

Exam 2 CSS/Hort 430/530 2010

1. The concept of “one gene: one polypeptide” is
 - a. Absolutely true
 - b. Useful except that the statement needs to be qualified by adding that not all genes encode polypeptides
 - c. Useful except that the statement needs to be qualified by adding that some genes may encode multiple polypeptides due to alternative splicing
 - d. B and C above**
 - e. None of the above

2. The following diagram illustrates the results of electrophoresis of PCR products, representing two possible alleles at a locus, from genomic DNA of Parent 1(P1), Parent 2 (P2), and the F1 derived from crossing P1 x P2.

P1	P2	F1
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- These alleles show
- a. Overdominance
 - b. Complete dominance
 - c. Codominance**
 - d. Incomplete penetrance
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3. One explanation for overdominance is
 - a. The alleles at a locus show epistasis
 - b. Gene deletions are fairly common and therefore heterozygotes will have at least one copy of each gene**
 - c. Both alleles at the locus have the same effect
 - d. Homozygotes are more fit than heterozygotes

 4. There can be both linkage and epistasis between two loci that are on the same chromosome
 - a. T**
 - b. F

5. In the case of the epistatic interaction between *VRN2* and *VRN1* of barley, the hypothesis is that in the absence of a period of cold treatment (vernalization)
- A repressor encoded by *VRN2* binds to *VRN1*, thus preventing the expression of *VRN1*
 - The mRNA transcribed from *VRN1* is degraded by *VRN2*
 - A premature stop codon in *VRN1* prevents expression of the gene in winter types
 - All of the above
6. Per the example of the sickle cell phenotype, alleles at a locus can only show one type of relationship, e.g. they are either codominant, dominant, or overdominant.
- T
 - F
7. Recessive alleles can be due to
- Gene deletion
 - Changes in gene sequence leading to altered transcription
 - Changes in gene sequence leading to altered translation
 - None of the above
 - All of the above
8. In the case of codominance and incomplete dominance, you would expect monohybrid (1 locus) F₂ phenotypic ratios to be
- 3:1
 - 1:1
 - 1:2:1
 - 9:3:3:1
- (Note: In the case of codominance, the "bands" visualized in electrophoresis can be considered phenotypes)*
9. In the case of two-locus epistasis (assume the loci show independent assortment), which of the following ratios would NOT be expected in an F₁-derived doubled haploid population?
- 2:2 (= 1:1)
 - 3:1
 - 1:2:1
 - 9:7

10. If you cross two plants, each of which is resistant to the same disease, which of the following statements is correct?
- If the F1 and all subsequent generations are resistant, the two plants have the same (or functionally equivalent) alleles
 - If the F1 is resistant and subsequent generations segregate for resistance, the two plants have the same (or functionally equivalent) alleles
11. Two of the key properties of DNA are that it is (i) capable of faithful replication, but it is also (ii) capable of change. Which of the following is the most likely cause of the “capacity for change”?
- Mutations: rare, heritable changes in the DNA code
 - Spontaneous generation of new life forms
 - Restriction digest of nuclear DNA
 - Loss of the nucleosome structure during transcription
12. Given the following DNA strand, which is the correct anti-parallel strand?
- 5' ATGGTATGCCTC 3'
- 3' ATGGTATGCCTC 5'
 - 5' UACCAUACGGAG 3'
 - 5' TACCATACGGAG 3'
 - 3' TACCATACGGAG 5'
13. During the S phase of mitosis, the hydrogen bonds between N-containing bases are easier to break than the phosphodiester bonds between nucleotides.
- T
 - F
14. During the S phase of meiosis, a DNA template is required to initiate replication.
- T
 - F
15. In eukaryotes there is only one type of DNA polymerase and it has helicase, replicase, and exonuclease activities.
- T
 - F

16. The primers that initiate DNA replication during the S phase of mitosis consist of
- DNA
 - Protein
 - Oligonucleotides
 - RNA**
17. Half of the individuals in any population of organisms will have interphase chromosomes which are mosaics of DNA and RNA due to the synthesis of Okazaki fragments on lagging strands.
- T
 - F**
18. Telomerase is a reverse transcriptase which
- Adds nucleotides to telomeres**
 - Removes nucleotides from telomeres
 - Connects spindle fibers to centromeres
 - Removes mis-matched bases during DNA replication
19. A “perfect” molecular marker is one that
- Is tightly linked to the target gene of interest
 - Interacts epistatically with the target gene of interest
 - Is always monomorphic
 - Is located in the target gene of interest**
20. All molecular markers are based on single nucleotide polymorphisms (SNPs)
- T
 - F**

For questions 21 - 25 does the term to the left of the “=” sign match the definition/example to the right?

21. PCR: Technique based on hybridization of labeled single strand DNA probe and single strand target DNA
- Yes
 - No**
22. Southern Blot: Technique for specifically amplifying a target sequence of DNA
- Yes
 - No**

23. Restriction enzyme: Thermostable DNA polymerase

- a. Yes
- b. No

24. Palindrome: Won't I panic in a pit now?

- a. Yes
- b. No

25. TAQ : Thermostable DNA polymerase

- a. Yes
- b. No

You would like to engage in some “defensive plant breeding” by selecting for a specific allele at a locus which confers resistance to a disease which is currently found only in a distant land. You do not have a perfect marker for the resistance allele, but you do have flanking markers. The situation can be diagrammed as follows, where each marker shows 10% recombination with the target gene.

___Marker 1 ___10%_____Target gene___10%_____Marker 2 ___

26. If you select only for Marker 1 in 100 progeny, approximately how many individuals will you select who have the right marker allele but not the target resistance allele?

- a. 1
- b. 10
- c. 100

27. If you select for markers 1 **and** 2 in 100 progeny, approximately how many individuals would have the right marker alleles but not the target resistance allele?

- a. 1 (or fewer)
- b. 10
- c. 100

28. The principal reason that PCR-based evidence alone is not sufficient to convict in criminal cases is that the technique produces an overabundance of fragments with DNA sequences outside the target region.

- a. T
- b. F

29. In a PCR reaction, the highest temperature step (typically ~ 95°C) is necessary for
- DNA replication
 - Primer annealing
 - Denaturing double stranded DNA
30. Which of the following properties make TAQ polymerase particularly useful for PCR?
- It is very cheap
 - It cuts double stranded DNA
 - It is easy to label with fluorescent dyes
 - It can replicate DNA at high (~ 70°C) temperatures
31. A southern blot (hybridization) refers to
- Using a single strand DNA probe to find a corresponding single strand DNA target
 - Using a single strand RNA probe to find a corresponding single strand DNA target
 - A cross between two varieties made somewhere south of the Mason-Dixon line
32. If used for a genomic DNA digest, a restriction enzyme with a four-base recognition site
- Will cut less often than a restriction enzyme with an eight-base recognition site
 - Will cut as often as restriction enzyme with an eight-base recognition site
 - Will cut more often than an enzyme with an eight-base recognition site
33. RNA differs from DNA in that
- It is usually single stranded
 - It contains ribose rather than deoxyribose
 - It contains the base uracil rather than thymine
 - All of the above
 - None of the above

For questions 34 - 37 does the term on the left of the “=” sign match the definition/example to the right?

34. mRNA: informational messenger RNA

- Yes
- No

35. tRNA: consists of 28S and 5.8S subunits

- Yes
- No

36. rRNA: a complex of RNA subunits and proteins involved in translation
- a. Yes
 - b. No
37. snRNA: amino acid transporter
- a. Yes
 - b. No
38. There are different types of RNA polymerases and they have specialized roles in transcribing DNA for rRNA, tRNA, and mRNA
- a. T
 - b. F
39. Where would you expect to find a TATA box?
- a. Intron
 - b. Exon
 - c. 5'UTR
 - d. Promoter
40. The DNA sequence between the transcription start site and the start codon is in the
- a. Promoter
 - b. 5'UTR
 - c. ORF
 - d. 3'UTR
41. Both transcription and translation terminate when a stop codon is encountered
- a. T
 - b. F
42. In eukaryotes mature mRNAs, as compared to primary transcripts, are usually
- a. Shorter
 - b. The same size
 - c. Longer
43. Introns are usually longer than exons
- a. T
 - b. F

44. Which of the following is responsible for intron excision?
- Intronosome
 - Ribosome
 - Spliceosome
 - Liposome

Given the following DNA sense strand sequence:
5' atg gac aca tag 3'

45. Which is the correct template (antisense) strand sequence?

- 3' tac ctg tgt atc 5'
- 5' tac ctg tgt atc 3'
- 5' atg gac aca tag 3'
- 3' atg gac aca tag 5'

46. Which is the correct mRNA sequence?

- 3' uac cug ugu auc 5'
- 5' uac cug ugu auc 3'
- 5' aug gac aca uag 3'
- 3' aug gac aca uag 5'

47. Which is the correct amino acid sequence? (*Assume left is the amino end of the polypeptide.*)

- Met Asp Thr
- Thr Asp Met
- None of the above
- Either of the above

48. A premature stop codon can occur as a consequence of which type of mutation?

- Frameshift
- Silent
- Missense
- Tyrannical

49. If you wanted to determine how many introns are in a gene, your best choice would be which type of sequence?

- cDNA
- EST
- Genomic DNA
- Mature mRNA

50. A dideoxynucleotide is useful for sequencing because
- It lacks a 5' phosphate group
 - It lacks a 3'OH
 - It has an extra 3'OH
 - It has the N-containing base Uracil rather than Thymine

		Second letter				
		U	C	A	G	
First letter	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA Stop UAG Stop	UGU } Cys UGC } UGA Stop UGG Trp	U C A G
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	U C A G
	A	AUU } AUC } Ile AUA } AUG Met	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U C A G
						Third letter