

# Week 5 Lecture 2

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## 1 Administrative drivel

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## 2 More on Cells

- More on organelles
  - New proteins are sent to the golgi apparatus in vesicles from the RER and SER
    - \* Vesicle: a pocket of membrane that is created by exocytosis from the ER.
  - the vesicles fuse with the membrane of the golgi apparatus, and the proteins and lipids are modified.
- **Golgi complex:**
  - Parts: Saccule/cistern, transfer vesicle
    - \* multiple stacked layers of cisterns (pockets)
  - vesicles enter into the back into a saccule, and enzymes work on the lipids and polypeptides
  - they work their way to the front of the golgi complex where they're fully formed, and moved into a vesicle via exocytosis from a cistern.
  - There's never an opening to allow things to leak into the containers of the golgi apparatus
  - the proteins are then sent off to do work
- **Mitochondria:**
  - The powerhouse of the cell
  - 2 membranes: outer and inner
    - \* inner has folds that greatly increase the internal surface area
    - \* The presence of the double membrane was what led to the hypothesis that the mitochondria was an independent organism brought in via endocytosis, and it's involved to be part of the cell
  - reproduce independently of the host, and have their own DNA
  - function: generate ATP
    - \* takes in glucose and makes 2 ATP per glucose even in the absence of oxygen, but oxygen allows for creating many more ATP per glucose.
    - \* note O<sub>2</sub> is not an absolute requirement for ATP synthesis
    - \* steps:
      - Take glucose and break the carbon-carbon bonds, and capture the energy as an excited electron
      - this is used to combine an ADP and a phosphate

- the glucose is split into 2 pruvic acids, making 2 atp
- this is fermentatation!
- these acids are high energy!
- the acids are broken down (using oxygen) till all of the carbon is turned into CO<sub>2</sub> and all of the hydrogen and oxygen become water
- the end result is usually 36 ATP (including the non-arrobic initial 2)
- this is generally the only place where ATP is made
- basic equation:
 
$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_{20} + 36ATP.$$
- this equation is exactly the reverse of photosynthesis! :D
- earliest organisms were syonobacteria 2.7 billion ish years ago
  - \* all of the oxygen were bound to rocks
  - \* these bacteria developed photosynthesis and turned the oxygen in the rocks into gaseous oxygen! Now mostly plants make the bulk of the oxygen
  - \* Nitrogen is the most abundant gas in the atmosphere, then oxygen, and everything else makes up less than 1 percent.
  - \* making ATP using other minerals would have been before photosynthesis for these reasons
- Clicker Q: When DNA sequence is packaged into chromosomes, what other category of molecule is also present? Protein! make up the histones
- summary:
  - Nuclues: contains DNA, the largest molecule in the cell as chromosomes
  - RER and SER where ribosomes read mRNA to make polypeptides, and fatty acids are made respectively
  - Golgi aperatus: where protiens and lipids are adjusted
  - Mitochondria: where ATP is made
- Clicker Q: What is an organelle? Structures in cells that have specialized functions

### 3 Tissues

Made up of cells!

- Tissues are aggragates of cells (usually of the same type)
- tissues are organized into organs
- 4 types of tissues:
  - Epithelial
    - \* Outer layer (not just skinn)
    - \* packed tight
    - \* dense sheet of closely packed cells attached to an underlying non-cellular layer (basement membrane)
      - usualy 1 celll thick
      - this basement membrane is an excreted structure made of proteins and other things.

- \* lung cells that line the lungs
  - \* cells lining the digestive system
    - mouth, esophagus, etc.
  - \* cells lining blood vessels
  - \* cells lining urinary and reproductive structures
  - \* also kidney and liver cells
    - Most of these are epithelial
- they tend to cover organs and line tube and cavity surfaces as a protective layer against things like micro-organisms.
- \* they also regulate what comes in and out of the body
  - \* they are the first line of defense - skin, and other layers protect against microorganisms
  - \* secrete proteins, e.g. keratin on the skin which microorganisms don't like to eat
    - e.g. digestive tract produces mucus (protein and carbohydrate slime) that coats the digestive tract preventing enzymes and digestive acid from eating your organs
  - \* has its own set of carrier proteins and pumps to regulate what goes through.
  - \* Control what goes through into underlying layers
    - e.g. the digestive system prevents toxins from getting in
  - \* Takes up specific ions/ other types of molecules, e.g. kidneys, digestive tract, liver
  - \* e.g. Small intestine epithelial cells
    - glandular cells, secrete mucus into the intestine helps stuff move through smoothly and prevent digestive enzymes from breaking down the intestinal wall. E-cells in the intestine take up broken-down carbs, lipids, and peptides
  - \* since they secrete things, they also make up glands
- Connective tissue/extracellular matrix
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