CO2 dissociation curve

Describes the relationship between PCO2 and total CO2 concentration in blood.

Three Forms of Carbon Dioxide in the Blood

1. **Physically dissolved CO2 (~5%)**

Henry's law : dissolved CO2 increases linearly with increases in PCO2

CO2 solubility = 0.06 mL CO2/dL blood/mm Hg (20 times higher than O2 solubility)

2. **Carbamino compounds (small)**

CO2 joins reversibly with non-ionized terminal amino groups (-NH2) of blood borne proteins

3. Most of the **CO2 in the blood is transported in the bicarbonate ion form via carbonic anhydrase:**

$CO2 + H2O \Leftrightarrow H2CO3 \Leftrightarrow H+ + HCO3-$

RBCs are source of carbonic anhydrase, and histidine residue of Hb carries the H+

The CO_2 dissociation curve describes the change in the total CO2 content of blood which occurs with changing partial pressure of CO_2.

- This curve is more linear and steep than the oxygen-haemoglobin dissociation curve. When CO_2 *content* increases substantially, *partial pressure* of CO_2 does not change very much
- It has no plateau(it just keeps going up)
- As the result of this, shunt has little effect on CO_2 (increasing the ventilation of already well-ventilated regions will improve CO_2 exchange, even though it will not improve oxygenation)

There are two main points of interest along this curve:

- **The arterial point** corresponds to the CO_2 content of arterial blood:
  - PCO_2 = 40 mmHg
  - CO_2 content is 480 ml/L (or, 48ml/dL)
- **The mixed venous point**: CO_2 content of mixed venous blood:
  - PCO_2 is 46 mmHg
  - CO_2 content is 520 ml/L.
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- Haldane effect: Deoxygenation of the blood increases its ability to carry carbon dioxide, and vice versa.
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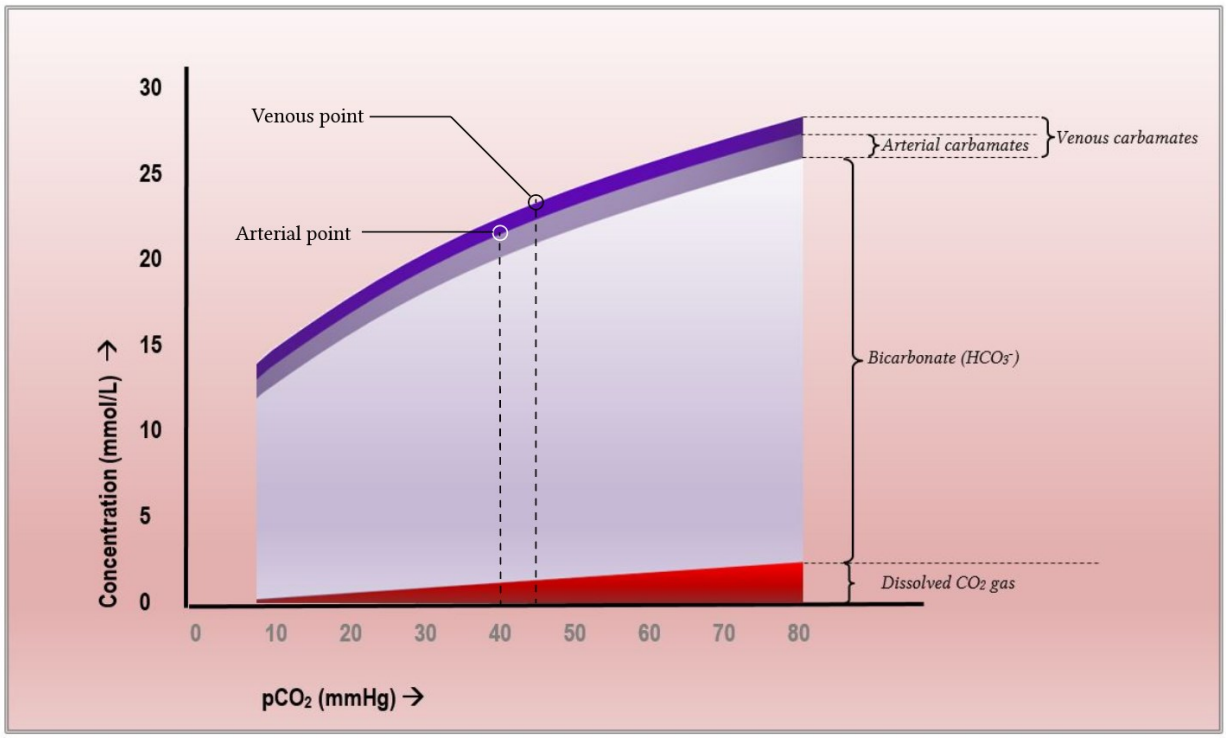
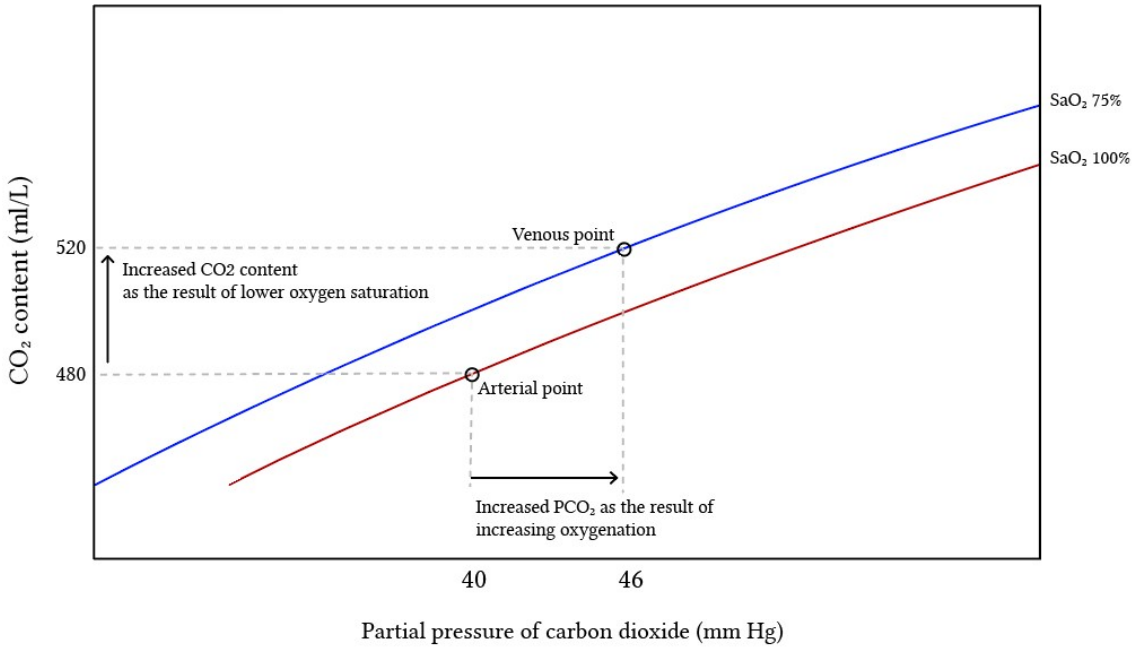
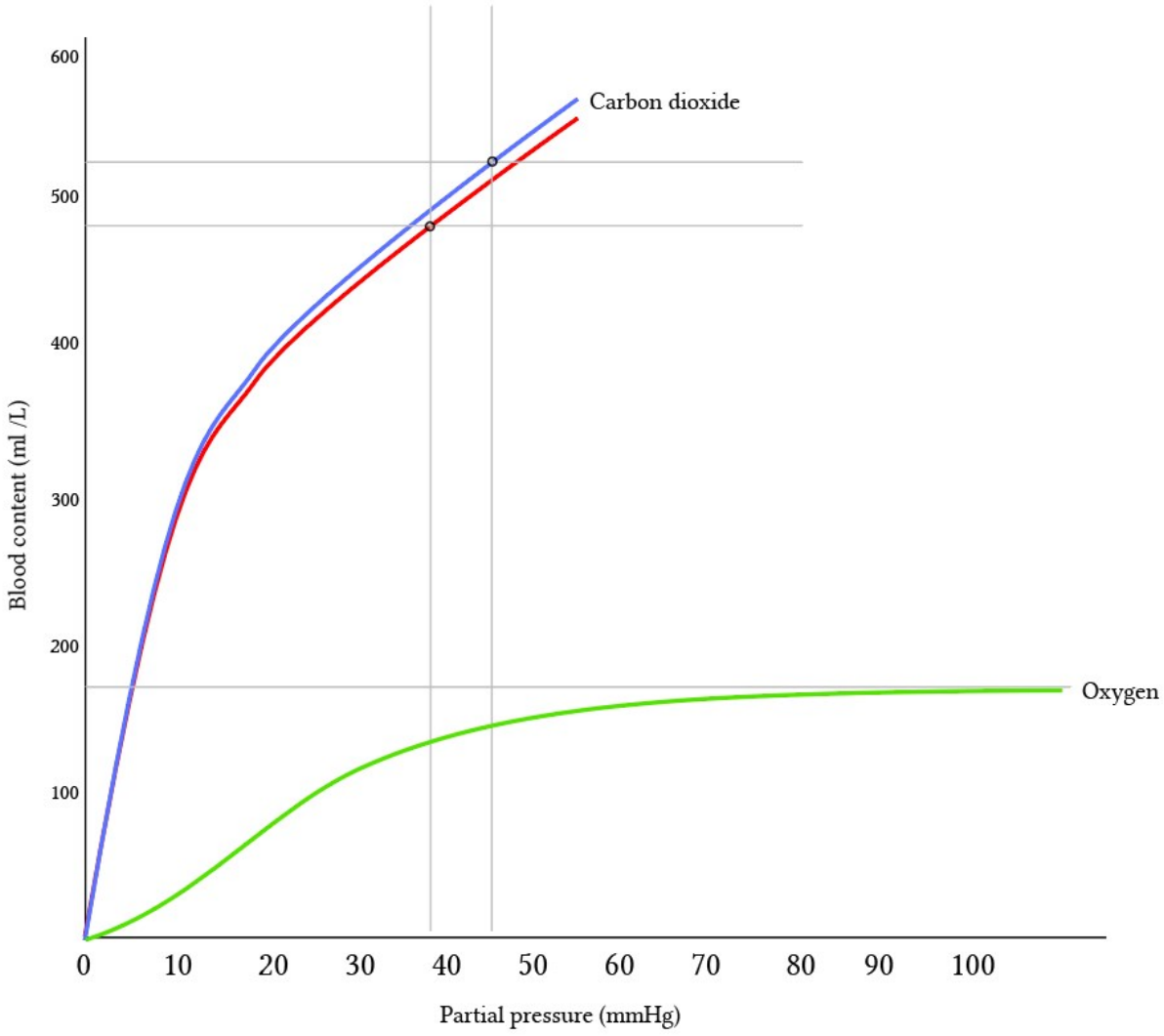
The physiological CO_2 dissociation curve is a line which connects the venous and arterial points, and represents the normal physiological progression of blood on the way through the circulation







A comparison of oxygen and carbon dioxide dissociation curves

The sigmoid shape (specifically, the plateau) of the oxygen-haemoglobin dissociation curve gives rise to a phenomenon whereby it is impossible to compensate for a shunt. As blood travelling through well-ventilated regions of the lung is already maximally oxygenated (i.e. lays along on the plateau), there is no way you can get any better oxygenation by increasing ventilation. In contrast, because the CO_2 dissociation relationship is more linear, increasing ventilation of the already well-ventilated regions will still continue to improve the CO_2 clearance from those regions, and increasing the minute ventilation can compensate for even very large shunt (up to 50%, apparently).