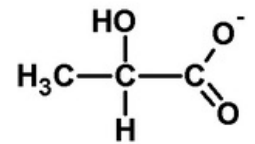


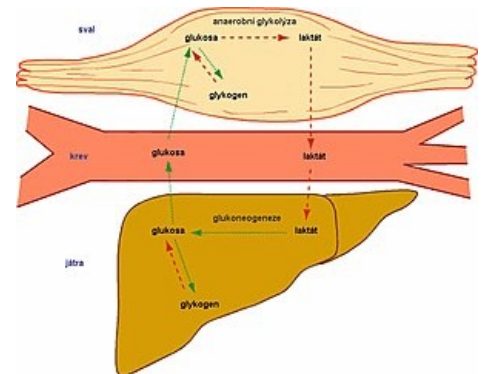
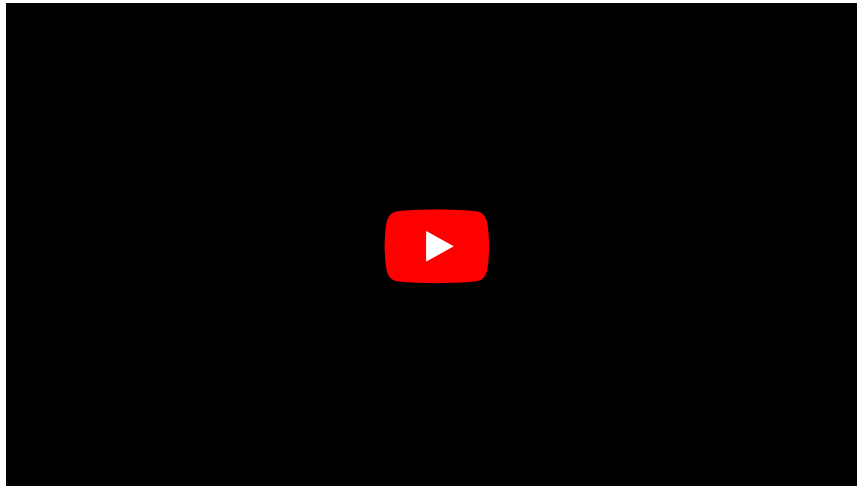
# Lactate

**Lactate** is the conjugate base of lactic acid, which is produced during anaerobic glycolysis by converting pyruvate using lactate dehydrogenase (LD). The level of lactate in the blood is determined by the ratio between its formation and its breakdown (gluconeogenesis) in the liver. Hyperlactatemia, later lactic acidosis, arises from either overproduction or insufficient utilization of lactate. The following are involved in the formation of lactate (in descending order): skin, erythrocytes, brain, muscles, intestinal mucosa, leukocytes, thrombocytes. Lactate is further transported by blood to the liver, where it is used for gluconeogenesis (Cori cycle), a smaller part of the lactate is used by the kidneys (for gluconeogenesis and urine excretion), the rest is metabolized by the myocardium and other organs. The accumulation of lactate in the muscles decreases the pH, and this is the cause of muscle fatigue and pain.



Lactate formula.

## Lactate acidosis:



Cori's cycle – connection of anaerobic glycolysis in muscles with gluconeogenesis in the liver.

**Reference limits** : lactate in blood serum = 0.6–2.1 mmol/l.<sup>[1]</sup>

**⚠ The concentration of lactate in the blood changes rapidly after sampling – its concentration rises due to glycolysis in the blood elements.**

## Hyperlactic acidemia

Causes:

- tissue hypoxia
- tissue ischemia and hypoperfusion
- hypoventilation (spontaneous or controlled)
- intensive short-term sports activity
- poisonings that lead to tissue hypoxia (e.g. CO poisoning, methemoglobinemia, cyanide poisoning)
- overproduction of lactate during ethanol intoxication and certain metabolic defects (mitochondrial disorders, type I glycogenosis, etc.)
- insufficient breakdown of lactate in some hepatopathies

[2]

## The role of lactate in glycolysis

In the absence of oxygen (absolute and relative), phosphoenolpyruvate is hydrolyzed to pyruvate during glycolysis to release energy. Pyruvate is further reduced (hydrogenated) to lactate using lactate dehydrogenase (LD). The hydrogen donor is  $\text{NADH} + \text{H}^+$ , which is oxidized to  $\text{NAD}^+$  in this reaction. The  $\text{NAD}^+$  level needs to be maintained for anaerobic glycolysis. <sup>[3]</sup>

Although the reaction of converting pyruvate to lactate is reversible, LD prefers the formation of lactate rather than its oxidation. At the same time, lactate is not further metabolized by another mechanism. If the reaction is to be reversed, pyruvate must be rapidly removed.

## Lactate breakdown

Lactate is transported by blood to the liver, where it is re-oxidized to pyruvate. Pyruvate is converted back to glucose in the liver for energy consumption.

 For more information see *Gluconeogenesis*.

## Clinical notes

- Values for shock:
  - 1.3-4.4 mortality 18-22%;
  - 4.5-8.9 - 73%;
  - above 13 - 100%;
- an increase in lactate in sepsis is a sign of the transition to a metabolically decompensated stage.<sup>[1]</sup>

## Links

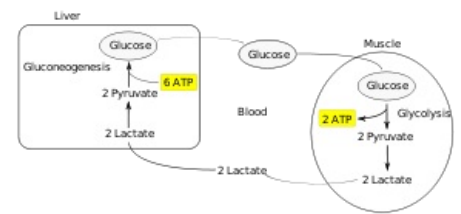
### Related Articles

- Lactate dehydrogenase
- Cori cycle
- Anaerobic glycolysis
- Gluconeogenesis
- Metabolic acidosis

### Reference

ws:Laktát

- 1.
2. [https://nemocnicepodhorska.agel.cz/obsah/oddeleni/okbh\\_bruntal/\\_downloads/lab/laktat.pdf](https://nemocnicepodhorska.agel.cz/obsah/oddeleni/okbh_bruntal/_downloads/lab/laktat.pdf)
- 3.



The Cori cycle.