

Signalling molecules

Inducing signalling molecules are substances that act on a group of responding target cells and are released from a **signalling center**. This group includes growth factors, cytokines and hormones. They consist of glycoproteins, polypeptides and peptides.

TGF- β Superfamily

The family of **transforming growth factors β** (*TGF- β*) was discovered in virus-transformed cells. TGF- β inhibit cell division and stimulate the secretion of extracellular matrix components. TGF- β is involved in the specification of body axes, the formation of mesoderm, cartilage and bone.

FGF Superfamily

The family of **fibroblast growth factors** (*FGF*) includes more than 10 members important for both embryonic and postnatal periods of life. A group of factors was discovered in 1974. The factors work in close association with the extracellular matrix and their function requires binding to heparan sulfate. It transmits a signal via the MAP-kinase pathway, stimulates the growth of limbs, contributes to the regionalisation of the brain and to the specification of the **dorsoventral arrangement**.

Hedgehog Family

This group got its name from **fruit fly larvae** with a recessive allele of the **hh** (spiny belly) **gene**. A special member of the family is the **Sonic Hedgehog** gene, which is responsible for the dorsoventral arrangement of the neural tube and the anteroposterior arrangement of the limbs. The **Indian Hedgehog** gene is important in skeletal development.

Wnt Family

Wnt is a water-insoluble single-chain *polypeptide*. Its signalling pathway contains two sites of **repression**. Wnt has an important function in **kidney development** and myotome formation.

Delta-Notch System

The components of the system are the **ligand**' (Delta) and the **receptor**' (Notch). Both are built into the cell membrane and their interaction is possible only in close cell contact. The **Delta-Notch** system is important for neurogenesis and somitogenesis.

Other factors

Other inducing factors include:

- **LIF family** - maintains mouse germ cell pluripotency and induces human **kidney development**,
- **Insulin family** - growth regulation,
- **Neurotrophic factors (NTFs)** - necessary for the survival of neurons.

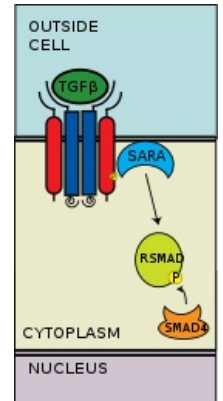
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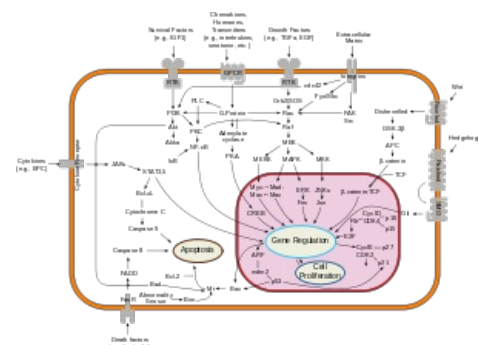
- Growth factors
- Cytokines
- Signal transmission in cells

Bibliography

- NOVOTNÁ, Božena. *Vývojová biologie pro mediky*. 1. edition. Karolinum, 2005. 99 pp. ISBN 80-246-1023-X.



TGF- β pathway (diagram)



Example of signal transduction pathways