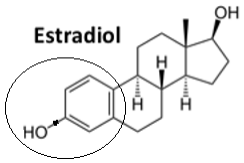
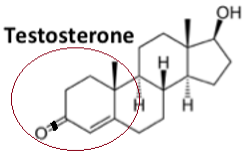
Molecules and Cells HW 11

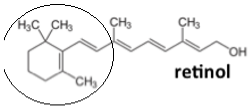
November 17th, 2016

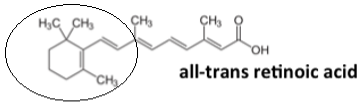
1. There is insufficient information.
2. Testosterone - Cytosol
Retinoic acid - Nucleus
Epinephrine - Plasma membrane
3a.

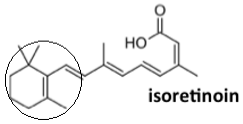




3b.







3c. Timing. The Hox genes are mainly expressed during embryonic growth, so this is when the retinol derivatives would have the greatest effect.

4a. When the ligand binds, the extracellular structure of the GPCR changes, which changes the conformation of the cytosolic parts of the GPCR which would allow signaling to begin.

4b.

1. The GPCR changes conformation, causing GDP to become phosphrylated and become GTP and activating the G-protein
2. The activated G-protein stimulates the activity of adenylyl cyclase
3. Increased cAMP production of ATP
3. cAMP increases causes phosphokinase A to activate and separate into two parts
4. The activated subunit of PKA enters the nucleus and uses ATP to phosphorylate CREB
5. CREB binds to the gene and recruits other transcription factors and controls translation

5a. D

5b. For the gene to affect anesthetics and pain, it must be expressed in the brain. In addition to this, the gene has to be able to respond to PRE otherwise a mutation in this gene would have no effect on pain or anesthetics. Finally, the mutation has to change how the cell responds to PRE or else both red haired and non red haired people would have the same responses.

5c. No.

5d. The signalling would control the activity of melanocytes, which are responsible for the production of melanin compounds.

6a. When blue light is shined, neuronal activity would increase because the influx of positive charge would trigger an action potential. When both lights are shined, neuronal activity would decrease because the NpHR would hyperpolarize the cell more than the ChR2 would depolarize it.

6b. Because the two have a very similar wavelength, it would be difficult to maximize the activity of ChR2 without also maximizing the activity of NpHR.