Signal Transduction Practice Problems:

1. Glucagon is a hormone that stimulates liver cells to break down glycogen into glucose and release this glucose into the blood. The glucagon receptor is a G_s-protein-coupled receptor that uses cAMP as a second messenger. You would like to develop a drug that will increase the magnitude of this response, causing liver cells to release more glucose when stimulate by glucagon. Which of the following actions would **increase** the response of a liver cell to glucagon?

a. Inhibit the dissociation of the α-subunit of the G_s-protein from the $\beta\gamma$-subunit
b. Inhibit binding of cAMP to the regulatory subunit of PKA
c. Increase the activity of adenlyate cyclase
d. Increase the activity of cAMP phosphodiesterase
e. Activate (with an agonist) a G_i-protein-coupled receptor

Clearly explain your choice, **and** why you did not choose the other four options.

2. You are trying to prevent the growth of new blood vessels (angiogenesis) to supply cancerous tumors. You are studying Vascular Endothelial Growth Factor (VEGF) receptors, located on the endothelial cells lining of blood vessels, which initiate cell growth and proliferation via a tyrosine kinase signal transduction pathway. You want to develop a drug that will block the response of these cells to VEGF. Which of the following actions would completely block this signal transduction pathway?

i. Inhibit GAP from interacting with Ras
ii. Inhibit Ras from interacting with MAPKKK
iii. Inhibit dephosphorylation of MAPKK

Clearly explain your choice, **and** why you did not choose the other two options.

3. Parkinson's Disease (PD) is a neurodegenerative disorder in which dopamine-producing neurons in the substantia nigra region of the brain die – more and more of these neurons die over time. Symptoms include increasingly impaired movement and cognitive abilities. Cabergoline (marketed under the names Dostinex and Cabaser) is a dopamine receptor agonist used to treat PD. After prolonged usage of cabergoline, patients with PD start to develop a tolerance to this drug (to generate a response of equal magnitude, a larger and larger dosage of this drug is required over time).

a) Clearly explain why cabergoline could help to reduce the symptoms of PD.

b) Why might patients eventually develop a tolerance to this drug? Explain.

Make sure to also try the "Possible exam wording" practice problems posted with the Clicker Questions online