

# Regulation of erythrocytes production

The regulation of erythropoiesis or the production of erythrocytes involves:

1. factors necessary for erythropoiesis
2. substances affecting erythropoiesis
3. hormones

## Factors necessary for erythropoiesis

These factors can be broadly divided into *substrates* and *biocatalysts*. Substrates are in particular substances necessary for the actual construction of erythrocytes, especially the construction of hemoglobin. Such substances are, for example, iron or amino acids. Biocatalysts are the various substances necessary for the synthesis of the individual erythrocyte components.

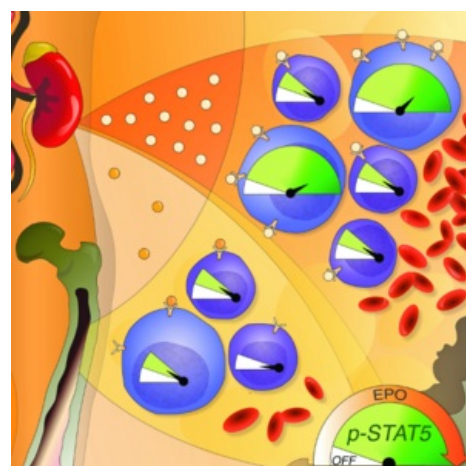
## Substances affecting erythropoiesis

These substances should not be missing in hematopoiesis, but they are not absolutely necessary. If some important substance missing, it could cause the erythropoiesis disorder or abnormal red blood cells. These include vitamin **B<sub>12</sub>** (important for the maturation of erythrocytes, important for DNA synthesis and therefore for the division of red blood cells, its deficiency develops pernicious anemia), **folic acid** (is part of the Coenzymes needed for DNAsynthesis, it is used in cell division and differentiation, deficiency causes macrocytic anemia), **vitamin B<sub>6</sub>** (required for synthesis heme), **vitamin C**, **zinc** (needed for transport iron from storage sites), **cobalt** (part of vitamin B<sub>12</sub>) and other **transcription factors** (eg. GATA-1).

## Hormonal regulation

The hormone involved in regulating erythrocyte production is **erythropoietin**. It is a glykoprotein that accelerates and stimulates erythrocyte proliferation and differentiation, increases the expression of transferrin receptors (which leads to greater iron uptake by the cell), further increases the expression of globin chains genes and enzymes required for heme synthesis. The erythropoietin receptors are on erythroblasts and progenitor cells.

Erythropoietin (EPO) is formed mainly in the liver and kidneys, which contain the most EPO mRNA. The stimulus for its formation is mainly tissue hypoxia. Conditions that lead to hypoxia can be, for example, higher altitude, heart failure, lung disease, etc. Other stimulatory causes are exercise, excitement, menstruation, pregnancy and menopause. Substances that also induce EPO production are cobalt salts, STH, ACTH, thyroid hormones, renal prostaglandins, testosterone. In contrast, EPO production is inhibited by higher doses of glukokortikoid and estrogens. The half-life of EPO in the blood is about five hours, it is degraded in the liver. Erythropoietin levels rise significantly in anaemia. **Recombinant erythropoietin**, is also used to treat anemia in chronic renal insufficiency, to stimulate erythrocyte production in patients who have had blood drawn before autotransfusion, and to reduce Dyspnoea in athletes (this is considered doping and is illegal).



Erythropoietin effect

## References

### Related articles

- Erythropoiesis
- Erythropoietin
- Hemoglobin

### Source

- CANTOR, Alan – ORKIN, Stuart. *Transcriptional regulation of erythropoiesis: an affair involving multiple partners* [online]. ©2002. [cit. 2022-02-03]. <<http://www.nature.com/onc/journal/v21/n21/abs/1205326a.html>>.

### Literature used

- GANONG, William F. *Přehled lékařské fyziologie*. 20. edition. Galén, 2005. 890 pp. ISBN 80-7262-311-7.

- TROJAN, Stanislav – TROJAN, Stanislav. *Lékařská fyziologie*. 4. edition. Grada, 2003. 772 pp. ISBN 80-247-0512-5.