

Multiple Choice Review – Mendelian Genetics & Inheritance Patterns

1. Jean-Baptiste Lamarck introduced a theory about inheritance in the early 1800s. Which of the following accurately describes his *Theory of Acquired Characteristics*?
 - a. Offspring traits are the result of the blending of traits from the parents.
 - b. Offspring traits are the result of parent individuals modifying their traits due to use or non-use.
 - c. Traits are acquired from genes, and arise only from the mother not from the father.
 - d. Traits are acquired from grandparents and skip the parent generation altogether.

2. Gregor Mendel was a critical contributor to our understanding of inheritance today. In his experiments he tracked seven visual traits of pea plants and ensured that they produced offspring identical to themselves. What are the terms that we used to identify two separate factors?
 - a. genotype; true breeding
 - b. genotype; cross breeding
 - c. phenotype; true breeding
 - d. phenotype; cross breeding

3. Mendel crossed two plants, called the P generation. The offspring of this cross are known as hybrids. What are hybrids?
 - a. The result of crossing two true breeding plants; they contain two genes, one of each allele.
 - b. The result of a hybrid cross; they contain two genes for each trait, both carrying the recessive allele.
 - c. The result of a hybrid cross; they contain two genes for each trait, both carrying the dominant allele.
 - d. The result of crossing two true breeding plants; they contain two genes of identical alleles.

4. Mendel observed patterns of inheritance for all of the traits he tested. The F₁ generation all had a phenotype identical to one of the parents in the P generation. What results did he find for the F₂ phenotypes?
 - a. $\frac{1}{2}$ had the phenotype of one P generation plant; $\frac{1}{2}$ had the phenotype of the F₁ parents.
 - b. $\frac{1}{4}$ had the phenotype of the F₁ generation and $\frac{3}{4}$ had the phenotype of one of the P generation parents.
 - c. $\frac{3}{4}$ had the phenotype of the F₁ generation and $\frac{1}{4}$ had the phenotype of one of the P generation parents.
 - d. The results were not repeatable and identical for the F₂ generation, only for the F₁ generation.

5. Which of the following statements **best** describes one aspect of the chromosomal theory of inheritance, posited after Mendel's time?
- Chromosomes account for all of the phenotypic traits found in every organism.
 - The hereditary factors from Mendel's experiments are actually single chromosomes.
 - Chromosomes can be found within alleles, accounting for different phenotypic traits.
 - The hereditary factors from Mendel's experiments are actually genes located on chromosomes.

Below is a Punnett square showing a cross between two parents. Use this information to respond to the next five questions.

P generation: BB x bb

Complete dominance: B = black rat b = white rat

	B	B
b	Bb	Bb
b	Bb	Bb

6. Referring to the Punnett square above, which of the following accurately represents the phenotypic and genotypic ratios of the F₁ generation?
- Phenotypic ratio 100% white, genotypic ratio 100% Bb.
 - Genotypic ratio 100% black, phenotypic ratio 100% Bb
 - Phenotypic ratio 100% black, genotypic ratio 100% Bb
 - Phenotypic ratio 50% black, 50% white, genotypic ratio 100% Bb
7. Using the information in the Punnett square above, how would we refer to the parents and the offspring?
- One parent homozygous, one is heterozygous, the offspring are homozygous
 - One parent is homozygous dominant, one parent is homozygous recessive, the offspring are heterozygous
 - One parent is homozygous dominant, one parent is heterozygous recessive, the offspring are homozygous dominant
 - One parent is heterozygous dominant, one is heterozygous recessive, the offspring are heterozygous dominant

8. If we were to cross the offspring in the Punnett square above (known as the F₁ generation) what will be the genotypic and phenotypic ratios of the F₂ generation?
- Phenotypic ratio 3:1; genotypic ratio 1:2:1
 - Phenotypic ratio 1:2:1, genotypic ratio 3:1
 - Phenotypic ratio 3:1, genotypic ratio 3:1
 - Phenotypic ratio 1:2:1, genotypic ratio 1:2:1
9. Mendel used dihybrid crosses in an effort to uncover more information about inheritance patterns. From this he developed two laws of inheritance. Which of the following accurately described the law of segregation?
- This law states that alleles, on different chromosomes, will be inherited independently of one another.
 - This law states that gametes each carry only one allele for a trait, to be combined when fertilization occurs.
 - This law states that gametes carry two alleles for each trait to ensure adequate inheritance by offspring.
 - This law states that alleles, on the same chromosome, will be inherited independently of one another.
10. What is considered to be incomplete dominance?
- When the phenotype of the hybrid is the same as for the homozygous recessive.
 - When the phenotype of the hybrid is the same as for the homozygous dominant.
 - When the phenotype of the hybrid shows an in-between phenotype of the two parents.
 - Then the phenotype of the homozygous dominant shows an in-between phenotype of the two parents.

A cross occurs between a black homozygous mouse and a white homozygous mouse. They produce gray offspring. Use this scenario to respond to the next three questions:

11. What type of dominance is reflected in the scenario above?
- codominance
 - incomplete dominance
 - complete dominance
 - blending of genes
12. What are the percentage probabilities for the genotype and phenotype of the offspring?
- 100% black; 100% Bb
 - 100% gray; 100% bb
 - 100% white; 75% Bb, 25% bb
 - 100% gray; 100% Bb

13. Referring to the mouse scenario noted above, what is the percentage phenotypic probability if we cross two gray mice from the F₁ generation?
- 100% black
 - 75%gray; 25% white
 - 25% black; 50% gray; 25% white
 - 50% black; 50% white
14. A cross occurs between a chicken with white feathers and a chicken with black feathers. This results in offspring with some black feathers and some white feathers. What type of inheritance is this?
- incomplete dominance
 - complete dominance
 - codominance
 - blended dominance
15. Sickle cell disease is the result of one gene abnormality. When two recessive alleles occur, sickle cell disease is inherited. The disease results in misshaped hemoglobin. What type of molecule is hemoglobin?
- protein
 - carbohydrate
 - lipid
 - RNA
16. Polygenic inheritance refers to which of the following conditions of inheritance?
- When one allele affects more than one trait.
 - When multiple alleles affect one trait.
 - When multiple alleles affect multiple traits.
 - When one allele dominates another allele.
17. A group of individuals have lived for generations on an island. Their average height is 5 feet 2 inches. Eventually, ships stop by the islands bringing more fruits, vegetables and meats to their diet and more food overall. While the islanders continue to marry islanders and produce children, over generations the average height of the islander population reaches 5 feet 6 inches. What was most likely the main factor in this change?
- changes and mutations in the genes within the island population of islanders
 - changes in nutrition that affected the phenotype, fully expressing the genotype
 - an influx of new genes from the incoming human population
 - the effect of medications brought by the ships stopping at the island

A man who is a carrier for cystic fibrosis marries a woman who is a carrier for cystic fibrosis. Respond to the next three questions based upon this scenario.

18. What is the percentage probability that this couple will have a child with cystic fibrosis?
- 50%
 - 100%
 - 75%
 - 25%
19. What is the percentage probability that they will have a child who is a carrier?
- 50%
 - 100%
 - 75%
 - 25%
20. The couple in the above scenario has four children. How many of their children will have cystic fibrosis?
- one
 - two
 - it could be none to all of their children
 - it depends whether they are male or female
21. Issues with inbreeding often occur with dog breeds, such as German shepherds. How can we best describe inbreeding?
- successive breeding with individuals from a variety of populations
 - successive breeding with individuals from within one population
 - breeding between different breeds to produce new breeds
 - breeding the same set of parents more than once
22. How does inbreeding increase the probabilities of recessive disorders?
- Carriers have an increased chance of reproducing together to produce a homozygous recessive condition.
 - Homozygous recessive individuals are more likely to live and reproduce when based within strong families.
 - Spontaneous mutations are increased when closely related organisms reproduce successively
 - The probability that individuals who are homozygous recessive increase as the heterozygous conditions increase

23. What is true about the majority of sex-linked disorders in humans?
- Females have a high probability of inheriting sex linked disorders
 - Males have a higher probability of inheriting sex linked disorders
 - Gender does not play a role in the probability of inheriting a sex linked disorder
 - Females have a higher probability of inheriting recessive sex linked disorders.

Use the information and the Punnett square below to respond to the next three questions:

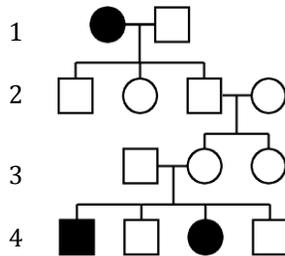
Hemophilia is an X linked recessive disorder

	X^H	X^h
X^H	X^HX^H	X^HX^h
y	X^Hy	X^hy

24. What are the chances that this couple will have a child with the hemophilia?
- 75%
 - 50%
 - 25%
 - 0%
25. The mother undergoes amniocentesis during her pregnancy, and is told that the child she is carrying is a boy. What are the chances that her son will have hemophilia?
- 75%
 - 50%
 - 25%
 - 0%
26. The mother has a second pregnancy four years later. She is told that her baby will be a girl. What are the chances that her daughter will have hemophilia?
- 75%
 - 50%
 - 25%
 - 0%

27. Which of the following is accurate about an X-linked trait?
- There is a 50% chance that a son inherits an X-linked trait from his father
 - There is a 25% chance that a son inherits an X-linked trait from his father
 - There is 0% chance that a son inherits an X-linked trait from his father
 - There is an 80% chance that a son inherits an X-linked trait from his father
28. Prenatal or fetal tests can be performed that can provide information about the genetic make-up. Which of the following is based upon family history to estimate probabilities of genetic disorders?
- amniocentesis
 - pedigrees
 - chorionic villus sampling
 - fetoscopy

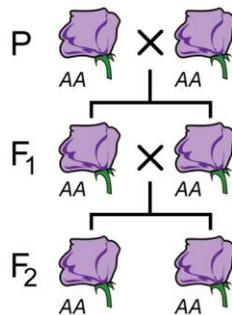
Use the pedigree shown below to answer the next two questions:



<http://faculty.clintoncc.suny.edu/faculty/michael.gregory/files/bio%20101/Bio%20101%20Laboratory/Pedigree%20Analysis/PEDIGREE.HTM>

29. Given the information provided in the pedigree above, what can we determine about the trait seen in the darkened circles and squares?
- The trait is autosomal dominant
 - The trait is autosomal recessive
 - The trait is x-linked dominant
 - The trait is x-linked recessive
30. What are the genotypes of the parents in level 1, in the above pedigree?
- mother is homozygous dominant, father is homozygous recessive
 - mother is homozygous recessive, father is homozygous dominant
 - mother is homozygous recessive, father is heterozygous
 - mother is heterozygous, father is homozygous dominant

31. What determines “maleness” in humans?
- An extra Y chromosome, resulting in YY
 - A single X chromosome, resulting in XO
 - A single Y chromosome, regardless of number of X chromosomes.
 - A single X chromosome, regardless of the presence of any Y chromosomes.
32. What does the term autosomal refer to?
- The non XY chromosomes found in an organism
 - The XY chromosomes found in an organism
 - The dominant homozygous trait
 - The recessive homozygous trait
33. Which of the following accurately describes the relationship between a dominant and a recessive allele?
- The dominant allele physically alters the recessive allele so that it cannot be expressed
 - The dominant allele blends with the recessive allele to produce an in-between trait
 - The dominant allele is expressed however the recessive allele is unaltered.
 - The dominant allele is more common in the species population than the recessive.
34. What type of organisms (for the trait of flower color) are shown crossed in the image below?



<http://cubocube.com/dashboard.php?a=1181&b=1259&c=103>

- false breeding plants
- heterozygous plants
- self-breeding plants
- true breeding plants

35. The probability of an event, such as inheriting a recessive allele, is $\frac{1}{2}$. The probability of inheriting a second recessive allele is $\frac{1}{2}$. What, then, is the probability of inheriting two recessive alleles?
- $\frac{1}{2}$
 - $\frac{1}{4}$
 - $\frac{1}{8}$
 - $\frac{1}{10}$
36. Consider a dihybrid cross between two rabbits LlBb x LlBb. What are the phenotypic ratios of the offspring? (L = long ears l = short ears; B = black b = white)
- 12 Long Black: 4 short white
 - 9 Long white: 3 Long Black: 3 short Black: 1 short white
 - 9 Long Black; 3 Long white: 3 short Black: 1 short white
 - 12 short Black: 4 Long Black
37. Blood type in humans is the result of multiple alleles. Blood type is also an example of which type of inheritance pattern?
- Complete dominance
 - Incomplete dominance
 - Co-dominance
 - X-linked inheritance
38. A female who is AO (i^A, i^O) mates with a male who is BO (i^B, i^O). What possible blood types can their children inherit?
- Types, A, AB, B and O
 - Types AB and O
 - Types A and B
 - Types A, B and O
39. Before having children, a couple prepares a pedigree of their family for one particular autosomal dominant disorder. They chart all of their relatives back three generations. From this information, can they determine whether or not they will have a child with the disorder?
- It is possible, but not guaranteed.
 - Yes, they can absolutely tell from this information
 - No, it is not possible with this type of disorder.
 - Yes, they can know with certainty.
40. What is meant by the term pleiotropy?
- When a single allele affects a single phenotype
 - When a single allele affects multiple phenotypes
 - When multiple alleles affect multiple phenotypes
 - When multiple alleles affect a single phenotype

Answer Key

Question #	Correct response		Question #	Correct response
1	B		21	B
2	C		22	A
3	A		23	B
4	C		24	C
5	D		25	B
6	C		26	D
7	B		27	C
8	A		28	B
9	B		29	B
10	C		30	C
11	B		31	C
12	D		32	A
13	C		33	C
14	C		34	D
15	A		35	B
16	B		36	C
17	B		37	C
18	D		38	A
19	A		39	D
20	C		40	B

