


Bio 115 Cells & Evolution of Life

## Cell Differentiation and Morphogenesis

# Cell Signaling



University of Idaho

Start Audio Lecture!

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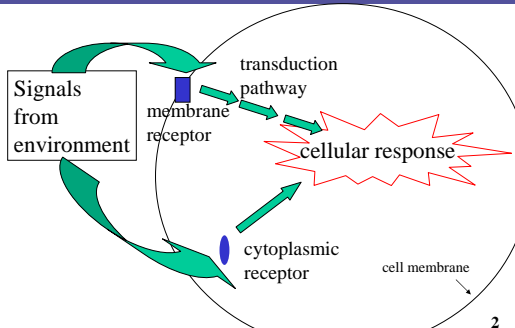
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## Cells Respond to their Environment



Signals from environment

membrane receptor

transduction pathway

cellular response

cytoplasmic receptor

cell membrane

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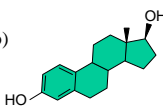
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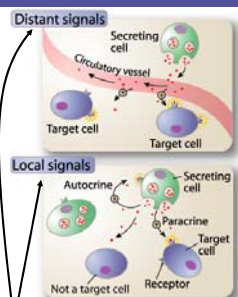
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## Signal Molecules

a)  $H_2C = CH_2$

b) 

Two signal molecules found in plants, ethylene (a) and brassinolide (b).



Distant signals

Local signals

Signals may come from far or near.

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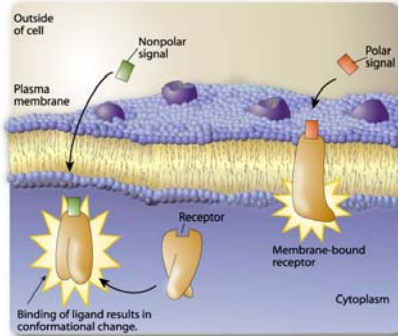
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### Generalized Signal Reception



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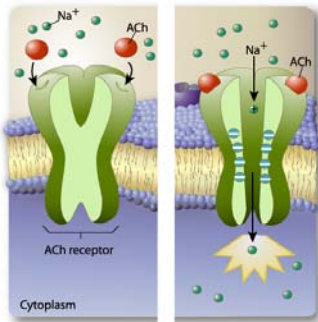
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### Ligand-Gated Ion Channels

#### Ligand-gated ion channels:

- integral membrane proteins
- control passage of ions (Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>2+</sup>, Cl<sup>-</sup>) into/out of cell
- may bind ligand directly  
⇒ conformational change




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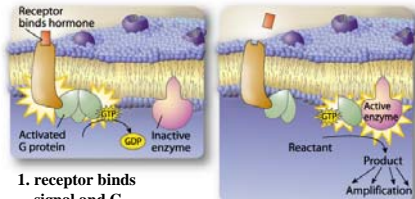
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### G Protein-Linked Receptors



1. receptor binds signal and G protein
2. GTP displaces GDP from the G protein
3. Activated G protein dissociates
4. Moves along the membrane, activates third enzyme
5. Activated final enzyme takes part in cellular reactions

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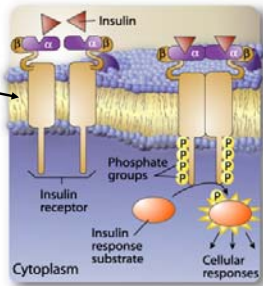
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### Protein Kinases

#### Protein kinases:

- integral membrane proteins
- conformational change exposes kinase site
- phosphorylate other molecules  
⇒ alters activity of other molecules



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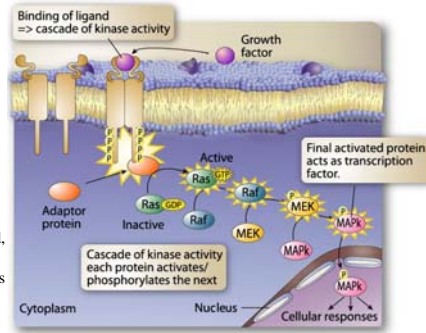
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### Ras Protein Kinase Cascade

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 signal is amplified, because each activated protein is able to activate many others.



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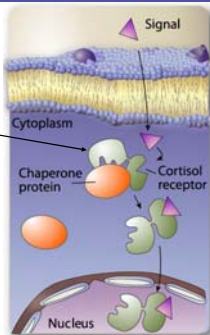
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### Cytoplasmic Receptors

#### Cytoplasmic Receptors

- proteins found in cytoplasm of cell
- bind small, non-polar ligands
- when activated serve as transcription factors



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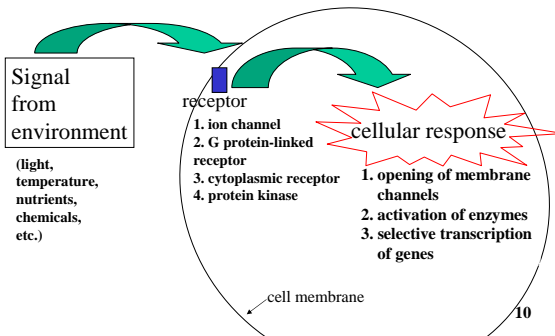
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### Recap of Material



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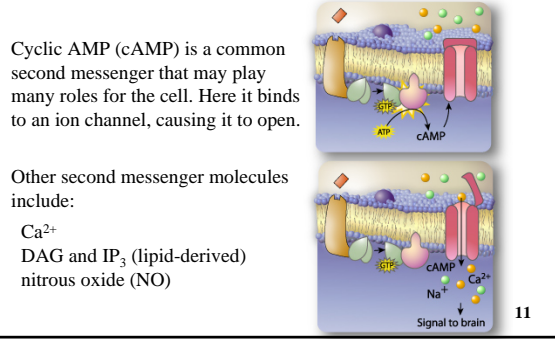
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### Indirect Transduction: Second Messengers



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