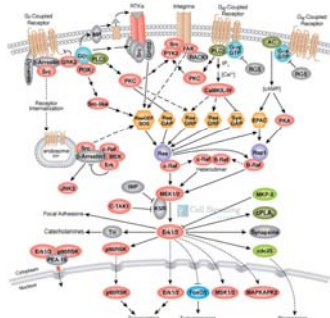


Topic 5 – Cell-to-cell signalling

- Reading
 - Chapter 8
- Objectives
 - The elements of a signalling system
 - Signals recognized by cell-surface receptors
 - Ligand-gated channels
 - Receptor tyrosine kinases
 - G protein-coupled receptors
 - Lipid-soluble signals & intracellular receptors



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<http://www.cellsignal.com/reference/pathway/>



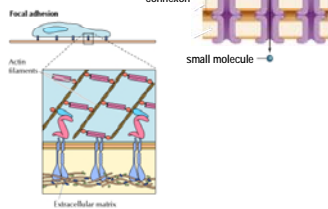
the cells in multicellular organisms, there are signals tht come from other cells as well, not just from the external environment.

gap junctions and plasmodesmata, moves signals between the cells. contact type communication, like cell crawling.

chemical messengers, they r synthesized by one cell, and they r used to affect other cells

The elements of a signalling system

- Types of cell communication
 - Gap junctions and plasmodesmata
 - Contact
 - Chemical messengers



<http://www.ncbi.nlm.nih.gov/books/NBK9874/>

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Fig. 3.2, Moyses & Schulte 2008



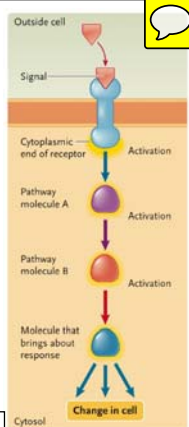
in order for the signal to continue, there has to be a proper receptor. ex: talkin to someone wid headphones on, they cant hear u. if the first messenger binds to the receptor, there is a

change tht will occur in the target cell. some cells can even be told to die. all this is called the signal transduction pathway. (converting primary signal into a cell response).

then there is termination where the signal pathway stops and the response is stopped. it is very imp. to terminate the response. it is as imp. as startin the signal.

The elements of a signalling system

- Signalling molecule (first messenger)
- Reception
 - Receptor – membrane, cytosolic or nuclear
- Transduction
 - Signalling cascades and second messengers
- Response
 - Changes in gene expression
 - Changes in activities of enzymes, transcription factors or other regulatory proteins, transporters, cytoskeleton etc
- Termination



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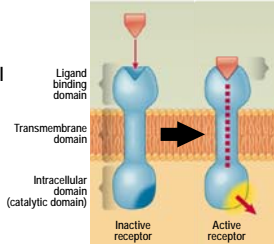
Fig. 8.2



on the extracellular side of the membrane there is the ligand binding domain. for signalling molecules tht cannot enter the cell, they bind to the ligand binding domain.

Membrane receptor signalling systems

- Signals are water-soluble chemicals
 - Signalling molecule does not enter cell
 - Signal removal
 - e.g. environmental chemicals, neurotransmitters, hormones
- Membrane receptors are integral membrane glycoproteins
 - Ligand-gated channels
 - Receptor tyrosine kinases
 - G protein-coupled receptors



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ligand gated chanel are ion chanel tht allow molculkes to pass thru them goin down the conc. gradient. they open and close by signalling molecules binding to the receptors. for ex, when ach binds to the channel protein causes the channel to open, allowing ions to pass, which causes the muscle to contract.

□ Ligand-gated channels

- e.g. Skeletal muscle activation by acetylcholine

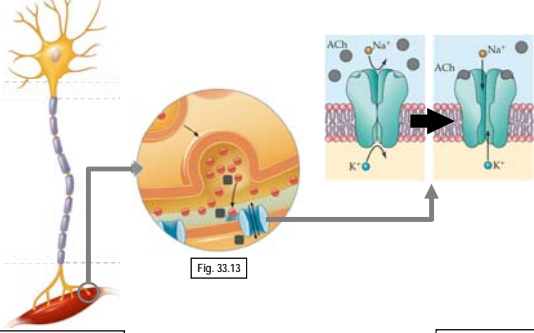
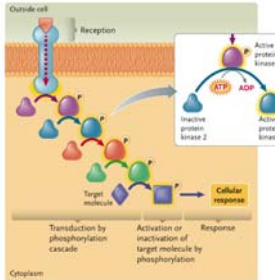


Fig. 4.1, Moyes & Schulte 2008 BIO 1140 – SLIDE 5 Fig.12.16, Hill et al. 2004

□ Signalling cascades

- Role of phosphorylation: kinases vs phosphatases
- Amplification
- Termination
 - Removal of ligand-receptor complex
 - Inactivation of receptor
 - Inactivation of signalling cascade



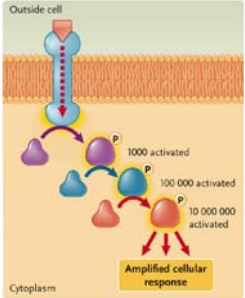
BIO 1140 – SLIDE 6 Fig. 8.5

here when the signalling molecules bind to them, they turn on a cascade of a long chain of reactions, until a specific protein is activated tht can turn on the cellular response. atp is hydrolized and the phosphate group is given to the target protein, and the protein is activated. kinase is what transfers these phosphates. kinases regulate phosphorylation. each protein in this signalling cascade acts as a kinase. (purple for blue, blue for red.....) the advantage of this is tht it allows amplification (amplify the signal). for ex: when the purple is activated, it is able to activate 100 blue ones.

we also have to be able to shut these cascades down. one way is to take away the phosphate group, using phosphatases. kinases are only active for short periods of time, because phosphatases are always active. another way to shut it down, is by turning the receptor off or by removing it from the membrane. we can also remove the signalling molecule in order to stop the cascade.

□ Signalling cascades

- Role of phosphorylation: kinases vs phosphatases
- Amplification
- Termination
 - Removal of ligand-receptor complex
 - Inactivation of receptor
 - Inactivation of signalling cascade



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