

LEA Medizintechnik

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Title

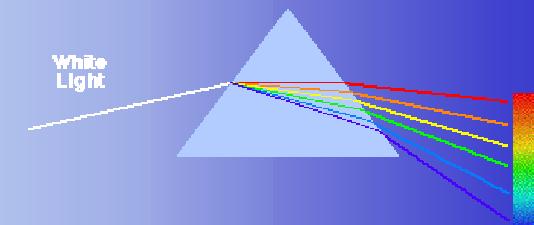
Determination of oxygen metabolism in tissues by combined white light spectrometry and laser spectroscopy – an overview about method and study results.

Key Technologies

- Laser Spectroscopy



- White Light Spectrometry



- Glas Fibre Technology

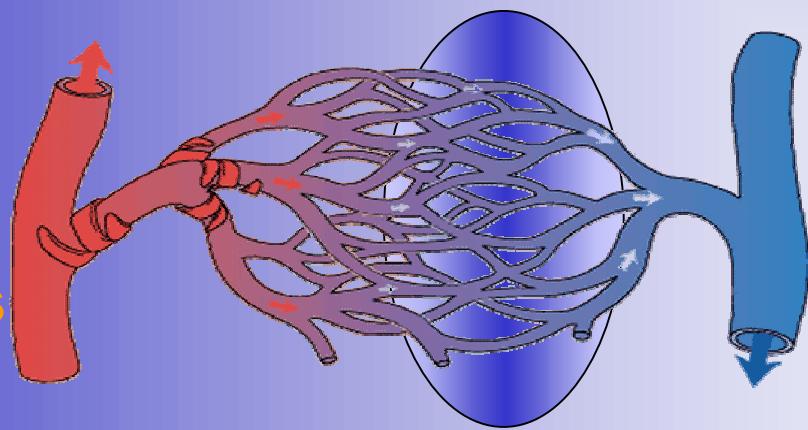


- Optical Sensors
(worldwide patents)



O2C (oxygen to see)

- Laser- and White-light spectroscopy
- continuous monitoring of
- blood flow (capillary microcirculation)
- venular oxygen saturation (hypoxia)
- capillar-venular filling with blood (venous congestion)
- 50 ms measurement time
- depth selectiv (e.g. skin, muscle, bone) 100 µm - 15 mm

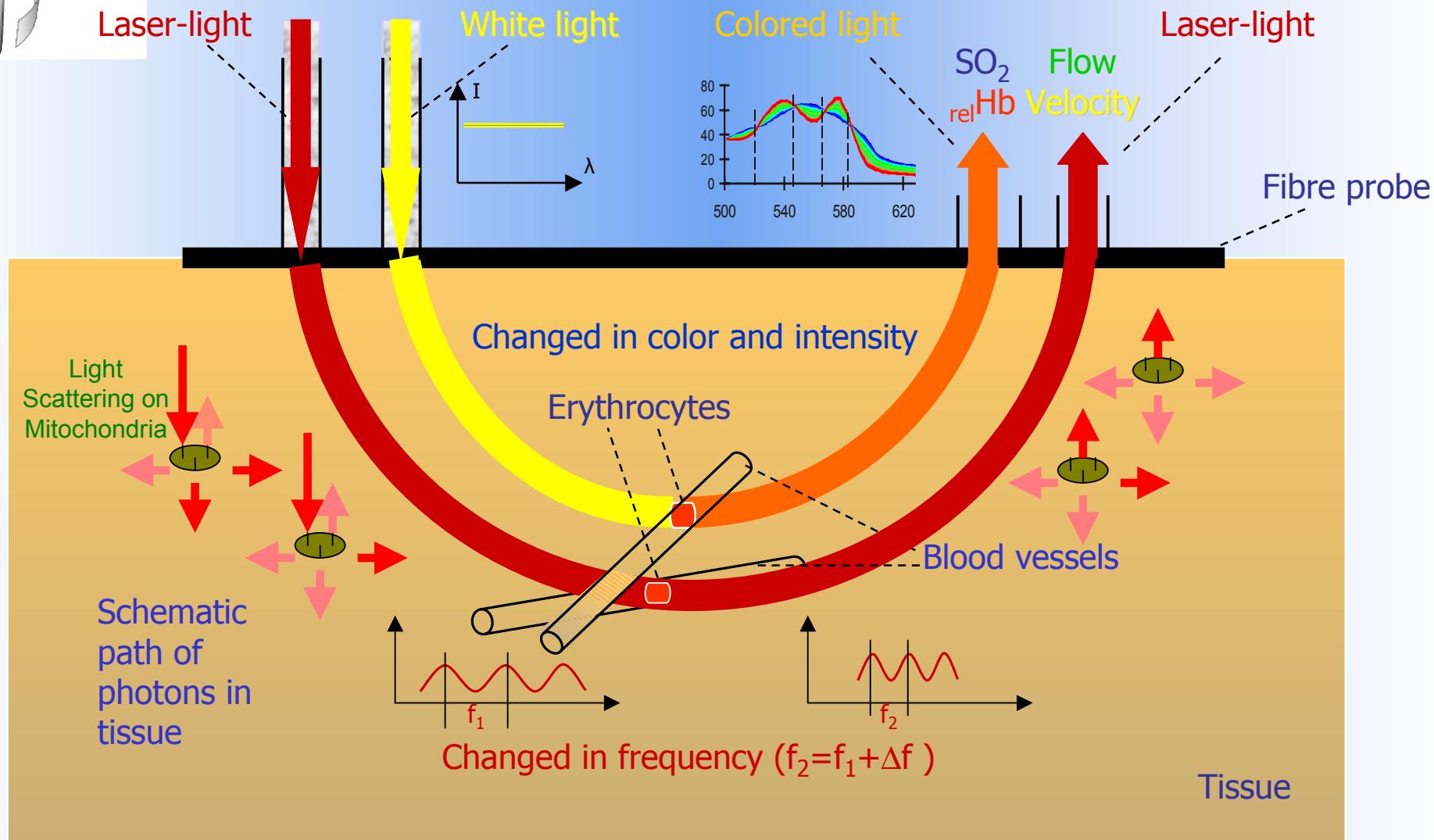


Disadvantages

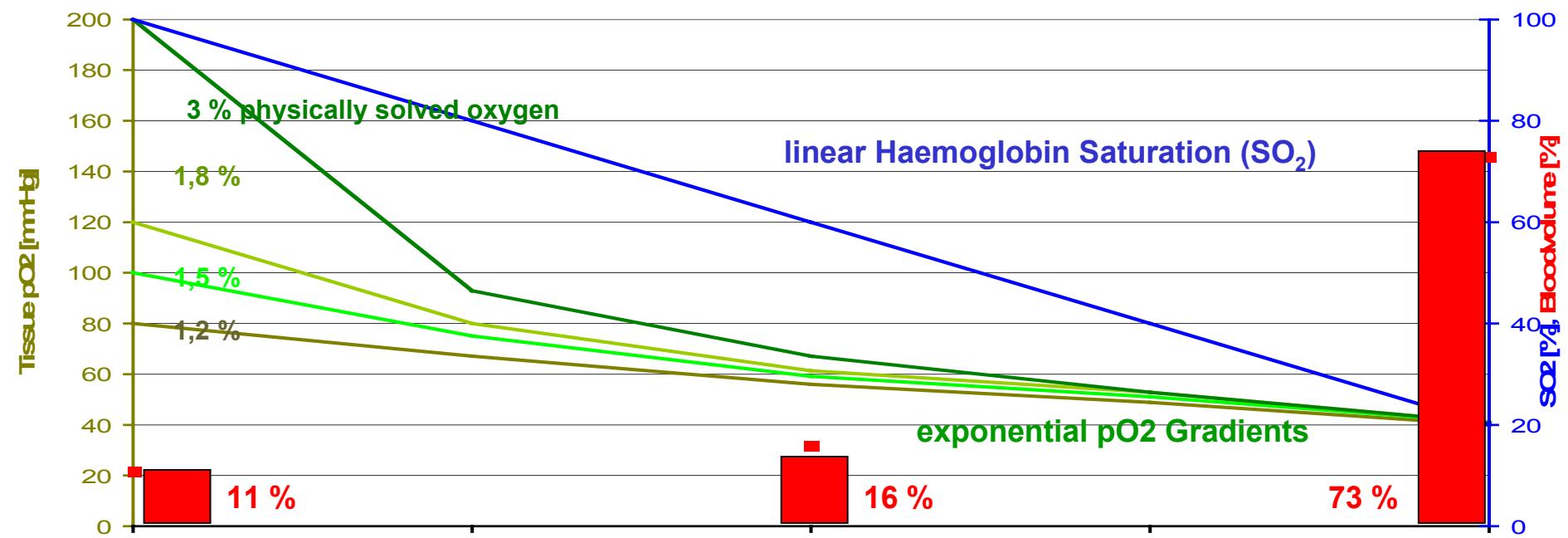
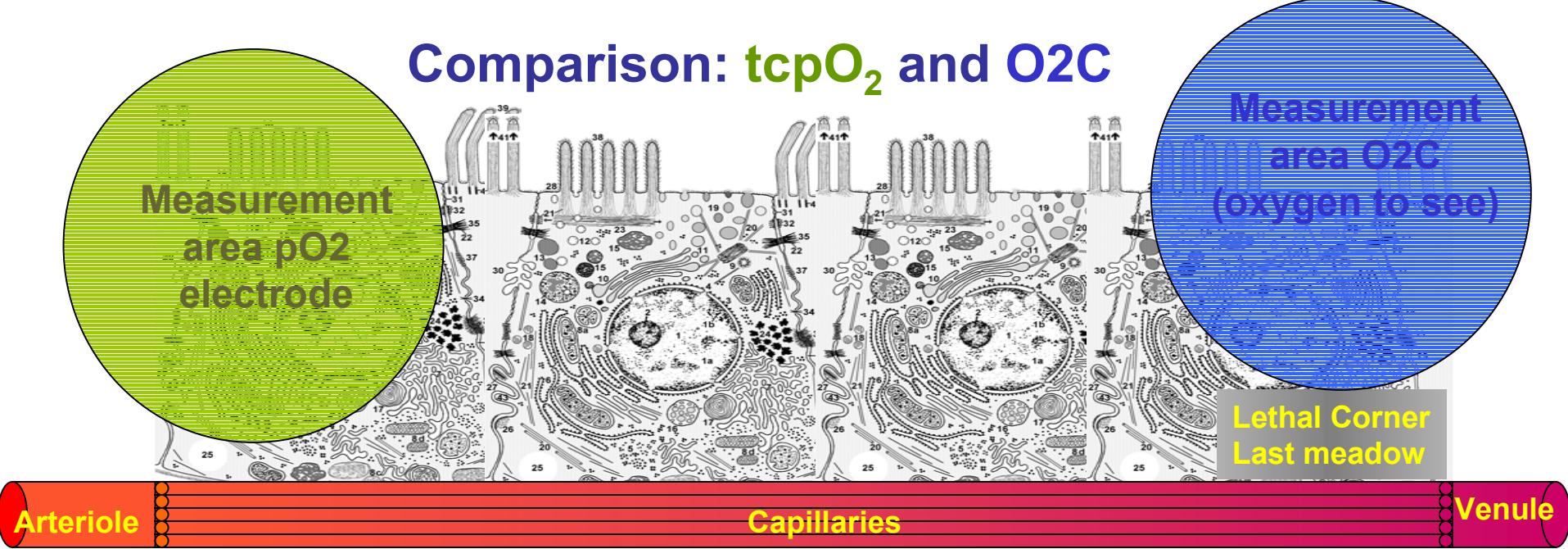
- No images



Tissue Spectroscopy and -Spectrometry

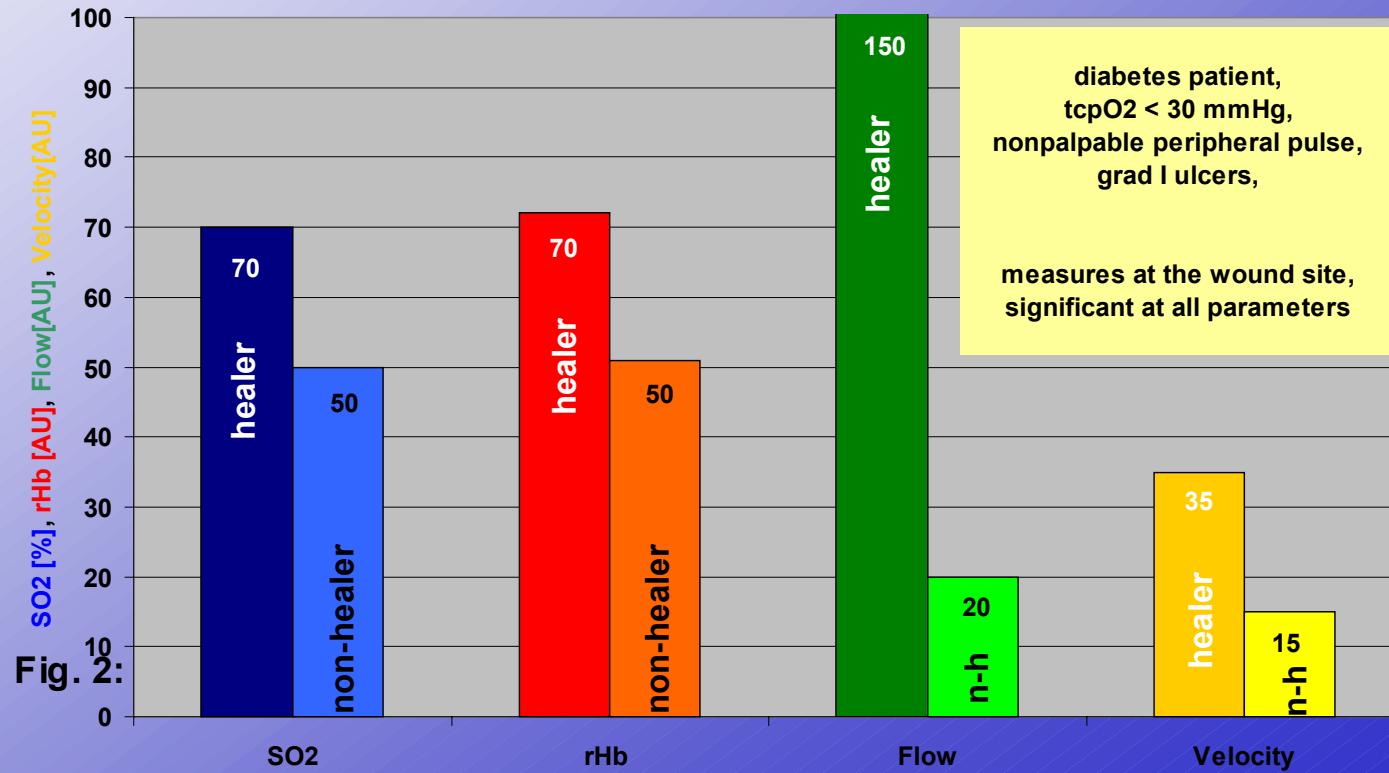


Comparison: tcpO_2 and O_2C

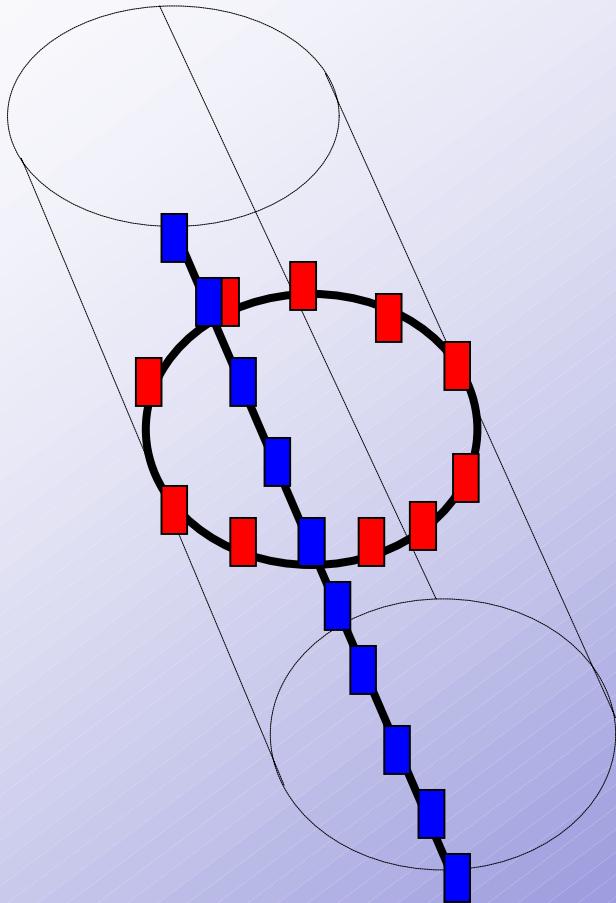


The Impact of O₂C for the Quantification of Tissue Ischemia in Diabetic Foot Ulcers (Diabetes Care, Vol. 27, Dec. 2004)

- Patient lying on his back
- Start of measurement after 10 minutes rest
- Definition of constant measurement time
- Opsite®-Film between wound and probe
- Same application pressure of the probe by fixation of the probe with Opsite®-Film of constant size
- No movement of the extremities during measurement



Amputation level assessment using lightguide spectrophotometry



Investigation sheme on the lower leg,
• **10 locations on a circle** and
• **10 locations in a row**

Prosthet Orthot Int 1995 Dec;19(3):139-47

Amputation level assessment using lightguide spectrophotometry.

Harrison DK, McCollum PT, Newton DJ, Hickman P, Jain AS

Critirea for ampuation due to insufficient wound healing

- Mean value smaller than 30% in SO₂ and
- Lowest values below 10% SO₂ more than 3 out of 20 values.

The combination of these criteria gave a sensitivity and selectivity of 1.0 for prediction of a successful outcome of transtibial amputations.



Parameters of Microcirculation and Healing Time of Burn Wounds

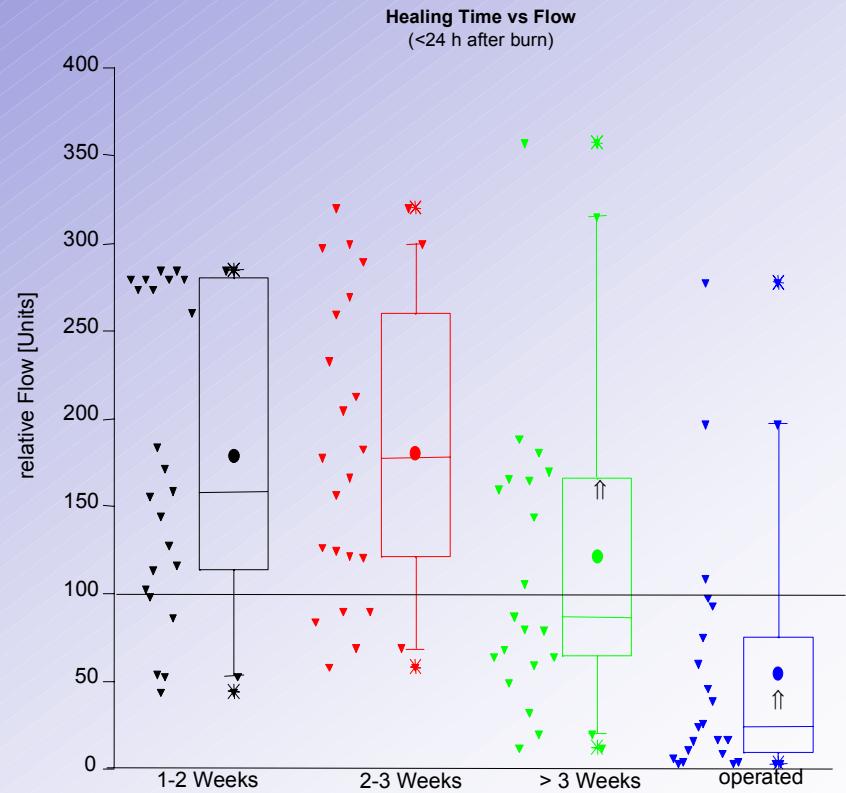
On 15 patient 86 burn wounds were examined. The wounds were clinically evaluated and examined additionally with the O2C (LEA Medizintechnik GmbH). The measurements were conducted within 24 hours and 3 days after the day of burn. The wounds were divided into 4 groups (healing time 1-2 weeks, 2-3 weeks, >3 weeks and operated wounds).



Clear healing tendency on P1, delayed healing on P2

The groups marked by $\hat{\wedge}$ are showing a significant reduction ($p<0,05$) of flow and velocity values compared to the other groups. The haemoglobin concentration and oxygen saturation of the operated group were significant lower to the group with 2-3 weeks healing. Neither flow, velocity, Hb concentration nor oxygen saturation were showing significant changes between the measurements on the first and the third day after burn.

M.Pfau, K.Merz, H.O.Rennekampff,H.E.Schaller
Klinik für Hand-, Plastische-, Rekonstruktive- und
Verbrennungschirurgie der BG-Unfallklinik Tübingen an der
Eberhard-Karls-Universität Tübingen



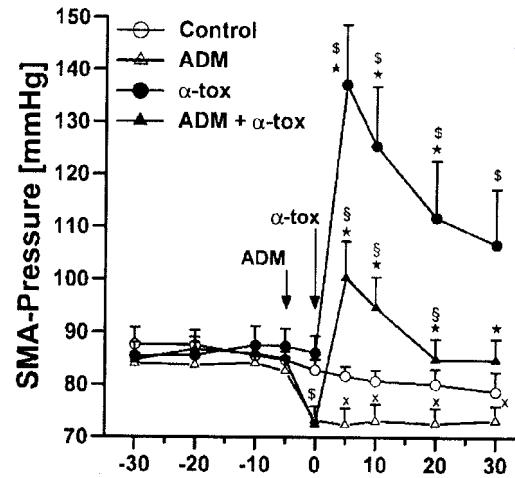
"Retrospective analysis shows a correlation between healing time and flow and velocity."

Increase microvascular permeability and perfusion mismatch are hallmarks of sepsis and septic shock

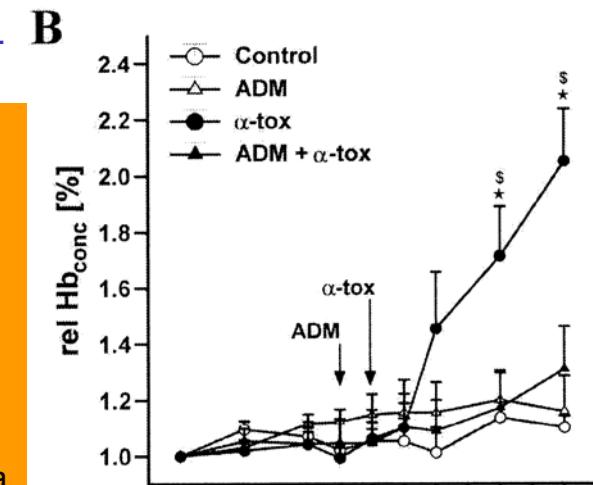
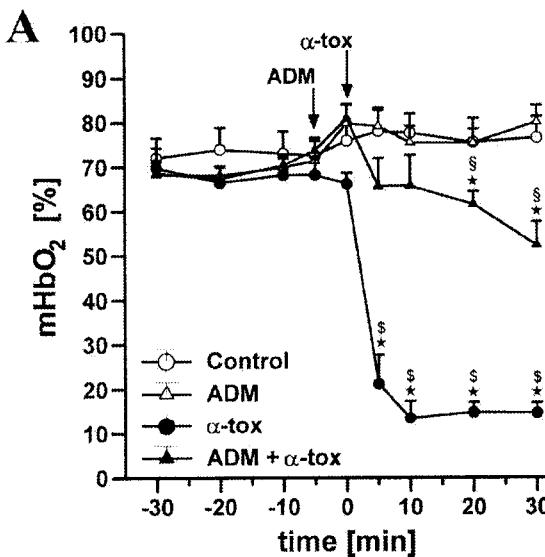
B. Brell, B. Temmesfeld-Wollbrück, et Al. Department of Internal Medicine/ Infection Diseases, University Medicine Berlin, Germany

Crit. Care Med. 2005 Vol. 33, No.4 pp 819-826

Adrenomedullin reduces *Staphylococcus aureus* α -toxin-induced rat ileum microcirculatory damage



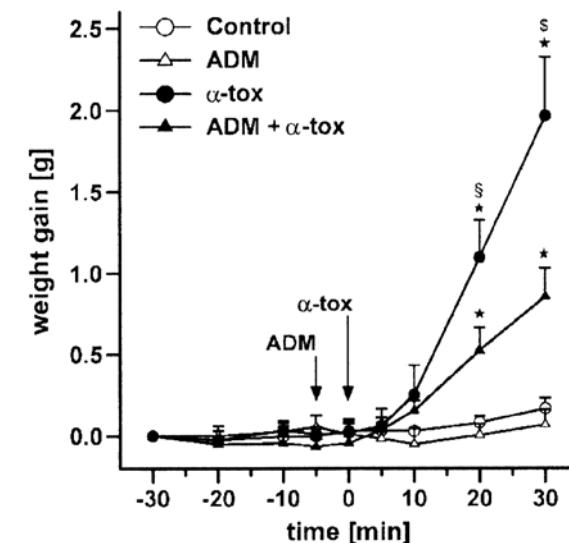
Measures in mucosa show good correlation between perfusion pressure (SMA-Pressure) and mucosal oxygen saturation SO_2 (mHbO_2) measured by O₂C



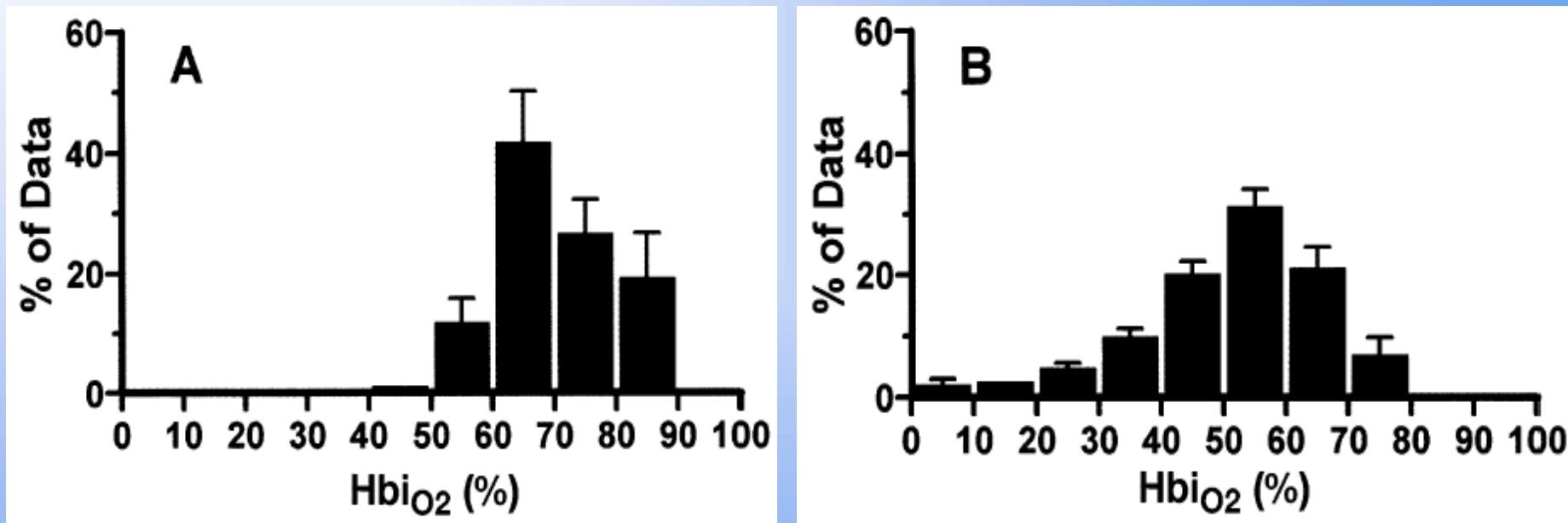
Measures on mucosa show good correlation between

- amount of hemoglobin rel.Hbcon and
- gain in weight of the gut

-> (venous congestion, edema)



Oxygen Saturation of mucosa of stomach in healthy persons (A) and patients with sepsis (B) taken from (10) recorded by O2C(oxygen to see)



(10) Am J Respir Crit Care Med 1998 May;157(5 t 1):1586-92

Abnormalities of gastric mucosal oxygenation in septic shock: arterial responsiveness to dopexamine.

Temmesfeld-Wollbrück B, Szalay A, Mayer K, Olschewski H, Seeger W, Grimminger F.

Postprandiale Dysfunktion der Mikrozirkulation nach einer Mahlzeit reich an Advanced Glycation Endproducts (AGE) bei Patienten mit Typ 2 Diabetes mellitus - protektive Rolle von Benfotiamin

Stirban A., et. al.; Bad Oeynhausen,
Poster, 40. Jahrestagung DDG, Berlin 5/2005

Methoden:

AGE-reiche Mahlzeit

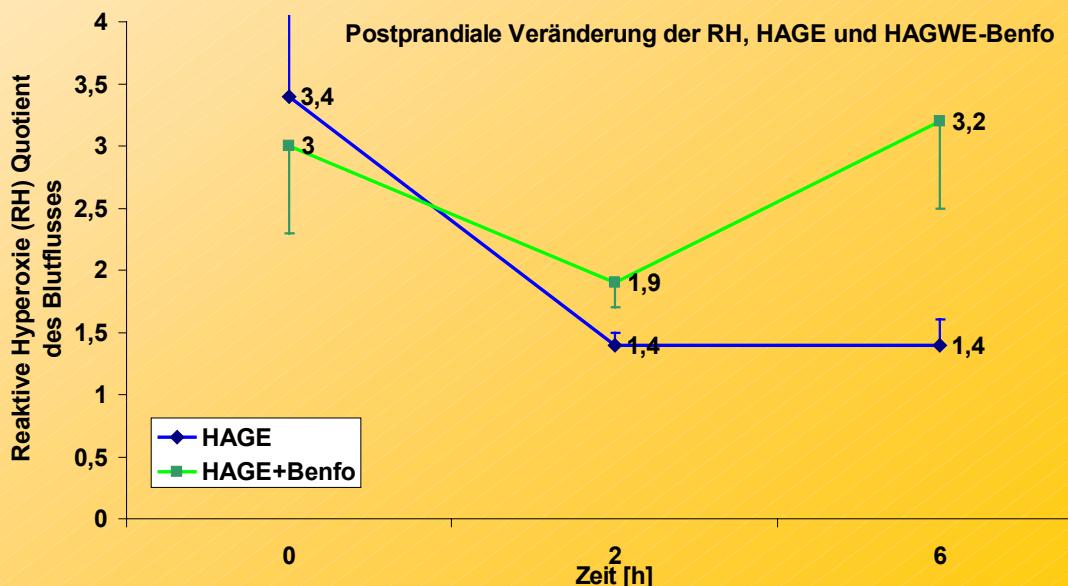
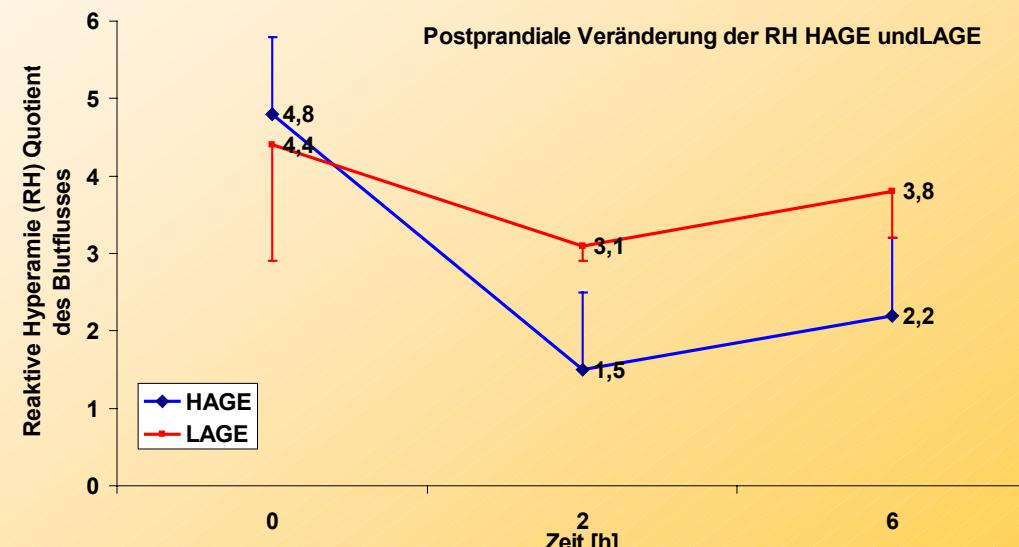
(HAGE): **15.100** kU AGE
gebacken/gebraten
- 220°C, 20 Min



◆ AGE-arme Mahlzeit
(LAGE): **2750** kU AGE
gekocht/gedünstet
- 100°C, 10 Min



- Eine **AGE-reiche**, Mahlzeit führt zu einem signifikanten **Abfall der Gefäßfunktion der Mikrozirkulation** (O₂C oxygen to see), der mindestens 6 Stunden anhält und ausgeprägter ist als nach einer AGE-armen Mahlzeit
- Benfotiamin kann diesen negativen Effekt **reduzieren**



MYOCARDIAL MICROCIRCULATION DURING ISCHEMIC PRECONDITIONING IN OFF-PUMP BYPASS SURGERY

Methods: 21 patients (14 males) scheduled for OPCAB were enrolled in the study. Intraoperatively, the LAD was occluded for 2 min followed by a 2 min reperfusion interval. The procedure was repeated three times.

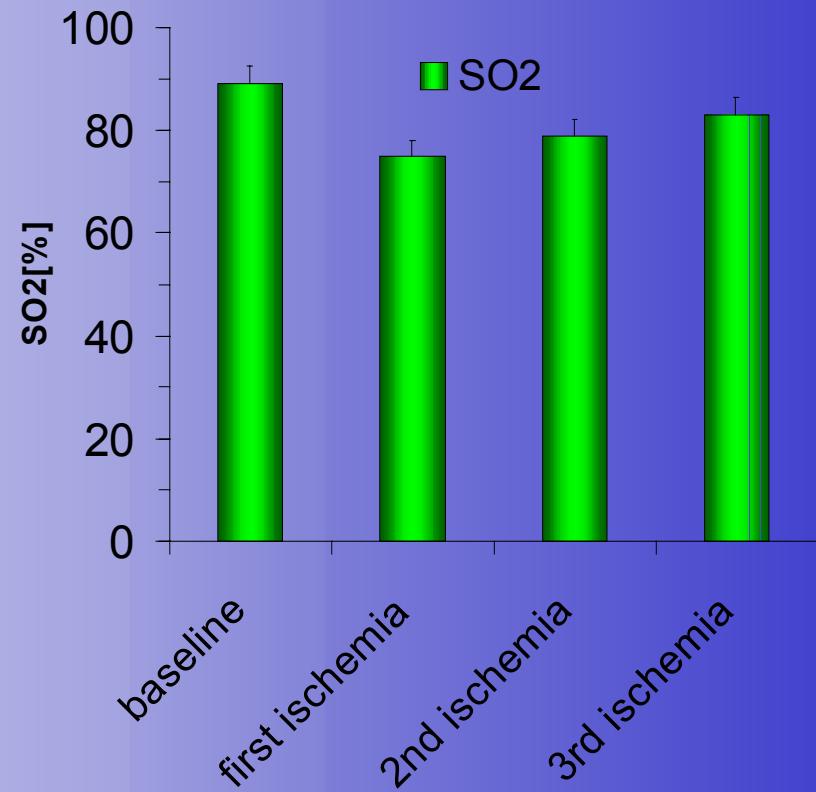
Tissue SO₂ increased going from the first to the third occlusion from $75\pm11\%$ to $83\pm8\%$ ($p<0.001$). rHb as a marker of postcapillary venous haemoglobin concentration increased significantly (77 ± 8 vs. 85 ± 6 , $p=0.002$). Superficial and deep myocardial blood flow decreased significantly (317 ± 17 vs. 308 ± 36 , $p < 0.001$; 402 ± 56 vs. 350 ± 50 , $p < 0.001$; respectively).



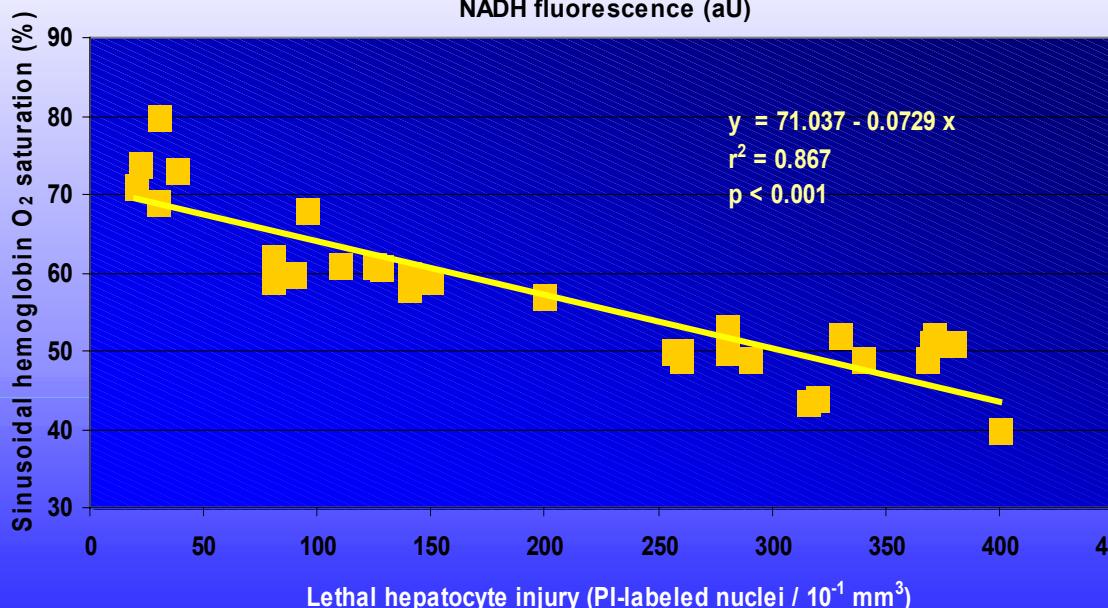
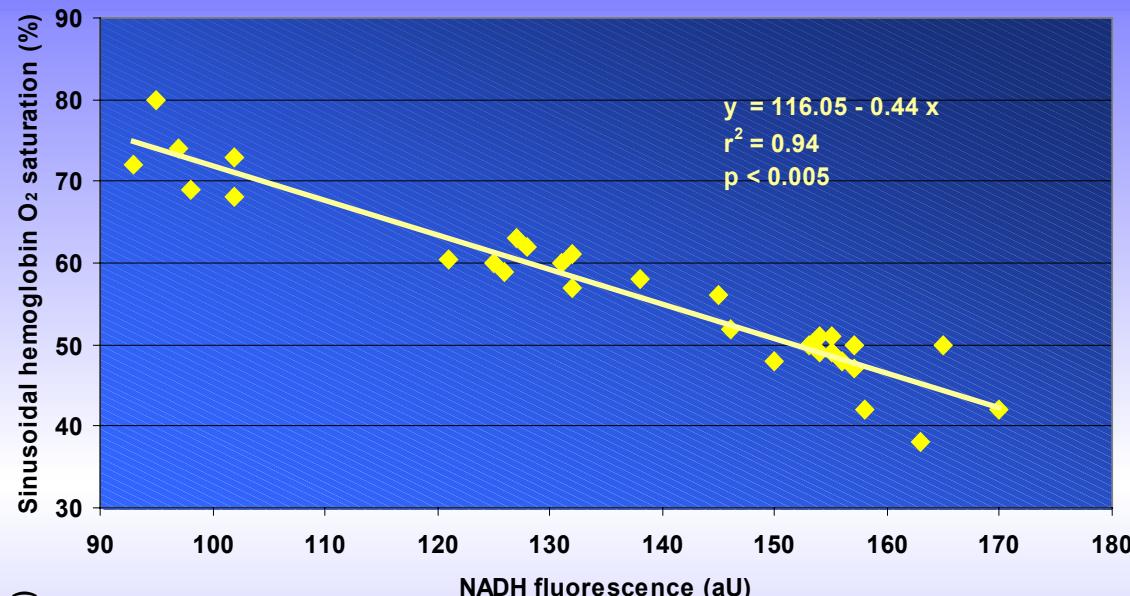
“Oxygen-to-see system is capable of detecting myocardial microcirculation in vivo real time.”

**A. Lichtenberg, K. Knobloch, M. Pichlmaier,
St. Ringes-Lichtenberg, H. Mertsching, U. Klima, A.
Haverich**

*Thoracic and Cardiovascular Surgery
Medizinische Hochschule Hannover, Germany*

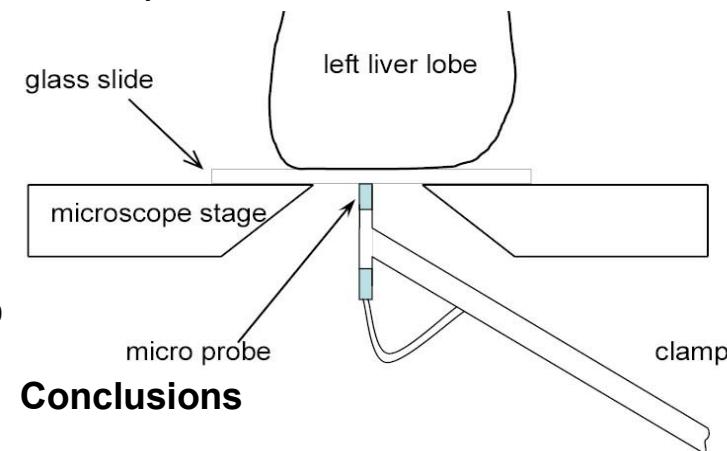


A remission spectroscopy system for *in vivo* monitoring of hemoglobin oxygen saturation in murine hepatic sinusoids, in early systemic inflammation (Comparative Hepatology 2005, 4:1 doi:10.1186/1476-5926-4-1)



C. Wunder, R. Brock, A. Krug, N. Roewer,
O. Eichelbrönnner

Anesthesiology, University of Würzburg, Germany
Department of Pharmacology & Toxicology,
University of Arkansas, USA



Conclusions

Remission spectroscopy (O₂C) represents a simple and reliable method for hepatic sinusoidal SO₂ determination.

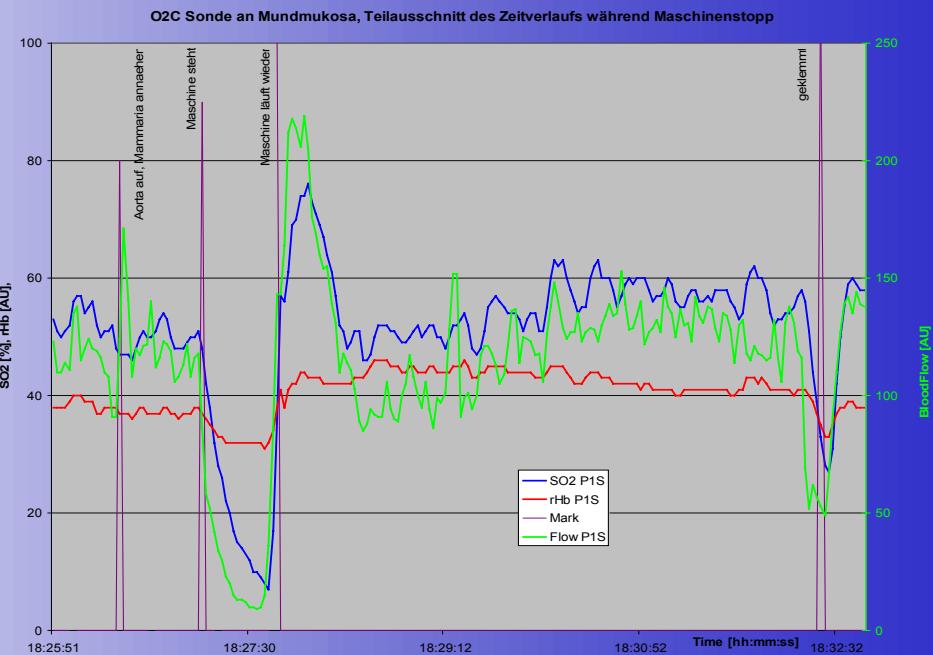
Significant reduction in hepatic SO₂ during early stages of systemic inflammation in parallel an increasing NAD(P)H autofluorescence (=inadequate oxygen supply)

O2C (oxygen to see) Monitoring on mouth mucosa during bypass surgery

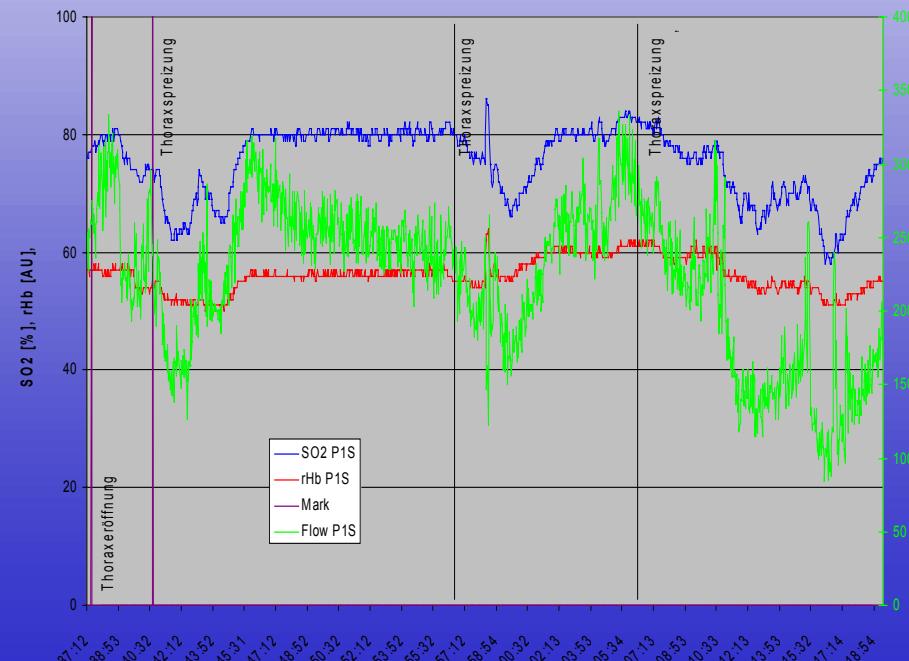
- Stop of HLM (8 sec.)

- Bolus of NO

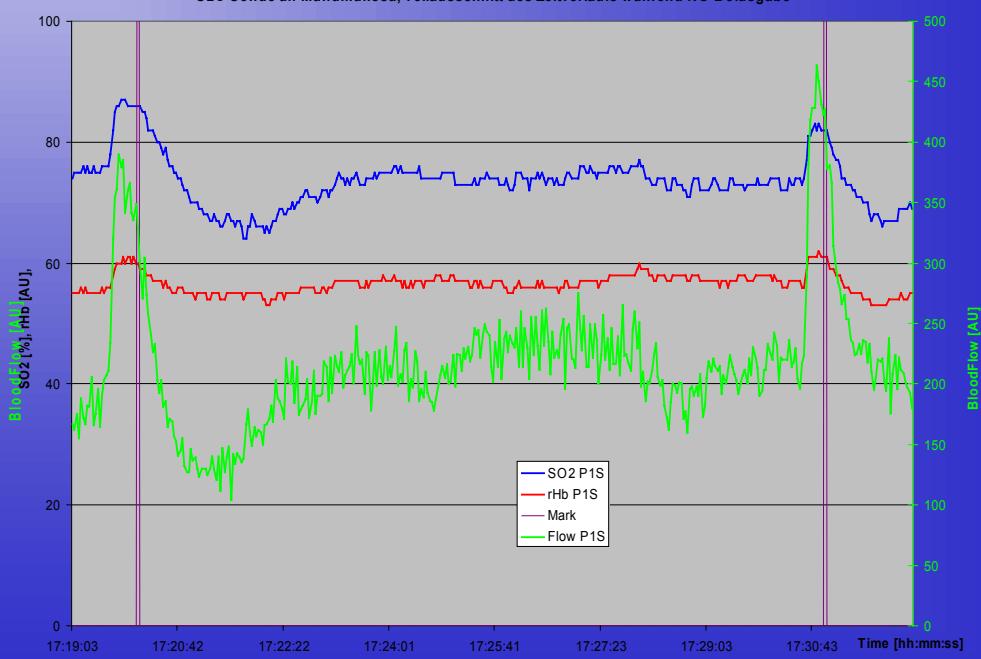
- Spreading of thorax



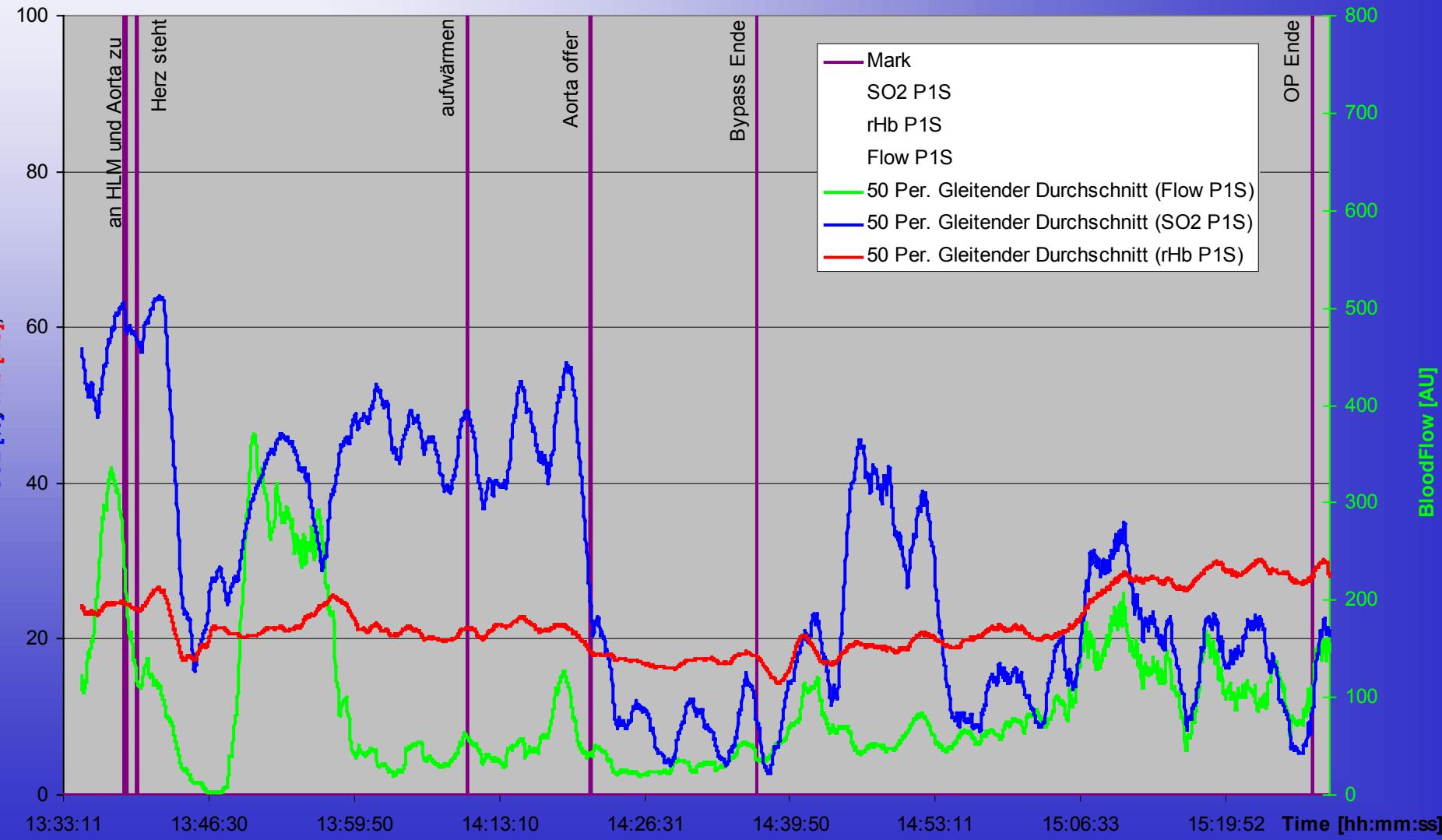
O2C Sonde an Mundmukosa, Teilausschnitt des Zeitverlaufs während Spreizung des Thorax



O2C Sonde an Mundmukosa, Teilausschnitt des Zeitverlaufs während NO-Bolusgabe



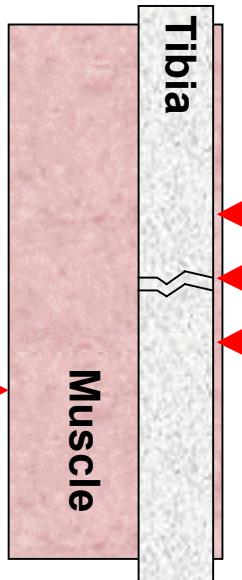
O2C (oxygen to see) probe in rectum,
Bad Oeynhausen,
Patient on HLM, Hypothermia 30 C



Influence of haemorrhagic shock on fracture healing

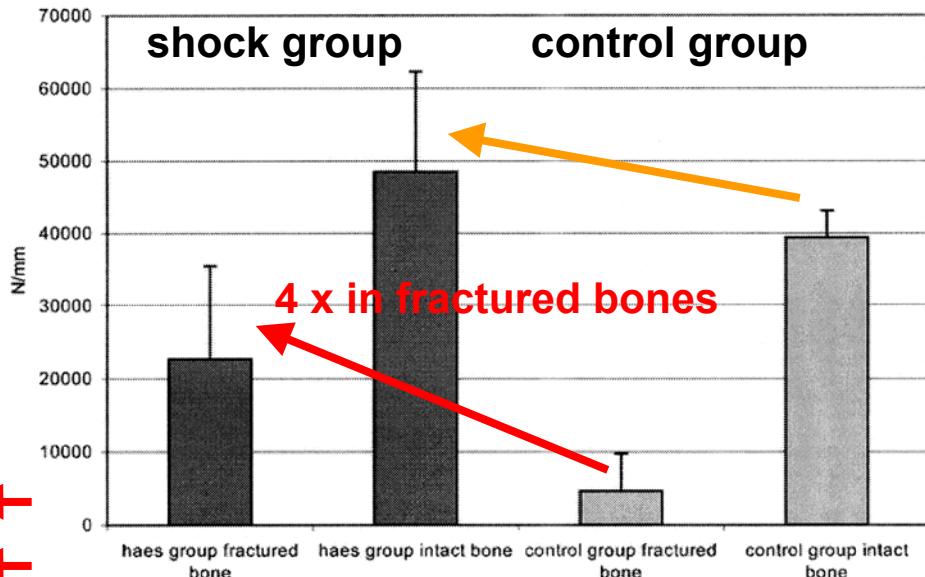
M. Bumann, T. Henke, H. Gerngross, L. Claes, P. Augat,
Department of Orthopaedic Research and Biomechanics, Uni Ulm, Germany
Langenbecks Arch Surg. 2003, Oct., 388(5):331-8.

Measurement at the level of fracture (tibia), 1cm distal/proximal and soft tissue with O₂C(oxygen to see)
Shock group with volume resuscitation
Control group without

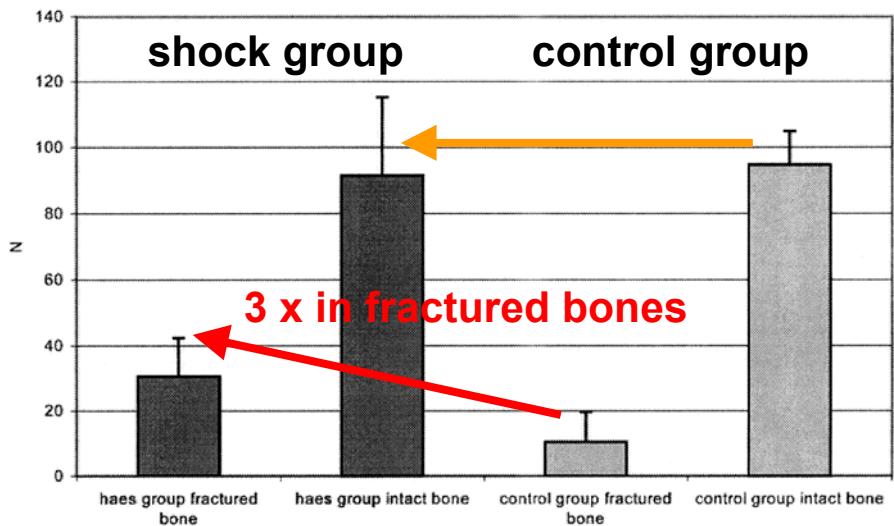


Shock group with volume substitution has no reduction in blood flow in the distal and soft tissue regions and shows a better fracture healing outcome.

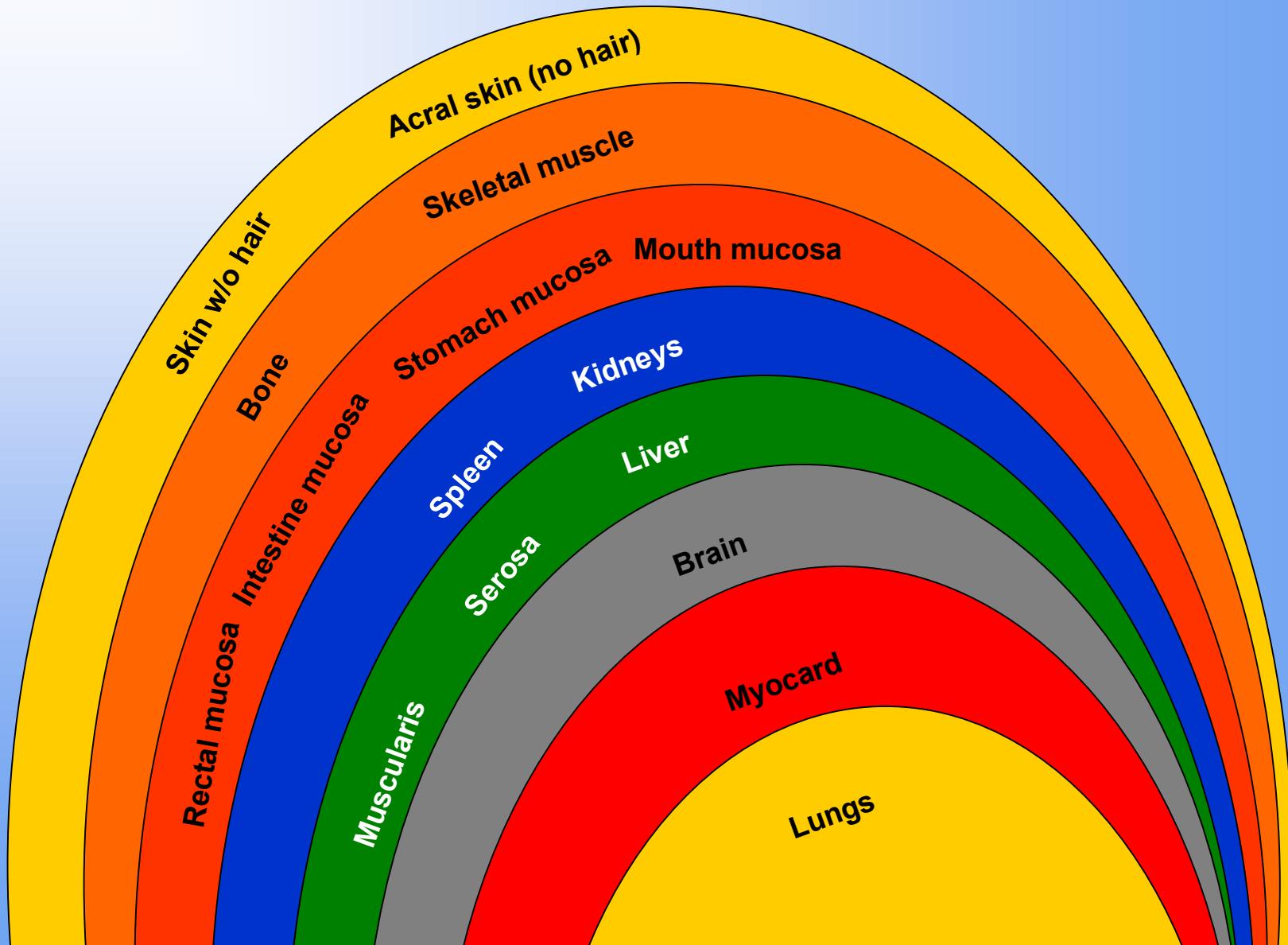
Flexural rigidity



Failure load

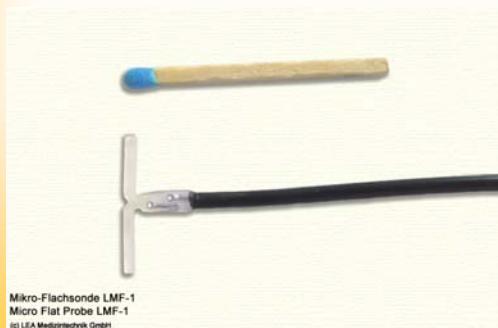


Monitoring of regional circulatory system - on a functional basis



Probetypes

- Flat probes for skin and muscle
(e.g 2 and 8 mm depth)
- Muscle probe 15 mm depth
- Micro-probes 0.8 mm and 2.3 mm diameter
- Redong probe for buried flaps and transplants (monitoring)



Thank you

www.LEA.de