

PART 1

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**IMPORTANT**

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**TO USE SUBJECTIVE SCORE FEATURE:**

- Mark total possible subjective points
- Only one mark per line on key
- 163 points maximum

EXAMPLE OF STUDENT SCORE:

50	40	30	20	10	0
50	40	30	20	10	0
9	8	7	6	5	4
4	3	2	1	0	0

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SCANTRON FORM NO. 882-E

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**BCHS 3304/ Exam II**

**March 27, 2003**

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**Instructions:**

- 1. There are 10 pages to this exam. Count pages prior to beginning exam. You may use the back pages of the exam as scratch paper.**
  - 2. This is a Scantron exam. All answers should be transferred to a scantron sheet using a #2 pencil.**
  - 3. Write your name in the appropriate box marked NAME on the front and the back side of the Scantron sheet. If your name is not clearly legible, you will be awarded 0 points for this exam.**
  - 4. Write your social security number next to your name on the back side of the scantron sheet. If your social security # is not clearly legible, you will be awarded 0 points for this exam.**
  - 5. Write BCHS 3304 in the box marked SUBJECT, EXAM II in the box marked TEST NO., and 3/27/03 in the box marked DATE.**
  - 6. Answer all questions.**
  - 7. When finished, turn in complete Scantron sheet and the copy of the exam to your instructor.**
- .....

1. An example of a conservative substitution would be
  - A) Ala to Trp.
  - B) Gly to Ser.
  - C) Asp to Glu.
  - D) all of the above.
  - E) none of the above.
  
2. The erythrocytes of birds and turtles contain a regulatory molecule different from 2,3-BPG. This substrate is also effective in reducing the oxygen affinity of human hemoglobin stripped of 2,3-BPG. Which of the following substrates would you predict to be most effective in this regard?
  - A) Arginine
  - B) Lactate Glucose 6-phosphate
  - C) Malonate
  - D) Inositol hexaphosphate
  - E) Lactate

3. The first type of antibody that is found in serum after antigen is detected is

- A) IgM.
- B) IgB.
- C) IgG.
- D) IgD.
- E) IgE.

4. Which of the following is not a property of the molten globule?

- A) It is compact
- B) It has a hydrophobic core
- C) It contains secondary-structure elements
- D) It has a defined three-dimensional structure
- E) It is more flexible than the native protein

5. What are lectins?

- A) proteins that bind the carbohydrates on glycoproteins and other macromolecules
- B) proteins that promote cell-cell interaction
- C) proteins found in animals, plants, and microorganisms
- D) all of the above
- E) none of the above

6. Amino acids to which sugars are commonly linked.

- A) tyrosine and asparagine
- B) serine, threonine, and asparagine
- C) serine, tyrosine, and asparagine
- D) serine and threonine
- E) a and d

7. An immunogen is

- A) a special type of antibody.
- B) a surface receptor for antibodies.
- C) a foreign molecule that can stimulate an immune response.
- D) a and b.
- E) a and c.

8. What is the name of the compound that is the mirror image of  $\alpha$ -D-glucose?

- A)  $\beta$ -D-glucose
- B)  $\beta$ -L-glucose
- C)  $\alpha$ -D-fructose
- D)  $\alpha$ -D-mannose
- E)  $\alpha$ -L-glucose

9. What is the effect of dissociation of  $\alpha_2\beta_2$  into monomeric subunits on the oxygen affinity of hemoglobin A in vitro?
- A) Increases oxygen affinity
  - B) Decreases oxygen affinity
  - C) No effect
  - D) Decreases oxygen affinity by a 3-fold factor
  - E) None of the above
10. Cech and Altman independently demonstrated RNA can function as \_\_\_\_\_.
- A) a catalyst.
  - B) a genetic blueprint.
  - C) DNA.
  - D) double-stranded molecules.
  - E) none of the above.
11. The prebiotic world tested using various conditions resulted in the synthesis of
- A) sugars.
  - B) several amino acids.
  - C) a base.
  - D) b and c.
  - E) all of the above.
12. Convergent evolution is attributed to similarities found between
- A) trypsin and elastase.
  - B) chymotrypsin and elastase.
  - C) chymotrypsin and subtilisin.
  - D) chymotrypsin and trypsin.
  - E) trypsin and kinase.
13. Which of the following is a structural feature of myoglobin
- A) All the prolines are found within  $\alpha$  helices
  - B) The surface of the molecule consists mainly of nonpolar residues
  - C) Seventy-five percent of the amino acids are in  $\alpha$  helices
  - D) The heme group is bound on the surface of the protein
  - E) The interior of the molecule is hollow so that it can accommodate many molecules of water

14. Pepsin cleaves IgG molecules on the carboxyl-terminal side of the interchain disulfide bond. How many physical pieces derived from the Fc region of IgG would result from the cleavage of IgG with pepsin?
- A) 1
  - B) 2
  - C) 3
  - D) 4
  - E) 5
15. Used to depict evolutionary relationships between a large number of different species.
- A) sequence alignments
  - B) Blosum matrix
  - C) evolutionary tree
  - D) all of the above
  - E) none of the above
16. The catalytic specificity of EcoRV endonuclease is due to
- A) the initial binding affinity.
  - B) unwinding of the DNA.
  - C) disruptive interactions and a kink in the DNA.
  - D) hydrogen bonding of the enzyme to the DNA backbone.
  - E) magnesium bridges.
17. The sequence Gly-X-X-X-Gly-Lys is referred to as a P-loop because
- A) it forms a lariat P shape.
  - B) it forms a high-energy bond.
  - C) it interacts with phosphoryl groups.
  - D) it interacts with a phenylalanine.
  - E) the loop becomes covalently bound to a phosphoserine residue.
18. Mechanism(s) to prevent osmotic crisis include
- A) development of an extra structure such as a cell wall.
  - B) development of energy-dependent ion pumps.
  - C) development of multi-compartmentalized cells.
  - D) a and b.
  - E) all of the above.

19. What components besides carbon sources were included in the system mimicking the prebiotic conditions on earth?
- A) ammonia, water, hydrogen, solar radiation, and electricity
  - B) ammonia, solar radiation
  - C) water, hydrogen, lipids, and electricity
  - D) b and c
  - E) all of the above
20. The first step in protein structure prediction is to
- A) ask whether the sequence of a new protein is similar to one whose the 3D structure is already known
  - B) determine the quaternary structure of your protein
  - C) remove parts of the new protein to determine their role in the folding process
  - D) perform pulsed-label NMR studies
  - E) construct the Ramandandran plot of the new polypeptide
21. The half-life of a cytosolic protein is primarily determined by the
- A) length of the protein chain.
  - B) amino terminal residue.
  - C) sequence at the carboxyl terminus.
  - D) all of the above.
  - E) none of the above.
22. The relaxed form of an allosteric enzyme has \_\_\_\_\_ affinity for the substrates.
- A) higher
  - B) equal
  - C) lower
  - D) no
  - E) none of the above
23. The amino terminal domain of the H chain is considered a
- A) constant region.
  - B) variable region.
  - C) hypervariable region.
  - D) diverse region.
  - E) none of the above.
24. Spiegelman demonstrated that
- A) replicating forms are energetically stable.
  - B) replicating molecules can generate new forms.
  - C) replicating forms are self-perpetuating.
  - D) a and c.
  - E) all of the above.

25. What is the Bohr effect?

- A) the ability of hemoglobin to retain oxygen when in competition with myoglobin
- B) the regulation of hemoglobin binding by hydrogen ions and carbon dioxide
- C) the alteration of hemoglobin conformation during low oxygen stress
- D) all of the above
- E) none of the above

26. Threading is

- A) A computational technique that determines the structure of a protein through homology modeling
- B) A computational technique that attempts to determine the unknown structure of a protein by ascertaining whether it is consistent with a known protein structure
- C) A computational technique used to study biochemical evolution of RNA molecules
- D) A computational technique used to predict the structure of a protein based only on its chemical and physical properties
- E) None of the above

27. Allosteric proteins

- A) contain distinct regulatory sites and have multiple functioning sites.
- B) display cooperativity.
- C) always consist of several identical subunits.
- D) a and b.
- E) all of the above.

28. An open reading frame is necessary to compare

- A) DNA promoter sequences.
- B) alignments of potential protein coding regions.
- C) cDNA alignments.
- D) all of the above.
- E) none of the above.

29. Which of the following is correct regarding the 26S proteasome

- A) the 20S domain consists of 20 subunits
- B) only the alpha subunits display protease activity
- C) there are 6 subunits in each of the four rings
- D) the alpha subunit display chaperone activity
- E) only the beta subunits display protease activity

30. Type II Restriction enzymes cut

- A) double stranded DNA, forming a 5' phosphoryl group and a 3' hydroxyl group on each strand.
- B) single stranded DNA, forming a 5' phosphoryl group and a 3' hydroxyl group on the strand.
- C) double stranded DNA, forming a 5' phosphoryl group and a 3' hydroxyl group on one strand.
- D) double stranded DNA, forming a 3' phosphoryl group and a 5' hydroxyl group on each strand
- E) single stranded DNA, forming two hydroxyl groups and loss of a phosphate group.

31. Predict whether the following peptide sequence is likely to be phosphorylated by protein kinase A and which residue would be phosphorylated

Gly-Arg-Arg-Ala-Thr-Ile

- A) There would be no phosphorylation
- B) Arg would be phosphorylated
- C) Thr would be phosphorylated
- D) Gly would be phosphorylated
- E) Ile would be phosphorylated

32. Paralogs differ in

- A) detailed biochemical functions.
- B) ancestral evolution.
- C) ornithology.
- D) all of the above.
- E) none of the above.

33. Protein sequence comparisons can provide estimates of

- A) protein function.
- B) protein shape.
- C) pathways of evolutionary descent.
- D) b and c.
- E) all of the above.

34. Align the two sequences below. What percentage identity do you see?

(i) SVGLNEVELASIMEIL (ii) SLGMNEQELSNLQQVL

- A) 10 %
- B) 24 %
- C) 44 %
- D) 51 %
- E) 61 %



35. Ubiquitin is added to \_\_\_\_\_ residues on proteins targeted for degradation.

- A) lysine
- B) aspartic acid
- C) glutamine
- D) all of the above
- E) none of the above

36. The chains of the CD8 dimers possess domains that are similar to

- A) immunoglobulin variable domains.
- B) immunoglobulin diverse domains.
- C) immunoglobulin constant domains.
- D) all of the above.
- E) none of the above.

37. The angles of rotation about the peptide bond are called

- A) phi and alpha.
- B) psi and alpha.
- C) phi and psi.
- D) alpha and beta.
- E) beta and psi.

38. The simplest carbohydrates are

- A) D- and L-glyceraldehyde.
- B) dihydroxyacetone and D- and L-glyceraldehyde.
- C) dihydroxyacetone and glycerate.
- D) all of the above.
- E) none of the above.

39. Osmotic crisis refers to the process wherein

- A) salts penetrate a cell membrane and disrupt its osmotic pressure.
- B) amphipathic molecules freely disperse into the aqueous medium.
- C) water moves across the membrane and the osmotic pressure causes the cell to burst.
- D) all of the above.
- E) none of the above.

40. An example of paralogs would include

- A) hemoglobin and myoglobin.
- B) actin and keratin.
- C) DNA polymerase and trypsin.
- D) all of the above.
- E) none of the above.

41. How do some viruses gain entry into specific cells?
- A) by attaching to ion channels
  - B) by cleaving the glycosidic bonds and altering protein shapes
  - C) by binding to glycoproteins on the cell surface that are unique to specific cells
  - D) all of the above
  - E) none of the above
42. The immunoglobulin with the highest serum concentration is
- A) IgM.
  - B) IgB.
  - C) IgG.
  - D) IgD.
  - E) IgE.
43. Which of the following statement is correct regarding the three-dimensional structure of the OmpF protein of E. coli (designated OMPF\_ECOLI in the SWISS\_PROT data base at ExPASy Molecular Biology server).
- A) OmpF is a heterodimer consisting of one large (25 kDa) and one small (12 kDa) subunits
  - B) OmpF is a homotrimer; each monomer folds into a beta-barrel structure of 16 antiparallel beta-strands
  - C) OmpF is a monomeric protein which folds into a beta-barrel structure of 12 antiparallel beta-strands
  - D) OmpF structure is rich in alpha helical structure
  - E) None of the above is correct
44. In order to determine if alignment scores are significant, sequences are compared to sequences that undergo
- A) repeated shuffling.
  - B) inverse alignments.
  - C) inversions.
  - D) all of the above.
  - E) none of the above.
45. Ramachandran plots
- A) display the secondary structure of a polypeptide
  - B) predict the folding motifs of a polypeptide
  - C) are the most reliable method to predict the 3D structure of proteins
  - D) display the conformation of the molten globule of a polypeptide
  - E) display allowed conformations of the main chain of a polypeptide

46. 2-3 Bisphosphoglycerate

- A) binds in a pocket of the T form of hemoglobin.
- B) preferentially binds to deoxyhemoglobin and stabilizes it.
- C) is present in the red blood cells.
- D) all of the above.
- E) none of the above.

47. The structure of deoxyhemoglobin is stabilized by each of the following interactions except for

- A) BPG binding
- B) Salt bridges between acidic and basic side chains
- C) Coordination of the hemes with the distal histidine
- D) Hydrophobic interactions
- E) Salt bridges involving N-terminal carbamates

48. Which of the following answers completes the sentence correctly? A Ramachandran plot

- A) Predicts  $\alpha$ -helical structures from given amino acid sequences
- B) Shows the x-ray diffraction pattern of a protein
- C) Represents the sterically allowed conformations of a polypeptide backbone
- D) Gives the frequency of occurrence of amino acids in  $\beta$  sheet structures
- E) Predicts the tertiary structure of a polypeptide chain

49. How does competition influence evolution?

- A) It alters resources available.
- B) It causes variation.
- C) It exerts selective pressure.
- D) All of the above.
- E) None of the above.

50. Adenylate kinase is treated with adenosine disphosphate (ADP). If the initial concentration of ADP is 1 mM, estimate the concentration of ADP after incubation with adenylate kinase for a long time

- A) 1 mM
- B) 1 M
- C) .33 mM
- D) .25 mM
- E) 3 mM