-carrying capacity.



WHITE BLOOD CELLS
 Lymphocytes are the smallest white blood cells; they form antibodies against disease.



PLATELETS
 Tiny cells that are activated whenever blood clotting or repair to vessels is necessary.

BLOOD CLOTTING



Filaments of fibrin enmesh red blood cells as part of the process of blood clotting.

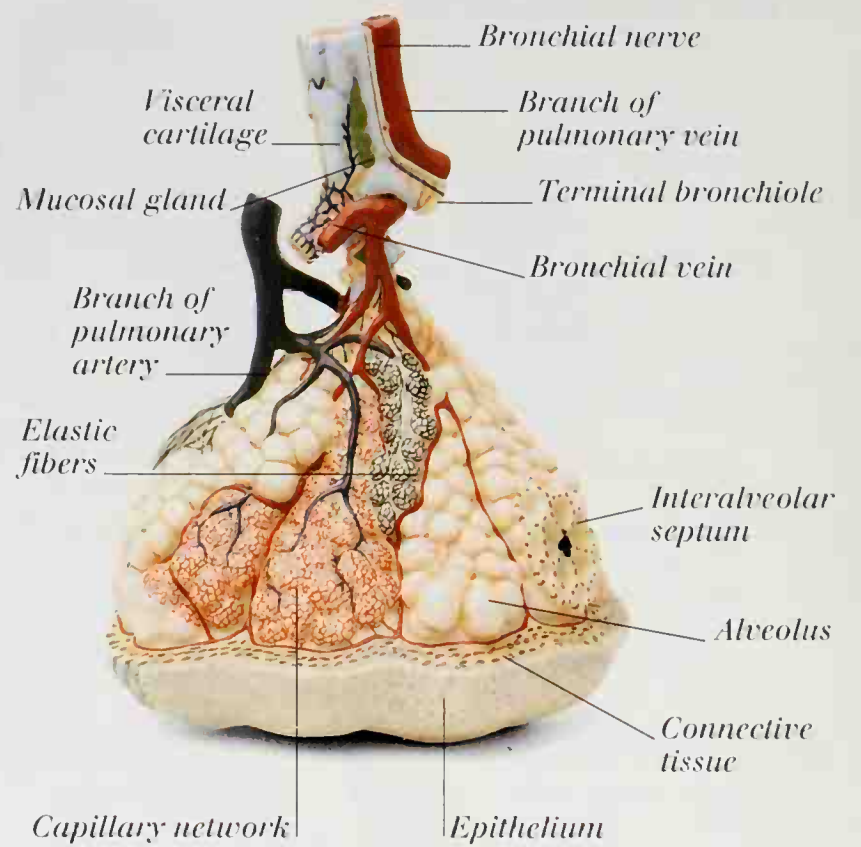
Respiratory system



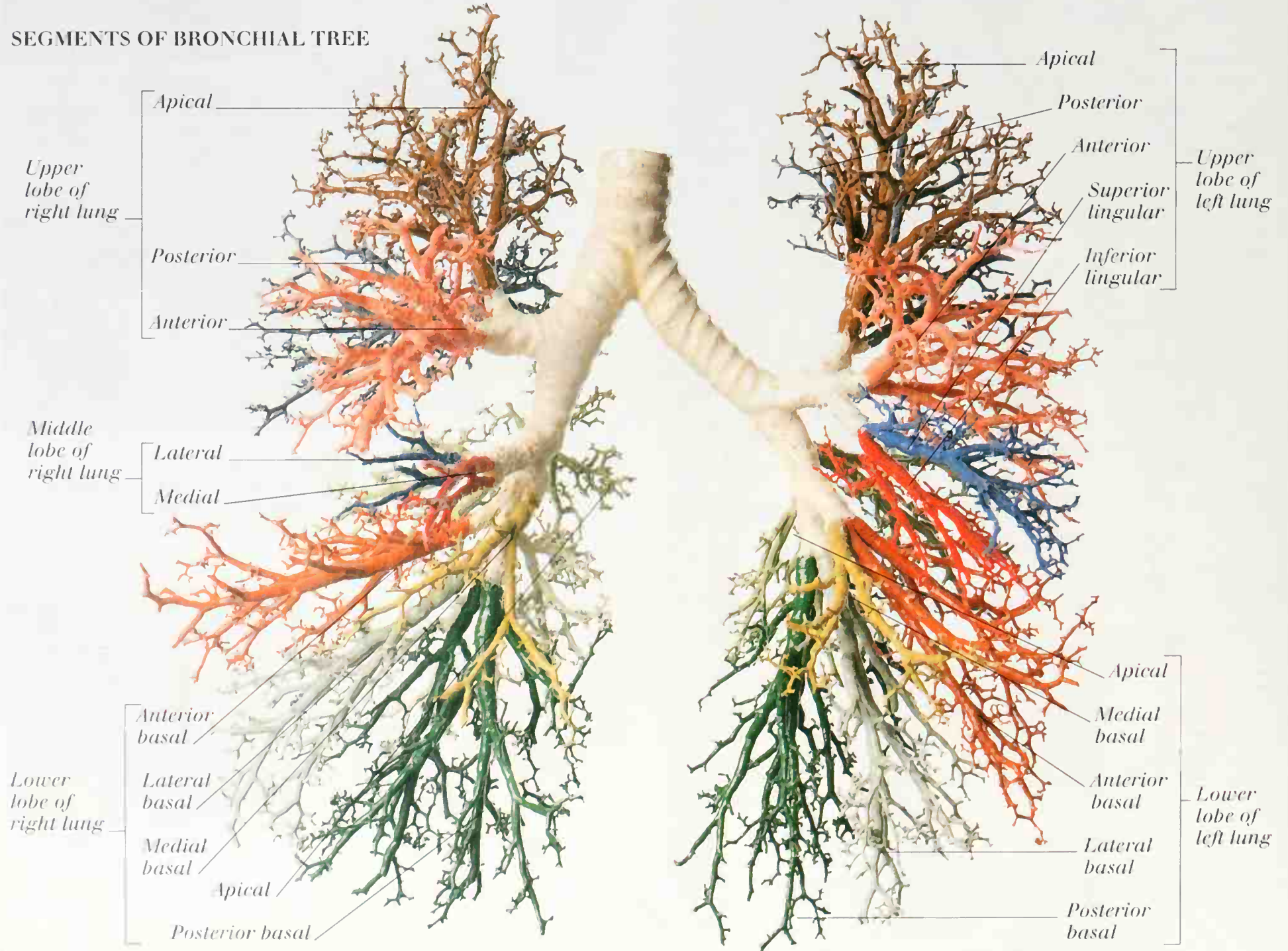
THE RESPIRATORY SYSTEM supplies the oxygen needed by body cells and carries off their carbon dioxide waste. Inhaled air passes via the trachea (windpipe) through two narrower tubes, the bronchi, to the lungs. Each lung comprises many fine, branching tubes called bronchioles that end in tiny clustered chambers called alveoli. Gases cross the thin

alveolar walls to and from a network of tiny blood vessels. Intercostal (rib) muscles and the muscular diaphragm below the lungs operate the lungs like bellows, drawing air in and forcing it out at regular intervals.

BRONCHIOLE AND ALVEOLI

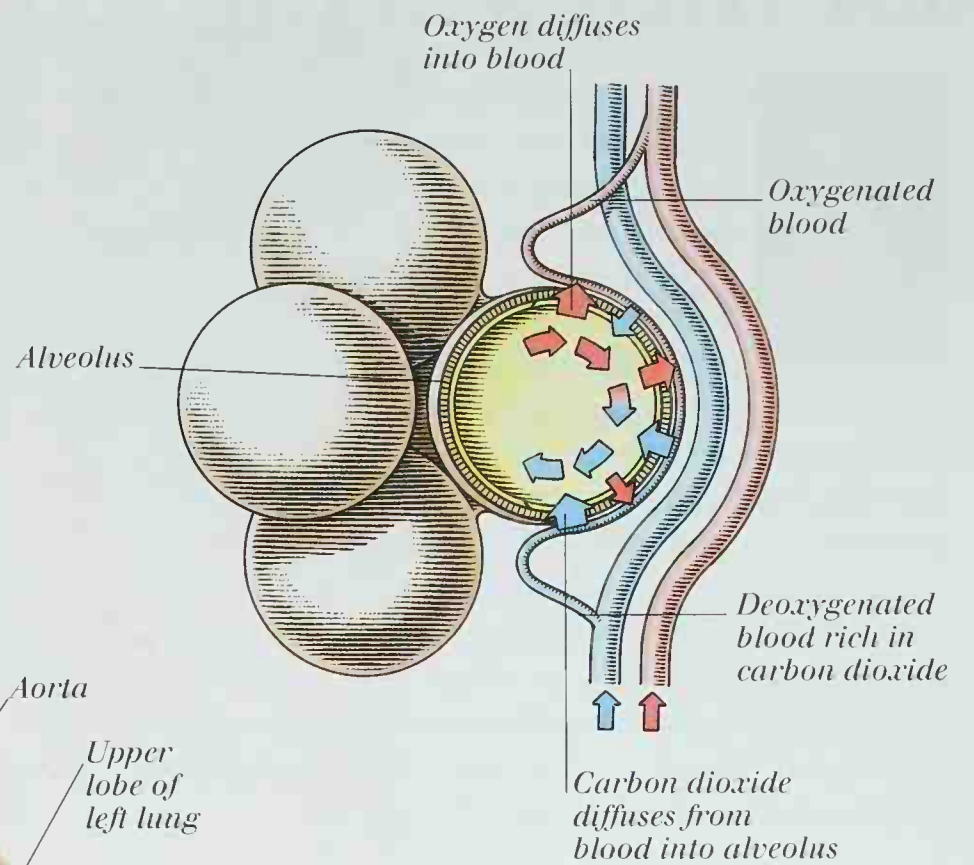
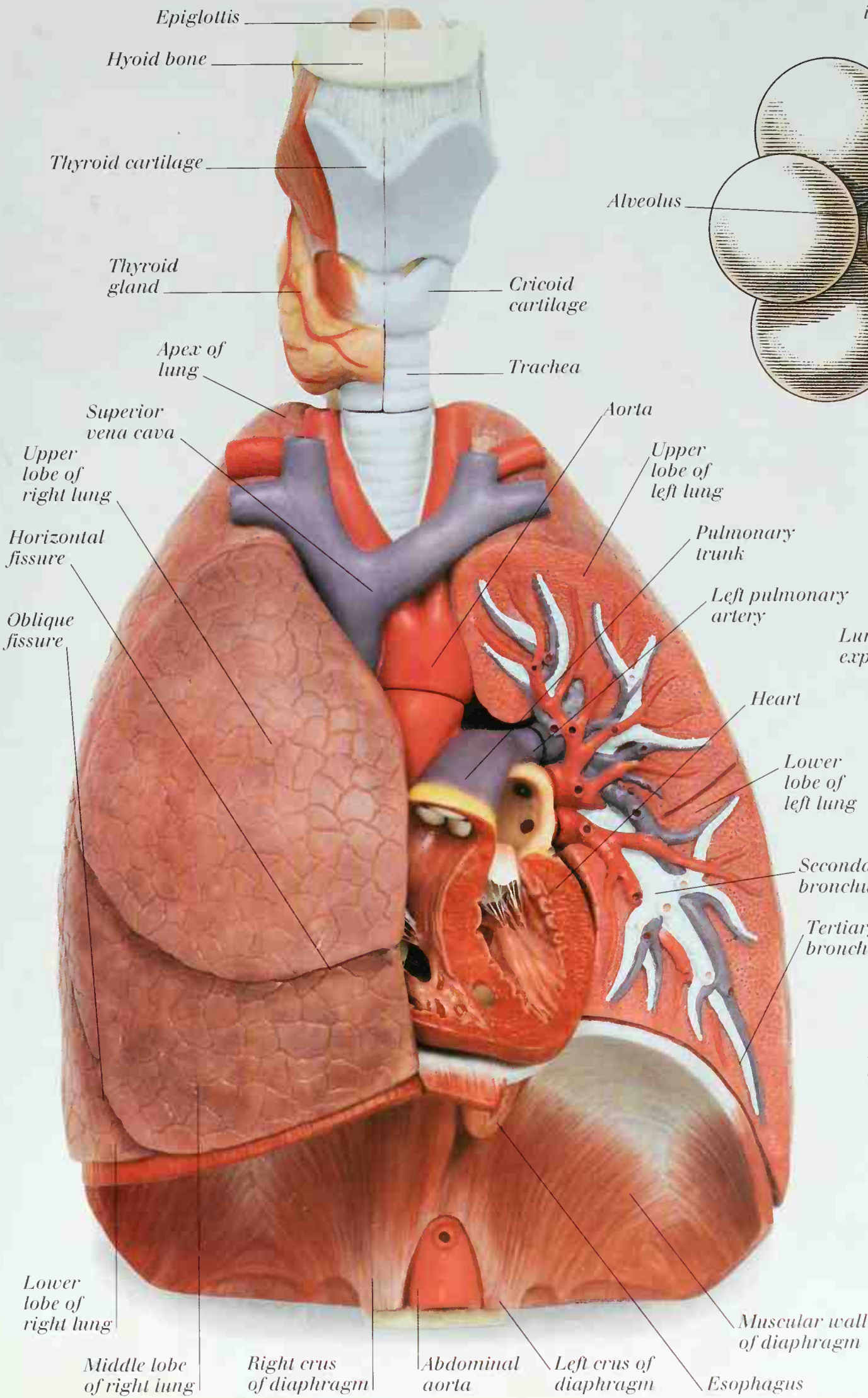


SEGMENTS OF BRONCHIAL TREE

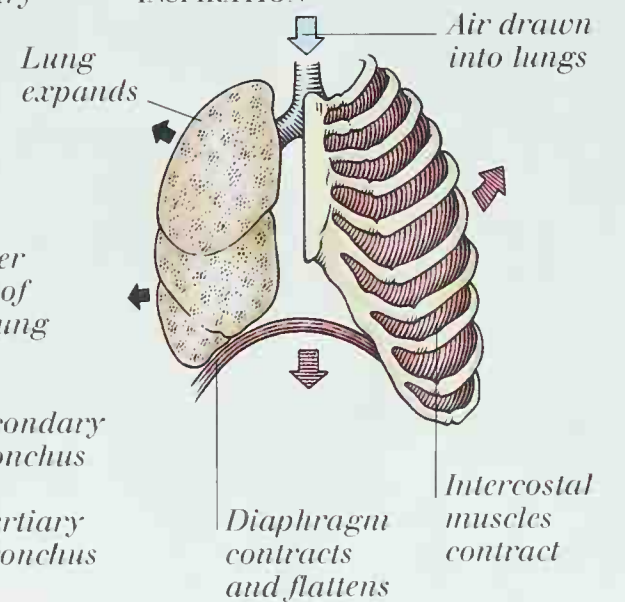


STRUCTURES OF THORACIC CAVITY

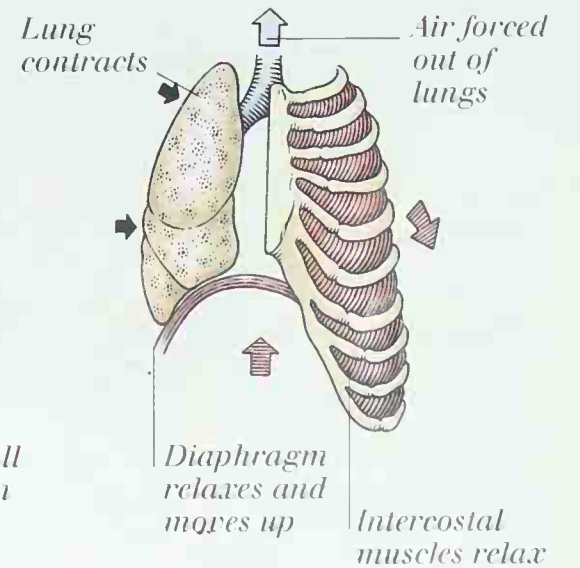
GASEOUS EXCHANGE IN ALVEOLUS



MECHANISM OF RESPIRATION
INSPIRATION



EXPIRATION



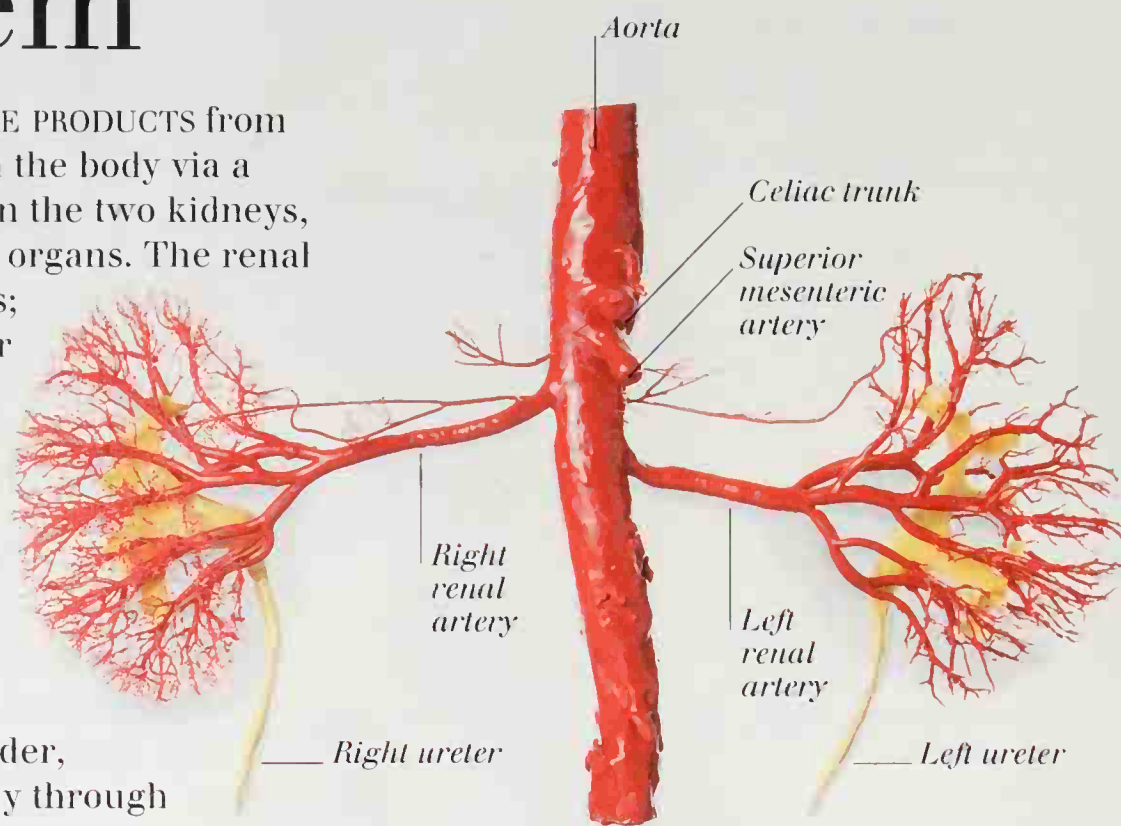
Urinary system



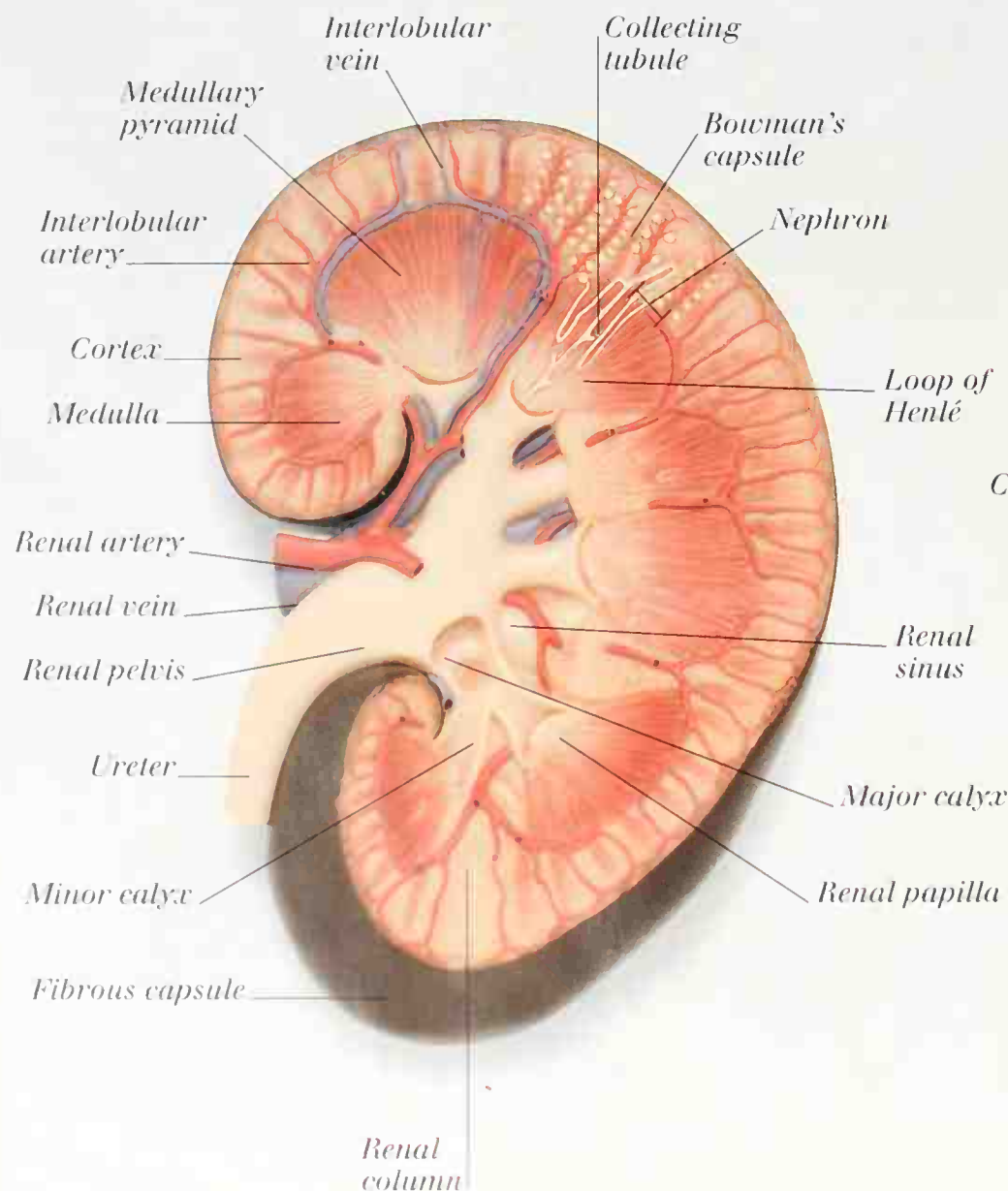
THE URINARY SYSTEM FILTERS WASTE PRODUCTS from the blood and removes them from the body via a system of tubes. Blood is filtered in the two kidneys, which are fist-sized, bean-shaped organs. The renal arteries carry blood to the kidneys; the renal veins remove blood after filtering. Each kidney contains

about one million tiny units called nephrons. Each nephron is made up of a tubule and a filtering unit called a glomerulus, which consists of a collection of tiny blood vessels surrounded by the hollow Bowman's capsule. The filtering process produces a watery fluid that leaves the kidney as urine. The urine is carried via two tubes called ureters to the bladder, where it is stored until its release from the body through another tube called the urethra.

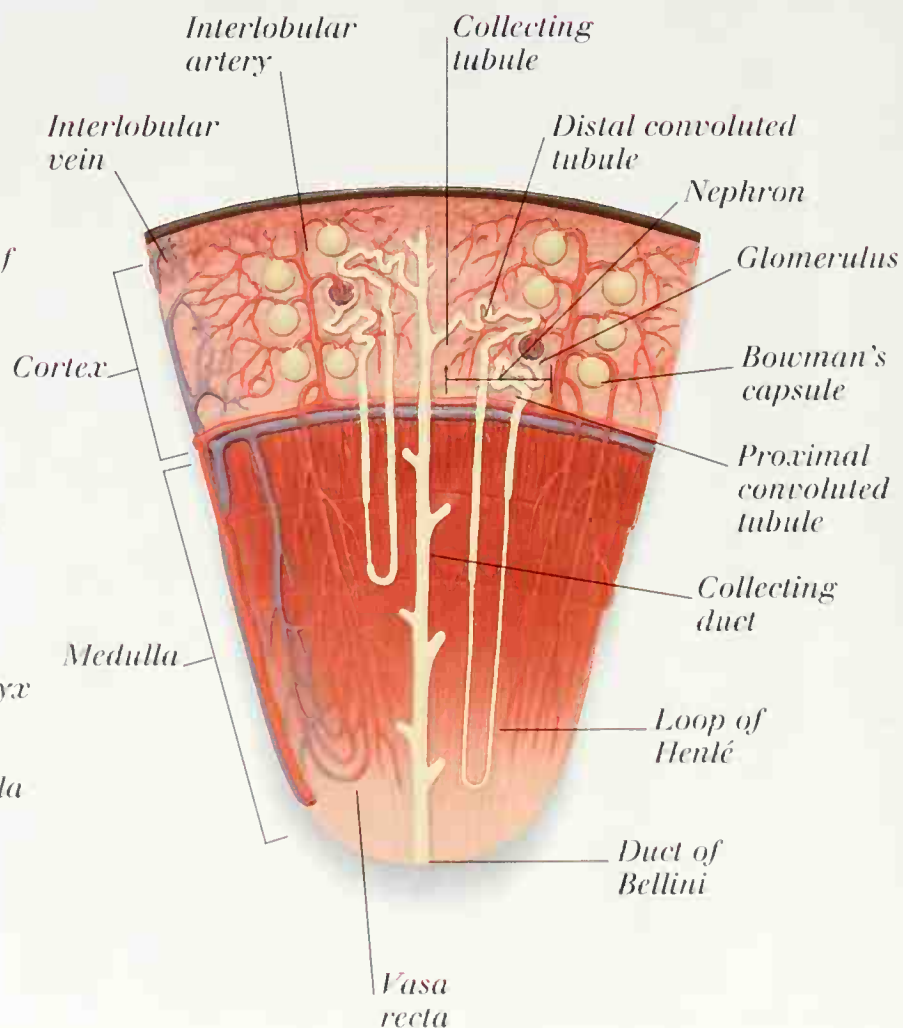
ARTERIAL SYSTEM OF KIDNEYS



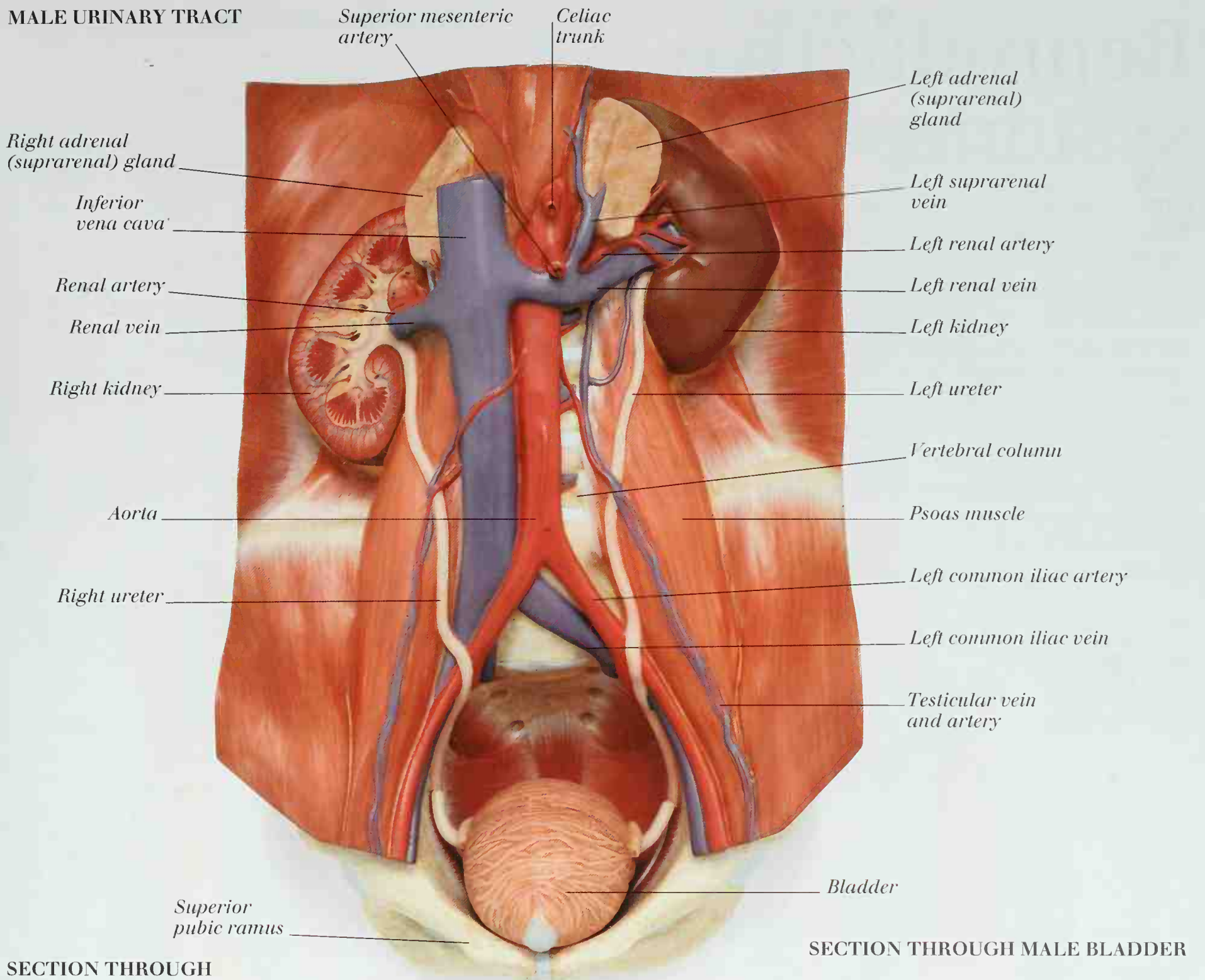
SECTION THROUGH LEFT KIDNEY



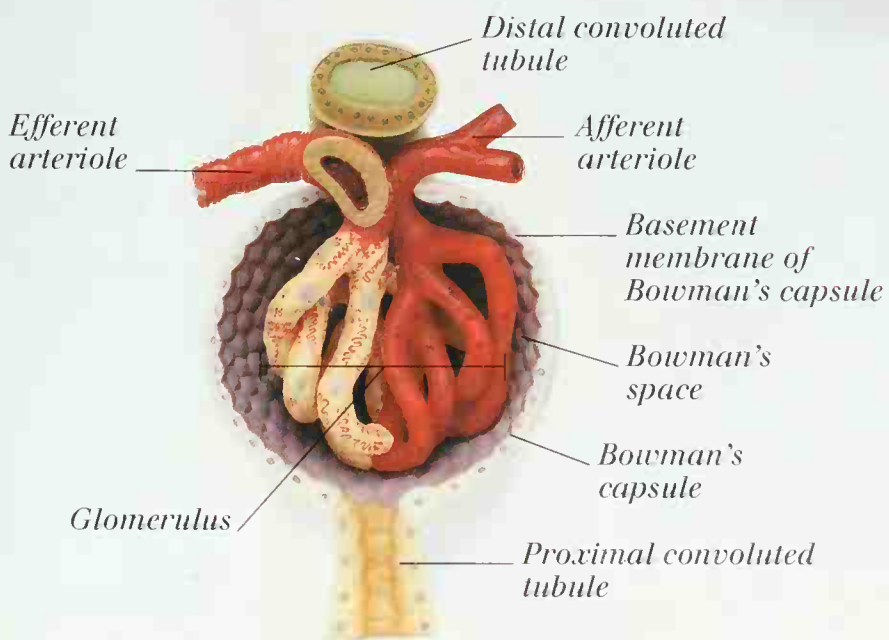
SECTION OF KIDNEY



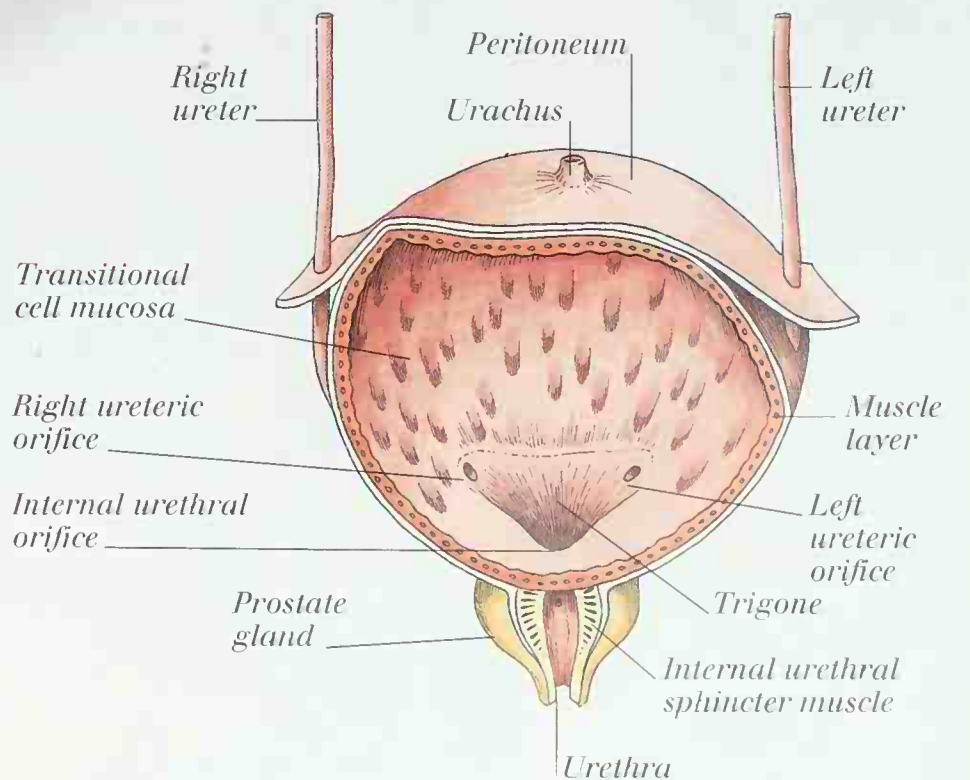
MALE URINARY TRACT



SECTION THROUGH BOWMAN'S CAPSULE



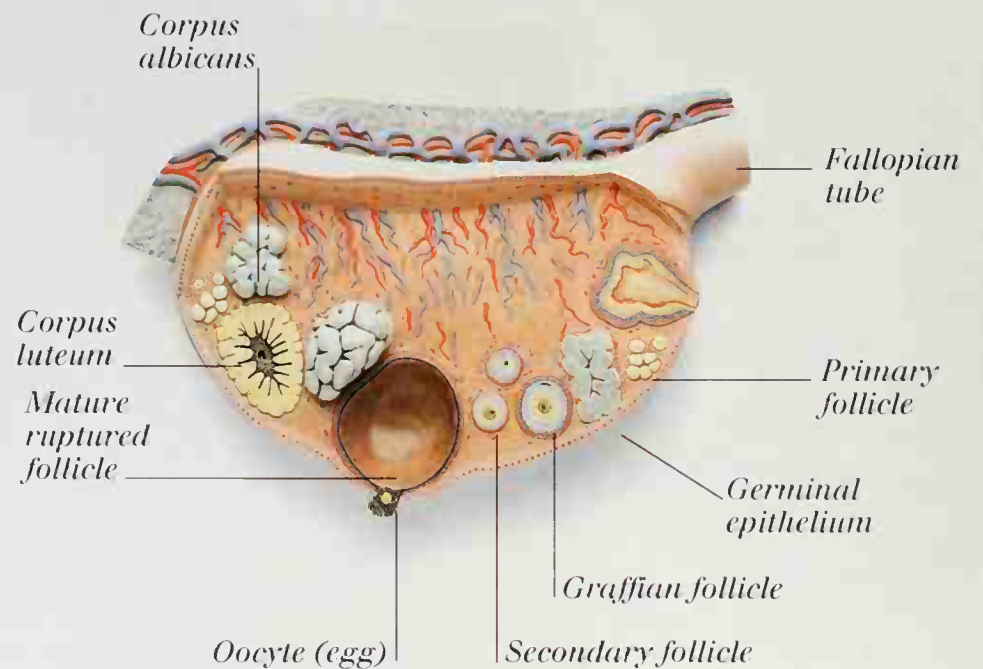
SECTION THROUGH MALE BLADDER



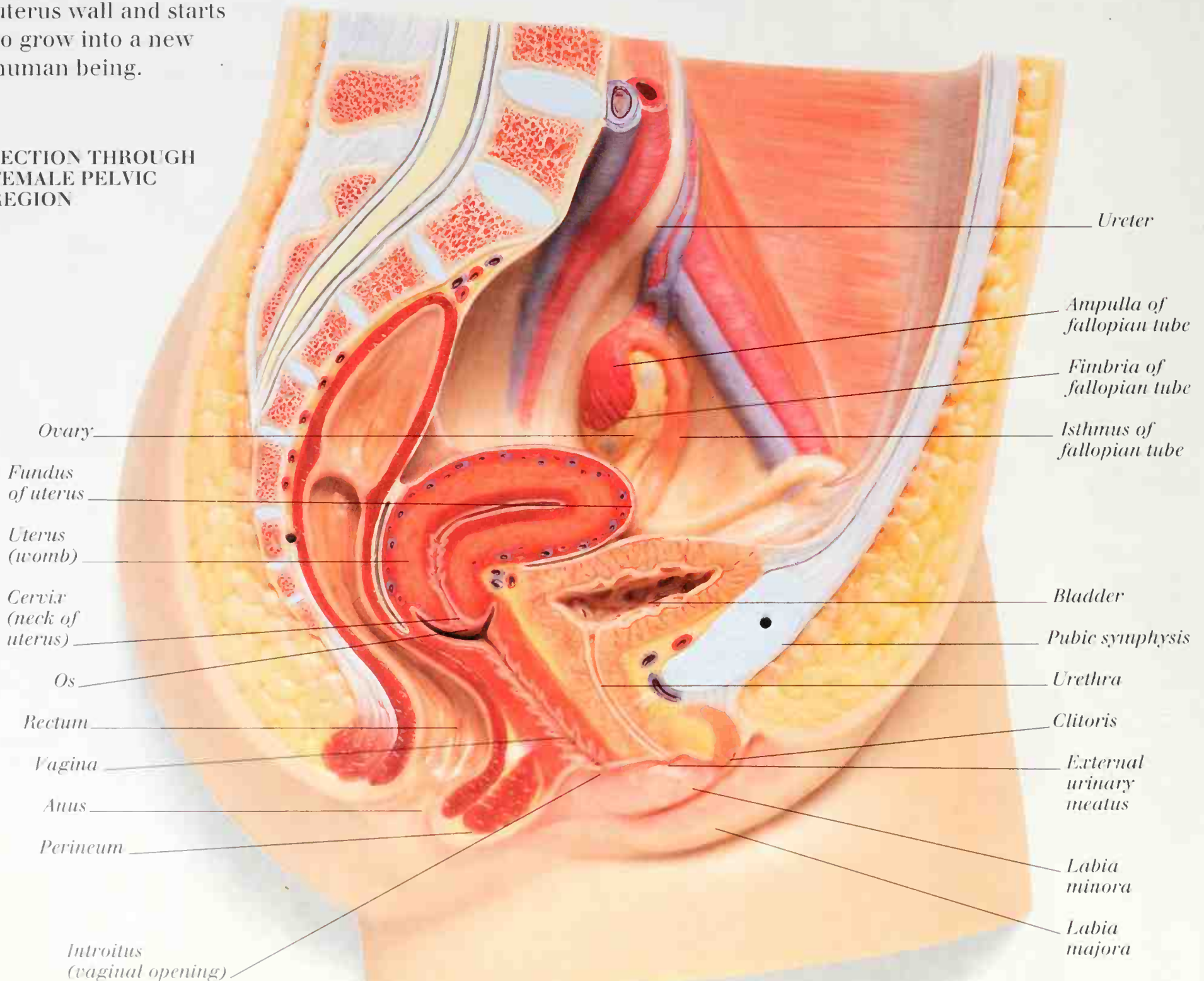
Reproductive system

SEX ORGANS LOCATED IN THE PELVIS create new human lives. Each month a ripe egg is released from one of the female's ovaries into a fallopian tube leading to the uterus (womb), a muscular pear-sized organ. A male produces minute tadpole-like sperm in two oval glands called testes. When the male is ready to release sperm into the female's vagina, many millions pass into his urethra and leave his body through the fleshy penis. The sperm travel up through the vagina into the uterus and one sperm may enter and fertilize an egg. The fertilized egg becomes embedded in the uterus wall and starts to grow into a new human being.

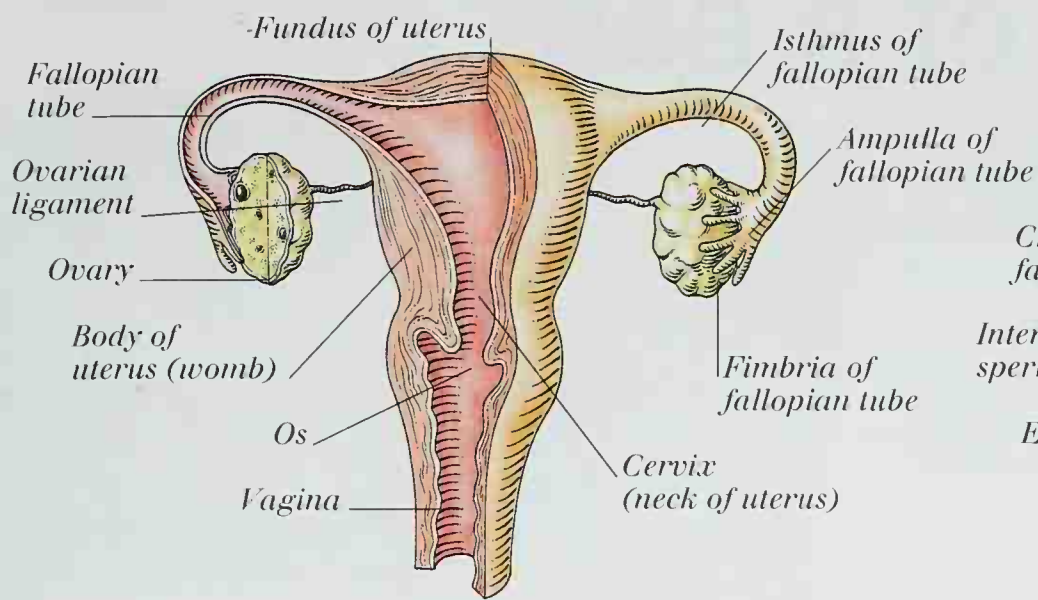
SECTION THROUGH OVARY



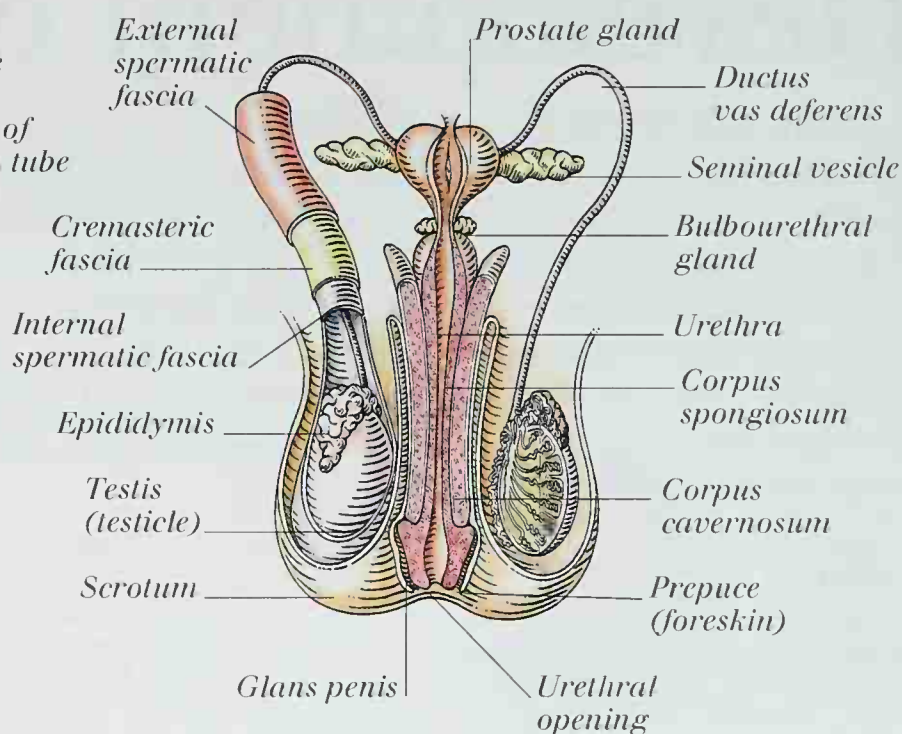
SECTION THROUGH FEMALE PELVIC REGION



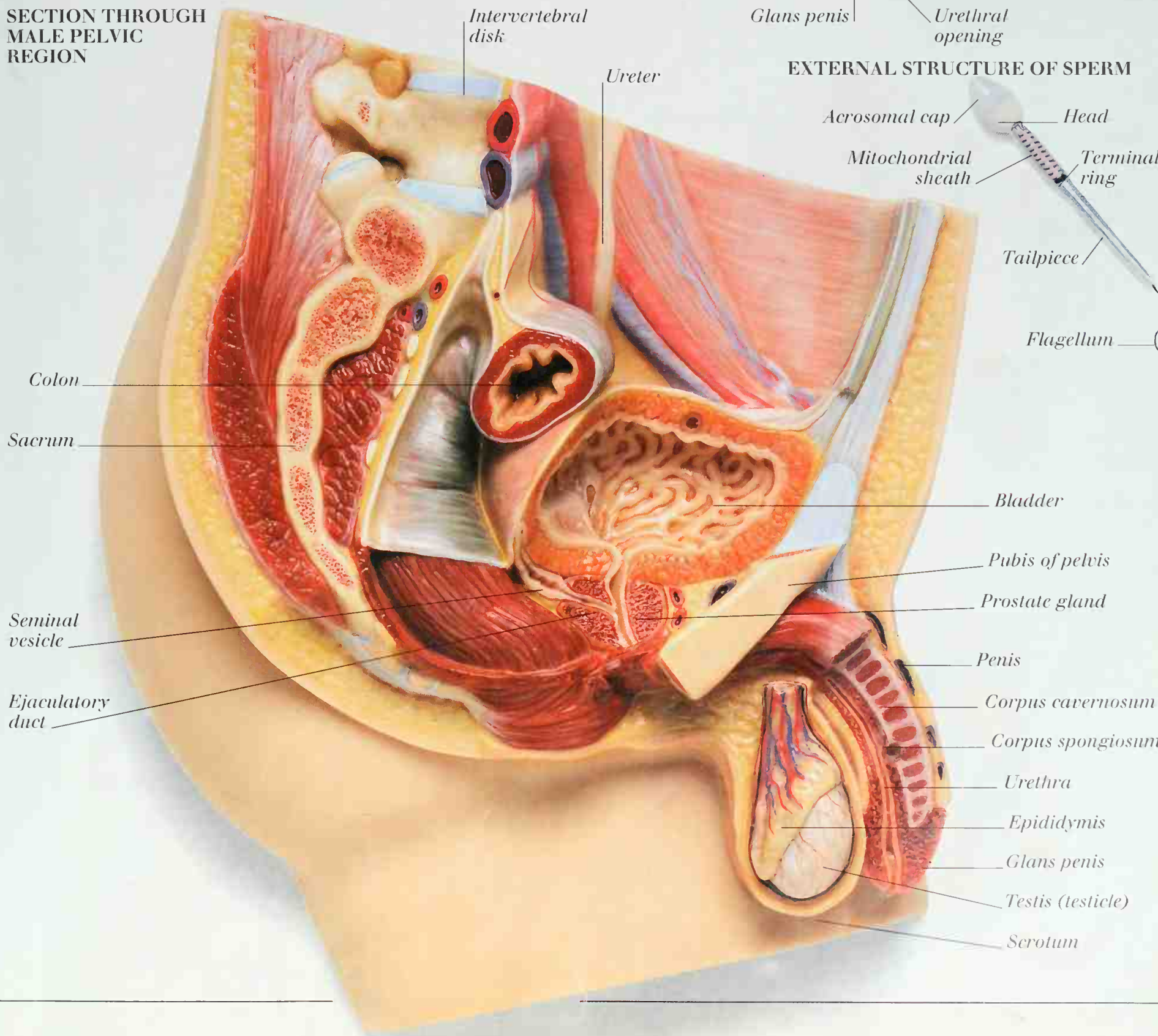
FEMALE REPRODUCTIVE ORGANS



MALE REPRODUCTIVE ORGANS



SECTION THROUGH MALE PELVIC REGION



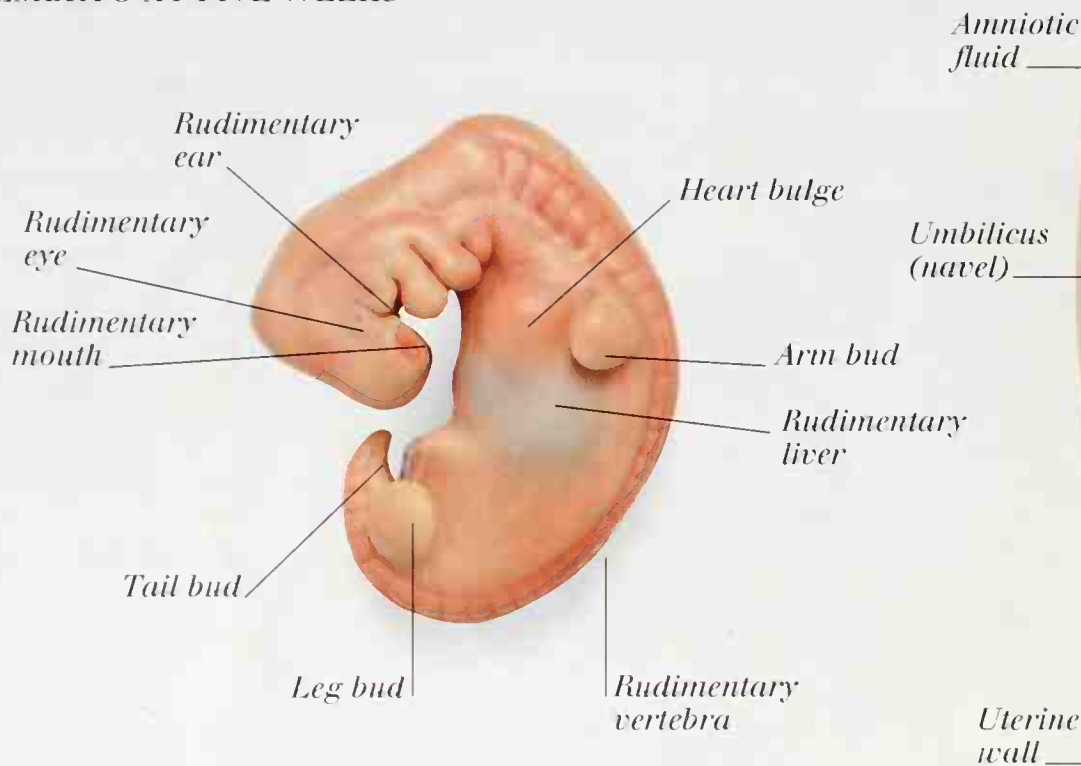
EXTERNAL STRUCTURE OF SPERM



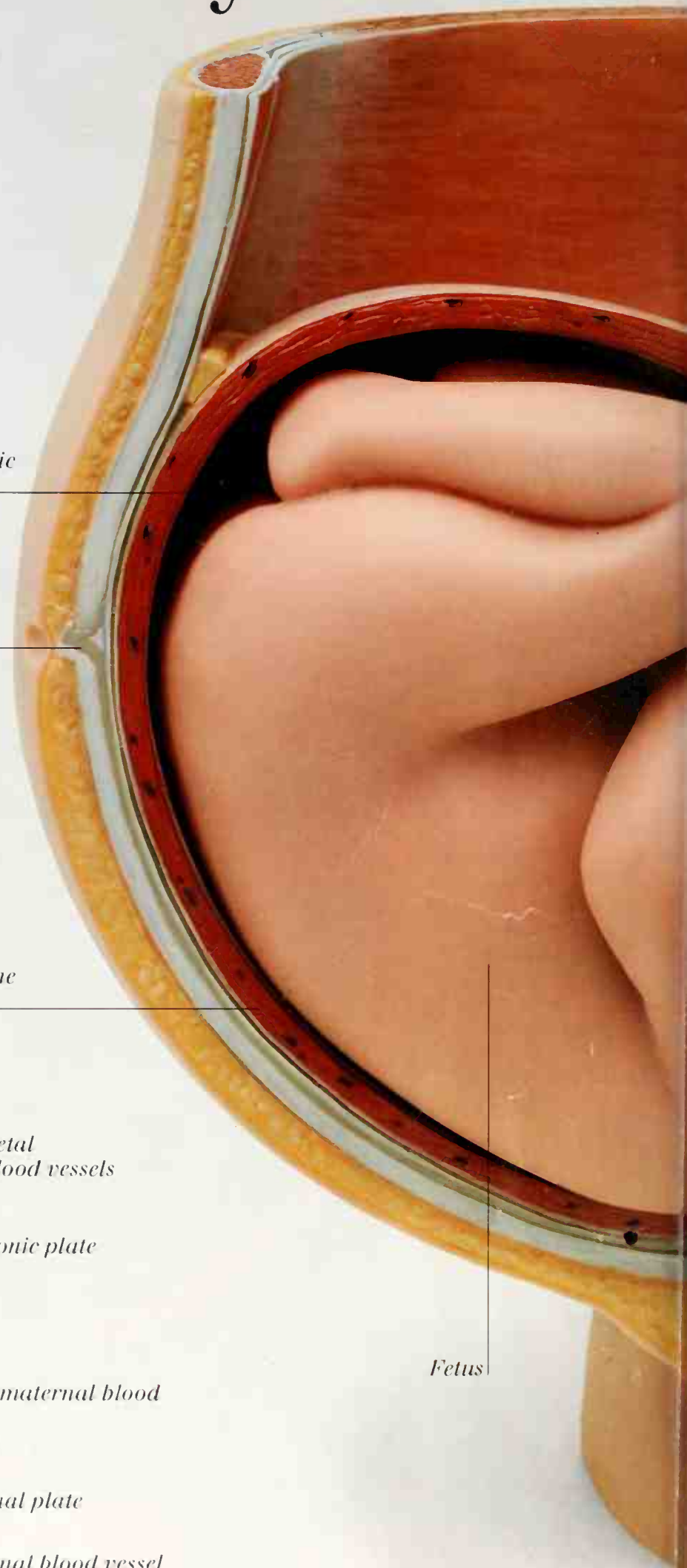
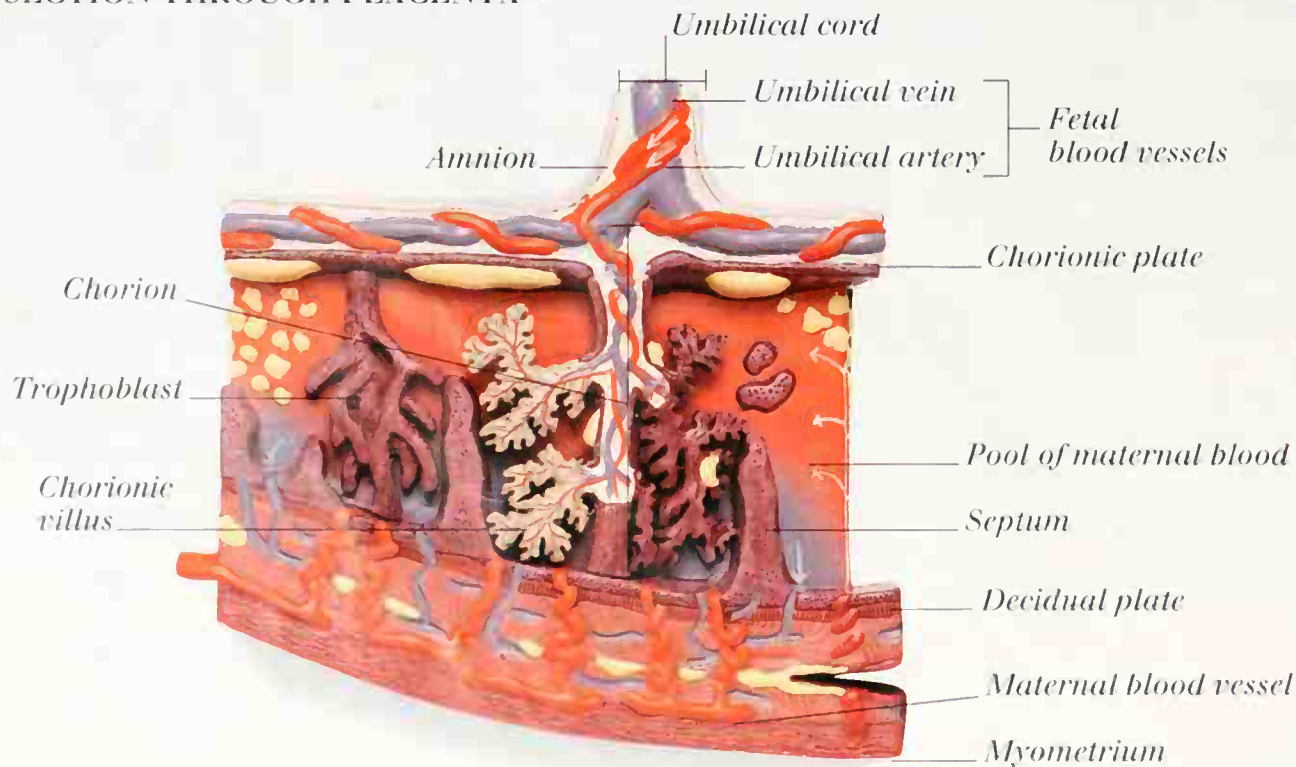
Development of a baby

A FERTILIZED EGG IS NOURISHED AND PROTECTED as it develops into an embryo and then a fetus during the 40 weeks of pregnancy. The placenta, a mass of blood vessels implanted in the uterus lining, delivers nourishment and oxygen, and removes waste through the umbilical cord. Meanwhile, the fetus lies snugly in its amniotic sac, a bag of fluid that protects it against any sudden jolts. In the last weeks of the pregnancy, the rapidly growing fetus turns head down: a baby ready to be born.

EMBRYO AT FIVE WEEKS

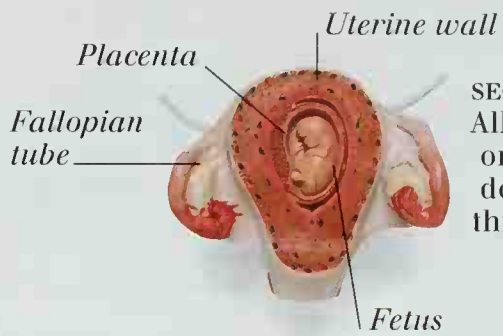
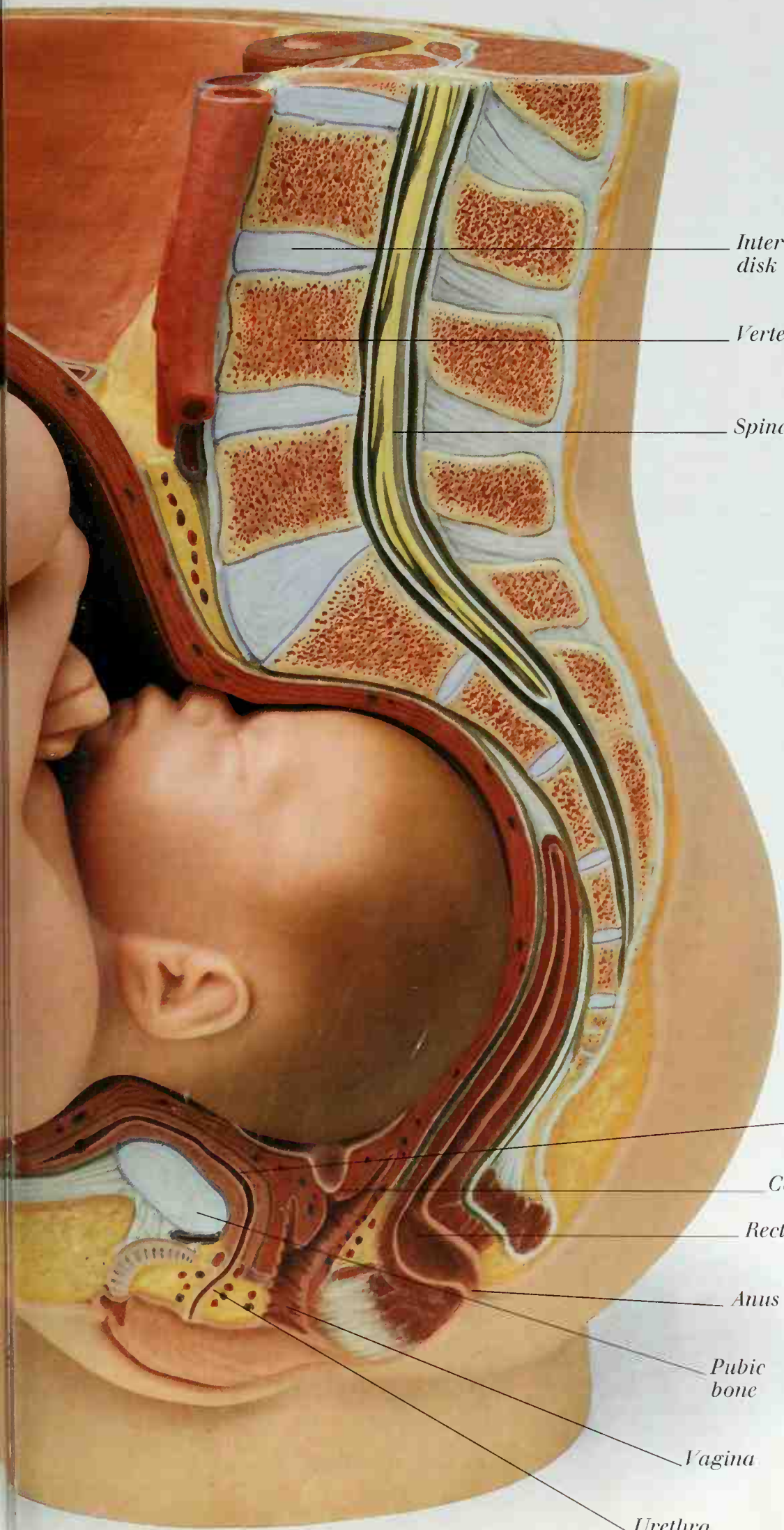


SECTION THROUGH PLACENTA



SECTION THROUGH PELVIS IN NINTH MONTH OF PREGNANCY

THE DEVELOPING FETUS



SECOND MONTH
All the internal organs have developed by this stage.



THIRD MONTH
The fetus is fully formed and now begins a period of rapid growth.

Intervertebral disk
Vertebra
Spinal cord

FIFTH MONTH
Although the fetus here is in breech (bottom down) position, it will probably turn by 180° before birth. By the fifth month the baby is moving actively and responds to sound.



Bladder
Cervix
Rectum
Anus
Pubic bone
Vagina
Urethra



SEVENTH MONTH
The internal organs are maturing in preparation for life outside the uterus. The baby has grown to such a size that there is less room for movement within the uterus.

Placenta

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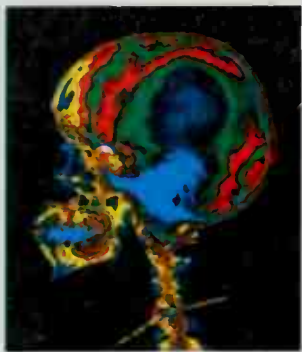
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