

Regulation of erythropoiesis

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The regulation of erythropoiesis (production of erythrocytes) with the following components:

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

Factors essential for erythropoiesis

These factors can generally be divided into so-called **substrates** and **biocatalysts**. Substrates are in particular substances needed for the construction of erythrocytes, in particular the construction of hemoglobin. Substrates are, for example, iron or amino acids. Biocatalysts are various substances needed for the synthesis of individual components of erythrocytes.

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 **B₁₂** (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 DNA synthesis, it is used in cell division and differentiation, deficiency causes macrocytic anemia), **vitamin B₆** (required for heme synthesis), **vitamin C**, **zinc** (needed for transport iron from storage sites), **cobalt** (part of vitamin B₁₂) and other **transcription factors** (eg. GATA-1).

Hormonal regulation

náhled|vpravo|Efekt erythropoetinu The hormone involved in regulating erythrocyte production is **erythropoietin**. It is a glycoprotein 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, growth hormone (GH), adrenocorticotrophic hormone (ACTH), thyroid hormones, renal prostaglandins, testosterone. In contrast, EPO production is inhibited by higher doses of glucocorticoids 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 anemia. **Recombinant erythropoietin** is also used to treat anemia in chronic renal failure, 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).

Links

Related articles

- Erythropoiesis
- Erythropoietin
- Hemoglobin

Source

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Used literature

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