

THE UNIVERSITY OF WESTERN ONTARIO

DEPARTMENT OF BIOLOGY

Biology 282b Midterm

TIME: 1:00-2:30

February 6, 2005

- 
- 1) Mark within the bubbles with a single or double stroke of an ordinary HB lead pencil. Marks made with a ball point pen or felt tip marker will NOT be detected. Do not make stray marks. Make all erasures complete.
  - 2) Fill in your name and course blanks on the SCANTRON sheet.
  - 3) STUDENT NUMBER: Print the digits of your student number in the squares provided. Mark the corresponding bubble in the column below each printed digit.
  - 4) SECTION  
Proctors will advise you to mark as 001 or 002 on the SCANTRON sheet.
  - 5) CODE  
Leave this area on the SCANTRON sheet blank.
  - 6) Mark one choice from the alternatives provided for each question.
  - 7) There are 35 questions in this test. Check your paper to ensure all questions are there. It is your responsibility to transfer all answers from the examination paper to the computer sheet within the 90 minute period.
  - 8) The SCANTRON sheet MUST be handed in at the end of the examination.
  - 9) Wrong answers WILL NOT be deducted from your score.
  - 10) There is only ONE correct answer for each question.

**\*\*NOTE\*\***

**When filling in the Scantron answer sheet, failure to properly include and "bubble in" your student number will result in a loss of 5% from your exam grade.**

Q1 p34<sup>cdc2</sup> is another name for a:

- a) cyclin dependent catalase
- ☒ b) cyclin dependent kinase
- c) calcium dependent collagen
- d) clathrin dependent coat
- e) cytosolic derived kinetochore protein

Q2 Lysosomal enzymes contain the:

- a) apoB signal
- b) C-terminal propeptide signal
- ☒ c) destruction box signal
- ☒ d) mannose-6-phosphate signal
- e) KDEL sequence signal

Q3 To get the best resolution possible in phase contrast microscopy, one would:

- a) try to collect more light onto the barrier filter
- ☒ b) increase the refractive indices (n) of the media surrounding the cell
- ☒ c) increase the wavelength of light
- d) all of the above
- e) none of the above

$$d = \frac{0.61\lambda}{N \sin \alpha} = \frac{0.61(1)}{1.22} = 0.61$$

(= wavelength)

$$= \frac{0.61}{1.22} = \frac{0.61}{2}$$

Q4 The major component of an endocytotic coated pit is:

- ☒ a) clathrin
- b) calmodulin
- c) tubulin
- d) proteasomin
- e) cdk2

Q5 The lamins:

- ☒ a) are a component of the nuclear envelope
- b) are destroyed by the cdc25 kinase
- c) are composed of collagen fibers
- d) attach chromatids to the mitotic spindle
- ☒ e) link the RER to the Golgi

Q6 How many of the following apply to the basic scanning electron microscope?

UV-light; a laser; heavy metals; phosphorescent screen; ~~barrier filter~~; secondary electrons

- a) 1
- ☒ b) 2
- c) 3
- d) 4
- e) 6



**Q7** In 2D gel electrophoresis proteins are first resolved by \_\_\_\_\_ and then by \_\_\_\_\_.

- ☒ a) IEF; SDS-PAGE
- b) SDS-PAGE; affinity chromatography
- c) SDS-PAGE; ion exchange
- d) IEF; gel filtration
- e) SDS-PAGE; western blot analysis

**Q8** Glycosylation, a post-translational modification to proteins, occurs in the

- a) Chloroplast
- b) Lysosome
- c) Nucleus
- ☒ d) RER
- e) Mitochondria

**Q9** In the accident that occurred several years ago at the Chernobyl nuclear facility, workers and firefighters were exposed to high levels of ionizing radiation. The individuals who were exposed suffered from severe skin blistering and other extreme sunburn-like problems. As a scientist you are given several skin samples to analyze, not knowing which were from patients and which were controls from unaffected individuals. Your job is to identify the level of specific proteins that might differ between the two groups. One protein of particular interest to you is \_\_\_\_\_, because it serves to transcribe \_\_\_\_\_ that gets translated into a polypeptide that arrests the cell cycle because it inhibits the activity of \_\_\_\_\_.

**Pick the correct combination of molecules to complete the sentence above.**

- a) p21; p34/cyclin; p53
- b) p21; p34/cyclin; p53
- c) p34/cyclin; p21; p53
- ☒ d) p53; p21; p34/cyclin
- e) none of the above

**Q10** From the list below which microscope provides the best resolution:

- a) fluorescence microscope
- b) brightfield microscope
- c) laser scanning confocal microscope
- d) differential interference contrast microscope
- ☒ e) atomic force microscope

**Q11** Wee1 is a protein responsible for:

- a) inhibiting RNA polymerase
- b) targeting proteins to the proteasome
- c) transcribing p21 (CIP)
- d) stabilizing p53
- ☒ e) phosphorylating MPF

**Q12** Gel filtration chromatography separates proteins based on their:

- a) charge
- b) pH
- ☒ c) mass
- d) density
- e) hydrophobicity

**Q13** When a protein is bound to ubiquitin, that specific protein is:

- a) secreted
- b) targeted to the nucleus
- ☒ c) degraded
- d) placed in the Golgi and used as a chaperone
- e) phosphorylated and activated

**Q14** How many of the following are common to all prokaryotic and eukaryotic cells?  
DNA; centrioles; nucleus; RER; mitochondria; Golgi complex; ribosomes

- a) 0
- b) 1
- ☒ c) 2
- d) 4
- e) 6

**Q15** Myeloma cells are:

- a) arrested in meiosis
- b) unable to synthesize a protein coat
- ☒ c) immortalized
- d) propagate in HAT media
- e) unable to activate MPF

**Q16** Transport vesicles return KDEL-containing proteins to the:

- ☒ a) trans-Golgi
- b) plasma membrane
- c) nucleus
- d) lysosome
- e) none of the above

**Q17** During mitotic metaphase the:

- ☒ a) microfilament spindle forms
- b) chromosomes move to opposite poles
- c) nuclear envelope reassembles
- d) chromosomes decondense
- e) none of the above

**Q18** How many of the following directly relate to cell cycle regulation?  
ampholytes; phosphatases; ubiquitin; hydroxylation; SRP; GFP; clathrin; ApoB

- a) 0
- b) 2
- c) 4
- ☒ d) 5
- e) 7

**Q19** A CURL is a type of organelle that plays a fundamental role in:

- a) ligand-specific phagocytosis
- b) prokaryotic cell cycle regulation
- c) protein transcription
- ☒ d) receptor-mediated endocytosis
- e) none of the above

**Q20** Which of the following directly applies to pulse-chase experiments?

- a) barrier filter and a fluorescent microscope
- b) ultracentrifuge and FACS
- ☒ c) autoradiography and an isotope
- d) sucrose gradient and ampholytes
- e) urea and affinity chromatography matrix

**Q21** A cleavage furrow forming at late mitosis would be affected specifically by:

- a) drugs that affect the uptake of ApoB
- ☒ b) drugs that affect myosin II binding to actin
- c) drugs that affect M6P-containing proteins
- d) drugs that affect DNA hydrolysis
- e) all of the above

**Q22** Hypercholesterolemia is a disease specifically associated with:

- a) a loss of cell cycle regulation
- b) uncontrolled exocytosis of M6P-containing proteases
- ☒ c) the failure to endocytose LDL particles
- d) a loss of DNA repair mechanisms due to a mutated p53 gene
- e) excess apoptosis of normal cells

**Q23** During translation how many of the following proteins would pass through the RER?  
actin; p21<sup>CIP</sup>; collagen; insulin; apoB; p34<sup>cdc2</sup>; histone H1

- ☒ a) 0
- b) 1
- c) 3
- d) 5
- e) 7

**Q24** HIV, which causes AIDS, is a retrovirus that is endocytosed only by certain specific human cells because these cells contain a cell surface receptor that recognizes the HIV coat protein. If you just had an antibody to this HIV receptor, what is the best method listed below to identify cells that had the potential to pick up HIV versus ones that could not be infected?

- ☒ a) Ion exchange chromatography
- b) Southern blotting
- ☒ c) Immunofluorescence microscopy
- d) IEF
- e) Northern blotting

**Q25** You are testing polypeptide modification during translation and have the following at your disposal: cell free system but no microsomes; a 900 nucleotide mRNA (405 nucleotides of which encode for a secreted protein with a 35 amino acid signal sequence); GTP; SRP; SRP receptors. Using SDS-PAGE and assuming each amino acid has a mass of 100 daltons, what is the size of the newly translated protein?

- a) 40500      b) 90000      **c) 13500**      d) 37000      e) 10000

**Q26** Monoclonal antibodies are used in combination with TEM:

- a) to detect actively transcribed genes  
b) to produce secondary electrons  
c) to fractionate cells into organelles  
d) to emit fluorescence  
**e) to identify the subcellular localization of proteins**

**Q27** I just got back from a trip and the flight was terrible because we flew through a thunderstorm. The adrenaline rush that I experienced in the turbulence instructed my hepatocytes to break down glycogen into glucose. You know this as the flight or fight response. One of the first steps in this common physiological response is the stimulation of adenylyl cyclase that produces the cAMP needed to activate protein kinase A (PKA). PKA belongs to a family of \_\_\_\_\_, one of which modifies glycogen phosphorylase kinase by adding \_\_\_\_\_ to it, which in turn activates glycogen phosphorylase triggering the breakdown of glycogen.

Pick the correct pair of words to complete the sentence above.

- a) proteases; ubiquitins**      **b) enzymes; phosphates**      c) polymerases; nucleotides  
d) nucleases; phospholipids      e) methyltransferases; lysines

**Q28** You are studying chaperones and have an antibody method to follow their expression and localization. Where would you find these proteins in bacteria?

- a) lysosomes      b) cis-Golgi cisterna      c) nucleus  
d) rough endoplasmic reticulum      **e) none of the above**

**Q29** Collagen is an abundant protein in our body, and blocking its secretion into the extracellular environment has frightful consequences. If an individual's cells were unable to \_\_\_\_\_, it would produce a form of collagen that would be fragile and not unlike that seen in severe cases of scurvy. This process takes place in the \_\_\_\_\_ and it requires Vitamin C as a cofactor.

Pick the correct combination of words to complete the sentences above.

- a) hydroxylate tyrosine; trans-Golgi  
b) hydroxylate glycine; Lysosome  
c) hydroxylate proline; Rough Endoplasmic Reticulum  
d) hydroxylate methionine; cis-Golgi  
**e) hydroxylate lysine; medial Golgi**

**Q30** The proteasome is an organelle that recognizes a specific signal on a protein and uses it to:

- a) glycosylate that protein
- b) shuttle that protein back to the RER
- c) retain that protein in the Golgi
- d) target the protein to an endocytotic pit
- ☒ e) none of the above

**Q31** In order for the two hybrid assay to work successfully, the:

- a) yeast must be able to grow in HAT media
- b) bait vector must fuse to the myeloma cell
- ☒ c) restored transcription factor must transcribe histidine
- d) UAS must be recognized by the fish activation domain
- e) none of the above

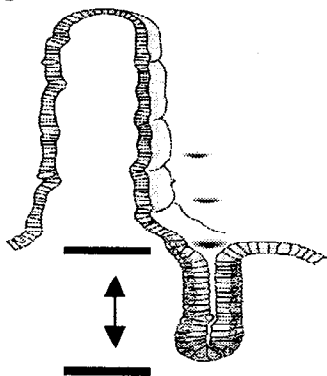
**Q32** The interactome is:

- ☒ a) mapping/understanding the whole protein interaction networks of life
- b) another name for a DNA microarray
- c) a device used to cut very thin sections for the electron microscope
- d) the micrograph obtained when using an atomic force microscope
- e) the organelle responsible for organizing microtubules during mitosis

**Q33** A DNA microarray is a powerful technique because it allows you to:

- a) identify newly-translated proteins
- b) produce monoclonal antibodies to a specific protein
- c) identify protein-protein interactions
- d) examine the ultrastructure of any cell or tissue
- ☒ e) monitor the expression of thousands of genes simultaneously

**Q34**



This structure is just one of millions present along the inside walls of your small intestine. The region between the two black lines and denoted by the arrow is referred to as a(n) \_\_\_\_\_, because it is within this region where \_\_\_\_\_ reside.

- a) islet; macrophages
- b) demilune; fibroblasts
- ☒ c) crypt; stem cells
- d) coated pit; B-cells
- e) villus; myeloma cells

**Q35** Which of the following methods can separate particles based on density?

- ☒ a) centrifugation
- b) ion exchange chromatography
- c) SDS polyacrylamide gel electrophoresis
- d) affinity chromatography