Cell theory
The cell is the smallest unit of life.
The cell is an organized container of chemicals, that we define as living.
All living things are made of cells.
All reproduction is done via cells.

3 parts of the Cell
- cell membrane = plasma membrane
- nucleus contains the genetic code - DNA
- cytoplasm organelles, chemicals, water

cell membrane
The plasma membrane has many functions: see fig 3.3
1. maintain the cell’s integrity -
   The phospholipid bilayer is a semipermeable membrane that separates intracellular from extracellular fluids and chemicals. It is permeable to lipids and some water.
   Cholesterol is present in and gives strength to all plasma membranes.
2. control transport in/out of cell -
   Living things (cells) must get nutrients from their environment.
   There are protein channels (pores) that provide a tunnel for specific chemicals to get into or out of the cell. These channels are molecule specific. They can be open or closed.
3. recognize external conditions / intercellular communication -
   Receptors are proteins in the plasma membrane and on its outer surface.
   They can be stimulated by hormones, neurotransmitters, foreign pathogens.
   Organs and cells communicate through the action of chemicals and receptors.
   Receptors help the body recocognize infections.
4. affect reactions in cytoplasm
   Some proteins can convert an external stimulus (outside of the cell) to an internal chemical reaction. (inside the cell). These proteins in the plasma membrane are called signal transducers.
5. Other chemicals on the cell's surface (eg. glycocalyx) can be used by the body to recognize which cells are our own. These "identification markers" are called antigens.

review these organelles and their functions: see fig 3.2
- ribosomes
- rough endoplasmic reticulum
- smooth endoplasmic reticulum
- mitochondria
- golgi apparatus
- lysosome
Nucleus contains genetic material = DNA
chromosome = 1 DNA molecule + attached protein
humans have 23 different chromosomes = haploid #
humans have 2 of each chromosome = 46 chromosomes = diploid #
~ 23,000 genes

DNA, RNA are made of nucleotides:
- A adenine / adenosine
- T thymine / thymosine (DNA only)
- C cytosine / cytidine
- G guanine / guanosine
- U uracil (RNA only)

A gene is a code for building a specific protein.

summary of protein synthesis:
DNA is made of nucleotides (A, T, G, C), in sets of 3 = triplet
mRNA is made of nucleotides, in sets of 3 = codon
tRNA contains 3 nucleotides, the anticondon, and one amino acid (AA)
protein is made of many amino acids in a specific order.

A gene is a piece of DNA with a specific order of triplets.
That order of triplets of the gene dictates the specific order of amino acids in the protein.
A different order of amino acids, yields a different protein, with a different function.

transcription – DNA (gene) is copied to mRNA. This occurs in the nucleus,
   The order of DNA triplets = order of mRNA codons
   This requires the enzyme, RNA polymerase.

translation – mRNA is used as a template to build a protein. This occurs at the ribosomes.
   tRNA anticodons line up with the mRNA codons.
   Each tRNA carries a specific amino acid (AA).
   The order of tRNAs yields the order of amino acids.

control of gene expression
Here's what is really significant to our understanding of genetics in physiology -
Genes can be turned on and turned off.
Chemicals that turn genes on/off are called transcription factors.
Transcription factors affect the binding of RNA polymerase to the promotor.
This allows the "copying" of DNA (gene) to mRNA.
Some transcription factors may inhibit the "copying" of DNA (gene) to mRNA.
Examples of transcription factors in our physiology include:
- hormones
- chemicals from adjacent cells
- growth factors
- other genes
- developmental chemicals

proteins and cell specialization

The body is made of many different cells with different functions.
A cell’s structure and function is based on its proteins

eg shape, size
- enzymes controls which chemical reactions take place in that cell
- receptors controls what chemicals can affect this cell
- protein channels controls what can get through the cell membrane
- inclusions chemicals in the cytoplasm with specific functions
  eg. hemoglobin; actin and myosin

All cells contain all our genes.
Cells differ by which of the genes are active, making specific protein.
Cells differ by the function of their proteins.

Mitosis = cell division
one diploid cell splits into 2 identical diploid cells
interphase cell growth
  DNA replication
prophase chromosomes appear
  centrioles form mitotic spindle
metaphase chromosomes line up at metaphase plate
anaphase chromosomes move to opposite poles
telophase cell membrane forms fissure
cytokinesis cell separation