1. All the membrane proteins known as G proteins: A
2. hydrolyze GTP
3. have a subunit that activates adenylate cyclase
4. are gated ion channels
5. are homotrimeric proteins
6. mediate the effects of insulin on cells
7. GTP plays all of the following roles in the cAMP-mediated second messenger pathway except: A
8. it associates with the ß subunit of the G-protein complex
9. hydrolysis of GTP drives the adenylate cyclase catalyzed reaction
10. its binding causes dissociation of the G protein
11. its effect is terminated by the GTPase activity of the G protein
12. it transduces information from a hormone-receptor complex to an intracellular system that produces an allosteric effector
13. Second messengers, such as cAMP, are important to cell function for all of the following reasons except they: E
14. provide information about the extracellular environment
15. permit a large intracellular response to relatively weak extracellular signals
16. provide a site for integrating the metabolic requirements of cells
17. reversibly regulate enzymatic activity in cells
18. are a source of energy for cells
19. Which of the following is not a signal transducer? B
20. Gi
21. ß–adrenergic receptor
22. Rhodopsin
23. Ubiquitin
24. PLC
25. Which statement correctly describes steroid hormones? C
26. Their intracellular actions are mediated by integral membrane proteins
27. Their effects on cells require a water-soluble intracellular signal
28. Their effects are mediated by binding to a water-soluble receptor protein
29. They are synthesized directly from amino acid precursors
30. Their effects usually involve the activations of other intracellular enzymes
31. Which of the following correctly describes the role of phospholipase C in mediating the cellular effects of hormones? C
32. It directly activates a protein kinase
33. It degrades triacylglycerols to fatty acids and glycerol
34. It indirectly increases intracellular calcium levels
35. It directly activates adenylate cyclase
36. It indirectly increases cAMP levels
37. Which of the following statements does not describe the phosphoinositide signaling pathway? A
38. Inositol triphosphate activates protein kinase C
39. One effect of activation of this pathway is to increase intracellular [Ca2+]
40. The pathway requires GTP
41. Protein kinase C is inactive in its soluble form
42. Phospholipase C activation produces two intracellular messengers
43. Gp-mediated activation of phospholipase C would be turned off by increasing: C
44. the concentration of αp subunits
45. the concentration of αs subunits
46. hydrolysis of GTP
47. the concentration of ß subunit
48. the concentration of γ subunits
49. A specific extracellular neurotransmitter of hormone (e.g., epinephrine) may have differing effects on different target tissues because: E
50. different types of receptors are activated in different tissues
51. channels may be opened in one tissue and closed in another in response to the same signaling molecules
52. different second messenger pathways can be activated in different tissues
53. the target proteins of the activated intracellular messenger pathway may differ
54. All of the above are true
55. Which of the following is not an example of signal amplification? E
56. The activation of PKA by cAMP in adipose cells
57. The phosphorylation of IRS-1 by the insulin receptor in liver cells
58. The conversion of cGMP to 5’-GMP by PDE in rod cells
59. The activation of Raf kinase by Ras in hepatocytes
60. A and D
61. What are the six general mechanisms that cells use to relay extracellular signals to the interior of the cell. What features do each of these schemes have in common; what aspects are different?

Receptor enzymes: the receptor itself have the ability to catalyze reaction.

Receptor with guanylyl cyclase: can catalyze the reaction that GTP convert to cGMP

Nuclear receptors (steroid receptor): bind to steroid hormone intracellularly.

G protein and second messenger: need G protein to active downstream signal transduction to produce second messenger to form signal cascades.

Adhesion receptor: Both signals and receptors are membrane proteins.

Gates ion channel: Binding of signals trigger the structure change of channels to change the permeability of membrane.

In common:

Signal transduction is remarkable specific.

Signal transduction always contain the process of amplification.

Signal transduction have the process of desensitization.

Different signals can be integrated.

1. How do hormones regulate metabolism only in the cells of specific target organs and not in cells of adjacent nontarget organs?

The receptors of hormones specifically present in the target cells membrane. The other cells cannot interact with hormones because they don’t contain the receptors.

1. How does the general structure of receptor enzymes differ from the structure of receptor channels?

Each subunits of receptor enzymes usually contain single transmembrane domain and do not form pore structure, whereas receptor channel contains multiple transmembrane domain to form pore structure.

1. What is “cyclic” about cyclic GMP?

The “cyclic” is refer to the special 3, 5-phosphodiester bonds in cGMP, in which a single phosphate group forms two ester bonds with 3’ and 5’ hydroxyl groups on single ribose.

1. What are the physiological effects of cGMP in kidney, intestine, and cardiac muscle tissues? Explain how the peptide hormone ANF decreases blood pressure by regulating the level of cAMP?

Kidney: Facilitate the excretion of Na and water.

Intestine: Facilitate Cl- secretion and consequently cause the decrease of water absorption.

Cardiac muscle tissues: relax cardiac and vascular muscles.

There are ANF receptors on vascular membrane. ANF bind to this receptor-guanylyl cyclase and increase the concentration of cGMP in muscle cells to trigger the downstream signal transduction which induce the relaxion of muscles and consequently decrease blood pressure.

1. Why is it possible for the guanylyl cyclase activated by NO to exist in the cytosol and not in the plasma membrane?

NO, a kind of nonpolar gas, is easy to pass through cell membrane by free diffusion.

1. How is the intracellular signaling pathway mediated by the ß–adrenergic receptor different from that of ANF? In what ways are these two pathways similar?

Different:

The downstream signal is transduced by G protein in beta-adrenergic receptor mediated signal pathway.

The second messenger of beta-adrenergic receptor is cAMP

The beta-adrenergic receptor doesn’t have catalyze activity.

Similar:

The receptors of both are integrate membrane proteins.

The second messengers of both can activate protein kinase.