

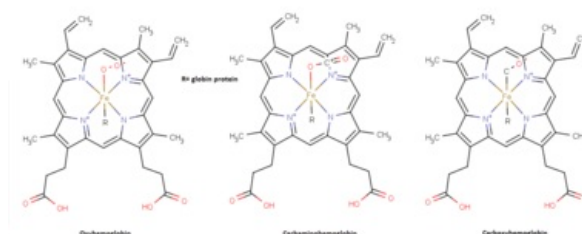
# Carboxyhemoglobin

**Carboxyhemoglobin (CO-Hb)** forms when carbon monoxide binds to the oxygen binding site on the hemoglobin molecule instead of an oxygen molecule. Carbon monoxide has a very strong affinity to hemoglobin, the **bond formed is 250-300 times stronger** than when oxygen binds to hemoglobin. It is only marginally soluble in water/blood plasma. In contrary to oxyhemoglobin, carboxyhemoglobin cannot bind and transport oxygen molecules which leads to cell hypoxia. Binding of carbon monoxide to hemoglobin is however reversible, which is used in the therapy of carbon monoxide poisoning. Oxygen (O<sub>2</sub>) therapy (breathing in 100% oxygen) is the first-line treatment.

Small amounts of **carbon monoxide are produced in the human body** in the metabolism, so a small percentage of hemoglobin is always bound to some residue carbon monoxide. In people living in the city, around 2% of hemoglobin molecules are in the form of carboxyhemoglobin. In avid smokers, the percentage of carboxyhemoglobin rises up to 10%.

Carbon monoxide is a colourless, odourless and tasteless gas and is highly toxic. Humans cannot detect CO by either sight, taste or smell, which may result in accidental intoxication. Inhalation is the only exogenous route for carbon monoxide exposure. Only a few minutes spent in a room, breathing in air containing 0.1% CO can increase the percentage of carboxyhemoglobin (compared to total hemoglobin) in blood to 50% due to its strong affinity to hemoglobin. <sup>[1]</sup>

Carboxyhemoglobin is **carmine red** in colour, which is the reason why patients with heavy carbon monoxide intoxication present with noticeably rosy skin.



Hemoglobin forms (structures)

Signs and symptoms of carbon monoxide (CO) poisoning

% CO-Hb values	Signs & symptoms
10	shortness of breath during exercise
20-40	headaches, fatigue, vomiting, shortness of breath (during rest)
40-60	hyperventilation, tachycardia, syncope, muscle spasms, chest pain
60-80	seizures, respiratory failure, coma, death

Carbon monoxide is produced by the incomplete combustion of fuels – carbonaceous fuels, such as petrol, wood, natural gas and coal. In cities, its main source are exhaust fuels from engines and during an accidental fire in enclosed spaces. Compared to hemoglobin, carboxyhemoglobin is more resistant to chemicals, thus changes more slowly under the influence of various chemical agents.

## Links

### Related articles

- Hemoglobin and its derivatives
- Carbaminohemoglobin
- Hemoglobin
- Carbon monoxide poisoning

### References

1. National Library of Medicine: National Center for Biotechnology Information. *WHO Guidelines for Indoor Air Quality : Carbon monoxide* [online]. World Health Organization, ©2010. [cit. 2022-11-17]. <<https://www.ncbi.nlm.nih.gov/books/NBK138710/>>.

### External links

- Carbon monoxide poisoning (Akutne.cz) (<https://www.akutne.cz/algorithm/cs/257--/>)