

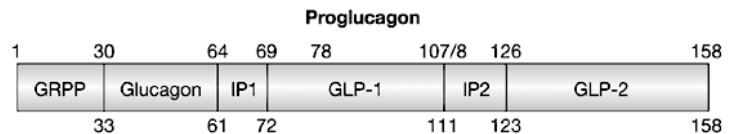
**Cell Physiology Final Exam
Fall 2009**

1. I am sure that most of you are “stressing” now. Your heart rate is higher than normal, your breathing faster and your senses more acute. What phase of stress response are you in?
 - Alarm
2. What signaling molecule is responsible for the increase of your heart rate?
 - Adrenaline
3. What type of receptor is involved?
 - G protein Coupled Receptor
4. Which channel is responsible for depolarization phase of cardiac action potential?
 - Opening of voltage gated Na⁺ channels
5. In a moment your heart rate will slow down, even if higher levels of adrenaline will be present in the blood. The process of diminished cellular response in constant present of signaling molecule is called
 - Adaptation
 - Desensitization
 - Tachyphylaxis
 - All of the above
6. Which molecular processes are responsible for adrenergic receptor adaptation
 - Phosphorylation
 - Binding of arrestin
 - Clathrin polymerization (and endocytosis)
 - All of the above are involved in adaptation
7. Inhibition of β adrenergic receptors by drugs called β blockers causes
 - Decrease of heart rate
8. If you came to the exam without eating breakfast, glucose necessary for the production of ATP in the heart will come from
 - Breakdown of stored glycogen in the hepatocytes
9. What is the effect of adrenaline on blood glucose levels?
 - Increase in blood glucose levels
10. Binding of adrenaline to β adrenergic receptors causes
 - Production of second messengers that activate glycogen breakdown in liver cells
11. Glycogen is a
 - polysaccharide
12. Which type of bonds are present in glycogen?
 - Glycosidic bonds
13. Your heart needs ATP for contraction. Where in the cell is ATP produced?
 - Mitochondria
 - Cytoplasm
 - Both of the above

14. Glucose necessary for ATP production will enter the cardiomyocyte through
 - GLUT 1
15. Which type of transport makes it possible for glucose to enter the neurons in the brain?
 - One of the GLUT uniporters – GLUT 3
16. What happens to the molecule of glucose after it enters brain cell?
 - It is broken to pyruvate, enters Krebs cycle and is oxidized to CO₂ and water.
17. If this molecule of glucose was radioactively labeled with C¹⁴, where inside the cell would you be able to find highest level of radioactivity a couple of minutes later?
 - Mitochondria
18. What are the final products of glucose metabolism in neurons?
 - CO₂ and water
19. During glycolysis, cells trap glucose inside the cell by
 - Phosphorylating it
20. Most enzymes of Krebs cycle are coded by nuclear DNA. They are they produced by
 - Free cytosolic ribosomes
21. After translation Krebs cycle enzymes are translocated to their final destination in the cell
 - Through the outer and inner membrane translocons (Tom and Tim)
22. The metabolic pathway we refer to as glycolysis is found in
 - All living organisms
23. KCN (potassium cyanide) blocks the mitochondrial cytochrome c-oxidase (one of the complexes in Electron Transport Chain). What would this most likely do?
 - No production of ATP
24. Majority of ATP in eukaryotic cells is synthesized in
 - Mitochondria
25. Which transporter was responsible for absorbing glucose in the intestinal tract (on the apical side of intestinal epithelium)?
 - SGLT – sodium glucose cotransporter
26. Patient A is suffering from malnourishment. Further tests reveal that there is a buildup of glucose and galactose in the intestinal tract. This may be a sign that there is a mutation preventing _____ from performing its function.
 - SGLT 1
27. Water from your morning coffee was absorbed into blood from the intestines through
 - Aquaporins
28. Which of the following substances do not require transport proteins to cross into blood from the intestines.
 - Alcohol

29. Drinks such as Gatorade are better in rehydrating the body than plain water because they create a gradient of sodium and sugar. Which transporter is responsible for this effect
- SGLT 1
30. Reabsorption of glucose in kidney epithelium is carried out by
- SGLT 1
31. What will happen to resting membrane potential of heart cells when the extracellular (blood) concentration of K^+ is raised due to kidney problems
- Myocytes will be depolarized
32. Production of stomach acid by parietal cells requires
- H^+/K^+ pump
33. The excess of glucose from the blood Let's assume that you ate a really big breakfast and your blood glucose level increased past 120 mg/ml following the meal.
- Stored in the form of glycogen
34. Increased uptake of glucose into the muscle happens through
- GLUT 4
35. ATP was used to facilitate increased uptake of glucose into the muscle cells.
- False
36. Which tissues have the ability (metabolic pathways) to store glucose "for later use"
- Muscle
37. Glucagon, a hormone that regulates blood sugar levels has following targeting sequences
- N-terminal ER targeting sequence
38. It (glucagon) was synthesized
- In association with ER membranes
39. Which of the following was NOT a step in the synthesis of glucagon?
- Translation started on the cytosolic ribosomes
 - Translation continued until signal sequence emerged from the ribosomal tunnel
 - SRP (with the new peptide and ribosome attached to it) directed the complex to the ER membrane
 - All were steps in the synthesis of glucagon

40. Final activation of glucagon from proglucagon (picture on the right) in Golgi is done by



- Proteolytic cleavage
41. Once vesicles containing glucagon detach from the trans-Golgi they
- lose their clathrin coat protein
42. What determines the direction of the vesicle delivery within a cell?
- Type of coat protein
43. Damaged glucagon molecules that are result of mistakes in translation are
- Degraded in the cytoplasm

44. Misfolded or damaged proteins are tagged for degradation by
- Ubiquitin
45. Degradation of defective cytosolic proteins is carried out in proteasomes. Proteasomes are
- Tunnel-like macromolecule with protease activity
46. Proteasomes are integral (intrinsic) proteins.
- False
47. Cellular stress such as starvation will result in degradation of cell's own material. Which of the choices below is most likely to describe the process?
- Autophagy

Going back to high blood glucose levels after the meal.

48. When blood glucose levels are high pancreatic β cells are

- Depolarized

49. Glucose enters pancreatic β cells through _____ and is used to produce _____

- GLUT 2, ATP

50. The sulfonylurea drugs are used to lower blood glucose levels. They close ATP dependent K^+ channels in pancreatic β cells. Sulfonylurea drugs

- Depolarize pancreatic β cells

51. Signaling by insulin is an example of _____ signaling.

A. Endocrine

52. Insulin binds to

- Receptor tyrosine kinases and increases transcription of GLUT 4 genes

53. Upon binding of insulin, insulin receptor (see picture) is phosphorylated on the cytoplasmic side. Which amino acid is phosphorylated

- Tyrosine

54. Drs used to taste a patients urine to diagnose *diabetes melitus* which means "sweet urine"

- True

55. Insulin resistance and following diabetes is the result of...

- Target cells not responding to insulin

56. When activated, insulin receptor interacts with IRS-1 and grb2 and sos adapter proteins. Adapter proteins

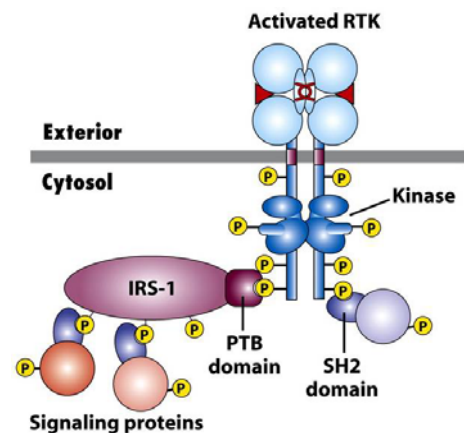
- Operate via direct protein-protein contact

57. Defects in the process of insertion of this transporter lead to type II diabetes mellitus

- GLUT 4

58. Which enzyme is activated during β adrenergic receptor signaling in liver cells?

- Glycogen phosphorylase



is

59. In muscle cells, glycogen phosphorylase kinase is activated by

- Phosphorylation of a specific serine residue

60. Which of the following is a second messenger involved in response to adrenaline in liver cells?

- cAMP
- IP3
- DAG
- All of the above

61. Which of the following is a second messenger involved in response to adrenaline in muscle cells?

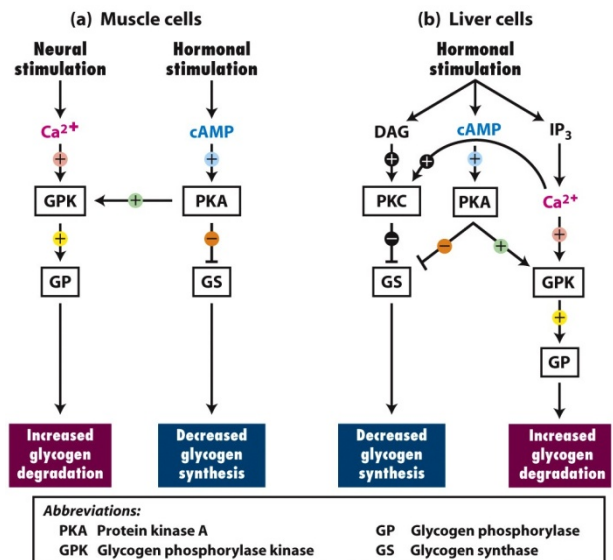
- cAMP

62. IP3 comes from

- Phospholipids in cell membranes

63. Protein Kinase A

- Attaches phosphate group to next enzyme in the cascade
- Is activated by dissociation of the regulatory subunit
- Both of the above



64. Forskolin, a drug that increases intracellular concentration of cAMP will lead to

- Increase in blood glucose levels

65. Pertussis (whooping cough) toxin prevents Gs protein from being activated. In whooping cough the levels of cAMP in the cell are

- Low

66. Testosterone will bind to following type of the receptor

- Receptors in the nucleus

67. Which statement about testosterone receptors is FALSE?

- Have multiple transmembrane domains

68. Testosterone is produced in the Leydig cells of testis from cholesterol. People with mutation in the internalization sequence of LDL receptor will have

- Low levels of cholesterol transport into the cells

69. Testosterone is an anabolic hormone. What is the most likely mechanism of anabolic action of testosterone receptor?

- Direct activation of transcription

70. Insertion of cholesterol into the cell membrane affects

- Membrane fluidity

71. Increased number of phospholipids with unsaturated fatty acyl chains in biological membrane

- Will increase membrane permeability to testosterone

72. During endocytosis of LDL, sorting of molecules that are degraded and the molecules that are recycled is based on
- pH gradient
73. Cells use endocytosis to
- Obtain cholesterol
74. What organelles play a vital role in endosomal pathway?
- Lysosomes
75. What pump generates the acidic pH of lysosomes?
- V class pump
76. I am sure you are tired now. When you close your eyes the Na^+ current flow (dark current) in the rods and cones of your retina will
- Increase
77. How will it affect membrane potential of rods and cones?
- Closing of the eyes depolarizes cell membrane
78. Closing of the eyes will intracellular concentration of cGMP in rods
- increase
79. In visual signal transduction cascade
- Receptor activation is caused by light
80. Which of the following events occur(s) during light activation of the rhodopsin receptor?
- Isomerization of retinal
 - Activation of cGMP phosphodiesterase
 - Both of the above
81. In the visual pathway, depolarization of rods and cones will cause what?
- inhibition of bipolar cells
82. When you walk out from this room to the bright light outside what would be a mechanism of the adaptation to brighter light?
- Phosphorylation of rhodopsin
 - Binding of arrestin
 - Both of the above
83. Cleavage furrow during cell division is formed from
- Actin
84. The disease Primary Ciliary Dyskinesia is characterized by immotile cilia in respiratory and reproductive tracts. Which of the following cytoskeletal elements causes cilia to be defective?
- Microtubules
85. During contraction of striated muscles
- Myosin pulls actin filaments together
 - "Walking" of myosin causes sarcomere to shorten
 - Myosin "walks" toward the barbed end of actin
 - All of the above

86. Which protein motif do you expect to find in Ca^{2+} sensitive proteins such as tropomyosin?
- Helix-loop-helix
87. Stiffness of bodies after death is caused by
- Myosin being bound to actin filaments
88. Muscle contraction is initiated by
- An increase in cytosolic Ca^{2+} concentration
89. Recovery of calcium back to intracellular stores after muscle contraction is accomplished by
- A pump
90. Muscle cells are rich in following organelles
- Mitochondria
 - Endoplasmic reticulum
 - Nuclei
 - All of the above
91. Myosin was translated
- In cytosol
92. Which is the property of microtubules?
- Go through random periods of shortening and lengthening
93. An anticancer drug Taxol works by disrupting polymerization of
- Tubulin
94. Anticancer drug vinculin blocks polymerization of microtubules. Which processes in the cell are affected?
- Formation of mitotic spindle
95. When a cancer patient stops responding to chemotherapy drugs the most likely explanation is
- cancer cells overexpress ABCB1 pump
96. ABC transport proteins
- Require ATP to work
97. Cytokines secreted by cancer cells that increase cancer growth are an example of which type of signaling?
- Autocrine
98. Pain sensation is caused by activation of pain receptors in sensory neurons and transmission of signals along the axon toward the brain. Depolarization phase of action potential in neurons is caused by
- Opening of voltage gated Na^+ channels
99. Late stage Alzheimers typically results in a break down in synaptic transmission. Synaptic transmission is an example of
- Paracrine signaling
100. Universality of the genetic code means that
- None of the above

