

**BIO 250 Practice December Exam****1. Which would you not find in a prokaryotic cell?**

- a. spliceosomes
- b. ribosomal RNA
- c. RNA primases
- d. aminoacyl-tRNA synthetases
- e. release factor proteins

**2. Which statement is CORRECT?**

- a. Prokaryotic cells have cell walls but eukaryotic cells do not.
- b. Prokaryotic cells have a very small nucleus.
- c. Prokaryotic cells never have internal membranes.
- d. All prokaryotic and eukaryotic cells have a plasma membrane that controls which organic molecules and ions can enter the cell.
- e. Gram-positive bacteria have an inner membrane that functions as the plasma membrane and an outer membrane outside of the cell wall.

**3. A polyribosome is**

- a) a gigantic ribosome found only in the Archaea
- b) a series of separate ribosomes translating a single mRNA molecule
- c) a cluster of ribosomal subunits formed just prior to translation
- d) generated only in the S-phase of the cell cycle
- e) the protein equivalent of a nucleosome

**4. Heterochromatin is:**

- a) A densely packed, unexpressed form of eukaryotic DNA
- b) a densely packed, highly expressed form of eukaryotic DNA
- c) found in bacterial endospores
- d) characteristic of bacterial operons
- e) not bound by histones

**5. A ribozyme is**

- a. an enzyme that degrades RNA
- b. involved in synthesizing primers for DNA replication
- c. required for RNA polymerase activity
- d. an RNA that has enzymatic activity
- e. used to convert dATP to ATP during transcription

**6. Which of the following bacterial components is made of DNA?**

- a. ribosomes
- b. plasmids
- c. lysosomes
- d. chromatophores
- e. magnetosomes

**7. The protein secondary structure.....**

- 1. known as an alpha helix is always found in an amphipathic form.
- 2. known as the beta strand can form a sheet in both parallel and antiparallel orientations.
- 3. known as an alpha helix can be easily formed by an alternating series of proline and glycine amino acids.

**Which statement(s) is/are correct?**

- a. 1, 3
- b. 1, 2
- c. 1, 2, 3
- d. 2

**8. Which of the following is NOT CORRECT?**

- a. A polypeptide has an amino terminus (N-terminus) and a carboxyl terminus (C-terminus).
- b. The linear order of amino acids constitutes the primary structure of a protein.
- c. Two amino acids with side chains R and R<sub>1</sub> combine through the carboxyl terminus of the first and the amino group of the second to form a peptide bond.
- d. The  $\alpha$ -helix is a common form of protein tertiary structure.
- e.  $\beta$ -sheets may be parallel or antiparallel.

**9. Which of the following are CORRECT?**

1. The  $\alpha$ -helix is a common form of secondary structure resulting from hydrogen bonding.
  2. The  $\beta$ -pleated sheet is an example of a protein's secondary structure arising from protein chains packed side by side and interacting by hydrogen bonds.
  3. The tertiary structure of a protein represents the total three-dimensional shape of a protein.
  4. Two or more individual polypeptides may fit together to yield the quaternary structure of a complex protein.
  5. Proteins that bind to DNA, such as TBP lose the tertiary structure upon DNA binding.
- a. 1, 2, 3, 4
  - b. 1, 5
  - c. 1, 2, 3, 5
  - d. 1, 2, 3
  - e. 2, 3, 4

**10. Which of the following is CORRECT?**

- a. Glutamine is a non-polar amino acid.
- b. Glutamate is a basic amino acid.
- c. Methionine is an acidic amino acid.
- d. Lysine is a basic amino acid.
- e. b and c

**11. The single letter code for the peptide**

- a. alanine- lysine-histidine is AKH.
- b. phenylalanine- leucine-tyrosine is PLT.
- c. cysteine-proline-tryptophan is CPT.
- d. valine-glutamic acid- lysine is VEL.
- e. glycine-tyrosine-threonine is GKT.

**12. The alpha helix is an example of what type of protein structure?**

- a. primary
- b. secondary
- c. tertiary
- d. quaternary

**13. Which group of amino acids shares a common property?**

- a. Valine, Glycine, Proline
- b. Tryptophan, Phenylalanine, Threonine
- c. Histidine, Alanine, Lysine
- d. Asparagine, Serine, Glutamine
- e. Cysteine, Glutamic acid, Isoleucine

**14. Which of the following is NOT CORRECT?**

- a. Glutamate is an acidic amino acid.
- b. Glutamine is a non-polar amino acid.
- c. Methionine is hydrophobic and a sulfur containing amino acid.
- d. Lysine is a basic amino acid.

**15. The following peptide is part of a larger protein that folds into two closely linked alpha-helices. What residue must be in the region separating the two helices?**

**HAVVVLSGPYAAMVTH**

- a. L
- b. S
- c. G
- d. P
- e. A

**16. Which group of amino acids shares a common property?**

- a. Valine, Asparagine, Glutamic acid.
- b. Tryptophan, Phenylalanine, Threonine.
- c. Alanine, Valine, Isoleucine.
- d. Histidine, Arginine, Methionine.
- e. Cysteine, Glutamic acid, Tyrosine.

**17. Define the term “condensation reaction” and sketch an example of such a reaction from the process of translation.**

**18. Which one of the following amino acid sequences is most likely to be found on the surface of a protein that circulates in the bloodstream?**

- a) MYAVI
- b) KNSKT
- c) VFYLE
- d) WIIHM
- e) FMLLV

**19. Noncovalent bonds include all the following except:**

- a. A carbon-carbon double bond.
- b. An ionic bond.
- c. A hydrogen bond.
- d. A van der Waals interaction.

**20. Which of the following is not an amino acid?**

- a) Cysteine
- b) Adenine
- c) Glutamine
- d) Glycine
- e) Alanine

**21. The two sides of a DNA molecule are held together at their bases by**

- a) James bond
- b) covalent bonds
- c) hydrogen bonds
- d) peptide bonds
- e) ionic bonds

**22. Which of the following is a feature of chromatin?**

- a) Moderate digestion of chromatin with DNases yields amino acids and deoxyribonucleotides.
- b) DNA that is actively being transcribed exists in cells as heterochromatin.
- c) Histones are the only proteins found in chromatin.
- d) Chromatin is found in its most condensed form in interphase.
- e) Regions of DNA that contain methylated cytosine are less likely to be transcribed.

**23. The solenoid structure of chromatin forms when**

- a) double-stranded DNA forms supercoils.
- b) double-stranded DNA wraps around the core histones.
- c) nucleosomes form a spiral shape with 6 nucleosomes per spiral.
- d) scaffold proteins attach to form a highly condensed form of chromatin.
- e) Chromatin is isolated in low (non-physiological) salt conditions.

**24. With respect to the packaging of nuclear DNA, which of the following statements is NOT CORRECT?**

- a) Some cis-acting regulatory elements are found in the linker region between nucleosomes.
- b) Core histones have different affinities for one another.
- c) The amino acid sequence of histones varies dramatically between organisms.
- d) The first step towards nucleosome displacement during transcription is the release of histone H2A-H2B dimers.
- e) Histone 1 is larger than the core histones.

**25. Which of the following statements concerning structure and synthesis of DNA are correct?**

1. Purines are linked via their nitrogen in position 9 to the 1' carbon of deoxyribose.
2. The pentose sugar in DNA has an hydroxyl group on the 2' carbon.
3. Ribonucleoside triphosphates are used to elongate DNA.
4. In the DNA double helix, 2 hydrogen bonds form between the complementary bases adenine and thymine.
5. A piece of double stranded DNA that is rich in G and C residues has a higher  $T_m$  in comparison to one that is rich in AT residues.

- a. 2,3,4,5
- b. 2,4,5
- c. 1,2,3,4
- d. 1,4,5
- e. 1,4

**26. High salt concentrations are used in the DNA isolation and the RNA isolation laboratories to**

- a. degrade histones.
- b. buffer the solutions.
- c. prevent nucleic acid degradation.
- d. promote nucleic acid precipitation.

**27. The sequence of one strand of a DNA fragment is: 5'ATGCGTGACTAATTTCG3'. Which of the following is the CORRECT double-stranded sequence?**

- a) 5'-ATGCGTGACTAATTTCG-3'  
3'-TACGCACTGATTAAGC-5'
- b) 5'-ATGCGTGACTAATTTCG-3'  
5'-TACGCACTGATTAAGC-3'
- c) 5'-ATGCGTGACTAATTTCG-3'  
3'-TUCGCUCTGUTTUUGC-5'
- d) 5'-ATGCGTGACTAATTTCG-3'  
3'-ATGGCACTGATTAAGC-5'
- e) 5'-ATGCGTGACTAATTTCG-3'  
3'-UACGCACUGAUUAAGC-5'

**28. Which of the following statements concerning RNA are correct?**

1. RNA is synthesized in the 3' to 5' direction.
2. RNA contains ribose.
3. The following nitrogenous bases are found in RNA: uracil, adenine, cytosine, guanine.
4. In eukaryotes the 5' end of the primary RNA transcript is modified.
5. If the sequence of the DNA template strand is 3'AAA TCG CCC 5', then the sequence of the RNA transcript is 5' UUU AGC GGG 3'.

- a. 1,2,3,4,5
- b. 2,3,4,5
- c. 1,2,4,5
- d. 1,2,3,4
- e. 1,3,5

**29. Which of the following statements concerning DNA structure are CORRECT?**

1. Forces that stabilize the double helix structure of DNA include hydrogen bonds, van der Waals forces and ionic interactions.
2. In complementary base pairing of cytosine and guanine, two hydrogen bonds stabilize the interaction.
3. Ribose is linked by the 5' carbon to an oxygen atom.
4. Adenine is covalently attached to the 1' carbon of deoxyribose.
5. Adenine is covalently attached from the 9' nitrogen to the 1' carbon of deoxyribose.

- a) 1, 3, 4, 5
- b) 2, 3
- c) 1, 2, 3
- d) 1, 4, 5
- e) 2, 3, 4, 5

**30. Which of the following statements concerning purine and pyrimidine structure are CORRECT?**

1. Adenine is a purine that binds via three hydrogen bonds to thymine.
2. Uracil is covalently attached to the 1' carbon of deoxyribose in DNA.
3. Guanine/cytosine and adenine/thymine complementary pairs are stabilized by three and two hydrogen bonds, respectively.
4. The melting temperature ( $T_m$ ) of DNA is related to the hydrogen bonding between complementary base pairs.
5. In nucleic acids and nucleotides, nitrogen 9 of purines and nitrogen 1 of pyrimidines are bonded to the 1' carbon of ribose or deoxyribose.

- a) 1, 2
- b) 3, 4, 5
- c) 1, 2, 4, 5
- d) 2, 3, 4, 5
- e) 1, 3, 5

**31. Which of the following statements is NOT CORRECT?**

- a) The subunits of DNA and RNA are nucleotides.
- b) Nucleotides have a phosphate group attached through a phosphodiester bond.
- c) A DNA precursor is deoxyadenosine-5'-triphosphate (dATP), which loses two phosphate groups when synthesis of DNA occurs.
- d) The DNA molecule has a 5' end bearing a phosphate group and a 3' hydroxyl group.
- e) Nucleotides contain a base linked to the 5' position of deoxyribose or ribose.

**32. Ethanol is used to precipitate nucleic acids because**

1. nucleic acids are dehydrated by ethanol.
2. double-stranded DNA is denatured by ethanol.
3. ethanol is soluble in chloroform.
4. ethanol is easy to remove after precipitation.

- a) 1, 3
- b) 2, 4
- c) 1, 2, 3
- d) 1, 4
- e) 2

**33. Which of the following statements describes a DIFFERENCE between the structure of DNA and RNA?**

- a) The 3' end of RNA has a hydroxyl group on carbon 3'.
- b) In DNA, the nitrogenous bases can be cytosine, uracil, guanine, and adenine.
- c) In RNA, the nitrogenous base is attached to carbon 1'.
- d) In DNA, there is no hydroxyl group attached to carbon 2'.

**34. If you know that a region of double-stranded DNA has a content of 60% G/C base pairs and 40% A/T base pairs, then what is the ratio of purines to pyrimidines in the DNA?**

- a. 60:40
- b. 40:60
- c. 50:50
- d. 20:80
- e. cannot be determined from the above information

**35. Which of the following statements concerning the structure of DNA is CORRECT?**

- a. Thymine is a purine that makes three hydrogen bonds with adenine.
- b. The nitrogen 1 of purines is bonded to the carbon 1' of deoxyribose.
- c. The free carbon 3' end of DNA has a phosphate group attached.
- d. Uracil is covalently attached to the carbon 1' of deoxyribose.
- e. Guanine is a purine that makes three hydrogen bonds with cytosine.

**36. When the first draft of the human genome was published in February, 2001. Scientists reported that the human genome contained**

- more genes than previously predicted.
- fewer genes than previously predicted.
- the same number of genes as previously predicted.
- no genes

**37. You have a polypeptide containing this sequence of amino acids: His-Met-Leu-Ile-Lys. Using the mRNA genetic code for amino acids listed below, choose the DNA template sequence that corresponds to this polypeptide.**

mRNA codon		amino acid
UUA		Leu
AUU		Ile
AUC	}	Met
AUA		
AUG		
CAC	}	His
CAU		
AAA		Lys

A DNA template sequence for this polypeptide could be

- 3'GUGUACAAUAUUUUU5'.
- 3'GTGTACAATATTTTT5'.
- 3'GTATACAATTAATTT5'.
- 3'GUAUACAAUAUUUU5'.
- 3'CAUAUGUAAUAAA5'

**38. The melting temperature (T<sub>m</sub>)**

- is the temperature at which all of the double strands of DNA have separated.
- increases when the number of C and G nucleotides increases.
- is the temperature at which half of the double strands of DNA have separated.
- increases when the number of A and T nucleotides increases.
- b and c

**39. You wish to amplify some DNA and notice that there is a high content of G and C at the ends of the sequence. You should increase the temperature in which step of the polymerase chain reaction?**

- a. annealing
- b. denaturation
- c. synthesis
- d. all of the above

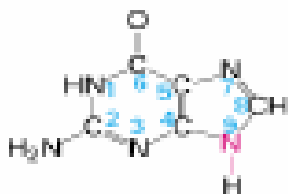
**40. If ten percent of the nucleotides in a piece of DNA contained adenine, the percentage of nucleotides containing thymine would be?**

- a. ten
- b. forty
- c. twenty
- d. eighty
- e. none of the above

**41. In which of the following DNA duplexes would complementary bases dissociate at the lowest temperature?**

- a. 5'-GCGCGCGC-3'  
3'-CGCGCGCG-5'
- b. 5'-ATATATAT-3'  
3'-TATATATA-5'
- c. 5'-GATCGATC-3'  
3'-CTAGCTAG-5'
- d. 5'-GGGGAAAA-3'  
3'-CCCCTTTT-5'
- e. 5'-GGGGGGGG-3'  
3'-CCCCCCCC-5'

42. The nitrogenous base shown is:



- a. thymine
- b. uracil
- c. adenine
- d. cytosine
- e. guanine

43. What is the percentage of adenines in a piece of RNA if the percentage of cytosine is 30%?

- a. 30%
- b. 20%
- c. 60%
- d. 40%
- e. Unable to calculate with the information provided.

44. Which of the following is NOT a characteristic of DNA?

- a. It is less susceptible to alkaline hydrolysis than RNA.
- b. It has a hydroxyl group attached to the 3' carbon at the 3' end.
- c. It is stabilized by hydrogen bonding, Van der Waals forces and ionic interactions.
- d. It can exist in four different helical conformations.
- e. It is synthesized in the 5' to 3' direction by DNA polymerase.

45. Guanosine

- a. is used by DNA polymerase for the synthesis of DNA.
- b. consists of guanine, deoxyribose, and one or more phosphates.
- c. is used by RNA polymerase in the synthesis of RNA.
- d. can also be called guanylate.
- e. consists of guanine and ribose.

**46. DNA is held together by hydrogen bonds, hydrophobic interactions, ionic bonds and van der Waals interactions. What is a van der Waals interaction?**

- a. A noncovalent bond in which one atom donates an electron to another atom.
- b. A covalent bond in which there is a sharing of electrons in the outer shell.
- c. A noncovalent bond involving oppositely charged dipoles.
- d. An aggregation of nonpolar molecules surrounded by highly ordered water molecules.
- e. A covalent bond involving a hydrogen atom and a carbon atom.

**47. Proteins of interest are frequently tagged with green fluorescent protein. In many cases addition of GFP does not alter the function of protein of interest. What is the most likely explanation for this observation?**

- a. GFP consists of a helix-loop-helix motif that binds to DNA when it enters the nucleus.
- b. GFP only has primary protein structure, so the tertiary structure of the protein of interest is not altered.
- c. GFP is always attached to the N-terminal end of the protein of interest.
- d. Proteins consist of functional and structural domains that fold and function as modular units.
- e. GFP-tagged proteins can be made and can act in living cells.

**48. The process of synthesizing mRNA along a DNA template is called**

- a. transcription.
- b. translation.
- c. transformation.
- d. replication.
- e. translocation.

**49. What is meant by the histone code?**

It refers to

- a) the sequence of ribonucleotides that code for each type of histone.
- b) histone modifications to which specific proteins bind, thereby altering transcription.
- c) the high degree of homology between all types of histones.
- d) the observation that the genes coding for histones are tandemly repeated genes.
- e) the specific sequence of deoxyribonucleotides that code for each type of histone.

**50.** A sequence of an RNA template found in telomerase is:  
5'UAGGGUAGGGUAGGG3'

**Which diagram represents the correct sequence of one of the ends of a chromosome taken from the same cell as the telomerase?** The “---” represents the middle part of the chromosome.

- a) -----TAGGGTAGGGTAGGG3'  
-----ATCCCATCCCATCCC5'
- b) ----- ATCCCATCCCATCCC 3'  
-----TAGGGTAGGGTAGGG 5'
- c) ----- CCCTACCCTACCCTA3'  
-----GGGATGGGATGGGAT5'
- d) ----- GGGATGGGATGGGAT3'  
----- CCCTACCCTACCCTA 5'
- f) none of the above.

**51. The addition of dideoxynucleotides (ddNTP) prevents further polymerization because ddNTP's,**

- a) are radioactive and unstable.
- b) lack oxygen on the 3' carbon.
- c) lack a phosphate group on the 5' carbon.
- d) are bulky and are not able to bind to other nucleotides.

**52. Which of the following is a feature of chromatin?**

- a) Chromatin is found in its most condensed form in interphase.
- b) Histones are the only proteins found in chromatin.
- c) Histone 2A is found in the linker region of chromatin.
- d) DNA that is actively being transcribed exists in cells as euchromatin.
- e) Moderate digestion of chromatin with DNases yields amino acids and deoxyribonucleic acid.

**53. Which of the following statements is CORRECT?**

- a) Prokaryotic genomes have lots of spacer DNA.
- b) Many genes devoted to a single metabolic pathway are found within complex transcriptional units in prokaryotes.
- c) Once the sequence of the human genome was known the function of all human proteins became known.
- d) Eukaryotic chromosomes consisting of DNA and proteins are circular.
- e) Genes in prokaryotes and eukaryotes always code for proteins.

**54. Which of the following is NOT a function of RNA?**

- a) It acts a peptidyltransferase during translation.
- b) It is required for RNA splicing.
- c) It is essential for the structure of ribosomes.
- d) It attaches the correct amino acid to tRNA.
- e) It recognizes the Shine-Dalgarno sequence.

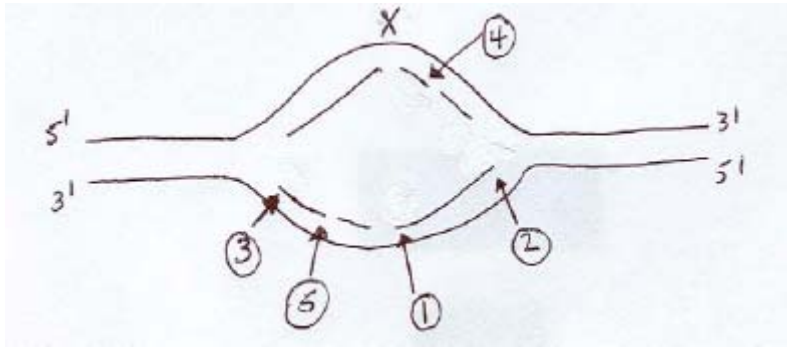
**55. Which CORRECT statement can be made concerning DNA replication or transcription in prokaryotes?**

- a) A DNA primer is required for DNA replication of the bacterial chromosome.
- b) RNA polymerase starts to transcribe from the TAC triplet on the template strand.
- c) A helicase is used to unwind DNA into single strands in transcription.
- d) A sigma factor directs the core RNA polymerase to the start site of transcription.
- e) The entire chromosome is copied in DNA replication and in transcription.

**56. Which of the following statements concerning DNA replication in prokaryotes and eukaryotes is CORRECT?**

- a) Discontinuous DNA synthesis of the lagging strand occurs in prokaryotes but not in eukaryotes.
- b) Single-strand binding protein and replication factor C (Rfc) both bind to single-stranded NA to prevent complementary base pairing. D
- c) In both prokaryotes and eukaryotes only one type of DNA polymerase is required to synthesize the daughter strands.
- d) The  $\tau$ -subunit of DNA polymerase III and PCNA in eukaryotes make DNA polymerase rocessive.
- e) DNA polymerase I in prokaryotes and DNA polymerase  $\delta$  in eukaryotes fill in the gap left by removal of RNA.

57. In diagram below illustrating DNA replication which numbers represent the 3' end of the single-stranded DNA. X = origin of replication.



- a) 6, 2
- b) 2, 4
- c) 3, 4, 5
- d) 2, 5
- e) 1, 2

58. What is the function of the nucleolus?

- a) The site where cellular rRNA is made.
- b) The site of transcription by RNA polymerase II.
- c) The region in prokaryotic cells where DNA is found.
- d) The region in eukaryotic cells where simple sequence DNA is found.
- e) The region in the eukaryotic nucleus where RNA splicing occurs.

59. Which enzyme catalyzes phosphodiester bond formation between two adjacent Okazaki fragments after the primers have been removed and the gap has been filled with appropriate nucleotides?

- a) DNA polymerase III.
- b) DNA polymerase  $\alpha$  (alpha).
- c) DNA ligase.
- d) DNA polymerase I.
- e) DNA polymerase  $\delta$  (delta).

60. Which of the following is not correct concerning the structure of RNA?

- a) The monomer units used for polymerization are ribonucleoside triphosphates.
- b) The monomer units are linked by phosphodiester bonds.
- c) The bridge between adjacent nucleotides involves two phosphate atoms.
- d) The bridge between adjacent nucleotides involves the 5' carbon and 3' carbon of adjacent subunits.
- e) The 2' carbon atom of each subunit contains a hydroxyl group.

**Note: Questions 61-75 relate to Labs 1-6.**

**61. What is the difference between NP-40 and SDS?**

- a. one is a detergent and one is an enzyme
- b. one solubilizes the plasma membrane and the other the nuclear envelope.
- c. one solubilizes the plasma membrane, while the other solubilizes the plasma membrane and the nuclear envelope
- d. they both solubilize the nuclear envelope.

**62. What is the purpose of NaCl in the DNA lab?**

- a. it breaks the nuclear membrane
- b. it breaks the interaction between DNA and histones
- c. it makes the DNA salty
- d. it brings together DNA and histones

**63. What is the function of EDTA?**

- a. it is a buffer
- b. it is a chelator, with low affinity for  $Mg^{2+}$
- c. it is a chelator, with high affinity for  $Mg^{2+}$
- d. it is a chelator, with high affinity for monovalent cations

**64. What is the difference between a nucleotide and a nucleoside?**

- a. nothing
- b. hexose sugar
- c. pentose sugar
- d. phosphate group
- e. base

**65. Why is proline a unique amino acid?**

- a. it has 5 side groups instead of 4 about the primary carbon
- b. it has a second amino group
- c. it is a detergent
- d. it lacks an amino group

**66. What is denaturation?**

- a. getting away from nature
- b. breaking DNA into double stranded fragments
- c. separation of DNA strands caused by the breakage of bonds between base pairs
- d. the same as hybridization

**67. Why is ethidium bromide used?**

- a. to visualize bands under X-ray
- b. to visualize bands under UV light
- c. to visualize bands by the naked eye
- d. to visualize bands under infrared light

**68. How does DNA run during electrophoresis?**

- a. from cathode to anode
- b. from anode to cathode
- c. away from the positive pole
- d. towards the negative pole

**69. Which is not found in the PCR master mix?**

- a. DNA polymerase
- b. primers
- c. buffer
- d. ddNTPs
- e. dNTPs

**70. What is the correct order for PCR amplification?**

- a. anneal, extend, melt
- b. anneal, melt, extend
- c. extend, melt, anneal
- d. extend, anneal, melt
- e. melt, anneal, extend

**71. Which tool would you use to determine the alignment of sequences?**

- a. BLAST
- b. PubMed
- c. Clustal W
- d. Ensembl
- e. SMART

**72. What is a BLAST search?**

- a. searches an entire unknown sequence against a database
- b. searches fragments of an unknown sequence against a database
- c. refers to as “one against all differences search”
- d. only searches nucleotide sequences

**73. When looking at a stained band after electrophoresis, what are you looking at?**

- a. numerous DNA molecules with approx. the same number of nucleotides
- b. one DNA molecule
- c. numerous DNA molecules of different sizes
- d. numerous nucleosides

**74. What is a restriction enzyme?**

- a. a synthetic enzyme
- b. a bacterial enzyme
- c. a detergent
- d. an RNA enzyme

**75. Which of the following occurs in Southern blotting?**

- a. a protein is detected
- b. gene of interest used as a probe to determine if it is present in a tissue
- c. a piece of RNA is detected
- d. gene of interest is used as a primer to determine its presence in a tissue
- e. sequencing of a genome