G-Protein Receptors

Gs, Gi Gp and Other Receptors

Psychology 372

Physiological Psychology

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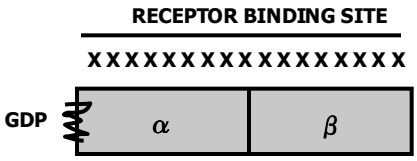
1

Gs Proteins Sequence

- NT
- Binds to the Receptor
- Causes GDT to leave
- GTP binds – Alpha and Beta Subunits dissociate
- Result – Free Alpha and Free Beta
- Alpha binds to AC
- Causes AC to make cAMP
- cAMP binds to Regulatory Subunit of PK
- Dissociates the PK
- Free Regulatory and Catalytic subunits
- Catalytic subunit phosphorlates (puts a phosphate group of the channel)
- Ions enter the membrane
- Depolarization

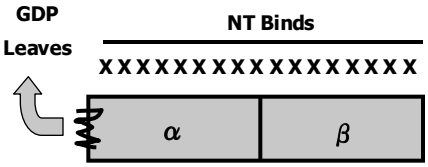
2

Receptor at Rest



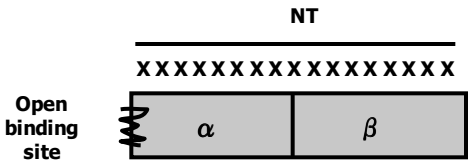
3

Stimulation begins



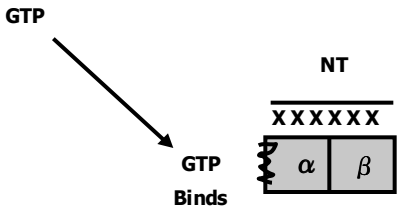
4

Open Binding Site



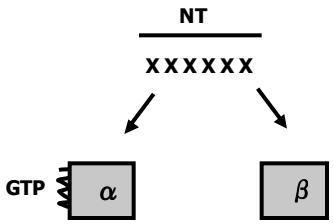
5

GTP Binds



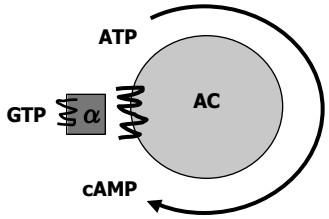
6

Dissociation Occurs

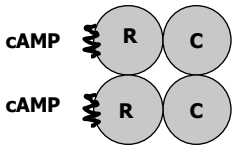


Adenylyl Cyclase (AC)

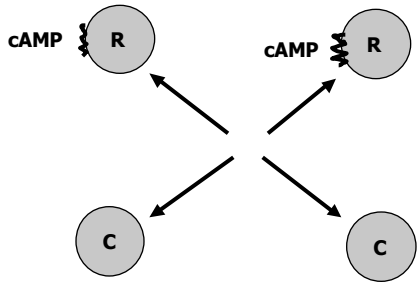
- When activated makes cAMP from ATP

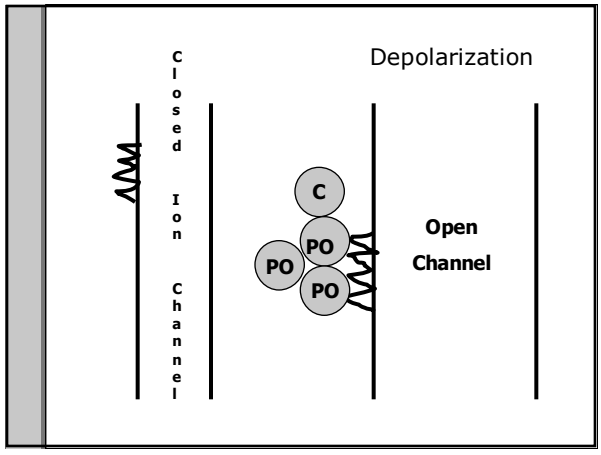


cAMP binds to Regulatory Subunit of PK



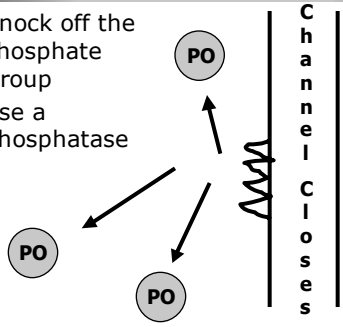
Free Regulatory and Catalytic subunits

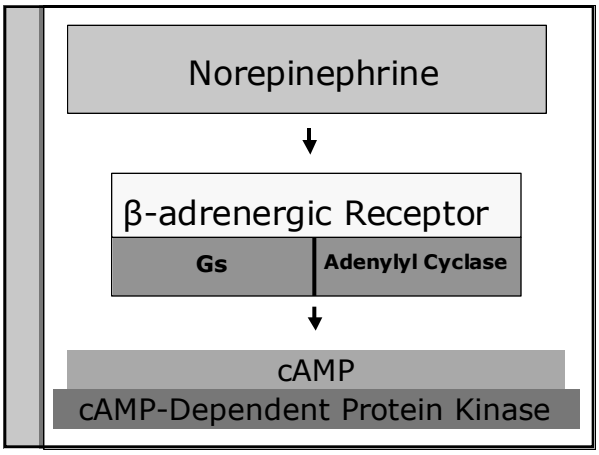




How to Shut Down the Channel

- Knock off the Phosphate Group
- Use a phosphatase





Gi Proteins

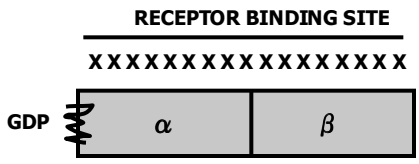
Gi Proteins

- Are not the same as Gs Proteins
- Causes a decrease in cAMP levels
- Alpha subunits are the different
- Beta subunits are same

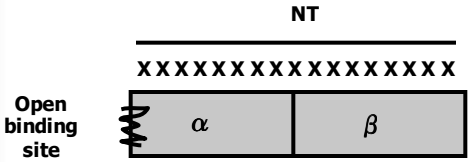
Gi Proteins Sequence

- NT
- Binds to the Receptor
- Causes GDT to leave
- GTP binds – Alpha and Beta Subunits dissociate
- Result – Free Alpha and Free Beta subunits
- Beta subunits begin to bind with Alpha S subunits
- Begin to decrease the activity of Adenylyl Cyclase
- Decreases cAMP production

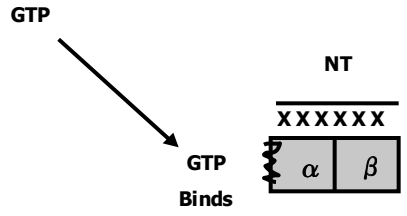
Receptor Binding Site at Rest



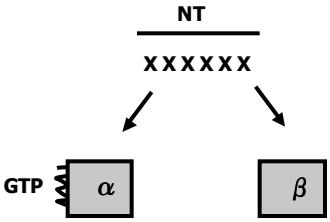
Open Binding Site



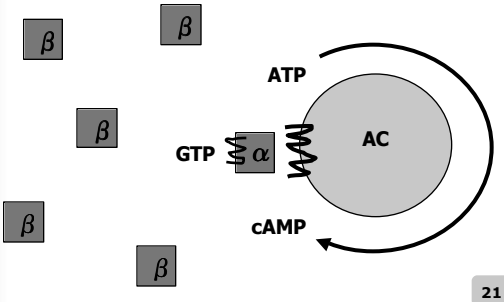
GTP Binds



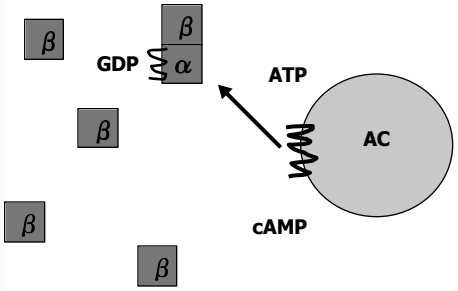
Dissociation Occurs



Adenylyl Cyclase (AC)



Adenylyl Cyclase (AC)



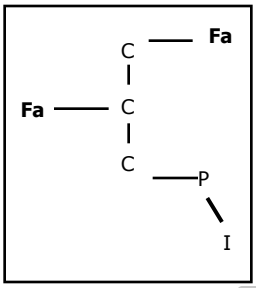
Result

- Decrease of cAMP
- Fewer PK dissociate
- Fewer ion channels open
- Less Depolarization

Gp Proteins
Phosphoinositol System

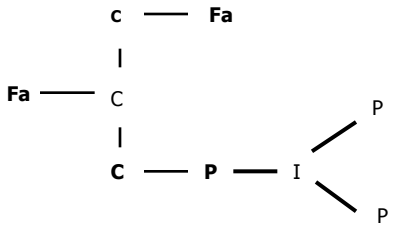
Phosphoinositol

- Basic Structure



Can Phosphorlate Two or More Times

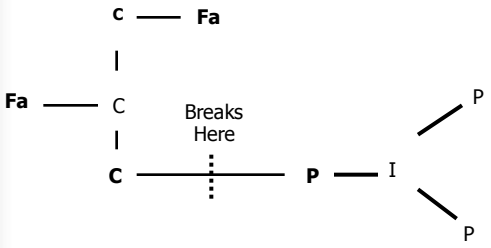
- Get Triphosphoinositol



Gp Proteins Sequence

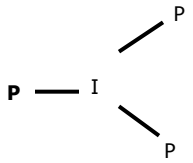
- NT
- Binds to the Receptor
- Causes GDT to leave
- GTP binds – Alpha P and Beta Subunits dissociate
- Result – Free Alpha P and Free Beta subunits
- Alpha P subunit activates Phospholipase C (Has 9 different forms)
- Phospholipase C splits Triphosphoinositol and breaks it into two groups
- DAG and IP-3

Breakage



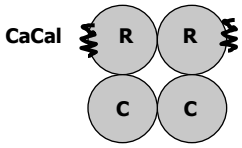
IP-3 System

- Is a potent releaser of Ca from smooth ER
- Get a surge of intracellular Ca
- Ca binds with Calmodulin (Cal)
- CaCal stimulates CaCal protein Kinase
- CaCal PK phosphorlates the ion channel
- Get depolarization



CaCal Protein Kinase

- Similar to cAMP PK
- Has four subunits
- Two Regulatory subunits
  - Where CaCal binds
- Two Catalytic Subunits
  - Puts Phosphate groups on Ions



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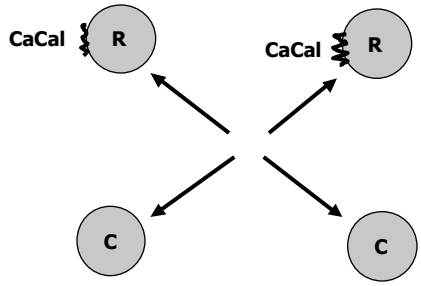
Free Regulatory and Catalytic subunits



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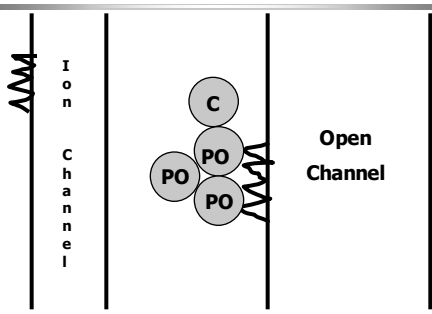
Depolarization



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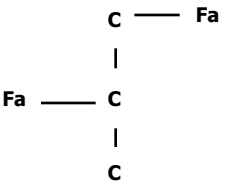
Diacylglyceral (DAG) System



- DAG binds with Protein Kinase C
- Increases the affinity for Ca
- Ca Binds with PK-C
- Causes Phosphorlation
- Channel opens
- Depolarization

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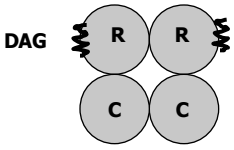
DAG Protein Kinase

- Similar to other PK
- Has four subunits
- Two Regulatory Subunits
  - Where DAG binds
- Two Catalytic Subunits
  - Puts Phosphate groups on Ions



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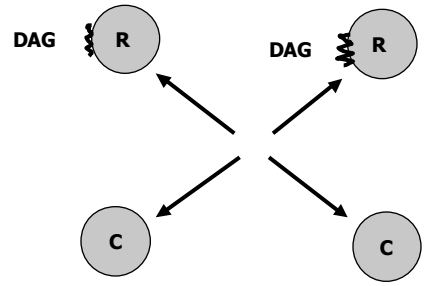
Free Regulatory and Catalytic subunits



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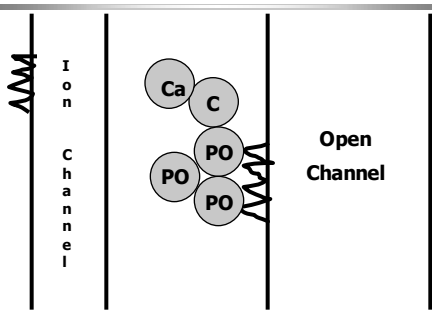
Depolarization



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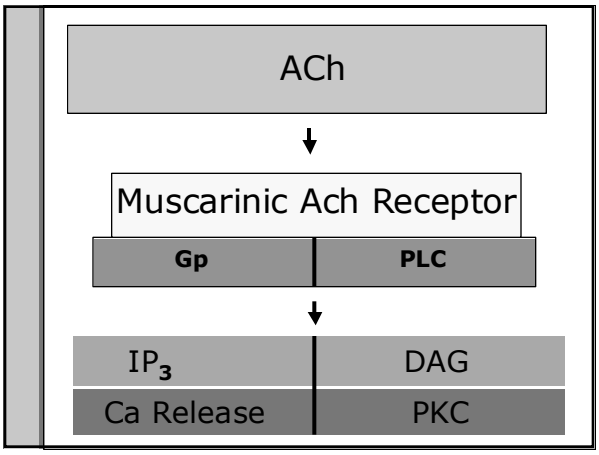
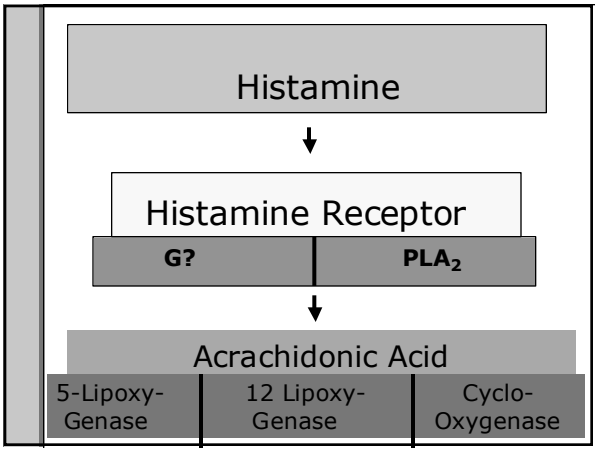


Other G Proteins

Arachidonic Acid System



3 Sites of Action, but Many More

5-Lipoxy - Genase	12 Lipoxy - Genase	Cyclo-OxyGenase
Several Active Metabolites	Leukotrienes	Prostaglandins and Thromboxanes
		Inhibited by ASA and nonsteroidal anti-inflamatory drugs

Summary

- Many types
- Hot area of Neurophysiology and Neurochemistry
- Are affected by many psychotropic drugs.