Tissue oxygen supply determined by Microvascular Oxygen Saturation (µSO2), Blood Flow (BF) and subcutaneous Tissue pO_2 (PsqO2) during whole Body Heating and Normobaric Hyperoxia in healthy Volunteers

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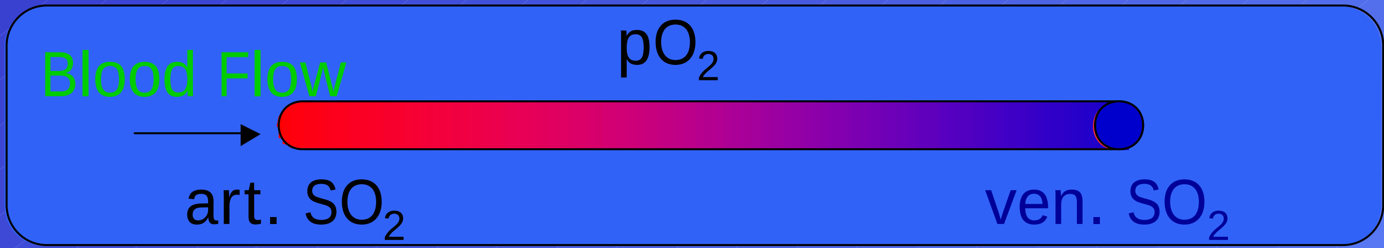
Introduction

Determination of **oxygen supply of tissue** needs observation of parameters of **microcirculation**



Aim:

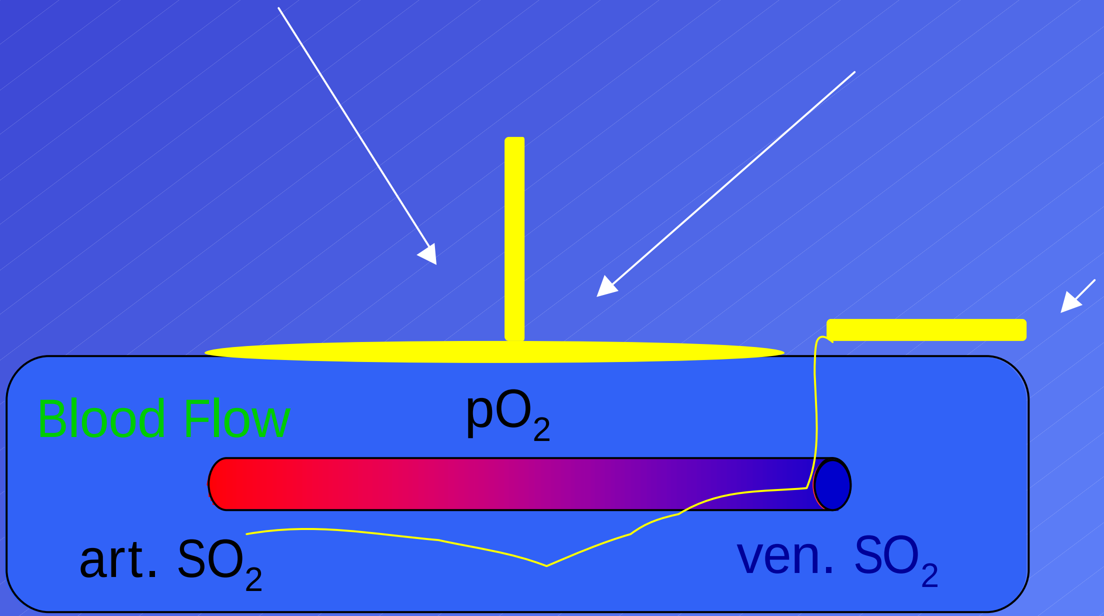
- **Comparison of methods of measurement of tissue oxygen supply**
  - established pO_2 Electrode + Laser Doppler with tissue spectometry
- **in modell of**
  - whole body warming
  - normobaric hyperoxia

<u>Methods</u>

Laser-Doppler (OptoFlow)

optical, Doppler Principle
Blood flow velocity (BF),
about 2 mm under probe

Tissue Spectrometry (AbTisSpec)
optical, Absorption-Remissionprinciple
Oxygen saturaiton of hemoglobin (μSO_2), about 2 mm below probe

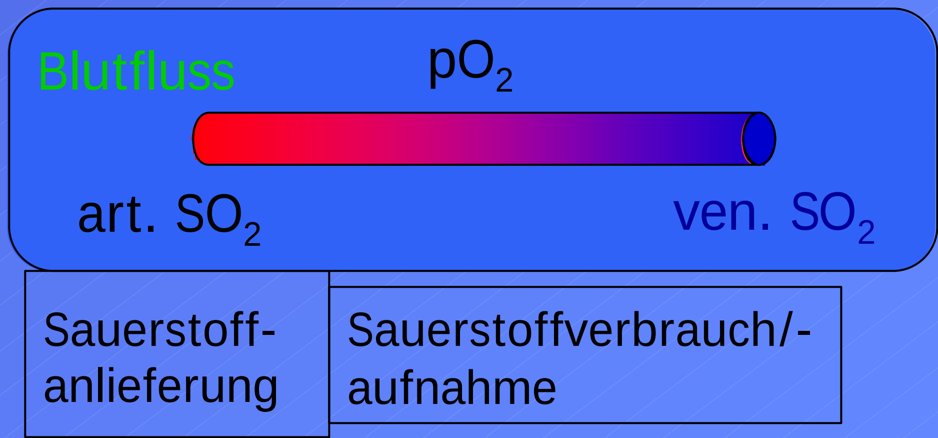


subcutaneous
oxygen electrode
(Licox)
polarographic
pO_2 ($PsqO_2$)
about 0,1 mm
distant of electrode

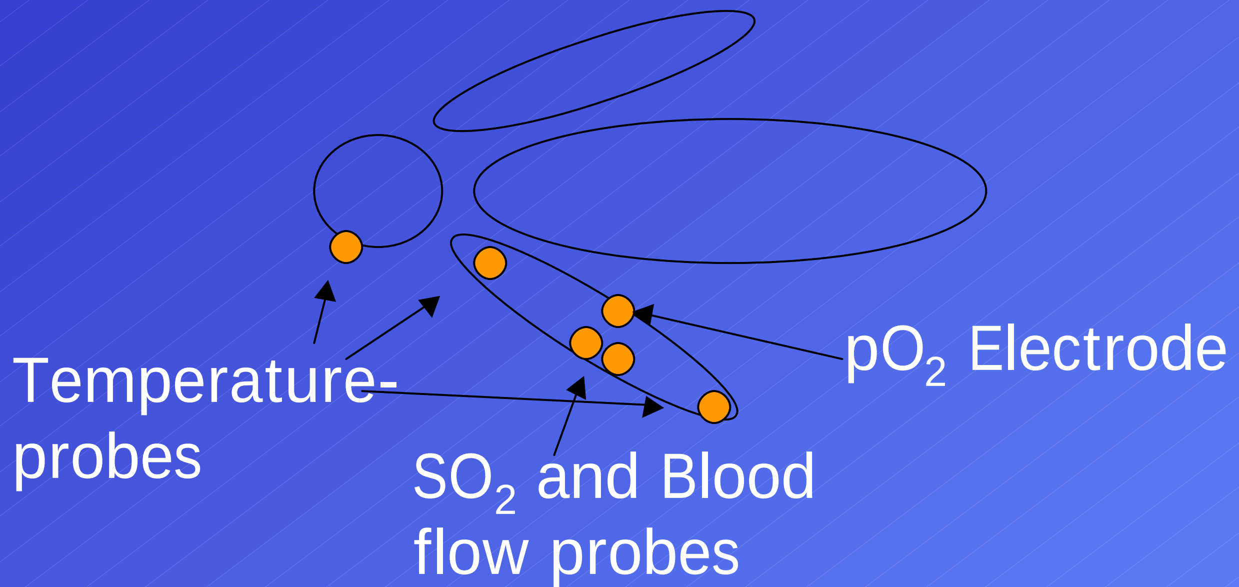
Modells

- Whole body warming
  - with warming blanked increasement of body temperature till sweating
  - active vasodilatation -> pO_2 and blood flow increases
  - Change in SO_2 because of increased delivery

- Normobaric hyperoxia
  - Increasement of blood oxygen content by about 15%
  - pO_2 increases, blood flow decreases, oxygen delivery?



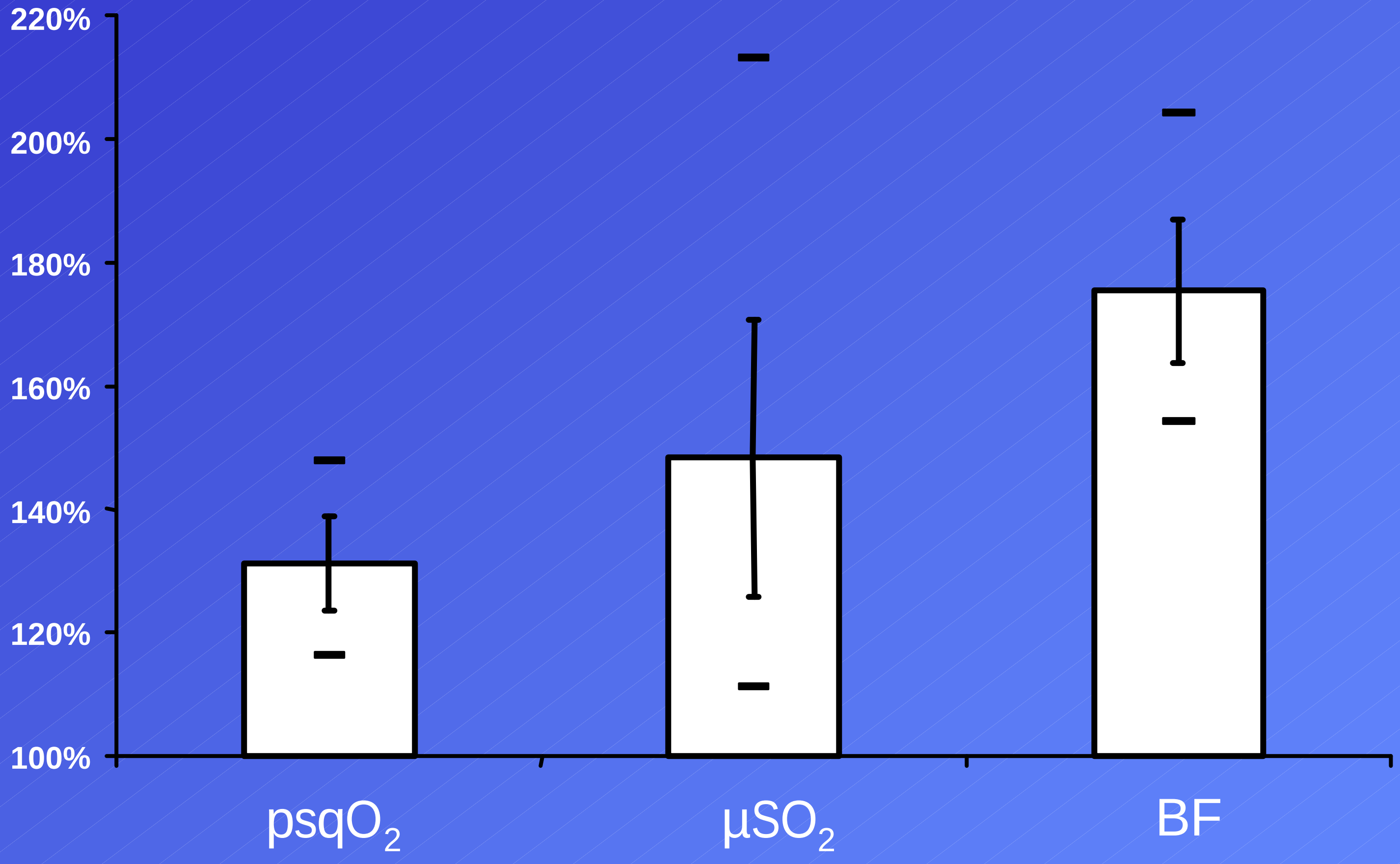
Experimental Protocoll



15 min Base-line	Increasing body temperature till sweating, maximally 1 h	15 min Base-line	15 min 100% O_2 through mask

Results whole body warming

Increase: PsqO2, µSO2, BF with S.E.M and minimum and maximum, n = 4

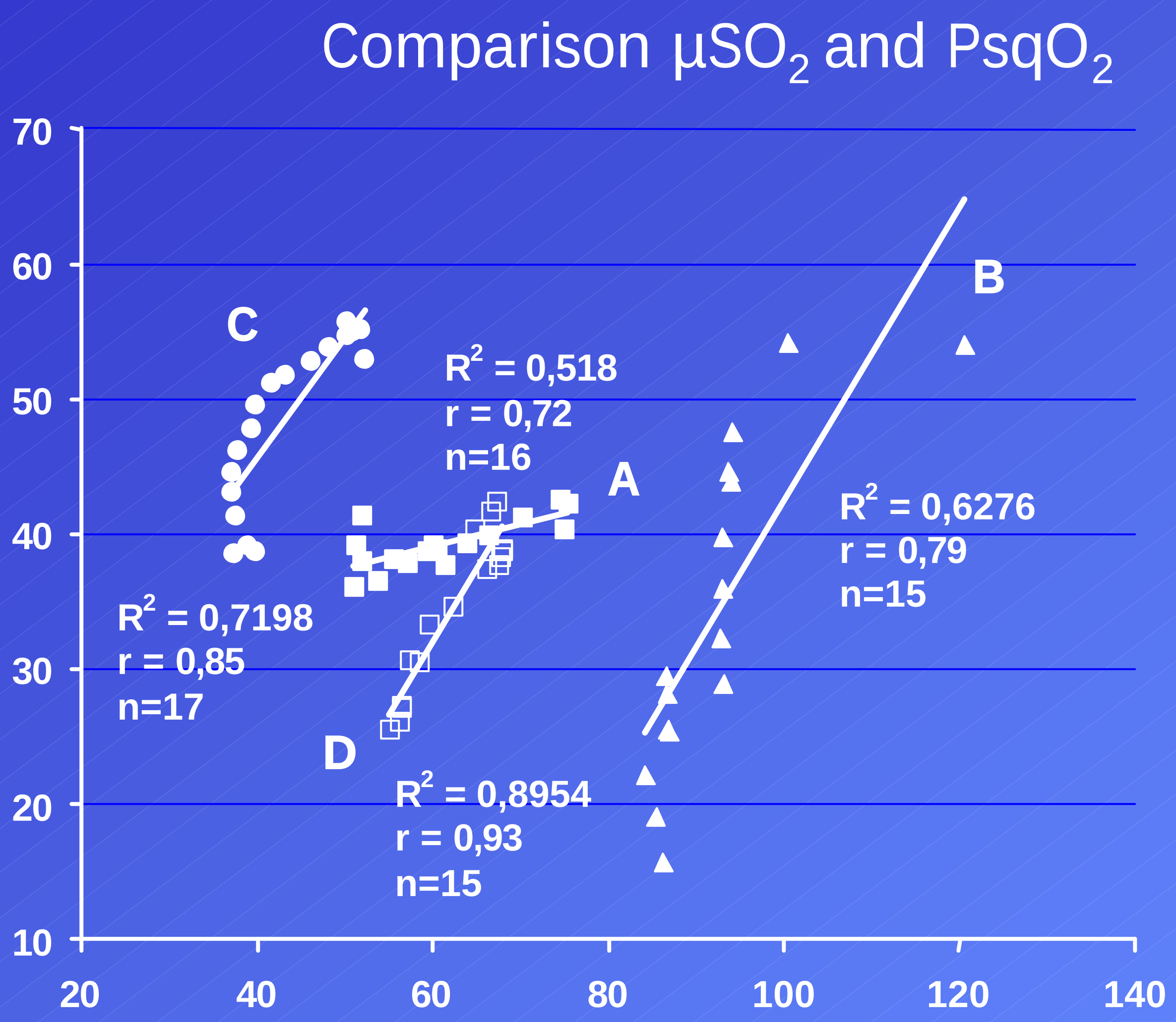


$PsqO_2$:
+ 0,31 ± 0,08
μSO_2:
+ 0,50 ± 0,20

BF:
+ 0,75 ± 0,12

Temp:
+0,11 ± 0,01

Results whole body warming



- BF, μSO_2, $PsqO_2$ increase
- Correlation between μSO_2 and pO_2, $p<0{,}005$
- no correlation of absolute values
- Correlation between BF and $PsqO_2$,

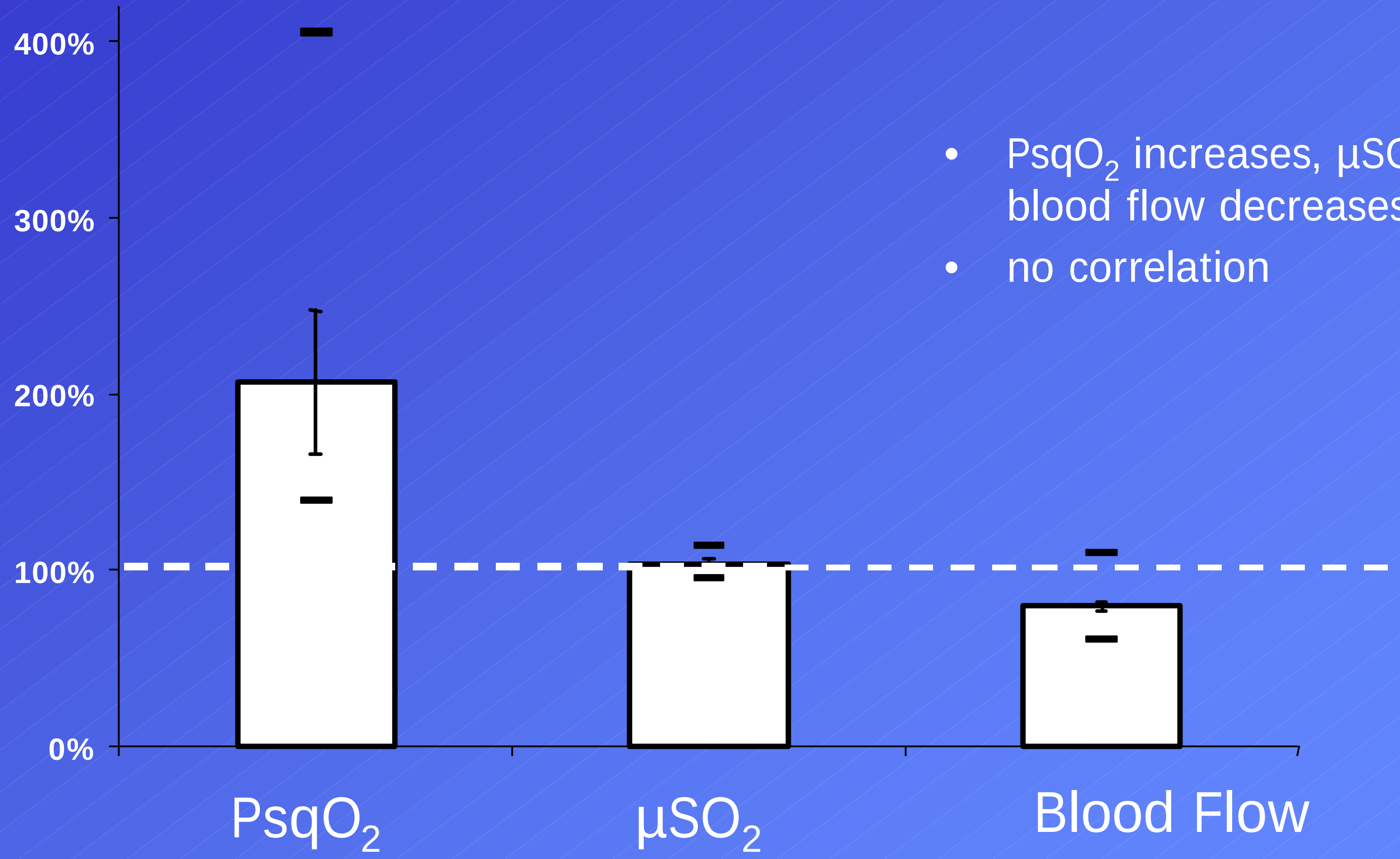
  (r: 0,89, 0,80, 0,96, 0, 88)

  BF and μSO_2

  (r: 0,54, 0, 87, 0,83, 0, 93)

Results Hyperoxia

$PsqO_2$, μSO_2, BF with S.E.M and min. and max., n = 6



- $PsqO_2$ increases, μSO_2 const., blood flow decreases
- no correlation

Discussion

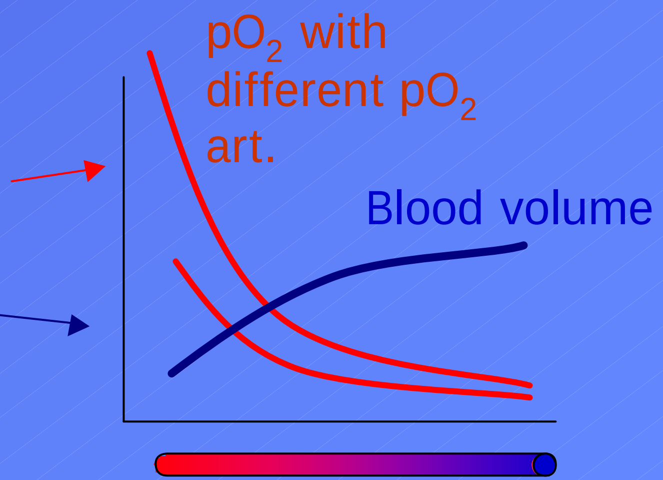
- during warming

  good correlation of $PsqO_2$, μSO_2, and BF, oxygen transport increased

- during hyperoxia

  no correlation, subcutaneous pO_2 measurement and local optic SO_2 measurement show different physiological parameter

- pO_2-Electrode especially sensitive for arterial pO_2
  - optic SO_2 determination especially in venous area + no arterial SO_2 change with increased arterial pO_2 -> no determination of arterial oxygen increase



Discussion

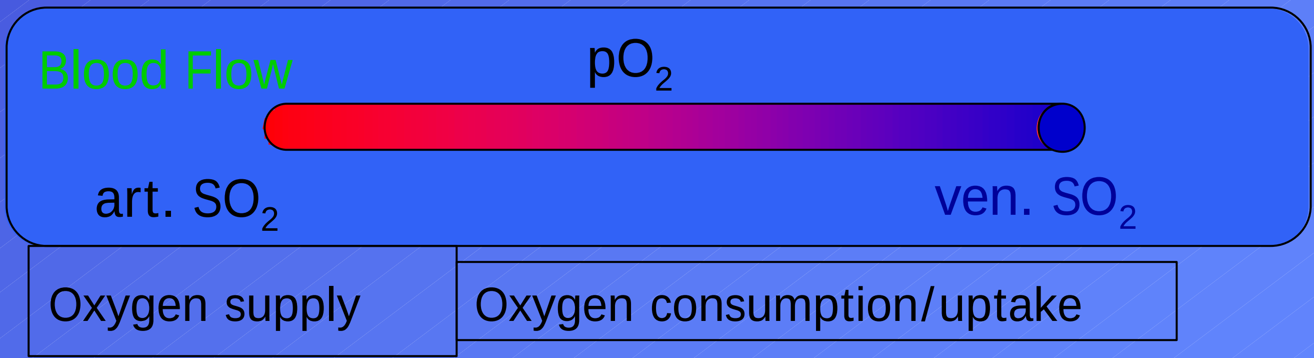
Implications for tissue oxygen supply during normobaric hyperoxia:

Art. or tissue-pO_2 increases, venous SO_2 constant, blood flow decreases:

◊ same oxygen supply with decreased blood flow

◊ increased oxygen supply (despite decreased flow) with increased consumption

◊ (Change of oxygen binding curve with increased oxygen uptake of tissue)



Conclusion + further Questions

- Local SO_2 and pO_2 are different measurement parameter
- Only by measurement of all parameter a complete picture of oxygen supply is achieved (Aim: Determination of supply, consumption, hypoxia „lethal corner“)
- Conditions of constant blood flow during hyperoxia?
  - Measurement in wound
  - Measurement in diabetic neuropathy
- Hyperbaric Hyperoxia?