PBG 430/530
Exam 2
2013

1. In a deoxyribonucleotide, 5' and 3' refer to the
   a. start site for transcription.
   b. start site for translation.
   c. carbons where (respectively) the phosphate and hydroxyl groups are attached.
   d. carbons where (respectively) the pyrimidine and purine bases are attached.

2. DNA is an ideal genetic material because it is capable of change. A structural change involving heritable change in DNA sequence is best described as:
   a. Acetylation event
   b. Epigenetic event
   c. Mutation
   d. Methylation event

3. In higher plants, each chromosome has a single bidirectional origin of DNA replication located at the centromere.
   a. T
   b. F

4. The RNA primers that initiate DNA replication in the S phase of mitosis
   a. remain in the daughter strands until the organism dies.
   b. are eventually removed and replaced with the corresponding DNA nucleotides.
   c. are the sites where non-sister chromatid exchange occurs.
   d. are found only on lagging strands.

5. What process gives rise to new combinations of alleles at different loci?
   a. Transcription
   b. Translation
   c. Mutation
   d. Recombination

6. In the S phase of meiosis, DNA replication is
   a. socialist.
   b. liberal.
   c. conservative.
   d. semiconservative.

7. A comparative analysis of the DNA sequence of the BAD genes of rice (per the assigned reading) revealed that there are at least two BAD genes in rice: BAD1 and BAD2. These genes are very similar in sequence and function, but they are located on non-homologous chromosomes. Which term best describes the genetic relationship between BAD1 and BAD2?
    a. Linkage
    b. Pleiotropy
    c. Orthology
    d. Synteny

8. Only the leading strand in the double helix serves as template for transcription throughout the entire length of the chromosome and throughout the life of the organism.
    a. T
    b. F

9. A promoter is
    a. at the 3' end of a gene
    b. translated as methionine.
    c. a binding site for TAQ polymerase.
    d. a binding site for RNA polymerase.

10. If you were searching a 2 kb piece of DNA for evidence of genes, what consensus nucleotide sequence would be diagnostic of a gene, if found 30 bp upstream (5') from the transcription start site?
    a. ATG
    b. TAG
    c. TATA
    d. AGCGC

11. The synthesis of the mRNA stops when
    a. a stop codon is encountered.
    b. the telomere is reached.
    c. a specific sequence in the DNA template is reached that serves as a signal for termination.
    d. the polymerase encounters the promoter.

12. mRNA processing in eukaryotes refers to
    a. 3' caps, 5' tails, and exon removal.
    b. 5' caps, 3' tails, and intron removal.
    c. transport of the mRNA to the cytoplasm.
    d. coupling of the ribosomal subunits.

13. The 5’ UTR
    a. Is transcribed but not translated
    b. Transcribed and translated
    c. Neither transcribed nor translated
    d. Is the site of assembly of ribosomes

14. Transfer RNAs (tRNAs)
    a. are specialized, with each tRNA able to carry a specified amino acid at its 5’ end.
    b. are specialized, with each tRNA able to carry a specified amino acid at its 3’ end.
    c. are very generic, with each tRNA able to carry any of a number of amino acids.
    d. consist of 15S and 35S subunits.

15. Using the codon table on the last page of this exam, determine which amino acid would be transported by a tRNA with the anticodon sequence 3’ CGU 5’.
    a. Tyr
    b. Val
    c. Ala
    d. Arg

16. The ribosomal RNA subunits are
    a. specific to each type of mRNA.
    b. transcribed in the nucleus.
    c. translated in the cytoplasm.
    d. b and c above

17. In the process of translation, the ribosome moves
    a. 5’ to 3’ on the mRNA.
    b. 3’ to 5’ on the mRNA.
    c. counterclockwise around the tRNA.
    d. 5’ to 3’ on the antisense DNA.

18. The mechanism by which a stop codon stops translation is that
    a. tRNAs with affinity to the stop codon always bring methionine.
    b. polymerases have exonuclease activity.
    c. there are no tRNAs with anticodons matching the stop codon.
    d. A tRNA arrives with the amino acid Stop.

19. The DNA code is degenerate because
    a. the same codons specify different amino acids in different organisms.
    b. start and stop codons are reversed in prokaryotes and eukaryotes.
    c. the same codon can specify different amino acids.
    d. the same amino acid can be specified by more than one codon.

20. If you know the amino acid sequence of a polypeptide you can deduce the exact DNA code of the corresponding gene.
    a. T
    b. F

21. The primary structure of a protein refers to
    a. the linear amino acid sequence.
    b. the 3- dimensional configuration.
    c. multiple components of a protein coming together.
    d. the DNA sequence.

Given the following DNA antisense (= template) strand

3' TAC CGG ACC TGA AGT 5'

22. Which is the corresponding DNA sense strand?
    a. 5' TAC CGG ACC TGA AGT 3'
    b. 5'ATG GCC TGG ACT TCA 3'
    c. 3' UAC CGG ACC UGA AGU 5'
    d. 3' TAC CGG ACC TGA AGT 5'

23. Which is the corresponding mRNA?
    a. 3' UAC CGG ACC UGA AGU 5'
    b. 5' AUG GCC UGG ACU UCA 3'
    c. 5' UAC CGG ACC UGA AGU 3'
    d. 3' AUG GCC UGG ACU UCA 5'

24. Which is the correct translation?
    a. Thr Ser Gly Pro Val
    b. Tyr Arg Thr Stop Ser
    c. Met Ala Trp Thr Ser
    d. Ser Thr Trp Ala Met

25. The following example of a single nucleotide change (T to C) showing sequence and codon alignments is an example of a silent mutation.
    a. T
    b. F

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*** CTG GGA GAT TAT GGC TTT AAG***
*** CTG GGA GAT TAT GGC TTC AAG***        alignment

   Leu Gly Asp Tyr Gly Phe Lys
   Leu Gly Asp Tyr Gly Phe Lys             translation
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26. The situation where heterozygotes at a locus are most fit - e.g. they have the highest phenotypic value - is called:
    a. partial dominance
    b. codominance
    c. dominance
    d. overdominance

27. The situation where two phenotypes are determined by the same gene is called
    a. codominance.
    b. epistasis.
    c. linkage.
    d. pleiotropy.

28. In the case of partial dominance, heterozygotes cannot be distinguished from dominant homozygotes based on phenotype.
    a. T
    b. F

29. In the case of codominance, heterozygotes can be distinguished from dominant homozygotes and recessive homozygotes.
    a. T
    b. F

30. In the case of a codominant molecular marker visualized via electrophoresis, the expected phenotypic ratio in the doubled haploid progeny of the cross between two completely inbred lines will be 1:2:1
    a. T
    b. F

31. In the assigned reading on aroma in rice, the authors report sequencing the BAD2 gene in many different varieties of rice. The recessive allele was always present in aromatic varieties. Any given rice plant (rice is a diploid) will have a maximum of how many of these different BAD2 alleles?
    a. 1
    b. 2
    c. 3
    d. 4

32. If a gene shows pleiotropy, the two alleles at the locus
    a. could show dominance for one trait and partial dominance for another trait
    b. will not show any type of allele interaction.
    c. will not be translated.
    d. will interact in an epistatic fashion.

33. Recessive alleles can be due to
    a. Gene deletion
    b. Changes in gene sequence leading to altered transcription
    c. Changes in gene sequence leading to altered translation
    d. None of the above
    e. All of the above

34. Epistasis is a very rare condition and it never applies to linked loci
    a. True
    b. False

35. At several points in this class, the point has been made that "Expected and observed ratios in cross progeny will be a function of: ……." This statement is followed by a list of factors (a – e below). Which of the five factors best describes epistasis?
    a. The degree of homozygosity of the parents
    b. The generation studied
    c. The degree of dominance
    d. The degree of interaction between genes
    e. The number of genes determining the trait.

36. Which of the methods of obtaining DNA is based on isolating mRNA and using the reverse transcriptase enzyme to create double stranded DNA?
    a. genomic DNA isolation, where concentration, purity, and fragment size
    b. cDNA
    c. synthesis of oligonucleotides
    d. tRNA

37. There are many types of vectors (e.g. plasmids, phages, BACs, etc.) and a primary difference between these vectors is that
    a. some are DNA and others are RNA.
    b. not all are capable of transcription.
    c. some can accommodate only non-coding sequences.
    d. they can accommodate different sizes of DNA inserts.

38. Clones in a genomic DNA library will be shorter than the original genomic coding sequences because the introns are removed.
    a. T
    b. F

39. In the assigned reading "The genome of woodland strawberry (*Fragaria vesca*)" the authors report using cDNA libraries made from fruits and roots. Which of the following best describes these cDNA libraries:
    a. Single stranded DNA generated by reverse transcriptase of mRNA
    b. Double stranded DNA generated by reverse transcriptase of mRNA
    c. Single stranded DNA fragments generated by irradiation of nuclei
    d. DNA fragments generated by a restriction digest of total nuclear DNA

40. In the assigned reading "The genome of *Theobroma cacao*" the authors report using bacterial artificial chromosome (BAC) clones. Which of the following best describes a BAC clone?
    a. A method for clonally propagating cocoa trees
    b. A technique for asexually transferring genes from bacteria to plants
    c. A tool for cloning whole plant chromosomes
    d. A tool for maintaining and propagating relatively large (hundreds of kb) inserts of the cocoa genomic DNA

41. You would expect a restriction enzyme with four-base recognition site to generate a larger number of fragments from a sample of genomic DNA than an enzyme with an eight-base recognition site.
    a. T
    b. F

42. Which of the following best describes a restriction endonuclease enzyme?
    a. DNA polymerase with proof reading function
    b. Cuts double stranded DNA at specific recognition sequence
    c. Cuts DNA completely at random
    d. Cuts DNA only when the DNA is denatured by heat

43. The primers that are used for a PCR reaction to amplify genomic DNA consist of
    a. amino acids.
    b. mRNA.
    c. Taq polymerase.
    d. oligonucleotides.

44. Which of the following steps is **not** associated with PCR amplification of genomic DNA?
    a. Denaturation of target DNA
    b. Hybridization of DNA to RNA
    c. Addition of single stranded oligonucleotides
    d. Annealing of primers to single stranded DNA

45. The temperature cycling used in PCR reactions is needed to
    a. stimulate restriction enzyme activity.
    b. alternately allow for double strand DNA denaturation, primer binding, and primer extension.
    c. force nitrogen containing bases to undergo phosphodiester bonding.
    d. assist in incorporating radioactively labeled nucleotides.

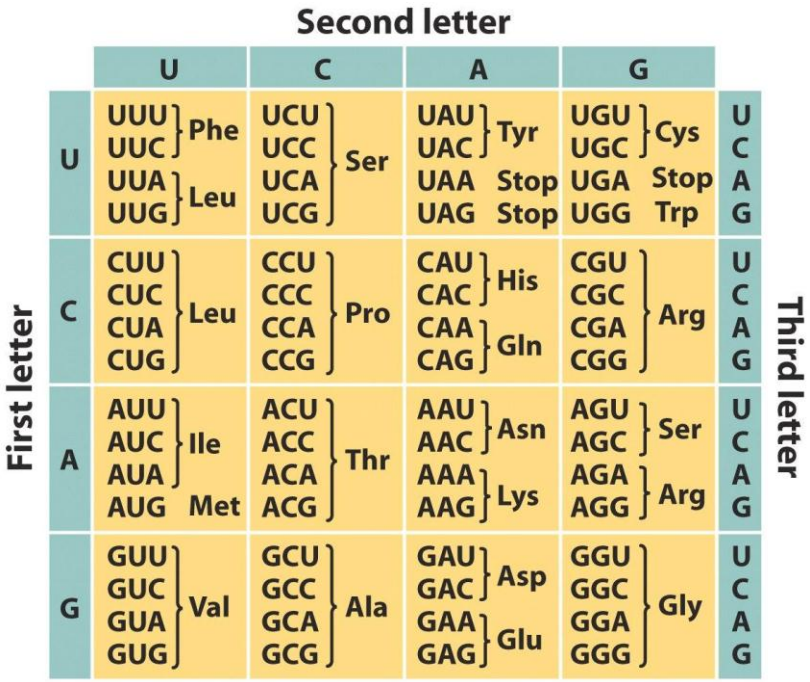
46. Which of the following terms best describes TAQ polymerase?
    a. Thermostable DNA polymerase
    b. Non-thermostable DNA polymerase
    c. Restriction endocuclease
    d. Enzyme that opens DNA helix

47. A dideoxy nucleotide
    a. Stops DNA synthesis because a phosphate group cannot attach to the 5' carbon
    b. Accelerates DNA synthesis because it has two 3' OH groups
    c. Has two phosphate groups – one attached to the 5' carbon and one to the 1' carbon
    d. Is useful for DNA sequencing because it lacks a 3'OH

48. The principal tool used for sequencing the *Theobroma* and *Fragaria* genomes was Sanger sequencing.
    a. True
    b. False

49. Key considerations in Next-Generation, massively parallel, and high throughput DNA sequencing techniques (e.g. 454 and Illumina) are:
    a. Speed, read length, and accuracy
    b. Whether to use radioactively or fluorescently labeled dideoxynucleotides
    c. Whether to determine the DNA sequence in picograms or in Megabases
    d. How many sequencing gels a technician can run in a day

50. In the *Fragaria* genome sequence paper, the term "scaffold" refers to
    a. The sequence of a complete chromosome, except for the centromeric region
    b. The sequence of one read (e.g. ~ 100 nucleotides)
    c. A series of contigs that are in the right order but not necessarily connected in one continuous stretch of sequence
    d. The n number of chromosomes in Fragaria


Second letter
U
C
A
G
First letter
Third letter
U
UUU Phe
UUC
UUA Leu
UUG
UCU Ser
UCC
UCA
UCG
UAU Tyr
UAC
UAA Stop
UAG Stop
UGU Cys
UGC
UGA Stop
UGG Trp
C
CUU Leu
CUC
CUA
CUG
CCU Pro
CCC
CCA
CCG
CAU His
CAC
CAA Gln
CAG
CGU Arg
CGC
CGA
CGG
A
AUU Ile
AUC
AUA
AUG Met
ACU Thr
ACC
ACA
ACG
AAU Asn
AAC
AAA Lys
AAG
AGU Ser
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AGA Arg
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