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Chapter 9, 10, 11 – *Inheritance, Molecular Biology, and Gene Expression*

GENETICS EXAM REVIEW

Chapter 9 – Mendelian Genetics (punnet squares, monohybrid/dihybrid crosses, pedigrees) **{Web/CD Activity 9A}**

The introductory modules of Chapter 9 discussed the basic principles of heredity and introduced the vocabulary of genetics. Reread modules 9.1 through 9.4 carefully and then revisit the vocabulary by matching each phrase on the right with a word or phrase on the left.

A. allele	1. a unit that determines heritable characteristics
B. homozygous	2. organisms that always produce offspring identical to parents
C. hybrid	3. the offspring of two different varieties
D. genotype	4. when two alleles of a pair are different, the one that is masked
E. segregation	5. an incorrect idea that acquired characteristics are passed on
F. F_2 generation	6. parent organisms that are mated
G. true-breeding	7. a diagram that shows possible combinations of gametes
H. heterozygous	8. a breeding experiment that uses parents different in one characteristic
I. self-fertilization	9. one of the alternative forms of a gene for a characteristic
J. dominant	10. relative numbers of organisms with various characteristics
K. P generation	11. an organism that has two different alleles for a characteristic
L. monohybrid cross	12. old idea that hereditary materials from parents mix in offspring
M. wild type	13. an organism's genetic makeup
N. phenotype	14. separation of allele pairs that occurs during gamete formation
O. cross	15. fertilization of a plant by pollen from a different plant
P. F_1 generation	16. an organism that has two identical alleles for a characteristic
Q. recessive	17. offspring of the P generation
R. homologous	18. a characteristic most commonly found in nature
S. gene	19. what an organism looks like; its expressed traits
T. phenotypic ratio	20. offspring of the F_1 generation
U. pangenesis	21. when pollen fertilizes eggs from the same flower
V. cross-fertilization	22. a hybridization
W. Punnett square	23. when two alleles of a pair are different, the one expressed
X. blending	24. where genes for a certain trait are located

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Test your knowledge of Mendel's principles by answering the following questions. You will need a sheet of scratch paper to test your ideas!

Monohybrid Cross

1. A pea plant with green pods is crossed with a plant with yellow pods. All their offspring have green pods.

a. Which allele is dominant? Which allele is recessive?

b. Using letters, what is the genotype of the green parent? The yellow parent?

c. What are the genotypes of the offspring?

2. F_1 pea plants from the above cross are crossed. Use a Punnett square to figure out the genotypic and phenotypic ratios in the F_2 generation.

a. Genotypic ratios:

b. Phenotypic ratios:

3. Two black mice mate. Six of their offspring are black and two are white.

a. What are the genotypes of the parents?

b. For which offspring are you sure of the genotypes?

4. A man and a woman, both without freckles, have four children. How many of the children would you expect to have freckles?

5. Both Fred and Wilma have widow's peaks. Their daughter Shirley has a straight hair-line. What are Fred and Wilma's genotypes?

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Dihybrid Cross

Mendel studied the inheritance of two characteristics at once and found that each pair of alleles segregates independently during the formation of gametes. In other words, if a tall pea plant with purple flowers is crossed with a short plant with white flowers, some of their descendants can be tall with white flowers. The tall and purple alleles do not have to stick together-they are independent.

Using page 160, write the genotypes of rabbits and gametes in the P, F_1 and F_2 generations in the blanks in the Punnett square on the next page. Then use the Punnett square to figure out the phenotypic ratios in the F_2 generation-the proportion of rabbits that you can expect to be brown and short-haired, brown and long-haired, white and short-haired, and white and long-haired.

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Pedigrees

Family trees called pedigrees are used to trace the inheritance of human genes. The two pedigrees below show the inheritance of sickle-cell disease which is caused by an autosomal recessive allele. Fill in the genotypes-***SS, Ss, or ss***-below the symbols in the first pedigree. Use the question marks to denote unknown genotypes. Complete the second pedigree by coloring in the symbols, following the rules described on page 163.

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Chapter 10 – Molecular Biology of the Gene **{Web/CD Activity 10J, K, and L}**

A. RNA viruses	1. consists of nucleic acid packaged in protein
B. prophage	2. leads quickly to breaking open of host cell
C. AIDS	3. phage DNA inserted into bacterial chromosome
D. Glycoprotein spikes	4. when virus "hides" as part of bacterial chromosome
E. Virus	5. responsible for toxins of diphtheria, botulism
F. DNA	6. rod-shaped plant virus
G. lytic cycle	7. this or DNA may be virus genetic material
H. vaccine	8. cause of flu, colds, polio, mumps, AIDS
I. nucleus	9. helps flu or mumps virus enter and leave host cell
J. membranous envelope	10. used by mumps virus or HIV to attach to host receptors
K. bacteriophage	11. Mumps virus reproduces here
L. provirus	12. Mumps virus makes this and protein from RNA template
M. HIV	13. Mumps virus gets envelope from this part of the host cell
N. reverse transcriptase	14. Herpes virus reproduces here
O. lysogenic cycle	15. genetic material of herpes virus
P. retrovirus	16. DNA of herpes virus inserted into host cell DNA
Q. White blood cell	17. can be used to prevent a viral disease
R. Prophage genes	18. virus that causes AIDS
S. tobacco mosaic	19. genetic material of HIV
T. plasma membrane	20. RNA virus that reproduces by means of DNA
U. RNA	21. enzyme that can make DNA from RNA template
V. Cytoplasm	22. form in which HIV "hides" in host cell
W. Hantavirus	23. Acquired immune deficiency syndrome
X. Ebola virus	24. kind of cell infected by HIV
	25. causes an African hemorrhagic fever
	26. virus like T2 that infects bacteria
	27. an RNA virus carried by rodents

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Modules 10.8 to 10.16 describe the genetic code, how biologists cracked the code, and how mutations change the meaning of the coded genetic message. Use the genetic code chart (figure 10.8A in the textbook, p. 194) to translate the following mRNA's into amino acid sequences and answer the questions.

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Chapter 11 – Gene regulation in eukaryotes and prokaryotes **{Web/CD Activity 11C}**

Review Chapter 11 and summarize the mechanisms that regulate gene expression in eukaryotes. Match each of the mechanisms of regulation with the stage of gene expression at which it acts. Choose from**: mRNA breakdown, addition of cap and tail, transcription, splicing, translation, and flow through nuclear envelope.**

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VIDEO: RNA

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VIDEO: The Science of HIV

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