

Cell Biology 282b MIDTERM EXAM # 1

EXAM CODE 444

February 11th, 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 35 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 TWO 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. Self renewal of adult stem cells is maintained by their interaction with:

- ~~a.~~ Tumor cells
- ~~b.~~ Restricted potential stem cells
- ~~c.~~ Progenitor cells
- ☒ d. Stem cell niche
- ~~e.~~ Blood cells

Q2. Yeast cells contributed a great deal to the initial identification of cell division cycle (cdc) genes. This was made possible using mutated cdc genes and which of the following techniques?

- a. Yeast two-hybrid cloning ✗
- b. Two dimensional SDS-PAGE ✗
- ☒ c. Functional complementation
- d. Immunogold electron microscopy ✗
- e. Laser confocal microscopy ✗

Q3. Human embryonic stem cells require which of the following to differentiate into other cell types when in cell culture?

- ☒ a. Fibroblast feeder cells. ✓
- ~~b.~~ Embryoid body
- ~~c.~~ Pigmented and unpigmented epithelial cells
- ~~d.~~ Blastocoel
- ~~e.~~ Neurons

Q4. The direction of COP I vesicle transport remains a matter of controversy. However, recent discoveries concerning mutated proteins essential for COP I docking with the Golgi/ER, and resulting swelling of the Golgi, are consistent with which of the following?

- a. Receptor mediated endocytosis hypothesis ✗
- ☒ b. Maturation hypothesis ✓
- c. Chemiosmotic hypothesis ✗
- d. Vesicular hypothesis ✗
- e. Protein kinase/phosphatase protein activity hypothesis ✗

Q5. In two separate experiments looking at proteins associated with mitosis, I injected mitotic cells with antibodies to tubulin and myosin II respectively. At what stages of mitosis would I expect to see these cells arrest? ↓

- a. Prophase, cytokinesis
- b. Metaphase, anaphase B ✗
- c. Interphase, cytokinesis ✗
- d. Metaphase, anaphase A ✗
- e. Cells would finish mitosis as cdc genes are unaffected ✗

↓ microtubule
(form spindle)
Prophase

cell division
(cytokinesis)

Q6. To confirm a protein:protein interaction determined using yeast two-hybrid cloning, one can use fluorescent energy transfer. If you tagged the FISH protein with yellow fluorescent protein (excitation wavelength of 490nm, emits at 527nm) and the BAIT protein with cyan fluorescent protein (excitation at 420nm, emits at 490nm) which of the following procedures would you use after introducing these two proteins into cells?

transfer light
= interaction

- a. Excite at 490nm and measure fluorescence at 527nm ✗
- b. Excite at 490nm and measure fluorescence at 420nm ✗
- c. Excite at 420nm and measure fluorescence at 490nm ✗
- d. Excite at 420nm and measure fluorescence at 527nm ✗
- e. Excite at 527nm and measure fluorescence at 490nm ✗

FISH

yellow

excite 490

emit 527

BAIT

blue

excite 420

emit 490

420

527

Q7. A unique aspect of the scientific method in cell biology relates to which of the following?

- a. It is always possible to prove that a hypothesis is correct.
- b. A hypothesis can be proven wrong, which of itself provides useful information.
- c. It is never possible to prove that a hypothesis is correct.
- d. A hypothesis is a problematic concept since it is never based on observations.
- e. Over time, hypotheses are always proven to be inaccurate. ✗

Q8. Gel filtration chromatography yields fractions of proteins with:

- a. Similar detergent solubility ✗
- ☒ b. Different molecular weights
- c. Similar net charge ✗
- d. Similar molecular weights ✗
- e. a and c ✗

Q9. During the cell cycle, cyclin levels decrease due to ubiquitin binding to:

- a. Cyclin's N-terminal destruction box ✗
- b. Wee1 ✗
- c. cdc2 protein kinase ✗
- d. cdc25 phosphatase
- ☒ e. None of the above

↳ 3' end C-terminal

Q10. During the translation of mRNA, how many of the following proteins would end up in the lumen of RER?

~~cdc2; SRP; CAK; RNA polymerase; collagen; ubiquitin; cdc14; p53.~~

B

- ☒ a. 0
- b. 1
- c. 2
- d. 3
- e. 4

Q11. The inability of cells to remove cholesterol from the blood stream is associated with :

- a. Misfolding of antiprotease in the RER of lung cells. ✗
- b. Excessive activity of elastase in the lung ✗
- c. Loss of p53 stabilizing proteins ✗
- ☒ d. Loss of the ability to endocytose LDL particles
- e. Loss of cell division cycle kinases ✗

Q12. In order to purify a specific protein from a fractionated cell, which of the following would be most useful?

- a. Ion exchange chromatography ✗
- b. Isoelectric focusing ✗
- c. Yeast two-hybrid cloning ✗
- ☒ d. Affinity chromatography ✗
- e. Mass spectroscopy ✗

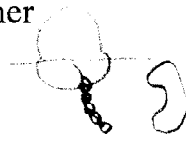


Q13. A cell biology researcher estimated that it would take three minutes for every five amino acids translated in a cell-free translation experiment. The mRNA being translated contained 1200 bases, 300 of which translated a signal sequence. In a cell-free experiment containing ribosomes, a complete mixture of amino acids, SRP and the mRNA, how long would the researcher have to wait for the translation of this message?

- a. 20 minutes
- ☒ b. 60 minutes
- c. 80 minutes
- d. 180 minutes
- e. 240 minutes

no SRP receptor
Stop translation => signal sequence

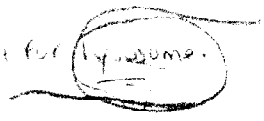
$$\frac{300 \text{ base}}{3} = \frac{100 \text{ aa}}{5} = 20 \text{ sections of Saa} \times 3 = 60 \text{ mins}$$



Q14. Tay-Sachs disease is a fatal genetic lipid storage disorder which can be treated by taking advantage of which of the following?

- a. Cell surface LDL receptors ✗
- b. Cell surface glycoproteins ✗
- c. Cell surface lamins ✗
- ☒ d. Cell surface M6P receptors ✗
- e. a and b

phosphotransferase → M6P
binds



Q15. In order to detect a specific protein in a Western blot, the protein sample must first be separated by which of the following?

- a. Ion exchange chromatography ✗
- b. Gel filtration chromatography ✗
- c. Isoelectric focusing ✗
- ☒ d. SDS-PAGE
- e. Functional complementation ✗

SDS

Q16. Many proteins are secreted by cells and the consequences can be serious if something goes wrong in the secretory process. Which of the following would have the most serious consequences for secretory proteins?

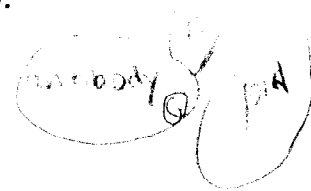
- A
- a. Cells could not synthesize the SRP receptor \times *no protein made*
 - b. Cells could not synthesize the KDEL sequence signal
 - c. Cells could not synthesize clathrin
 - d. Cells could not synthesize enzyme required for producing M6P \checkmark *lysosome target (poison)*
 - e. Cells could not acidify the lysosomes. \times *toxin*

Q17. The function of membrane proteins can be maintained when solubilized in which of the following?

- a. Ionic detergents *denature* \times
- b. Sodium deoxycholate $\uparrow \times$
- c. Sodium dodecylsulfate $\uparrow \times$
- d. Triton X-100 \rightarrow *non-denaturing*
- e. Urea *denature* \rightarrow *no change* \times

Q18. In order to visualize gold particles using immunogold electron microscopy, the gold particles must first be bound to:

- a. Protein antigen \times
- b. Protein A \checkmark
- c. Metal coating of the specimen \times
- d. Fc domain \times
- e. Antibody \times



Q19. Recently, discovering the mechanism by which p53 senses DNA damage was brought closer to reality by demonstrating:

- a. p53 results in CIP binding to MPF \times
- b. A p53 binding protein released from the nucleosome upon DNA damage \checkmark
- c. Targeting of p53 to the proteasome \times
- d. Polyubiquitination of p53 \times
- e. p53 promotes the transcription of p21 \rightarrow *Arrest*

Q20. The final screen using yeast two- hybrid cloning to detect protein:protein interactions requires that the recombinant yeast cells be incubated:

- a. In a medium containing leu and trp
- b. In a medium containing his ✕
- c. In a medium lacking leu and trp but containing his ✕
- d. In a medium lacking leu, trp and his ✕
- e. In a medium containing leu, trp and his ✕

Q21. How many of the following directly apply to a fluorescent microscope?

scanning coils; barrier filter; primary electrons; phosphorescent screen;
objective lens; dichroic mirror; excitation filter;

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

Q22. Enzymes that are destined to become lysosomal proteins must contain the lysosomal address, consisting of which of the following?

- a. The KDEL sequence signal ✕
- b. A destruction box ✕
- c. M6P associated proteins ✓
- d. A C-terminal signal sequence ✕
- e. Two of the above ✕

Q23. MPF consists of which of the following components?

- a. Wee1 and CAK ✕
- b. p53 and p21 ✕
- c. cdc2 and cdc25 ✕
- d. p34^{cdc2} and cyclin^{cdc13} ✓
- e. cyclin and cdc2

heavy
↓
light
↑ ER

Q24. During differential centrifugation, the microsome fraction will be pelleted:

- nucleus → ER → mito
- C
- a. Before the mitochondria but after the nuclei are pelleted
 - b. Before the lysosomes but after the ribosomes are pelleted x
 - c. Before the ribosomes but after the mitochondria are pelleted x mito → ER → mito
 - d. Before the nuclei but after the mitochondria are pelleted x
 - e. Requires centrifugal forces not available with current ultracentrifuges. x

Q25. DNA microarrays are useful for which of the following?

- a. Detecting protein:protein interactions x
- b. Detecting B-cell hybridoma antibody production x
- c. Receptor mediated endocytosis x
- d. Detecting gene expression in cells during differentiation ✓
- e. Routes of intracellular protein traffic x

Q26. Which of the following would best describe the order of transport of a glycoprotein to its final destination?

- a. Ribosome, RER, medial then trans Golgi, lysosome, plasma membrane x
- b. RER, trans then cis Golgi, peroxisome, plasma membrane x
- c. Ribosome, cis then medial then trans Golgi, secretory vesicle, plasma membrane ✓
- d. Glycoproteins remain in the RER x
- e. Ribosome, RER, COP II, COP I, RER x

Q27. Myeloma cells can be used to make monoclonal antibodies because:

- hybridoma
- 1
- a. They survive and grow in HAT selection medium x
 - b. They cannot proliferate x
 - c. They cannot fuse with B-cells x
 - d. They are an immortal cell line ✓
 - e. None of the above
- killing

Q28. Bacterial toxins enter cells via receptor mediated endocytosis but avoid being digested in the lysosome by which of the following?

- a. Receptor recycling ✗
- b. Contain KDEL signal ~~SECRET~~ ✓
- c. Bind chaperone proteins
- d. Escape via pores formed in the endosome ✓
- e. b and d

Q29. Enzymes targeted to the lysosome require interaction with which of the following enzymes?

- a. Wee1 ✗
- b. Phosphotransferase → M6P ✓
- c. ubiquitin
- d. CIP ✗
- e. Protein kinase A ✗

Q30. Detergents and membrane lipids will form micelles:

- a. At concentrations below the CMC ✓
- b. When mixed with membrane proteins ✗
- c. When mixed with soluble proteins ✗
- d. At concentrations above the CMC
- e. When mixed with octylglucoside ✗

Q31. The DARC conspiracy relates to a wide variety of viruses using a single family of cell surface receptors to gain entry into the cells while also preventing the receptors from signaling the cells to:

- a. Initiate programmed cell death ✓
- b. Proliferate ✗
- c. Initiate the cell cycle ✗
- d. Initiate protein secretion ✗
- e. Initiate cell signaling ✗

Q32. I-cell disease is a lysosomal disorder characterized by patients whose cells do not contain which of the following?

- a. Clathrin
- b. AP complex *✗* *→ COPI + ABC → (u)*
- c. Phosphotransferases *→ M6P Tag*
- d. Mid endosomes *✗*
- e. KDEL receptors *✗*

Q33. Screening for monoclonal antibody hybridoma cells depends on which of the following?

- a. The ability of mouse spleen cells to grow indefinitely
- b. The absence of an enzyme in mouse spleen and myeloma cells
- c. The ability of myeloma cells to grow on HAT selection medium
- d. The ability of hybridoma cells to grow on HAT selection medium *✓*
- e. The ability of mouse spleen cells to grow indefinitely on HAT selection medium.

Q34. Which of the following is not a characteristic of cancer stem cells (CSC)?

- a. CSC's will proliferate to form new CMC's *✓*
- b. CSC's will form secondary tumors *✓*
- c. CSC's are susceptible to conventional chemotherapy *+ ✓*
- d. CSC's will produce tumor cells which cannot produce secondary tumors *✗*
- e. CSC's are malignant *✓*

Q35. Polyubiquitination is part of the cell's security system which targets proteins to:

- a. The lysosome *✓*
- b. The proteasome *✓*
- c. The RER
- d. The metabolome
- e. The proteome *✗*