Chapter 10: Meiosis

Introduction

- heredity: the transmission of traits from one generation to the next
- variation happens in offspring
- genetics: the scientific study of heredity/inherited variation

Section 1: Offspring acquire genes from parents by inheriting chromosomes

- genes: genetic information
- info is passed in the form of each gene's specific sequence of DNA nucleotides
- transmission happens by the replication of DNA
- gametes: reproductive cells that transmit genes from one generation to the next
- DNA is in chromosomes in the nucleus
- somatic cells: non-sexual cells with 46 chromosomes
- chromosomes have one long DNA molecule
- locus: a gene's specific location on the chromosomes
- asexual reproduction: a single individual is the sole parent, passes copies of its genes to offspring without gamete fusion
  - may use mitotic cell division
  - genomes are exact copies (genetically identical) → clones
- sexual reproduction: two parents have offspring with unique combo of genetic information
  - genetic variation occurs

Section 2: Fertilization and meiosis alternate in sexual life cycles

- life cycle: generation-to-generation sequence of stages in the reproduction history of an organism
- mitosis: chromosomes condense
  - results in 46 chromosomes - 23 from each parent
- Karyotype: image of stained chromosomes
- homologous pair (homologs): two chromosomes with same length/centromere position/staining pattern
  - have genes with same inherited characters
- males: XY
- females: XX

  ] sex chromosomes (other ones called autosomes)
- 46 chromosomes in somatic cells are two sets of 23 (one paternal set, one maternal set)
- diploid cell: any cell with two chromosome sets (2n)
- haploid cells: cells with a single set of chromosomes
  - gametes (in humans have 23)
- fertilization: union of haploid gamete from sperm and haploid gamete of eggs
- zygote: fertilized egg (diploid)

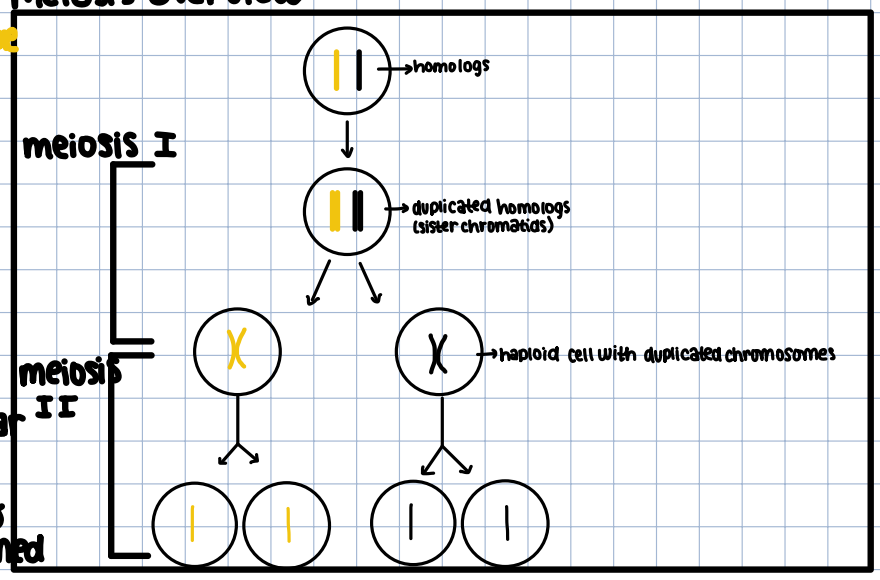
Section 3: Meiosis reduces the # of chromosome sets from diploid to haploid

- meiosis happens after chromosomes are duplicated
  - two cell divisions
  - 4 daughter cells
- homologous pair: one chromosome from each parent

PROPHASE I

- centrosomes move, spindles form, and nuclear envelope breaks down
- crossing over happens: DNA molecules of nonsister chromatids are broken and rejoined

Meiosis Overview



- chiasmata: where crossovers occur
- microtubules attach to kinetochores

METAPHASE I:
- homologs aligned at metaphase plate
- attach to microtubules from opposite poles

ANAPHASE I:
- proteins holding together homologs breakdown
- homologs move to opposite sides

TELOPHASE I / CYTOKINESIS
- half cell has complete haploid set of chromosomes
- cleavage furrow forms

repeated in meiosis II

CROSSING OVER

1) chromosomes have already been duplicated
   - held together by cohesins
   - chromatids start to condense
2) zipper-like protein complex (synaptonemal complex) forms, attaching homologs
   - chromatin condenses
3) synaptonemal complex formed, homologs in synapsis
   - DNA breaks closed, connected to corresponding segments of nonsister chromatid