

BIOL 214 Genes and Evolution

Exam 2

Fall 2013

October 13, 2013


Name: _____

Test No: B

Period: 2PM

Please put your multiple choice answers on the scantron sheet. Fill in your name, the Test No. as B and the period as 2PM.

Note, there are short answer questions beginning on page 9 , write your answers to these questions on the exam.

 SCANTRON®		<i>FOR USE ON TEST SCORING MACHINE ONLY</i>	
FORM NO. 882-E			
NAME	Your Name		
SUBJECT		TEST NO.	Letter
DATE		PERIOD	Time

Multiple Choice Questions, 2 points each, put your answers on the scantron.

1. An operon is
 - A. A molecule that can turn genes on and off
 - B. An inducer bound to a repressor
 - C. A series of regulatory sequences controlling transcription of protein-coding genes
 - D. A promoter, an operator, and a group of structural genes
 - E. Any long sequence of DNA

2. Which statement about selective gene transcription in eukaryotes is not true?
 - A. Regulatory proteins can bind at a site on DNA distant from the promoter.
 - B. Transcription requires transcription factors.
 - C. Genes are usually transcribed as groups called operons.
 - D. Both positive and negative regulation occur.
 - E. Many proteins bind at the promoter.

3. In prokaryotes, the concentration of cAMP
 - A. decreases with increased glucose concentration.
 - B. increases with increased glucose concentration.
 - C. negatively regulates operons such as the lac operon.
 - D. makes CAP.
 - E. degrades CAP.

4. In the *E. coli* lac operon, what would happen if there is a mutation in the operator?
 - A. RNA polymerase could not bind to the DNA
 - B. The structural genes would not be expressed
 - C. The structural genes would always be expressed
 - D. Allolactose could not bind to the repressor protein
 - E. This answer is wrong and is just taking up space.

5. In the *E. coli* trp operon, what would happen if there is a mutation in the repressor protein gene resulting in a repressor protein that can not bind to DNA?
 - A. The structural genes would not be expressed
 - B. The structural genes would always be expressed
 - C. The structural genes would only be expressed when tryptophan was absent
 - D. The structural genes would only be expressed when tryptophan was present
 - E. Once again, this answer is wrong and is just taking up space.

6. In my favorite bacterial organism, an operon exists that has as its structural genes the enzymes necessary to synthesize the amino acid histidine. Which of the following conditions would result in transcription of the His operon structural genes?
- A. the presence of histidine and absence of glucose
 - B. the presence of histidine
 - C. the absence of histidine
 - D. the absence of tryptophan
 - E. the absence of both histidine and glucose
7. Which of the following statements about enhancers is correct?
- A. They contain a unique base sequence called the TATA box.
 - B. They are located just 5' to the promoter.
 - C. They are found in exons.
 - D. They are found quite distant from the genes they control.
 - E. They are part of the 3' UTR.
8. Which statement accurately describes the relationship between RNA interference, small interfering RNA (siRNA) and micro RNAs (miRNA)?
- A. They all describe different methods of post-translational gene regulation.
 - B. Micro-RNAs can be broken down into two types: RNA interference molecules and small interfering RNAs.
 - C. RNA interference occurs in two ways: by micro RNA or by small interfering RNAs.
 - D. Small interfering RNAs bind to dicer protein, micro RNAs do not; both are types of RNA interference.
 - E. Micro RNAs are transcribed from viruses, small interfering RNAs are transcribed from nuclear DNA; both are types of RNA interference
9. Methylation regulates transcription
- A. via the addition of methyl groups to thymine bases of RNA
 - B. via the addition of a methyl group to thymine bases of DNA
 - C. via the addition of methyl groups to cytosine bases of DNA
 - D. via the addition of methyl groups to cysteine bases of RNA
 - E. via the addition of methyl groups to cysteine in RNA polymerase

10. What types of proteins bind to the promoter-proximal elements?

- A. Basal transcription factors and RNA polymerase
- B. Negative regulators of transcription like repressors
- C. Histone remodeling proteins
- D. Regulatory transcription factors such as activators
- E. Regulatory transcription factors such as enhancers

11. Micro RNAs (miRNAs)

- A. are short sequences only 22 or so bases long.
- B. are noncoding RNA sequences that bind to a protein complex.
- C. can regulate mRNA translation by cleaving the mRNA.
- D. can prevent translation of its target mRNA by blocking the ribosome.
- E. all of these

12. How does active CAP induce expression of the genes of the lactose operon?

- A. It terminates production of repressor molecules.
- B. It degrades the substrate allolactose.
- C. It stimulates splicing of the encoded genes.
- D. It stimulates the binding of RNA polymerase to the promoter.
- E. It binds steroid hormones and controls translation.

13. If inflated pod type is dominant in pea plants, a cross between a true breeding inflated pod plant with a true breeding constricted pod plant will result in

- A. half the plants with inflated pods, half the plants with constricted pods
- B. all inflated pods in the F1 generation
- C. all constricted pods in the F1 generation
- D. all pod shape that is intermediate in shape, slightly inflated, but with some constrictions
- E. mostly inflated pods in the F1 generation with a few constricted pods

14. A sexually reproducing animal has two unlinked genes, one for foot size (L) and one for tail length (T). It's genotype is LlTt. Which of the following genotypes is a possible gamete from this organism?

- A. L
- B. Ll
- C. LlTt
- D. Lt
- E. Tt

15. Inheritance of the M and N blood type is best described by which of the following terms
- A. codominance
 - B. multiple alleles
 - C. pleiotrophy
 - D. epistasis
 - E. incomplete dominance
16. In the example of the Labrador dogs, an epistatic gene blocks coat color and must be in the homozygous condition for epistasis to result. Black coat color is dominant to brown coat color. What then is the ratio of Black to Brown to Yellow (blonde) labs in a dihybrid cross?
- A. 1 : 2 : 1
 - B. 9: 3 : 3 : 1
 - C. 9 : 4 : 3
 - D. 9 : 3 : 4
 - E. 12 : 3 : 1
17. If nondisjunction occurs in meiosis II during gametogenesis, what will be the result at the completion of meiosis?
- A. All the gametes will be diploid.
 - B. Half of the gametes will be $n + 1$, and half will be $n - 1$.
 - C. one of the gametes will be $n + 1$, one will be $n - 1$, and two will be n .
 - D. There will be three extra gametes.
 - E. Two of the four gametes will be haploid, and two will be diploid.
18. Which of the following is true of a species that has a chromosome number of $2n = 16$?
- A. The species is diploid with 32 chromosomes per cell.
 - B. The species has 16 sets of chromosomes per cell.
 - C. At prophase I there will be 32 separate chromosomes.
 - D. Each cell has 8 homologous pairs.
 - E. A gamete from this species has 4 chromosomes.

19. After telophase I of meiosis, the chromosomal makeup of each daughter cell is
- A. haploid, and the chromosomes are each composed of two chromatids.
 - B. haploid, and the chromosomes are each composed of a single chromatid.
 - C. diploid, and the chromosomes are each composed of a single chromatid.
 - D. diploid, and the chromosomes are each composed of two chromatids.
 - E. tetraploid, and the chromosomes are each composed of two chromatids.
20. During meiosis an error can occur resulting in gametes with incorrect chromosome numbers. What is this type of error called?
- A. translocation
 - B. nondisjunction
 - C. duplication
 - D. replication
 - E. the Philadelphia chromosome
21. The following is a map of four genes on a chromosome:



- Between which two genes would you expect the highest frequency of recombination?
- A. A and W
 - B. W and E
 - C. E and G
 - D. A and E
 - E. A and G
22. Referring to the map in the previous question, the map units are shown between each pair of genes. What recombination frequency would be experimentally observed between W and G?
- A. 15 %
 - B. A value slightly larger than 15%
 - C. A value slightly smaller than 15%
 - D. 30%
 - E. 8%

23. In your fly lab you perform a cross between a red eyed, long winged female and a purple eyed, dumpy winged male. Which of the following offspring would represent a recombinant phenotype?
- A. Red eyed, long winged of either sex
 - B. Red eyed, long winged male
 - C. Purple eyed, long winged of either sex
 - D. Purple eyed, dumpy winged female
 - E. White eyed, long winged of either sex
24. In humans, sex-linked disorders are more common in males. Which of the following can account for this observation?
- A. Most sex-linked disorders are found on the Y chromosome
 - B. Males inherit one copy of the X chromosome so recessive disorders are more likely to be phenotypically expressed
 - C. Males inherit their X chromosome from their dad, so are likely to inherit sex-linked disorders.
 - D. Male to male transmission is rare.
 - E. Recessive disorders skip generations.
25. Vermillion eyes is a sex-linked recessive characteristic in fruit flies. If a female having vermilion eyes is crossed with a wild-type male, what percentage of the F₁ males will have vermilion eyes?
- A. 0%
 - B. 25%
 - C. 50%
 - D. 75%
 - E. 100%
26. In your role as a genetic counselor, you meet with a couple that is concerned about having a child. Both potential parents are of normal height. The woman has a sister with Achondroplasia (a type of dwarfism) and the man's mother is also an Achondroplastic dwarf. They know that dwarfism is caused by an autosomal dominant gene and would like to know their probability of having a child with dwarfism.
- A. 0%
 - B. 25%
 - C. 50%
 - D. 75%
 - E. 100%

Use the following information for the next two questions:

Stem length, pod color and seed shape were three characters that Mendel studied. Each is controlled by an independently assorting gene and has a dominant and recessive expression as follows:

<u>Character</u>	<u>Dominant</u>	<u>Recessive</u>
Stem length	Tall (T)	dwarf (t)
Pod color	Green (G)	yellow (g)
Seed shape	Round (R)	wrinkled (r)

27. If a plant that is heterozygous for all three characters is allowed to self-fertilize, what is the probability of producing progeny which are homozygous for all three traits? (a dwarf plant with yellow pods and wrinkled seeds)

- A. $1/9$
- B. $1/16$
- C. $1/64$
- D. $3/8$
- E. $1/32$

28. Again, if a plant is heterozygous for all three characters is allowed to self-fertilize, what is the probability of a plant that is tall with yellow pods and wrinkled seeds?

- A. $1/9$
- B. $3/32$
- C. $3/64$
- D. 1
- E. 0

29. The Philadelphia chromosome is formed when there is a translocation involving chromosomes 9 and 22. This is highly associated with a blood cancer, why is this the case?

- A. The translocation results in over activity of the ABL gene due to its position near the BCR gene.
- B. The translocation results in no activity of the ABL gene due to its position distant from the BCR gene.
- C. The translocation is not associated with the cancer cell growth
- D. I can't think of any other choices, so don't choose this one.
- E. This choice is just taking up space, so is incorrect.

30. In pea plants, flowers can be either purple or white. Mendel's experiments showed that blending traits was not the method of inheritance for flower color in these plants. Which of Mendel's observations was important to disproving the blending model of inheritance?
- A. The F1 plants all had pink flowers
 - B. The F2 generation produces some plants with purple flowers and some with white flowers
 - C. The number of purple to white flowering plants was equal in the F1 generation
 - D. The number of purple to white flowers was a 9: 3: 3: 1 ratio in the F2
 - E. This experiment did not disprove the blending hypothesis

Short Answer Questions, write your answers on these pages.

1. Radish flowers may be red, purple or white. A cross between a red-flowered plant and a white-flowered plant yields all-purple offspring. The part of the radish we eat may be oval or long, with long being the dominant characteristic.
 - A. Describe the phenotypes F1 progeny from a cross between a true-breeding red long radish and a true breeding white oval radish. (4 pts)

 - B. Determine the phenotypes and the phenotypic ratios from the F2 progeny resulting from a self-cross of the F1 progeny from part A. (4 pts)

 - C. The flower color trait observed in these radishes is an example of what type of inheritance? (2 pts)

2. Three babies were recently mixed up in a hospital. After consideration of the data below, assign the correct baby to each couple and write the genotypes of each baby. (8 pts)

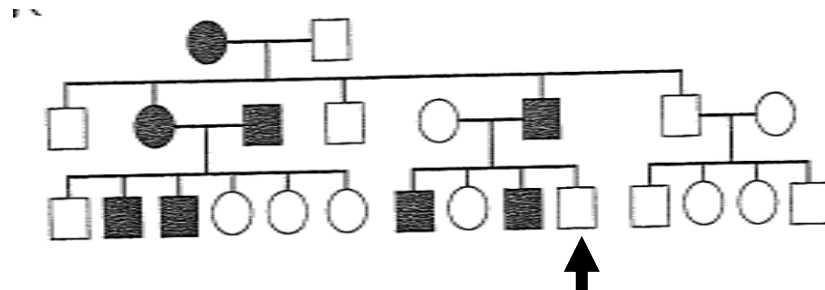
Couple #	I	II	III
Blood groups	A and A	A and B	B and O
Baby #	1	2	3
Blood groups	B	O	AB

3. A wild-type fruit fly (heterozygous for gray body color and normal wings) is mated with a black fly with vestigial wings. The offspring, have the following phenotypic distribution: wild type, 778; black body-vestigial wings, 785; black body –normal wings, 158; gray body –vestigial wings, 162.

A. Using symbols consistent with the method of labeling genes in drosophila, list the genotype of the black fly with vestigial wings. (4 pts)

B. Calculate the recombination frequency between body color and wing type. Show your work. Indicate the parental phenotypes and the recombinant phenotypes. (10 pts)

4. Individuals affected by a condition known as polydactyly have extra fingers or toes. The following pedigree shows the pattern of inheritance for this trait in one family:



From the pedigree, can you tell if polydactyly comes from a dominant or recessive allele? (2 pts) Is the trait sex-linked? (2 pts) What is the genotype of the individual indicated by the arrow? (4 pts)