

# Cytokines

Cytokines are molecules that transduce important informations between cells and have the power over growth regulation, cell division differentiation, inflammation and immunity defense.<sup>[1]</sup> At the same time they are fundamental regulators of the immune system and for some goals is necessary to coordinate the influence of different cytokines - these synergic and antagonistic interactions between cytokines are called **cytokine net**.<sup>[2]</sup> Cytokines are present in the body dissolved in a liquid (plasma, tissue fluid) or conjuncted to a membrane (so called membrane form). střed|náhled|550 px| Cytokinové receptory a přenos signálu – všeobecné schéma

## Basic characteristic of cytokines

- **pleiotropia:** cytokines effect more than one type of cell (e.g. B-lymfocytes, mast cells),
- **specificity:** the effect is typical only for a particular cytokine,
- **redundancy:** some cytokines, for a change, can be replaced with others e.g. IL-2 i IL-4 stimulates proliferation of B-lymfocytes,
- **synergism:** effects of different cytokines complete each other
- **antagonism:** one cytokine enables the effect of another cytokine (e.g. IFN- $\gamma$  blocks the switch to the synthesis of IgE, that induces IL-4<sup>[1]</sup>), náhled|250 px| Působení cytokinů
- cascade effect: one cytokine induces the production of another cytokine.

The effects of cytokines (determined by the distance of the target) can be:

- autocrine,
- paracrine,
- endocrine. (see the picture on the right for particularities)

## Receptors of cytokines

náhled|150 px| Příklad receptoru pro IL-7 náhled|250 px| Zapojení cytokinů do regulace buněčného cyklu a apoptózy Cytokine's receptor are composed of two subunits (sometimes three):

1. the first subunit is needed for a specific cytokine bond (is deposited in the extracellular matter),
2. the second (eventually third) is needed for a junction with intracellular signalisation molecules.

Signal transduction is allowed thanks to **protein kinase** (usually kinases of the group **How**). These kinases are non covalently joint to the intracellular part of the receptor. After the merge with a cytokine the kinases come closer together and activate each other. The activated enzymes phosphorylate other proteins and induce a cascade of reactions.

Beside protein kinases is important to mention **G-proteins** (btw. in 2012 for the studying of G-proteins was awarded the Nobel prize Nobelova cena (<https://www.nobelprize.org/?p=10071>)). Receptors for chemokines (see below) are associated with G-proteins. The principle of function is different from the principle of protein kinases, but the outcomes are similar: change of enzyme activity, regulation of cell cycle, degranulation ect.

In the end exist some receptors (e.g. for FGF, EGF, TGF- $\beta$ ), that have in their cytoplasm space a kinase domain (so called **receptor kinase**).

Final signalisation outcomes depend on the receptor's type and on the cooperation of other signals. Almost anything can happen form the stimulation proliferation, passing through the change of activity ionic channels and membrane enzymes to the activation of Apoptosis.

## Classification <sup>[2]</sup>

Historically there were lymphokines and monokines (molecules produced by lymphocytes, monocytes), but is not that accurate and nowadays is not used anymore. Cytokines can be than divided in these groups:

- interleukines (regulate mostly leukocytes),
- chemokines (e.g. IL-8, have a characteristic activity),
- interferons (part of antivirus immunity),
- transforming growth factors (*transforming growth factors*, TGF) – TGF- $\alpha$  stimulates mitosis, TGF- $\beta$  inhibits mitosis (structurally different molecules),
- colony stimulating factors (*colony stimulating factors*, CSF) – stimulate the differentiation of cells in bone marrow,
- tumor necrosis factors (*tumour necrosis factors*, TNF) – usually induce apoptosis,
- other growth factors – e.g. erythropoetin, FGF.

## Function classification

This division is only approximative, but it provides at least a closer orientation in the confusing cytokine net:

- inflammation supporting cytokines (**pro inflammation**), included chemokines: TNF, IL-1, IL-4, IL-6, IL-8, IL-12,
- inflammation inhibiting cytokines (**anti inflammation**): IL-6, IL-10, TGF- $\beta$ ,
- cytokines with growth factor activity of homopoetic cells: IL-2, IL-3, IL-4, IL-5, C-CSF, CD70, CD30L,
- cytokines fulfilling in **humoral immunity** (Th2): IL-4, IL-5, IL-9, IL-10, IL-13, TGF- $\beta$ ,
- cytokines fulfilling in **cell immunity** (Th1): IL-1, IL-2, IL-12, IL-15, IFN- $\gamma$ , TNF,
- cytokines with antiviral effect: IL-28, IFN- $\alpha$ , IFN- $\beta$ , IFN- $\gamma$ .

## Odkazy

### Související články

- Interferony
- Interleukiny
- Kolonie stimulující faktor
- Přenos signálů v buňkách

### Externí odkazy

- Cytokines & Cells Online Pathfinder Encyclopedia (<http://www.cells-talk.com/routingold/>)

### Reference

- 1.
- 2.

### Použitá literatura

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Kategorie:Imunologie Kategorie:Molekulární biologie Kategorie:Biochemie