Week 5 Lecture 0

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1 Administrative drivel

- Exams are in: $\mu = 51.6\%$
- the curve is 23.4%, so add that percent to your score to get your actual score
- no clicker qs today

2 More on Cells

- Passive diffusion
  - molecules in high concentration move accross the membrane to low concentration
  - only happens for molecules that can pass through the membrane
    - Non-polar lipids
    - hydrophobic molecules
    - e.g. fat soluble vitamins – vitamin A, K, E
    - Gasses: O2, CO2
      - this is nice, since O2 is an input of metabolic activity, and CO2 is an output of metabolic activity
    - Plus H2O (to some extent)
      - not as smoothly as oxygen and CO2
      - the polarity of water makes it move through slowly
      - cells have ways of accelerating this
      - this is called osmoses
  - most molecules are regulated accross the membrane
- What doesn't cross by passive diffusion?
  - Most biological molecules –
    - anything large or polar (e.g. glucose, proteins

  - Ions – anything with a charge (e.g. Na^+)

- **Osmosis**: movement of water accross a membrane
  - It gets its own name since it's the solvent inn which biochemistry happens
  - Movement of water through biological membrane if one sie has more solutes (salt, sugar) than the other
  - this is a slow-ish process, since H2O is polar
  - if you increase the concentration something that cannot pass through the membrane on one side of the membrane, the water will move accross the membrane to acheive equilibrium.
  - other forces may prevent equilibrium from occuring (e.g. gravity)
  - gravity prevents all of the water ending up on one side of the membrane
  - there is also reverse osmosis

- clicker q: Why are biological membranss so important?
  - Provide structural organization
  - allow the cell to regulate what goes in and out
  - they seperate the inside and outside of the cell
    * Metabolic processes produce toxins, and it's good to get them out
      · e.g. amonia

- proteins in the membrane
  - Because the membrane is a barrier tomost things that need to get into the cell (e.g. glucose) or out of the cell (e.g. waste molecules) there are proteins in the membraane that assist with such movements
  - a protien is placed in the membrane that creates a channel for the specific molecule the cell "wants" to allow through the membrane
  - charge points allow the protiens to prevent certian molecultes from getting through.
  - two kinds:
    * Fascilitated diffusion (AKA passive transport thru channel) – movement *down* the gradient from areas of high to lowconcentration
    * Active transport – movement is *against* the gradient from areeas of low to high concentration (requires expenditure of energy/ATP)

- Facilitated diffusion – 2 kinds

- A channel protien: opens a tube to allow 1 kind oof molecule through
  - bi-directional, kind of indescriminate
  - useful for ions and pollar molecules
    - all have their own channel (cute)
  - no energy required
- A carrier protien: pacman like mechanism allows specific molecule through 1 at a time
  - opening changes its shape to move a molecule from one side to the other
  - allows rate to be regulated
  - typically bidirectional
  - still passive (high to low concentration)
  - no energy required
  - there are unidirectional protiens, but they're beyond this course
  - there are hundreds of these
- Active trasport – requires energy
  - Expends ATP
  - still has a pathway to move molecules, but you need energy to move it
  - very few kinds of these molecular "pumps" (12 ish)
  - most common is the sodium-potasium pump
    - used in muscle contraction, movement of info
    - takes in 2 potasiums or 3 sodiums, and moves the potasium from the outside of the cell to the inside, and sodium moves from the inside to the outside
    - phosphate breaking off atp changes the shape
    - each cycle take 1 ATP: phosphate broken off to expend sodium, then the phosphate is broken off of the protien to pull the phosphates in
    - allowing these imballances of gradients make potential energy for later use in work
  - moves molecules against the concentration gradient
- **Endocytoss and Exocytosis**
  - What is used when things are to **big** foor carier protiens
  - Invelopes the object in a peice of the cell membrane
  - this makes a vexical
  - exo – gets things out
    - membrane around the object fuses with the cell membrane on exit
  - endo – gets things in

        - folds the cell membrane to make a pocket that breaks away from the cell membrane
    - throughout this process there is **NEVER** a hole in the cell membrane
    - if a hole were made, the cell would die
- parts of the cell:
    - Membrane – seperates in from out
    - cytoplasm – liquid inside the cell
        - mostly water
    - Organells – structures inside the cell
        - separated by membranes, so the same principals of transport apply to organelle membranes