

LIST OF MNEMONICS FOR OAT – CrackOAT.com

BIOLOGY/BIOCHEMISTRY

Sodium-Potassium Pump

Naming the DNA Strand = SNoT CODE

Nonpolar/Hydrophobic Amino Acids

Amino Acids with AROMATIC side chains = HTTP

Amino Acids with AMIDE in side chain = AG

Amino Acids with CARBOXYLIC ACID in side chain = AG

Amino Acids with HYDROXYL (-OH) in side chain = "SHOTT"

Sulfur-Containing Amino Acids = "SCUM"

Basic Amino Acids = "HAL" or... LAH LAH LAH LAH I'M SO POSITIVELY HAPPY

Essential Amino Acids

PriVaTe TIM HALL (uses 1st letter of amino acid - NOT the one letter code)

Polar/Hydrophilic Amino Acids

Urea Cycle Compounds

Products of Krebs Cycle/Citric Acid Cycle/TCA Cycle

Carbohydrates

Aldohexoses: All Altruists Gladly Make Gum In Gallon Tanks

Native vs. SDS Page

eCommon Monosaccharides

Anomeric Carbons

Hydrogen Bonding: Hold the F-O-N

Periodi

c Trends

Fates of Pyruvate

Go Ahead And Lactate (GAAL)

Products of Pyruvate Oxidation

Gluc-Mechanisms

Substrates of Glycolysis

Catabolic Steps of Branched-Chain Amino Acids

Clostridium is an obligate anaerobe. = Meaning in the presence of atmospheric oxygen, the bacteria will die off.

CLOSTRIDIUM

Types of Bacteria

Conjugation (Bacteria Reproduction)

Types of White Blood Cells

Never Let Monkeys Eat Bananas (from most abundant to least abundant)

Five Classes of Immunoglobulins (Antibodies)

T cell CD4 and CD8

Antidiuretic Hormone (ADH) aka Vasopressin

Start and Stop Codons

Prokaryote vs. Eukaryote Ribosomal Subunits

Hormones Produced & Secreted by the Anterior Pituitary

Pancreatic Secretions from Islet of Langerhans

Types of Osteocytes

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BIOLOGY/BIOCHEMISTRY

Sodium-Potassium Pump



To remember the # of ions that are pumped across the membrane in the sodium-potassium pump. The Na⁺/K⁺ pump kicks **3 sodium ions OUT** of the cell and lets **2 potassium ions IN** to the cell. As you can see, Na⁺ consists of 3 different things: (1) the letter “N,” (2) the letter “a,” and (3) a plus symbol...so, the Na/K pump sends **THREE** sodium ions out.

“O-K, come **IN!**” → “OK”= 2 letters

“**Na**h, get **OUT!**” → “Nah”= three letters

Naming the DNA Strand = **SNoT CODE**

*Apply the “**SNoT CODE**” when trying to identify the various terms that refer to the same DNA strand

Ssense strand = **N**on-**T**emplate = **C**oding strand

The lazy DNA strand that sits back and relaxes while his complementary DNA strand does all the work, so the DNA police calls over the radio, “We’ve got a Code SNoT.”

Nonpolar/Hydrophobic Amino Acids

Pro VAG LIP (uses first letter of the amino acid - i.e., NOT the one letter code)

Proline

Valine

Alanine

Glycine

Leucine

Isoleucine

Phenylalanine

OR

Procure **VAGinal LIP To Me!!!!**

Proline

Valine

Alanine

Glycine

Leucine

Isoleucine

Phenylalanine

Tryptophan

Methionine

Amino Acids with AROMATIC side chains = **HTTP**

Histidine

Tryptophan



Tyrosine
Phenylalanine

Amino Acids with AMIDE in side chain = AG

Asparagine
Glutamine

Amino Acids with CARBOXYLIC ACID in side chain = AG

Aspartate
Glutamate

Amino Acids with HYDROXYL (-OH) in side chain = "SHOTT"

Serine
(HO-)
Tyrosine
Threonine

Sulfur-Containing Amino Acids = "SCUM"

(S)
Cysteine
(U)
Methionine

Basic Amino Acids = "HAL" or... LAH LAH LAH LAH I'M SO POSITIVELY HAPPY

Histidine
Arginine
Lysine

Essential Amino Acids

PriVaTe TIM HALL (uses 1st letter of amino acid - NOT the one letter code)

Phenylalanine
Valine
Threonine
Tryptophan
Isoleucine
Methionine

Histidine
Arginine
Leucine
Lysine

OR.....using the one letter codes for amino acids

MLK HIV WTF ("Martin Luther King has HIV...WTF?") OR "WTF, MLK has HIV?"

(M) = Methionine
(L) = Leucine
(K) = Lysine

(H) = Histidine

(I) = Isoleucine

(V) = Valine

(W) = Tryptophan

(T) = Threonine

(F) = Phenylalanine

Polar/Hydrophilic Amino Acids

Tyrone got a Cyst on his Glutes while eating Three Asparagi with Serena.

Tyrosine

Cysteine

Glutamate

Threonine

Asparagine

Serine

OR.....

Some Times They Are Good Chemists.

Serine

Threonine

Tyrosine

Arginine

Glutamine

Cysteine

Urea Cycle Compounds

Ordinarily, Careless Crappers Are Also Frivolous About Urination

Ornithine

Carbamoyl

Citrulline

Argininosuccinate

Aspartate

Fumarate

Arginine

Urea

VOMIT

Valine

Odd Chain Fatty Acids

Methionine

Isoleucine

Threonine

Products of Krebs Cycle/Citric Acid Cycle/TCA Cycle

Citrate Is Kreb's Starting Substrate For Making Oxaloacetate



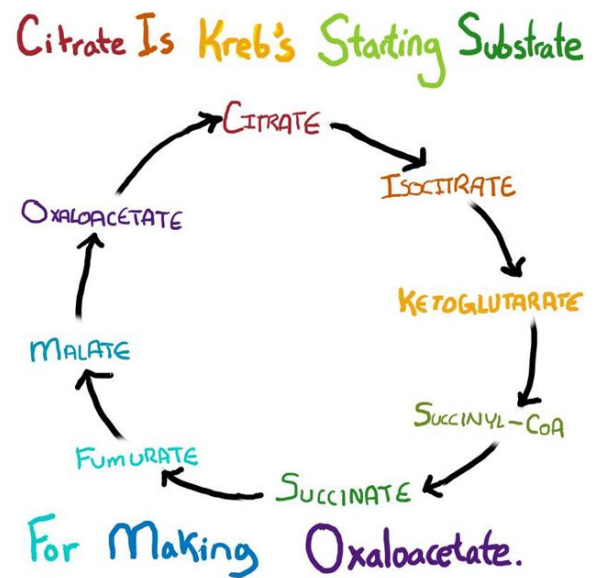
Citrate Is **K**reb's **S**pecific **S**ubstrate **F**or **M**itochondrial **O**xidation

Can I **K**eeP **S**elling **S**ex **F**or **M**oney, **O**fficer?

- Citrate (citric acid)
- Iso citrate
- K** - alpha Ketoglutarate
- S**uccinyl CoA
- S**uccinate (nate is late)
- F**umarate
- M**alate
- O**xaloacetate (first reactant/final product)

Number of Carbons in each step:

C	1	6
I	2	6
K	3	5
S	4	4
S	5	4
F	6	4
M	7	4
O	8	4



*labeled each letter 1 through 8 then I matched up the carbons- the 4's match up.

Carbohydrates

Aldotriose: Glyceraldehyde

Aldo**ET**roses: **ET**

- Erythrose
- Threose

Aldopentoses: Rats Are X-rated Lovers or Sno**RLAX** the Pokémon

- Ribose
- Arabinose
- Xylose
- Lyxose

Aldohexoses: **All Altruists Gladly Make Gum In Gallon Tanks**

- Allose (C3 epimer of glucose b/c "all" has 3 letters)
- Altrose
- Glucose
- Mannose (C2 epimer of glucose b/c has two n's)
- Gulose
- Idose
- Galactose (C4 epimer of glucose b/c "gala" has 4 letters)
- Talose

Native vs. SDS Page

Native Page → Protein is in its **native** environment so it chills and doesn't break down

SDS Page → you get paged to the hospital at 2am and you **break down** crying because you don't want to wake up at that time.

Common Monosaccharides

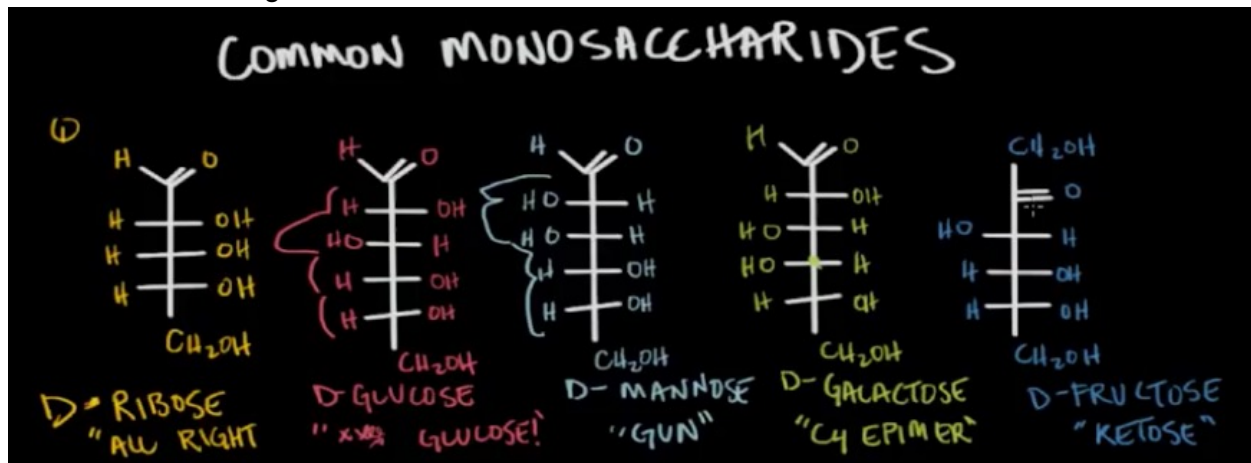
Ribose- "All Right"

Glucose- "Middle finger flipping you off"

Mannose- Man holding a gun or middle is the area where there is a change in the constituents.

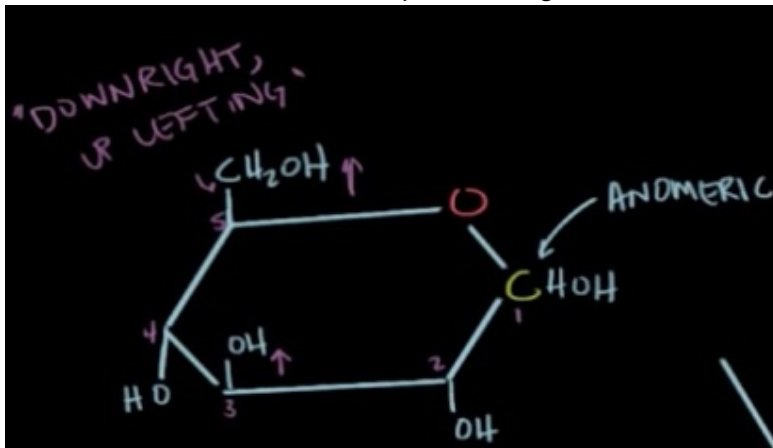
Galactose- C4 epimer; Looks like a "G" when you connect the OH groups

Fructose- Ketose of glucose



Play on the saying "Downright up lifting" = **"DownRight Up Lefting"**

Means: When you have a Fischer projection the members on the right will face down in the ring and the members on the left will face up in the ring.



Anomeric Carbons

The stereochemistry of the anomeric carbon determines whether the Glycosidic linkage is α or β

In α -glycosidic linkages, the anomeric carbon points **DOWN!**

In β -glycosidic linkages, the anomeric carbon points **UP!**

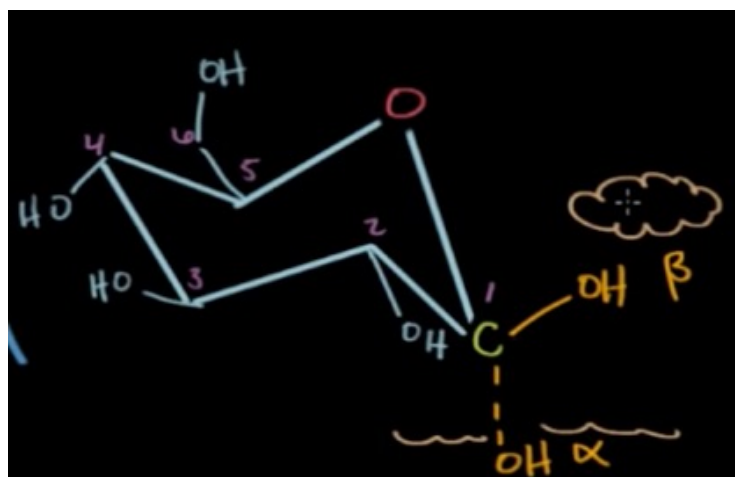
An alpha symbol looks like a fish and fish swim **DOWN** in the ocean!!



A beta symbol looks like a butterfly and butterflies fly **UP** in the sky!!



“Fishies are down in the sea (trans) while Birds are up in the air (cis)”



OR

Beta position = up because BE HAPPY/UPLIFTING/UPBEAT !

Beta= birds are in the sky in the clouds.

Beta = Looks like a thumbs up. Flip the Beta up and it looks like a thumbs up.

Hydrogen Bonding: **H**old the **F-O-N**

Hydrogen + (bonded to) **F**luoride, **O**xygen, and **N**itrogen = Protic solvent.

Bonding:

BARF – break (a bond), Absorb (energy), Release (energy),, Form (a bond) SNAP - Symmetrical (molecule)

Nonpolar Asymmetrical (molecule) Polar TICS -Transfer Ionic, Covalent Share

I Can't Handle Dirty Vans - (Ionic, Covalent, Hydrogen, Dipole, Van der Waals – strength of bonds and intermolecular forces from strong to weak)

Periodic Trends

Write **B.E.A.R** starting in the upper left hand corner of the periodic table in a clockwise fashion or **B.E.A.N**

B = basicity; Upper left

E= All the E's: Ionization energy, electronegativity, electron affinity, ionization energy

A= Acidity

R= Radius

B = basicity; Upper left

E= All the E's: Ionization energy, electronegativity, electron affinity, ionization energy

A= Acidity

N= Nucleophilicity

A hand-drawn periodic table with arrows indicating trends. A green box highlights the top right corner (B, C, N, O, F, Ne). A blue arrow points from the top left (B) towards the bottom right (At). A green arrow points from the top right (He) towards the bottom left (Fr). A blue arrow points from the bottom left (Fr) towards the top right (He). A green arrow points from the bottom right (At) towards the top left (B). The word 'Basicity' is written in blue at the top left. 'Electronegativity' is written in green at the top right. 'Acidity' is written in blue at the bottom right. 'Nucleophilicity' is written in blue at the bottom left.

Fates of Pyruvate

Go **A**head **A**nd **L**actate (**GAAL**)

Glucose

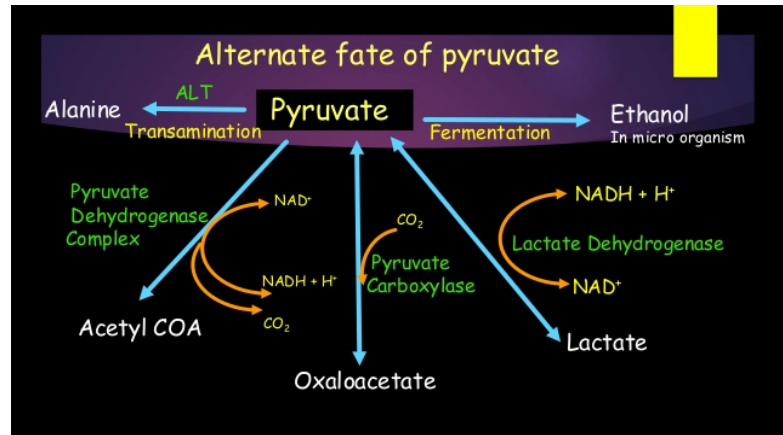
Alanine

Acetyl CoA

Lactate

OR

Pyruvate says, "**MA GOAL**" is the following as alternative processes of usage...



Malate

Alanine

Glucose via Gluconeogenesis *

Oxaloacetate

Acetyl CoA

Lactate

*all happen when the body needs energy except G which occurs when the body does not need extra energy

Roles of Acetyl CoA

Acetyl CoA is **The KFC** of all molecules!

T= TCA reactant

K= Ketone Bodies synthesis donor

F= Fatty Acid synthesis donor

C= Cholesterol synthesis donor

Fatty Acid Metabolism

FATTY Antioni**O!** **OH OH, C** what you did now!

FATTY Acid **O**xidation

Step 1: **O**xidation (yields trans alkene)

Step 2: **H**ydration

Step 3: **O**xidation (only uses NAD⁺)

Step 4: **C**leavage of acetyl CoA (yields CO₂ and acyl CoA)

KREB Cycle Enzymes

Enzymes involved in cycle:

CAIK Sounds So Fucking Mint.

This corresponds to:

Citrate synthase
Aconitase
Iso-citrate dehydrogenase
Alpha-Ketoglutarate dehydrogenase
Succinyl-coA synthetase
Succinate dehydrogenase
Fumerase
Malate dehydrogenase

OR

CAIKeS are **So F**ucking **M**oist!

Products of Pyruvate Oxidation

4 NAked **F**un = **3 C**Oeds + **1 G**uy

4 NADH

FADH₂

3 CO₂

1 GTP

Pyruvate products of complete oxidation

"4 Nice Fun (get) 3 Coors + 1 Guinness"

Complete oxidation of pyruvate yields: 4 NADH, 0 FADH₂, 3 CO₂, 1 GTP

Gluc-Mechanisms

-olysis → breakdown of -neo → new
-genesis → creation of

- Glycolysis – metabolism of glucose to pyruvate
- Gluconeogenesis – metabolism of pyruvate to glucose (making CHO from non-CHO source)
- Glycogenesis – metabolism of glucose to glycogen
- Glycogenolysis – metabolism of glycogen to glucose
- Lipolysis – breakdown of triglyceride into glycerol and fatty acids
- Lipogenesis – creation of new triglyceride (fat)

Substrates of Glycolysis

Goodness Gracious, Father Franklin Didn't Go Buy Perfect Pumpkin to Prepare Pies

Glucose

Glucose-6-phosphate (G6P)

Fructose-6-phosphate (F6P)

Fructose-1,6-bisphosphate

Dihydroxyacetone phosphate (DAP)

Glyceraldehyde phosphate (GAP)

B = 1,3-bisphosphate

P = 3-phosphoglycerate

P = 2-phosphoglycerate

to

Phosphoenolpyruvate (PEP)

Pyruvate

Tissues active with Pentose Phosphate Pathway

MALT OATs

Mammary Gland

Adipose Tissue

Liver

Testes

Ovaris

Adrenal Gland

tissue task is

synthesis

Tissues with active PPP

Tissue	Function
Adrenal gland	Steroid synthesis
Liver	Fatty acid and cholesterol synthesis
Testes	Steroid synthesis
Adipose tissue	Fatty acid synthesis
Ovaries	Steroid synthesis
Mammary gland	Fatty acid synthesis

MyFancy LiFe AS an Orthopedic Surgeon is cool AsFack



Mammary - Fatty Acid synthesis
Liver - Fatty Acid and cholesterol synthesis
Adrenal gland - Steroid synthesis
Ovaries - Steroids synthesis
Adipose Tissue - Fatty Acid synthesis

Catabolic Steps of Branched-Chain Amino Acids

Truck hit the OX to Death

Transamination

Oxidative decarboxylation

Dehydrogenation

Clostridium is an obligate anaerobe. = Meaning in the presence of atmospheric oxygen, the bacteria will die off.

CL₂STRIDIUM

Types of Bacteria

Gram-Positive bacteria ⇒ **stains PURPLE** due to thick peptidoglycan wall

positive (+) sign is thicker than a negative (-) sign ⇒ gram-positive bacteria have thick peptidoglycan wall

Conjugation (Bacteria Reproduction)

F Factor= "Fuck" Factor. "Bacteria Sex"

Types of White Blood Cells

Never Let Monkeys Eat Bananas (from most abundant to least abundant)

Neutrophils

Lymphocytes

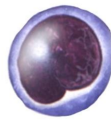
Monocytes

Eosinophils

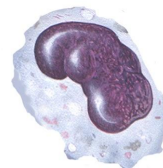
Basophils



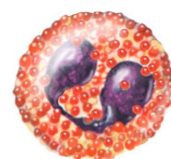
Neutrophil



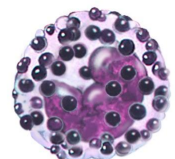
Lymphocyte



Monocyte



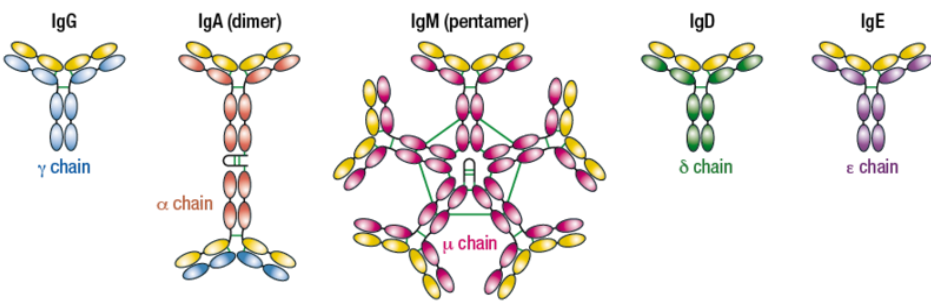
Eosinophil



Basophil

Five Classes of Immunoglobulins (Antibodies)

MAGDEline (girl's name pronounced Mag-deh-line): Follow the letters *MAGDE* like a *line* to determine order of immune response: IgM is first to be released by B cells after exposure to antigen (primary response) followed by IgA or IgG (secondary response)



pentamer because an "M" points

dimer because an "A" is

Ig**M** ← has 5

Ig**A** ← symmetrical with 2 sides

Ig**G** ← trimer

Ig**D** ← trimer

Ig**E** ← trimer because an "E" has 3 lines

OR

Ig**D**
 Ig**A**
 Ig**M**
 A
 Ig**G**
 Ig**E**

or **GAMED**

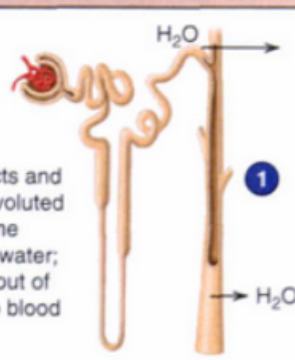
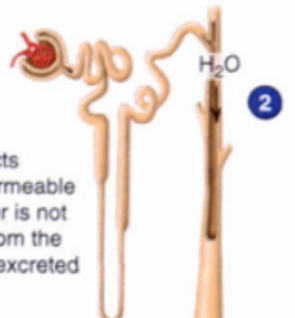
T cell CD4 and CD8

CD FO(U)R = for helping = T helper cells
 CD EIGHT(ATE) = ate cells = T killer cells

Antidiuretic Hormone (ADH) aka Vasopressin

Always **D**igging **H**oles:

- ADH regulates the volume of the blood by making the collecting ducts and distal convoluted tubule more permeable to water. So, if you imagine ADH as always digging holes in the renal tubule, more water is being collected back into the body causing more water to be retained
- Also, **ADH** has an abbreviation the same length (3 characters) as **H₂O**, so ADH affects H₂O permeability

ADH LEVEL	EFFECT ON KIDNEY
Increased ADH Levels	 Collecting ducts and the distal convoluted tubules become permeable to water; water moves out of ducts and into blood
Decreased ADH Levels	 Collecting ducts become impermeable to water; water is not reabsorbed from the filtrate and is excreted

Start and Stop Codons

AUG - in**AUG**urate protein synthesis

UAA - **U** **A**re **A**nnoying

UGA - **U** **G**o **A**way

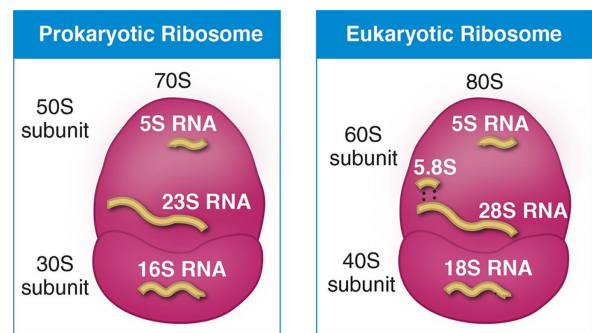
UAG - **U** **A**re **G**one

Prokaryote vs. Eukaryote Ribosomal Subunits

All differ by 20, but prokaryotes < eukaryotes by 10

Prokaryote - odd, 30S + 50S = 70S

Ekaryote - even, 40S + 60S = 80S



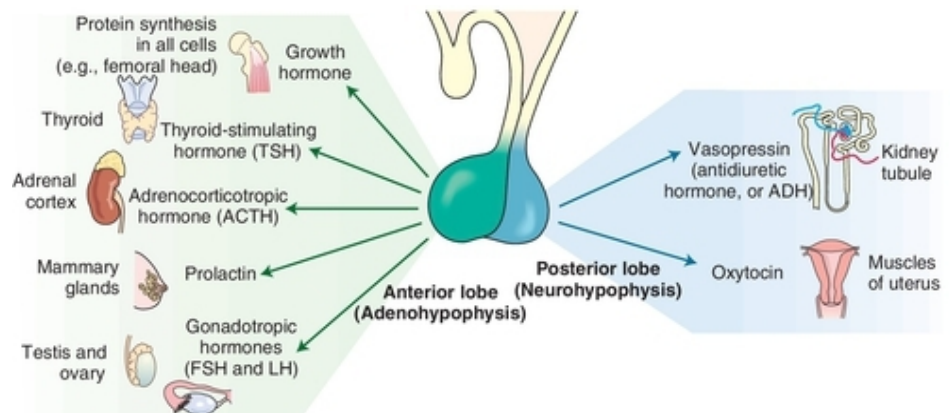
Hormones Produced & Secreted by the Anterior Pituitary

FLAT PEG

Follicle Stimulating Hormone (FSH)
Luteinizing Hormone (LH)
Adrenocorticotropin Hormone (ACTH)
Thyroid Stimulating Hormone (TSH)

Prolactin
Endorphins
Growth Hormone

*Note: FLAT refers to tropic hormones while PEG refers to direct acting hormones.



OR

“**FLAT PiG** lived in the **ANT PIT** (anterior pituitary)”

FSH
LH
ACTH
TSH

Prolactin
i
GH

OR

FLAT PEGgy is a **Direct** woman who lived in the **ANT PIT**.

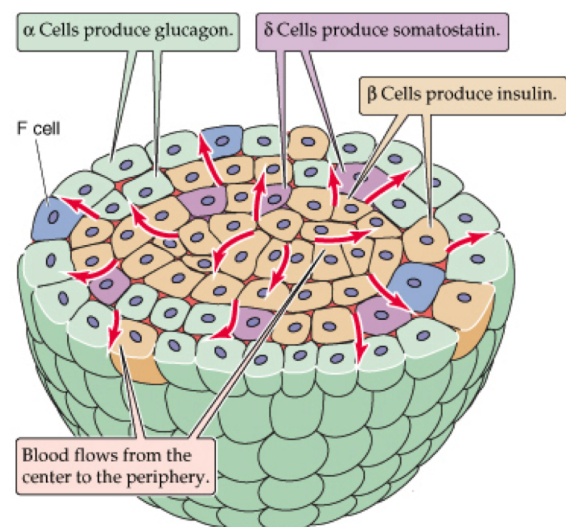
PEG = **direct** hormones; the others all are tropic hormones.

OR

FLAT trop (**ical**) beach and pegs go directly into a board (**FLAT** = **tropic** hormones)

Pancreatic Secretions from Islet of Langerhans

α-cells - secrete glucagon
β-cells - secrete insulin
δ-cells - secrete somatostatin



Types of Osteocytes

Osteo**B**lasts = bone **B**uilders

Osteo**C**lasts = bone **C**rackers

OR Think of **C** like a PAC**C**MAN that eats everything up!

calci**T**ONE in "tones" down the calcium level in the blood
and stimulates osteo**B**lasts ("bone Builders")
so, C (since PTH would be the opposite)

Path that Sperm Travels = **SEVEN UP**

Seminiferous tubules

Epididymis

Vas deferens

Ejaculatory duct

Nothing

Urethra

Penis

Ovarian & Menstrual Cycles Stages = **FOL(d) M(a)PS**

Ovarian Cycle

Follicular phase

Ovulatory phase

Luteal phase

(d)

Menstrual Cycle

Menstrual flow

(a)

Proliferative phase

Secretory phase

Myelin-producing Cells in the Nervous System =

COPS

CNS ⇒ **O**ligodendrocytes

PNS ⇒ **S**chwann

OR

SPOC(k) → Star Trek reference:

Schwann ⇒ **P**NS

Oligodendrocytes ⇒ **C**NS

Neurotransmitters (**FAFSA**)

Note: The primary neurotransmitter in the parasympathetic system is acetylcholine (the receptors are cholinergic). The receptors in the sympathetic system are adrenergic and use epinephrine.

Fight

Acetylcholine (preganglionic fibers)

Flight

Sympathetic

Adrenaline (postganglionic fibers)

Enzymes/Hormones of the Small Intestine

SLAM DECS

Sucrase

Lactase

Aminopeptidase

Maltase

Dipeptidase

Enterokinase

Cholecystokinin (CCK)

Secretin

OR

Garlic Cloves Smell Exquisite

Gastrin

Cholecystokinin (CCK)

Secretin

Enterogastrone (aka gastric inhib peptide)

OR

“i C Damsels in distress” (because their hormones make them poop!).

Cholecystokinin (CCK)

Dipeptidase

Aminopeptidase

Maltase

Sucrase

Enterokinase

Lactase

Secretin

Proteases of Duodenum

Eat **T**ender **C**hicken **C**hunks **E**legantly

Enterokinase (converts trypsinogen → trypsin)

Trypsin (converts other trypsinogen molecules → trypsin)

Chymotrypsin (converts chymotrypsinogen → chymotrypsin)

Carboxypeptidase (converts procarboxypeptidase → carboxypeptidase)

Elastase (converts proelastase → elastase)

OR

CELECT → sounds like “select”

Chymotrypsin (converts chymotrypsinogen → chymotrypsin)

Enterokinase (converts trypsinogen → trypsin)

L

Elastase (converts proelastase → elastase)

Carboxypeptidase (converts procarboxypeptidase → carboxypeptidase)

Trypsin (converts other trypsinogen molecules → trypsin)

*Note: The first enzyme (enterokinase) is produced by intestinal mucosal cells, while the others are produced in inactive precursor forms by the pancreas.

Hormones that Increase Blood Glucose

STENGG

GGENTS → “Ladies & **GGENTS**” I present to you MORE GLUCOSE, cuz why not?!?

Somatotropin (growth hormone)

Thyroid hormone (thyroxine and T3)

Epinephrine

Norepinephrine

Glucagon

Glucocorticoids

Spinal Cord Nerve Origins

Sensory Neurons are afferent & on the dorsal side, while Motor Neurons are efferent & on the ventral side.

SAME DAVE:

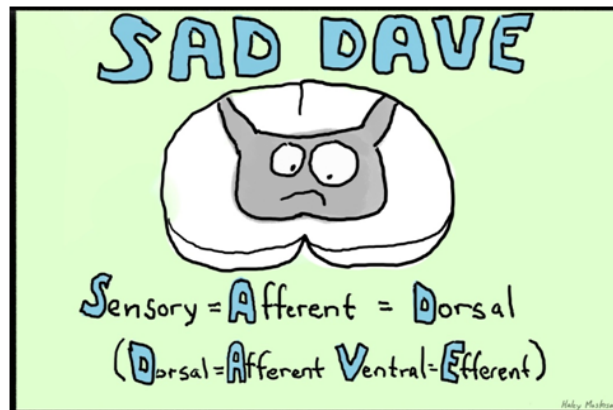
Sensory
Afferent
Motor
Efferent

Dorsal
Afferent
Ventral
Efferent

OR

SAD DAVE

(see image on right)



Respiration Pathway

Please Leave The Boobs Alone

(Pharynx → Larynx → Trachea → Bronchioles → Alveoli)

Taxonomic Order

"King Philip Came Over For Great Sex"

Kingdom
Phylum
Class
Order
Family
Genus
Species

Hypothalamus Functions

"TAN HATS"

Thirst and water balance
Adenohypophysis (aka Anterior Pituitary) or Ant Pit
Neurohypophysis (aka Posterior Pituitary)

Hunger and satiety
Autonomic regulation
Temperature regulation
Sexual urges and emotions

“Hypo the llamas” → think of spraying a hypo filled with water on llamas because they are thirsty. So you are regulating their temperature. Cold showers cool your body and make horny ppl less horny so controls sexual urges.

Hunger Regulating Hormones

GHrelin = HUnger HOrmone (opposite of Leptin)

Endotoxin Features

“ENDOTOXIN”

EEndothelial cells

Negative (gram bacteria)

DDeath/DIC

⇐ what's DIC stand for?

OOuter membrane

TNF

O-antigen

⇐ what do you mean by “O-antigen”?

Xtremely heat stable

IInterleukin 1 (IL-1)

Nitric oxide/neutrophil chemotaxis

Functions of Complement System = “COIL”

CChemotaxis of phagocytes

Opsonization of pathogens

IInflammation

Lysis of pathogens

Blotting Techniques

S - Southern blot

D - DNA (via DNA probe)

N - Northern blot

R - RNA (via DNA probe)

O - omit

O - omit

W - Western blot

P - protein (via antibody probe)

SNOW
DROP

Smooth Muscle Contraction

Calico Cats Contract Muscles = Calcium Cation attaches to Calmodulin, which activates Myosin

Sarcomere Structure

Z-line denotes the BoundareeZ of the sarcomere

Z-line is at the end of the sarcomere like Z is at the end of the alphabet

M-line is in the Middle

H is a THICK letter so it is only the THICK filament

I is a THIN letter so it is only the THIN filament

A band is made up of the thick And thin filament

A is Always the same length

Muscle Filaments

Actin - pronounced "act thin" (thin filaments) → can also pronounce with a lisp... "actthin"

Myosin - mayonnaise makes you fat (thick filaments)

Layers of the Adrenal Cortex = GFR (outer to inner layer)

G = zona **G**lomerulosa makes aldosterone → salt regulation

F = zona **F**asciculata makes cortisol

R = zona **R**eticularis makes sex hormones (testosterone/estrogen)

Cell Types (Germ cells vs Soma Cells)

"**Sperms are Germs**" since boys have germs (cooties). Also it rhymes!

Genetic Diseases

- **Down's Syndrome = Trisomy 21**
 - Tri-s(even) = 21. Those with Down's must trY harder.
- **Edward's Syndrome = Trisomy 18**
 - Edward Cullen of Twilight was (is?) all the rage with the 18 year olds
- **Patau Syndrome = Trisomy 13**
 - Sounds like Judd Apatow whose name has 10 letters, closest to 13

The Cell Cycle

Go **S**anta **G**o, **M**erry **C**hristmas!

Go **S**ally **G**o, **M**ake **C**ells!

Good **S**omatic cells **G**row in **M**itosis **C**lose!

G1

S-phase

G2

Mitosis

Cytokinesis

OR

THE CELL CYCLE			
State	Phase	Description	Real Life Comparison
Resting	Gap 0	Cell has left the cycle and has stopped dividing.	You're born. No romantic inclinations.
Interphase	Gap 1	Cells increase in size. The G1 checkpoint ensures that everything is ready for DNA synthesis.	You start dating. Go through some people. Friends come in and don't approve. They don't like your choices in life.
	Synthesis	DNA replication occurs.	This is when you take a break, and try to "find yourself" and what you want and need in life.
	Gap 2	Cell continues to grow. The G2 checkpoint control mechanism ensures that everything is ready to enter the M (mitosis) phase and divide.	You know who you have is great. He/she meets your parents and they give you the okay!
Cell Division	Mitosis	Cell growth stops and cellular energy is focused on the orderly division into two daughter cells (PMAT).	You make babies.

Mitosis = PMAT

Prophase

Metaphase

Anaphase

Telophase

Primary oocyte arrests in Prophase I

And Secondary oocyte arrest in Metaphase II

So, PRI PRO SEC MET

think of it like a chant

Nucleotides

Purines are **PUR**e **As** **Gold** $\Rightarrow$ 2 ringed structures

A = adenine

G = guanine

Pyrimidines: **CUT** the **Py** $\Rightarrow$ 1 ring structures (Pys--like the "pies" you eat--have only 1 circle/ring)

C = cytosine

U = uracil

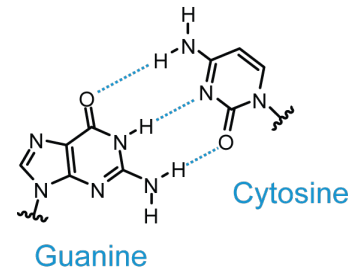
T = thiamine

Strength of Nucleotides

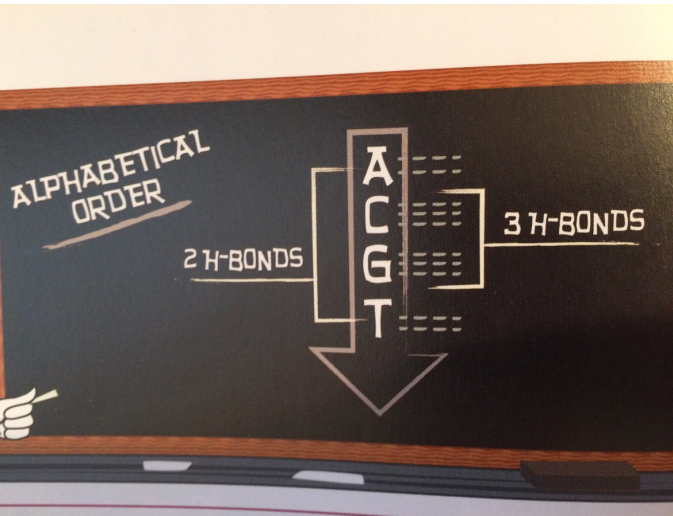
Crazy **G**lue

Strongest bonds are between **C**ytosine and **G**uanine
(3 H-bonds)

OR



Hydrogen bonding between base pairs:

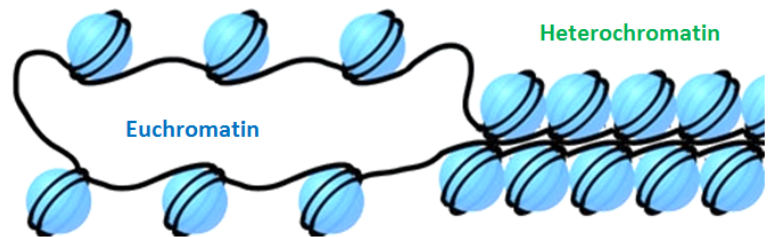


To remember the number of hydrogen bonds alphabetically arrange the base pairs and then the middle 2 i.e. C and G have 3 and the first and last i.e. A and T have 2

Chromatin Structure

Hetero**C**hromatin = **H**ighly **C**ondensed

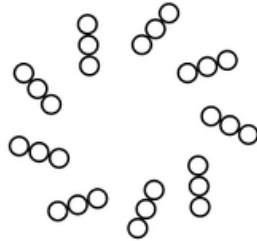
EuChromatin = truly transcribed (**eu** means true)



Microtubule Arrangement

Centriole

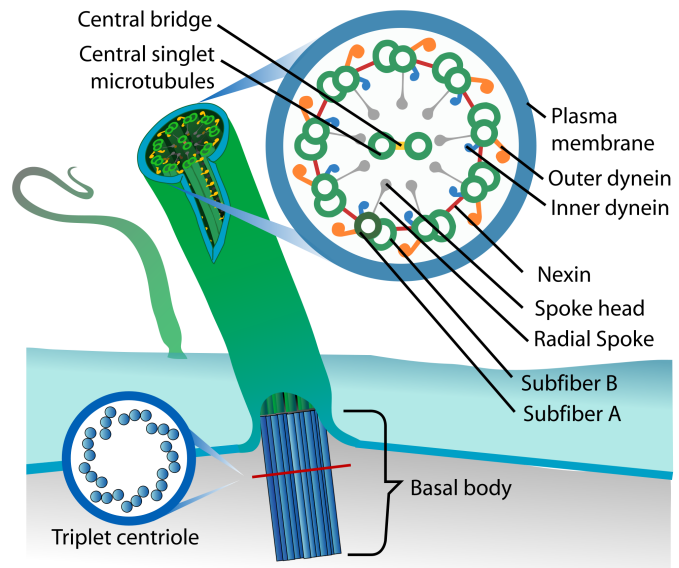
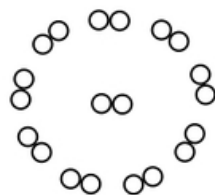
9 **tr**iplets



Flagella Cilia

'9+**2** arrangement'

9 pairs + **a pair**



Embryonic Germ Layers

Ectoderm = **E** words- exterior layer/ enamel/ encephalon (brain), epidermis

Mesoderm = **M** words- middle layer/ mesenchyme/ muscles

ENdoderm = **IN**_{doderm}. **IN**side layer (GI tract, resp tract and thyroid/thymus)

OR

ectoderm= **ATTRACTO**-DERM

endoderm= In(**EN**)-side

mesoderm= means of **m**ovement (blood, circulatory system, muscles, bones, all these structures help you move or are fluids that move/flow inside the body)

OR

MESO: DAN'S C-class MERC

Think MErc = MEso

Dermis

Adrenal Cortex

Notochord

Skeletal (Bones)

Circulatory System

Muscles

Excretory system

Reproductive System

Cavity Living

ECTODERM: CAMPS TAN

(think tanning happens outside... ecto = outside)

C= Cornea and lens

AM= anus/mouth epithelial

P= Pineal and pituitary gland Epithelial

S= Sensory receptors in epidermis

T= Tooth enamel

A= Adrenal medulla

N= Nervous system

S= Skin Epidermis (sweat glands, hair follicles)

ENDODERM: DR, UR LiTT!

(when you are Litt means inside are drunk and endo = inside OR you need lights to be lit inside)

D= Digestive tract epithelial lining

R = Respiratory tract epithelial lining

.

U = Urethra. Urinary bladder

R = Reproductive system

L = Liver

(i) = nothing

T = Thymus

T = Thyroid and parathyroid

Chordate Features

CHORey!- **D**o **N**ot **P**inch **P**eople

Dorsal, hollow nerve cord

Notochord

Pharyngeal slits

Postanal tail

Stages in Embryonic Development

Must **B**e **G**ood

Morula

Blastula

Gastrula

OR

Developing Embryos (babies) Must Be Good

Come, **L**et's **G**et **S**un**B**urned

C - (stratum) corneum

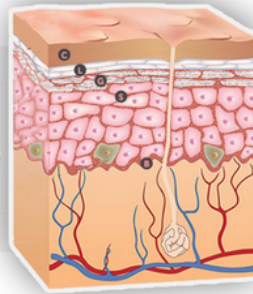
L - (stratum) lucidum

G - (stratum) granulosum

S - (stratum) spinosum

B - (stratum) basale

C CORNEUM
L LUCIDUM
G GRANULOSUM
S SPINOSUM
B BASALE



Layers of the Epidermis

Eukaryotic Transcription in the nucleus

"RoomMaTes in the nucleus"

The 3 types of Eukaryotic RNA polymerase make:

RNA pol I- **r**RNA

RNA pol II- **m**RNA

RNA pol III- **t**RNA

(1,2,3....r,m,t) → chant it... "one, two, three...are, emm, tee" (kinda rhymes)

Bacterial Transcription

The 3 types of DNA polymerase:

DNA pol I- **remove** (RNA Primer)

DNA pol II- **repair**

DNA pol III- **replicate** (and proofreading)

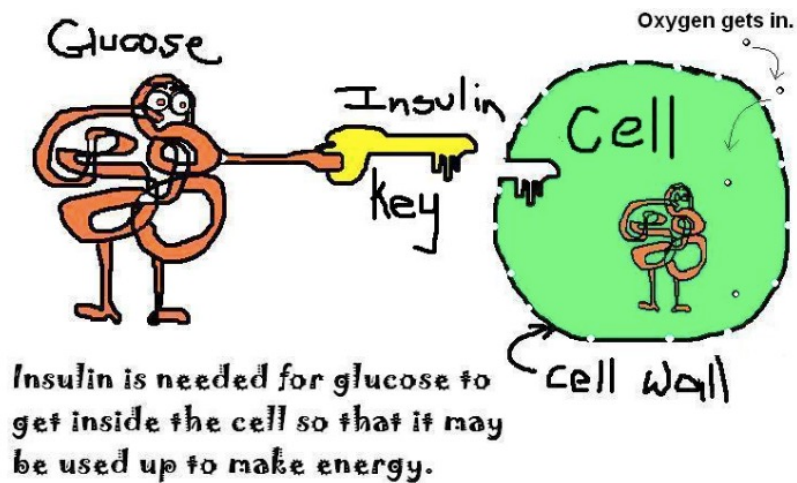
***Notice I, II, III are in alphabetical order: reMove, rePAir, rePLicate.**

Insulin

Insulin functions on cells: INSullIN stim 2 things to go IN 2 cells= K⁺ and glucose

OR

Think, Insulin = A KEY. You need a key to open the door (for glucose to come in).



Oxygen Dissociation Curve

O₂ dissociation rightwards shift:

Remember that a right shift is a **DATE** w/ CO₂

D- 2,3 Diphosphoglycerate DPG

A- acidosis

T- temperature

E- exercise

ACE BATs right-handed

Acid

CO₂

Exercise

2,3-**B**PG

Altitude

Temperature

Right shift—**ACE BATs** right handed:

Acid

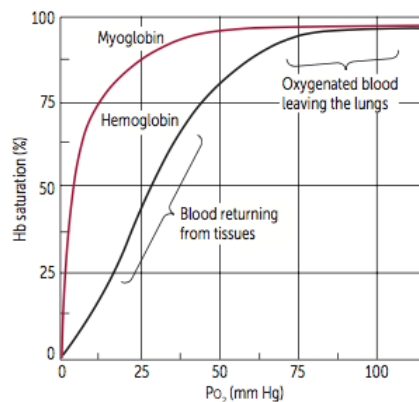
CO₂

Exercise

2,3-**B**PG

Altitude

Temperature



Liver Functions = (PUSH DoG)

Protein synthesis

Urea synthesis

Storage

Hormone synthesis

Detoxification

O

Glucose and fat metabolism

Electron Transport Chain (ETC)

Auburn S: For the ETC, I remember the number of hydrogens pumped by each complex by....you know how in football plays, the quarterback will yell a color and then a number for example like, "blue 40, red 42"?

4 0 4 2

Complex I → pumps 4 protons

Complex II → pumps 0 protons

Complex III → pumps 4 protons

Complex IV → pumps 2 protons across the inner mitochondrial membrane.

Side Note:

Cytochrome c = 1e- at a time for a total of 2

Q= 2e-

Functions of Proximal Tubules

ROW USA

Reabsorb

Organic solutes

Water

Urea

Secretes

Ammonia

Deviations from Hardy-Weinberg Equilibrium are caused by:

Maggie Mae Does Not Smoke

Mutations

Migration

Drift (genetic drift)

Non-random mating

Selection

Heart Circulation (sequence blood flows through valves)

Toilet Paper My Ass

RA/Tricuspid/RV → Pulmonic valve → LA/Mitral valve/LV → Aortic valve

OR

LABRAT

Left Atrium Bicuspid Right Atrium Tricuspid

OR

“Tri B4 you Bi” - Tricuspid before Bicuspid Valve

B Vitamins:

“These ribs need paprika. Pile it on boy. Faster, come!”

These: Thiamine = B1

Ribs: Riboflavin = B2

Need: Niacin = B3

Paprika: Pantothenic acid = B5

Pyle: Pyridoxine = B6

Boy: Biotin = B7

Faster: Folate = B9

Come: Cobalamine = B12

Chemistry/Organic Chemistry

General:

Roy Hates To Order Fries (for half life problems – Radioisotope, Half life, Total time, Original mass, Final mass)... if you're given 2 times, divide them... if you're given 2 masses, do arrows.

Endo – energy on left (N comes first alpha), Exo – energy on right (X comes last alpha)

Vaporization – boil, evaporate, vaporize, condense Fusion – freeze, melt, solidify, crystallize

Sublimation – S to G

Deposition – G to S

S to L to G endo

G to L to G exo

“mobile sea of electrons” metallic bonding

α to β to γ least to most penetrating (alpha, beta, gamma)

Complete combustion makes CO_2 , incomplete combustion makes CO.

Fission (split), Fusion, Unite

Fission – Uranium, Fusion – H or He

Acids and Bases: irtty

Electrolytes- ABS (acids, bases and salts) BAAD (bases accept H^+ , acids donate H^+)

ATE/IC/ITE/OUS The disease you get when you try to name your oxyacids. AA- Add Acid to Water

Cations

atom with a loss of electron. Has a + charge. ; Mnemonic: $\text{Ca}^{+} \text{Cl}_2^{-} = \text{CA}_{\text{tion}}^{+} \text{Cl}_2$

The “t” in cation looks like a “plus” sign, thus cations have a + charge

Acid/Base Definitions

	Donor	Acceptor	
Proton (H ⁺)	ACID	BASE	Bronsted
Electron (e ⁻)	BASE	ACID	Lewis

Bro(**H**)s(**+**)ed → Proton (H⁺) donor or acceptor.

L(**e**-)wis → electron (e⁻) donor or acceptor

+ is the opposite of - so Bronsted ACID will always be the opposite: (Lewis) Base

Membrane + Cholesterol

Temperature	Without Cholesterol	With Cholesterol
Cold	Rigid Solid	Fluidity
Hot	Fluidity	Rigid Solid

Cram C holesterol to make C lose C ontact between hydrophobic tails!

Cholesterol = Door Wedge. Put a door wedge to prevent the door from moving. (making it rigid)

Oxidation & Reduction

LEO the lion, goes GER

Loss of E lectrons → O xidation

Gain of E lectrons → R eduction

OR

OIL RIG

Oxidation is Loss

Reduction is Gain

Anodes in galvanic: (Anode = Negative)

Cathode/Anodes in Electrodes: "An Ox or a RED FAT CAT"

OR

"RED CAT is a Fat Cat"

RED CAT = Reduction is Cathode

FAT Cat = electrons flow From Anode To Cathode

"An ox"

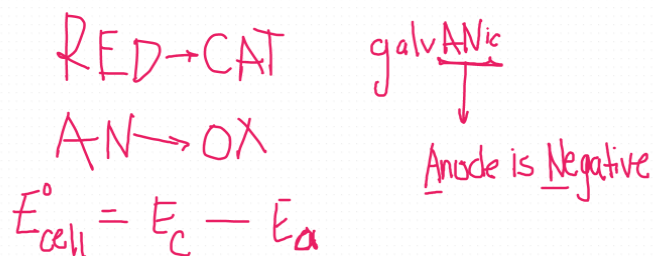
Anode for oxidation

AOL	vs	RCG
anode/oxidation/loss of e-	vs.	reduction/cathode/gain of e-

Electrolysis

MIT is nF (enough)

M-moles deposited at an electrode = It/nF



Acidity Factors (also Induction effects) :

5 Factors: **CARDIO**

- **C**harge
- **A**tom
- **R**esonance
- **D**ipole Induction
- **O**rbitals

Gabriel^L Synthesis steps

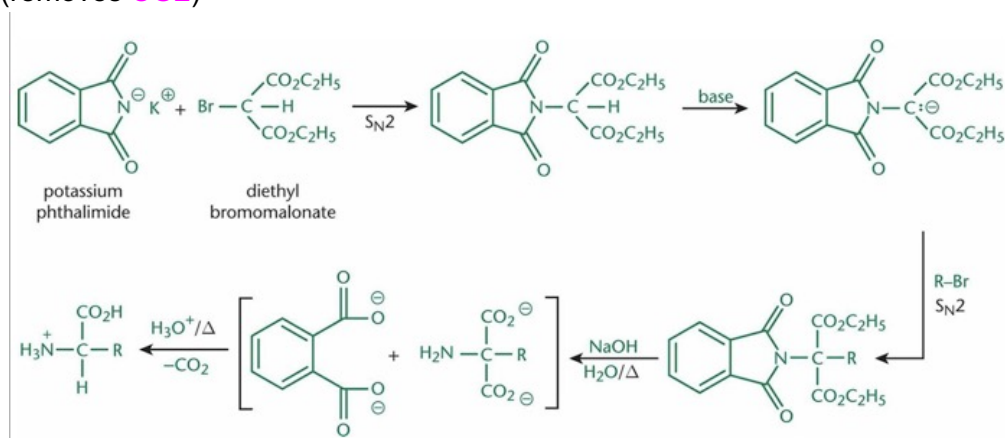
L amino acid synthesis!

SoB SoB i Hate Cutting Onions²

S=SN2

B=Base

H=Heat (removes **CO₂**)



Strecker Synthesis Steps:

Think Streck**L**er = **L** amino acid synthesis

AWw - **P**atty **W**on't display **P**ublic **A**ffection

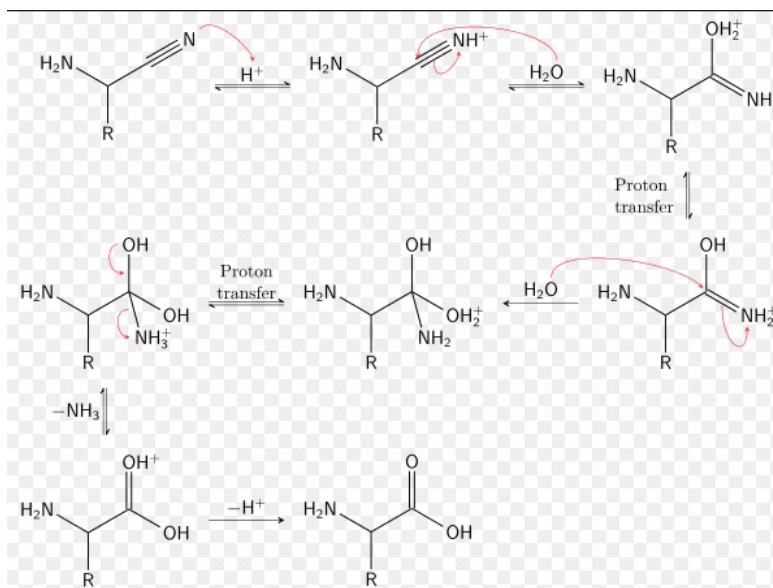
Acid

Proton Transfer

Water

Proton Transfer

Acid



Energy Levels

Bruce Banner (not all hulked out and in his human form) is of "low-energy" and when he becomes the Hulk, he's "high energy"....when he makes this transition, he absorbs his green-ness. So, when going from a low energy level to a high energy level, a photon is absorbed. The reverse is also true, when the Hulk dehulkifies (definitely just made up that word) he goes from a high energy state to a low energy state and releases his green-ness. Thus, when an electron goes from a high to low energy level, a photon is released/emitted

Spectra Line Emissions

"**I R P**aschen"

Paschen = **I R** light

Balmer = "to **B**e **VIS**ible"

Lyman = UV light

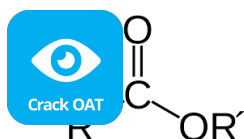
Lyman= "**LUV**"

Lyman = UV light

Functional Groups

Esters:

ESTER likes to drink **COORs**



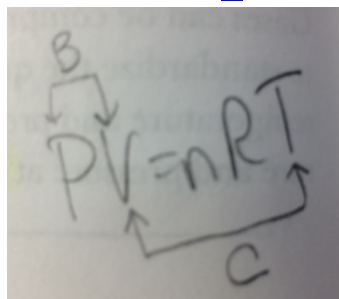
rEthers:

I always remember ethers because “ether” sounds like “either”so, “either-OR””ethe**R-OR**”

Gas Laws

Charles Law and Boyle’s Law

B comes before C



OR

“**Voil under Pressure**” = V/P

OR

Sam’s story to to remember the gas laws:

1. Avogadro’s Law

- a. He was into counting big numbers, so his law focuses on the number of molecules. Therefore, Avogadro’s law deals with the relationship between moles of gas and volume.

2. Boyle’s law

- a. Big Boy Boyle sat on his lunch and smashed it (decreased the volume of his sandwich), by increasing the pressure on it. Therefore, Boyle’s law deals with the relationship between pressure and volume.

3. Charles Law

- a. Good ol’ Chuck overheated his popcorn and it scattered all over (increased its volume). Therefore, Charles law deals with the relationship between temperature and volume.

PLIGHT for conditions when a gas will behave more ideally. Pressure Low Ideal Gas High Temp

Solubility

Ag (silver), **Pb** (lead), and **Hg** (mercury) are INSOLUBLE, except when they **NAP**

Nitrates

Acetate

Perchlorate

Solubility Rules

(almost) ALWAYS Soluble Elements: **NAG SAG**.

Think, when your pants SAG, someone will always NAG you to bring them back up.

almost Solubility Rules (Tricks)
ALWAYS Soluble

N itrates (NO_3^-)	Exceptions (2 groups) 1. "PMS" * - P $\rightarrow$ Pb⁺² (lead) - M $\rightarrow$ Mercury (Hg_2^{+2}) - S $\rightarrow$ Silver (Ag^+)
A cetates ($\text{C}_2\text{H}_3\text{O}_2^-$)	
G roup 1 (Li^+ , Na^+ , etc)	2. Castro Bear * Ca⁺² Sr⁺² Ba⁺²
* S ulfates (SO_4^{-2})	
A mmonium (NH_4^+)	
* G roup 17 (F^- , Cl^- , Br^- , etc)	

Watch reference for explanation. Reference: <https://www.youtube.com/watch?v=AsCLuLS-yZY?>

Solubility exceptions:

S(ully) and her fluffy **Castro Bear** are inseparable when she is **PMS**ing!

Su- sulfates

Castro Bear- *see above*

PMS- *see above*

Castro bear is inseparable from **S**nickers but hates **SOH**da.

S- sulfates

S- sulfides

OH= hydroxides

Addition of amine to carbonyl group: **SE PI** or **SEe Ple**

SE= secondary amine- enamine

PIE/PE= primary amine- Imine

BONDING- HONC

H- req 1 electron

O- 2 electrons

N- 3 electrons

C- 4 electrons

Dicarboxylic Acids

Oh **M**y **S**uch **G**reat **A**pple **P**ie!

Oxalic Acid

Malonic Acid

Succinic Acid

Glutaric Acid

Adipic Acid

Pimelic Acid

Cyclohexane Conformations

Gauche = its "gauche" aka inappropriate for 1 CH₃ group to stand too close to another group

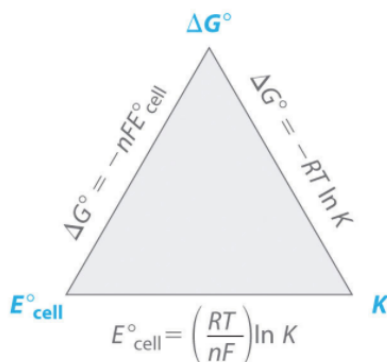
Cyclohexane ring: when you have low energy, you sit down in a CHAIR to rest

BOATS can be tippy so they are less stable

Gibbs Free Energy

Good Honey Tastes Sweet

$$\Delta G = \Delta H - T\Delta S$$



ΔG°	E°_{cell}	K	Direction of Reaction
< 0	> 0	> 1	spontaneous in forward direction
> 0	< 0	< 1	spontaneous in reverse direction
0	0	1	no net reaction: system at equilibrium

Spontaneity (controlled by Free Energy) in Thermodynamics

DELICIOUS GRAPEFRUIT - NOT FOR EVERYONE

$$\Delta G = -nFE$$

So,

-E → +G thus not spontaneous

+E → -G thus spontaneous

Meta-Directing Groups (Benzene Ring)

Queen Elizabeth II (S)econd's Navy Commands, Controls, and Communicates

Quaternary amino (-RNH₃⁺)

Ester (-COOR)

Sulfonic acid SO₃H

Nitro (-NO₂)

Carbonyl (-CHO)

Carboxylic acid (-COOH)

Cyano (CN-)

Acidity Factors:

5 Factors: **CARDIO**

- Charge
- Atom
- Resonance
- Dipole Induction
- Orbitals

OR

Order of importance: **ARIO**

A- atom



R- resonance

I- induction

O- orbital

Molar mass: DIRTY (drT) Pee (P)

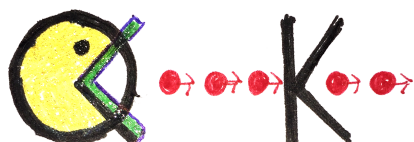
drT/P

Nernst equation

We minus Arty (RT) (is) Enough (nF), Thank You (lnQ)

$$E = E_a - (RT/nF) \ln Q$$

K vs. Q Reaction direction



When you draw a "<" into the Q it makes it look like Mrs. Pacman wants to eat K so it will go RIGHT to eat K
The legs of K makes a "<" and turns into an arrow that points to the LEFT.

Ortho and Para directing groups on a benzene ring : " AHA AHA P"

Alkyl (-R)

Halogen (X)

Alkoxy (-OR)

Amino -NH₂, NHR, NR₂

Hydroxyl (-OH)

Amide- NHCOR

Phenyl (-C₆H₅)

am(pH)oteric= having both acid and base functional groups.

State Functions

VG PHEST (Very Good Festival)

Volume

Gibbs free energy (ΔG)

Pressure

H - entHalpy (ΔH)

E - (i)nternal **E**nergy (ΔE)

S - entropy (ΔS)

Temperature

Types Of Reactions

SEA MOuRNS CANNed PEAs

Substitution Electrophilic Aromatic

Most Other Reactions - Nucleophilic Substitution Carbonyl Addition Nucleophilic

Pi bonds- Electrophilic Addition

Diatomic Elements

Have No Fear Of Ice Cold Beer

H₂ N₂ F₂ O₂ I₂ Cl₂ Br₂

Rates of inhibition

Mnemonics:

▪ KoMpEtitive INhibitor

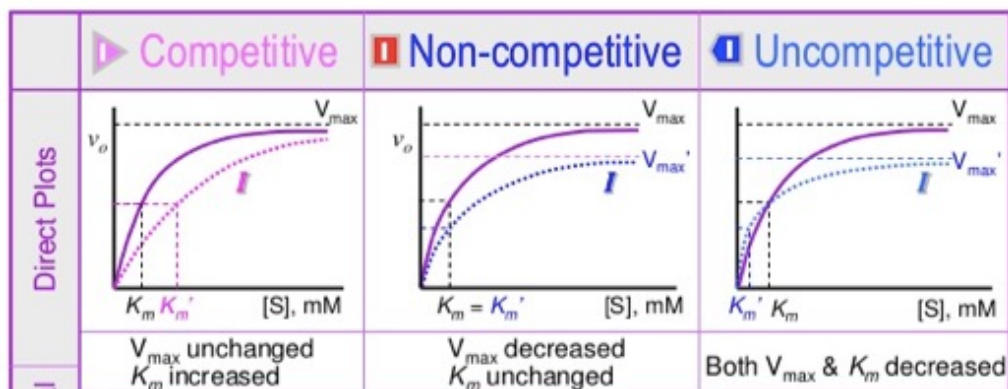
- KM INcreases

▪ NOOnKoMpEtitive Inhibitor

- NO KM INcrease

▪ UNcompetitive

- "Both go UNder"



PHYSICS

Capacitors-Charge

Quintessential Curriculum Vitae

$$Q=CV$$

or

$$Q = VC \text{ (like....QVC, the shopping channel)}$$

OR

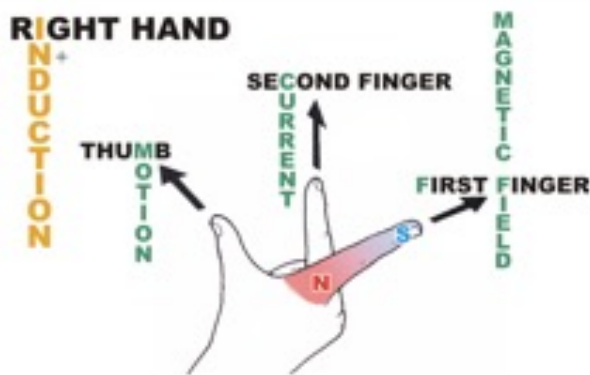
Quite Curvy and Voluptuous

Capacitors-Energy

England Hails Queen Victoria

$$E= 1/2 QV$$

Induction- Right hand



Vision (Myopia & Hyperopia)

Myopia ⇒ **NEAR**sighted vision.

- a person with myopia would say: Come near me, so I can see you.
- come **NEAR MY OPIum!**

Hyperopia ⇒ **FAR**sighted vision

- since hyper means above or beyond you know they can only see above and beyond normal distance.

Electromagnetic Spectrum (in order of increasing frequency and decreasing wavelength)

Ronald Mcdonald Invented Very Unusual & eXcellent Gherkins

OR

Ronald Mcdonald Is Visiting Ur X-Girlfriend (with increasing frequency)

Radio

Micro

Infrared

Visible spectrum

Ultra-violet

X-rays

Gamma

VISIBLE LIGHT (in order of increasing frequency): ROYGBIV

Violet is violent therefore it contains a lot of energy and has the longest frequency.

Force on a Charge Moving in a Magnetic Field:

if direction is perp. To magnetic field

Fast Quality Vitalizes Business

$$F = qvB$$

$$\text{Newtons} = C \times m/s \times T$$

Optics

ConcaveD = think "D- for diverging". Can't add D to Convex. ConvexD isn't a word!"

Convex= think that the bottom of the lense makes a "V" as in conVex.

D DUV

Diverging mirrors and lense the image is always

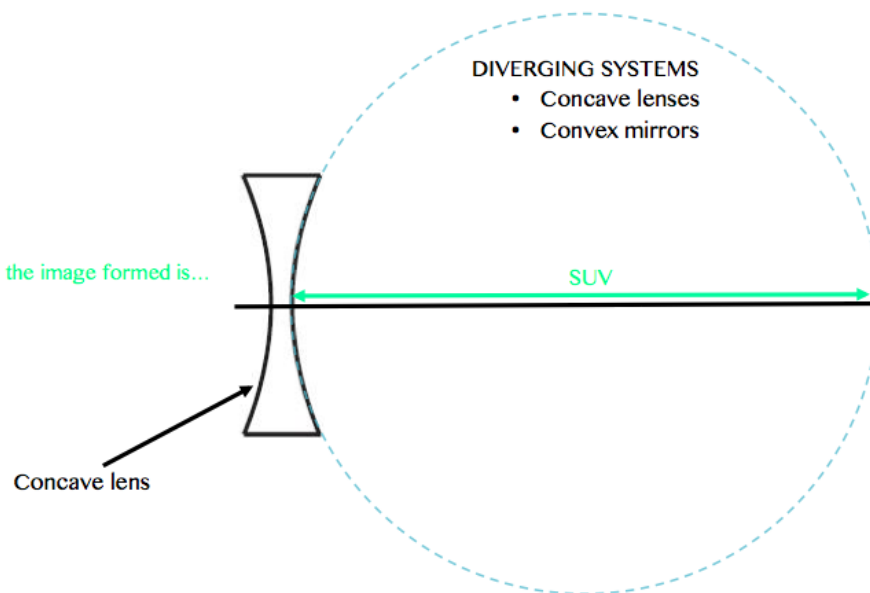
Diminished

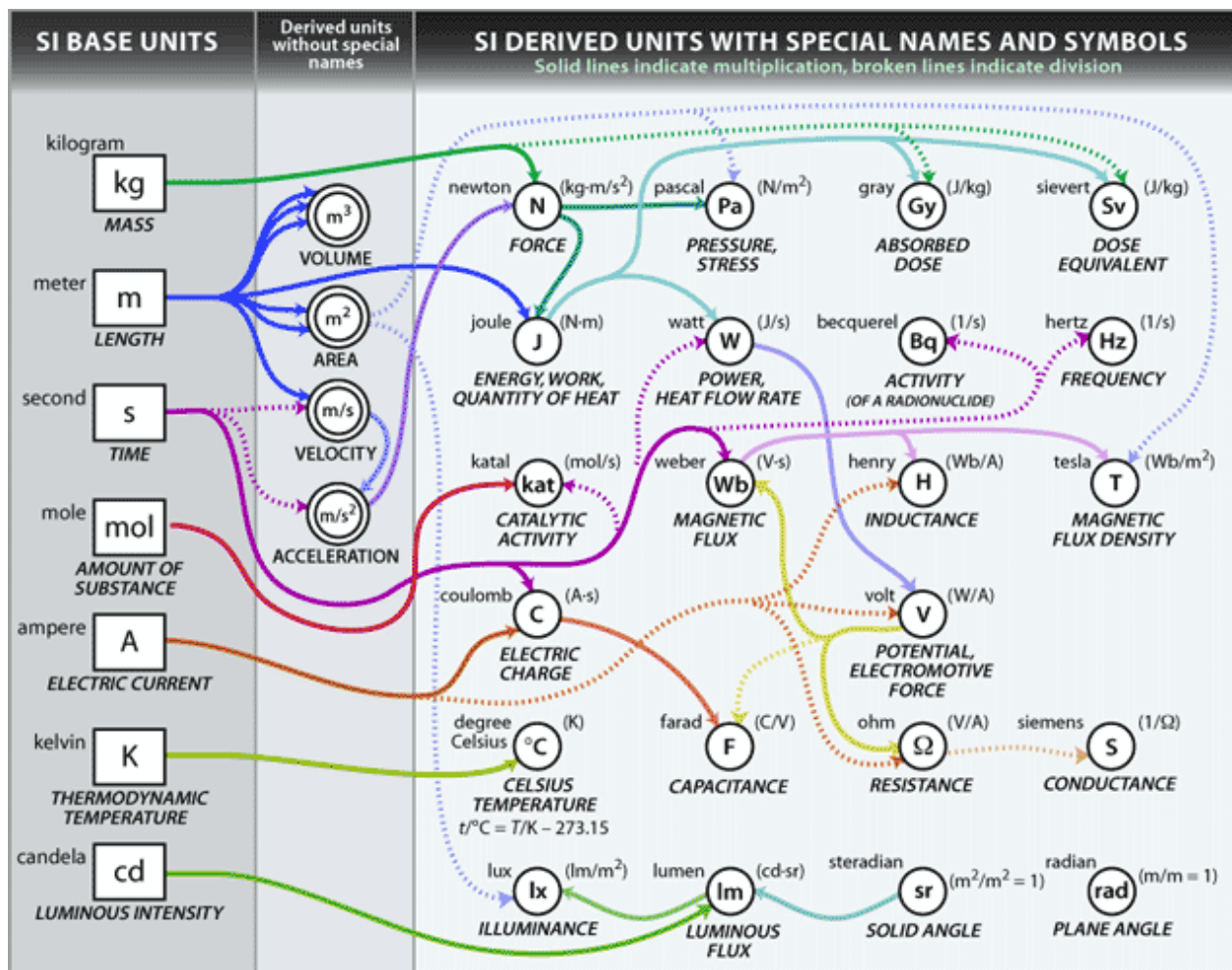
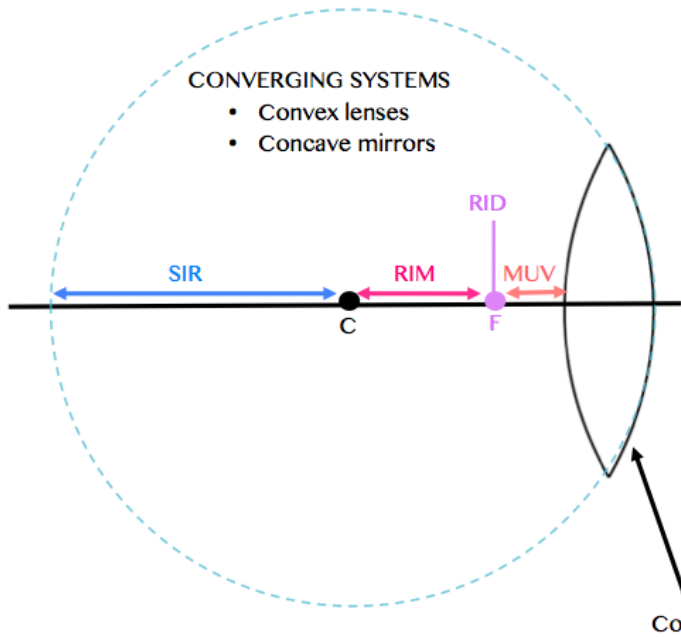
Upright

Virtual

When...

- Object is placed ANYWHERE, the image formed is...
Small
Upright
Virtual





SOCIOLOGY/PSYCHOLOGY

VMH = **V**entro-**M**edial **H**ypothalamus aka => **V**ery **M**uch **H**ungry

LH = **L**ateral **H**ypothalamus => **L**ack **H**unger

AH = **A**nterior Hypothalamus => **A**sexual

OR

Lateral Hypothalamus: **L**otta **H**unger! (*hunger center*)

Ventromedial Hypothalamus: **V**anquished **H**unger! (*satiety center*)

Anterior Hypothalamus: **A**ss **H**unger! (*sexuality*)

MesoLimbic Pathway

Ve **DO** <3 **NAP**py **HIPPO**s

- **V**entral tegmental area (pathway begins here)
 - **DO**pamine (made in VTA)
- **N**ucleus **A**ccumbens,
- **P**refrontal cortex
- **HIPPO**campus.

Lobes of Cerebrum

F **POT**

Pants **O**ff

Frontal

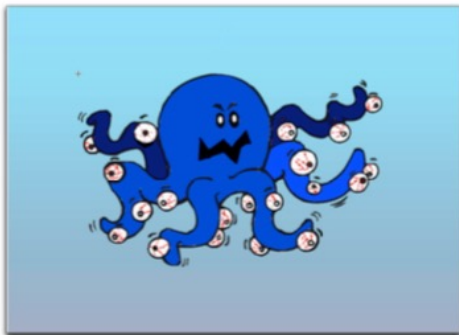
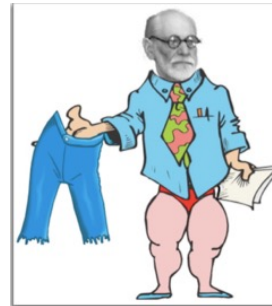
Parietal

Occipital

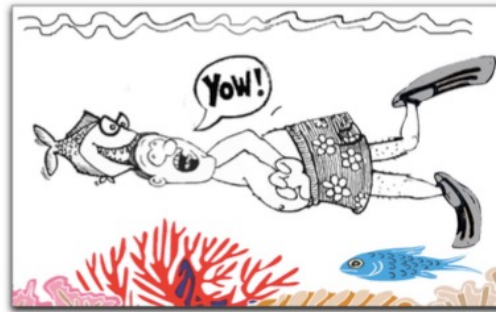
Temporal

OR

Freud **T**ore his



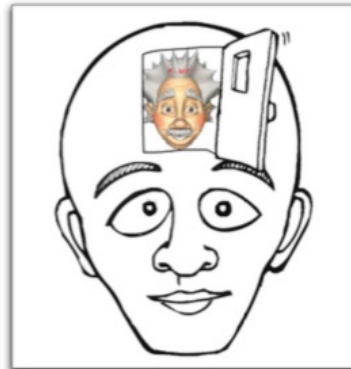
Occipital Lobe: Use the “Occ” part of the word Occipital and imagine an octopus. Since the occipital lobe processes visual information, picture eyeballs instead of suckers on the tentacles. Always good to make your image scary if you can.



Parietal Lobe: processes sensory information. Use a “piranha” fish as your mnemonic. The piranha bites you on the top of the head (where the parietal lobe is located). That’s a sensation the parietal lobe would process.



Temporal Lobe: the temporal lobe is where auditory processing occurs. Use “tempo” as your mnemonic and picture a metronome above your ear (where the temporal lobe is located)



Frontal Lobe: the frontal lobe is where complex thinking occurs. Use “front door” as your mnemonic. Put the front door on your forehead and put Einstein (complex thinker) behind the door.



Hippocampus: involved in memory. Use “compass”: picture someone (perhaps yourself) who is lost and can't remember how to get home, so you need a compass.



Amygdala: regulates our fear response

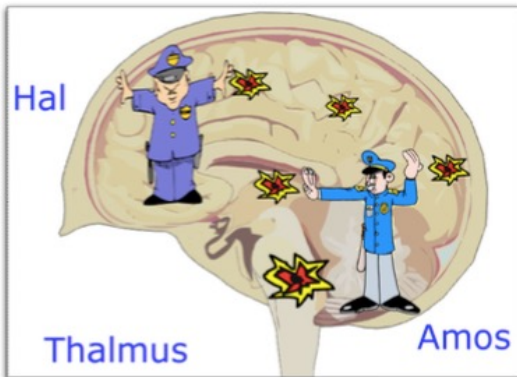
Keyword: the "myg"
in Amygdala rhymes
with wig



Mnemonic: a scary wig

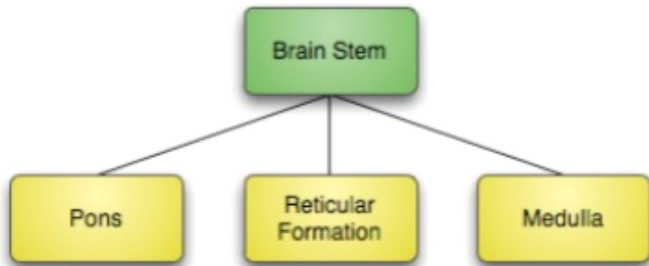
Amygdala:
involved in your
fear responses.
Picture a scary
wig (rhymes with
"myg") with
dollars in the hair
(similar to
"dala").

Amygdala: if
you're familiar
with attack
planes, a "MIG"
is a scary attack
fighter jet.



Thalamus: the
thalamus relays
information from
the body to
different areas of
the brain for
processing.
Picture Hal and
Amos as traffic
cops.

The Brain Stem



The Brainstem

Pavlov's Really Frickin' Mad
P
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R
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u
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a
r
F
o
r
m
a
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M
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d
u
l
l
a



Acronym: **P**avlov's **R**eally **F**rickin' **M**ad!

Pons

Think of dreamy, relaxing "Ponds"



Pons: the pons is the part of the brain that regulates waking and relaxing. Put a "d" in pons and you have "ponds". Ponds are relaxing to look. Your pons is activated when you look at a calm, relaxing pond.

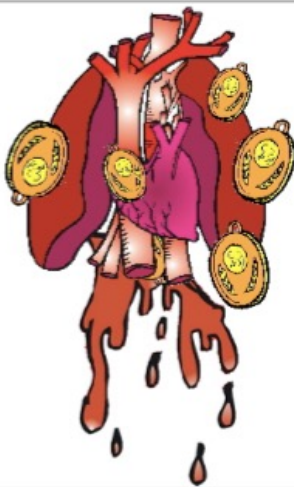
Reticular Formation:

if you were tickled while
you were asleep..

...your Re-Tickle-ular
Formation would
alert you.



Reticular Formation: the reticular formation is involved in motivation and alertness. Use "tickle" as your mnemonic. If you (or your roommate) were asleep and someone tickled you, your reticular formation would wake you up.



Medulla: the medulla regulates the autonomic activity of the heart and lungs. Use medals as your mnemonic and stick the medals in a bloody heart and lungs. Or picture an Olympic athlete wearing gold medals around her neck and covering her heart and lungs.

Eardrum (tympanum)

Think of a bad accent saying "Me hear and me saw crow". Me hear and "MI-SOW-CRoW"

Malleus → Incus → Stapes → Oval Window → Cochlea → Round Window

Neurotransmitters

glyCine= **I**nhibits CNS by allowing **Cl⁻** to enter neuron (thereby, hyperpolarizing the neuron)



Feature Detection (Cells)

Parvocellular cells= sha**P**e= Spatial resolution

Magnocellular cells= **M**otion= temporal resolution

Touch Receptors

mei**SS**ner's ---- hairle**SS** skin ---- remember the tip of your fingers they are hairle**SS** --- you use them for fine touch --- they are fine and quick (adaptation)

mer**K**el's ---- folli**K**les(of hair) --- hairy skin --- for crude touch --- they are crude and slow(adaptation)

Pacinian ----- **P**ressure+ vibration ---- they vibrate quickly(adaptation)

Ruffini endings: **R**uffini sounds like **Rafiki** (from the Lion King), and I picture him standing on top of the ledge presenting Simba to the pack, with outstretched arms. All to remember that Ruffini endings respond to stretch.

Kidney Filtration

DUMP the HUNK (proximal convoluted tubule)
Lose the **H**⁺, **U**rea, **NH**₃, **K**⁺

Be Prepared To Look Happy During mCat Testing

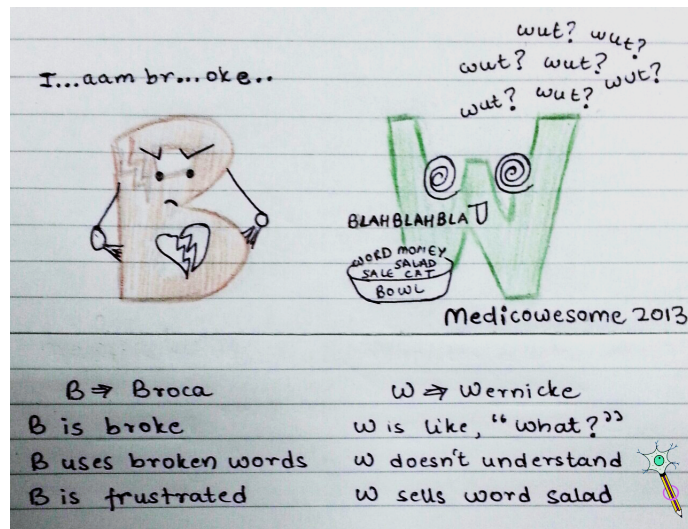
1) Bowmans, 2) Proximal Tubule, 3) Loop Henle, 4) Distal and Collecting Tubule

Language Areas of the Brain

BROCa = **B**ROC(k)en

Wernicke = Comp**W**ension or Words

LEFT brain = **L**anguage



Math Tricks:

- $\sqrt{2} = 1.4$ (2/14 Valentine's Day)
- $\sqrt{3} = 1.7$ (3/17 St. Patty's)

