

5' cap

a methylated guanine nucleotide added to the 5' end of eukaryotic mRNA. The cap is necessary to initiate translation of mRNA

A band

The band of the sarcomere that extends the full length of the thick filament. The A band includes regions of thick and thin filament overlap, as well as a region of thick filament only. A bands alternate with I bands to give skeletal and cardiac muscle a striated appearance. The A band does not shorten during muscle contraction.

Absolute refractory period

A period of time following an action potential during which no additional action potential can be evoked regardless of the level of stimulation. (usually because  $\text{Na}^+$  channel closed while  $\text{K}^+$  efflux)

Accessory glands

The three glands in the male reproductive system that reproduce semen: the seminal vesicles, the prostate, and the

Accessory organs

(1) In the GI tract, organs that play a role in digestion but not directly part of the alimentary canal. These include the liver, the gallbladder, the pancreas, and the salivary glands.

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# Amino Acid

The monomer of a protein; amino acids have an amino group on one end of the molecule and a carboxylic acid group on the other, and one of two different side chains.

## Amino acid acceptor site

The 3' end of a tRNA molecule that binds an amino acid. The nucleotide sequence at this end is CCA

## Aminoacyl tRNA

A tRNA with an amino acid attached. This is made by an aminoacyl-tRNA synthetase specific to the amino acid being attached.

## Aminion

A sac filled with fluid (amniotic fluid) that surrounds and protects a developing embryo.

## Amphipathic

The characteristics of a molecule that has both polar (hydrophilic) and non-polar hydrophobic regions, e.g. phospholipids, bile, etc.

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# Auditory tube

The tube that connects the middle ear cavity with the pharynx; also known as the Eustachian tube. Its function is to equalize middle ear pressure with atmospheric pressure so that pressure on both sides of the tympanic membrane is the same.

# Autoimmune reaction

An immune reaction directed against normal (necessary) cells. For example, diabetes mellitus (type 1) is an autoimmune reaction directed against the beta cells of the pancreas (destroying them and preventing insulin secretion) and against insulin itself.

# Autonomic nervous system (ANS)

The division of the peripheral nervous system that innervates and controls the visceral organs (everything but the skeletal muscles). It is also known as the involuntary nervous system and can be subdivided into the sympathetic and parasympathetic divisions.

# Autosome

A chromosome that does not determine gender (is not a sex chromosome). Humans have two sex chromosomes and 22 autosomes.

# Autotroph

An organism that makes its own, typically using CO<sub>2</sub> as a carbon source.

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# Bile

A green fluid made from cholesterol and secreted by the liver. It is stored and concentrated in the gallbladder. Bile is an amphipathic molecule that is secreted into the small intestine when fats are present, and serves to emulsify the fats for better digestion by lipases.

# Binary fission

An asexual method of bacterial reproduction that serves only to increase the size of the population; there is no introduction of genetic diversity. The bacterium simply grows in size until it has doubled its cellular components, then it replicates its genome and splits into two.

# Bipolar neuron

A neuron with a single axon and a single dendrite, often projecting from opposite sides of the cell body. Bipolar neurons are typically associated with sensory organs; an example is the bipolar neuron in the retina of the eye. - note that one axon may innervate many different muscles, or other things.

# Blastocyst

A fluid-filled sphere formed about 5 days after fertilization of an ovum that is made up of an outer ring of cells and inner cell mass. This is the structure that implants in the endometrium of the uterus.

# Bohr effect

The tendency of certain factors to stabilize the hemoglobin in the tense conformation, thus reducing its affinity for oxygen and enhancing the release of oxygen to the tissues. The factors include increased  $\text{PCO}_2$ , increase temperature, increased bisphosphoglycerate (BPG), and decreased pH. Note that the Bohr effect shifts the oxy-hemoglobin saturation curve to the right.

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Catalase

The primary enzyme in peroxisomes; catalase catalyzes the hydrolysis of hydrogen peroxide ( $H_2O_2$ ) into water and oxygen.

Catalyst

Something that increases the rate of a chemical reaction by reducing the activation energy for that reaction. The free energy of reaction remains unchanged.

cDNA

Complementary DNA. DNA produced synthetically by reverse transcribing mRNA. Because of eukaryotic mRNA splicing, cDNA contains no introns.

Cecum

The first part of the large intestine.

Cell surface receptor

An integral membrane protein that binds extracellular signaling molecules, such as hormones and peptides.

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## Connective tissue

One of the four basic tissue types in the body (epithelial, connective, muscle, and nervous). Connective tissue is a supportive tissue consisting of a relatively few cells scattered among a great deal of extracellular material (matrix), and includes adipose tissue (fat), bone, cartilage, the dermis of the skin, tendons, ligaments, and blood.

## Convergent evolution

A form of evolution in which different organisms are placed into the same environment and exposed to the same selection pressures. This causes the organisms to evolve along similar lines. As a result, they may share functional, but not structural similarity (because they possessed different starting materials). Convergent evolution produces analogous structures.

## Cooperativity

A type of substrate binding to a multi-active site enzyme, in which the binding of one substrate molecule facilitates the binding of subsequent substrate molecules. A graph of reaction rate vs. substrate concentration appears sigmoidal. Note that cooperativity can be found in other situations as well, for example, hemoglobin binds oxygen cooperatively.

## Cornea

The clear portion of the tough outer layer of the eye ball, found over the iris and pupil

## Corona radiata

The layer of granulosa cells that surround an oocyte after it has been ovulated.

# Diaphysis

The shaft of a long bone. The diaphysis is hollow and is made entirely from compact bone.

# Diastole

The period of time during which the ventricles of the heart are relaxed.

# Diastolic pressure

The pressure measured in the arteries while the ventricles are relaxed (during diastole).

# Diencephalon

The portion of the forebrain that includes the thalamus and hypothalamus.

# Differentiation

The specialization of cell types, especially during the embryonic and fetal development.

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Endosymbiotic theory

the theory that mitochondria and chloroplasts originated as independent unicellular organisms living in symbiosis with larger cells

Endotoxin

A normal component of the outer membrane of Gram-negative bacteria. Endotoxins produce extreme immune reactions (septic shock), particularly when many of them enter the circulation at once.

End plate potential

The depolarization of the motor end plate on a muscle cell.

Enteric nervous system

The nervous system of the gastrointestinal tract. It controls secretion and motility within the GI tract, and is linked to the central nervous system.

Enterogastrone

A hormone secreted by the small intestine (duodenum) in response to the presence of food. It decreases the rate at which chyme leaves the stomach and enters the small intestine.

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## Frank Starling mechanism

A mechanism by which the stroke volume of the heart is increased by increasing the venous return of the heart (thus stretching the ventricular muscle).

## Functional syncytium

A tissue in which the cytoplasm of the cells are connected by gap junctions, allowing the cells to function as a unit. Cardiac and smooth muscle tissues are examples of functional syncytiums.

## Gallbladder

A digestive accessory organ in the liver. The gallbladder stores and concentrates bile produced by the liver and is stimulated to contract by cholecystokin (CCK).

## Gametogenesis

The formation of haploid gametes (sperm or ova) via meiosis.

## Ganglion

A clump of gray matter (unmyelinated neuron cell bodies) found in the peripheral nervous system.

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# Intron

A nucleotide sequence that intervenes between protein-coding sequences. In DNA, these intervening sequences typically contain \*\*regulatory sequences, however, in RNA they are simply spliced out to form the mature (translated) transcript.

# Ion channel

A protein channel in a cell membrane that is specific for a particular ion, such as  $\text{Na}^+$  or  $\text{K}^+$ . Ion channels may be constitutively open (leak channels), or regulated (voltage-gated or ligand-gated).

# IPSP

Inhibitory postsynaptic potential; a slight hyperpolarization of the postsynaptic cell, moving the membrane potential of that cell further from threshold.

# Iris

A pigmented membrane found just in front of the lens of the eye. In the center of iris is the pupil, a hole through which light enters the eyeball. The iris regulates the diameter of the pupil in response to the brightness of light.

# Islets of Langerhans

Also called simply, "islet cells" these are the endocrine cells of the pancreas. Different cell types within the islets secrete insulin, glucagon, and somatostatin

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# Jejunum

The middle (approximately 40%) of the small intestine.

## Juxtaglomerular apparatus (JGA)

A contact point between the afferent arteriole of the glomerulus and the distal convoluted tubule of the nephron. It is involved in regulating blood pressure.

## Juxtaglomerular cells.

The cells of the afferent artery at the juxtaglomerular apparatus. They are baroreceptors that secrete renin upon sensing a decrease in blood pressure.

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## Keratin

A protein-based substance secreted by cells of the epidermis as they migrate outward. The keratin makes the cells tougher (better able to withstand abrasion) and helps make the skin waterproof.

## Kinase

An enzyme that phosphorylates something else. Kinases are frequently used in regulatory pathways, phosphorylating other enzymes.

# Krebs cycle

The third stage of cellular respiration, in which acetyl-CoA is combined with oxaloacetate to form citric acid. The citric acid is then decarboxylated twice and isomerized to recreate oxaloacetate. In the process, 3 molecules of NADH, 1 molecule of FADH<sub>2</sub>, and 1 molecule of GTP are formed (per acetyl-CoA)

# Labia

The folds of skin that enclose the vaginal and urethral openings of females.

# Labor contractions

Strong contractions of the uterus (stimulated by oxytocin) that force a baby out of the mother's body during childbirth. Labor contractions are part of a positive feedback cycle during which the baby's head stretches the cervix, which stimulates stretch receptors and activate the hypothalamus, which stimulates the posterior pituitary to release oxytocin, which stimulates strong uterine contractions (labor contractions) that cause the baby's head to stretch the cervix. The cycle is broken once the baby is delivered.

# Lacteals

Specialized lymphatic capillaries in the intestines that take up lipids as well as lymph.

# Lactic acid

Produced in muscle cells from the reduction of pyruvate (under anaerobic conditions) to regenerate NAD<sup>+</sup> so that glycolysis can continue. A rise in lactic acid usually accompanies an increase in physical activity.

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# Metaphase II

The second phase of meiosis II. Metaphase II is identical to mitotic metaphase, except that the number of chromosomes was reduced by half during meiosis I.

# MHC

Major Histocompatibility complex, a set of proteins found on the plasma membranes of cells that help display antigen to T cells. MHC I is found on all cells and displays bits of proteins from within the cell; this allows T cells to monitor cell contents and if abnormal peptides are displayed on the surface, the cell is destroyed by killer T cells. MHC II is found only on macrophages and B cells. This class of MHC allows these cells (known as antigen presenting cells) to display bits of "eaten" (phagocytosed or internalized) proteins on their surface, allowing the activation of helper Ts --> thus further activating immune response.

# Microfilament

The cytoskeleton filaments with the smallest diameter. Microfilaments are composed of the contractile protein actin. They are dynamic filaments constantly being made and broken down as needed and are responsible for events such as pseudopod formation and cytokinesis during mitosis.

# Microtubule

The largest of the cytoplasmic filaments. Microtubules are composed of two types of protein, alpha tubulin and beta tubulin. They are dynamic fibers, constantly being built up and broken down, according to cellular needs. Microtubules form the mitotic spindle during cell division, form the base of cilia and flagella, and are used for intracellular structure and transport.

# Microvilli

Microscopic outward folds of the cells lining the small intestine; microvilli serve to increase the surface area of the small intestine for absorption.

# Myofibril

A string of sarcomeres with a skeletal muscle cell (hence smaller than myofiber). Each muscle cell contains hundreds of myofibrils.

# Myoglobin

A globular protein found in muscle tissue that has the ability to bind oxygen. Myoglobin helps to store oxygen in the muscle for use in aerobic respiration (it does not move, just stays there). Muscles that participate in endurance activities (including cardiac muscle) have abundant supplies of myoglobin.

# Myometrium

The muscular layer of the uterus. The myometrium is made of smooth muscles that retain its ability to divide in order to accommodate the massive size increases that occur during pregnancy. The myometrium is stimulated to contract during labor by the hormone oxytocin.

# Myosin

One of the contractile proteins in muscle tissue. In skeletal and cardiac muscles, myosin forms the thick filaments. Myosin has intrinsic ATPase activity and can exist in two conformation, either high energy or low energy.

# Myosin light-chain kinase (MLCK)

A kinase in smooth muscle cells activated by calmodulin in the presence of  $\text{Ca}^{2+}$ . As its name implies, this kinase phosphorylates myosin, activating it so that muscle contraction can occur.

# Operon

A nucleotide sequence on DNA that contains three elements: a coding sequence for one or more enzymes, a coding sequence for a regulatory protein, and upstream regulatory sequences where the regulatory proteins can bind. An example is the lac operon found in prokaryotes.

# Optic disk

The 'blind spot' of the eye, this is where the axons of the ganglion cells exist the retinal to form the optic nerve. There are no photoreceptors in the optic disk.

# Optic nerve

The nerve extending from the back of the eyeball to the brain that carries visual information. The optic nerve is made up of the axons of the ganglion cells of the retina.

# Organ of Corti

The structure in the cochlea of the inner ear made up of the basilar membrane, the auditory hair cells, and the tectorial membrane. The Organ of Corti is the site where auditory sensation is detected and transduced to action potentials.

# Organogenesis

The stage of human development during which the organs are formed. Organogenesis begins after gastrulation and is completed by the eighth week of gestation.

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# Oval window

The membrane that separates the middle ear from the inner ear.

# Ovarian cycle

The 28 days of the menstrual cycle as they apply to events in the ovary. The ovarian cycle has three subphases: the follicular phase, ovulation, and the luteal phase.

# Ovary

The female primary sex organ. The ovary produces female gametes (ova) and secretes estrogen and progesterone.

# Ovulation

The release of a secondary oocyte (along with some granulosa cells) from the ovary at the approximate midpoint of the menstrual cycle (typically around day 14). Ovulation is triggered by a surge in LH.

# Oxaloacetate

A four-carbon molecule that binds with the two-carbon acetyl unit of acetyl-CoA to form citric acid in the first step of the Krebs cycle.

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# Peptide bond

The bond formed between the carboxyl group of one amino acid and the amino group of another.

# Peptide hormone

A hormone made of amino acids (in some cases just a single, modified amino acid). Peptide hormones are generally hydrophilic and cannot cross the plasma membranes of cells, thus receptor for peptide hormones must be found on the cell surface. An exception is thyroxine, which is hydrophobic enough to enter the cells easily. Binding of a peptide hormone to its receptor usually triggers a second messenger system within the cell.

# Peptidoglycan

A complex polymer of sugars and amino acids; the substance from which bacterial cell walls are made.

# Perfusion

The flow of blood through a tissue; ischaemia is when there is no blood flow, anoxia when there is no O<sub>2</sub> available (ischemia is more dangerous b/c of waste build-up)

# Peripheral chemoreceptors

Receptors in the carotid arteries and the aorta that monitor blood pH to help regulate ventilation rate.

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# Polyspermy

The fertilization of an oocyte by more than one sperm. This occurs in some animals, but in humans, blocks to polyspermy exist (the fast block and the slow block) so that only a single sperm can penetrate the oocyte.

# Population

A subset of a species consisting of members that mate and reproduce with one another.

# Pore

A pathway through a plasma membrane that restricts passage based only on the size of the molecules. Pore are made from porin proteins.

# Portal systems

A system of blood vessels where the blood passes from arteries to capillaries to veins, then through a second set of capillaries, and then through a final set of veins. There are two portal systems in the body, the hepatic portal system and the hypothalamic portal system.

# Posterior pituitary gland

Also known as the neurohypophysis, the posterior pituitary is made of nervous tissue and stores and secretes two hormones made by the hypothalamus; oxytocin and ADH. The posterior pituitary is controlled by action potentials from the hypothalamus.

## Postganglionic neuron

In the autonomic division of the PNS, a neuron that has its \*cell body located in the autonomic ganglion\* (where a preganglionic neuron synapses with it) and whose axon synapses with the target axon.

## Potassium leak channel

An ion channel specific for potassium found in the plasma membrane of all cells in the body. Leak channels are constitutively open and allow their specific ion to move across the membrane according to its gradient. Potassium leak channels allow potassium to leave the cell.

## Power stroke

The step in the sliding filament theory during which myosin undergoes a conformational change to its low energy state, in the process dragging the thin filaments (and the attached Z lines) toward the center of the sarcomere. Note that power stroke requires ATP only indirectly: to set the myosin molecule in its high-energy conformation during a different step of the sliding filament theory.

## Preganglionic neuron

In the autonomic division of the PNS, a neuron that has its \*cell body located in the CNS\*, and whose axon extends into the PNS to synapse with a second neuron at an autonomic ganglion. (The second neuron's axon synapses with the target axon)

## Primary active transport

Active transport that relies directly on the hydrolysis of ATP.

Renal absorption

The movement of a substance from the filtrate (in the renal tubule) back into the bloodstream. Reabsorption reduces the amount of a substance in the urine.

Renal tubule

The portion of the nephron after the glomerulus and capsule; the region of the nephron where the filtrate is modified along its path to becoming urine.

Renin

An enzyme secreted by the juxtaglomerular cells when blood pressure decreases. Renin converts angiotensinogen to angiotensin I.

Replication

The duplication of DNA

Relication fork(s)

The site(s) where the parental DNA double helix unwinds during replication.

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RNA dependent RNA polymerase

A viral enzyme that makes a strand of RNA by reading a strand of RNA. All prokaryotic and eukaryotic RNA polymerases are DNA dependent; they make a strand of RNA by reading a strand of DNA.

RNA  
polymerase

An enzyme that transcribes RNA. Prokaryotes have a single RNA pol, while eukaryotes have three; in eukaryotes, RNA pol I transcribes rRNA, RNA pol II transcribes mRNA, and RNA pol III transcribes tRNA.

Rods

Photoreceptors in the retina of the eye that respond to dim light and provide us with black and white vision.

Rough endoplasmic reticulum

A large system of folded membranes within a eukaryotic cell that has ribosomes bound to it, giving a rough appearance. These ribosomes synthesize proteins that will ultimately be secreted from the cell, incorporated into the plasma membrane, or transported to the Golgi apparatus or lysosome.

rRNA

Ribosomal RNA; the type of RNA that associates with ribosomal proteins to make a functional ribosome. It is thought that the rRNA has the peptidyl transferase activity.

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Seminiferous tubules

Small convoluted tubules in the testes where spermatogenesis takes place.

Sertoli cells

Cells that form the walls of the seminiferous tubules and help in spermatogenesis Sertoli cells are also called sustentacular cells.

Serum

Plasma with the \*clotting factors removed\*. Serum is often used in diagnostic tests because it does not clot.

Sex-linked trait

A trait determined by a gene on either the X or Y chromosomes (the sex chromosomes).

Shine-Dalgarno sequence

The prokaryotic ribosome-binding site on mRNA, found 10 nucleotides 5' to the start codon.

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# Summation

(1) The integration of input (EPSPs and IPSPs) from many presynaptic neurons by a single postsynaptic neuron, either temporally or spatially. Summation of all input can either stimulate the postsynaptic neuron and possibly lead to an action potential, or it can inhibit the neuron, reducing the likelihood of an action potential. (2) The integration of single muscle twitches into a sustained contraction (tetany).

# Supercoiling

A method of DNA protection utilized by prokaryotes in which their large circular chromosome is coiled upon itself.

# Surfactant

An amphipathic molecule secreted by cells in the alveoli (type 2 alveolar cells) that reduces surface tension on the inside of the alveolar walls. This prevents the alveoli from collapsing upon exhale and sticking together, thus reducing the effort required for inspiration.

# Sympathetic nervous system

The division of the autonomic nervous system known as the "fight or flight" system. It causes a general increase in body activities such as heart rate, respiratory rate, and blood pressure, and an increase in blood flow to skeletal muscle. It causes a general decrease in digestive activity. Because all of its preganglionic neurons originate from the thoracic or lumbar regions of the spinal cord, it is also known as the thoracolumbar system.

# Symporter

A carrier protein that transports two molecules across the plasma membrane in the same direction. For example, the Na<sup>+</sup>-glucose cotransporter in intestinal cells is a symporter.

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# Thymus

An immune organ located near the heart. The thymus is the site of T cell maturation and is larger in children and adolescents.

## Thyroid stimulating hormone (TSH)

A tropic hormone produced by the anterior pituitary gland that targets the thyroid gland, stimulating it to produce and release thyroid hormone.

# Thyroxine

Also called thyroide hormone, thyroxine is produced and secreted by follicle cells in the thyroid gland. it targets all cells in the body and increases overall body metabolism.

## Tidal volume

The volume of air inhaled and exhaled in a normal, resting breath, typically about 500 mL.

## Tight junction

Also called occluding junctions, tight junctions form a seal between cells that prevents the movement of substances across the cell layer, except by diffusion through the cell membranes themselves. Tight junctions are found between the epithelial cells lining the intestines and between the cells forming the capillaries in the brain (the blood-brain barrier).

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Transmembrane  
domain

The portion of an integral membrane protein that passes through the lipid bilayer.

Transversion mutation

A point mutation in which a pyrimidine is substituted for a purine, or vice versa.

tRNA

Transfer RNA: the type of RNA that carries an amino acid from the cytoplasm to the ribosome for incorporation into a growing protein.

tRNA loading

The attachment of an amino acid to a tRNA (not that this a specific interaction). tRNA loading requires two high-energy phosphate bonds.

Trophoblast

The outer ring of cells of a blastocyst. The trophoblast takes part in the formation of the placenta.

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## Tympanic membrane

The membrane that separates the outer ear from the middle ear. The tympanic membrane is also known as the eardrum.

## Umbilical cord

The cord that connects the embryo of a developing mammal to the placenta in the uterus of the mother. The umbilical cord contains fetal arteries (carry blood toward the placenta) and veins (carry blood away from the placenta). The umbilical vessels derive from the allantois, a structure that develops from the embryonic gut.

## Uniporter

A carrier protein that transports a single molecule across the plasma membrane.

## Universal acceptor

A person with blood type AB+. Because this person's red blood cells possess all of the typical blood surface proteins, they will not display an immune reaction if transfused with any of the other blood types.

## Universal donor

A person with blood type O-. Because this person's red blood cells possess none of the typical blood surface proteins, they cannot initiate an immune reaction in a recipient.

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