

MODULE 3

Introduction to Anatomy & Physiology

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MODULE 3 OBJECTIVES

- 1 Define anatomy and physiology
- 2 Describe the *six levels* of structural organization within the body
- 3 Define pH and describe the scale used for pH
- 4 Describe the anatomical position
- 5 Define and apply the directional terms for anatomy

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REDUCTIONIST VS. VITALIST

Reductionist Point of View

Dieticians and medical professionals have a basic premise that we are “only” the sum of the parts—that biochemistry is the extent of our makeup

Vitalist Point of View

We believe there is more there than biochemistry—that there is an innate intelligence along with the biochemical components. Our premise is that the whole is “greater” than the sum of the parts

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ALBERT SZENT-GYOERGYI

“At every step, more complex and subtle qualities are created, and so in the end, we are faced with properties which have no parallel in the inanimate world...”

We must not lose our bearings or else we may fall victim to the simple idea that any level of organization can best be understood by pulling it to pieces—by the study of its components—the study of the next lower level. This may make us dive to lower and lower levels in the hope of finding the secret of life there.”

“This made, out of my own life, a wild goose chase.”

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INNATE INTELLIGENCE

The body's *innate intelligence* constantly prioritizes and makes decisions about the control of its internal environment and the maintenance of homeostasis

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ANATOMY VS. PHYSIOLOGY

Anatomy:

The study of the body's parts or the body's structure

Physiology:

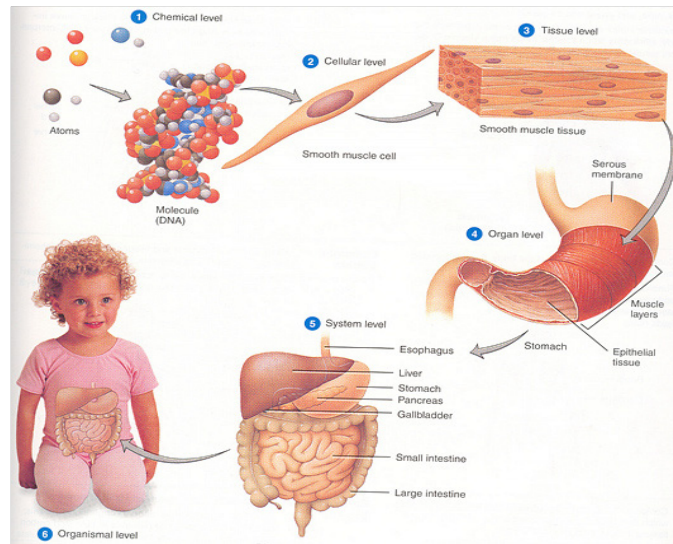
The study of how the body parts work or how the body functions

Structure Determines Function
Function Determines Structure
(These two sciences are inseparable)

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BASICS OF HUMAN ANATOMY



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LEVEL 1: CHEMICAL

We are chemical machines

We are wondrous containers of millions of chemical reactions

LEVEL 1: CHEMICAL (CONTINUED)

- Atoms are the smallest possible piece of an element that retain all the properties of that element

Example: An atom of hydrogen reacts the same as a basket full of hydrogen

- The body is composed of atoms bonded together in various formations

Chemical Elements	% of Body Mass
Oxygen	65
Carbon	18.5
Hydrogen	9.5
Nitrogen	3.2
Calcium	1.5
Phosphorus	1
Potassium	0.35
Sulfur	0.25
Sodium	0.2
Chlorine	0.2
Magnesium	0.1
Iron	.005

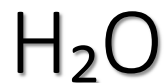
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LEVEL 1: CHEMICAL (CONTINUED)

60% of our body composition is

Water

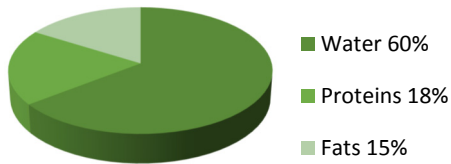


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Chlorine	0.2
Magnesium	0.1
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LEVEL 1: CHEMICAL (CONTINUED)



Water= *Hydrogen/Oxygen*

Proteins= *Hydrogen/Nitrogen/Carbon/Oxygen*

Fats= *Hydrogen/Carbon*

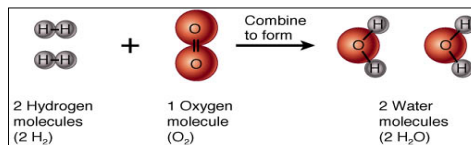
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LEVEL 1: CHEMICAL BONDS

When two or more atoms are bonded together, they form a molecule or compound



The forces that holds the atoms together are referred to as chemical bonds

Ionic Bonds	Covalent Bonds	Hydrogen Bonds
opposite ions attract	shared electron pairs	hydrogen + electronegative atom

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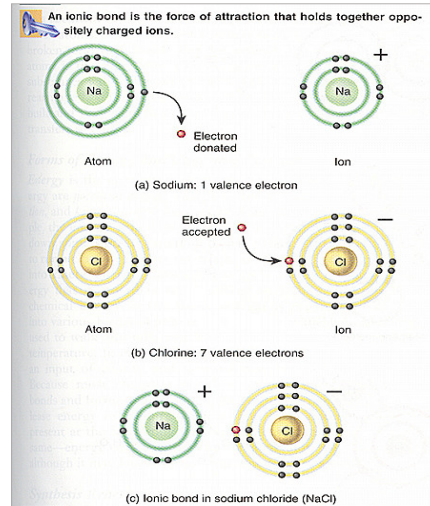
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IONIC BONDS

Ions are atoms that have either given up or accepted an electron

Example: If a sodium atom gives up its electron in the outer shell, it becomes a sodium ion

The bond that holds ions together is a magnetic bond between a positively charged ion (*cation*) and a negatively charged ion (anion)



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LEVEL 2: CELLULAR

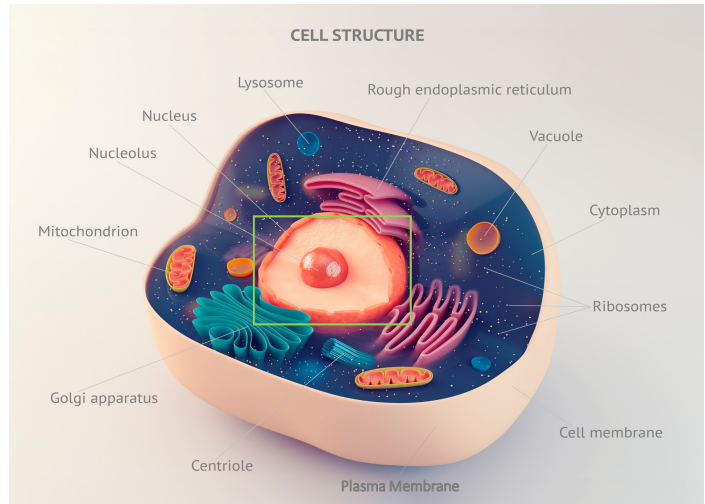
- Cells are made up of many different types of molecules
- While you breathe, cells exchange bad air for good
- While you eat, cells produce enzymes (*proteins that speed up a chemical reaction*) that digest the food and convert the nutrients to a useable form of energy

**Cells are basically the tiny motors
that keep us running**

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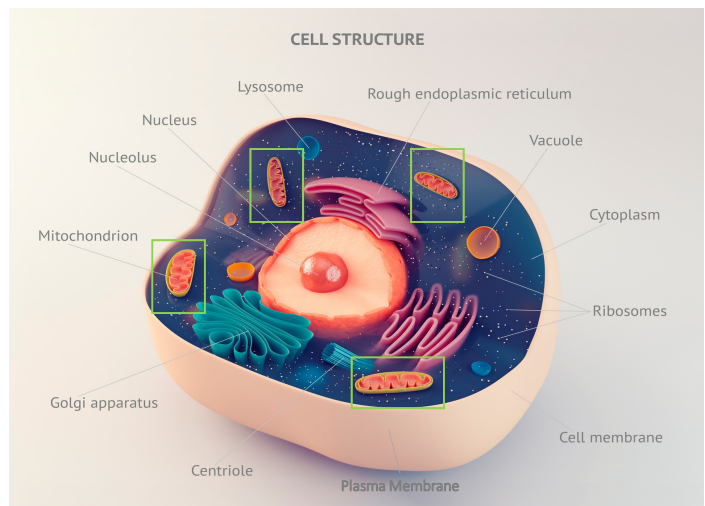
THE FUNDAMENTAL UNIT OF LIFE



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MITOCHONDRIA

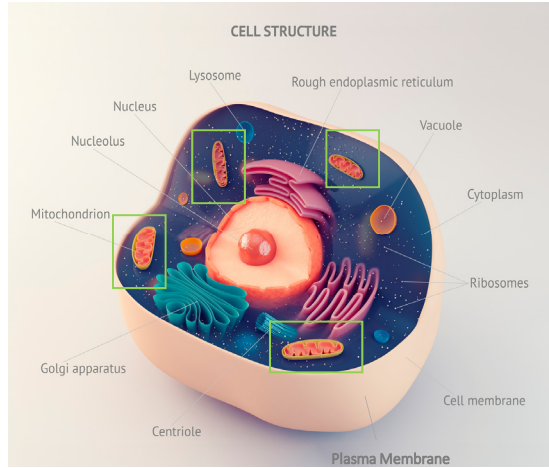


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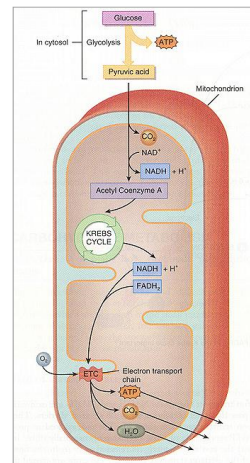
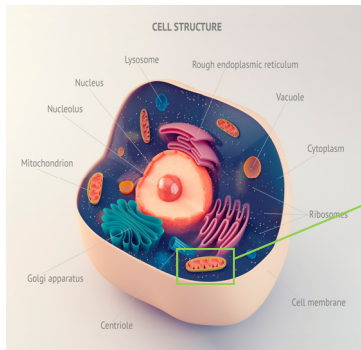
ATP: CELL ENERGY

Metabolic reactions within the cell convert the nutrients in our food (*the fuel*) to the cell's usable form of energy, adenosine triphosphate



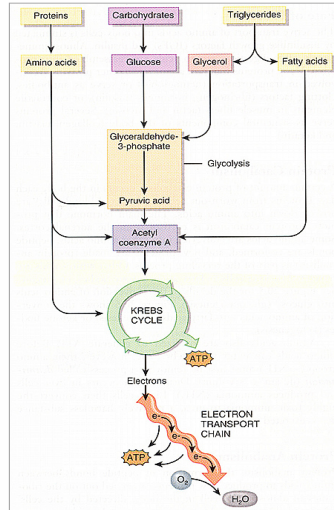
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ATP PRODUCTION



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ATP PRODUCTION (CONTINUED)



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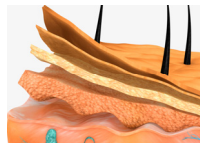
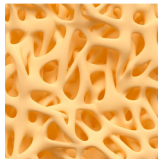
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LEVEL 3: TISSUE

Tissues are made up of cells that work together and perform the same function

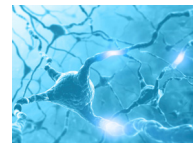
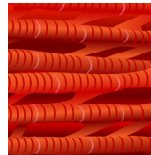
There are FOUR Classes of Tissue:

Connective Tissue



Epithelial Tissue

Muscle Tissue

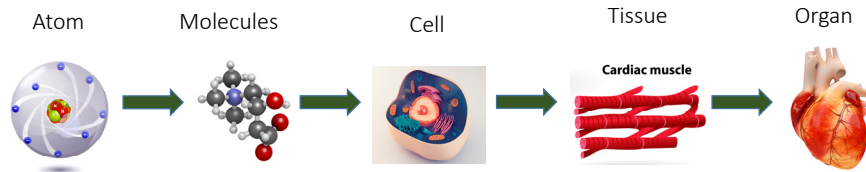


Nerve Tissue

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LEVEL 4: ORGANS



An organ performs a specialized physiological function

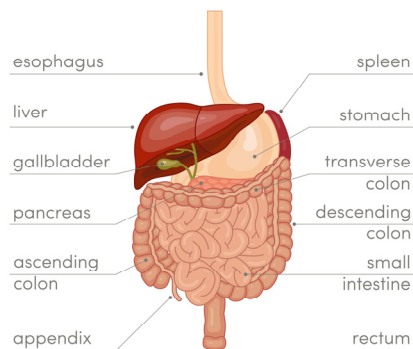
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LEVEL 5: SYSTEMS

An organ system is a group of specialized organs working together to achieve a specific function

DIGESTIVE TRACT



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LEVEL 6: ORGANISM

All the systems of the body combined make up an organism or human being

- The organism (our body) is continuously fine tuning itself to maintain or restore balance among its systems in a process known as **homeostasis**
- Anything that stresses the body (*heat, cold, pain, etc.*), creates a need for adaptation, which means the cells don't work at the optimal level



DEFINITION OF pH

pH stands for **Power of Hydrogen**

It is a numerical value that represents the *acidity* or *alkalinity* of a substance

- *The more hydrogen (H+) the more **acidic***
- *The more hydroxide (OH-) the more **alkaline***
- *A balance of H+ and OH- is **neutral***

The scale for pH runs from 0 to 14, with **0** representing **pure acid**, **7** representing **neutral** and **14** representing **pure alkalinity**

DEFINITION OF pH (CONTINUED)

- Keep in mind that the pH scale represents exponential differences
- Each pH unit represents a tenfold difference of the H+/OH- concentration
- That means a pH of 2 is not twice as *acidic* as a pH of 4, it is **100** times more acidic than a pH of 4
- A pH of 2 is **1,000** times more acidic than a pH of 5

10^0 mol/l	1 mol/l
10^{-1} mol/l	100 mmol/l
10^{-2} mol/l	10 mmol/l
10^{-3} mol/l	1 mmol/l
10^{-4} mol/l	$100 \text{ }\mu\text{mol/l}$
10^{-5} mol/l	$10 \text{ }\mu\text{mol/l}$
10^{-6} mol/l	$1 \text{ }\mu\text{mol/l}$
10^{-7} mol/l	100 nmol/l
10^{-8} mol/l	10 nmol/l
10^{-9} mol/l	1 nmol/l
10^{-10} mol/l	100 pmol/l
10^{-11} mol/l	10 pmol/l
10^{-12} mol/l	1 pmol/l
10^{-13} mol/l	100 fmol/l
10^{-14} mol/l	10 fmol/l

0
1
2
3
4
5
6
7
8
9
10
11
12
13
14

DEFINITION OF pH (CONTINUED)

While the pH scale is defined based on the hydrogen content of a substance, it is the OH⁻ content that determines the alkalinity

A pH of 10 is 100 times more alkaline than a pH of 8

A pH of 12 is 10,000 times more alkaline than a pH of 8

A pH of 7 (*neutral*) is 1,000,000 times more alkaline than a pH of 1

It is equally correct to say a pH of 1 is 1,000,000 times more acidic than a pH of 7

PH EXAMPLES

pH	Examples
14	Lye
13	Oven Cleaner
12	Household Bleach
11	Household Ammonia
10	Milk of Magnesia
9	
8	Seawater
7	Pure Water, Human Blood
6	Urine
5	Black Coffee, Rain Water
4	Tomato Juice
3	Vinegar, Wine, Cola
2	Lemon Juice, Stomach Juices
1	Sulfuric Acid, Hydrochloric Acid
0	

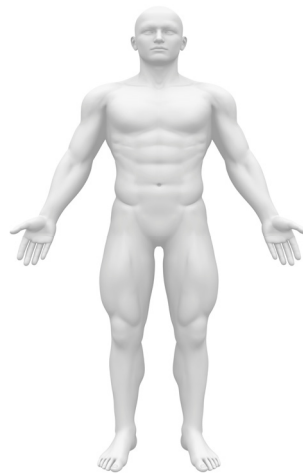
pH OF BODY FLUIDS

pH	Example
7.6 – 8.6	Bile
7.1 – 8.2	Pancreatic Juice
7.35 – 7.45	Blood
6.35 – 7.2	Saliva
4.6 – 8.0	Urine
1.5 – 3.0	Gastric Juice

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ANATOMICAL POSITIONING

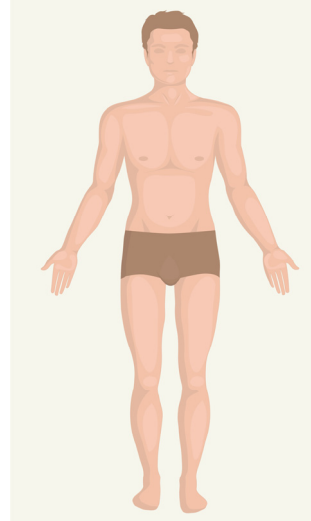


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ANATOMICAL POSITION

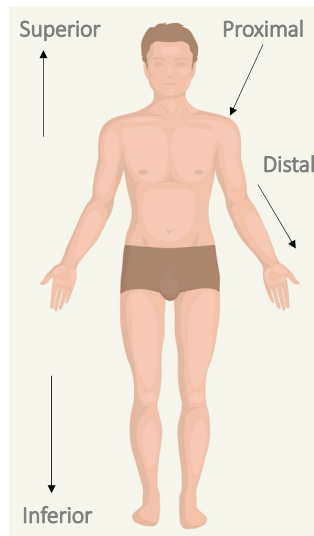
- Face forward
- Look forward
- Arms hanging by your side
- Palms facing forward



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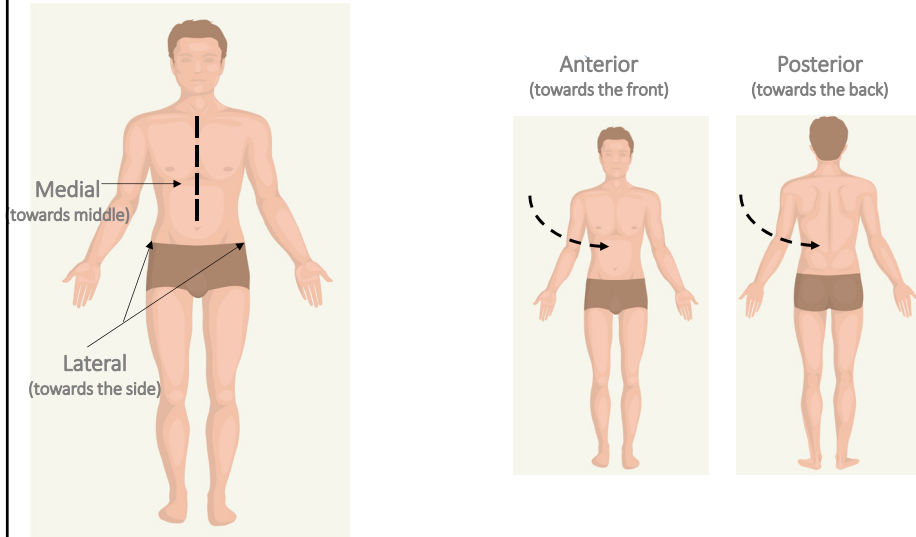
DIRECTIONAL TERMS



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DIRECTIONAL TERMS *(CONTINUED)*



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OTHER DIRECTIONAL TERMS

Ipsilateral	On the same side of the body
Contralateral	On the opposite side of the body
Superficial	Toward or on the surface of the body
Deep	Away from the surface of the body
Bilateral	Relating to or having two sides
Unilateral	Occurring only on one side

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MODULE 3 SUMMARY

- 1** Define anatomy and physiology
- 2** Describe the *six levels* of structural organization within the body
- 3** Define pH and describe the scale used for pH
- 4** Describe the anatomical position
- 5** Define and apply the directional terms for anatomy