BIO 1110 - INTRODUCTION TO CELL BIOLOGY

MIDTERM EXAM — Feb. 8, 2003 9:30 A.M. – 10:30 A.M.

PLEASE DO NOT OPEN EXAM UNTIL TOLD TO DO SO. THANK YOU.

CLOSED BOOK: NO BOOKS, NOTES OR CALCULATORS PERMITTED

PROFESSOR J. FENWICK **60 MINUTES**

PLEASE READ THESE GENERAL INSTRUCTIONS FIRST!

PART A

(20 marks) ANSWER THE MULTIPLE CHOICE QUESTIONS ON THE COMPUTER SHEET. USE AN **HB PENCIL** AND FILL IN THE APPROPRIATE SPACES FULLY AND CAREFULLY. INDICATE THE MOST COMPLETE ANSWER. IF YOU ERASE, ERASE COMPLETELY! INDICATE ONLY ONE ANSWER FOR EACH QUESTION! MARKS WILL NOT BE DEDUCTED FOR INCORRECT ANSWERS UNLESS YOU GIVE MORE THAN ONE ANSWER FOR A QUESTION. DO NOT FOLD OR PUT ANY EXTRA MARKS ON THE COMPUTER SHEET. BE CERTAIN TO FILL IN YOUR NAME AND STUDENT NUMBER ON THE COMPUTER SHEET **BOTH IN PRINTING AND BY FILLING IN THE SPACES**. IF YOU HAVE A SIX DIGIT STUDENT NUMBER YOU MUST PUT A 0 (ZERO) IN FRONT BEFORE ENTERING IT ON YOUR ANSWER SHEET. **YOU MAY TAKE PAGES 1 THROUGH 4 HOME. TEAR OFF PAGE 5 AND HAND THIS SHEET IN.**

PART B

(15 marks) ANSWER USING ONLY THE SPACE PROVIDED AND WRITE ONLY ONE LINE PER LINE! YOU MUST DO ALL THREE QUESTIONS. **WRITE OR PRINT YOUR ANSWERS IN INK!!** Be certain to **PRINT** your name and student number on the answer sheet. **NO PRINTED NAME WITH LAST NAME FIRST AND STUDENT NUMBER ON PAGE 5 AND YOU WILL GET A MARK OF 0**!

GOOD LUCK!

PART A

1. In biological systems, which of the following is not typically a weak-bond or weak bond interaction?

   a. hydrogen bond
   b. Van der Waal's
   c. hydrophobic
   d. disulphide bond*
   e. ionic bond

2. Approximately how thick is a cell membrane? (a nice 'ballpark' figure) (Check Topic 5 Slide 6)

   a. 1 nm b. 5 nm c. 10 nm* d. 1 μm e. 5 μm

3. Which of the following statements is (are) not true?

   a. Membrane proteins are not necessarily the same on the two sides of the same membrane.
   b. Most pore forming proteins are multispanning.
   c. Integral proteins are all amphipathic
   d. The lipid bilayer is completely covered with a layer of proteins on both sides.*
   e. Both 'b' and 'd'.

4. How many unit membranes separate the DNA in the nucleoid from the plasmalemma?

   a. 0* b. 1 c. 2 d. 3 e. >3

5. Which one of the following unit membranes would be the least fluid?

   a. one consisting primarily of phosphoglycerides with saturated long hydrocarbon chains*
   b. one consisting primarily of phosphoglycerides with saturated short hydrocarbon chains
   c. one consisting primarily of phosphoglycerides with unsaturated long hydrocarbon chains
   d. one consisting primarily of phosphoglycerides with unsaturated short hydrocarbon chains
   e. one consisting primarily of phosphoglycerides with unsaturated long hydrocarbon chains and lots of cholesterol

6. The actual limit of resolution of the transmission electron microscope when viewing cellular structure is typically in the range of:

   a. 0.03 Å b. 1.0 Å c. 3 to 5 Å d. 10 to 15 Å* e. 1 μM

7. Which of the following is likely our closest prokaryotic relative.

   a. cyanobacteria
   b. slime moulds
   c. fungi
   d. methanobacterium*
   e. *E. coli*

8. Chemically, the α/β barrel is most specifically described as a:

   a. peptide
   b. pore
   c. motif*
   d. domain
   e. multiprotein complex

9. Sugars have the general formula of $(CH_2O)n$. What is the n in sugars of biological importance?

a. 3 b. 5 c. 6 d. 3 to 7* e. 5 or 6

10. Which is not true concerning typical prokaryotes and eukaryotes.

a. Share an essentially identical genetic language.
b. Can have both the glycolytic scheme and kreb's cycle.
c. Similar mechanisms for the synthesis of RNA.
d. Similar mechanisms for the synthesis of proteins.
e. Both use the rER for protein synthesis and packaging.*

11. Which of the following statements about glycogen are incorrect? (both 'b' and 'd' will be marked correct)

a. Glycogen is a polysaccharide.
b. Glycogen is a straight chain polymer of glucose.*
c. Glycogen consists of glucose monomers joined together by glycosidic bonds.
d. Most of the sugar units of glycogen are joined together by $\alpha(1\rightarrow6)$ glycosidic bonds.*
e. both 'c' and 'd'

12. Which is the best description of a carbonyl group?

a. a carbon and hydrogen atom
b. an oxygen duble-bonded to a carbon and a hydroxyl group
c. a nitrogen and a hydrogen bonded to a carbon atom
d. a sulfur and a hydrogen bonded to a carbon atom
e. a carbon atom joined to an oxygen atom by a double bond*

13. Band 8.9 protein in a liver cell transports PO_4^{-2} into the cell in exchange for Cl^- which is transported out of the cell. The Band 8.9 protein then is a:

a. symport
b. coupled
c. antiport
d. uniport
e. both 'b' & 'c'*

14. Which of the following statements is not correct?

a. Ribosome are involved in protein synthesis.
b. Microfilaments perform an important role in intracellular transport.
c. Mitochondria, when present, might well be considerd as the cell's power house.
d. Lysosomes perform an important function in intracelluar digestion.
e. Centrioles are very important in the process of mitosis.*

15. Which bonds are most directly responsible for the secondary structure of a protein?

a. P eptide bonds
b. Hydrogen bonds*
c. Hydrophobic interactions
d. ionic bonds
e. disulphide bonds

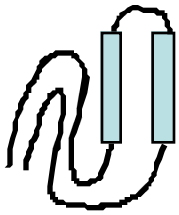
16. Supposing you measure the amount of DNA per nucleus in a very large number of cells from a growing fungus and find the measured amount of DNA to range from 3 to 6 pg per nucleus. One nucleus had 5 picograms of DNA. What stage of the cell cycle was this cell in?

    a. G_O b. G_1 c. S* d. G_2 e. M

17. Which of the following is <u>inconsistent</u> with the others?

    a. hydrophobic
    b. lipophilic
    c. traverses unit membrane easily
    d. low oil/water partition coefficient*
    e. non-polar

18. What is the highest degree of structure shown by this protein?



    a. primary
    b. secondary
    c. alpha helix
    d. tertiary*
    e. quaternary

19. Which of the following are clearly associated with Anaphase B movement. Best answer!

    a. astral microtubules
    b. kinetochore microtubules
    c. dynein
    d. kinesin*
    e. both ‘a’ and ‘b’

20. (This question is very specific and is here to ensure that nobody gets 100% without truly deserving it.) In a RBC membrane, spectrin is linked to:

    a. ankyrin
    b. band 3 protein
    c. Band 4.1 protein
    d. actin
    e. All of ‘a’, ‘b’, ‘c’ and ‘d’ *

_____ N.B.!_____

STUDENT NUMBER **LAST NAME FIRST, INITALS.**

PART B (15 MARKS) WRITE OR PRINT YOUR ANSWERS IN THE SPACE PROVIDED, ONE LINE PER LINE. YOU MUST USE EITHER BLACK OR BLUE INK. NO NAME AND NUMBER, NO MARK!

1. **(FIVE MARKS)** Describe the essence of the Fluid Mosaic Model of cell membranes.

- has as its central component a **fluid bilipid layer** (may use **fluid unit membrane** but if they
do then they must also say that the unit membrane consists of a lipid lipid bilayer)
(may say phospholipids, phosphoglycerides or even just lipids.)
The key words are fluid and lipid of some sort. Fat will not do.
- also must have the idea that the mosaic part consists of **different** membrane **proteins**
- the rest is not necessary for full marks but should be worth marks:
- proteins embedded in (integral proteins) or are attached to (peripheral proteins) the lipid bilayer
– lipids in the two layers (leaflets) may be different
– may mention that cholesterol is present in animal cells but not prokaryotes or plants
– may say it was proposed by Singer and Nicholson

2. (FIVE MARKS) Tell me what you know about MPF?

Maturation or mitosis or M promoting factor) they need not put more than one
stimulates entry **into mitosis** (from G_2)
-and/or **may** just say controls the cell cycle
has **two subunits**: (MPF really a cyclin -Cdk- complex: this would be worth a mark)
a) a catalytic subunit that acts as a kinase, (might say **Cdks** or cyclin dependent kinases)
b) regulatory subunit called cyclin
Cdk concentration remains relatively constant during the entire cell cycle
Cyclin concentration varies during the cycle

3. **FIVE MARKS** Name, draw and label all parts of any one completely non-ionized amino acid other than alanine or glycine. **The answer must be perfect or you get zero! (I promised this.)**

To get full marks they must show the **name of the amino acid**, have a **perfect drawing** of that amino acid (see attached page) and must have the following parts labelled. **α-carbon**, **hydrogen**, **amino (or amine) group**, **carboxyl (or carboxy) group**, and **R group** (I mean they need just put the **R** or **R plus R group label** , alternatively, they may label the R group as **'side chain'**, **radical** or may even give **the actual chemical name,** any is acceptable). The R group (side chain) may or may not show the charges, this does not matter. The amino group* and the carboxyl group must be shown as in the figure below. **The amino acid must not be alanine or glycine.**

Note the NON-IONIZED in the question, most answers I saw were of the ionized form. Correct forms:

***— NH_2 (not — NH_3 because this would be — NH_3^+ and certainly not —NH_4)**

***-COOH or C = O but not COO^- or C=O**