

STUDY GUIDE: EXAM TWO

Cellular Division: Mitosis and Meiosis: (Chapter 17)

- 1. A.** In your own words, define cellular division. **B.** What is the purpose of cellular division in single celled organisms? **C.** in higher animals? **D.** what two types of cell division have we learned about?
- 2. A.** Define in your own words the following terms (use drawings to help explain): chromatin, chromosome, sister chromatid, centromere, homologous chromosomes (or homologues) **B.** Do sister chromatids carry identical genetic information? **C.** Do homologous chromosomes?
- 3. A.** Describe the relationship between autosomes (somatic chromosomes), sex chromosomes, somatic cells and sex cells (you can use a drawing to help illustrate your point.) **B.** Describe the terms diploid (2N) and haploid (N) in relation to the types of cells above.
- 4. A.** What is the cell cycle all about or what does it show? (briefly) **B.** Draw a simplified illustration of the cell cycle using only the words interphase, and mitosis. **C.** What is the longest phase of the cell cycle? **D.** This phase is divided up into three distinct stages. What are they and describe briefly what happens in each. **E.** Why must DNA replicate prior to mitosis and exactly when does this occur? **F.** What is cytokinesis and when does it occur?
- 5. A.** What is the purpose of mitosis? **B.** Mitosis has four distinct stages. What are they and describe in detail what happens in each stage.
- 6. A.** If a cell has 13 chromosomes as a haploid cell, how many chromosomes are found in the diploid cell of the same organism? **B.** If a somatic cell has 30 chromosomes, how many are in the gametes? **C.** A gamete has 8 chromosomes, is this the N or 2N number? and, how many chromosomes then, are in the somatic cells? **D.** If a somatic cell has 24 chromosomes, how many homologues are there? **E.** What is the haploid and diploid number of chromosomes in humans?
- 7. A.** What is the purpose of meiosis in higher animal such as humans?
B. Why is this also called reduction division? **C.** Does the DNA replicate during the S stage of interphase prior to meiosis just like it does in mitosis forming sister chromatids?
- 8. A.** Meiosis is broken into two large divisions: meiosis I and meiosis II.
Name the stages within each of those large divisions. **B.** what is crossing over? **C.** when does it occur in meiosis? **D.** what is the significance of crossing over? **E.** Describe how the separation of chromosomes is different in Anaphase I and Anaphase II.

9. **A.** How is the outcome of mitosis different from meiosis in cell number and chromosome number? **B.** If a cell has 32 chromosomes and undergoes meiosis, how many chromosomes would be found in each daughter cell? **C.** what if the original cell undergoes mitosis?

Molecular Biology: (Chapter 17)

1. **A.** What is the monomer unit of DNA and what are its three parts? **B.** Draw a DNA nucleotide. **C.** What is the shape of a DNA molecule? What makes up the sides of the "ladder"? What makes up the steps of the "ladder"? **D.** Where in the cell is DNA found? **E.** Diagram a short section of DNA with six bases on one side. (use each possible base at least once)

2. **A.** What is the monomer unit of RNA and what are its three parts? **B.** What is the shape of an RNA molecule **C.** Where in the cell can RNA found? **D.** What are the three different types of RNA studied? **E.** Diagram a short section of RNA with six bases. (use each possible base at least once)

3. Name five differences (physical and/or functional) between DNA and RNA.

4. **A.** What is the overall purpose of DNA replication? **B.** During which stage (specifically) of the cell cycle does DNA replication occur?

5. **A.** In your own words, what are the basic steps in DNA replication. **B.** where in the cell does DNA replication occur? **C.** describe what is meant by "semi-conservative" replication. **D.** How could semi-conservative replication provide an advantage the cell?

6. **A.** What does the term protein synthesis mean? **B.** What are the two major steps involved in protein synthesis? **C.** Must DNA replication occur in order for an individual cell to make proteins?

7. **A.** In your own words, give a simplified description of what happens during transcription. **B.** briefly outline the steps of transcription. **C.** what happens after transcription, before the mRNA strand is ready to begin translation? (Hint: use the terms intron, exon, cap, tail)

8. **A.** Why is mRNA called a template? **B.** Where does transcription occur? why does it have to occur there? **C.** Where does the mRNA molecule move after transcription is complete?

9. **A.** In your own words, describe what happens during translation. **B.** briefly outline the steps of translation: include at least the terms: mRNA, codon, ribosome, tRNA charged w/ amino acid, anticodon, polypeptide. **C.** where in the cell does translation occur? why does it have to occur there?

10. **A.** What is an anti-codon and on what molecule is it located? **B.** By what process are the amino acids joined together? **C.** Once a polypeptide chain is formed (primary structure) what has to happen before it can become a functional protein? Where does this occur?

11. In review, briefly explain how the master "code" for a particular protein found in the DNA, is ultimately expressed by the production of that same protein in the cytoplasm. (brief overview of protein synthesis)

12. **A.** In your own words, what is a gene mutation? **B.** What do we call things that can cause mutations in DNA? **C.** What are the two main types of DNA mutations? **D.** Which type is likely to be more damaging to the protein?

Biotechnology: (Ch. 20)

1. **A.** What is meant by "recombinant DNA" **B.** What are restriction enzymes" and how are restriction enzymes used in making recombinant DNA? **C.** How is it possible the same restriction enzyme can cut DNA from two different people into different lengths of DNA segments? **D.** what are these lengths of DNA called?

2. **A** Describe the process of making recombinant DNA as outlined in class. **B.** What are some uses for this technology?

3. **A.** What is meant by a DNA "fingerprint"? **B.** Explain how/why electrophoresis can separate DNA fragments (RFLP's) from each other. **C.** In a few sentences explain how DNA fingerprinting could allow you to help solve a murder mystery.

4. Give some example of the following and how they might benefit humans: **A.** Transgenic bacteria **B.** Transgenic plants **C.** Transgenic animals. **D.** Briefly discuss the controversies?

Heredity: (Ch. 19)

1. Define the following terms, give examples to help explain your answer: **a.** gene, **b.** allele, **c.** dominant allele, **d.** recessive allele, **e.** genotype, **f.** homozygous dominant, **g.** homozygous recessive, **h.** heterozygous/hybrid **i.** phenotype

2. **a.** Who was Gregor Mendel? **b.** What organism did he use in his study? **c.** What is meant by Mendelian Inheritance?

3. **a.** When doing a punnett square, what do the letters outside of the box represent and where do they come from (be specific)? **b.** If a parent is homozygous dominant for a trait, how many different kinds of gametes can (s)he make? Give an example **c.** If the parent is homozygous recessive ...? Example? **d.** If the parent is heterozygous ...? Example? **e.** What do the letters inside the box represent (be specific)?

4. Show a monohybrid cross using the following information:
L = long wings, l = short wings Show the punnett square and give the genotypic and phenotypic outcomes of the offspring.

5. Explain Mendel's principle of segregation: to help illustrate your point give an example.
6. Show a dihybrid cross using the following information:
L = long wings, l = short wings and N = notched wings, n = smooth wings Show the punnett square and give the genotypic and phenotypic outcomes of the offspring.
7. Explain Mendel's principle of independent assortment: to help illustrate your point, give an example.
8. **a.** Distinguish between complete dominance, co-dominance and incomplete dominance.
b. Human blood groups have which two types of dominance? Explain/show how this works.
9. **a.** What is meant by multiple alleles? **b.** give an example **c.** If a man of blood type B and a woman of blood type A have children, show (by punnett square) how they could have children of all blood phenotypes (A, B, AB and O)
10. **a.** What is meant by Polygenic Inheritance? **b.** Give an example of a human trait that is governed by polygenic inheritance.
11. **a.** what are sex-linked traits? **b.** What are X-linked traits? Give some examples. **c.** which sex is generally affected in a greater percentage? **d.** If a colorblind male marries a carrier female, what are the chances that their children will be color-blind? **e.** Cross: $X^H X^h$ and $X^H Y$ What % of offspring are normal? **f.** what are sex influenced traits? Give an example
- 12.**a.** For what scientific purpose are pedigrees used? **b.** draw and label the pedigree symbols used in class. **c.** be able to fill out an autosomal dominant or recessive pedigree and an X-linked dominant or recessive pedigree (study class notes)
13. Chromosomal abnormalities: **a.** What is meant by "non-disjunction"? **b.** What is trisomy? Give an example **c.** what is monosomy? Give an example
14. Describe the following: **a.** amniocentesis, **b.** karyotype, **C.** chorionic villus sample
15. **a.** What is meant by an "autosomal recessive trait"? **b.** give some examples of autosomal recessive diseases. **c.** What is meant by an "autosomal dominant trait"? **d.** give some examples of autosomal dominant diseases.