

Designer Genes Test

Names:

Team #:

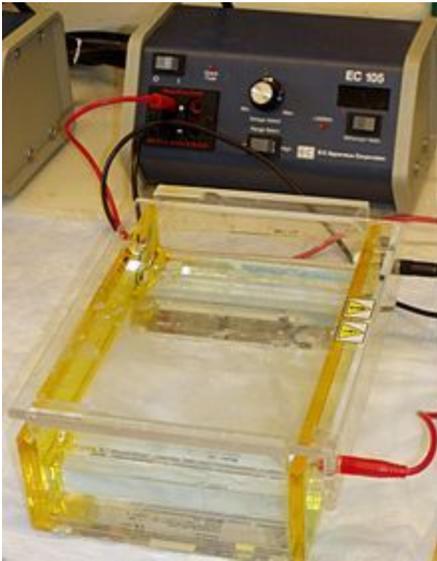
School:

Part 1: Multiple Choice

Each question is 2 points each.

1. Jackie crosses a red haired Pokemon with a white haired pokemon. Hair color is solely determined by a single gene, with the allele coding for red hair being dominant. What is the probability that the offspring of the crossed pokemon will exhibit a white haired phenotype?
 - a. 25%
 - b. 50%
 - c. 75%
 - d. 100%
 - e. Cannot be determined by the given information
2. A common form of sickle cell anemia is caused by a mutation that results in hemoglobin proteins that aggregate together but have the same size and shape of normal hemoglobin. What kind of mutation is the most likely cause of this form of sickle cell anemia?
 - a. Frameshift mutation
 - b. Deletion mutation
 - c. Nonsense mutation
 - d. Missense mutation
3. On average, the child of an affected individual with Huntington's Chorea, a rare disease, has a 50% chance of inheriting the disease. What is the mode of inheritance for Huntington's Chorea?
 - a. Autosomal recessive
 - b. Autosomal dominant
 - c. X-linked recessive
 - d. X-linked dominant
4. Two populations of salamanders are in Hardy-Weinberg equilibrium for a gene with two alleles, M and m. The frequency of m alleles in population 1 is 0.2 and 0.4 in population 2. If there are 100 salamanders in each population, what is the difference in the number of heterozygous salamanders between the two populations?
 - a. 8
 - b. 12

- c. 16
- d. 24
- e. 32



5. Shown above is a magnificent piece of biotechnology. What is it?
 - a. Centrifuge
 - b. Gel electrophoresis apparatus
 - c. Autoclave
 - d. Agarose Synthesizer
6. Spliceosomes are not composed of which of the following:
 - a. snRNA
 - b. Proteins
 - c. Introns
 - d. Uridine
 - e. More than one of the above
7. What is of the following nucleotide base sequences will code for methionine?
 - a. AUU
 - b. AUG
 - c. AUA
 - d. AGA
8. How many hydrogen bonds are between guanine and cytosine in RNA?
 - a. 0
 - b. 1
 - c. 2
 - d. 3
9. Down syndrome is not which of the following?
 - a. Aneuploidy
 - b. Triploidy
 - c. A disorder resulting from a mistake during meiosis

- d. Monoploidy
10. Johnny was running down a hill when he scraped his knee. He noticed blood coming out and marvelled at how blood was so different from his skin, despite both being cells of his body. What is the mechanism by which cells differentiate from each other in the human body?
- a. Cells keep only the genes they need to make the proteins essential for their purpose in the body
 - b. Cells express only the proteins essential for the function in the body, but they all have the same set of genes
 - c. Cells receive cGMP molecules from the bloodstream that direct the way in which they differentiate
 - d. Cells receive cAMP molecules from the bloodstream that direct the way in which they differentiate
11. Bobby crosses a black colored albatross with a white colored albatross. He is surprised to see that all offspring in the F1 generation are gray in color. What could explain this?
- a. Intermediate dominance
 - b. Codominance
 - c. Y-linked inheritance
 - d. X-linked inheritance
 - e. None of the above
12. Synapsis occurs in which of the following stages?
- a. Prophase 1
 - b. Metaphase 1
 - c. Prophase 2
 - d. Metaphase 2
 - e. Cytokinesis
13. Which of the following sequences of DNA is weakest against heat stress?
- a. ATATATAT
 - b. ATATGCGC
 - c. CGCGATAT
 - d. CGCGCGCG
 - e. AUAUAU
14. Transcription occurs in what cytoplasmic component?
- a. Cytosol
 - b. Golgi apparatus
 - c. Ribosome
 - d. Nucleolus
 - e. None of the above
15. mtDNA can code for which of the following proteins?
- a. Lysosomal enzymes
 - b. Ubiquitin
 - c. Cytochrome enzymes
 - d. Phosphatidylserine

- e. Pepsinogen
16. Which of the following amino acids is likely to be least abundant in histone proteins?
- a. Lysine
 - b. Arginine
 - c. Histidine
 - d. Serine
17. Which of the following does not occur in post-transcriptional modification of mRNA?
- a. Addition of a 5' cap
 - b. Addition of a 3' poly-A tail
 - c. miRNA silences the mRNA until it exits the nucleus
 - d. snRNPs participate in the excision of introns
 - e. All of the above
18. Taq polymerase is a DNA polymerase used in Polymerase Chain Reaction (PCR). For what property is it valued?
- a. Salt tolerance
 - b. Thermal tolerance
 - c. Acidity tolerance
 - d. Mechanical stress tolerance
 - e. All of the above
19. Viroids infect which of the following groups of organisms?
- a. Animals
 - b. Plants
 - c. Fungi
 - d. Bacteria
 - e. Archaea
20. Which of the following least accurately describes human telomerase reverse transcriptase?
- a. Ribozyme
 - b. Rich in adenine and cytosine
 - c. Seen in eukaryotes only
 - d. Least active during metaphase

Part 2: Mix-and-Match

Match the following terms to their descriptions. Each correct answer is worth 1 point. Some descriptions will not be used, and some definitions may be used more than once.

Terms	Descriptions
1. Epistasis	a. A coenzyme for RNA polymerase in some prokaryotes

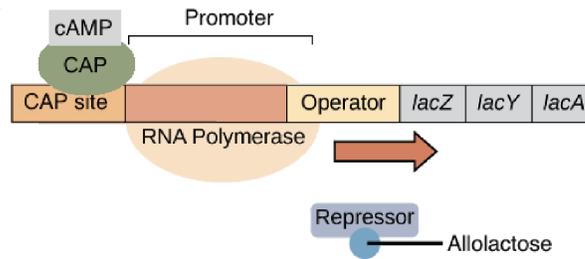
2. Exon	b. The part of a genome composed of exons
3. Cross-over	c. A DNA-binding protein that inhibits the expression of genes coding for proteins
4. Operon	d. The interactions of genes that are not alleles but still can affect the phenotype
5. Promotor	e. An individual showing features characteristic of a genotype other than its own, but produced environmentally rather than genetically
6. Sigma factor	f. A segment of DNA involved mainly in the polymerization of tRNA
7. Exome	g. A part of a gene that will code for mRNA
8. Haplotype	h. A group of genes within an organism that was inherited together from a single parent
9. Phenocopy	i. A unit of linked genes
10. Pleiotropy	j. An area in DNA rich in Thymine-Adenine sequences
	k. A process that occurs in the pachytene stage of Prophase 1 of meiosis
	l. When one gene influences two or more seemingly unrelated phenotypic traits

Part 3: Free response

Each question is three points each.

1. What class of proteins is associated with DNA in a nucleosome?
2. What enzyme catalyzes the formation of peptide bonds?
3. What structure in the nucleus has the highest concentration of rRNA?

Glucose absent, lactose present:



- Above is a diagram of a lac operon. Name one segment of DNA downstream of the lacZ gene.
- From what property of chromosomes does their name come from?
- Single stranded binding proteins are involved in what genetic process?
- What functional group is found in RNA but not DNA?
- Barr bodies are the inactive form of what type of chromosome?
- Polycomb-group proteins are a family of protein complexes first discovered in fruit flies that can remodel chromatin such that epigenetic silencing of genes takes place. Right after morphological development, what genes would be most likely to be affected by Polycomb-group proteins?
- What property of histones and DNA attracts them to each other?
- How many combinations of three nucleotide base pairs code for a stop codon?
- The frequency (in percent) with which a dominant or homozygous recessive gene or gene combination manifests itself in the phenotype of the carriers is known as?
- Genes A, B, C, and D are located on the same chromosome. The recombination frequency between genes A and B is 10%, between B and D is 40%, between A and C is 20%, and between C and D is 50%. Order the genes on the chromosome starting from gene C.
- How many membranes does the nucleus have?
- How many membranes does the nucleolus have?
- What type of electromagnetic radiation causes spontaneous formation of thymine dimers?
- Xeroderma pigmentosum is the lack of ability to perform what genetic process?
- What is the last name of the person who first discovered that there are equal amounts of purines and pyrimidines in DNA?
- The pentose phosphate pathway creates what carbon containing molecule that is a part of DNA's backbone?
- Malaria is most commonly transferred to humans by what vector?
- You have a sample of flies with white eyes and black eyes. You know that only one gene affects eye color, and all your flies are homozygous for this gene. Describe a procedure that can determine whether white or black eye color is dominant.
- Explain how there can be only 45 tRNAs in most prokaryotes when there are 64 different codons.

23. Describe the two processes in meiosis that contribute to the genetic differences seen in biological siblings.