

- 1  **Meiosis**  
Chapter 13
- 2  **Meiosis and Sexual Life Cycles**  
Chapter 13
- 3  **Heredity**
  - Hereditary is the continuity of biological traits from one generation to the next
  - Results from transmission from parents to offspring
  - Genes are the unit of heredity
  - One gene ~ one polypeptide
  - Expression of proteins coded by genes produce an organism's inherited traits
- 4  **Comparison of Asexual & Sexual Reproduction**
  - 1
    - Single indiv is sole parent
    - All parent genes passed on
    - Offspring genetically identical to parent
    - Clones
  - 2
    - Differences due to mutations
    - 2 parents for offspring
    - Parent 1/2 genes passed on
    - Offspring unique combinations genes
    - Combination of 2 parents' genes major source of variation
- 5  **Terminology**
  - Somatic cell: body cells (soma=body)
  - Germ cell: reproductive cell; formed in ovary or testes; egg or sperm
  - Karyotype: photomicrograph of metaphase chromosomes arranged sequentially
  - Homologues: pair of chromosomes; same size, same location of centromere, same genes
  - Autosome: chromosome that is not X or Y
  - Diploid: 2 sets chromosomes; 2n
  - Haploid: 1 set chromosomes; n
- 6  **Meiosis**
  - Cell division resulting in formation of gametes – REDUCTION division
  - Fertilization restores diploid condition
  - In animals, gametes are only haploid cells
  - Following replication of chromosomes, there are 2 divisions of the nuclear material resulting in 4 haploid cells
- 7  **Stages of Meiosis**
  - Meiosis I: prophase I, metaphase I, anaphase I, telophase I, followed by cytokinesis

- Meiosis II: prophase II (only if cell entered interkinesis); metaphase II, anaphase II, telophase II, followed by cytokinesis

## 8 Interphase I

- Precedes meiosis
- Chromosomes replicate
- Centriole pairs replicate into two pairs

## 9 Prophase I

- Chromosomes condense
- **SYNAPSIS** occurs: homologous chromosomes come together as pairs forming tetrads of chromatids
- Nonsister chromatids are attached by x-shaped chiasmata (chi Greek letter is "X")
- **CROSSING OVER** occurs
- Nuclear envelope fragments
- Centriole pairs migrate to poles as spindle forms
- 90% of time in meiosis is spent in prophase I

## 10 Metaphase I

- Tetrads line up on prime meridian
- Each homologue attached to kinetochore microtubules

## 11 Anaphase I

- HOMOLOGUES migrate to each pole
- Sister chromatids don't separate

## 12 Telophase I and Cytokinesis

- Each pole has diploid set chromosomes
- Sister chromatids are still attached at the centromere
- Cytokinesis occurs simultaneously w telophase I
- In some species, nuclear membranes and nucleoli reappear and cells enter interkinesis
- In most species, daughter cells immediately enter meiosis II
- NO DNA REPLICATION OCCURS

## 13 Prophase II

- If cell entered interkinesis, the nuclear envelope and nucleoli disperse
- Spindle apparatus forms

## 14 Metaphase II

- Chromosomes align on metaphase plate
- Kinetochores of sister chromatids point towards opposite poles

- 15  **Anaphase II**
- Centromeres of sister chromatids separate
  - Each individual chromosome moves towards opposite poles of the cell
- 16  **Telophase II and Cytokinesis**
- Nuclei form at opposite poles of the cell
  - Cytokinesis occurs producing 4 haploid daughter cells
- 17  **Oogenesis vs Spermatogenesis**
- Spermatogenesis results in 4 viable haploid sperm cells as described in meiosis
  - Oogenesis results in 1 viable egg; there may be 1, 2 or 3 polar bodies formed
  - Polar bodies have no cytoplasm and are assimilated by the body
- 18  **Mitosis vs Meiosis I**
- 1
- Prophase no synapsis
  - Metaphase chromosomes align on metaphase plate
  - Anaphase centromeres divide and sister chromatids move to opposite poles
- 2
- Prophase I synapsis & crossing over
  - Metaphase I homologous pairs line up on metaphase plate
  - Anaphase I centromeres do not divide and sister chromatids stay together; homologues separate & pairs move to poles
- 19  **Sources of Genetic Variation**
- short list
- Independent assortment: number of possibilities =  $2^n$  where n is haploid #
  - For humans  $2^{23} \sim 8$  million possibilities
  - Crossing over during prophase I  $\sim 1-3$  per chromosome pair
  - Random fusion of gametes during fertilization  $8E6$  mom x  $8E6$  dad = 64 trillion possibilities
- 20  **adaptation**
- Variation is the key to evolutionary adaptation
  - Natural selection increases frequency of inheritable variations that favor reproductive success of some individuals
  - Adaptation is accumulation of inheritable variations favored by environment
  - Genetic variation increases likelihood that some members of population will survive environmental stresses