

# Week 5 Lecture 1

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## 1 Administrative drivell

- A few exams still need to be collected
- The first draft (polished!) is due Friday at Noon

## 2 More on Cells

- Parts of cells:
  - Membrane – separates in from out
  - Cytoplasm – liquid inside the ceell
    - \* bulk of the volume
  - Organelles – membrane-bound structures inside the cell
    - \* Mitochondria (all eukariotes have) – double membrane bound
      - thought to previously have been independent organisms
      - traded some of its genetic material with the genetic material of the host
      - reproduce independently of the cell
      - called the endo-symbiot hypothesis
      - Mitochondria are calleld the "powerhouse" of the cell
    - \* Chloroplasts just in plant cells for photosynthesis – double membrane bound
      - Same sub items as mitochondria above, sans powerhouse
    - \* there are other organelles that are similar to these
    - \* organelles do work for the cell
- clicker q: What would the best transport mechanism be for moving a charged ions accross a membrane from high to low concentration? Facilitated diffusion. (not passive diffusion, since ions can't cross the membrane on their own)

### 2.1 Some organelles

- Nucleus
  - only in eukareotic cells
  - a prominant structure in the cell, one of the larger
  - primary function: house the DNA
  - parts: Nucleolus, Chromatin, Nuclear envelope, nuclear pore
  - membrane bound, has 2 membranes
  - surface covered in openings called nuclear pores that allow bigger things through

- \* allows mRNA to get out
  - \* many other things can get through, but are beyond this course
- Transcription takes place inside, producing mRNA
- Nucleolus is involved in managing the chromosomes and DNA (unwinding, rewinding, transcription things, blah)
- Endoplasmic reticulum is attached to the outside (where the proteins are built)
- Chromatin:
  - \* Is the DNA
  - \* is an unwound chromosome
  - \* DNA is wrapped around histones (proteins that give structure and organization to the chromosome)
  - \* these bundles around the histones are called nucleosomes
  - \* these are further wrapped into chromosomes
  - \* this structure is so small that enzymes and other molecules can't get to the information to make mRNA without unwinding the DNA.
  - \* this is outside the nucleolus
  - \* DNA structure:
    - DNA is a double-helix, but the two helices are separate molecules. These two helices are held together with hydrogen bonds
    - one helix is used to make an mRNA during transcription, and the other is used for error correction.
- First step in synthesizing a protein:
  - \* A section of DNA (i.e. a gene) is copied into a strand of mRNA
    - DNA unzipped
    - Complementary copy made
    - DNA re-zips
- Endoplasmic reticulum (ER)
  - This is the membrane system close to and connected to the nucleus
  - mRNA leaves the nucleus through a pore and into the ER
  - is continuous with the membrane of the nucleus
  - there is a rough and smooth ER
    - \* the rough has ribosomes on it between layers
      - ribosomes run the translation to build the polypeptides that will fold into proteins
      - mRNA is read from one end to the other and assembles the amino acid chain. (there's a start code and a stop code)
      - reads a codon, grabs the amino acid and adds to the chain, then to the next codon, adds the amino acid, and so on.
      - there are thousands, and each mRNA goes to exactly one ribosome
      - made up of 80-90 proteins
      - the polypeptide is released in the inner layers of the endoplasmic reticulum, where it's transported to an end of the ER, where a little vesicle is formed to be transported to the Golgi apparatus
    - \* rough is directly connected to the nucleus and the smooth is connected to the rough
    - \* smooth doesn't have any ribosomes, hence it is smooth
      - doesn't receive direct instruction from the nucleus
      - produces fatty acids and steroids

- these are coded for indirectly (no genes)
- proteins that have been made in the rough ER come back from the Golgi apparatus to build fatty acids and steroids.
- hollow, with an internal space, and a space between layers
- 2 functions: smooth for lipids, rough for proteins
  - \* the resultant molecules are retained or exocytosed for use elsewhere
  - \* proteins go to the Golgi apparatus where it's modified to become a functional protein (e.g. ends might be cut off)
  - \* lipids are modified in the Golgi apparatus as well
- clicker Q: What do the blobs (green ribosomes) do? Translate mRNA sequence into a chain of amino acids