Classic Science

For the Family

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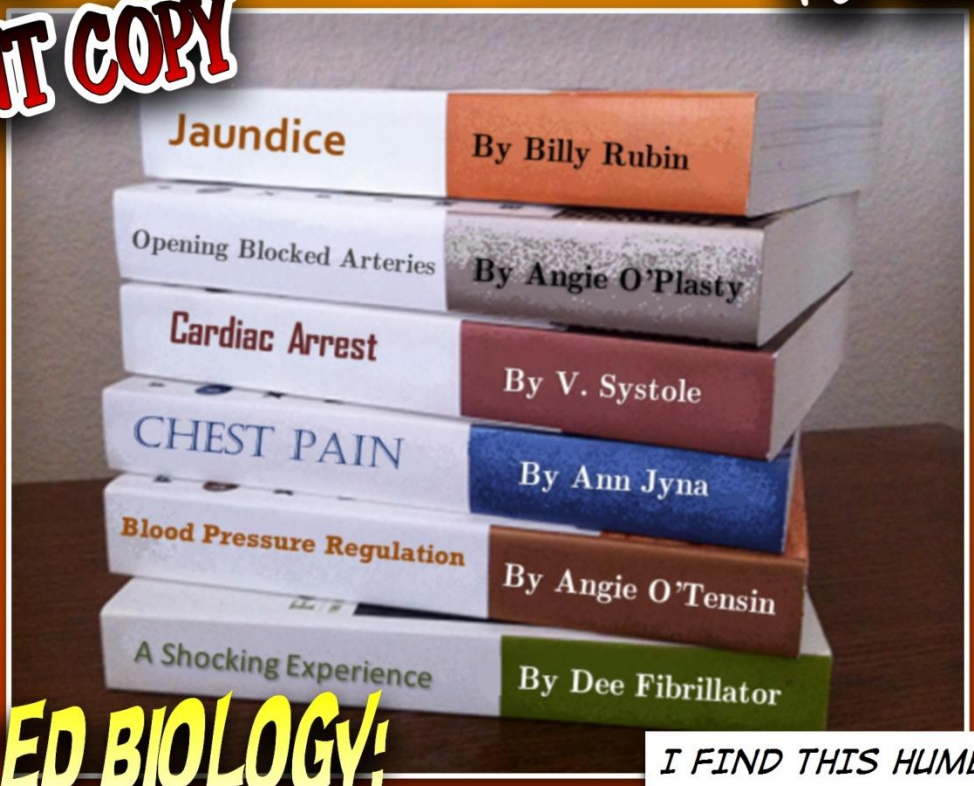


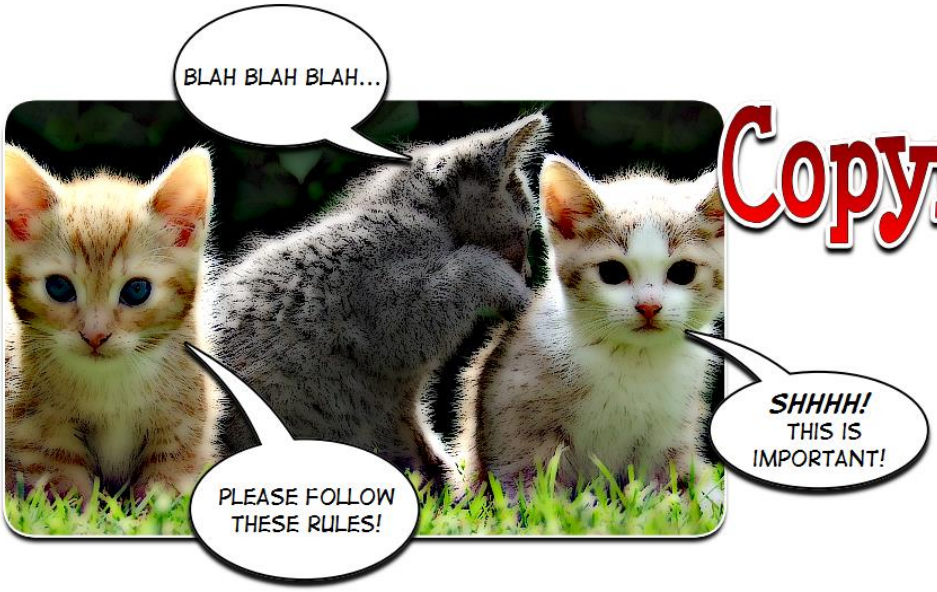
I FIND THIS HUMERUS...

ADVANCED BIOLOGY: ANATOMY and PHYSIOLOGY

The lab of MR.Q

ZZZZ...

Scott McQuerry



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First of all thank you very much for choosing to use this book with your family. You will not be disappointed! I have been asked by several families the same question, "**Who** are you and **why** are you doing this?" Without going into great detail, E=McQ is owned, operated and stressed over by me. Yep… little o' me. I am an educator by profession and began working with homeschool families several years ago while offering free programs to area families to explore various concepts in science. I guess I can't stop doing what I love!

This product is the fruit of my 15-year labor in science education. Having worked with homeschool families over these years I have gained an appreciation for your needs, struggles and wants. I could not make this curriculum any simpler for your child to master the concepts of science. It is easy to follow, relatively cheap (I tried to keep it under the cost of a tank of gas), and adaptable to various needs at home and as fun as humanly possible.

Like I said, I am an "army of one." I have no problem with you using this one copy for your entire family. However, if you give or loan this book out to another family you are putting a lot of pressure on me. If this happens too often, I may not be able to continue producing this curriculum. I am not telling you to keep this curriculum a secret, but I have provided some options for you should another family wish to use this curriculum:

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Chapter One

Body sections and Homeostasis

Before we get started digging in too deeply, let me ask you to imagine going to the pet store and picking up all of the supplies needed to set up an aquarium. What would you need?

You'd likely pick up the aquarium, a filter, a feeder, a heater, an air pump, water, and the fish itself. All of these items must be in working order so that your fish will survive, correct?

The air pump must supply a continuous supply of oxygen to the water for the fish to live. The filter will keep all of the fish waste from poisoning the water. The heater (with the help of its tiny thermostat) will maintain a relatively constant water temperature for the fish as well. And, the feeder will naturally provide a steady supply of food for it to live.

What does all of this have to do with the human body?

Well, you can break down each individual item within your aquarium into various physical objects and their functions, right? This is how the study of the human body is broken down as well. The study of the body's physical structures (heart, lungs, fingers, toes, etc.) is known as **anatomy** while the study of their functions is known as **physiology**.

In this book, we will be studying both the anatomy and physiology of the human body at the same time. And if you have spent any time at all working with the books in this series you should have learned that everything in the universe is connected together. There is no exception to this rule within the human body as well.

Everything within the human body is connected to each other!

Let's look back at our aquarium to see how everything can be connected together. First of all, I mentioned that the heater within your aquarium contains a tiny thermostat. You wouldn't want to place a heater within your aquarium without a way to turn it off and on automatically. You'd cook your fish if you did!

The thermostat "tells" the heating elements to turn on when its thermometer senses the water temperature is too cold. And it will allow these elements to remain on until the thermometer senses that the water temperature is too high. When this occurs, the thermometer will send its information to the thermostat which will turn off the heating element and allow the water to cool down on its own before starting over again.

The maintaining of the aquarium's water temperature is very similar to how our own bodies regulate our temperature as well.

(No. We do not have little aquarium heaters within our bodies. However, you are going to LOVE how it is truly done!)

The property which regulates our internal environment to create a stable and constant set of properties is known as…

Homeostasis

It is the goal of this book to describe several of these properties as it relates to the various structures within our body. Although the desired effect of homeostasis is to maintain a constant level of properties such as temperature, oxygen levels, amount of sugar within the blood, etc., the method in which this can occur may take one of two different forms:

Negative feedback and Positive feedback

To explain how these methods work, let's look again at how our aquarium heated up. The aquarium heater contains a receiver which is the thermometer, a control center which is the thermostat, and an effector which is the heating element itself. "Feedback" is the message sent from the thermometer to the thermostat indicating the temperature of the water. Since the effector (heating element) acted to reverse what was being sensed by the receiver (thermometer) the action is said to be negative. Therefore, **negative feedback** occurs when the message results in a reversal of the direction of change. A cold water temperature triggers a reaction causing it to be warmed and vice-versa. Negative feedback is much more common within our bodies as you will see.

Positive feedback occurs when the message results in an increase of the change. For example, if the thermometer sensed the water temperature was getting colder, it would send a message to the thermostat which would turn on an effector that would cool the water down even more! Naturally, this would not be something you (or the fish) would typically want to happen; however, there are instances within the human body where positive feedback is necessary for our survival. You will explore both of these feedback methods in your studies of anatomy/physiology.

Since we are on the topic of structures within the body, you should understand another concept that tends to cause trouble in the minds of most anatomy/physiology students:

Size

The size of objects within the human body can be a little challenging. That is why we will be focusing a lot on this concept throughout the book. It is very important that you have a strong understanding of the relative size of structures as compared to each other. For your reference, here is a general look at how the structures of the human body are organized from smallest to the largest:

Cells, Tissues, Organs, Organ systems, and Organisms

Can we study things smaller than cells? You bet! How about larger things than organisms? Of course! What is most important is that you can identify the difference in size between these items as we work through our studies.

Simply put, groups of cells work together to create specific tissues; and, groups of tissues work together to create organs, and so on... In addition, throughout this book you will learn how atoms and molecules affect our cells as well. However, the majority of our time will be spent within the five structures mentioned above. Learn them well, as it is vitally important that you can identify how they work together.

The following chart will give you a brief idea of the major organ systems within the human body...

Systems providing protection, support, and movement of the organism		
Integumentary system	Protection against injury and dehydration; defense against foreign invaders; regulation of temperature	Skin, hair, and nails
Skeletal system	Supports, protects, and allows for body movement; formation of red blood cells	Bones, cartilage, and joints
Muscular system	Causes body movement	Muscles and tendons

Systems providing integration (the interpretation of things you can sense) and regulation		
Nervous system	Enables sense organs reasoning and memory; regulates body activities	Brain, spinal cord, and nerves
Endocrine system	Chemically controls and integrates many processes	Pancreas and glands

Systems providing internal transport and protection		
Circulatory system	Transports materials via blood; regulates acid–base balance; protects against disease and fluid loss	Heart, blood vessels, and spleen
Immune	Defense against foreign invaders; formation of white blood cells	White blood cells, lymph vessels and nodes

Systems providing absorption and secretion		
Respiratory system	Supplies oxygen to the blood and eliminates carbon dioxide; helps regulate acid–base balance	Nose, pharynx, larynx, trachea, lungs
Digestive system	Processes ingested foods for cellular use; eliminates undigested wastes	Tongue, teeth, pharynx, esophagus, stomach, small intestine and large intestine; liver and pancreas
Urinary system	Filters blood; regulates chemical balance of blood	Kidney, urinary bladder, and ureters

System providing longevity		
Reproductive system	Produces gametes and sex hormones; reproduces the organism	Gonads and genital organs

Imagine if you lived in a world without the cardinal directions of north, south, east and west.

Can you think of any potential problem that may occur? Here's a simple scenario. What if you were to become lost in a forest and needed to find your way home? Luckily, you pull out a map which says "turn right at the large oak tree." You may find your way to the large oak tree and turn right but you may soon find yourself still lost within the woods. Without a standard reference point on your map, "turning right" could mean north, south, east, or west depending on which direction you approached the oak tree. Your perspective is vital to your survival in this case.

This situation is very similar within all of the sciences. A common language is needed to help find our way around. This brings us to the three **planes of reference** which are imaginary flat surfaces passing through the body. These fictional divisions are frequently used to help identify specific locations in, on, and around the body. These planes include:

Sagittal plane

Divides the body into right and left portions; these areas are identified from a patient's perspective. For example, when you go to the doctor and complain about a pain in your left leg, the doctor will examine your left leg despite the fact that from her perspective, your left leg is on the right side!

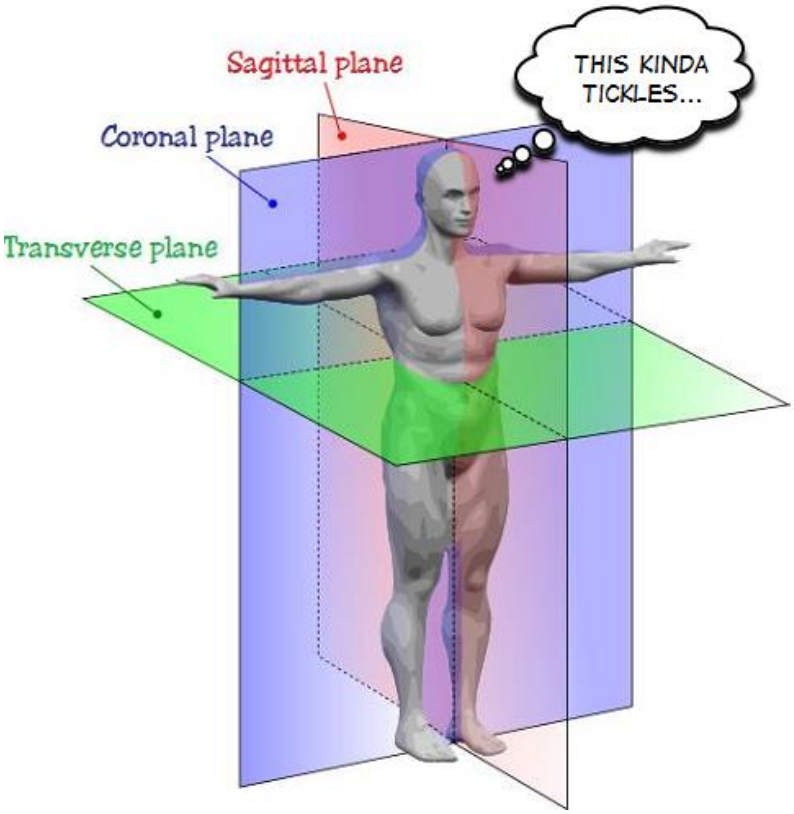
Coronal (frontal) plane

Divides the body into **anterior** (front half) and **posterior** (back half) portions

Transverse plane

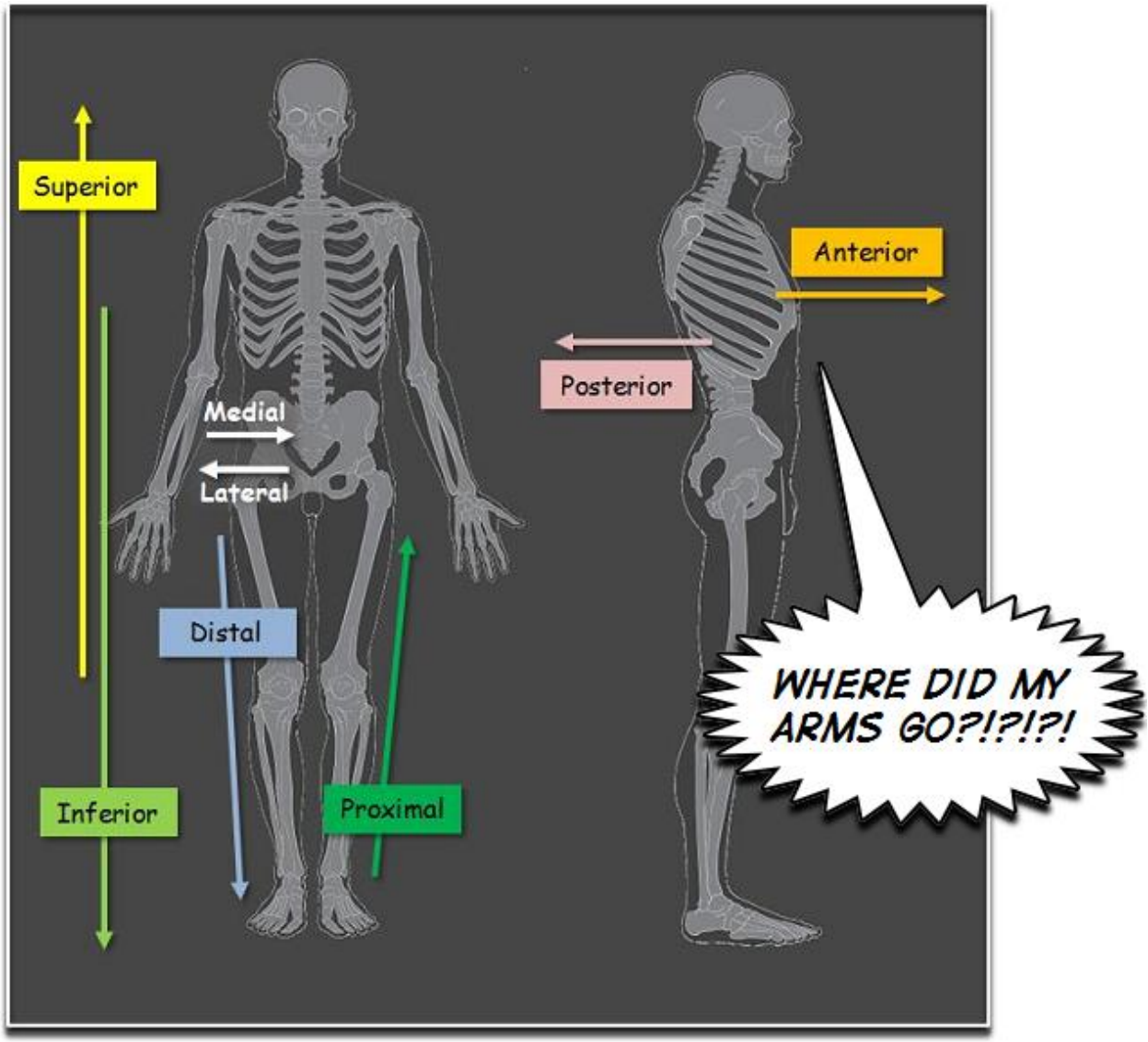
Divides the body into **superior** (top half) and **inferior** (bottom half) positions

Don't let all of these names confuse you. Most of the directional terms used to describe the human body can be found in the chart below. You may want to spend a little time reviewing them as they may pop up throughout the book. And remember - these terms are universal for all humans regardless if they are sitting, standing, or laying down!



Directional terms for the human body

Term	Definition	Example
Superior	Toward the head; toward the top	The head is superior to the shoulders.
Inferior (caudal)	Away from the head; toward the bottom	The knees are inferior to the head.
Anterior (ventral)	Toward the front	The nose is on the anterior side of the body.
Posterior (dorsal)	Toward the back	The shoulder blades are posterior to the toes.
Medial	Toward the midline of the body	The heart is medial to the shoulders.
Lateral	Away from the midline of the body	The ribs are lateral to the lungs.
Internal (interior)	Away from the surface of the body	The heart is internal to the skin.
External (superficial)	Toward the surface of the body	The muscles are external to the bones.
Proximal	Towards or near to the trunk of the body	The elbow is proximal to the hand.
Distal	Away from the trunk of the body	The foot is distal to the knee.



Okay! It's time to start digging into the meat of our studies (no pun intended). Remember to look for the key concepts of homeostasis, size, and direction throughout your studies. And never forget the most important rule within anatomy and physiology:

Everything within the human body is connected to each other!

Match the following vocabulary terms with their correct definition:

anatomy	**interior**	**posterior (dorsal)**
anterior (ventral)	**lateral**	**proximal**
coronal (frontal)	**medial**	**sagittal plane**
distal	**negative feedback**	**superior**
external (superficial)	**physiology**	**transverse plane**
homeostasis	**planes of reference**	
inferior (caudal)	**positive feedback**	

1)	_____	a set of three planes (imaginary flat surfaces) passing through the body used to identify specific locations in, on, and around the body
2)	_____	away from the midline of the body
3)	_____	away from the surface of the body
4)	_____	away from the trunk of the body
5)	_____	occurs when the feedback results in an increase of the change
6)	_____	occurs when the response to a stimulus (feedback) results in a reversal of the direction of change
7)	_____	directional term meaning "toward the back"
8)	_____	directional term meaning "toward the bottom"
9)	_____	directional term meaning "toward the front"
10)	_____	directional term meaning "toward the top"
11)	_____	plane of reference which divides the body into anterior and posterior portions

12)	_____	plane of reference which divides the body into inferior and superior portions
13)	_____	plane of reference which divides the body into right and left sides
14)	_____	the property which regulates our internal environment to create a stable and constant set of properties
15)	_____	the study of the body's physical structures
16)	_____	the study of the body's functions
17)	_____	toward the midline of the body
18)	_____	toward the surface of the body
19)	_____	toward the trunk of the body

Choose the correct answer from the following questions:

1) **The plane of reference which divides the body into equal right and left parts is called:**
   A) sagittal
   B) oblique
   C) transverse
   D) frontal
   E) coronal

2) **Which of the following lists correctly identifies the level of structural organization from smallest to largest in size:**
   A) tissue, cellular, organ system, organ, organism
   B) cellular, tissue, organ system, organism, organ
   C) cellular, tissue, organ, organ system, organism
   D) cellular, tissue, organ, organism, organ system
   E) organism, organ system, organ, tissue, cellular

3) **Which of the following organ systems is linked most accurately to the function it provides:**
   A) respiratory system - digestion
   B) nervous system - excretion
   C) muscular system - maintaining boundaries
   D) integumentary system - movement
   E) nervous system - responsiveness

4) **Which of the following elements of a system detects a change in its environment:**
   A) receiver
   B) control center
   C) effector
   D) stimulus

5) Imagine seeing a large object moving dangerously fast to you. Which of the following lists correctly describes your actions as you attempt to get out of the way?

A) receiver, stimulus, control center, effector, response
B) stimulus, effector, control center, receiver, response
C) receiver, stimulus, control center, effector, response
D) stimulus, receiver, control center, effector, response
E) effector, stimulus, control center, receiver, response

6) Which of the following directional terms for the human body have opposite meanings:

A) medial and anterior
B) external and proximal
C) posterior and intermediate
D) distal and proximal
E) medial and distal

Application Question:

Identify the correct directional terms for the following areas of the body: (i.e. caudal, dorsal, distal, etc.)

a. The navel is _____ to the nose.

b. The nipple is _____ and _____ to the lung.

c. The upper arm is _____and _____ to the forearm.

d. The eye is _____ to the ear.

Chapter Two

Cells and Tissues

This week we will be looking at the two smallest structures on our anatomical list:

Cells and Tissues

As you should know by now, cells are the basic building blocks of all life and are the foundation for tissues, organs, organ systems, and the entire organism itself. Even though our cells have a variety of different functions within the human body, all cells share a few common structures.

The cell is a fluid-filled container surrounded by a **cell membrane** and contains a set of specialized structures called **organelles.** Each organelle maintains its own unique function for the cell's survival. The cell's internal fluid, **cytoplasm**, is a storage area for gases, food, wastes, and a variety of items which are vital to the cell's survival.

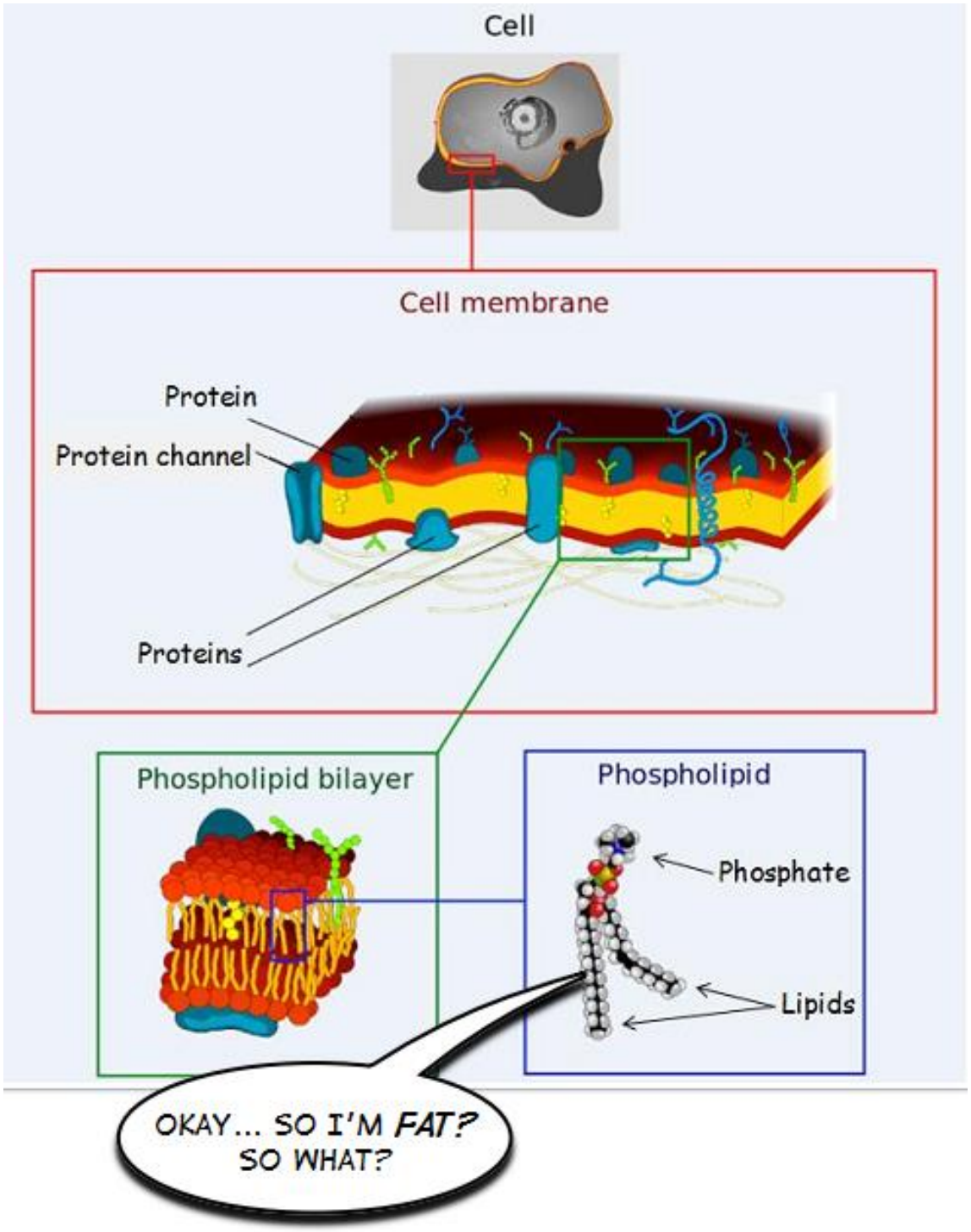
We do not have enough time to talk about each of the individual organelles in this book; however, it is worth discussing how items can be transported into and out of a cell. You will see this process from time to time throughout the various organs and organ systems.

Let's take a closer look at the cell membrane.

It is common sense that our bodies require food and water in order to survive. More specifically, these nutrients must find their way into the cell; and, once they are used up and converted to waste materials, they must be removed from the cell in some way.

How is this done? To know this you first must understand what the structure of a cell membrane looks like.

Cell membranes are made up of a bilayer of large molecules known as **phospholipids** which contain two separate parts: a molecule known as a **phosphate** (a chemical made of one atom of phosphorus and four oxygen atoms) and two long "tails" of **lipids** (aka – fat). If you were to cut an ice cream sandwich in half and look inside, the sandwich portions would represent the phosphate and the ice cream would be the location of the lipids. Now imagine taking several straws and driving through the ice cream sandwich. The straws which pass through the entire sandwich represent various types of **proteins** (large organic molecules each possessing a unique function) that exist within the cell membrane. It is through these straws that water, nutrients, and waste products can travel back and forth.

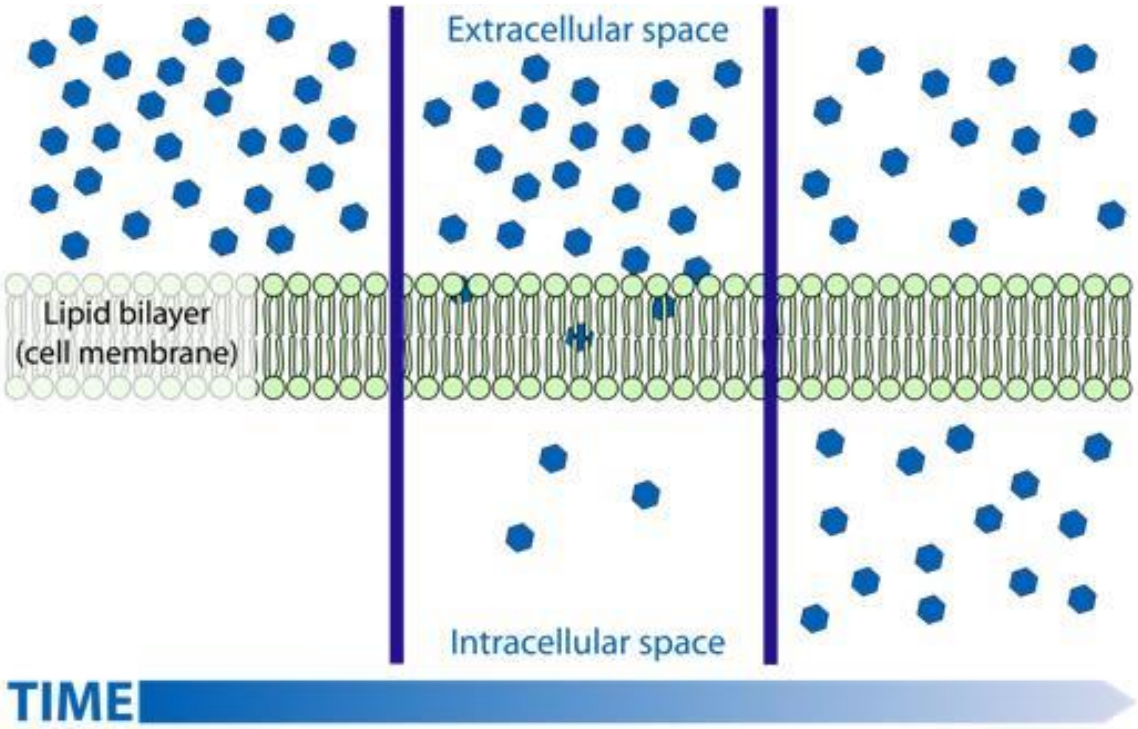


The cell membrane is known as a **semipermeable** membrane which means that it regulates which substances are allowed in and out of the cell in specific ways. The four main methods of moving items through the membrane are:

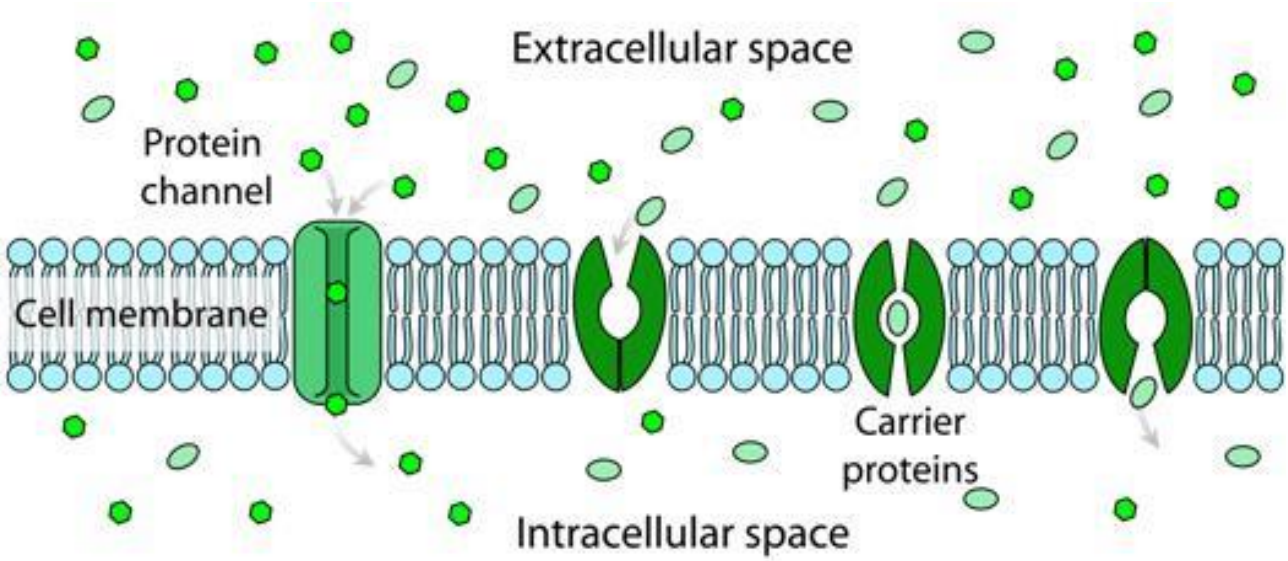
Diffusion, Osmosis, Facilitated diffusion, and Active transport

Diffusion is simply the movement of any substance from an area of high concentration to an area of low concentration. This is how oxygen enters the blood within the lungs. When we inhale, the concentration of oxygen within our lungs becomes much higher than is found within the blood. Therefore, oxygen diffuses from the lungs to the blood.

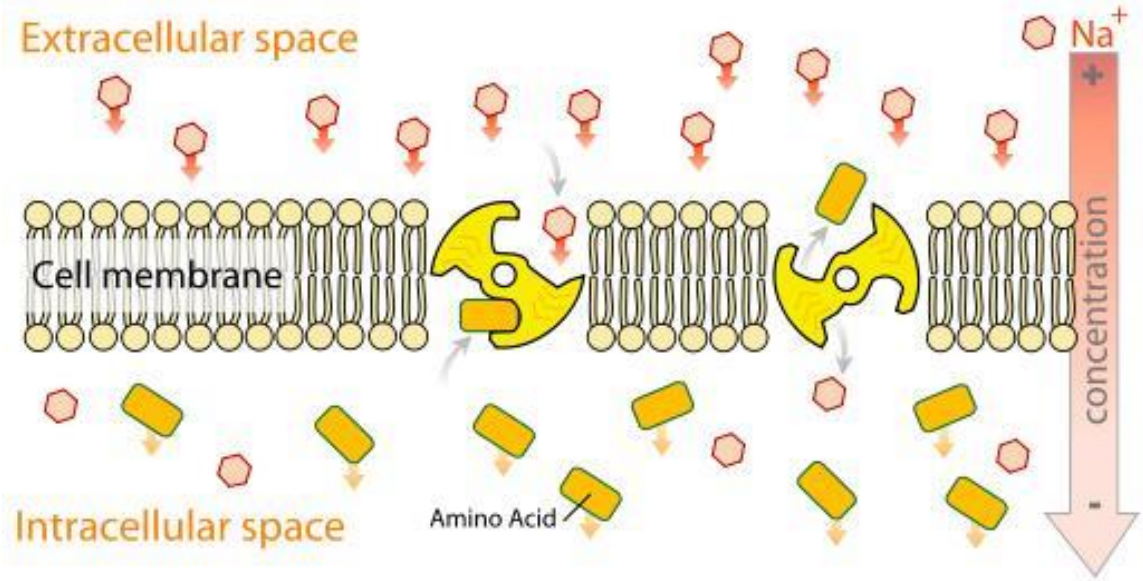
Osmosis is a special type of diffusion in which <u>only water</u> is being transported through a semipermeable membrane. It is safe to assume there are always substances dissolved within the water in our bodies. Therefore, during osmosis, water will naturally pass through the membrane from areas with low concentrations of dissolved substances into areas which contain high concentrations of dissolved substances.



To understand **facilitated diffusion**, think back to the "proteins" you stuck through your ice cream sandwich model. Some proteins within the cell membrane act as gates or revolving doors which are specific for only certain types of particles to pass through.



Active transport works very much like a pump which can drive particles in and out of the cell <u>against</u> the normal flow of diffusion. Much like facilitated diffusion, proteins within the cell membrane are used as these organic pumps. Naturally, this takes a lot more energy to accomplish but it does get the job done!



As you read earlier, cells have a variety of different functions within the human body. As groups of cells divide and bond together in the first few weeks/months of our life, they begin to differentiate into four anatomically different classes of cells, each containing its own unique functions. These four groups of cells continue to grow in numbers and become what is referred to as tissues.

There are four main types of tissues found in the human body:

Epithelial, Connective, Muscle, and Nervous

Epithelial tissue

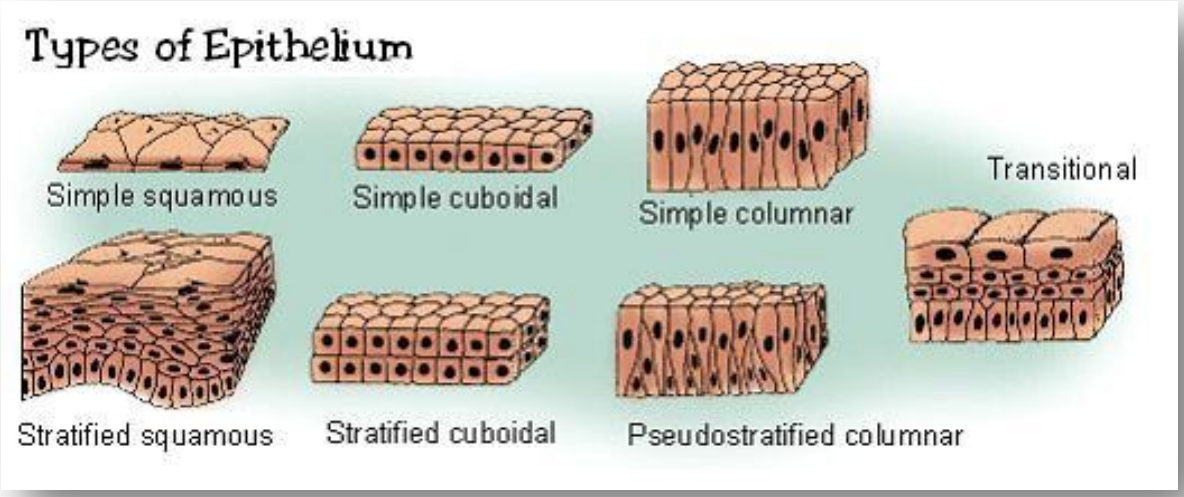
Epithelial tissue covers the outside of the body, the surfaces of all our organs, **body cavities** (any space in the body between the skin and the outermost tissues of the internal organs), and various **glands** which are responsible for creating and releasing specific chemicals throughout the body.

Our skin is made up of epithelial tissue which protects us from potentially dangerous objects in our environment. One way it accomplishes this is by producing the protein **keratin** which covers the epidermis of our skin and serves as an effective outer barrier. Epithelial tissue also is responsible for absorbing nutrients and gases within the digestive and respiratory systems. It secretes several different chemicals throughout our body and it helps the body excrete urine.

Epithelial tissue can be placed into several different categories depending on the number of layers it contains and on its shape. Single-layer epithelial tissue is known as **simple** while tissue with more than one layer is called **stratified**. The shape of the tissue cells also help to classify the epithelial tissue. **Squamous** identifies a thin, flat cell; **cuboidal** is cube-shaped; and, **columnar** cells are much taller than they are wide. The following chart will help you identify the general locations and functions for each of the major epithelial cells in the human body:

Epithelial Tissue Types

Epithelial Tissue type	Structure	Function	Location
Simple squamous epithelium	Single layer of flattened, tightly bound cells	Diffusion and filtration	Forms capillary walls; lining alveoli and body cavities; covering organs
Simple cuboidal epithelium	Single layer of cube-shaped cells	Excretion, secretion, or absorption	Covering surface of ovaries; lining salivary ducts
Simple columnar epithelium	Single layer of column shaped cells	Protection, secretion, and absorption	Lining digestive tract, gallbladder, and excretory ducts of some glands
Stratified squamous epithelium (keratinized)	Multilayered, contains keratin, outer layers flattened and dead	Protection	Epidermis of skin
Stratified squamous epithelium (not keratinized)	Multilayered, lacks keratin, outer layers moistened and alive	Protection and pliability	Linings of oral and nasal cavities, esophagus, vagina, and anal canal
Stratified cuboidal epithelium	Usually two layers of cube-shaped cells	Strengthening of lumen walls	Ducts of larger sweat glands, salivary glands, and pancreas
Pseudostratified columnar epithelium	Single layer of columnar cells	Secretion and absorption	Trachea and upper respiratory tract
Transitional epithelium	Numerous layers of rounded nonkeratinized cells	Swelling	Lining urinary bladder and portions of ureters and urethra



Connective tissue

Connective tissue is the most widespread tissue as it is found around all muscles, blood vessels, and organs. There are four main types of connective tissue in the human body:

Connective tissue proper, Cartilage, Blood, and Bone

With the exception of blood, connective tissue acts as "cellular glue" by forming the framework and support structures for all of our body tissues and organs.

Of these four connective tissues, **cartilage** and the **connective tissue proper** both provide a wide array of functions to the human body. Although these two connective tissues contain types which vary in function, both share common features which allows for the support, cushioning, and flexibility of the majority of structures throughout the body.

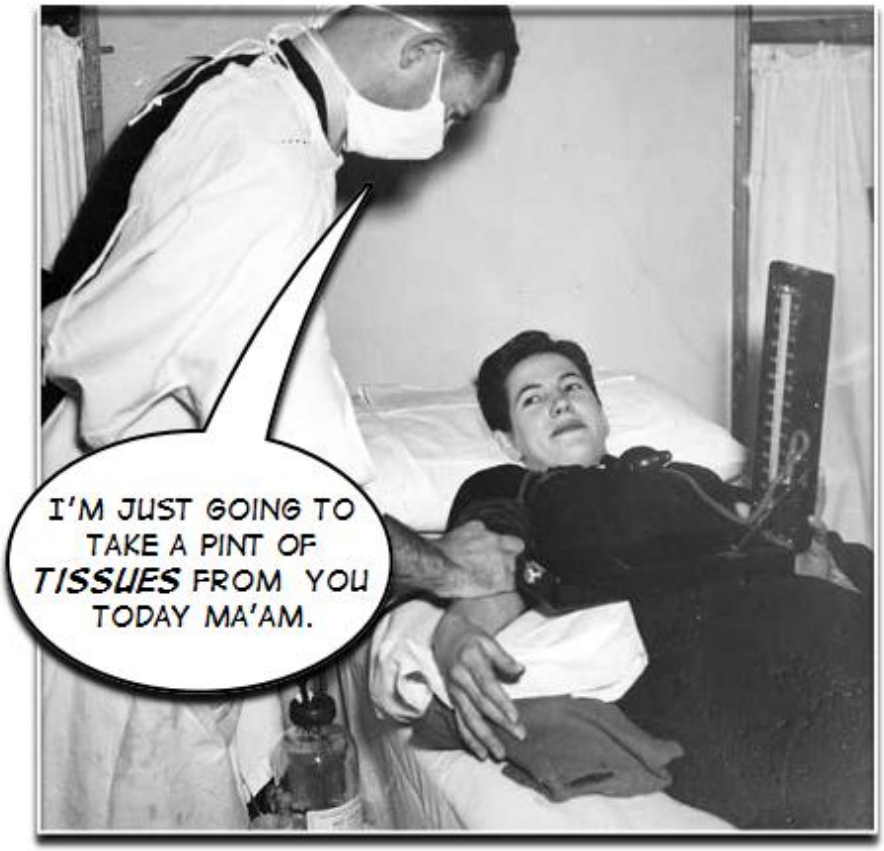
By far, the majority of connective tissues are made up of a group of proteins collectively known as **collagen**. Nearly 30% of the total protein content within humans is collagen, thus making it the most abundant protein in the human body. Collagen has a significant commercial value to modern industry. Through simple procedures, this protein can be modified into a highly usable compound known as **gelatin**.

Future chapters will focus upon the both blood and bone tissues. But first, you may be wondering...

How can blood be considered a tissue?

Connective tissue is actually a combination of fluid and fibers of various strengths known as a **matrix**, and a few cells. By this definition, our blood is a form of connective tissue as it is a combination of various types of cells, cell parts, and a fluid called **plasma** which contains several dissolved substances as well.

On the following page you will find a chart identifying the name, location, and function of the many types of connective tissue in the human body. As you can see, there is a wide variety of uses for this tissue!



Connective Tissue Types

	Connective Tissue type	Function	Location
Connective tissue proper	Loose (areolar)	Binding and packing; protection and nourishment; holds fluids	Deep to skin; surrounding muscles, blood vessels, and organs
	Dense fibrous	Strong, flexible	Tendons, ligaments
	Elastic	Flexibility	Arteries, larynx, trachea, bronchi
	Reticular	Absorbs waste material	Liver, spleen, lymph nodes, bone marrow
	Adipose (fat)	Stores fat (lipids)	Hypodermis, surrounds most organs
Cartilage	Hyaline	Covers and protects bones; provides support	Joints, trachea, nose
	Fibro-cartilage	Withstands tension and compression	Knee joint and spinal discs
	Elastic	Flexible strength	Outer ear, larynx, ear canal
Bone	Spongy bone	Light, strong, vascular, internal support	Interior of bones
	Compact bone	Strong support, passage of nutrients and waste	Exterior of bones
Blood	Blood	Movement of nutrients	Circulatory system

Muscle tissue

Muscle tissues are made up of a collection of elongated cells which **contract** (shorten) to enable the movement of the organism or its internal organs. This type of tissue makes up over one half of our total body weight. Even while we rest, these tissues are always contracting and expanding a little bit which generates a lot of heat for our bodies. There are three different types of muscle tissue which are named after their location within the body:

Cardiac muscle, Skeletal muscle, and Smooth muscle

Cardiac muscle is an **involuntary** tissue (this means it doesn't need to be told what to do by your brain) which is responsible for pumping blood. It is found in the walls of the heart and is **striated** in appearance. A tissue which is striated contains visual stripes on its surface when viewed under a microscope.

Skeletal muscle is responsible for movement and is considered a **voluntary** tissue. It is classified as "voluntary" because an organism has full control over its movement. The cells which make up skeletal muscle are very long and threadlike and are also referred to as **muscle fibers**. Much like cardiac muscle, skeletal muscle is also striated in appearance.

Smooth muscle is responsible for slow, involuntary movements of the internal organs. It can be found in the **lumen** which is the inside space of a tubular structure like the **esophagus** (the muscular tube which carries your food to the *stomach*). Smooth muscle is not striated, which is the reason for why it has been named "smooth".

Muscle Tissue Types

Characteristic	Skeletal muscle	Smooth muscle	Cardiac muscle
Location	Attached to tendons which are attached to bones	Walls of blood vessels and lumen of organs	Only in the heart
Function	Movement of the body	Movement of materials through lumen and control of blood vessel diameter	Pumping of blood
Cell shape	Long and cylindrical	Spindle-shaped (think of a stretched football)	Branched
Striations	Present	Absent	Present
Mode of control	Voluntary	Involuntary	Involuntary

Nervous tissue

Nervous tissue is responsible for creating and sending **nerve impulses** throughout the body. A nerve impulse can be considered a wave-like signal that moves through the body by an electric current. Nervous tissue is made up of two different structures:

Neurons (nerve cells) and Neuroglia (supporting cells)

The **neurons (nerve cells)** are responsible for sending the nerve impulses throughout the body in a method we will be looking at in a future unit. Neurons are assisted by nearly five times as many supporting cells called **neuroglia**. Specific neuroglia cells are responsible for the production of **myelin**, a lipid which covers parts of the neurons and is vital for the promotion of nerve impulses. You will explore more about nervous tissue during your study of the nervous system.

You have just learned the basics of how cells transport materials in and out of the cell membrane and the four main tissues of the human body. The next few chapters will go much deeper into each specific tissue as it relates to individual organs and organ systems.

I know it's a lot of information, but I know you can do it! I'll see you next week when we dig deeper into...

...the Skin!

Match the following vocabulary terms with their correct definition:

active transport	**facilitated diffusion**	**organelles**
body cavity	**gelatin**	**osmosis**
cardiac muscle	**glands**	**phosphate**
cartilage	**involuntary**	**phospholipids**
cell membrane	**keratin**	**plasma**
collagen	**lipid**	**proteins**
columnar	**lumen**	**semipermeable**
connective tissue	**matrix**	**simple epithelial tissue**
connective tissue proper	**muscle fibers**	**skeletal muscle**
contracts	**muscle tissues**	**smooth muscle**
cuboidal	**myelin**	**squamous**
cytoplasm	**nerve impulse**	***stratified epithelial tissue***
diffusion	**nervous tissue**	
epithelial	**neuroglia**	**striated tissue**
esophagus	**neurons (nerve cells)**	

1)	_____	voluntary tissue which is responsible for movement
2)	_____	"gates" or "revolving doors" within cell membranes which allow certain types of particles to pass through
3)	_____	a chemical made of one atom of phosphorus and four oxygen atoms
4)	_____	a lipid which covers parts of the neurons and is vital for the promotion of nerve impulses
5)	_____	a collection of elongated cells which contract (shorten) to enable locomotion of the organism or movement of the internal organs
6)	_____	a combination of fluid and fibers of various strengths which makes up connective tissue

7)	_____	a pump which drives particles in and out of the cell against the normal flow of diffusion
8)	_____	a special type of diffusion in which only water is being transported through the membrane
9)	_____	a thin, flat skin cell
10)	_____	a wave-like signal that moves through the body by an electric current
11)	_____	actions which are not controlled by the brain
12)	_____	an involuntary tissue making up most of the heart's mass which is primarily responsible for pumping blood
13)	_____	any space in the body between the skin and the outermost tissues of the internal organs
14)	_____	compound formed from processed collagen; used for a variety of industrial products
15)	_____	cube-shaped skin cell
16)	_____	epithelial tissue made of a single layer
17)	_____	epithelial tissue made of several layers
18)	_____	fat
19)	_____	fluid portion of blood
20)	_____	fluid within a cell which acts as a storage area for gases, food, wastes, etc.
21)	_____	group of proteins making up ~30% of all connective tissues; easily and widely converted into gelatin for industrial uses
22)	_____	large molecule made up of a phosphate and two long "tails" of lipids; found in doubled layers as the main component of cell membranes
23)	_____	large organic molecules each possessing a unique function)

24)	_____	most widespread tissue; acts as "cellular glue" forming the framework and support structures for all body tissues and organs
25)	_____	organs responsible for creating and releasing specific chemicals throughout the body
26)	_____	property of the cell membrane which regulates the substances allowed in and out of the cell
27)	_____	protective covering which surrounds a cell
28)	_____	protein produced and used by the epidermis of the skin which provides a protective barrier against infection
29)	_____	responsible for creating and sending nerve impulses throughout the body
30)	_____	responsible for sending the nerve impulses throughout the body
31)	_____	responsible for slow, involuntary movements of the internal organs
32)	_____	skin cells which are much taller than they are wide
33)	_____	specialized structures within a cell
34)	_____	supporting cells: help to support the neurons throughout the body
35)	_____	the inside spaces of a tubular structures such as the esophagus
36)	_____	the movement of any substance from an area of high concentration to an area of low concentration
37)	_____	the muscular tube which carries your food to the stomach
38)	_____	tissue which covers the outside of the body, outer surfaces of organs, body cavities, and various glands
39)	_____	tissues which contain visual stripes on its surface when viewed under a microscope

40)	_____	to shorten
41)	_____	type of connective tissue responsible for protection of bones and flexibility of joints; not as rigid as bone tissue but less flexible than muscle tissue
42)	_____	type of connective tissue which includes tendons, ligaments and fat tissue; strong and flexible tissue which allows the body to hold onto fluids, absorb waste material, and stores fat
43)	_____	very long and threadlike cells which make up skeletal muscle

Choose the correct answer from the following questions:

1) **Facilitated diffusion requires the use of:**
   A) phospholipids
   B) protein gates or channels
   C) cytoplasm
   D) epithelial tissue
   E) organelles

2) **The epithelial tissue found within internal areas that are regularly exposed to friction, such as the esophagus, is:**
   A) transitional
   B) simple squamous epithelium
   C) pseudostratified columnar epithelium
   D) simple cuboidal epithelium
   E) stratified squamous epithelium

3) **The movement of a fluid through a cell membrane from a lower concentrated area to a higher concentrated area is called:**
   A) active transport
   B) bulk transport
   C) osmosis
   D) diffusion

4) **Fat is otherwise known as:**
   A) adipose tissue
   B) loose connective tissue
   C) osseous tissue
   D) areolar tissue
   E) dense connective tissue

True or false:

5) The four main tissue types are squamous, simple, cuboidal, and columnar.

6) The process of facilitated diffusion does not require energy.

7) Stratified epithelium consists of one layer of epithelial cells.

8) Smooth muscle cells are spindle-shaped cells that have an involuntary mode of control.

Application Question:

Compare the cell shapes and thicknesses of the epithelium tissues. Focus specifically on tissues which provide protection and those which carry out diffusion and/or secretion of materials.