Biol 111

UNIT 1 – DNA, Mitosis, Protein Synthesis, & Cancer

Unit 1, part 2: Cell Reproduction, Chromosomes, the Cell Cycle, and Mitosis

**CELL DIVISION: SEXUAL & ASEXUAL REPRODUCTION**

5.1 Cell division provides for reproduction, growth, and repair

* The Cell Theory
  + All living things are made of cells
  + Cells arise from preexisting cells
* Cell Division – 1 cell splits into 2 cells to create more cells or offspring
* SEXUAL REPRODUCTION – produces genetically unique offspring
  + Fertilization joins gametes of male & female to produce a zygote
  + Zygote divides and develops to produce an organism
  + After birth, cell division creates new cells for growth & repair
* ASEXUAL REPRODUCTION – produces genetically identical offspring
  + Binary Fission – a single cell splits into 2 cells
  + Plant Reproduction – by sprouting or sending out runners
  + Regeneration – regrowth of lost body parts

**CHROMOSOMES, CHROMOSOME NUMBER & STRUCTURE**

5.2 Chromosomes are associations of DNA and protein

* DNA – the biomolecule that contains our genes
* Genes – segments of DNA that code for proteins; about 21,000
* Chromosomes - condensed DNA molecules
  + Contain genes and non-coding DNA
* CHROMOSOME NUMBER
  + Humans have 23 pairs (46) of chromosomes
  + Other organisms have different numbers of chromosomes
  + Chromosome number not related to complexity of organism
  + Only 0.5 % of DNA is different between people
* CHROMOSOME STRUCTURE
  + Chromatin – DNA wrapped around proteins
  + Chromosomes - condensed, replicated DNA
    - Centromere – region that connects DNA
    - Sister Chromatids – each strand of replicated DNA

**THE CELL CYCLE**

5.3 Cells have regular cycles of growth and division

* Cell Cycle - The events in the life of a cell from its creation to its division
  + INTERPHASE
    - 90% of time of cell’s life
    - Cell performs its normal functions
    - CHROMOSOME REPLICATION
  + MITOTIC PHASE
    - Mitosis – cell divides and splits chromosomes into two sets
    - Cytokinesis – cytoplasm is divided and cell splits in two cells
  + TELOMERES – DNA at the end of chromosomes that shortens each cell division

**DNA REPLICATION**

6.2 During DNA replication, a cell duplicates its chromosomes

* DNA 🡪 DNA
* For continuity of life, DNA is passed on from one generation to the next
* SEMI-CONSERVATIVE REPLICATION
  + Two strands separate
  + Each strand is a template
  + Each new molecule contains half the original molecule
* THE PROCESS OF DNA REPLICATION
  + UNWINDING: Helicase 🡪 attaches at origins of replication 🡪 separates strands 🡪 forms replication bubble where DNA strands exposed
  + ATTACHMENT: DNA Polymerase 🡪 attaches complementary nucleotides
    - DNA Ligase 🡪 joins the fragments
    - Produces duplicated sister chromatids and duplicated homologous chromosomes
    - Sister chromatids – identical copies of chromosomes, connected by a centromere
    - 3 billion base pairs in 8 hours
  + PROOF READING – DNA Polymerase looks for and repairs mistakes

**MITOSIS**

5.4 During mitosis, the nucleus is ~~duplicated~~ divided

* INTERPHASE - DNA is duplicated during interphase
* MITOSIS - DNA is separated during mitosis
  + Prophase
    - Chromatin condenses into chromosomes
    - Nuclear membrane dissolves
    - Mitotic spindle assembles
  + Metaphase
    - Sister chromatids align at the equator
  + Anaphase
    - Sister chromatids are pulled apart to opposite sides of the cell
  + Telophase
    - Chromosomes relax back into chromatin
    - Mitotic spindle disassemble
    - Nuclear envelope reforms

**CYTOKINESIS IN PLANT AND ANIMAL CELLS**

5.5 During cytokinesis, the cell is split in two

* Cytokinesis – splitting of the cytoplasm
* CLEAVAGE FURROW IN AN ANIMAL CELL
  + A ring of protein filaments pinches the cytoplasm apart
* CELL PLATE IN A PLANT CELL
  + A strip of membrane that forms along the center of cell