Cell Communication Project Packet Name

Projects that are not typed and spellchecked (over 10 spelling errors will prove to me that you have not spellchecked) will receive a 10 point deduction.

**You will need a good internet connection to complete much of this project.** Students not having this available should plan on either spending time in the library. Your completion of this packet will also serve as your note packet for this information.

Part 1

There are five basic mechanisms for cellular communication. Do some research and briefly but concisely describe each of these and provide a neat drawing of each process.

1-2. autocrine signaling**: This form of cell signaling occurs when the target cell is near the signal-releasing cell. Cells will bind to receptors on cells that release them.**

3-4. direct contact (juxtacrine signaling): **Juxtaposition means to compare two objects side to side, so this form of cell signaling involves a cell membrane-bound molecule and a receptor from the target cell.**

5-6. paracrine signaling: **this form of cell signaling secretes a hormone that affects nearby cells. This chemical messenger known as an autocrine agent binds to autocrine receptors on the same cell and cause changes in the cells.**

7-8. endocrine signaling: **This form is unlike others since it affects a distant cell. This image shows hormones** **in blood stream moving to the receptor target cell and the activated Target cell synthesizes estrogen to simulate feminization.**

9-10. synaptic signaling: **This form of cell signaling** **is similar to paracrine signaling, but there is a special structure called the synapse between the cell and the target cell. Synaptic signaling only occurs between cells with the synapse. For example: between a neuron and the muscle that is controlled by neural activity.**

View the cell communication animation at the following URL and use this to answer the following questions.

**http://www.phschool.com/science/biology\_place/biocoach/biomembrane2/surface.html**

11. What is a receptor? **The receptor is the G-Protein, and it mediates a phosphate.**

12. What is signal transduction? **The relaying of outside signals that causes specific responses inside the cells.**

View the cell communication animation at the following URL and use this to answer the following questions.

**http://media.pearsoncmg.com/bc/bc\_campbell\_biology\_7/media/interactivemedia/activities/load.html?11&A**

13. What are the three stages in the cell signaling process? **The ligand goes into the receptors and the cell will undergo cellular response. The last step involves cellular response including activation of enzymes, rearrangement of certain cytoskeleton, or activation of specific genes.**

14. What is a ligand? **It is the receptor molecule complementary to the signal molecule.**

15. Why does the ligand have to fit with the receptor molecule? **Ligand only will fit to the receptor molecule when it has a specific combination of atoms. Interaction will not occur if the size, shape, and charge combination does not match.**

16. Why does signal transduction often involve a change in the shape of the receptor? **The receptor must hold the messenger and understand the function.**

17. List three cellular responses that signal transduction can produce. **Signal transduction can produce gene activation and metabolism alterations. Nerve cells can triggered in the form of electric signaling.**

View the cell communication animation at the following URL and use this to answer the following questions.

**http://media.pearsoncmg.com/bc/bc\_campbell\_biology\_7/media/interactivemedia/activities/load.html?11&B**

18. How do most signal molecules act on target cells? **Most signal molecules act on cell binding to receptors in the cell membrane.**

\*\* Click on the G-protein linked receptor in the animation. Then click on the correct signal molecule to activate the G-protein-linked receptor shown.

19. List four different kinds of receptors in target cells. **The four different kinds of receptors in target cells are: G-protein receptor, intracellular receptor, receptor tyrosine kinase, and ion-channel receptor.**



 20. Discuss at least two events involved in causing the change in enzyme activity once the G-protein linked receptor is activated**. G—Protein linked receptors spans the cell membrane with the use of G-protein. Intracellular is located inside the cell. Steroids and thyroid hormones acts on this type of receptor; nonpolar molecules like steroid can enter the cell membrane and activate the intracellular receptor and turn DNA on and off.**

\*\* Click on the receptor tyrosine kinase in the animation. Then click on the correct signal molecule to activate the receptor tyrosine kinase shown.

 21. How does the bonding of the signal molecule to the receptor tyrosine kinase lead to the activation tyrosine-kinase enzymes? **Bonding the signal molecule to tyrosine kinase leads to the activation of tyrosine-kinase enzymes by phosphorylating the tyrosine in the tail of the other polypeptide.**

22. How does the activated receptor tyrosine kinase trigger several different effects within the cell? **The activated receptor tyrosine kinase trigger different affects within the cell when the receptor protein is recognized by several relay proteins.**

\*\* Click on the ion channel receptor in the animation. Then click on the correct signal molecule to activate the ion channel receptor shown.

23. What are ligand gated ion channels? **Ligand gated ion channels are pores that allow or prevent the entering of ions through the cell membrane.**

24. Explain how signal proteins can activate ion channel proteins. **Signal proteins can activate ion channel proteins by changing the shape of the channel protein and ion concentration triggers cellular response.**

\*\* Click on the intracellular receptor Then click on the correct signal molecule to activate the intracellular receptor shown.

25. Where are intracellular receptors located? **Intracellular proteins act inside the cell.**

 26. List two examples of steroid hormones that act on intracellular receptors. **Steroid hormones including testosterones and estrogen.**

27. Explain why nonpolar molecules are able to pass through the plasma membrane to bind to intracellular receptors. (thought question) **They are able to enter since the lipid bilayer of the plasma membrane is also nonpolar, so the molecules do not need protein assistance.**

 28. Explain how steroids cause changes inside a cell. **Steroids causes changes inside a cell by causing the genes to turn on and off.**



View the cell communication animation at the following URL and use this to answer the following questions. **http://media.pearsoncmg.com/bc/bc\_campbell\_biology\_7/media/interactivemedia/activities/load.html?11&C**

29. What are signal transduction pathways? **Signal transduction pathways allow the amplification of signals and signal coordination and regulation.**

30. List two things signal transduction pathways allow for. **The pathway can link mechanical or chemical stimulus to a specific cellular response.**



31. What are second messengers? **Second messengers are small, nonprotein water-soluble molecule or ion, that relays a signal to a cell’s interior**

32. List 2 important second messenger molecules. **Calcium and Cyclic AMP.**



33. What is a protein kinase? **An enzyme to transfers phosphate group from ATP to a protein.**

Now view the **Cell Communication Video Podcast** (downloadable from the links below) and answer the following

**http://www.youtube.com/watch?v=xnGXItWrJ3k** (blocked in school)

35. List two examples of cell to cell communication. **No distance and short distance.**

36. What is an antigen? **Antigen is the invader like a bacteria or a virus.**

37. What does an APC or antigen presenting cell do? **APC is able to send the shape to make antibodies, more macrophage, and more killer T-cells.**

38. How does the T-helper cell get activated? **The cell gets activated by accepting the shape of the antigen piece.**

39. Identify two kinds of cells that T-helper cells in turn activate. **B cell (make more antibodies and memory cells) and killer T-cell( targets other similar cells).**

40. How do the previous sequence of events (addressed in questions 36-39) compare to a post-it note? **The instructions are passed off from the APC to the T-helper cells. Like a post-it note, the T-helper now knows what to do.**

41. Why are local regulators like neurotransmitters like e-mail? **Neuron takes message and sends it to another neuron. Like an e-mail, the message is sent to only 1 neuron.**

42. Explain why hormones are like facebook status posts. Use the animation below to assist you in answering questions. **The hormone chemical can go throughout the body and help certain parts grow, and the body parts can choose to act on the hormone. Like Facebook statuses, the body parts are like the friends, and they could choose to respond to the message.**

View **https://www.sumanasinc.com/webcontent/animations/content/diphtheria.swf**

43-44. Discuss how defective G protein function is associated with cholera.

**G-Protein’s function become defective when the A subunit adds an ADP-ribose to the G protein. ADP-ribosylation causes the G-Protein to become permanently active. When the G-Protein become active, the enzyme adenyl cyclase converts ATP into cAMP. Increase levels in the cAMP blocks the transportation of sodium from the lumen into the bloodstream. Chloride and bicarbonate also increases. Due to the continuous increase of the ions, water moves into by osmosis from the bloodstream and diarrhea occurs.**

 Using a search engine, answer the following.

45-46. Discuss how defective receptors are associated with type II diabetes. Draw a picture to support your answer comparing the normal receptors with defective receptors. **Type II diabetes occurs when the insulin receptors in the cell membrane. The sensitivity to insulin is lost and the glucose levels in blood increases since they are not properly stored in cells.**

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47. Identify acetylcholine and its role in nervous transmission. **Acetylcholine is a neurotransmitter that helps muscles like skeletal and cardiac muscles move. Acetylcholine may also play a role in learning, memory, and mood.**

 48. Why do nerve impulses not continue forever? Include discussion of the enzyme involved in preventing this from occurring in your explanation. **If nerve impulses were to continue forever, then the body will keep accepting the message. Enzymes play a role in breaking down the neurotransmitter. Neuroreceptor channels can be blocked by enzymes and switch off a synapse.**

49. Why do nerve agents such as insecticides result in organisms literally twitching themselves to death? **Pesticides kill insects by disrupting the nerve impulses, which kills the nerve cells. The insect is no longer able to function properly as a result. Organophosphates bind to acetylcholinesterases that interfere with nerve function.**

50. Explain how "the pill" functions as a birth control agent at the hormonal level. Make certain to discuss the role of LH in your answer. **The birth control pills contain estrogen and progestin, which stabilizes and eggs will not be released. The estrogen stop the production of luteinizing hormone and prevent ovulation.**

**Cell Communications Multiple Choice Quiz (all correct answers will add 1/2 bonus point per question to your score)**

51. Which molecule is most likely to serve as a signal molecule? (1.) ligand (2.) protein (3.) initiator (4.) key (5.) receptor

Use the diagram below from the Campbell website and your knowledge of biology to answer questions



52. Which is a receptor molecule?

(1.) A (2.) B (3.) C (4.) D (5.) E

53. Which is a signal molecule?

 (1.) A (2.) B (3.) C (4.) D (5.) E

54, Which of these molecules could diffuse through a plasma membrane and bind to an intracellular receptor?

(1.) estrogen (2.) glycerol (3.) cellulose (4.) glucose (5.) starch

55. Which molecule catalyzes the formation of second messenger molecules?

 (1.) carrier protein (2.) gap junction (3.) cAMP (4.) adenylate cyclase (5.) G-protein

56. Which is most associated with paracrine signaling?

 (1.) insulin stimulating glucose intake into cells (2.) growth factors stimulating neighboring cells (3.) epinephrine in the blood stream (4.) pheromones communicating between members of a species

57. What are the carbohydrates on the surface of the plasma membrane used primarily for?

(1.) none of these (2.) give energy to other cells (3.) communication between cells (4.) energy storage

58. Which serves as an intracellular second-messenger molecule?

(1.) carrier protein (2.) gap junction (3.) cAMP (4.) adenylate cyclase (5.) G-protein

59. Second messengers tend to be both water-soluble and small. This accounts for their ability to

(1.) rapidly cross the plasma membrane (2.) rapidly move throughout the cell by diffusion (3.) pass quickly from cell to cell (4.) move from substrate to substrate during a phosphorylation cascade (5.) cross the nuclear membrane and interact with DNA

60. The use of chemical messengers by microbes to communicate with other nearby cells to regulate overall population growth is known as

(1.) quorum sensing (2.) embryonic induction (3.) direct contact (4.) phosphorylation

61. In liver cells, epinephrine stimulates the breakdown of glycogen. As the signal-transduction pathway progresses,

 (1.) the signal is reduced (2.) the number of molecules involved decreases (3.) the number of molecules involved remains constant (4.) the signal is amplified

62. Which would be most directly involved with the enhancement of lipophilic signals in the blood (1.) carrier protein (2.) gap junction (3.) cAMP (4.) adenylate cyclase (5.) G-protein

63. Phosphorylation within the cell

(1.) always inactivates a protein (2.) activates G-protein-linked receptors (3.) can either activate or inactivate a protein (4.) is accomplished by protein phosphatases (5.) always activates a protein

64. A steroid hormone is different from many other types of hormones in that:

(1.) the steroid hormone is made of amino acids (2.) the steroid hormone causes a change to how the cell functions (3.) the steroid hormone binds to a receptor in the cytoplasm of the target cell (4.) the steroid hormone usually does not enter target cells

65. The sequence of events involved in cell signaling is (1.) transduction reception response (2.) response reception transduction (3.) reception response transduction (4.) reception transduction response