

Cell Signaling Pathways

Receptor Types

- GPCR: G-protein coupled
- RTK: receptor tyrosine kinase
- Ion channel receptors
- Nuclear receptors

Second Messengers

- cAMP: activates PKA
- Ca^{2+} : multiple targets
- IP_3 and DAG
- Amplify signal

Kinase Cascades

- MAPK pathway
- Sequential phosphorylation
- Signal amplification
- Specificity and crosstalk

Feedback Regulation

- Negative feedback: stability
- Positive feedback: switches
- Desensitization mechanisms
- Temporal dynamics