

## Mr. Epithelium's 2018 SSSS Heredity Test

You have 50 minutes to complete this test packet. One 8.5 x 11 cheat sheet is allowed, along with 1 non-programmable calculator dedicated to computation. Good luck!

Every question is worth 1 point unless otherwise specified

Name(s): \_\_\_\_\_ Score: \_\_\_/91+\_\_\_/1 bonus point= \_\_\_/92

### Part I: Terminology

1. An alternate form of a gene is commonly known as

- A. Homozygosity
- B. Allele
- C. Heterozygosity
- D. Differentiation genes

2. Humans have \_\_\_ pairs of autosomes.

- A. 22
- B. 23
- C. 44
- D. 46

3. The P generation gives rise to the \_\_\_ generation.

- A. P1
- B. Offspring
- C. F1
- D. O1

4. \_\_\_ are the coiled, unused X-chromosome in females.

- A. Nondisjunction Complexes
- B. Telomeres
- C. Lagging Strand
- D. Barr bodies

5. If 8/10 individuals carrying an allele expresses the trait, the trait is said to be 80% \_\_\_\_ (2 pts)

- A. Penetrant
- B. Expressed
- C. Common
- D. Dominant

6. The phase in the cell cycle in which the cell prepares for mitosis is the

- A. G1 Phase
- B. G2 Phase
- C. S Phase
- D. Cytokinesis

7. Smaller chunks of separately made units in the lagging strand by DNA polymerase are called

- A. Exonucleases
- B. Small subunits
- C. Okazaki fragments
- D. Introns

8. Cytosine and Thymine collectively are known as

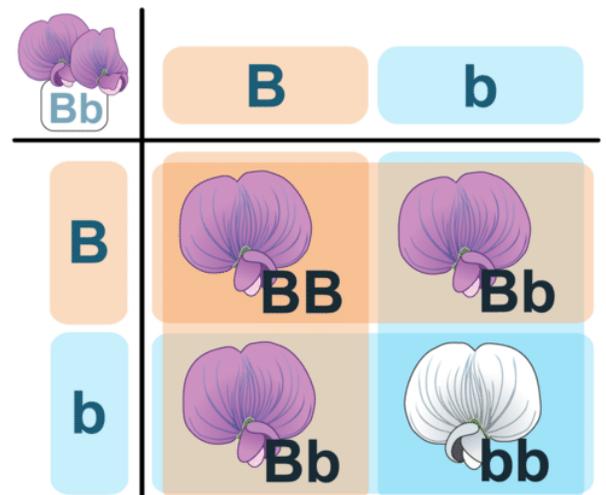
- A. Nucleosides
- B. Nucleotides
- C. Purines
- D. Pyrimidines

### Part II Inheritance and Punnett Squares

9. Examine the Punnett square (Figure 1.1) to the right.

a. This is an example of

- A. Mendelian Cross



B. Incomplete Dominance

C. Codominance

D. Monohybrid Cross

b. Use Figure 1.1 to find the genotype frequency

\_\_\_\_\_

c. Use Figure 1.1 to find the phenotype frequency

\_\_\_\_\_

10. The Punnett square to the right (Figure 1.2) shows a certain species of mice that can have 3 different fur colors- tan, black, and white- based on the genotype of the offspring.

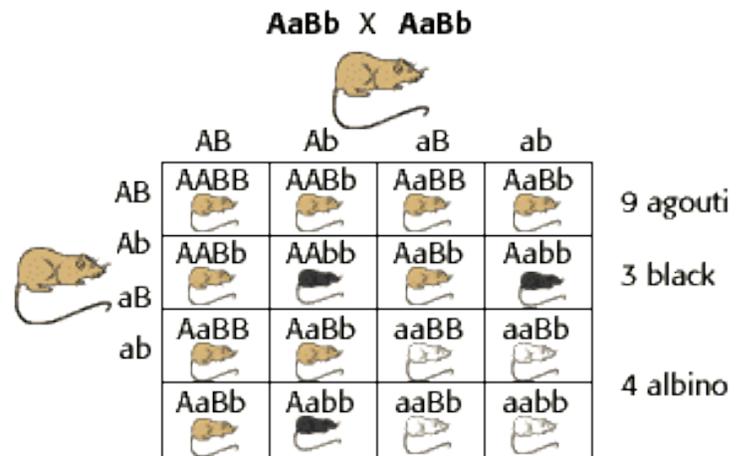
a. From the genotypes of the Punnett square and the given information, determine the mode of inheritance show in Figure 1.2

A. Epistasis

B. Multifactorial inheritance

C. Pleiotropy

D. Sex-linkage



b. In a few sentences (or just one), explain you answer to question 10a. Be sure to explicitly include information in the Punnett square in your answer. (3pts)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

11. When 2 snapdragons that are red and white cross, they give rise to an all pink progeny.

a. What type of inheritance is shown?

A. Codominance

B. Incomplete dominance

C. Multiple alleles

D. Pleiotropy

b. If the pink progeny are crossed, what phenotypic frequency will be shown? (2pts)

\_\_\_\_\_

12. A male has type AB blood, and a female has type AB blood. What type of blood is not possible for their child to have? Fill in the Punnett square to accompany your answer. (2pts)

\_\_\_\_\_

13. A certain species of pumpkin has genes that determine the color and size of the pumpkin. One pumpkin has alleles for red (Rr) and small (bb). Another pumpkin has alleles for white (rr), and large (Bb).

a. What is the probability for a red and small offspring if the 2 pumpkins are crossed? (2pts)

\_\_\_\_\_

b. What's the probability that the offspring will be white and large? (2pts)

\_\_\_\_\_

14. A brown-eyed male is heterozygotic for the 2 alleles B and b, which control eye color. A female is homozygous recessive for the 2 alleles.

a. What is the theoretical phenotypic ratio of the offspring they have?

\_\_\_\_\_

b. What is the genotypic ratio?

\_\_\_\_\_

c. Suppose one of their children has a child with a person that is heterozygous for the 2 alleles. What are the possible genotypes?

\_\_\_\_\_

15. A sex-linked trait in humans is red-green colorblindness, which is found in more men than women. A female with normal vision but had a colorblind father has a child with a male that has normal vision.

a. Fill in the Punnett square to the right with the information provided in 15.

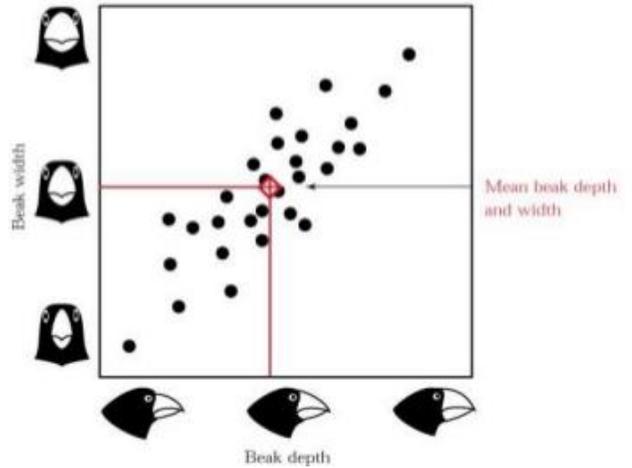
b. If having a child of either sex is of equal probability, what are the chances that the couple has a colorblind female?

\_\_\_\_\_

c. If a colorblind male marries a female carrier for the disease, what fraction of their male offspring will have normal vision?

\_\_\_\_\_


16. Charles Darwin traveled to the Galapagos Islands to study finches. He discovered (among other observations) that the shallower and narrower the finch's beak was, the deeper and wider it was as well (as shown in figure 1.3).



a. What type of inheritance is this? (2pts)

\_\_\_\_\_

b. We can say that the 2 variables have a \_\_\_\_ relationship.

- A. Positive
- B. Negative
- C. Inverse
- D. Joint proportional

17. Suppose in a species of mice, there are numerous genes that control what it looks like. R determines coat color (white or brown), T determines tail color (tan or white). Gene D is special. If D is homozygous recessive, it will make coat and tail color white, regardless of R or T. T, R (white), B, and D are dominant. t, r (brown), b, and d are recessive.

a. A  $TtRrBbDd$  mouse mates a  $ttRrBbdd$  mouse. What are the chances that one of the offspring is white coat, white tail? (5pts)

\_\_\_\_\_

b. What type of inheritance is this?

\_\_\_\_\_

c. The mouse also has gene B, a lethal gene (if it is homozygous recessive, the mouse will die). What's the probability, out of the living offspring, that the mouse has a white coat and tail? (5pts)

\_\_\_\_\_

18. First experimented on by Gregor Mendel, it was recognized by him as a phenomenon in which several pea plant traits seemed to be inherited as a group. What type of inheritance was described?

- A. Epistasis
- B. Pleiotropy
- C. Multifactorial
- D. Coinheritance

### Part III The Cell Cycle

19. The \_\_\_ phase is where the cell grows and synthesizes new DNA.

- A. G1 Phase
- B. S Phase
- C. G2 Phase
- D. Mitosis

20. When the spindle fibers attach to the chromosomes, they line up at the: (2pts)

\_\_\_\_\_

21. What is the phase of mitosis in which the chromosomes separate?

- A. Prophase
- B. Metaphase
- C. Anaphase
- D. Telophase
- E. Cytokinesis
- F. Interphase

22. \_\_\_ is commonly separated from mitosis, however, it occurs during telophase. What is the name for the process in which the cytoplasm splits to make two new cells?

- A. Metaphase
- B. Anaphase
- C. Telophase
- D. Cytokinesis

23. DNA replication is the process in which new DNA is formed and synthesized in a cell.

a. How many times does the DNA replicate in meiosis?

\_\_\_\_\_

b. How many times does the DNA replicate in mitosis?

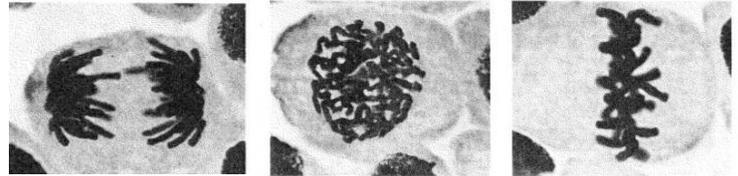
\_\_\_\_\_

24. Which part of mitosis is essentially the opposite of prophase?

\_\_\_\_\_

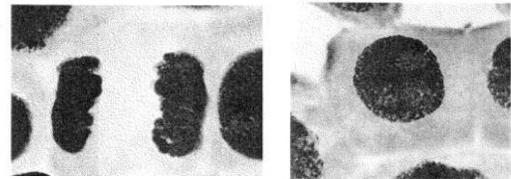
25. Starting from the top left and clockwise, list the stages of mitosis based on pictures taken under a microscope. (5pts)

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,  
 \_\_\_\_\_, \_\_\_\_\_



25a. Bonus!!! For the Microbe Mission fans, what type of microscope most likely took this picture?

\_\_\_\_\_



**Part IV DNA, Replication, Translation and Transcription**

26. During the cellular process of transcription, the template strand is read \_\_\_\_ and the mRNA is synthesized \_\_\_\_.

- A. 5'-3', 5'-3'
- B. 5'-3', 3'-5'
- C. 3'-5', 5'-3'
- D. 3'-5', 3'-5'

27-32. Match each enzyme with its function:

27. DNA Ligase	A. Unwinds the DNA
28. DNA Primase	B. Attaches the nucleotides after the primer
29. DNA Polymerase I	C. Seals up fragments of DNA
30. DNA Polymerase III	D. Replaces RNA primers with nucleotides
31. Helicase	E. Unzips DNA
32. Topoisomerase	F. Creates starting strand of RNA primers.

33. DNA replication is- (2pts)

- A. Conservative
- B. Semiconservative
- C. Mixed
- D. Anaerobic

34. Which nitrogenous base can only be found in RNA?

- A. Uracil
- B. Thymine
- C. Cytosine
- D. Guanine

35. What type of RNA carries genetic code from the DNA into the cytoplasm?

- A. Ribosomal RNA
- B. Transfer RNA
- C. Codon RNA
- D. Messenger RNA

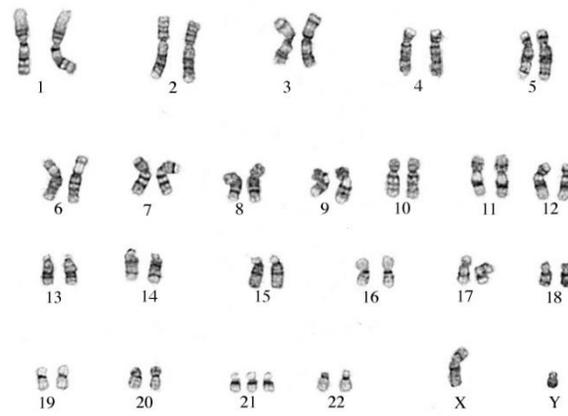
36. A segment of DNA has the following sequence of nitrogenous bases- AATGCATTCCGTAA. Write out the sequence that would be found on the opposing RNA template.

\_\_\_\_\_

### **Part V Pedigrees and Karyotypes**

37. Suppose the trait of dimples runs in a family line. John, a male with dimples marries Mary, a female that's younger than John and has no dimples. Both heterozygotes, that have 4 children, (listed youngest to oldest), Lucy, an unaffected female; Andy, a male with dimples; Jordan, an unaffected male; and Veronica, a female with no dimples. The 2<sup>nd</sup> oldest out of the 4 siblings marries a younger, unaffected female, and has 3 daughters, the youngest with dimples. The youngest out of the 4 siblings marries a younger male called Jake, who doesn't know whether or not he has dimples. Jake's parents, listed from birth date, are Jeff, with no dimples, and Amy, with dimples. Jake and the youngest of the 4 siblings have 3 unaffected children, the oldest and youngest are sons, and middle being a daughter.

- a. Construct a pedigree for this situation. (15pts)
- b. What type of inheritance is shown?
- c. Find Jake's phenotype.



38. Examine figure 5.1 to the right.

- a. What is the sex of the person to the right?
- b. Name any nondisjunction disorder if any. (2pts)