TIPS & TRICKS

An Introduction to Anatomy and Physiology

• Supine means up. In order to carry a bowl of soup, your hand must be in the supine position.

• The imaginary lines dividing the abdominopelvic regions resemble a tic-tac-toe game.

The Chemical Level of Organization

• Think of the ***t*** in ca***t***ion as a plus sign (+) to remember that a ca***t***ion has a positive charge, and think of the ***n*** in a***n***ion as standing for ***n***egative to remember that a***n***ions have a ***n***egative charge.

• Remember this mnemonic for the bonding of hydrogen, oxygen, nitrogen, and carbon atoms: **HONC 1234**. ***H***ydrogen shares ***1*** pair of electrons (H-), ***o***xygen shares ***2*** pairs (-O-), ***n***itrogen shares ***3*** pairs (-N--), and ***c***arbon shares ***4*** pairs (--C--).

• Jell-O provides an observable example of a reversible reaction. Once Jell-O has been refrigerated, the gelatin sets up and forms a solid; if it sits without refrigeration for too long, it reverts to a liquid again.

• To distinguish between hydrophobic and hydrophilic, remember that a phobia is a fear of something, and that –philic ends with "lic", which resembles "like".

The Cellular Level of Organization

• To understand the mechanism of cellular channels, think about entering a store that has a double set of automated sliding doors. When you near the first set of automated doors, it opens. As you step onto the mat between the sets of doors, the doors behind you close, trapping you in the vestibule. When you take another step forward, the second set of doors opens, enabling you to enter the store.

• In order to remember the correct sequence of events during mitosis, imagine the contour rug in front of your toilet as the **P-MAT**, for ***p***rophase, ***m***etaphase, ***a***naphase, and ***t***elophase.

• When considering the relative length of time that a cell spends in interphase compared to mitosis, think about taking a test. You prepare a long time (interphase) for something that happens quickly (mitosis).

The Tissue Level of Organization

• To help you remember the meanings of the terms *squamous* and *stratified*, associate the word "**squa**mous" with "**sca**ly," and the word "**strat**ified" with "**strat**osphere," the upper layer of Earth's atmosphere.

• Associate the sound of the word **stri**ated with the sound of the word **stri**ped.

• To remember the direction of electrical impulses in a neuron, associate the "t" in dendri**t**e with "**t**o" and the "a" in **a**xon with "**a**way".

The Integumentary System

• **Strat**um means layer, as in **strat**ified.

• Associate the word *germinativum* with *germinate*, which means to sprout or grow. Just as blades of grass sprout upward and extend beyond the soil, the daughter cells of stem cells dividing in the stratum germinativum are pushed toward the skin surface; on the way, they elongate, acquire organelles, and mature.

• Associate the word *vellus* (peach fuzz) with "velvet".

Osseous Tissue and Bone Structure

• To understand the relationship of collagen fibers to bone matrix, envision the placement of reinforcing steel rods (rebar) in concrete. Like the rebar in concrete, collagen adds strength to bone.

The Axial Skeleton

• To remember the difference between the atlas and the axis and their respective movements, consider Greek mythology and the Earth. In this case, the head (Earth) is held up by Atlas and is capable of nodding "yes" movements; the Earth rotates on its axis, and the axis allows for us to shake our heads in a "no" movement.

• To remember the number of bones in the first three spinal curves, think about mealtimes. You eat breakfast at 7a.m. (7 cervical vertebrae), lunch at 12 p.m. (12 thoracic vertebrae), and dinner at 5 p.m. (5 lumbar vertebrae).

The Appendicular Skeleton

• The memory tool for olecranon involves the letter "*l*": The knob you feel at the e**l**bow is the o**l**ecranon of the u**l**na. You can remember that the trochlear notch is a feature of the ulna because this notch forms a U in lateral view.

• It may help you to identify the eight carpal bones if you remember the sentence "Sam Likes To Push The Toy Car Hard." In lateral-to-medial order, the first four words stand for the proximal carpal bones (**s**caphoid, **l**unate, **t**riquetrum, **p**isiform), and the last four stand for the distal carpal bones (**t**rapezium, **t**rapezoid, **c**apitate, **h**amate).

• To remember how to distinguish the fibula from the tibia, consider the "fib" and "l" parts of the word *fibula*. To tell a small **l**ie is to **fib**. The **fib**ula is sma**ll**er than the tibia, and is also **l**ateral to it.

• To remember where the talus is located, think that the **t**alus is on **t**op of the foot and articulates with the **t**ibia.

• To remember the names of the tarsal bones in the order presented in this text, try the memory aid "Tom Can Control Not Much In Life.

Articulations

• When someone is **abduct**ed, they are taken away, just as **abduct**ion takes the limb away from the body. During **add**uction, the limb is **add**ed to the body.

• In order to carry a bowl of *soup*, the hand must be *sup*inated.

• The inter**spinous** ligament and supra**spinous** ligament get their names because they are attached to the **spinous** processes of the vertebrae.

• The rotator cuff muscles can be remembered by using the acronym **SITS**, for **s**upraspinatus, **i**nfraspinatus, **t**eres minor, and **s**ubscapularis.

Muscle Tissue

• You can remember that actin forms the backbone of a thin filament by associating the "tin" in ac*tin* with the word *thin*. The th**I**n filaments look l**I**ght and form the **I** band; the **A** bands are d**A**rk.

• The sliding of filaments during a muscle contraction is similar to the way an accordion operates. To better understand the actions of sliding filaments during muscle contraction, hold your hands in front of you, palms toward your body and thumbs sticking straight up. Now move your hands together, so that the fingers of one hand move in between the fingers of the other hand. Your fingers represent thin and thick filaments, and your thumbs the Z lines. Notice that finger length stays the same, but your thumbs move closer together.

• During an isotonic contraction such as lifting a baby, muscle tension remains constant while muscle length changes; during an isometric contraction such as holding a baby at arm's length, muscle length remains constant but muscle tension changes.

The Muscular System

• The medial and lateral pterygoid muscles are named for their origin on the pterygoid ("winged") portion of the sphenoid bone. The *pter*odactyl was a prehistoric winged reptile.

• The supraspinatous and infraspinatous muscles are named for their locations above and below the spine of the scapula, respectively, not because they are located on the backbone.

• The acronym **SITS** is useful in remembering the four muscles of the rotator cuff: **s**upraspinatus, **i**nfraspinatus, **t**eres minor, and **s**ubscapularis.

• To remember that three muscles make up the hamstrings, think "the three little pigs." These three muscles are portions of the cut of meat sold as ham.

• Think of the quadriceps muscles as "the four at the fore.

• The soleus is so named because it resembles the flatfish we call sole.

Neural Tissue

• To distinguish between afferent and efferent, associate the "a" in **a**fferent with the "a" in **a**ccessing, and the "e" in efferent with the "e" in **e**xisting.

• The overall color of CNS tissue is related to its structure and function. **Gr**ay matter has a **gr**eat concentration of neuron cell bodies and is a region of inte**gr**ation. **Wh**ite matter has a **wh**ole lot of myelinated axons and **wh**isks nerve impulses.

• To remember the sign of the resting membrane potential, associate **N**egative with i**N**side and p**O**sitive with the **O**utside.

• Flushing a toilet provides a useful analogy for an action potential. Nothing happens while the handle is being pressed, until the water starts to flow (threshold is reached). Thereafter, the amount of water that is released is independent of how hard or quickly you pressed the handle (all-or-none principle). Finally, the toilet cannot be flushed again until the tank refills (refractory period).

• The "wave" performed by fans in a football stadium illustrates the continuous propagation of an action potential. The "wave" moves, but the people remain in place.

• **Cholin**ergic synapses are so named because the neurotransmitter involved is acetyl**cholin**e.

• **Endorphin**s are so named because they act like **endo**genous (coming from within the body) m**orphin**e.

The Spinal Cord, Spinal Nerves, and Spinal Reflexes

• Facilitation and inhibition are similar to what happens when a symphony conductor raises or lowers one hand to control the music's volume while keeping the rhythm going with the baton hand: The basic pattern of beats doesn't change, but the loudness does.

Spinal Nerves

• Another to assist with remembering spinal nerve function is, "cervical nerves III, IV, V keep the diaphragm alive." Or, "C_3, C_4, C_5 keep the diaphragm alive."

The Brain and Cranial Nerves

• Two useful mnemonics for remembering the names of the cranial nerves in order are "**O**h **O**h **O**h, **T**o **T**ouch **A**nd **F**eel **V**ery **G**reen **V**egetables, **A**h **H**eaven!" and "**O**h, **O**nce **O**ne **T**akes **T**he **A**natomy **F**inal, **V**ery **G**ood **V**acations **A**re **H**eavenly!"

Neural Integration I: Sensory Pathways and the Somatic Nervous System

• The ***P*** in substance ***P*** stands for ***p***eptide and is involved with ***p***ain, which it transmits ***p***eripherally.

• To remember that Meissner corpuscles perceive pressure sensations, associate the *m* and *ss* in "***M***ei***ss***ner" with ***m***a***ss***age.

Neural Integration II: The Autonomic Nervous system and Higher-Order Functions

• Each autonomic ganglion functions somewhat like a baton handoff in a relay race. Within the ganglion, one runner (the preganglionic fiber) hands off the baton (a neurotransmitter) to the next runner (the postganglionic fiber), who then carries on toward the finish line (the target effector).

The Special Senses

• Associate the "r" in **r**od with the "r" in da**r**k, and associate the "c" in **c**ones with the "c" in **c**olor and in a**c**uity.

The Endocrine System

• The structure of a thyroid follicle is similar to that of a gel capsule. The simple cuboidal epithelium is comparable to the capsule itself, and the colloid to the capsule's viscous contents.

• To help in differentiating between the polysaccharide storage molecule "glycogen" and the pancreatic hormone "glucagon," remember that glyco**gen** literally means **gen**erates sugar; and associate gluca**gon** with the Penta**gon** both of which "issue orders."

• The function of **in**sulin is to get glucose **in**to cells.

Blood

• Remember that **neu**trophils are the most **nu**merous of the white blood cells.

• A **mon**ocyte is the **mon**ster cell that engulfs debris and pathogens.

• To remember the various white blood cell populations, think "**N**ever **l**et **m**onkeys **e**at **b**ananas" for **n**eutrophils, **l**ymphocytes, **m**onocytes, **e**osinophils, and **b**asophils.

The Heart

• The term *intercalated* means "inserted between other elements"; thus, intercalated discs appear to have been inserted between cardiac muscle cells.

• The saying "To tug on your heartstrings" may help you remember the functions of the papillary muscles and the chordae tendineae: Contractions of the papillary muscles pull on the chordae tendineae, which "tug" on your heart's valves.

• To remember the locations of the tricuspid and bicuspid (mitral) valves, think "**try** to be **right**" for the ***tri***cuspid, and associate the ***l*** in mitra***l*** with the ***l*** in ***l***eft.

• To remember that systole is contraction, relate "***syst***" to "***syst***em," as in during systole, a contraction sends blood out of the heart and into the circulatory system. The word part "***di***" can mean two, so during ***di***astole, the heart "puts two feet up" and relaxes.

• To remember the effect of the sympathetic nervous system on cardiac performance, remember that **s**ympathetic input **s**peeds and **s**trengthens the heartbeat.

Blood Vessels and Circulation

• Arteries and veins are defined by the direction of blood flow relative to the heart, not the oxygen content of the blood they carry. So if you remember that ***a***rteries carry blood ***a***way from the heart, and veins carry blood toward the heart, you can remember that the pulmonary ***a***rteries carry oxygen-poor blood ***a***way from the heart to the lungs, and the pulmonary veins deliver oxygen-rich blood to the heart.

• Remember that the *external* carotid artery supplies the face (which is *external*), and that the *internal* carotid supplies the brain (which is *internal*).

• The aorta resembles a walking cane: the ascending aorta, aortic arch, and the start of the descending aorta form the cane's handle, while the thoracic and abdominal segments of the descending aorta form the cane's shaft.

The Lymphoid System and Immunity

• Helper T cells "help" translate the message from the antigen-presenting cells of the nonspecific response to the cells of the specific immune responses.

• Membrane markers and chemotaxis are like putting up the flag on your mailbox. They signal the need for awareness and action.

• ***Perfor***in gets its name because it ***perfor***ates the target cell.

• The classes of immunoglobulins---Ig***M***, Ig***A***, Ig***D***, Ig***G***, Ig***E***--- spell ***MADGE***.

• The antibody response is like ordering a custom suit. The first suit (the primary antibody response) takes time to make because the tailor (an activated B cell) must first make a pattern (ca clone of memory cells). Subsequent suits (secondary responses) are made much more quickly because the pattern already exists.

The Respiratory System

• To recall the boundary between the upper and lower respiratory systems, remember that the ***l***ower respiratory system begins at the ***l***arynx.

• The mucus layer of the respiratory epithelium functions like sticky flypaper, but instead of trapping flies, it traps particles and debris in the air moving past it.

• Intelligible sound requires both phonation and articulation. Saying "ahhhh" while your tongue is depressed during a tonsil examination is an example of phonation; saying "hot" adds articulation to that sound.

• The term ***surfactant*** is derived from its purpose as a ***surf***ace ***act***ive age***nt***.

• Tidal volume floods and ebbs like the ocean tides.

The Digestive System

• Because the parasympathetic nervous system plays a role in the digestive process, it is often referred to as the "rest and digest" division.

• Squeezing toothpaste out of a tube is similar to peristalsis: Your squeezing hand (contracting circular muscles) forces toothpaste (the bolus) along and out of the tube (the digestive tract).

• Here's how to remember the timing of dental succession: The deciduous (primary) teeth are present during the primary grades, and the secondary (permanent) teeth are present during and after the secondary grades.

• Just as security gates control the passage of people by opening and closing, sphincters control the passage of material through them by dilating and constricting.

• The stomach squeezes chyme into the small intestine just as you squeeze cake frosting out of a pastry bag.

• Both plicae circulares and rugae allow a large surface area to fit within a small volume, just as crumpling a sheet of paper rearranges its surface area so that it occupies a small space. When the stomach fills, its rugae allow its volume to expand, so that the stomach's lining can hold a larger volume of chyme.

• To remember the order of the small intestine segments, beginning at the stomach, use this mnemonic: ***D***on't ***J***ump ***I***n---***d***uodenum, ***j***ejunum, and ***i***leum. Also, do not confuse ileum, the last segment of the small intestine, with ilium, which is a bone.

• Oil and water don't mix. The emulsification process helps mix oils and water-soluble enzymes so that fats can be broken down.

Metabolism and Energetics

• To remember what occurs with electrons in oxidation and reduction reactions, think ***OIL RIG*** for ***o***xidation ***i***s ***l***oss and ***r***eduction ***i***s ***g***ain.

• To make several similar-sounding terms easier to tell apart, learn these word parts: *genesis* means "the formation of," *lysis* means "the breakdown of," *glyco* and *gluco* refer to glucose, and *neo* means "new." So, ***gluconeogenesis*** is the formation of new glucose, ***glycogenesis*** is the formation of glycogen (the storage form of glucose), ***glycogenolysis*** is the breakdown of glycogen to glucose, and ***glycolysis*** is the breakdown of glucose to pyruvic acid.

• The absorptive state is like harvest time: Food is being gathered and stored. The postabsorptive state corresponds to the time between harvests, when stored food is used for sustenance.

The Urinary System

• To visualize the kidney's retroperitoneal positions, think of each kidney as a picture on the body wall that got covered over by wallpaper (the parietal peritoneum).

• In the nephron, the terms *proximal tubule* and *distal tubule* refer to how far along the renal tubule from the renal corpuscle these structures are situated. Think of *proximal* (nearer the renal corpuscle) as being first, and *distal* (farther from the renal corpuscle) as being second.

• *Secretion* occurs when cells produce and then discharge substances into the urine, whereas *excretion* is the elimination of wastes from the body in the form of urine, sweat, and feces.

• To remember that the urethra is the urinary tract's conduit to the exterior, proclaim, "Eureka! Your urine! It's coming out the urethra!

Fluid, Electrolyte, and Acid-Base Balance

• The "p" in pH refers to power. Hence, pH refers to the **p**ower of **H**ydrogen.

• Water movement between compartments, driven by osmotic pressure, is like water movements between compartments in a waterbed mattress: The total amount of fluid doesn't change; fluid merely moves from one compartment to another, driven by pressure differences.

• The chemical symbols for sodium (Na) and potassium (K) are derived from their Latin names, **Na**trium and **K**alium.

The Reproductive System

• **Progesterone** literally means a steroid (**-one**) that favors (**pro-**) gestation (**-gest**).

• The maturation of an ovum takes several cycles to complete; that is why at any given time, oocytes are in various stages of development within the ovary.

Development and Inheritance

• Amphimixis means "both mixed together."

• Like a deep-sea diver's air hose or a space-walking astronaut's tether, the umbilical cord supplies the fetus with life-sustaining substances and removes waste products.