

## Exam 3 Review Outline

### Chapter 9:

#### 1. Control of the Cell cycle

- 3 checkpoints
  - G<sub>1</sub>(Restriction) Checkpoint
  - G<sub>2</sub> Checkpoint
  - Metaphase Checkpoint

#### 2. Mitotic Cell Division

- Prophase
  - Early Prophase:
    - Nucleolus fades
    - Chromosomes condense
    - Spindle apparatus forms
      - Spindle consists of microtubules between two microtubule organizing centers containing pair of centrioles
  - Late Prophase:
    - Nuclear envelope disappears
    - Microtubules attached to kinetochores of chromosomes
    - Centrioles are at opposite poles
    - Polar microtubules radiate toward the cell's equator
    - Spindle microtubules capture chromosomes at centromeres
- Metaphase
  - Centrioles positioned at opposite ends (poles) of the cell
  - Chromosomes move to and align on the equator of the cell
- Anaphase
  - Movement of the chromosome is accomplished by depolymerization of the microtubules at the kinetochore
  - Cell begins to elongate because the polar microtubules grab onto each other and push the poles apart as they lengthen.
- Telophase
  - Polar microtubules elongate (pushing out on the ends of the cells) helps cause the formation of the cleavage furrow.
  - Daughter nuclear envelopes form
  - Chromatin begins de-condensing
  - By the end of Telophase - replication of the nucleus is complete and two genetically identical daughter nuclei are present.
- Cytokinesis
  - The division of the cytoplasm that forms 2 separate daughter cells each containing a single nucleus.
  - The division of the nucleus is usually followed quickly by cytokinesis

- End result
  - 2 identical daughter cells (Diploid)

### 3. Meiotic Cell Division

- Crossing Over
  - When the maternal and paternal chromosomes (of a homologous pair) have exchanged the genetic material. This exchange of DNA is called crossing over.
  - Pairs are held together by chiasmata
- Independent Assortment
  - Which side (maternal or paternal) faces which pole is random
  - This randomness is called independent assortment
- End result
  - Four haploid cells (Gametes)
- Meiosis I – First Division
- Meiosis II – Second Division (very similar to mitosis)

### 4. Genetic Diversity:

- The level of biodiversity, refers to the total number of genetic characteristics in the genetic makeup of a species. It is distinguished from genetic variability, which describes the tendency of genetic characteristics to vary.

### 5. Life Cycles

- Haploid
  - One set of chromosomes (we have 23)
  - (Eggs and Sperm)
  - Two haploid gametes unite during fertilization to form a zygote
- Diploid
  - All of our cells are diploid. Meaning the chromosomes are in pairs (2 sets of chromosomes), not singular
  - Diploid is the condition in which cells contain two sets of chromosomes, abbreviated 2n. Fig. 9.17
  - (Zygote)
- Alternation of Generations (also known as alternation of phases)
  - a. Metagenesis
    - A term primarily used to describe the life cycle of plants. A multicellular gametophyte, which is haploid with n

chromosomes, alternates with a multicellular sporophyte, which is diploid with  $2n$  chromosomes, made up of  $n$  pairs.

## Chapter 10:

### 1. Gene vs. Allele

Allele: are alternative forms of a gene that occupy a specific position (locus) on a specific chromosome.

- Each homologous pair of chromosomes has the same genes at the same place (locus), but they can have different alleles for the same gene

### 2. Homozygous v. heterozygous

- Homozygous: both the alleles are the same of a given trait

- Homozygotes are true-breeding

- Heterozygous: the two alleles are different for a given trait

- Heterozygotes are not true-breeding

### 3. Phenotype v Genotype

- Phenotype: is an organism's expressed traits

- What it looks like

- Genotype: is an organism's genetic traits

### 4. Mendel's Experiment

- True Breeding

- Varieties in which self-fertilization leads to offspring which are the same type as parent

- F1 (Generation)

- First generation offspring

- F2 (Generation)

- Second generation offspring

### 5. Test Cross

- According to the law of independent assortment, genes for different characters are inherited independently of each other

- The parental crosses that Mendel did in his earlier experiments involved parental varieties that differed in a single trait (i.e., monohybrid crosses)

### 6. Two trait cross

- Consider two traits for pea:

- Color: Y (yellow) and y (green)

- Shape: R (round) and r (wrinkled)

- Each dihybrid plant produces 4 gametes types of equal frequency.

- YyRr (adult) → four gametes types: YR, Yr, yR, or yr