

# ER $\alpha$ activators

## one receptor - multiple inputs

### ligands

Estrogens  
Androgens  
27-OH-cholesterol  
Xeno-estrogens  
Phyto-estrogens  
Farnesyl PP  
Metallo-estrogens  
(Cd<sup>2+</sup>, Co<sup>2+</sup>, Cu<sup>2+</sup>, Ni<sup>2+</sup>,  
Pb<sup>2+</sup>, Hg<sup>2+</sup>, Sn<sup>2+</sup>, Cr<sup>2+</sup>)  
Vanadate  
Arsenite, Selenite  
Nitrite

Peptide growth factors  
(EGF, Heregulin, TGF $\alpha$ , IGF, bFGF)  
Dopamine  
GnRH  
IL-6, Leptin  
Prolactin

other signals

Cyclins  
PI3K, Akt, Pak1, v-Src, IKK $\epsilon$   
Protein kinases A and C $\delta$   
Vav3  
Ets-1, Hif-1 $\alpha$   
AhR/Arnt (Dioxin receptor)  
(Progesterone and androgen receptors  
[in non-genomic signaling])

other factors