Cell Biology 282b Final

EXAM CODE 333

April 24, 2007

READ INSTRUCTIONS CAREFULLY:

1. **NO QUESTIONS** can be asked of the proctors. If issues arise with specific questions, they will be dealt with **AT A LATER DATE**.
2. Completely fill in the bubbles with an ordinary lead pencil. Marks made with a ballpoint pen or felt tip marker will NOT be detected. Do not make stray marks and completely erase errors.
3. Print your name and course in the blanks on the top of the SCANTRON sheet.
4. STUDENT NUMBER: Print the digits of your student number in the squares provided. Mark the corresponding bubble in the column below each printed digit.
5. SECTION: Fill in your course section:
   001 (1:30pm lecture) or 002 (11:30am lecture)
6. CODE: Fill in the exam code you are writing (top of this sheet).
7. Mark the one best choice from the alternatives provided for each question.
8. There are 50 questions in this test. Check your paper to ensure all questions are present. It is your responsibility to transfer all answers from the examination paper to the SCANTRON sheet WITHIN THE THREE HOUR time period.
9. THE SCANTRON sheet MUST be handed in at the end of the examination. You may keep the question booklet.
10. Wrong answers WILL NOT be deducted from your score.

****NOTE****

When filling in the SCANTRON answer sheet, failure to PROPERLY include and "bubble in" your student number, section or exam code will result in a loss of 5% from your exam grade. Be sure to triple check!!!

Q1. The inability to remove cholesterol form the bloodstream, resulting cardiovascular disease, can be the result of which of the following?

a. Apoptotic death of brain cells
b. Excessive exocytosis of M6P-containing proteins in the pancreas
c. Inability to endocytose LDL particles in the liver
d. A loss of cell cycle control genes in the pancreas
e. A loss of p53 stabilization in cells of the liver

Q2. Which of the following is **NOT** typical of the "cargo" moved by molecular motors?

a. secretory vesicles
b. lysosomes
c. mRNA
d. ATP
e. peroxisomes

Q3. You are studying an animal and inject fluorescein, a fluorescent dye with the molecular weight of 332 Da, into a single cell on the surface epithelium of the animal. After a brief period of time, the dye spreads to cells neighboring the injected cell. What do you conclude?

a. The cells are connected by the cell wall.
b. The cells are connected by focal adhesions
c. The cells are connected by tight junctions.
d. The cells are connected by gap junctions.
e. The cells are connected by fibronectin

Q4. Which lipid molecules are distributed relatively equally between exoplasmic and cytosolic leaflets of the plasma membrane?

a. phosphatidylethanolamine
b. phosphatidylcholine
c. phosphatidylserine
d. sphingomyelin
e. cholesterol

Q5. The yeast cell cycle genes were discovered mainly by analyzing mutant cells using which of the following techniques?

a. yeast two-hybrid assays
b. monoclonal antibodies and Western Blots
c. functional complementation
d. equilibrium density centrifugation
e. DNA and protein microarrays

Q6. Which is not a property of biomembranes?

a. fluid
b. closed compartment
c. symmetric
d. semi-permeable
e. all the above

Q7. In yeast cells, sporulation in response to carbon/nitrogen deprivation would cease in the presence of inhibitors of which of the following gene products?

a. raf B. Fus3 c. Kss1 d. Mpk1 e. Smk1

Q8. A cell biologist was successful in showing that ras g-proteins interact with MAP3K (raf) using yeast two-hybrid assays. Which of the following techniques would you recommend the cell biologist use to confirm that the interaction occurs in the mammalian cells from which the ras/raf genes were isolated?

a. SDS-PAGE
b. Fluorescent energy transfer
c. Scanning electron microscopy
d. Rate-zonal centrifugation
e. 'd' followed by 'a'

Q9. What is the name of a molecule with the following structure:
sphingosine + fatty acid + glucose?

a. ganglioside
b. phosphoglyceride
c. glucosylcerebroside
d. phospholipid
e. sphingomyelin

Q10. During the insulin signaling pathway, to become fully active, PKB requires which of the following?

a. PIP2 and PDK
b. IP3 and IRS
c. Ca^{2+} and PKC
d. cAMP and PKA
e. ras and raf

Q11. A transport system that moves a single solute into a cell per cycle could be called a(n)

a. uniport
b. antiport
c. symport
d. cotransport
e. superport

Q12. Metformine is beneficial to Type II diabetics because it increases the expression of GLUT 4 on the cell surface by:

a. Inhibiting IRS phosphorylation on tyrosine amino acids
b. Increasing recruitment of IRS to the insulin receptor via SH2 domains
c. Increasing the recruitment of IRS to the insulin receptor via PTB domains
d. Inhibiting ser/thre protein kinases which normally inhibit IRS
e. Decreasing vesicular traffic to the cell membrane

Q13. The tightest attachment between a cell and its extracellular matrix is seen at the site where an epithelial cell is attached to the underlying basement membrane. This specialized adhesive structure is called a(n):

a. tight junction
b. spot desmosome
c. adherence junction
d. hemidesmosome
e. selectins

Q14. Steroid hormone receptors are composed of which of the following domains?

a. regulatory, catalytic
b. DNA binding, catalytic, ligand binding
c. Variable, ligand binding, catalytic
d. DNA binding, variable, ligand binding/dimerization
e. 'b' and 'd'

Q15. ESC self renewal within the stem cell niche occurs via cytokine receptor activation, and even in the presence of ligands promoting cell differentiation via the MAPK pathway, are able to self renew by transcribing which of the following genes?

a. RTKs
b. MEK
c. Trimeric G-proteins
d. MAPKPpase
e. Monomeric G-proteins

Q16. Cholera and Pertussis toxins alter G-protein function such that:

a. Protein Kinase A is not activated
b. Cellular levels of cAMP increase
c. Cholera toxin increases, while pertussis toxin decreases cAMP levels
d. The beta/gamma subunits of the G-protein complex remain bound to the alpha subunit
e. GAP cannot bind to the alpha subunit

Q17. A knockout of hopscotch in friutflies would lead to which of the following phenotypes?

a. Wingless
b. Hemocyte deficient
c. Eyeless
d. Tumerous lethal
e. Footloose

Q18. Which of the following is **FALSE**?

a. the cytoskeleton is the intricate network of protein filaments that extend throughout the cytoplasm
b. αβ heterodimer is basic "subunit" of microfilaments
c. profilin promotes actin polymerization
d. minus (-) ends of microtubules are associated with MTOC
e. cortical actin is the actin rich cortex underlying the plasma membrane

Q19. The G-protein binding domains of 7TM G-protein coupled receptors can be ascertained using which of the following techniques?

a. Protein chimeras
b. DNA microarrays
c. Protein arrays
d. Site directed mutagenesis
e. 'a' and 'd'

Q20. The alpha subunit of trimeric G-proteins differs from monomeric G-proteins by the latter always requiring:

a. RTK and MAPK
b. Cyclic nucleotides and PKA
c. GAP and GEF
d. TPA
e. None of the above

Q21. With respect to topogenic sequences, which statement is FALSE?

a. all type I proteins possess stop-transfer anchor sequence
b. all type II and II proteins possess only signal-anchor sequence
c. in the case of type III proteins, the signal-anchor sequence is located near C-terminus
d. a signal-anchor internal topogenic sequence directs the insertion of protein into the ER membrane
e. type IV proteins have several internal topogenic sequences

Q22. An important property of **both** facilitated transporters and pumps is

a. conformational changes
b. rigidity
c. softness
d. α-helix
e. phosphorylation

Q23. Beta/gamma subunit g-protein promoted signaling includes which of the following?

a. Potassium transporters
b. Ste 5 scaffold activation
c. Ste 25 kinase
d. Muscle relaxation via nitric oxide
e. 'a' and 'b'

Q24. Which molecules in biological membranes have both hydrophobic and hydrophilic regions?

a. transmembrane proteins and phospholipids
b. phospholipids only
c. transmembrane proteins only
d. phospholipids, but only when cholesterol is present
e. peripheral proteins

Q25. What is the distinguishing characteristic of a P-type pump?

a. It must be pumped during the cycle.
b. It must be phosphorylated during the cycle.
c. It must be protonated during the cycle.
d. It must be deprotonated during the cycle.
e. It must be potassiumated during the cycle.

Q26. Protein-aided transport of an ion or small molecule down its gradient across a cell membrane would be best described as?

a. transmembrane exchange
b. facilitated osmosis
c. simple diffusion
d. facilitated diffusion
e. active transport

Q27. Which of the following is **FALSE**?

a. formation of a branched network of microfilaments depends on Arp2/3 complex
b. cytoplasmic Ca^{2+} gradient is associated with direction of cell movement
c. Rho activation at the rear of a migrating cell leads to myosin II activation
d. desmin stabilizes sarcomeres
e. the contractile ring is a transient structure comprised of intermediate filaments that assembles at the equator of a dividing cell

Q28. What is FALSE regarding peripheral proteins?

a. function often as adapter proteins
b. can be glycosylated
c. can interact with polar heads of lipids
d. have a short transmembrane domain
e. can interact with integral proteins

Q29. Athletes have and continue to get caught 'bulking up' and increasing athletic performance using drugs which promote cell signaling by which of the following?

a. monomeric G-protein signaling
b. anabolic intracellular receptors → steroid hormone
c. RTKs
d. 7TM G-protein coupled receptors
e. 'a' and 'd'

Q30. As in the case of other viruses, the human immunodeficiency virus uses a coat protein to bind to surface receptors in order to gain entry into specific human cells. Supposing that you have isolated sufficient virus coat protein, which of the following techniques would most likely allow you to isolate the cell surface receptor?

a. Northern blotting
b. Southern blotting
c. Affinity chromatography
d. Ion exchange chromatography
e. 2D-PAGE

Q31. Fugu is a culinary delicacy prepared from the meat of the pufferfish. This dish is lethally poisonous if prepared incorrectly and therefore, has become one of the most celebrated and notorious dishes in Japanese cuisine. It is estimated that a single pufferfish has enough poison to kill 30 adult humans. Pufferfish are lethal because they contain tetrodotoxin. Symptoms of ingestion include initial increased paresthesia followed by respiratory distress and cardiac arrhythmia. Death is the usual prognosis because tetrodotoxin:

a. Inhibits the release of acetylcholine
b. Inhibits RNA polymerase II
c. Inhibits depolarization of resting membrane potentials
d. Inhibits ATP production
e. Inhibits protein synthesis

Q32. What kind of membrane protein penetrates into the hydrophobic part of the lipid bilayer?

a. integral protein
b. lipid-anchored protein
c. peripheral protein
d. b and c
e. a and b

Q33. Although ricin and botulinum toxin (botox) result in very different symptoms, they **both** exploit a common mechanism in cell biology to achieve their toxic effects. This mechanism is?

a. KDEL tagging to avoid degradation
b. Poor ubiquitination to avoid targeted degradation in the proteosome
c. M6P targeting to endosomes where proteins can escape before ending up in the lysosome
d. Receptor mediated endocytosis
e. Calcium modulation by IP3 DAG and PKC

Q34. What is largely responsible for the negative charge on many oligosaccharide chains?

a. aspartic acid
b. sialic acid
c. glutamic acid
d. glucose
e. galactose

Q35. Phorbal esters are tumor promoting agents because:

a. they mimic IP3 and continuously release Ca^{2+} from the ER
b. they mimic DAG resulting in phosphorylation of raf by PKC
c. they mimic PIP2 which continuously activates PKB
d. they mimic DAG resulting in the release of IP3
e. 'a' and 'd'

Q36. Which lipid anchor(s) is/are responsible for insertion of lipid-linked proteins in lipid rafts?

a. GPI
b. acyl
c. prenyl
d. hydrophobic α-helix
e. cholesterol

Q37. Membrane-associated carbohydrates exhibit a major asymmetry in their distribution. What is it?

a. Membrane-associated carbohydrates face the cytoplasm in all cases.
b. Plasma membrane-associated carbohydrates face the extracellular space.
c. Internal cellular membrane carbohydrates face the organelle interior and away from the cytosol.
d. b and c
e. Carbohydrates are only associated with the nuclear membrane.

Q38. Signal amplification is best described by which of the following?

a. Increased numbers of receptors on the cell surface.
b. Dependency on low frequency amplifiers
c. Stepwise amplification by signaling components
d. Dependency on high frequency amplifiers
e. Increased numbers of protein kinases

Q39. Following the activation of the insulin receptor, the activation of PKB requires the 'upstream' activation of which of the following enzymes?

a. MAP3K b. PDK1 c. MAPK d. JAK e. PI Kinase

Q40. Viagra relaxes arterial muscle by inhibiting which of the following?

a. PKG b. Phosphodiesterase c. cGMP d. PLC e. NO synthase

Q41. With respect to fatty acids, what is **FALSE**?

a. fatty acids are amphipathic molecules
b. melting temperature of saturated fatty acids is lower than those of unsaturated fatty acids
c. membrane lipids usually have two fatty acyl groups
d. in general, fatty acids in biosystems contain only cis double bonds
e. some fatty acids cannot be synthesized by mammals, and must be supplied in their diet

Q42. The regulatory domain of PKC has binding sites for which of the following?

a. Ca^{2+} b. cGMP c. DAG d. TRP e. 'a' and 'c'

Q43. The formation of MPF is critical for mitosis and, using yeast two hybrid assays, has recent studies confirm that MPF consists of:

a. Wee1 and CAK
b. Cdc2 and cdc25
c. Cyclin F and cdc25
d. Cdc2 and CAK
e. $P34^{cdc2}$ and cyclin ^{cdc13}

Q44. Which of the following **does NOT** readily pass through plasma membrane?

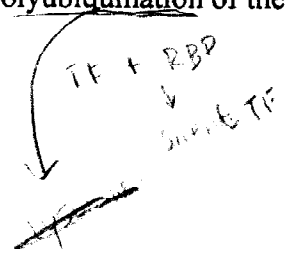
a. ATP
b. CO_2
c. Ethanol
d. K^+
e. Two of the above

Q45. What is special about the exoplasmic domain of glycophorin?

a. interacts with band 4.1 protein
b. highly glycosylated
c. flanked near membrane with positively charged amino acids
d. a and b
e. b and c

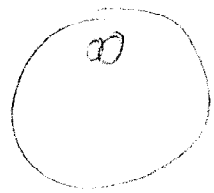
Q46. The regulation of transcription factors (TF) often involves regulatory binding protein (RBP) which silences the TF. Cell signaling mechanisms can instruct transcription to proceed by phosphorylation and polyubiquination of the RBP. The modified RBP leaves the TF and is targeted to:

a. The nucleosome
b. Nuclear pores
c. Histones
d. The proteosome
e. The RER



Q47. What is NOT a microfilament-based structure?

a. microvilli
b. cilia
c. cortical actin
d. filopodia
e. stress fibers



Q48. Which transporter is specific for the sarcoplasmic reticulum membrane?

a. Na+/K+ ATPase
b. voltage-gated Ca2+ channel
c. K+ resting channel
d. ligand (IP3)-gated Ca2+ channel
e. 2Na/glucose symporter

Q49. What is the expected effect of increased unsaturated fatty acid levels on the fluidity of biological membranes?

a. no changes occur
b. membranes become more fluid
c. membranes become more rigid
d. membrane fluidity does not depend on lipid composition
e. the result can vary depending on the type of unsaturated fatty acid

Q50. PKA is exceptional because, unlike other protein kinases:

a. the regulatory domain is on the cell surface
b. the catalytic domain is activated by Ca^{2+} and DAG
c. the regulatory domain includes a PH domain
d. the catalytic domain cleaves phosphate from phosphorylated proteins
e. the catalytic and regulatory domains separate upon activation