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7 Cardinal Signaling Pathways – What You Need to Know

Pathway	Ligand	Receptor	Signaling Cascade	Txn Factor
TGFβ	**BMPs**	**Type 1 and II receptors** - Ser/Thr kinases - Dimerize upon ligand binding	Activated receptors phosphorylate/activate Smad	**Smad** - Activated in cytosol Translocates to nucleus
Hedgehog	**SHH**	**Patched** - Patched inhibits Smoothened - Shh inhibits Patched - When Shh bound, Smoothened is active	Smoothened inhibits Fused, a kinase which causes phosphorylation/cleavage of Gli (also called CI)	**Gli** - When not cleaved, translocates to nucleus
Wingless	**Wnt**	**Frizzled** - Activated Frizzled (bound to Wnt) inhibits GSK3β	GSK3β is a kinase which phosphorylates and causes degradation of β-catenin	**TCF** - When GSK3β is inhibited, β-catenin translocates to nucleus and activates TCF
Ras	**EGF, FGF**	**Tyrosine kinase receptors** - Dimerize and autophosphorylate when bound to ligand	Receptors activate Ras, a small G-protein (by stimulating exchange of GDP for GTP). Ras activates the MAP kinase cascade.	Several in nucleus - Activated by phosphorylation
Notch	**Delta**	**Notch** - Delta ligand is a transmembrane protein on another cell	Delta/Notch interaction causes cleavage of a Notch intracellular domain	**Su(H**) - Notch domain translocates to nucleus and activates Su(H)
Toll	Many	**Toll-like receptors** - Dimerize upon ligand binding	NFKβ activated in cytosol	**NF-Kβ** - Translocates to nucleus after activation
Steroid hormones	Many	**Intracellular receptor** - Present in cytosol and nucleus	Carrier protein binds steroid outside cell, pass through membrane	**Receptor** - Activated receptor acts as txn factor

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