

Proto-oncogenes

★ Proto-oncogenes :

- Receives and process growth stimulating signals that are originating in extracellular environment.
- In presence of mutation, the cell receives continuous dysregulated stream of growth stimulating signals.
- Codes for
 - Growth factors : *Sis*
 - Growth factor receptors : *Her2*
 - Protein kinases/activators : *Src*, *Ras* and *Raf*
 - Cell cycle regulators : *Cyclin D*
 - Apoptotic proteins : *Bcl-2*
 - Transcription factors : *Myc*
- Not all growth factors are oncogenes and cell cycle regulators are proto-oncogenes.

★ Proto-oncogene to oncogene transformation could take place via:

