Cell Structures

Cell Theory –
Protoplasm –
Nucleus –
- **Deoxyribonucleic acid (DNA)** –
- **Ribonucleic acid (RNA)** –
- **Nucleolus** –
- **Nucleoplasm** –

Nuclear Membrane –
Cytoplasm –
Ribosome –
Endoplasmic Reticulum-
- **Rough ER –**
- **Smooth ER -**

Golgi Complex -

Cell Structures

Cell Theory – if it's alive it's got to be a cell. For something to be living, the smallest unit of life is called a cell. To be life, the basic unit has to be a cell. But this falls apart with Prions, etc.
Protoplasm – It's the internal matrix of a cell. (It supports life)
Nucleus – The control center of the cell. Contains the genetic material that controls what the cell does.
- **Deoxyribonucleic acid (DNA)** – That's the chemical that forms the genetic material.
- **Ribonucleic acid (RNA)** – chemically similar to DNA,but it's more of a photocopy of DNA. (Goes out into the cell to give directions.)
- **Nucleolus** – Organelle inside the nucleus for storing RNA. The nucleolus contains RNA in the nucleus. It's the closet for RNA storage in the nucleus.
- **Nucleoplasm** – The protoplasm found in the nucleus.

Nuclear Membrane – The membrane that surrounds the nucleus. It's a less complex structure than the cell membrane.
Cytoplasm – It's the protoplasm between the nuclear membrane and the cell membrane. 70%-80% water.
Ribosome – These are small pieces of RNA. They serve as templates for the formation of protein.
Endoplasmic Reticulum- A membranous channel system that connects various parts of the cell together. It transports various materials to different parts of the cell. It can carry stuff as well as produce things like, lipids, carbohydrates, and proteins.
- **Rough ER –** Ribosomes stud the surface. The site of a lot of protein synthesis.
- **Smooth ER -** Does not synthesize proteins.

Golgi Complex - It makes vesicles that contain chemicals that need to be kept quarantined.

Cell Structures Cont.

Lysosomes and peroxisomes -
Autophagy and heterophagy -
Mitochondria –
Cytoskeleton –
- **Microtubules –**
- **Cillia and flagella –**
- **Centrioles** –
- **Microfilaments** –

Cell Structures Cont.

Lysosomes and peroxisomes - Vesicles produced by the golgi complex that contain digestive enzymes that are being produced by the endoplasmic reticulum Lysosomes contain things like acid. Peroxides are contained within peroxisomes.
Autophagy and heterophagy - Auto – self, hetero – other, phage is to eat. Autophagy – lyosomes and perixisomes that are eating the cells own waste material. Heterophagy – ingesting and destroying things that have come from outside the cell.
Mitochondria – The energy producing site of the cell. **(**The mitochondria come from the mother's side only.)
Cytoskeleton – Structures within the cell that hold the shape of the cell.
- **Microtubules –** A long slender tubes that are made of tubulin proteins. Can be supportive or can transport things.
- **Cillia and flagella –** Variations of microtubules that project from the out surface of the cell membrane. Cillia are multiple in the respiratory tracts, etc. There come in many. Flagella are found in sperm. There one single long slender tubule.
- **Centrioles** – paired organelles involved with reproduction. They are very tightly coiled tubules.
- **Microfilaments** – Solid structures. They come in thin, thick, or intermediate widths.

Cell Membrane

Cell Membrane –
- **Bilipid layer** –
- **polar head** –
- **fatty acid tail** –
- **assorted attached proteins –**
- **glycocalyx** –

Cell Membrane

Cell Membrane – (aka plasa membrane) – Made of phospholipid. A triglyceride with two attached fatty acid and one phospholipid.
- **Bilipid layer** – The cell membrane is a double layer of phospholipids.
- **polar head** – The polar head of the phospholiped that is hydrophilic. It sticks to the outside of the cell wall (either within the cell or to the outside of the cell).
- **fatty acid tail** – The middle of the bilipid layer. It is hydrophobic.
- **assorted attached proteins –** Biologically active chemical with multiple functions.
- **glycocalyx** – The cell coat. A "fuzzy" layer, a cotton candy, surrounding the cell. It's involved with cell recognition. It's also involved with cell adhesion.

Metabolism

Anabolism –
Catabolism –
ATP –
Adenine –
Ribose –
Phosphates-
High Energy Bonds –
Anaerobic Metabolism –
Glycolysis – t
Aerobic Metabolism –
Citric acid cycle (Kreb's cycle)/electron transport system –

Metabolism

Anabolism – building up. Putting things together. Making things. (yin)
Catabolism – Breaking down. Energy using. (yang)
ATP – adenine, ribose, and thee phosphates. The phosphates are attaches with a high energy bond. You "shoot" your phosphate and go from ATP to ADP and release the energy from one of the high energy bonds.
Adenine – contains an amine group (NH2). It a nitrogenous base.
Ribose – a five carbon sugar.
.Phosphates- Attached to the ribose are three phosphate groups.
High Energy Bonds – connect phosphate groups 1-2 and 2-3 in an ATP molecule. A substantial amount of energy is release when these bonds are broken. There's "one molecule" of energy stored in each of these bonds.
Anaerobic Metabolism – energy production without the proper amounts of oxygen.
Glycolysis – the burning of glucose inside of the cytoplasm. This can take place either anaerobically or aerobically – i.e. With or without oxygen. If it takes place w/o the proper oxygen, it produces lactic acid. With oxygen it produces pyruvic acid.
Aerobic Metabolism – energy production with the proper amounts of oxygen.
Citric acid cycle (Kreb's cycle)/electron transport system – takes place inside the mitochondria. This can't happen w/o oxygen. Citric acid cycle takes place within the matrix of the mitochondria. The electron transport takes place along the inner walls of the mitochondria. You can burn protein and lipids within the Kreb's cycle. They need to have oxygen to do this.

Passive Transport

Solvent –
Solute –
Diffusion –
Speed and ease of movement depends on the following:

- **Concentration Gradient** –
- **Particle Size –**
- **Lipid Solubility –**
- **Electrical Gradient –**

Osmosis -
Facilitated Diffusion -
Transport protein -

Passive Transport

Solvent – water in human water.
Solute – any small water soluble molecules. Does this physically to the solvent, but not chemically.
Diffusion – totally passive form of transport. Movement of solute across a semi-permeable membrane.
Speed and ease of movement depends on the following:

- **Concentration Gradient** – The higher the concentration gradient, the faster the diffusion happens. (How much more is on one side versus the other).
- **Particle Size –** the smaller the particle size the faster and easier it is to diffuse.
- **Lipid Solubility –** If you have a lipid soluble solute, it will go across a lipid membrane quicker and easier.
- **Electrical Gradient –** refers to opposite charges on either side of the membrane. The higher the electrical gradient, the faster and easier the diffusion occurs.

Osmosis – When solute is to large to move through the semi-permeable membrane. The solvent goes in the opposite direction instead.
Facilitated diffusion – also passive. But there is a protein that helps the solute go through the semi-permeable membrane.(insulin is a facilitated diffusion mechanism).
Transport protein – the helper in a facilitated diffsion.

Active Transport

Active transport –
    Primary Active Transport -
    Secondary Active Transport –
Cotransport (symport) –
Countertransport (antiport) –
With larger particles:
Endocytosis –
    phagocytosis –
    pinocytosis –
Exocytosis –
Filtration -

Active Transport

Active transport – can go against the gradient, but requires energy (ATP). A particle is being taken across the cell membrane, but it takes energy.
Primary Active Transport - what's being taken a across the membrane primarily.
Secondary Active Transport – There is a second associated molecule that is moving along with the first. This sometimes happens.
Cotransport (symport) – If the secondary is moving in the same diection as the primary.
Countertransport (antiport) – The secondary is moving in the opposite direction from the primary (The sodium potassium pump is an example of this).

With larger particles:
Endocytosis – a cell engulfing large particles
    phagocytosis – the engulfment of large particulate matter.
    pinocytosis – endocytosis of liquid material (smaller amounts)
Exocytosis – the openeing of the cell membrane and getting rid of larger materials. (hormones are often put out this way, so are nerve transmitions.)
Filtration *– not an ATP requiring process*

Intracellular Communication

Hormonal communication –
Paracrine communication –
    gap junction –
Autocrine communication –

Intracellular Communication

Hormonal communication – generally talking about one cell, releasing something into the blood stream and having an affect on a distant cell.
Paracrine communication – a cell releasing a hormone having n affect on a nearby cell.
    gap junction – When close cells have microtubules are in contact with a second cell.
Autocrine communication – a cell releasing a hormone like substance that will feedback and affect the same cell.

Hormones

Hormones –
Steroids hormones –
Thyroid hormones –
Cell membrane receptor site –
First messenger –
Second messenger –
Signal transduction –
Down-regulation -
Up-regulation –

Hormones

Hormones – affect mostly at the cell membrane level
Steroids hormones – at the cytoplasm levels (they are mostly lipid)
Thyroid hormones – at the nucleus level.
Cell membrane receptor site – a hormone can only act on a cell if there is the appropriate receptor site to act upon.
First messenger – most hormones are first messengers. They get to the cell membrane, but don't enter it. They cause a reaction at the cell membrane. But they will not penetrate the membrane. It causes an energy causing reaction.
Second messenger – This is the second substance, the chemical inside the cells that the first messenger has indirectly affected.
Signal transduction – the message that goes from the membrane to the second messenger.
Down-regulation - there's too much hormone, the body recognizes that, and the cells loose receptor sites.
Up-regulation – There's not enough substance out there, and it will increase the number of receptor sites.

Neurophysiology

Outer surface vs. Inner surface charges –
Membrane potential –
Ion Channels –
Sodium/potassium pump –
Nernst Equation –
Neuron –
Neurotransmission –
Axons, cell body, dendrite -
Resting membrane potential –

Neurophysiology

Outer surface vs. Inner surface charges – outer surface charges will have a net positive charge as compared to the inner surface which will have a net negative charge.
Membrane potential – the term that describes the electrical difference between the outer and inner cell membranes.
Ion Channels – the in membrane there are small openings (protein molecules) that allow ions to move through the cell wall quicker.
Sodium/potassium pump – An active movement process (requires energy) keeps sodium on the outside and potassium on the inside. (three sodiums on the outside to two potassiums on the inside)
Nernst Equation –A formula that allows you to calculate the eqillibrium potential across a membrane. EMF (electromotive force) in millivolts = -61 * Ion Concentration on the inside/ Ion concentration on the outer side.
Neuron – a nerve cell
Neurotransmission – the production of a nerve impulse carried along a nerve cell.
Axons, cell body, dendrites -Axon –a long process carring nerve transmission away from the body. – **cell body**- where the nucleus is, **dendrite** is multiple short processes carrying nerve transmission toward the body.
Resting membrane potential – a nerve cell is a resting state. Positive on the outside and negative on the inside.

Nerve Impulse

NA/K Pump –
Polarized neuron –

Resting Potential -

Momentary destabilization of the NA/K pump –
Depolarized neuron –
Action potential -
Threshold potential -
Refractory period –
    Absolute refractory period –
    Relative refractory period -
Speed of an impulse-

Nerve Impulse

NA/K Pump – an energy requiring mechanism that matains this potential. It maintains the sodium on the outside in a hgher concentration than the potassium ions on the inside. It maintains the potential.
Polarized neuron – a neuron is a resting state that is positive on the outside and negative on the inside.

-30mv to -90mv – the resting potential varies by cells.

Momentary destabilization of the NA/K pump – this is what a nerve impulse is.
Depolarized neuron – Not the entire nureon, just one little part of it has become destabilized, or depolarized.
Action potential - the momentary reversal across the membrane. This is what steps along.
Threshold potential - You have to alter the the charge to a certain level before the Na/K pump will kick-out.
Refractory period – There is a certain minimal period of time in which the neuron will not react a second time.
    Absolute refractory period – the minimal amount of time before you can make anything happen.
    Relative refractory period - the minimal amount of time before you can get a partial, ineffective stimulation.
Speed of an impulse - 1 meter per second

Myelin

Myelin –
Nodes of Ranvier –
Saltatory Conduction –
Nerve impulses travel

Gray matter –
White matter-

Myelin

Myelin – a fatty substance that insulates an axon.
Nodes of Ranvier – "bare areas" between the myelin
Saltatory Conduction – refers to the fact the areas of depolarization, can jump from node to node to node. MS is a disease where you have lost myelination of the axons. A disease characterized by the loss of myelination characterized by loss in through time and space.
Nerve impulses travel 100 times faster in mylinated than in unmylinated nerves.
Only the axons are mylinated.

Gray matter – refers to cell bodies and their dendrites. They are gray matter because thats what they look like w/o the mylin.
White matter- mylinated axons.

Synapse

Presynaptic neuron –
postsynaptic neuron –
synapse –
    electrical synapse and gap junctions –
    chemical synapse –
    synaptic cleft –
Transmitter vesicles –
Transmitter molecules –
Postsynaptic receptors –

Synapse

Presynaptic neuron – first neuron in the chain carrying the impulse.
postsynaptic neuron – the neuron being stimulated
synapse – the area where one neuron stimulates a second neuron.
    electrical synapse and gap junctions – a few places where there is an actual gap junction (microtubule)
    chemical synapse – The first nueron elicits a neurontransmitter and affects the second neuron.
    synaptic cleft – the actual space.
Transmitter vesicles – the bag that contains the transmitter molecules. Releases via exocytosis into the synaptic cleft.
Transmitter molecules – the nuerotransmitter that is acutally released.
Postsynaptic receptors – the postsynaptic nueron will have specific receptors for a given specific neurotransmitter.