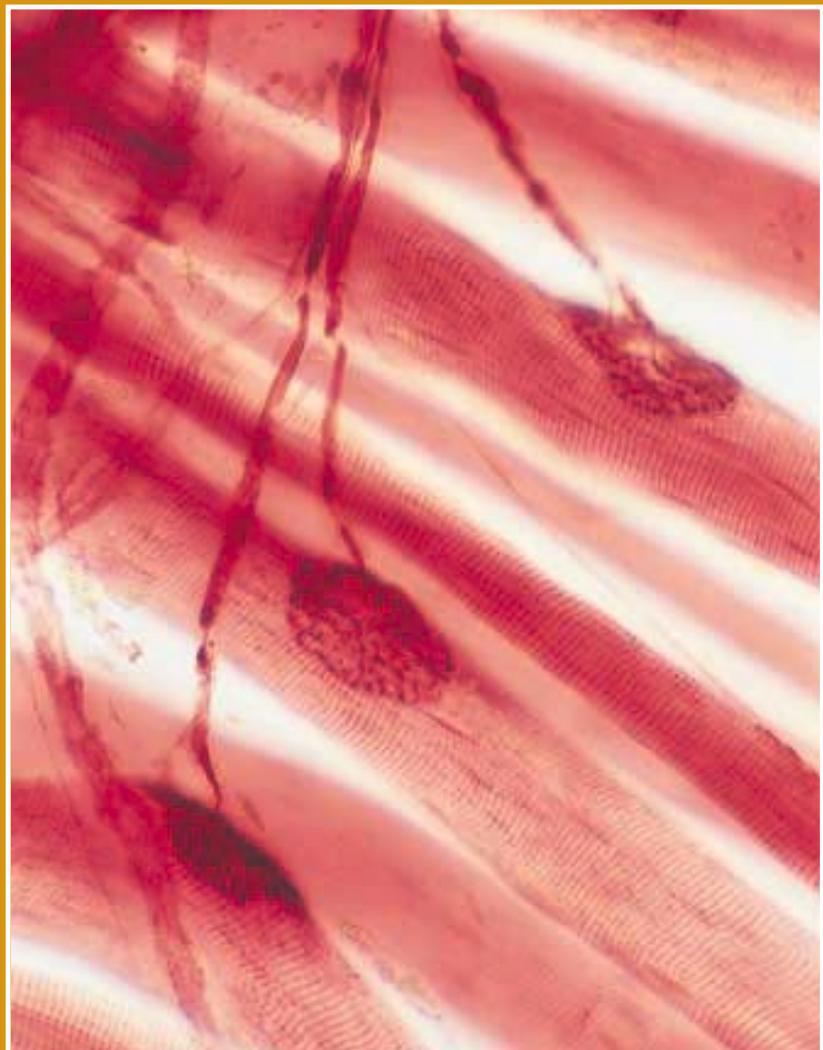




Reference Tables



Innervation of Skeletal Muscle: Motor Endplate

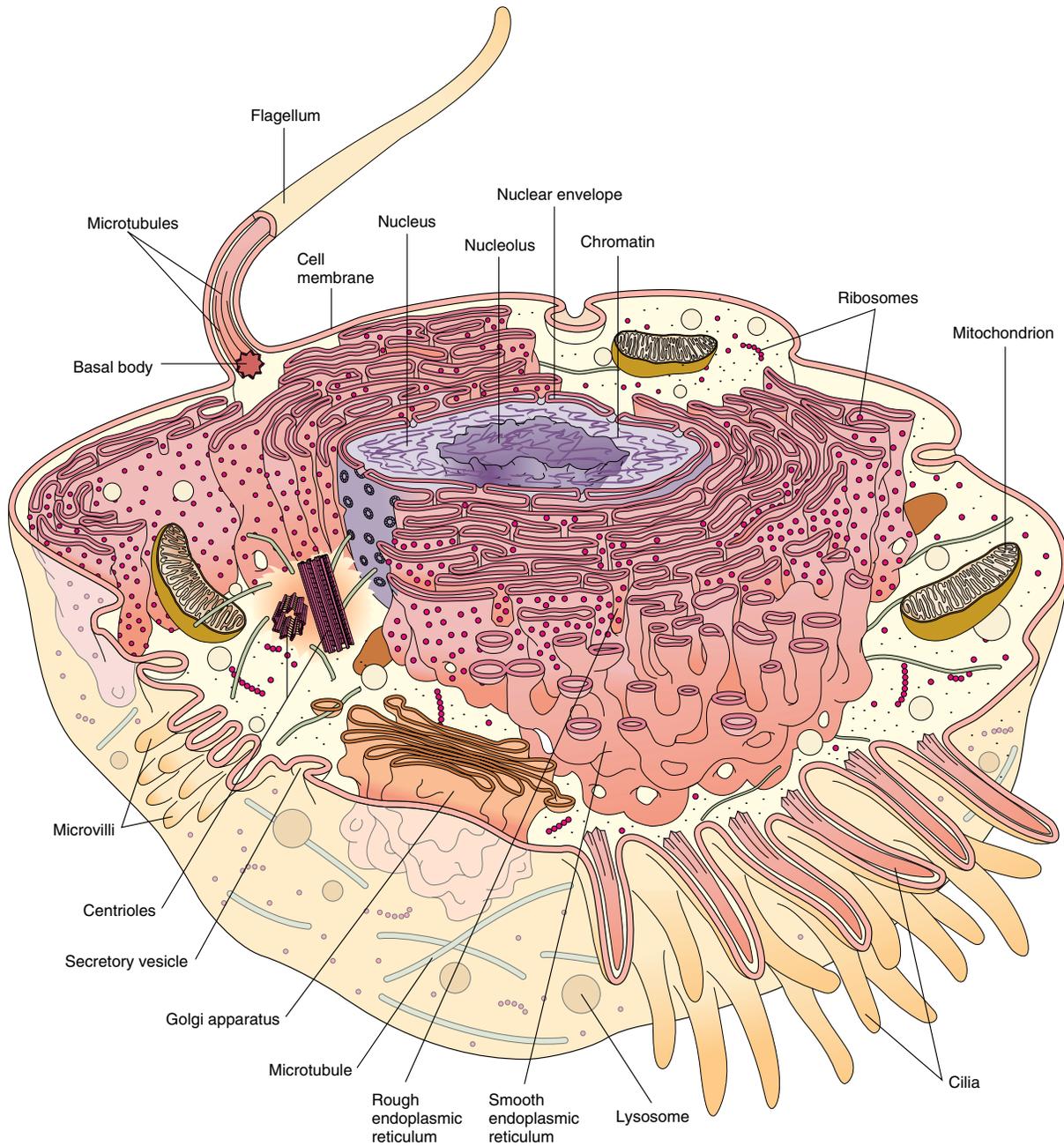


Figure 5-1
Generalized illustration of a cell.

TABLE 5.1

Structure and Function of Some Cellular Components

STRUCTURE	DESCRIPTION AND FUNCTION
MEMBRANOUS	
Plasma membrane	Composed mainly of phospholipid bilayer with globular proteins floating dynamically on, in, and through it. Separates living cell contents from nonliving environment. Maintains cellular integrity. Embedded molecules serve as identifying cell markers (antigens), receptor molecules for hormones and related substances, signal transducers, selective ion channels, and transporter mechanisms.
Endoplasmic reticulum	Complex of membranous canals, sacs, and vesicles. Transports material within the cell; provides attachment for ribosomes; contributes to synthesis of lipids, steroids, and some carbohydrates used to form glycoproteins.
Golgi apparatus	Flattened membranous sacs. Synthesizes and packages carbohydrates and glycoproteins.
Lysosomes	Small membranous sacs. Contains enzymes used in intracellular digestion.
Peroxisomes	Small membranous vesicles. Contains peroxidase enzymes used in breakdown of complex toxins and other organic molecules.
Mitochondria	Small membranous sacs with complex internal structure and separate DNA. Contains enzymes of Krebs cycle; central to carbohydrate metabolism and synthesis of ATP.
Nucleus	Nuclear contents, notably DNA, separated from cytoplasm by porous nuclear envelope.
NONMEMBRANOUS	
Ribosomes	Small structures composed of two parts containing protein and RNA molecules. Often associated with endoplasmic reticulum. Synthesizes proteins under instructions of messenger RNA triplet code.
Centrosome	Double structure composed of two, short, rod-like centrioles. Important in distribution of chromosomes during cell division and in formation of cilia.
Microfilaments and microtubules	Composed of protein complexes. Acts as cytoskeletal framework. Functions in whole-cell and local membrane movements, cellular elasticity, and formation of cellular extensions (e.g., microvilli).
Cilia and flagella	Movable membranous extensions. Important in movement of fluid environment over stationary cell surface (cilia) and cell itself (flagellum of sperm cell).
Nucleolus	Dense object composed of protein and RNA molecules. Essential in ribosome formation.

TABLE 5.2

Some Membrane Transport Processes

PROCESS	DESCRIPTION
PHYSICAL PROCESSES: DO NOT REQUIRE LOCAL EXPENDITURE OF METABOLIC ENERGY	
Bulk flow	Movement of substances from higher pressures toward lower pressures. Examples: movement of gases in and out of ventilatory tree during breathing, movement of blood through arteries and veins due to pumping action of heart.
Diffusion	Movement of ions or molecules from higher concentrations toward lower concentrations due to random molecular collisions. Examples: movement of sodium and potassium ions and glucose molecules in extracellular fluid.
Filtration	Bulk flow through a semipermeable membrane. Example: movement of fluid and small molecules through kidney capillary walls due to hydrostatic pressure.
Dialysis	Diffusion of solute molecules through a semipermeable membrane. Example: passage of lipid-soluble substances, such as steroid molecules, through cell membrane.
Osmosis	Diffusion of water down <i>its</i> concentration gradient through a semipermeable membrane. Osmosis generally operates <i>against</i> concentration gradient of solute(s) to which the membrane is <i>impermeable</i> . Example: net movement of extracellular fluid into the venous ends of capillaries under influence of <i>impermeant</i> plasma proteins.
Facilitated diffusion	Diffusion through an otherwise impermeable membrane by means of carrier molecules. Example: movement of glucose through muscle cell membranes (requires insulin to enhance action of facilitating carriers).
PHYSIOLOGICAL PROCESSES: REQUIRE LOCAL EXPENDITURE OF METABOLIC ENERGY	
Active transport	Carrier-mediated transport of ions or molecules through a living membrane via energy-requiring shape change of carrier molecule. Energy expenditure permits transport from lower to higher concentration. Examples: movement of sodium from inside to outside of resting nerve cells; transport of potassium and calcium from outside to inside cells, thereby causing high internal concentrations of these ions.
Phagocytosis and pinocytosis	Transport of large particles or fluid into a cell via engulfing action of membrane followed by pinching off to form an intracellular vesicle. Both are processes of endocytosis. Example: trapping of bacteria by white blood cells.
Exocytosis	Transport of substances out of a cell by fusion of internal vesicle with cell membrane and release of contents to the exterior. Examples: secretion of hormones and neurotransmitters, such as prolactin and acetylcholine.

TABLE 5.3

Terms for Bone Structure

TERM	DEFINITION
Epiphysis	Either rounded end of head of a long bone
Diaphysis	The shaft of a long bone
Anatomic neck	The epiphyseal growth plate
Surgical neck	The narrow part of a long bone, just past the head, where fracture is most likely
Ramus	A branch
Cornu	A horn
Hamulus	A hook
Lingula	A tongue
Foramen (pl. foramina)	A hole; an opening into or through a bone to permit passage of blood vessels, nerves, or ligaments
Fossa	A valley; a relatively deep pit or depression
Fovea	A relatively small pit or depression
Sulcus	A narrow valley
Meatus	A tunnel
Trochanter	A large, blunt, rounded process that serves as a site for muscle attachment
Tubercle	A small, blunt, rounded process that serves as a site for muscle attachment
Tuberosity	A large, rounded, often rough eminence or surface that serves as a site for muscle attachment
Condyle	A large, rounded process at the end of a bone, usually contributing to a joint
Epicondyle	A smaller, rounded process at the end of a bone, on top of a condyle, usually contributing to a joint
Trochlea	A pulley; a smooth notched surface often found at a joint
Facet	A face; a smooth, nearly flat surface at a joint
Fissure	A crack or cleft
Crest or crista	A narrow ridge
Spine	A pointed ridge
Fontanel	Specifically, six spaces between the cranial bones of the fetal and infant skull prior to closure of the sutures
Second and fifth intercostal spaces	Specifically refers to a place between the 2nd and 3rd rib and a place between the 5th and 6th ribs where the second and first heart sounds, respectively, can be heard especially well

TABLE 5.4

Bones of the Human Skeleton

PART OF THE BODY	NAMES OF BONES
AXIAL SKELETON (80 BONES TOTAL)	
Skull (28 bones)	
Cranium (8 bones)*	Frontal (1) Parietal (1 pair) Temporal (1 pair) Occipital (1) Sphenoid (1) Ethmoid (1)
Face (14 bones)	Lacrimal (1 pair) Nasal (1 pair) Palatine (1 pair) Inferior nasal conchae (turbinates) (1 pair) Vomer (1) Maxillae (1 pair) Zygomatic (malar) (1 pair) Mandible (1)
Middle ear (6 bones)	Malleus (1 pair) Incus (1 pair) Stapes (1 pair)
Hyoid bone (1)	
Spinal column (26 bones total)	Cervical vertebrae (7) Thoracic vertebrae (12) Lumbar vertebrae (5) Sacrum (4–5 fused into 1) Coccyx (4–5 fused into 1)
Sternum and ribs (25 bones total)	Sternum (1) True ribs (7 pairs) False ribs (5 pairs)
APPENDICULAR SKELETON (126 BONES TOTAL)	
Shoulder girdle and arm (64 bones total)	Clavicle (1 pair) Scapula (1 pair) Humerus (1 pair) Ulna (1 pair) Radius (1 pair) Carpals (8 pairs; navicular (scaphoid), lunate, triangular (triquetrum), pisiform, greater multangular (trapezium), lesser multangular (trapezoid), capitate, hamate) Metacarpals (5 pairs) Phalanges (14 pairs)
Pelvic girdle and leg (62 bones total)	Os coxae (1 pair: 2 innominate bones each formed by fusion of ilium, ischium, and pubis) Femur (1 pair) Patella* (1 pair) Tibia (1 pair) Fibula (1 pair) Tarsals (7 pairs: Talus, calcaneus, navicular, medial cuneiform, intermediate cuneiform, lateral cuneiform, cuboid.) Metatarsals (5 pairs) Phalanges (14 pairs)

*A variable number of rounded bones known as **sesamoid bones** (because of their supposed resemblance to sesame seeds) may appear in various tendons, especially those in the wrist, knee, ankle, and foot. Only two of them, the patellae, are commonly found. **Wormian bones** are found in variable numbers within the suture lines of the skull. While most are commonly smaller than the size of fingernails, some can be surprisingly large.

TABLE 5.5

Comparison of Female and Male Skeletons

Differences between male and female skeletons are graded, not discrete. Female skeletons can have many masculine features, and vice versa. Nevertheless, there are trends, including those listed below. A typically masculine pelvis is called *android*; a typically feminine pelvis is called *gynecoid*. Many intermediate types exist.

PORTION OF SKELETON	FEMALE	MALE
GENERAL FORM	Bones lighter and thinner Muscle attachment sites smaller and smoother Joint surfaces relatively small	Bones heavier and thicker Muscle attachment sites larger and rougher Joint surfaces relatively large
PELVIS		
Pelvic cavity	Wider in all dimensions Shorter and roomier Pelvic outlet relatively large	Smaller in all dimensions Deeper Pelvic outlet usually obstructed
Sacrum	Short, wide, flat concavity more pronounced in a posterior direction; sacral promontory less pronounced	Long, narrow, with smooth concavity of sacral curvature; sacral promontory more pronounced
Coccyx	More movable and follows posterior direction of sacral curvature	Less movable
Pubic arch	Greater than a 90° angle	Less than a 90° angle
Ischial spine, ischial tuberosity, and anterior super iliac spine	Oriented outward and further apart	Oriented inward
Greater sciatic notch	Narrow	Wide

TABLE 5.6

Extrinsic Muscles of the Eye

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Rectus superior	Tendinous ring of tissue which surrounds optic foramen at back of orbit	Top of eyeball	Rolls eye upward	Oculomotor
Rectus inferior		Bottom of eyeball	Rolls eye downward	Oculomotor
Rectus lateralis		Lateral side of eyeball	Rolls eye laterally	Abducens
Rectus medius		Medial side of eyeball	Rolls eye medially	Oculomotor
Obliquus superior		Top of eyeball under rectus superior, through trochlea	Prevents rotation of eyeball on axis; directs gaze down and laterally	Trochlear
Obliquus inferior	Maxilla at front of orbit	Lateral side of eyeball under rectus lateralis	Prevents rotation of eye on axis; directs gaze up and laterally	Oculomotor

TABLE 5.7 Facial Muscles

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Buccinator	Maxillary and mandibular alveolar processes	Into orbicularis oris at sides of mouth	Compresses cheek, retracts corner of mouth as in playing a brass musical instrument	Facial
Orbicularis oris	Maxillae, mandible, nasal septum	Fibers encircle mouth, insert on fascia	Puckering, shaping of mouth in speech	Facial
Orbicularis oculi	Maxillae, frontal bone	Fibers encircle orbit	Closes eye, assists in squinting	Facial
Epicranius (Occipitofrontalis)	Occipital bone	Skin around eyebrows and above nose	Moves scalp, elevates eyebrows	Facial
Zygomaticus major	Zygomatic bone	Into orbicularis oris at corners of mouth	Retracts and elevates corners of mouth as in smiling	Facial
Zygomaticus minor	Zygomatic bone	Into orbicularis oris of upper lip	Elevates upper lip, assists in smiling	Facial
Levator palpebrae superioris	Lesser wing of sphenoid	Skin of upper eyelid	Elevates upper eyelid	Oculomotor
Corrugator supercilii	Bridge of nose, orbicularis oculi	Skin of eyebrows	Depresses and adducts eyebrows; furrows forehead as in frowning	Facial

TABLE 5.8 Chewing Muscles

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Masseter	Zygomatic arch and maxilla	Lateral surface of mandible	Closes jaw	Trigeminal
Temporalis	Temporal bone	Coronoid process of mandible	Closes jaw	Trigeminal
Pterygoid (medial and lateral)	Pterygoid processes of sphenoid bone	Medial surface of mandible	Moves jaw from side to side; grates teeth for chewing	Trigeminal

TABLE 5.9 Muscles of the Throat

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Digastric	Mastoid process of temporal bone	Mandible	Elevates hyoid bone; depresses and retracts mandible	Posterior portion: Facial Anterior portion: Mandibular branch of trigeminal
Mylohyoid	Mandible	Hyoid	Elevates floor of mouth when mandible is fixed; depresses mandible when hyoid is fixed	Mandibular division of trigeminal
Omoxyoid	Superior border of scapula and tendon from clavicle	Hyoid	Depresses hyoid; stabilizes hyoid when opening mouth	C1–C3 via ansa hypoglossi
Sternohyoid	Manubrium of sternum; costal cartilage 1	Hyoid	Depresses hyoid; stabilizes hyoid when opening mouth	C1–C3 via ansa hypoglossi
Sternothyroid	Manubrium of sternum; costal cartilages 1 and 2	Thyroid cartilage	Depresses larynx; stabilizes larynx when opening mouth	Upper cervical nerves via ansa cervicalis and ansa hypoglossi

TABLE 5.10 Muscles of the Tongue

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Intrinsic muscles: Longitudinal, vertical, and transverse	Within tongue	Within tongue	Change shape of tongue in speaking, chewing, licking	Hypoglossal
Genioglossus	Genu of mandible	Tongue	Depresses and protrudes tongue	Hypoglossal
Hyoglossus	Hyoid	Side of tongue	Depresses and retracts tongue	Hypoglossal
Styloglossus	Styloid process of temporal bone	Inferior and lateral aspect of tongue	Retracts tongue	Hypoglossal

NOTE: The three above-named muscles are **extrinsic muscles of the tongue**, so identified because their origins lie outside the muscular tongue itself.

TABLE 5.11 Muscles of the Pharynx and Palate

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Constrictor pharyngis inferior	Cricoid and thyroid cartilages	Median raphe of pharynx	Constricts lower pharynx during swallowing	Glossopharyngeal and vagus
Constrictor pharyngis medius	Greater and lesser cornu of hyoid	Median raphe of pharynx	Constricts middle pharynx during swallowing	Glossopharyngeal and vagus
Constrictor pharyngis superior	Middle pterygoid plate, mandible, floor of mouth	Median raphe of pharynx	Constricts upper pharynx during swallowing	Glossopharyngeal and vagus
Stylopharyngeus	Styloid process of temporal bone	Sides of pharynx; thyroid cartilage	Elevates and dilates pharynx	Glossopharyngeal
Palatopharyngeus	Soft palate	Pharynx	Narrows fauces; depresses palate; elevates pharynx	Glossopharyngeal and vagus
Palatoglossus	Soft palate	Tongue	Narrows fauces; elevates back of tongue	Pharyngeal plexus
Levator veli palatini	Temporal bone and cartilage of Eustachian tube	Soft palate	Elevates soft palate	Glossopharyngeal and vagus
Tensor veli palatini	Sphenoid bone and cartilage of Eustachian tube	Soft palate	Increases tension of soft palate; opens Eustachian tube as in yawning	Mandibular division of trigeminal

NOTE: The palatopharyngeus muscle and its mucous membrane covering form the clearly seen arch of the soft palate, from which hangs the uvula. Just anterior to this arch on each side is the palatoglossus muscle which, with its mucous membrane covering, forms the more lateral and less clearly seen glossopalatine arch. Between these two arches on each side is a fossa that houses the lymph node known as the palatine tonsil.

TABLE 5.12 Muscles That Move the Head

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Sternocleidomastoid	Sternum and clavicle	Mastoid process of temporal bone	Bows head, rotates head	Spinal accessory, C2–C3
Trapezius	Acromial process of clavicle and spine of scapula	Occipital bone, ligamentum nuchae, spines of 7th cervical and all thoracic vertebrae	Extends head, rotates head	Spinal accessory, C3–C4
Obliquus capitis inferior	Spinous process of axis	Transverse process of atlas	Rotates head	Branch of suboccipital
Splenius capitis	Ligamentum nuchae, spines of 7th cervical and top four thoracic vertebrae	Occipital bone and mastoid process of temporal bone	Extends head, rotates head	Middle and lower cervical spinal nerves
Semispinalis capitis	See MUSCLES OF THE VERTEBRAL COLUMN. The capitis division of this muscle inserts on the occipital bone. When the vertebrae serve as the origin and the occipital bone as the insertion, this muscle (bilaterally) extends the head or (unilaterally) draws the head toward the contracting side.			
Longissimus capitis	See MUSCLES OF THE VERTEBRAL COLUMN. The capitis division of this muscle inserts on the mastoid process of the temporal bone. When the vertebrae serve as the origin and the occipital bone as the insertion, this muscle (bilaterally) extends the head or (unilaterally) draws and rotates the head toward the contracting side.			

TABLE 5.13 Muscles That Move the Shoulder

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Trapezius	See MUSCLES THAT MOVE THE HEAD. If origin and insertion are reversed, this muscle causes elevation of shoulders, as in shrugging, by elevating clavicle and scapula.			
Pectoralis minor	Outer surface of third, fourth, and fifth ribs	Coracoid process of scapula	Depresses shoulder, rotates scapula forward and down; can assist in elevating ribs	Long thoracic
Serratus anterior	Outer surface of upper eight or nine ribs	Ventral surface of vertebral border of scapula	Rotates scapula forward and toward thoracic wall; can assist in elevating ribs	Spinal accessory, C3–C4
Rhomboides major	Spines of second to fifth thoracic vertebrae	Vertebral border of scapula	Adducts scapula, rotates slightly upward	Dorsal scapular
Rhomboides minor	Spines of seventh cervical and first thoracic vertebrae	Vertebral border of scapula	Adducts scapula	Dorsal scapular

NOTE: The **triangle of auscultation** is formed at the caudal medial border of the scapula by the edges of the latissimus dorsi, trapezius, and rhomboides muscles.

TABLE 5.14 Muscles That Move the Upper Arm

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Pectoralis major	Clavicle, sternum, cartilages of second to sixth ribs	Crest and greater tubercle of humerus	Flexes and adducts arm	Anterior thoracic
Latissimus dorsi	Spinous processes of lower six thoracic and all lumbar vertebrae, sacral spine, iliac crest and lower four ribs	Intertubercular groove of humerus	Extends, adducts, rotates arm medially, draws shoulder down and back	Thoracodorsal
Deltoides	Clavicle and acromion and spine of scapula	Deltoid tuberosity of humerus	Abducts arm	Axillary
Coracobrachialis	Coracoid process of scapula	Medial surface of humerus	Adducts arm; assists in flexion and medial rotation	Musculocutaneous
Teres major	Medial border of scapula	Just distal to lesser tubercle of humerus	Adducts, extends, rotates arm medially	Lower subscapular
Teres minor	Medial border of scapula	Greater tubercle of humerus	Rotates arm laterally	Axillary
Subscapularis	Subscapular fossa of scapula	Lesser tubercle of humerus	Extends and medially rotates arm	Subscapular C5, C6
Supraspinatus	Supraspinous fossa of scapula	Greater tubercle of humerus	Initiates abduction of arm	Suprascapular C5, C6
Infraspinatus	Infraspinous fossa of scapula	Greater tubercle of humerus	Extends and laterally rotates arm	Suprascapular C5, C6

NOTE: The **rotator cuff** is formed from the tendons of the last four muscles named above because together they form a cuff that binds the humerus into the shallow glenoid fossa. A rotator cuff injury involves damage to one or more of these muscles or their tendons.

NOTE: Alone, the deltoid cannot initiate the first 15° of abduction, which is a duty of the supraspinatus muscle and its innervation and which is separate from that of the deltoid. Differential assessment of peripheral nerve injury is possible by asking a patient to abduct the arm from anatomical position.

TABLE 5.15 Muscles That Move the Lower Arm

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Biceps brachii	Long head: Tuberosity above glenoid cavity of scapula Short head: Coracoid process of scapula	Radial tuberosity	Flexes and supinates arm and forearm	Musculocutaneous
Brachialis	Anterior surface of distal humerus	Tuberosity and coronoid process of ulna	Flexes forearm	Musculocutaneous, radial, and median
Brachioradialis	Supracondyloid ridge of humerus	Proximal to styloid process of radius	Flexes forearm	Radial
Triceps brachii	Long head: Infraglenoid tuberosity of scapula Lateral head: Posterior surface of humerus above radial groove Medial head: Posterior surface of humerus below radial groove	Olecranon process of ulna	Extends forearm	Radial
Anconeus	Lateral epicondyle of humerus	Olecranon process and proximal one-fourth of ulna	Extends forearm	Radial
Pronator teres	Medial epicondyle of humerus, coronoid process of ulna	Middle third of lateral surface of radius	Pronates and flexes forearm	Median
Pronator quadratus	Distal shaft of ulna	Distal shaft of radius	Pronates forearm	Median
Supinator	Lateral epicondyle of humerus, proximal end of ulna	Proximal third of radius	Supinates forearm	Median

TABLE 5.16 Muscles That Move the Wrist and Hand

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
FLEXORS				
Flexor carpi ulnaris	Ulna; medial epicondyle of humerus	Fifth metacarpal; pisiform and hamate	Flexes and adducts wrist; flexes forearm	Ulnar
Palmaris longus	Medial epicondyle of humerus	Palmar fascia	Tenses palmar fascia; flexes wrist	Median
Flexor carpi radialis	Medial epicondyle of humerus	First and second metacarpals	Flexes and abducts wrist	Median
Flexor digitorum profundus	Ulna	Distal phalanges 2–5	Flexes fingers and wrist	Median and ulnar
Flexor digitorum superficialis	Medial epicondyle of radius	Middle phalanges 2–5	Flexes fingers and wrist	Median
Flexor pollicis longus	Radius	Distal phalanx of thumb	Flexes thumb and wrist	Median
EXTENSORS				
Extensor carpi ulnaris	Ulna; lateral epicondyle of humerus	Metacarpal 5	Extends hand; adducts little finger	Radial
Extensor digitorum	Lateral epicondyle of humerus	Phalanges 2–5	Extends fingers and wrist	Radial
Extensor carpi radialis brevis	Lateral epicondyle of humerus	Metacarpal 3	Extends and abducts wrist	Radial
Extensor carpi radialis longus	Lateral supracondylar ridge of humerus	Metacarpal 2	Extends and abducts wrist	Radial
Extensor indicis	Ulna	Phalanx 2	Extends forefinger and wrist	Radial
Abductor pollicis longus	Posterior ulna and radius; interosseous membrane	Metacarpal 1	Abducts and extends thumb and wrist	Radial
Extensor pollicis longus	Dorsal surface of ulna	Base of thumb, second phalanx	Extends end of thumb	Radial
Extensor pollicis brevis	Dorsal surface of radius	Dorsal surface of thumb, first phalanx	Extends and abducts thumb; abducts wrist	Posterior interosseous

NOTE: These last two muscles cross the lateral surface of the wrist to form the **anatomical snuff box**. Extend the thumb laterally to see this structure. The radial artery passes through the snuff box; the pulse can be felt there.

TABLE 5.17 Muscles That Move the Chest Wall: Breathing

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
NOTE: These muscles are overlaid by the latissimus dorsi, trapezius, and the pectoralis, which are functionally part of the appendicular muscle division.				
External intercostals	Inferior border of rib	Superior border of rib	Draws adjacent ribs together	Intercostal
Internal intercostals	Inferior border of rib	Superior border of rib	Draws adjacent ribs together	Intercostal
Transversus thoracis	Lower one third of sternum	Costal cartilage of true ribs (except first rib)	Depresses ribs in exhalation	Intercostal
Diaphragm	Xiphoid process, costal cartilages of lowest six ribs, lumbar vertebrae	Central tendon	Depresses floor of thoracic cavity in inhalation	Phrenic
Sternocleidomastoid	See MUSCLES THAT MOVE THE HEAD. If head acts as origin, then this muscle acts to elevate sternum and rib cage.			
Scalenes	Transverse processes of second to seventh cervical vertebrae	First two ribs	Elevates ribs in inhalation	C5–C8
Levatores costarum	Transverse processes of seventh cervical and first eleven thoracic vertebrae	Angle of rib immediately below origin	Elevates ribs in inhalation	Intercostal

TABLE 5.18 Muscles That Move the Abdominal Wall

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
External oblique	Lower eight ribs	Iliac crest, linea alba	Compresses abdominal contents	Intercostals 8–12, iliohypogastric, ilioinguinal
Internal oblique	Iliac crest, inguinal ligament, lumbodorsal fascia	Costal cartilages of last three or four ribs	Compresses abdominal contents	Same as external oblique
Transversus abdominis	Iliac crest, inguinal ligament, lumbar fascia, costal cartilages of last six ribs	Xiphoid process, linea alba, pubis	Compresses abdominal contents	Intercostals 7–12, iliohypogastric, ilioinguinal
Rectus abdominis	Pubic crest, symphysis pubis	Xiphoid process, costal cartilages of fifth, six, and seventh ribs	Flexes trunk, compresses abdominal contents	Intercostals 7–12

TABLE 5.19

Muscles of the Pelvic Floor: The Pelvic Diaphragm

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Levator ani	Posterior surface of pubis, ischial spine	Coccyx	Support pelvic organs. Supports pregnant uterus, participates in childbirth	Pudendal
Coccygeus (posterior continuation of levator ani)	Ischial spine	Coccyx, sacrum	Same as levator ani	Pudendal
Spinctor ani externus	Coccyx	Central tendon of perineum	Closes anal canal	Pudendal and S4
Spinctor urethrae	Pubic ramus	Central tendon of perineum	Constricts urethra	Pudendal
Ischiocavernosus	Ischial ramus	Corpus cavernosum	Compresses base of penis or clitoris	Pudendal
Transverse perinei	Ischial ramus	Central tendon of perineum	Supports pelvic floor	Pudendal
Bulbospongiosus (male)	Perineum and bulb of penis	Central tendon of perineum	Constricts urethra and erects penis	Pudendal
Bulbospongiosus (female)	Central tendon of perineum	Base of clitoris	Erects clitoris	Pudendal

TABLE 5.20 Muscles of the Vertebral Column: Muscles of Erect Posture

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
NOTE: Muscles of the abdominal wall function as postural muscles.				
Iliopsoas	Postural muscle when femur acts as origin	See MUSCLES LOCATED IN THE ANTERIOR HIP		
ERECTOR SPINAE GROUP				
Composed of three muscle groups, each of which has subgroups. The three major groups are the laterally placed iliocostalis , the intermediately placed longissimus , and the medially placed spinalis .				
Iliocostalis Lumborum Thoracis Cervicis	Iliac crest and all ribs	Ribs or transverse processes roughly six vertebrae above origin	Extends trunk and neck, maintains erect posture, rotates trunk and neck	Dorsal rami of lumbar, thoracic, and cervical spinal nerves
Longissimus Thoracis Cervicis Capitis	Transverse processes of thoracic and lumbar vertebrae	Transverse processes roughly twelve vertebrae above origin, some ribs, and mastoid process of temporal bone	Extends trunk and neck, maintains erect posture, rotates trunk and head	Dorsal rami of lumbar, thoracic, and cervical spinal nerves
Spinalis Thoracis Cervicis Capitis	Spinous processes of upper lumbar and lower thoracic vertebrae	Spinous processes of upper thoracic vertebrae, cervical vertebrae and occipital bone	Extends trunk	Dorsal rami of lumbar and thoracic spinal nerves
Semispinalis	Transverse processes of seventh cervical and thoracic vertebrae	Spinous processes roughly six vertebrae above origin, occipital bone	Extends and rotates vertebral column and head	Dorsal rami of spinal nerves
Multifidus	Pelvic girdle, lumbar vertebrae, transverse processes of thoracic and lower cervical vertebrae	Spinous processes three vertebrae above origin	Extends and rotates trunk	Dorsal rami of lumbar, thoracic, and cervical spinal nerves
Quadratus lumborum	Posterior iliac crest and lower three lumbar vertebrae	Twelfth rib and transverse processes of top four lumbar vertebrae	Lateral flexion of trunk, pelvic extension	T12, L1

TABLE 5.21 Muscles Located in the Lateral Hip

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Tensor fasciae latae	Anterior iliac crest	Through iliotibial band to lateral tibia	Tenses and abducts thigh	Superior gluteal

TABLE 5.22 Muscles Located in the Anterior Hip

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Iliopsoas Two components: Iliacus and psoas	Transverse processes of lumbar vertebrae, iliac fossa	Lesser trochanter of femur and iliopubic junction	Flexes and laterally rotates thigh, also flexes trunk	L1–L3
Rectus femoris	See MUSCLES LOCATED IN ANTERIOR THIGH			

TABLE 5.23 Muscles Located in the Posterior Hip

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Gluteus maximus	Posterior iliac crest, sacrum, coccyx	Iliotibial tract and gluteal tuberosity of femur	Extends and rotates thigh laterally	Inferior gluteal
Gluteus medius	Lateral surface of ilium	Greater trochanter of femur	Abducts and rotates thigh medially	Superior gluteal
Gluteus minimus	Lateral surface of ilium	Greater trochanter of femur	Abducts and rotates thigh medially	Superior gluteal
Piriformis	Sacrum	Greater trochanter of femur	Abducts and rotates thigh laterally	S1–S2

TABLE 5.24 Muscles Located in the Anterior Thigh

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
QUADRICEPS FEMORIS GROUP				
Rectus femoris	Anterior inferior iliac spine	Tibial tuberosity via patellar tendon	Flexes thigh and extends leg	Femoral
Vastus lateralis	Greater trochanter and linea aspera	Same as rectus femoris	Extends leg	Femoral
Vastus medialis	Linea aspera of femur	Same as rectus femoris	Extends leg	Femoral
Vastus intermedius (located immediately posterior to rectus femoris)	Anterior surface of femur	Same as rectus femoris	Extends leg	Femoral

TABLE 5.25 Muscles Located in the Medial Thigh

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
ADDUCTOR GROUP				
Adductor brevis	Inferior pubic ramus	Linea aspera of femur	Adducts, rotates, and flexes thigh	Obturator
Adductor longus	Pubic crest and symphysis pubis	Linea aspera of femur	Adducts, rotates, and flexes thigh	Obturator
Adductor magnus	Ischial tuberosity, ischiopubic ramus	Linea aspera of femur	Adducts, rotates, and flexes thigh	Obturator
Gracilis	Symphysis pubis and pubic arch	Medial surface of tibia	Flexes leg and adducts thigh	Obturator
Pectineus	Pubic spine and iliopubic junction	Pectineal line of femur (distal to lesser trochanter)	Flexes and adducts thigh, rotates thigh laterally	Femoral

TABLE 5.26 Muscles Located in the Posterior Thigh

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
HAMSTRING GROUP				
Biceps femoris	Long head: Ischial tuberosity Short head: Linea aspera of femur	Lateral portion of head of fibula, lateral tibial condyle	Flexes leg and extends thigh	Tibial and peroneal
Semitendinosus	Ischial tuberosity	Proximal medial tibia	Flexes leg and extends thigh	Tibial
Semimembranosus	Ischial tuberosity	Medial condyle of tibia	Flexes leg and extends thigh	Tibial

TABLE 5.27 Muscles Located in the Lower Leg

NAME	ORIGIN	INSERTION	ACTION	INNERVATION
Gastrocnemius	Lateral and medial tibial condyles, knee capsule	Calcaneus via Achilles tendon	Plantar flexes foot, flexes leg	Tibial
Soleus	Head of fibula, medial surface of tibia	Calcaneus via Achilles tendon	Plantar flexes foot	Tibial
Plantaris	Linea aspera of femur	Calcaneus via Achilles tendon	Plantar flexes foot, flexes leg	Tibial
Popliteus	Lateral condyle of femur	Posterior tibia	Flexes and medially rotates leg	Tibial
Peroneus brevis	Fibula	Metatarsal 5	Plantar flexes foot	Peroneal
Peroneus longus	Fibula and lateral condyle of tibia	Cuneiform 1; Metatarsal 1	Plantar flexes foot	Peroneal
Flexor hallucis longus	Shaft of fibula	Distal phalanx of great toe	Flexes great toe, plantar flexes foot	Tibial
Flexor digitorum longus	Posterior surface of tibia	Distal phalanges of four lateral toes	Flexes toes, plantar flexes foot	Tibial
Tibialis posterior	Interosseous membrane of tibia and fibula	Several tarsals and metatarsals	Plantar flexes foot	Tibial
NOTE: The tendons of the three preceding flexor muscles pass through the ankle just posterior and inferior to the medial malleolus. From posterior to anterior, the order of these tendons is <i>T. posterior</i> , <i>F. digitorum longus</i> , and <i>F. hallucis longus</i> , which has led to their being casually referred to as <i>Tom, Dick, and Harry</i> .				
Extensor hallucis longus	Shaft of fibula, interosseous membrane	Distal phalanx of great toe	Extends great toe, dorsiflexes foot	Deep peroneal
Extensor digitorum longus	Lateral tibial condyle, anterior fibular surface	Middle and distal phalanges of four lateral toes	Extends toes, dorsiflexes foot	Deep peroneal
Tibialis anterior	Lateral condyle and body of tibia	First metatarsal and first cuneiform	Dorsiflexes foot	Deep peroneal
Peroneus tertius	Fibula and interosseous membrane	Metatarsal 5	Dorsiflexes and everts foot	Deep peroneal

TABLE 5.28 The Cranial Nerves

NUMBER AND NAME	EXIT FROM SKULL	FUNCTION
I. Olfactory	Cribriform plate of ethmoid	Sensory: Olfaction. Rhythmic sensitivity follows hormonal cycles in females.
II. Optic	Optic foramen	Sensory: Vision. Probable efferents may regulate retinal metabolism and structural renewal.
III. Oculomotor	Orbital fissure	Motor: Rectus superior, rectus inferior, rectus medius, and obliquus inferior muscles. Sensory: Proprioception. Autonomic (parasympathetic): Muscles of iris, ciliary muscle to control lens.
IV. Trochlear	Orbital fissure	Motor: Obliquus superior muscle. Sensory: Proprioception.
V. Trigeminal		
Ophthalmic branch	Orbital fissure	Sensory: Cornea, upper eyelid, scalp, skin of upper face.
Maxillary branch	Foramen rotundum	Sensory: Palate and upper jaw, teeth and gums, nasopharynx, skin of cheek, lower eyelid, upper lip.
Mandibular branch	Foramen ovale	Sensory: Lower jaw, teeth and gums, anterior two-thirds of tongue, mucous membrane of cheek, skin of lower lip, chin, and ear. Motor: Muscles of chewing, throat, middle ear.
VI. Abducens	Orbital fissure	Motor: Rectus lateralis muscle. Sensory: Proprioception.
VII. Facial	Stylomastoid foramen and internal auditory meatus	Motor: Muscles of facial expression, throat middle ear. Sensory: Proprioception, taste (anterior two-thirds of tongue), palate. Autonomic (parasympathetic): Tear glands, salivary glands, and secretory glands in pharynx.
VIII. Auditory	Internal auditory meatus	Sensory: Hearing (cochlear branch), balance (vestibular branch).
IX. Glossopharyngeal	Jugular foramen	Sensory: Posterior one-third of tongue, posterior pharynx, taste (posterior one-third of tongue), proprioception. Motor: Pharyngeal muscle. Autonomic (parasympathetic): Salivary glands, carotid sinus.
X. Vagus	Jugular foramen	Sensory: Inferior pharynx, larynx, internal organs. Motor: Posterior pharynx, larynx, tongue. Autonomic (parasympathetic): Thoracic and abdominal viscera.
XI. Spinal accessory	Jugular foramen	Motor: Posterior pharynx, sternocleidomastoid, trapezius muscles. Sensory: Proprioception.
XII. Hypoglossal	Hypoglossal canal	Motor: Tongue and throat. Sensory: Proprioception.
XIII. Vomeronasal	Internal to skull	Parts of nasopharynx. May allow desert mammals to sense humidity. Function in humans unknown; may respond to pheromones.

Several mnemonic devices exist to aid remembering the names of the 12 standard cranial nerves in order. The most common (and least bawdy) of these is: "On Old Olympus' Towering Tops, A Finn and German Viewed Some Hops." The recently discovered unpaired thirteenth cranial nerve is not contained in this rhyming couplet.

TABLE 5.29 Spinal Nerves and Their Branches

NERVE	SPINAL COMPONENT	INNERVATION	
CERVICAL PLEXUS: C1, C2, C3, C4			
Superficial cutaneous branches			
Lesser occipital	C2, C3	Skin of scalp above and behind ear	
Greater auricular	C2, C3	Skin in front of, above, and below ear	
Transverse cervical	C2, C3	Skin of anterior aspect of neck	
Supraclavicular	C3, C4	Skin of upper portion of chest and shoulder	
Deep motor branches			
Ansa cervicalis			
Anterior root	C1, C2	Geniohyoid, thyrohyoid, and infrahyoid muscles of neck	
Posterior root	C3, C4	Omohyoid, sternohyoid, and sternothyroid muscles of neck	
Phrenic	C3–C5	Diaphragm	
Segmental branches	C1–C5	Deep muscles of neck (levator scapulae ventralis, trapezius, scalenus, and sternocleidomastoid)	
BRACHIAL PLEXUS: C5, C6, C7, C8, T1			
Axillary	Posterior cord (C5–C6)	Skin of shoulder; shoulder joint, deltoid and teres minor muscles	
Radial	Posterior cord (C5–C8, T1)	Skin of posterior lateral surface of arm, forearm, and hand; posterior muscles of brachium and antebrachium (triceps brachii, supinator, anconeus, brachioradialis, extensor carpi radialis brevis, extensor carpi radialis longus, extensor carpi ulnaris)	
Musculocutaneous	Lateral cord (C5–C7)	Skin of lateral surface of forearm; anterior muscles of brachium (coracobrachialis, biceps brachii, brachialis)	
Ulnar	Medial cord (C8, T1)	Skin of medial third of hand; flexor muscles of anterior forearm (flexor carpi ulnaris, flexor digitorum), medial palm and intrinsic flexor muscles of hand (profundus, third and fourth lumbricales)	
T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12:			
No plexus in these segments; branches run directly to intercostal muscles and skin of thorax.			
LUMBOSACRAL PLEXUS: L1, L2, L3, L4, L5, S1, S2, S3, S4, S5			
Lumbar	Iliohypogastric	T12–L1	Skin of lower abdomen and buttock; muscles of anterolateral abdominal wall (external abdominal oblique, internal abdominal oblique, transversus abdominis)
	Ilioinguinal	L1	Skin of upper medial thigh, scrotum and root of penis in male and labia majora in female; muscles of anterolateral abdominal wall with iliohypogastric nerve
	Genitofemoral	L1, L2	Skin of middle anterior surface of thigh, scrotum in male and labia majora in female; cremaster muscle in male
	Lateral cutaneous femoral	L2, L3	Skin of anterior, lateral, and posterior aspects of thigh
	Femoral	L2–L4	Skin of anterior and medial aspect of thigh and medial aspect of lower extremity and foot; anterior muscles of thigh (iliacus, psoas major, pectineus, rectus femoris, sartorius) and extensor muscles of leg (rectus femoris, vastus lateralis, vastus medialis, vastus intermedius)
	Obturator	L2–L4	Skin of medial aspect of thigh; adductor muscles of lower extremity (external obturator, pectineus, adductor longus, adductor brevis, adductor magnus, gracilis)
	Saphenous	L2–L4	Skin of medial aspect of lower extremity
Sacral	Superior gluteal	L4, L5, S1	Abductor muscles of thigh (gluteus maximus, gluteus medius, tensor fasciae latae)
	Inferior gluteal	L5–S2	Extensor muscle of hip joint (gluteus maximus)
	Nerve to piriformis	S1, S2	Abductor and rotator of thigh (piriformis)
	Nerve to quadratus femoris	L4, L5, S1	Rotators of thigh (gemellus inferior, quadratus femoris)
	Nerve to internal obturator	L5–S2	Rotators of thigh (gemellus superior, internal obturator)
	Perforating cutaneous	S2, S3	Skin over lower medial surface of buttock
	Posterior cutaneous femoral	S1–S3	Skin over lower lateral surface of buttock, anal region, upper posterior surface of thigh, upper aspect of calf, scrotum in male and labia majora in female
	Sciatic	L4–S3	Composed of two nerves (tibial and common fibular); splits into two portions at popliteal fossa; branches from sciatic in thigh region to “hamstring muscles” (biceps femoris, semitendinosus, semimembranosus) and adductor magnus muscle
	Tibial (sural, medial, and lateral plantar)	L4–S3	Skin of posterior surface of leg and sole of foot; muscle innervation includes gastrocnemius, soleus, flexor digitorum longus, flexor hallucis longus, tibialis posterior, popliteus, and intrinsic muscles of the foot
	Common fibular (superficial and deep fibular)	L4–S2	Skin of anterior surface of the leg and dorsum of foot; muscle innervation includes peroneus tertius, peroneus brevis, peroneus longus, tibialis anterior, extensor hallucis longus, extensor digitorum longus, extensor digitorum brevis
Pudendal	S2–S4	Skin of penis and scrotum in male and skin of clitoris, labia majora, labia minora, and lower vagina in female; muscles of perineum	

TABLE 5.30 Formed Elements of Blood

CELL TYPE	DESCRIPTION (WRIGHT'S STAIN)	NORMAL NUMBER (CELLS/ μ L OF BLOOD)	FUNCTION
Erythrocytes (Red blood cells, RBC)	7.5 μ diameter, biconcave disk, no nucleus	4–6 million	Transport of respiratory gases (O ₂ and CO ₂)
Leukocytes (White blood cells, WBC)		5,000 to 10,000/mm ³	Aid in defense against infections by microorganisms
Granulocytes			
Neutrophil	12–15 μ diameter, multilobed nucleus, small pink-purple granules	3,000–7,000 (65% of total leukocytes)	Phagocytosis; elevated in number during acute infections
Eosinophil	10–14 μ diameter, bilobed nucleus, large orange granules	100–400 (3% of total leukocytes)	Destroys antigen-antibody complexes, phagocytosizes parasites, involved in allergic response
Basophil	8–12 μ diameter, bilobed large purple granules that may obscure nucleus	20–50 (1% of total leukocytes)	Contains biogenic amines; releases heparin, histamine, other chemicals during inflammatory response
Agranulocytes			
Lymphocyte	5–16 μ diameter, round or nucleus, indented, single-lobed nucleus, variable amount of cytoplasm	1,500–3,000 (25% of total leukocytes)	Immune response by direct cellular contact or via antibody production; elevated in infectious mononucleosis; suppressed by steroid therapy
Monocyte	12–20 μ diameter, horseshoe-shaped nucleus	100–700 (6% of total leukocytes)	Macrophages; phagocytosis
Platelets	2–4 μ , appear as cytoplasmic fragments	25,000 to 500,000	Coagulation

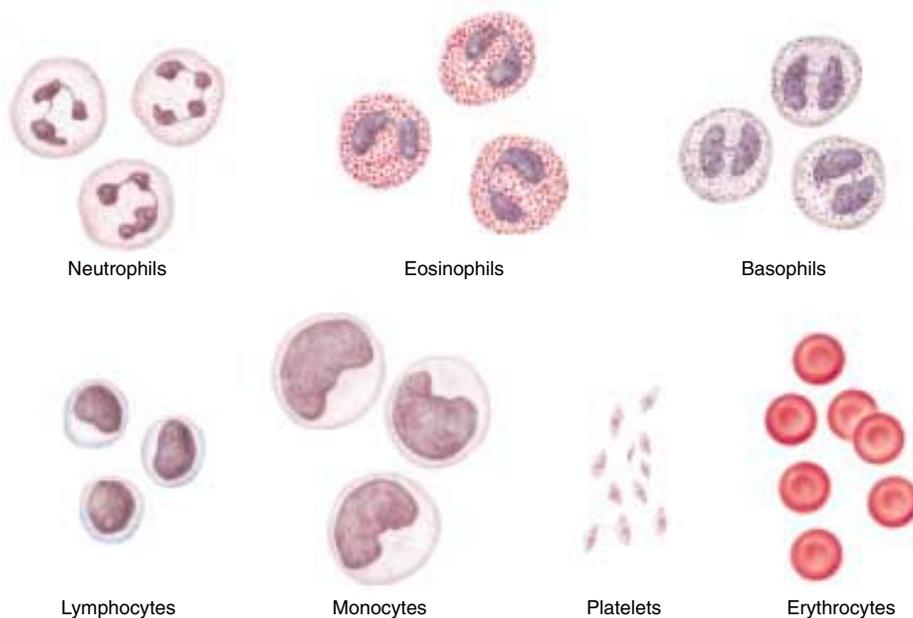


Figure 5-2
Cellular components in blood.

TABLE 5.31 Events of the Cardiac Cycle

PHASE	ELECTRICAL EVENTS	MECHANICAL EVENTS	HEART SOUND
Late diastole		AV valves open; semilunar valves closed. Blood enters all chambers by passive filling from venae cavae and pulmonary veins.	
Atrial systole	P wave: SA node depolarizes, wave spreads throughout atria P-R interval: Wave of depolarization reaches SA node. Typical P-R interval (beginning of P-wave to onset of next deviation from baseline) is <0.2 seconds	Atria contracted in response to depolarizing signal. Blood engorges ventricles, adding to stretch of ventricular walls.	
Isometric ventricular contraction	QRS complex: Depolarization of SA node. Bundle of His, and Purkinje fibers spread depolarization through valve ring into ventricular muscle	Ventricles contract in response to depolarizing signal. Papillary muscles relax, allowing AV valves to close. Typically, mitral closure slightly precedes tricuspid closure. Reverberation of blood against valve cusps produces low pitched "lub" of first heart sound. With all valves closed, ventricular pressure rises.	First heart sound (may be split with mitral component preceding tricuspid component).
Ventricular ejection	S-T segment: Entire ventricle is uniformly depolarized	Ejection begins when ventricular pressures exceed back pressures in aorta and pulmonary trunk. Semilunar valves open, blood from this cycle enters aorta and pulmonary trunk. Maintained depolarization during S-T segment permits efficient, coordinated ventricular emptying.	
Isometric ventricular relaxation	T-wave	Repolarization wave spreads through ventricles, permitting relaxation. As ventricular pressures drop below those of aorta and pulmonary trunk, semilunar valves close. Typically, aortic semilunar closes slightly before pulmonary semilunar. Reverberation of blood against closed valve cusps creates higher pitched "dub" of second heart sound. Lowered intraventricular pressures permit papillary muscles to pull AV valves open. Ventricular filling begins.	Second heart sound (typically split with pulmonary component slightly following aortic component, especially during inhalation).

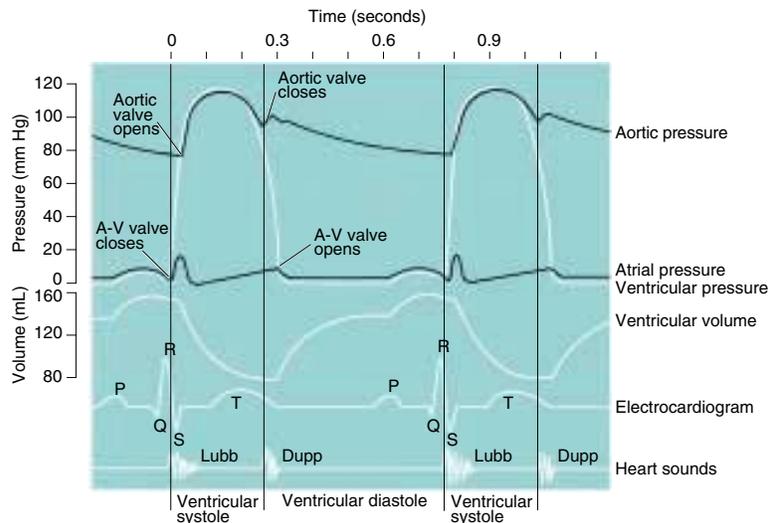


Figure 5-3
A graph of changes that occur in left ventricle during a cardiac cycle.

TABLE 5.32

Major Blood Vessels and Their Branches

MAJOR ARTERY	MAIN BRANCHES
Ascending aorta	Coronary arteries (right and left)
Aortic arch	Innominate (brachiocephalic) Left subclavian Left common carotid
Innominate	Right subclavian Right common carotid
Common carotid (right and left)	Internal carotid External carotid
Subclavian (right and left)	Vertebral (right and left) Axillary (continuation of subclavian)
Axillary	Brachial (continuation of axillary)
Brachial	Radial Ulnar
Radial and ulnar	Palmar arches (superficial and deep)
Circle of Willis	Vertebrals join in cranium to form basilar artery, which then divides to form left and right posterior cerebral arteries. Internal carotids, upon entering cranium, become left and right anterior cerebral arteries. A pair of posterior communicating arteries and an anterior communicating artery join the cerebrals to form an arterial anastomosis, the circle of Willis.
Descending aorta	Intercostal arteries and spinal branches Celiac trunk (branches to hepatic, splenic, and right and left gastric arteries) Mesenteric (superior and inferior) Renal (right and left) Gonadal (spermatic or ovarian; right and left) Parietal branches to diaphragm, dorsal skin and skeletal muscles, and spinal cord Common iliac (right and left)
Common iliac	Internal iliac (or hypogastric; right and left) External iliac (right and left)
External iliac	Femoral (right and left)
Femoral	Popliteal (right and left)
Popliteal	Tibial (anterior and posterior; right and left)
Tibial	Plantar arches
MAJOR VEIN	COMMENT
UPPER EXTREMITY (RIGHT AND LEFT)	
Palmar arch (superficial and deep)	
Medial cubital	Connects cephalic and basilic
Median antebrachial	Median antebrachial and median cubital flow into basilic
Radial and ulnar	Radial and ulnar flow into brachial
Basilic and brachial	Basilic and brachial flow into axillary
Cephalic	Cephalic and axillary flow into subclavian
Axillary (continuation of brachial)	Cephalic and axillary flow into subclavian
Subclavian (continuation of axillary)	Flows into innominate (brachiocephalic)

TABLE 5.32

Major Blood Vessels and Their Branches (continued)

MAJOR VEIN	COMMENT
LOWER EXTREMITY (RIGHT AND LEFT)	
Plantar arch	
Dorsal venous arch	
Anterior tibial	Anterior and posterior tibials unite to form popliteal
Posterior tibial	Anterior and posterior tibials unite to form popliteal
Small saphenous	Flows into popliteal
Popliteal	Popliteal and peroneal unite to form femoral
Peroneal	Popliteal and peroneal unite to form femoral
Femoral	Femoral and great saphenous unite to form external iliac
Great saphenous	Femoral and great saphenous unite to form external iliac
External iliac	External and internal iliacs unite to form common iliac
Internal iliac	External and internal iliacs unite to form common iliac
Common iliac	Flows into inferior vena cava
ABDOMEN	
Lumbar (several pairs)	Flows into inferior vena cava and azygous system
Gonadal (spermatic or ovarian; right and left)	Flows directly into inferior vena cava
Renal (right and left)	Flows directly into inferior vena cava
Suprarenal (adrenal; right and left)	Flows directly into inferior vena cava
Hepatic	Flows directly into inferior vena cava
Mesenteric (superior and inferior)	Flows into hepatic portal system
Splenic	Flows into hepatic portal system
Gastroepiploic (right and left)	Flows into hepatic portal system
Hepatic portal	Conveys blood to liver; hepatic vein flows from liver
THORAX	
Left intercostal	Flows into hemiazygos
Hemiazygos	Flows into azygos
Accessory hemiazygos	Flows into azygos
Right intercostal	Flows into azygos
Azygos	Flows into inferior vena cava
Coronary (right and left)	Flows into right atrium of heart
HEAD AND NECK	
Superior sagittal sinus	
Inferior sagittal sinus	Flows into straight sinus
Straight sinus	Flows into transverse sinus
Cavernous	Flows into petrosal sinus
Petrosal sinus (right and left)	Flows into transverse sinuses
Transverse sinuses (right and left)	Flows into sigmoid sinuses

TABLE 5.32

Major Blood Vessels and Their Branches (continued)

MAJOR VEIN	COMMENT
Sigmoid sinuses (right and left)	Flows into internal jugular vein
Internal jugular	
External jugular	
Vertebral (right and left)	
Innominate (or brachiocephalic; right and left)	Flows into superior vena cava
Superior vena cava	Flows into right atrium of heart
FETAL SYSTEM	
Placenta → Umbilical vein → Ductus venosus (bypasses liver) → Inferior vena cava → Right atrium of fetus → Mostly through foramen ovale → Left atrium → Left ventricle → Mostly to fetal head → Return to right atrium → Mostly to right ventricle → Pulmonary trunk → Mostly through ductus arteriosus → Descending aorta → Common iliac arteries → Internal iliac arteries → Umbilical arteries → Placenta	

TABLE 5.33 Major Hormones of the Pituitary Gland

HORMONE	CHEMICAL STRUCTURE	TARGET	REGULATION	MAJOR ACTION
ANTERIOR PITUITARY (ADENOHYPHYSIS)				
Growth Hormone (GH, Somatotropin)	Protein	General	GH Releasing Hormone from hypothalamus	Enhances protein anabolism, fat catabolism; enhances growth, wound healing, positive nitrogen balance
Prolactin (Prl)	Protein	Breast tissue	Inhibited by dopamine (a prolactin-inhibiting hormone) from hypothalamus	In female, mimics many actions of GH during pregnancy; enhances breast tissue anabolism for lactation
Adrenocorticotrophic hormone (ACTH)	Polypeptide	Adrenal cortex	Corticotrophin releasing hormone from hypothalamus	Promotes secretion of glucocorticosteroids by adrenal cortex
Endorphins (several)	Peptide	Central nervous system neurons	Neural activity in hypothalamus in response to stress and probably suckling	Inhibits transmission of pain impulses; enhances feeling of well-being
Thyroid stimulating hormone (TSH)	Glycoprotein	Thyroid gland	Thyroid releasing hormone (TRH) from hypothalamus	Stimulates release of thyroid hormones
Follicle stimulating hormone (FSH)	Glycoprotein	Gonads	Gonadotropin releasing hormone (GnRH) from hypothalamus	Female: Maturation of ovarian follicle; estrogen secretion Male: Sperm production
Luteinizing hormone (LH)	Glycoprotein	Gonads	Gonadotropin releasing hormone (GnRH) from hypothalamus	Female: Rupture of follicle; ovulation Male: Testosterone secretion
POSTERIOR PITUITARY (NEUROHYPHYSIS)				
Antidiuretic hormone (ADH, Vasopressin)	Peptide	Kidney tubules	Neural activity in hypothalamus in response to brain osmoreceptors; stress	Increase water retention; elevation of blood pressure
Oxytocin	Peptide	Breast tissue, uterus	Neural activity in hypothalamus in response to suckling, uterine stimulation	Let down of milk in lactating breast; uterine smooth muscle contractions

NOTE: The above-named list of hormones is not an exhaustive list of substances now known to be secreted by the pituitary gland. In addition, the listed hormones are known to have several actions, many of which are also not included.