SNS COLLEGE OF PHARMACY AND HEALTH SCIENCES

UNIT 1

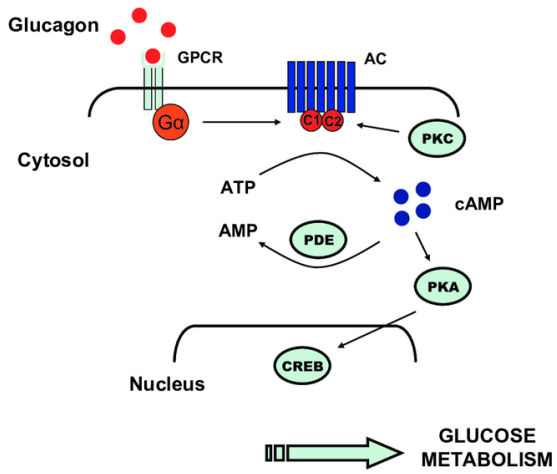
COURSE NAME: MEDICINAL BIOCHEMISTRY

TOPIC: cAMP

Case Study Question 1: Fight or Flight Response

During a stressful situation, an individual experiences increased heart rate and dilated airways due to the release of adrenaline (epinephrine). This hormone binds to receptors on target cells, triggering a rapid intracellular response without entering the cell.

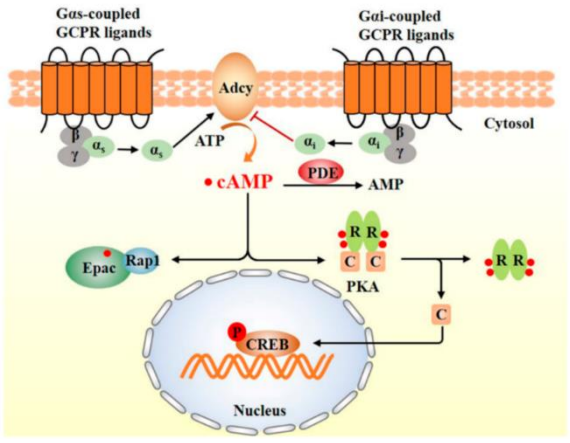
Question: Describe the role of the cAMP pathway as a second messenger system in the activation of G-protein-coupled receptors (GPCRs) by hormones like epinephrine.



Case Study Question 2: Hormone Signal Amplification

A patient with a tumor overproducing a certain hormone shows exaggerated responses in liver cells, leading to excessive glucose release. The signal from one hormone molecule results in the production of many second messenger molecules.

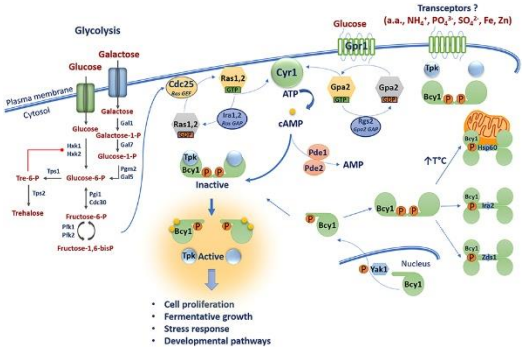
Question: Explain how adenylyl cyclase catalyzes the conversion of ATP to cAMP, and why this step leads to signal amplification in the pathway.



Case Study Question 3: Downstream Effector Activation

In a research study, elevated cAMP levels cause the dissociation of a key enzyme, releasing active catalytic subunits that phosphorylate target proteins.

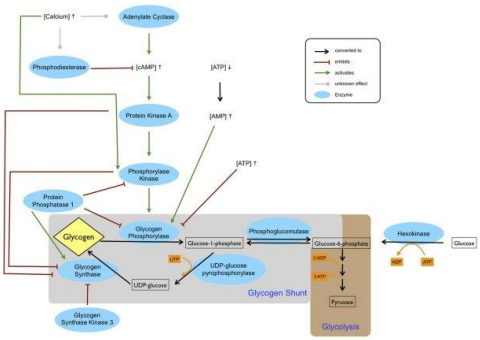
Question: How does cAMP activate protein kinase A (PKA), and what are the consequences of PKA activation in cellular responses?



Case Study Question 4: Glycogen Breakdown in Energy Mobilization

During fasting, glucagon release stimulates liver cells to break down glycogen stores, rapidly increasing blood glucose levels through a cascade involving phosphorylation events.

Question: Outline the cAMP pathway's role in the regulation of glycogen metabolism, including the activation of glycogen phosphorylase.



Case Study Question 5: Overall Pathway Integration

In cholera infection, a bacterial toxin modifies a G-protein, preventing GTP hydrolysis and causing persistent activation of the pathway, leading to severe diarrhea due to ion secretion in intestinal cells.

Question: Summarize the complete cAMP signaling pathway from receptor activation to cellular effects, and explain how it functions as a second messenger system.