Biological Frameworks for Engineers

ME 411 / ME 511

Biological Frameworks for Engineers

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Class Organization

- Lab 2 report
  - Due on Monday
- Exam 1
  - Take-home (honor code)
  - Due Fri Oct 31
- Tiny Workhorses
  - 2 pairs formed
  - Selected helicase and actin-myosin

Biological Frameworks for Engineers

ME 411 / ME 511

Cell Signaling

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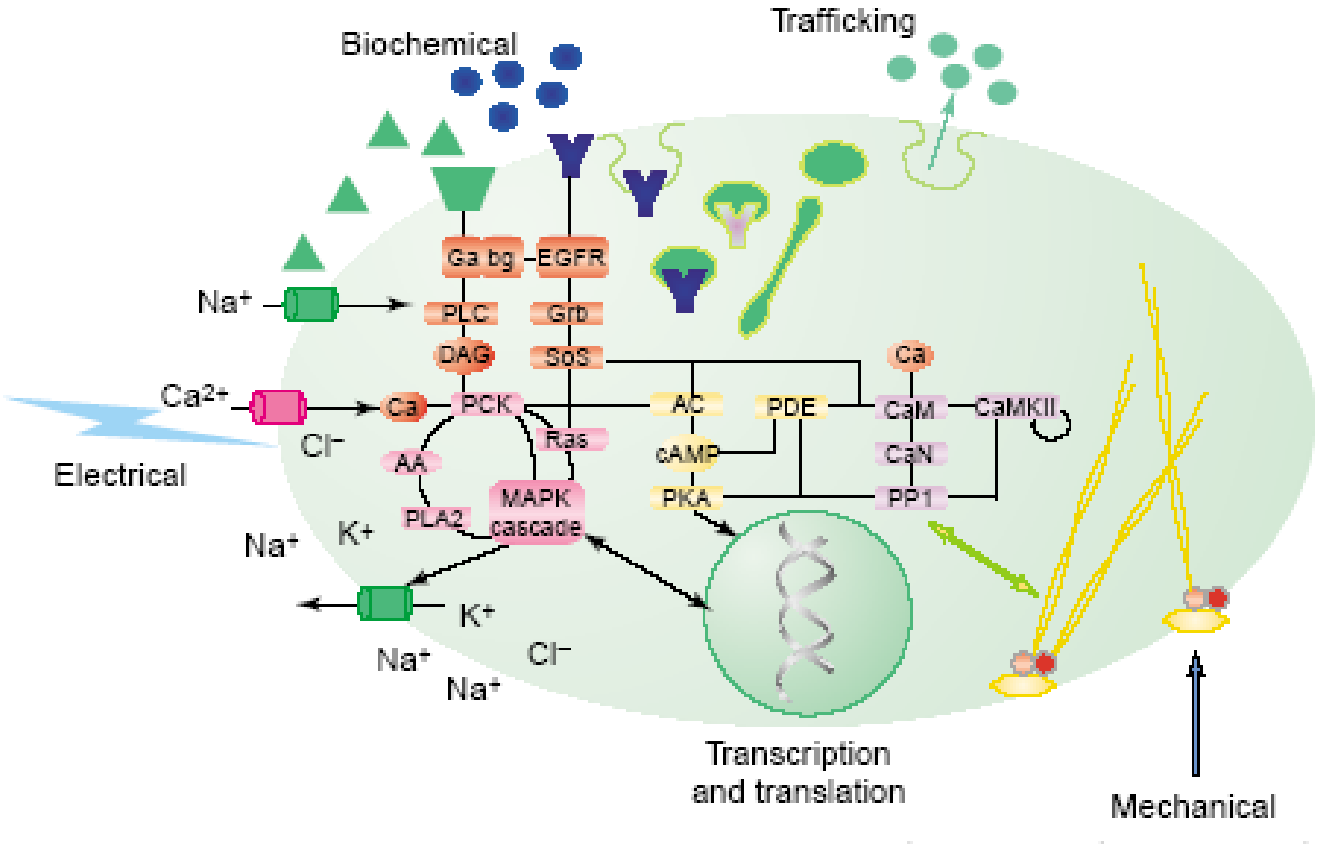
Cell Signaling



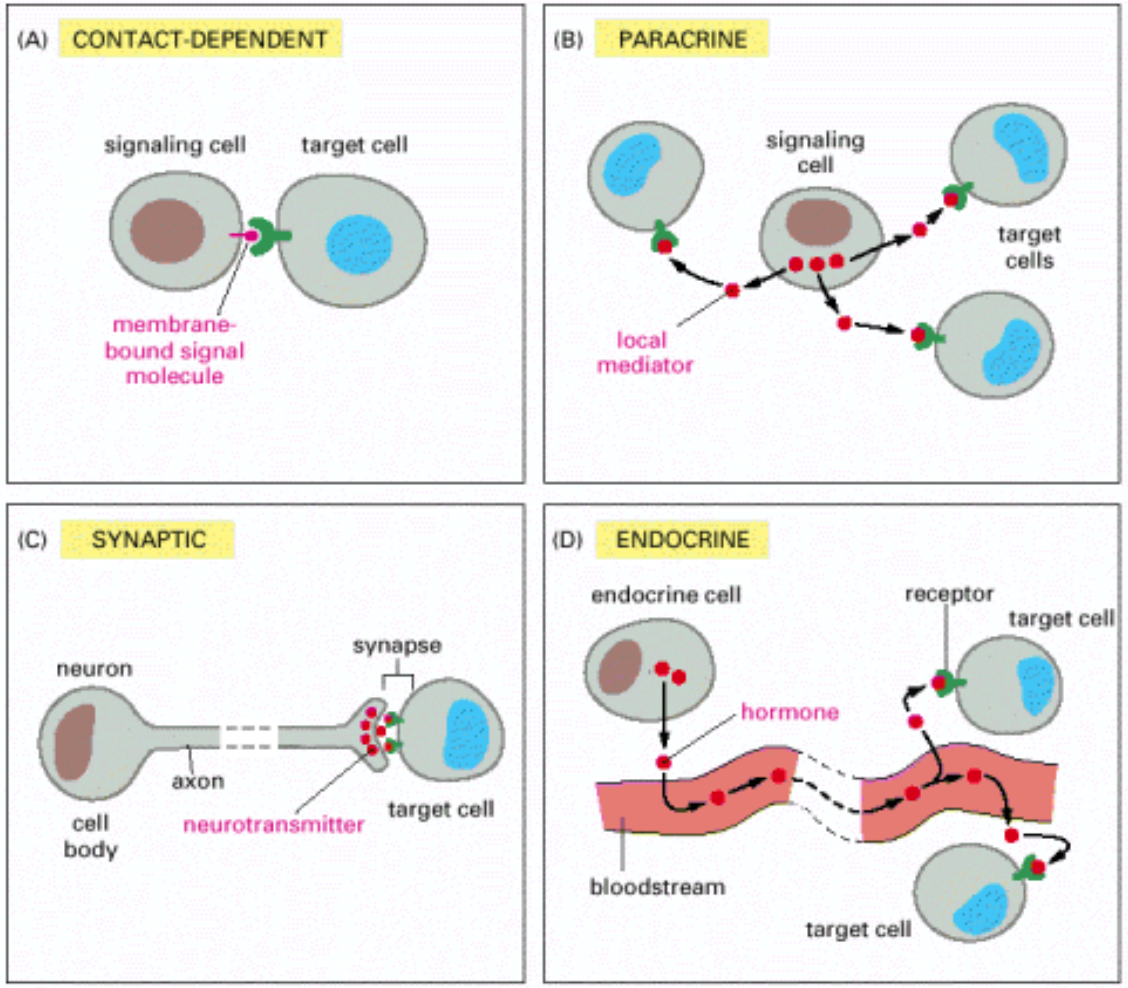
Cell Communication

Very Local

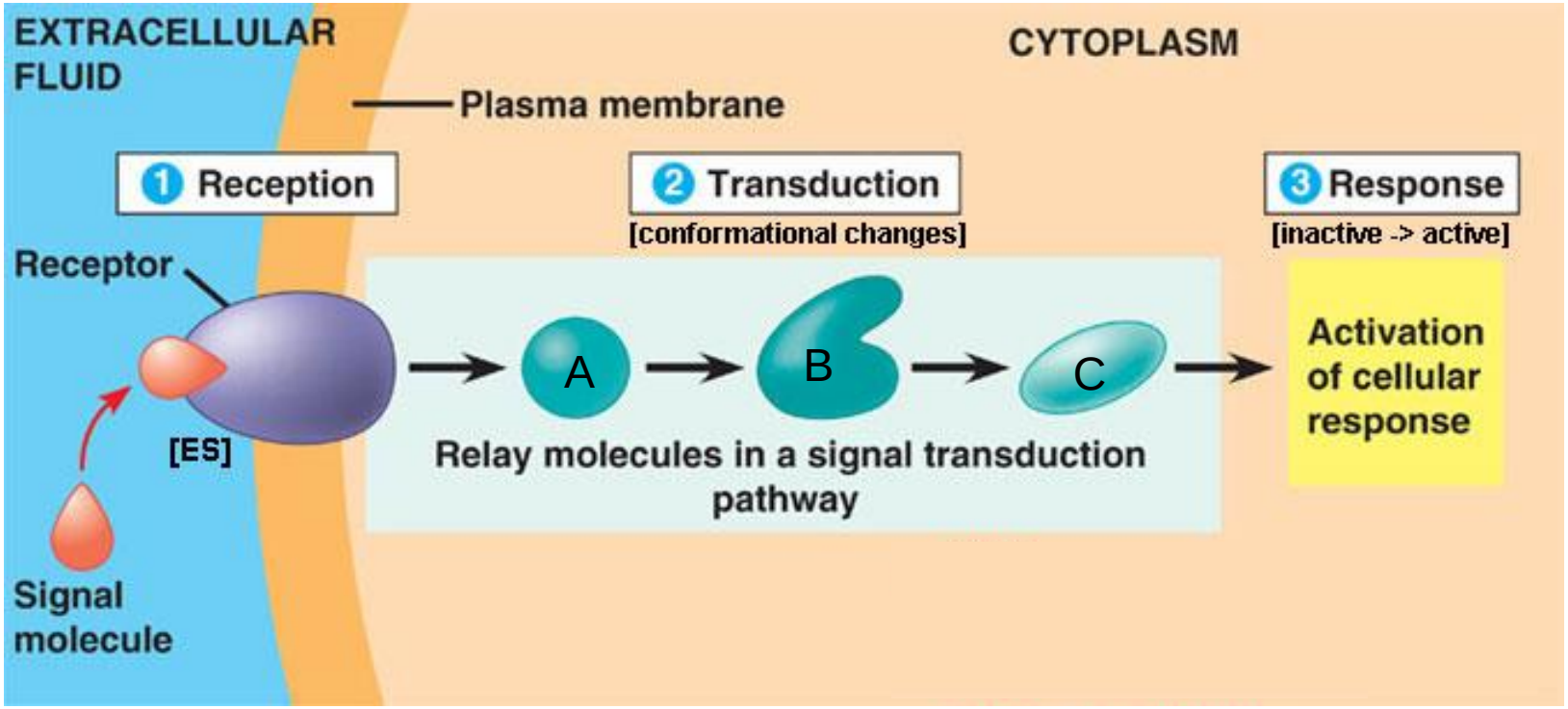
Local

Local

Distance



Cell Signaling



Signal Logic

Latent gene regulators activate at cell surface and initiate transcription

Scaffolds cluster proteins together

Relays simply pass along a signal

Adaptors transmit signal between two others

Bifurcators involve multiple pathways

Amplifiers enhance a signal strength

Transducers covert signal to other forms

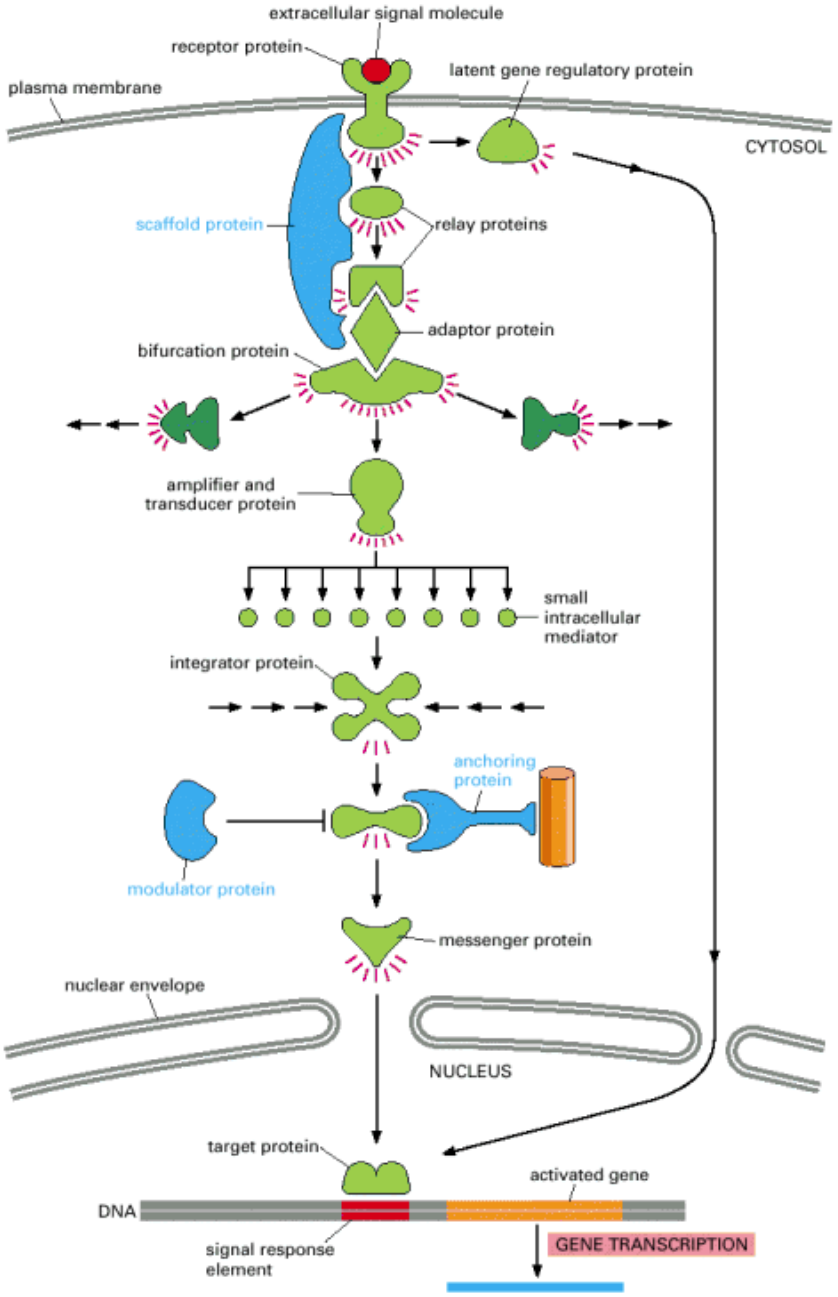
Small intracellular molecules promote rapid signal transport

Integrators cross-reference different signaling pathways

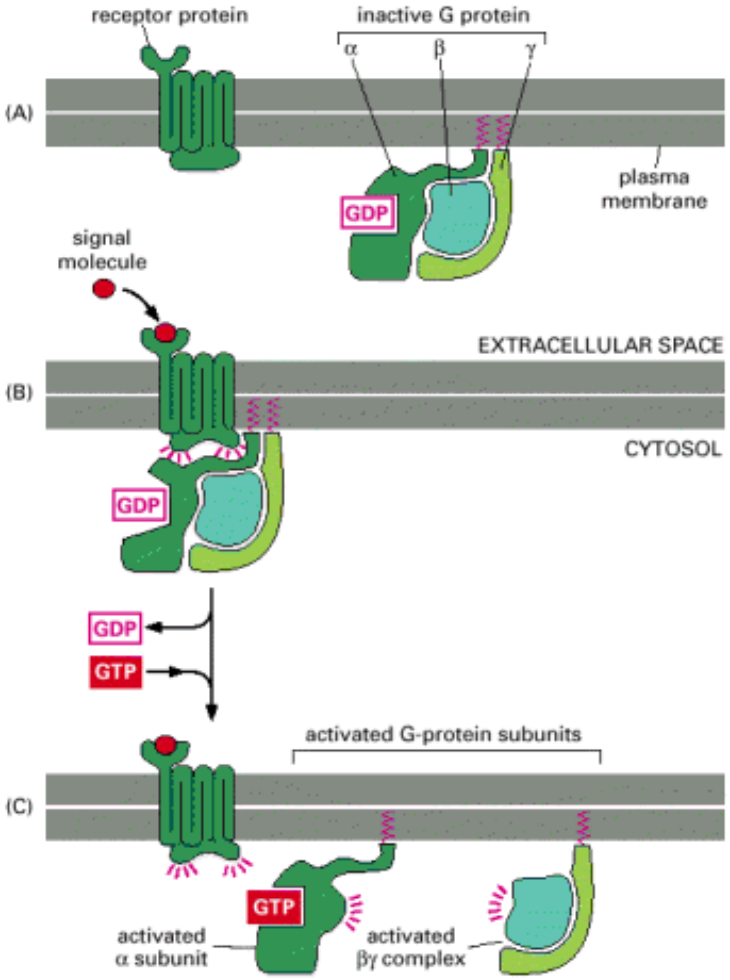
Modulators enhance signaling activity

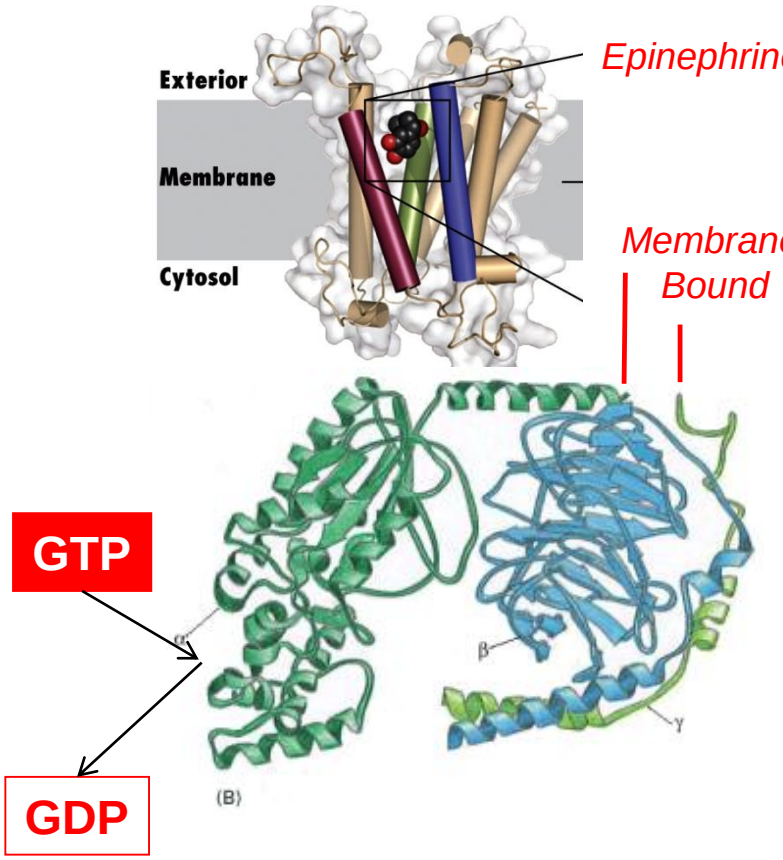
Anchors localize proteins at key sites

Messengers carry signal into nucleus



G-Protein Linked Receptors





Secondary Messengers

- Carries signal by change in concentration

Ca^{2+} ions

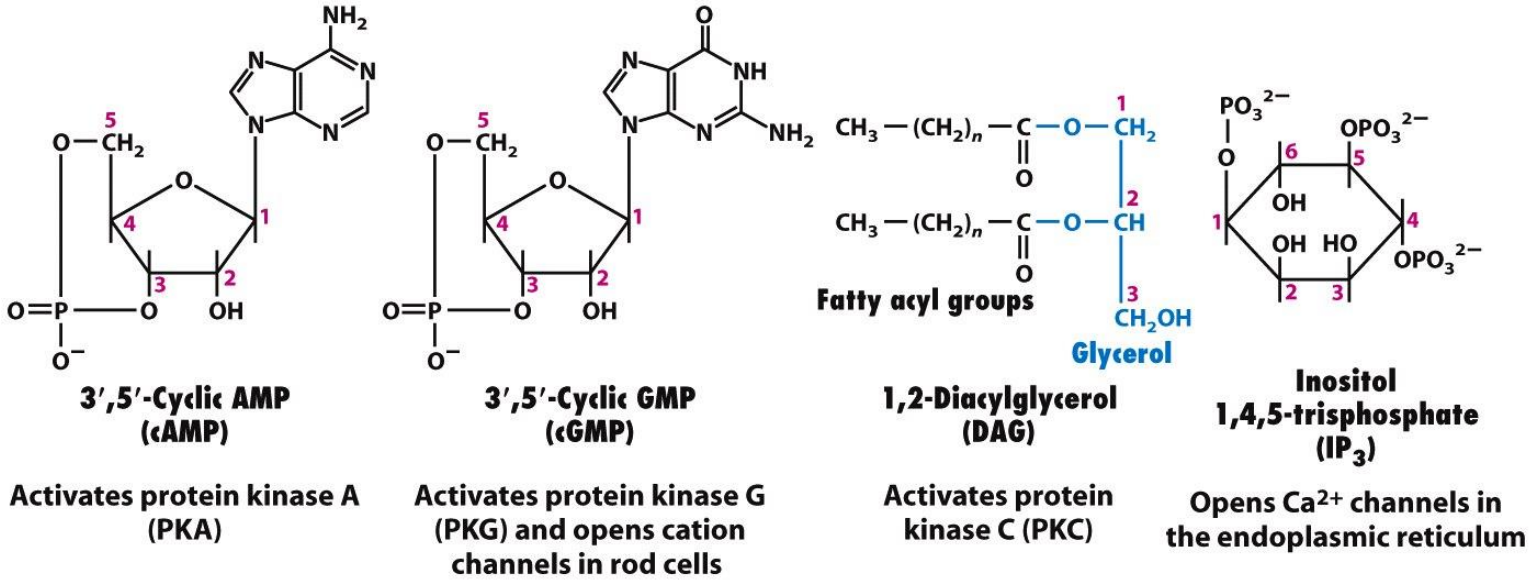
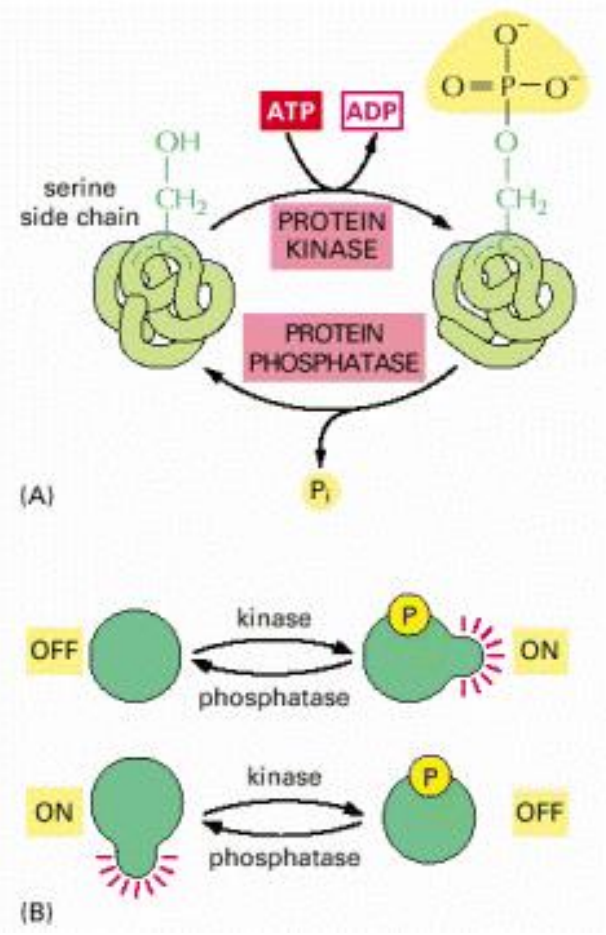


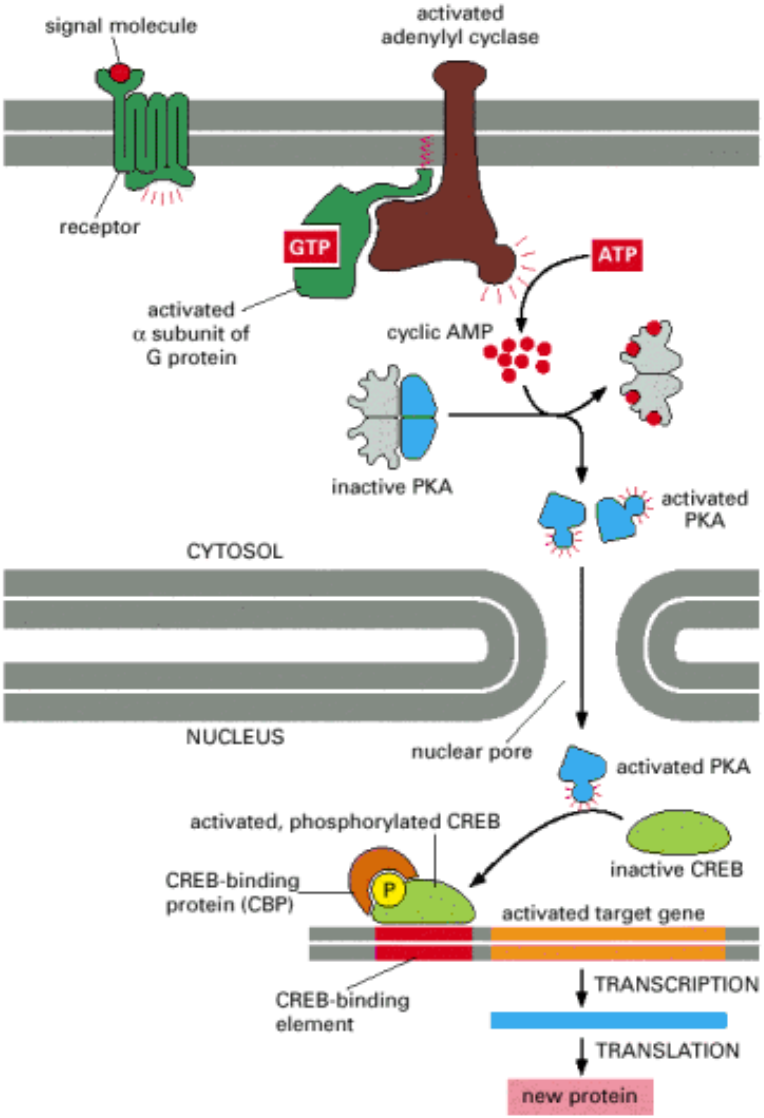
Figure 15-9
Molecular Cell Biology, Sixth Edition

Phosphorylation

- Kinase:
  - attachment of phosphate group from ATP
  - binds to –OH amino acid on Serine (S), Threonine (T) or Tyrosine (Y)
- Phosphatase:
  - removal of (P)
- Conformational Switch
  - Off→On or On→Off

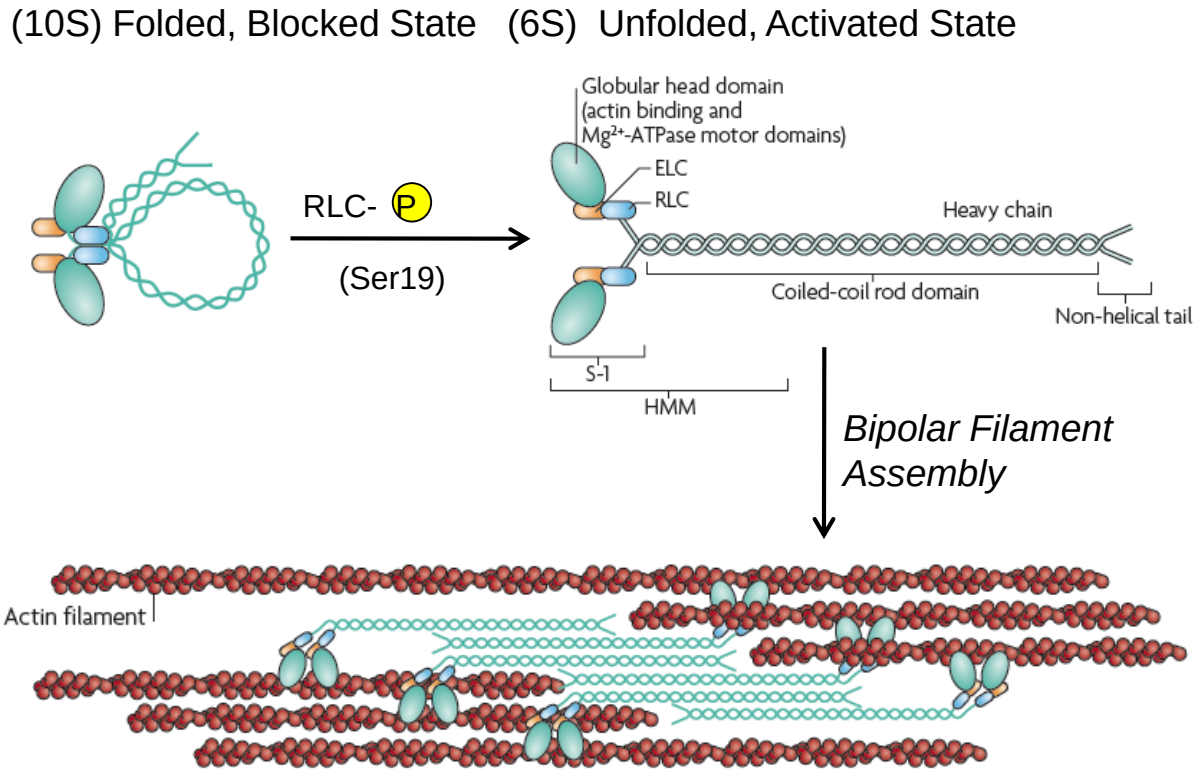


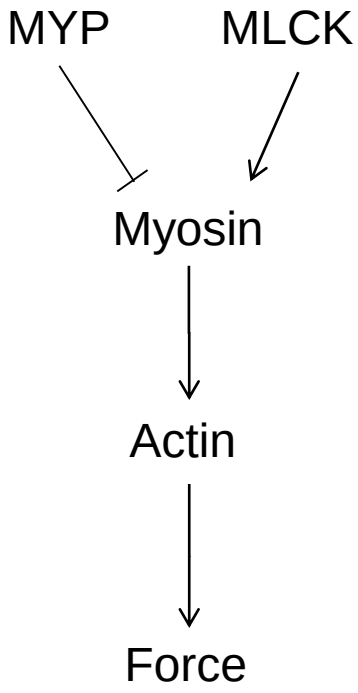
Gene Transcription



Nonmuscle Myosin Activation

Phosphorylation needed for contractile filament assembly





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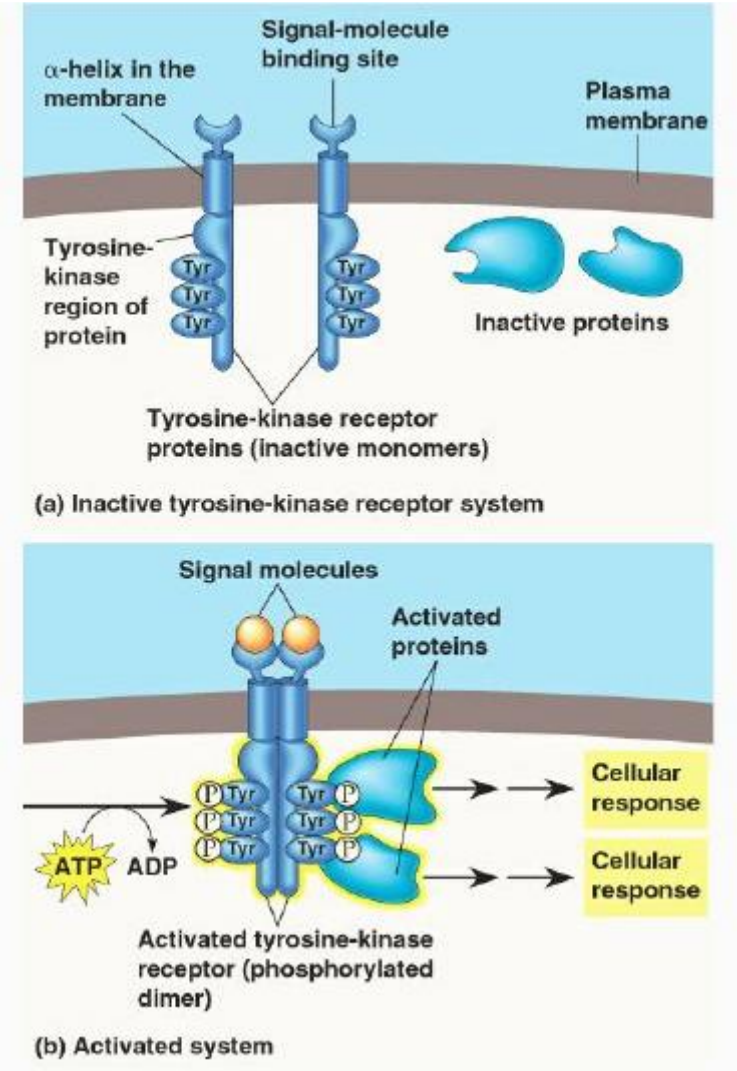
Adapted from Vicente-Manzanares, M., et al. (2009) *Nat Rev Mol Cell Bio*. 10(11):778-90

Receptor Tyrosine Kinase



Epidermal Growth Factor Receptor Activates Ras

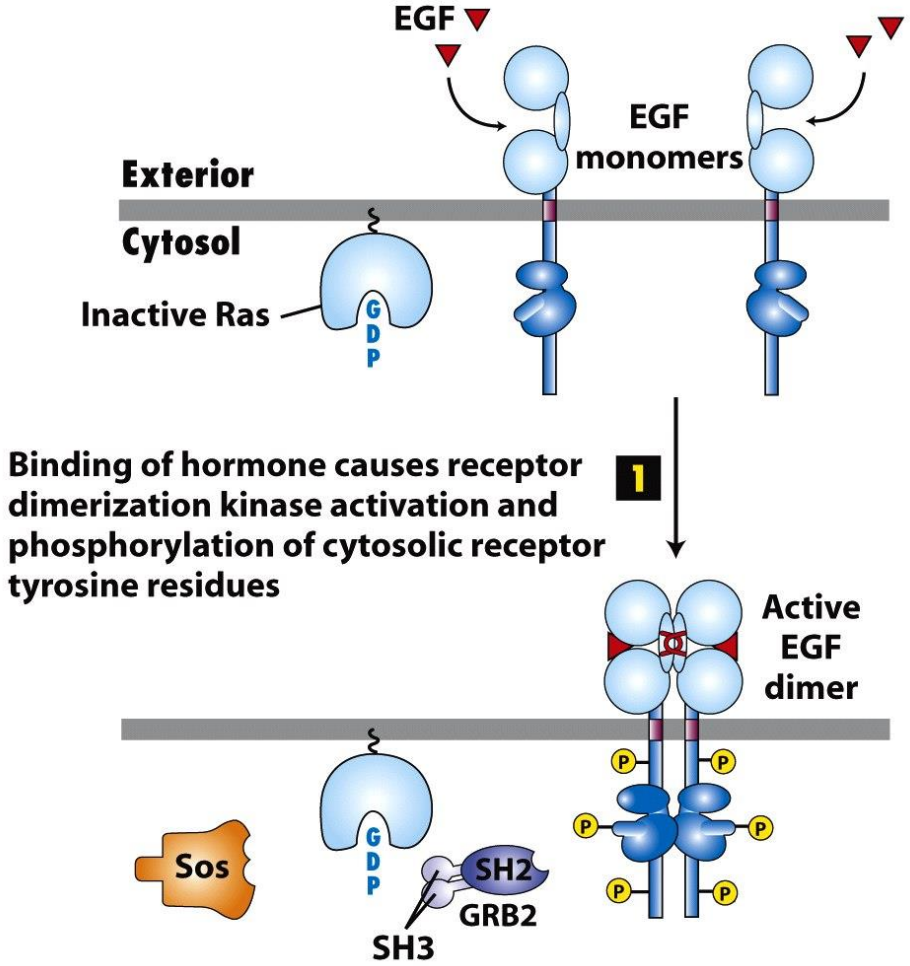


Figure 16-20 part 1
Molecular Cell Biology, Sixth Edition

EGFR-P → GRB2-SOS-Ras

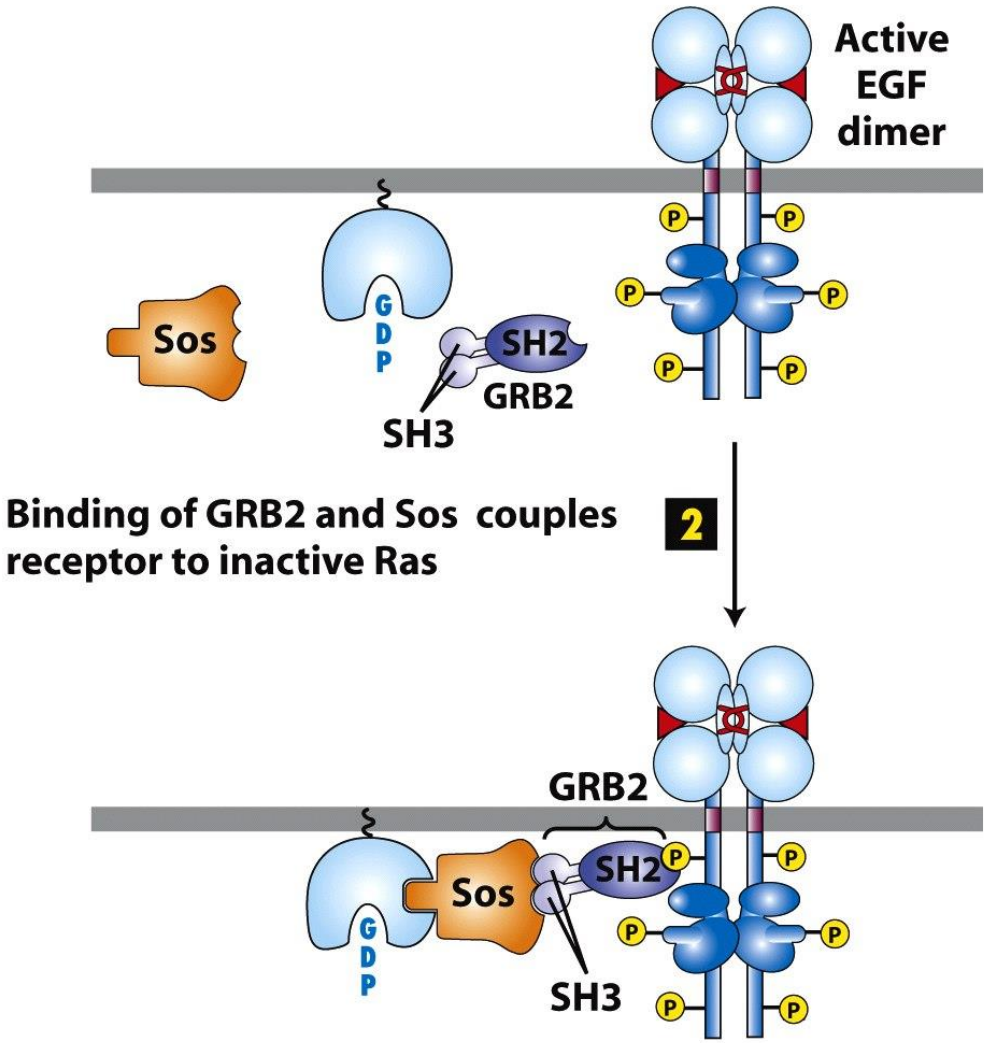


Figure 16-20 part 2
Molecular Cell Biology, Sixth Edition

SOS → Active Ras

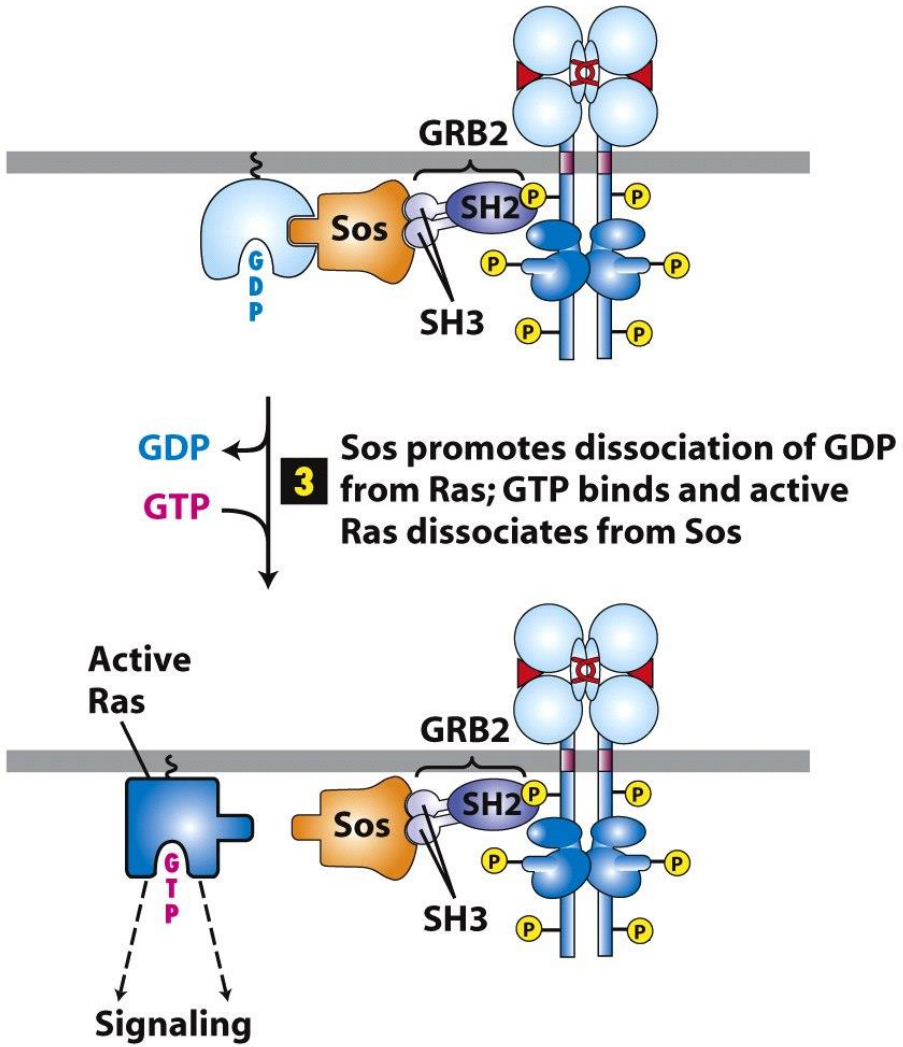


Figure 16-20 part 3
Molecular Cell Biology, Sixth Edition

How does Sos Work?

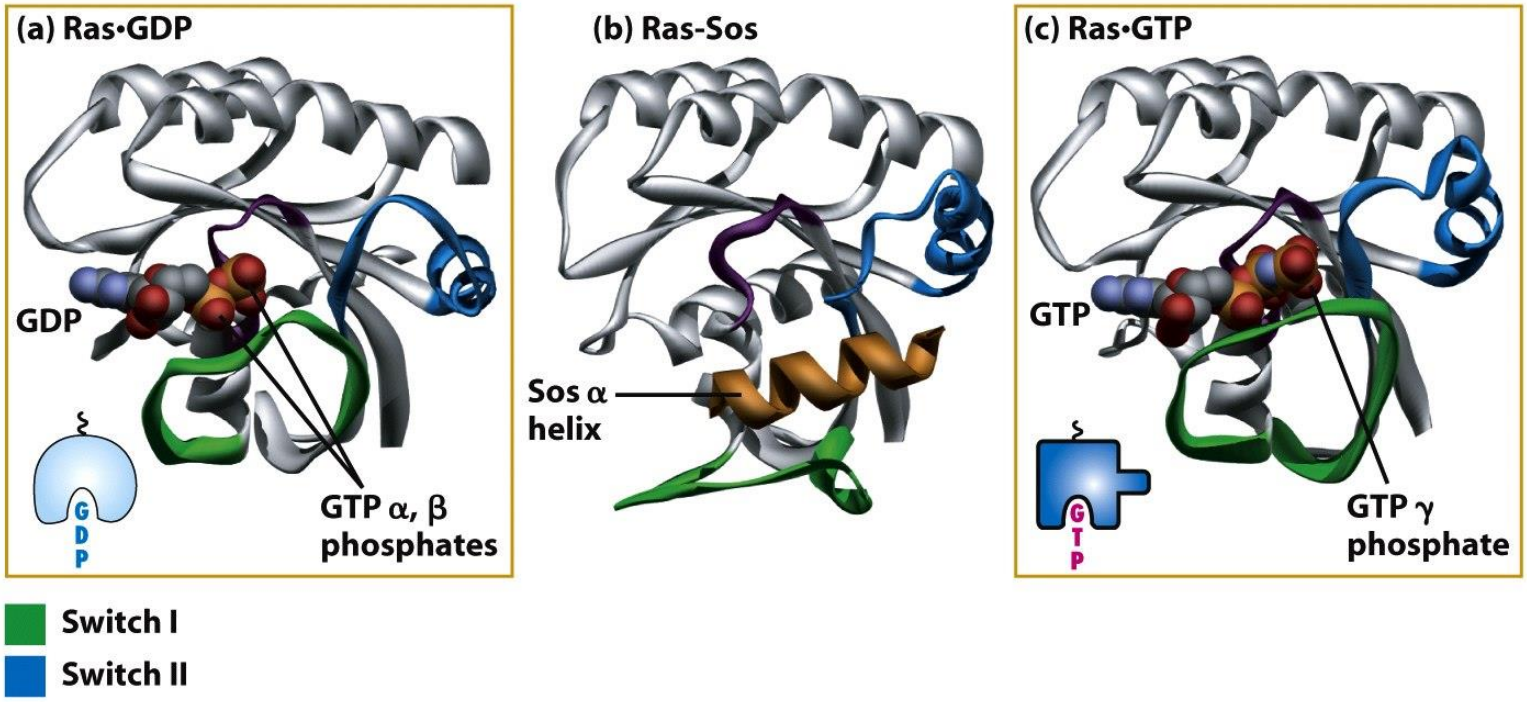


Figure 16-24
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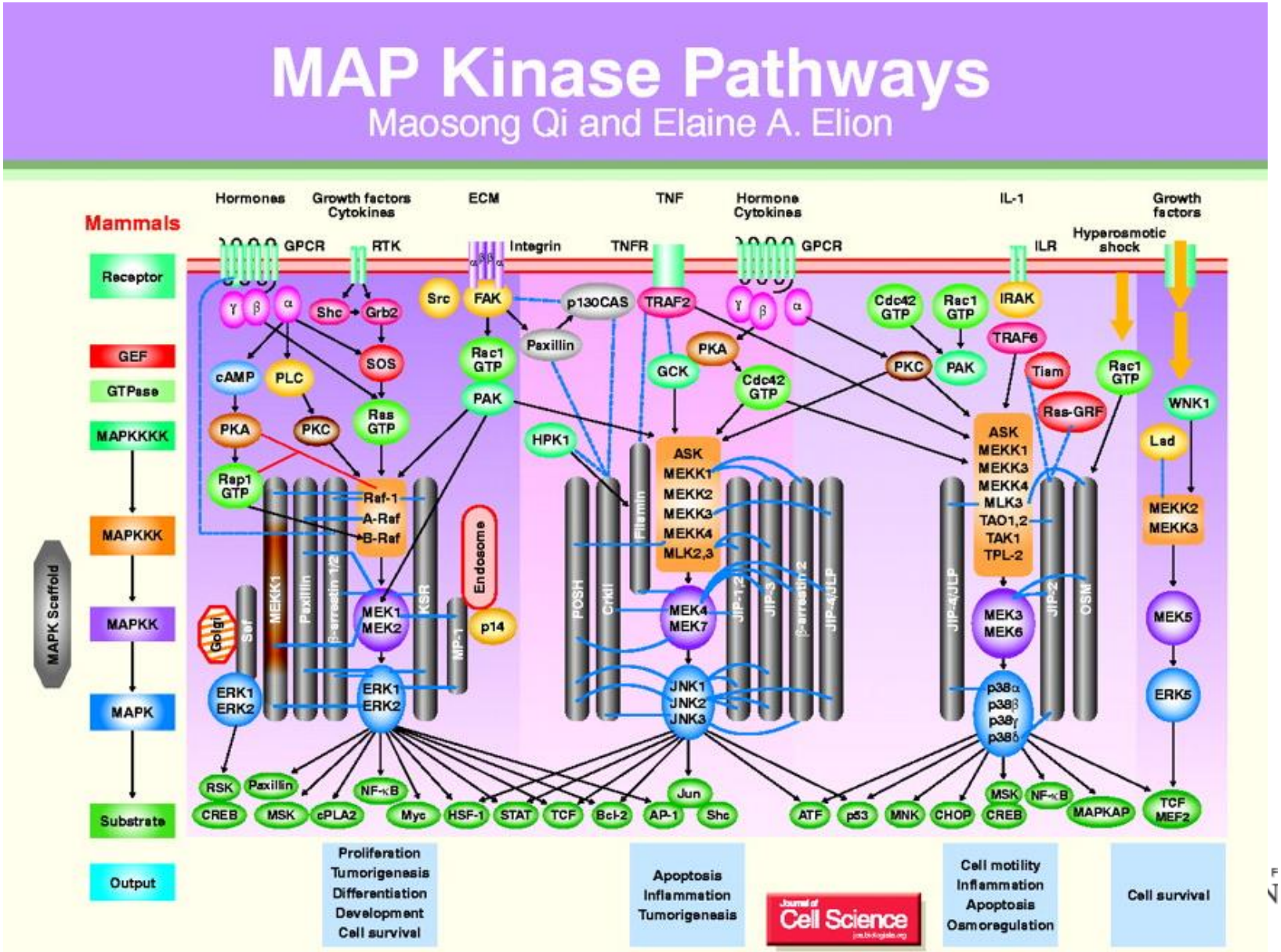
Signaling Pathways



Questions?