

BIOL 213
Third Exam

Please print and sign your name on the back page. Where needed all atoms, chemical bonding and structures must be complete and correct for full credit.

(5 pts) **1.** What are the five crucial functions of an intracellular signalling cascade?

(3 pts) **2.** Identify the three major families of cell-surface receptor proteins.

(3 pts) **3.** True or False: *Ras* is an oncogene?

Explain:

(3 pts) **4.** Give three examples of signalling molecules that enter cells directly to activate intracellular receptor proteins.

(10 pts) 5. Describe the molecular characteristics of a receptor tyrosine kinase, its activation by an extracellular signalling molecule and the molecular events that would result in cell proliferation.

(8 pts) 6. At a resting membrane potential for a neuron, describe the functional state and function for each of the following:

a) Na^+ - K^+ pump:

b) Voltage-gated Na^+ channels:

c) Voltage-gated K^+ channels:

d) Voltage-gated Ca^{++} channels:

(4 pts) **7.** At the membrane site where a neurotransmitter such as acetylcholine triggers membrane depolarization by binding with an acetylcholine receptor (postsynaptic cell, such as a muscle cell) describe the functional state of:

a) Voltage-gated Na^+ channels in the immediate vicinity of the depolarization:

b) Na^+ - K^+ pump:

c) Voltage-gated Ca^{++} channels in the endoplasmic reticulum:

(4 pts) **8.** In anticipation of taking an exam, I become quite anxious. To calm down I take valium. Describe the molecular basis of valium action to calm my nervous feelings.

(5 pts) **9.** Describe the molecular and chemical structure of a collagen fibril.

(5 pts) **10.** Describe the structure of a proteoglycan macromolecule.

(6 pts) **11.** On cells that possess a collagen extracellular matrix, describe the molecular properties of fibronectin that allow this protein to transduce intracellular signalling cascades by IP₃, DAG, or cAMP second messenger pathways.

12. How are adherens junctions and desmosome junctions:

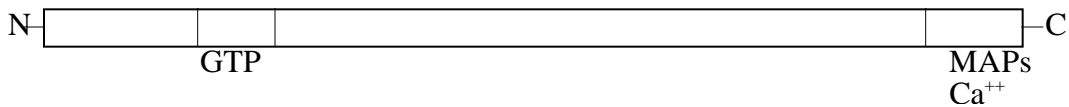
(3 pt) a) Similar?

(4 pts) b) Dissimilar?

(3 pts) **13.** A mutation occurs in a laminin gene that produces the laminin protein for the hemidesmosome junctions of epithelial cells. As a result of this mutation the tertiary structure is altered so it can no longer function properly. Give the possible consequences of this mutation.

(5 pts) **14.** Describe the structure, formation and molecular associations of intermediate filament tetramers.

(6 pts) **15.** The following depicts the general structure of a tubulin protein:



Shown in the structure of the protein are the domains for binding GTP and the domain for interaction with MAPs and Ca⁺⁺. Describe the functions of these motifs relative to microtubule assembly and disassembly.

(8 pts) **16.** Kinesin is a macromolecular complex of heterooligomeric protein subunits. Describe the general molecular structure of a kinesin “motor” and functions of domains that transport vesicles on microtubules.

(1 pt) **17.** What domain of the kinesin protein is responsible for microtubule cross bridging?

(4 pts) **18.** Actin microfilaments of the cytoskeleton are able to serve a variety of functions in cells. This involves cell movement, cell division and stabilizing the shape of a cell. This is because of the possible arrangements of actin filaments in cells depend on.....(**finish this sentence**)

Give at least three examples to qualify your statement.

(3 pts) **19.** What is the function of the troponin protein complex (troponin C, troponin I, troponin T)

(3 pts) **20.** Identify three types of cellular activity that can be influenced or regulated by the extracellular matrix.

(4 pts) **21.** The actin protein has several binding sites for other proteins and factors. Briefly explain the function for each:

a) Actin binding site:

b) Myosin binding site:

c) ATP/ADP binding site: