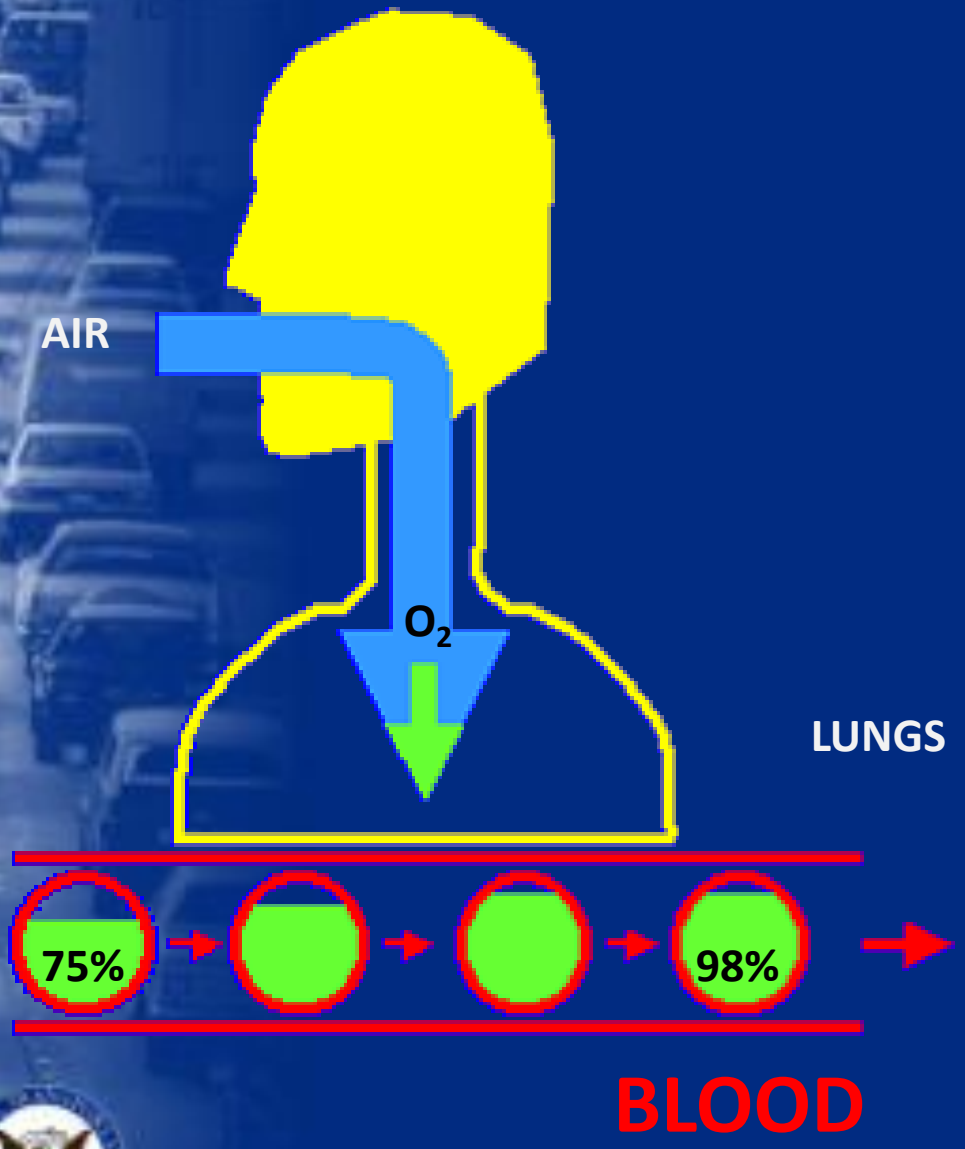
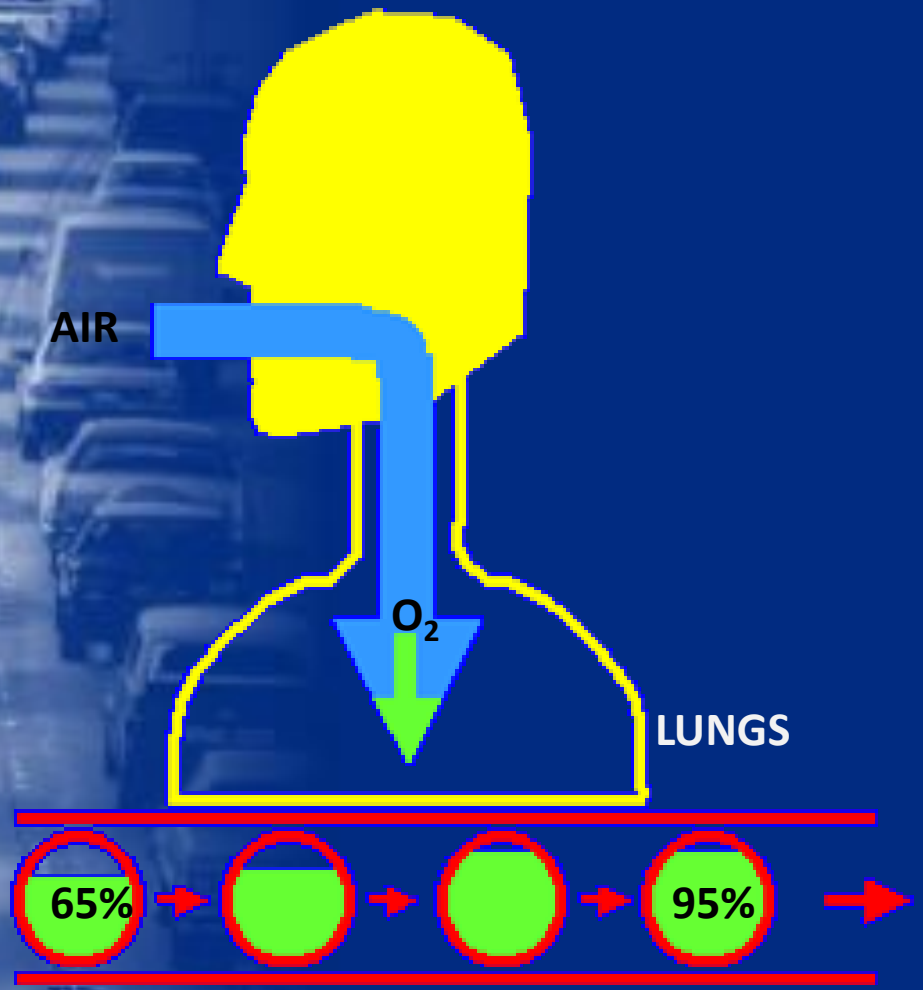
Physiology of altitude-related hypoxia

Sea Level



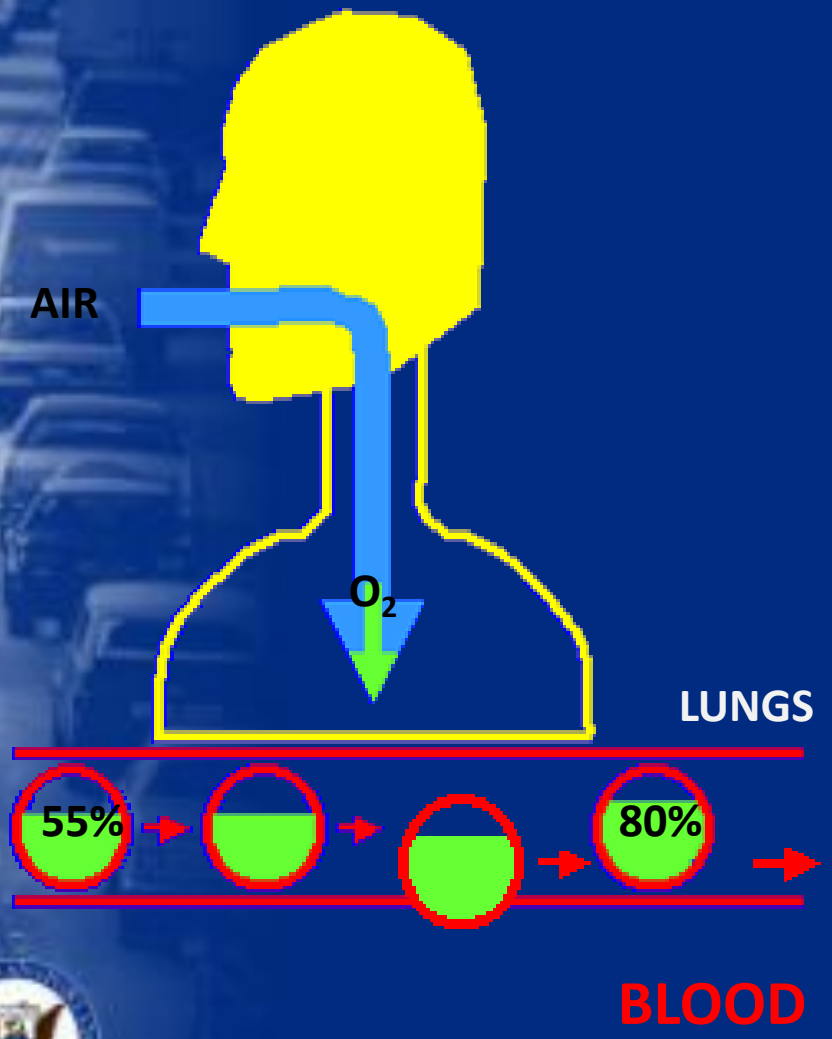
- breathing - air drawn into lungs
- 21% oxygen
- blood enters lungs 75% full of oxygen
- blood leaves lungs 98% full to supply body, brain (12-14 seconds later)

8,000 feet



- 25% lower air, O_2 pressure
- blood enters lungs 65% saturated, leaves 95%
- effects:
  – worse night vision
  – difficulty with new tasks

15,000 feet

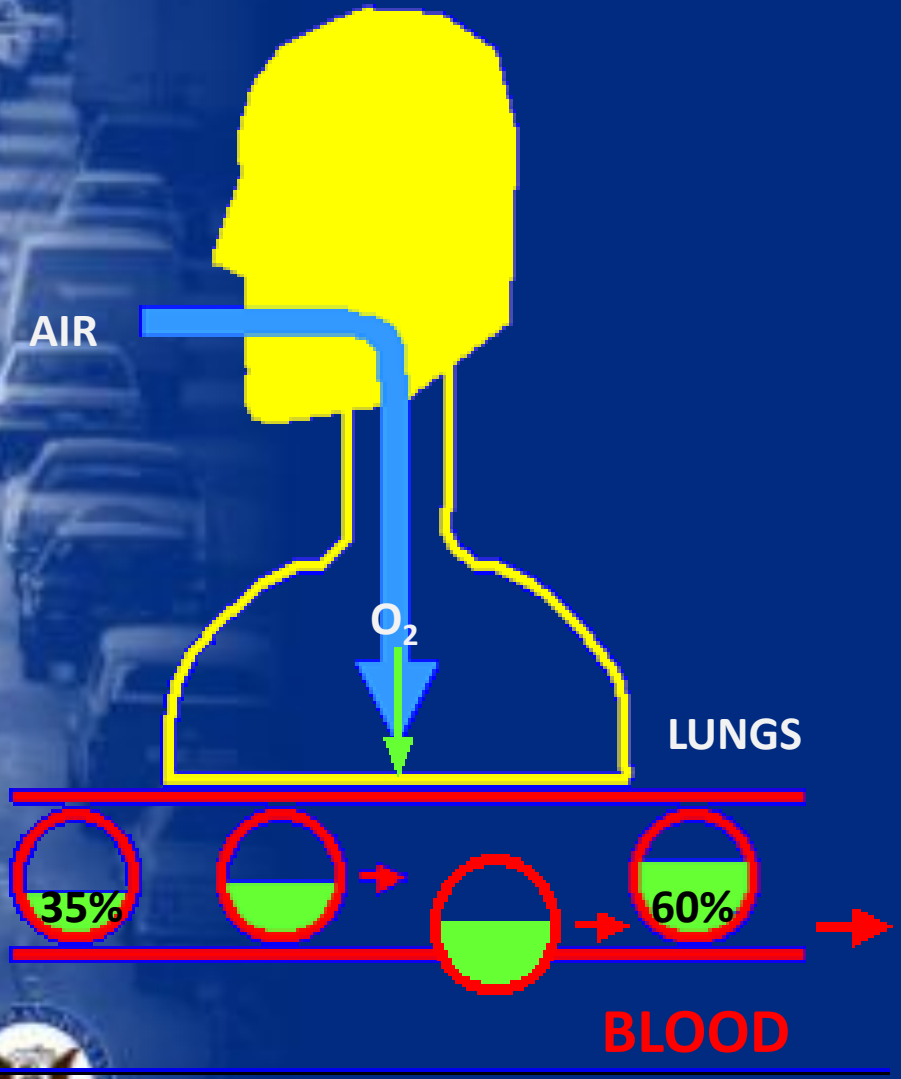


- 45% lower air, O_2 pressure

- blood enters lungs 55% saturated, leaves 80%

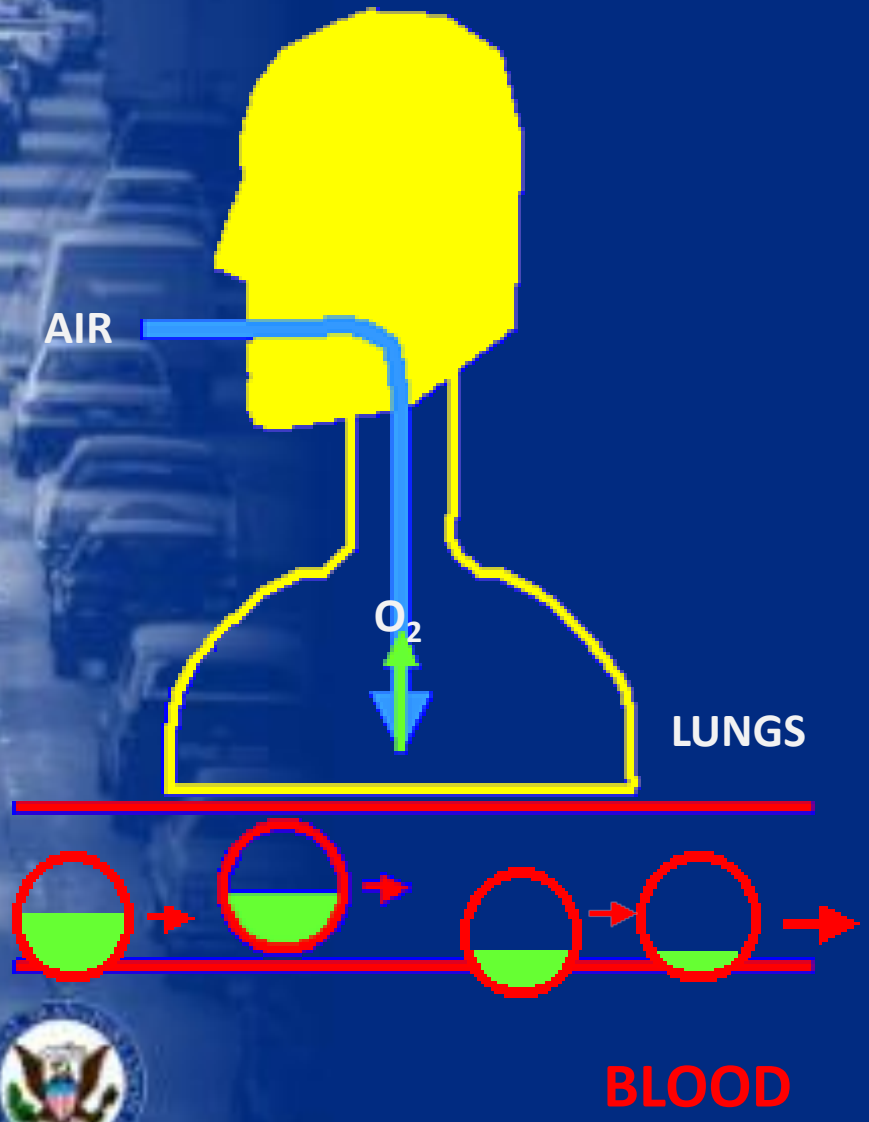
- Effects:
  - -reduced physical capacity
  - -impaired skilled task performance

25,000 feet



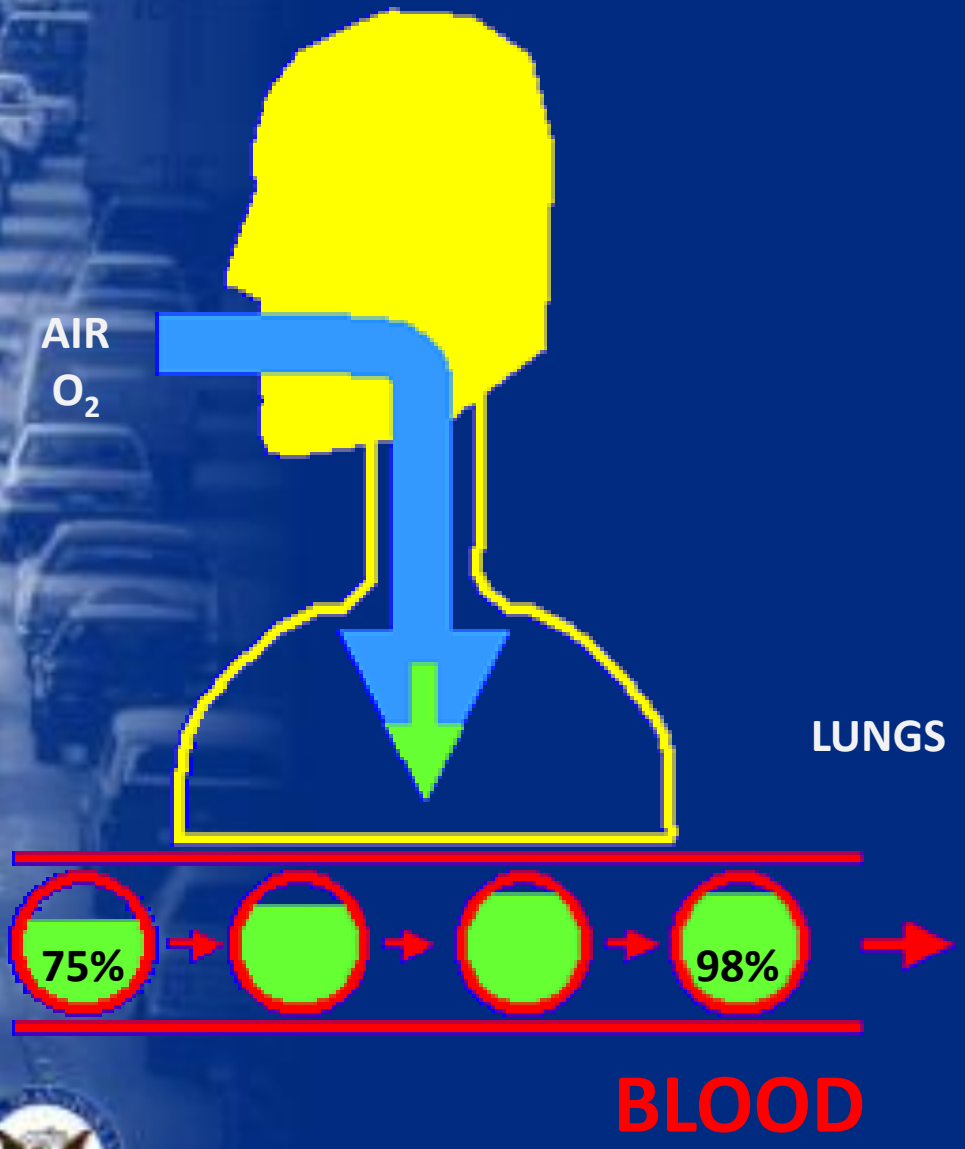
- 65% lower air, O_2 pressure
- blood enters lungs 35% saturated, leaves 60%
- effects:
  - -obvious physical, mental impairment
  - -unconsciousness

35,000 feet



- 75% lower air, O_2 pressure
- oxygen may flow from the blood into the air
- effects:
  -incoherence in seconds
  -loss of consciousness

35,000 feet (with O_2)



- air pressure still 75% lower
- O_2 pressure the same as at sea level
- in decompression, rapid delivery of 100% O_2 restores normal saturation in seconds

Time of Useful Consciousness
(Effective Performance Time)

- Used to suggest length of time before incapacitation due to hypoxia
- Based on studies using very simple tests
- Doesn't account for prior impairment
- Example: - 30,000 feet
  - textbook: 1-2 min of useful consciousness
  - study: 8 seconds to saturation of 76%

Rapid Decompression
S_aO_2 - delay in 100% O_2 supply

(from Marotte H et.al. *Rapid decompression of a transport aircraft cabin: Protection against hypoxia.* Aviat. Space Environ. Med. 1990; 61;21-7.)