



Dept. Internal Medicine VII / Sports Medicine

UniversitätsKlinikum Heidelberg

A Century of Research at the Capanna Regina Margherita

Peter Bärtsch

www.klinikum.uni-heidelberg.de/sportmedizin

























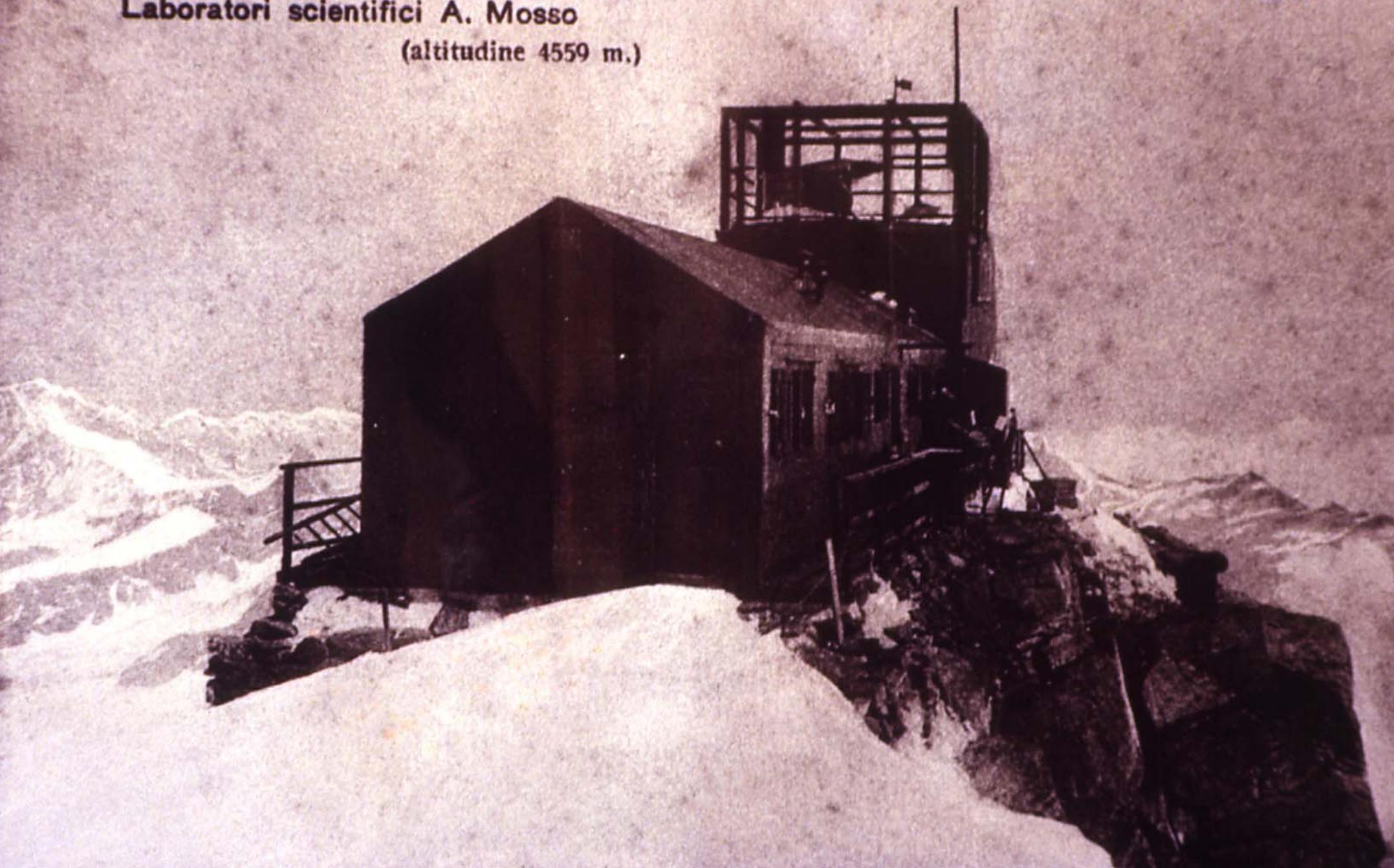




S. M. LA REGINA MARGHERITA.

Capanna Regina Margherita sul Monte Rosa
Laboratori scientifici A. Mosso
(altitudine 4559 m.)

In Valsesia



Dufour Peak,
4,635 m.

Zumstein Peak,
4,563 m.

Gnifetti Peak,
4,560 m.



H.M. Queen Margaret of Italy about to make the ascent of Gnifetti Peak, August 18, 1893.

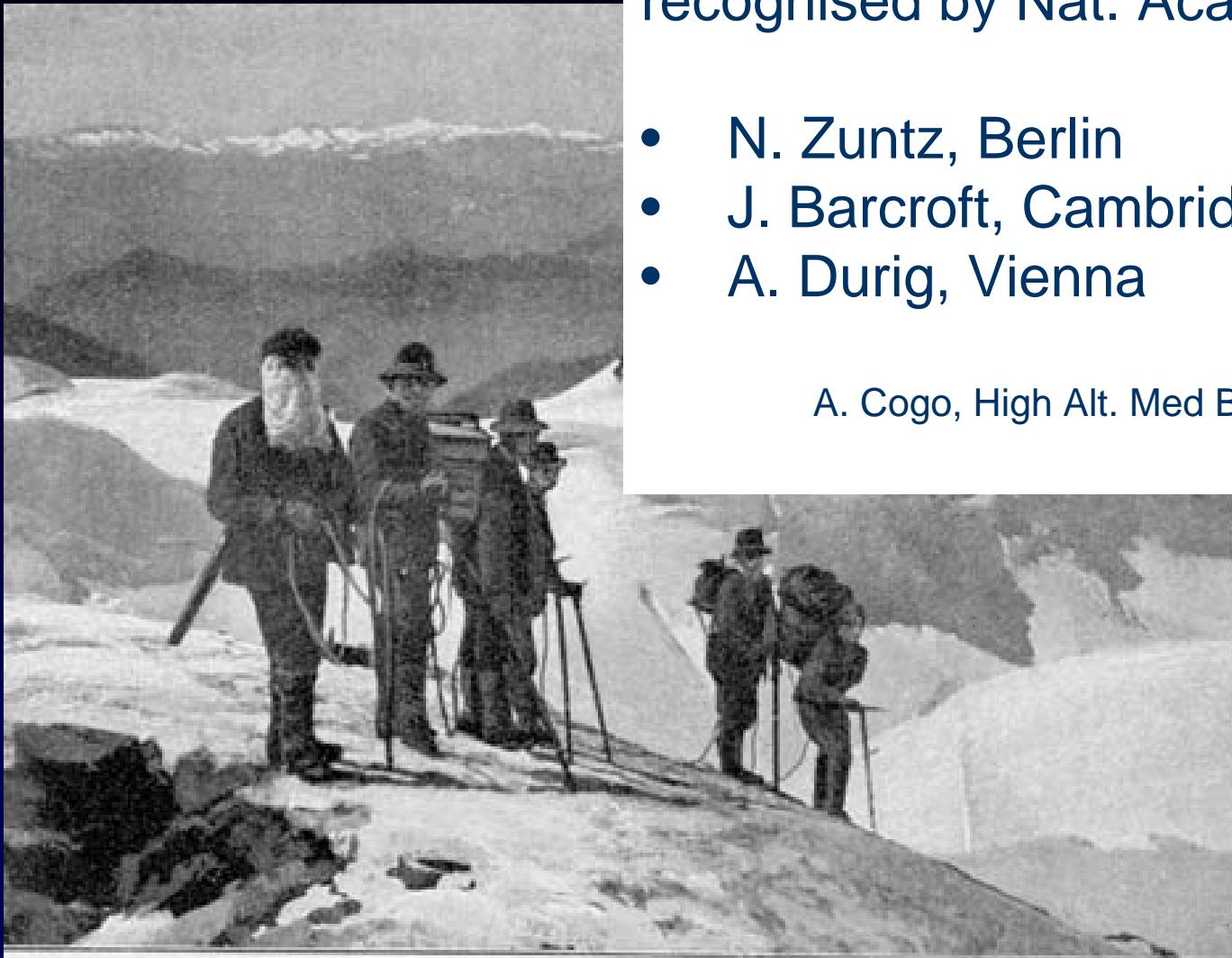


73. Inauguration de la cabane Marguerite par S. M. la Reine Marguerite le 18 Août 1893.

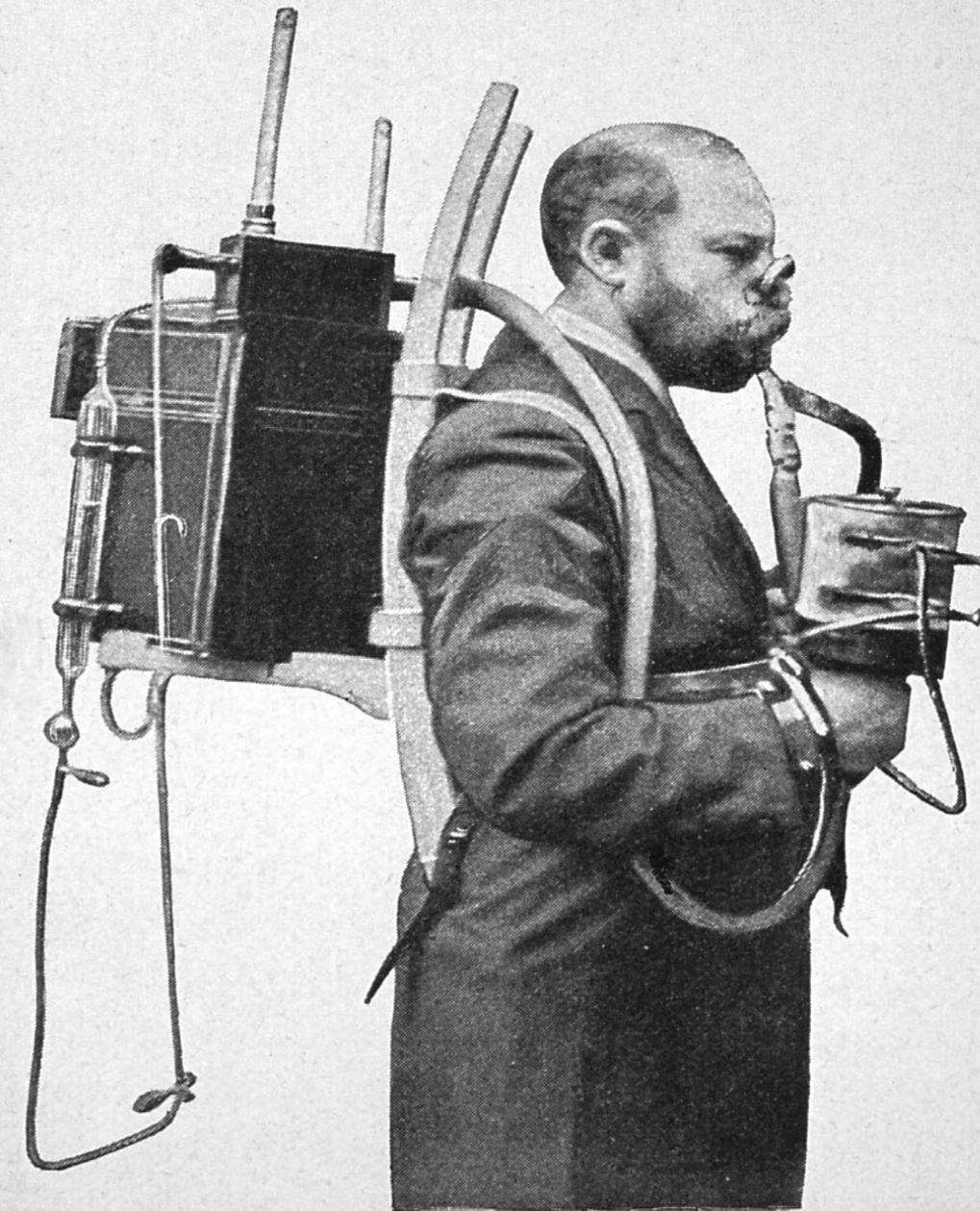
International Research Institution
recognised by Nat. Acad. Sci. US

- N. Zuntz, Berlin
- J. Barcroft, Cambridge
- A. Durig, Vienna

A. Cogo, High Alt. Med Biol 1: 137-147, 2000



Abstieg von der Margherita-Hütte.

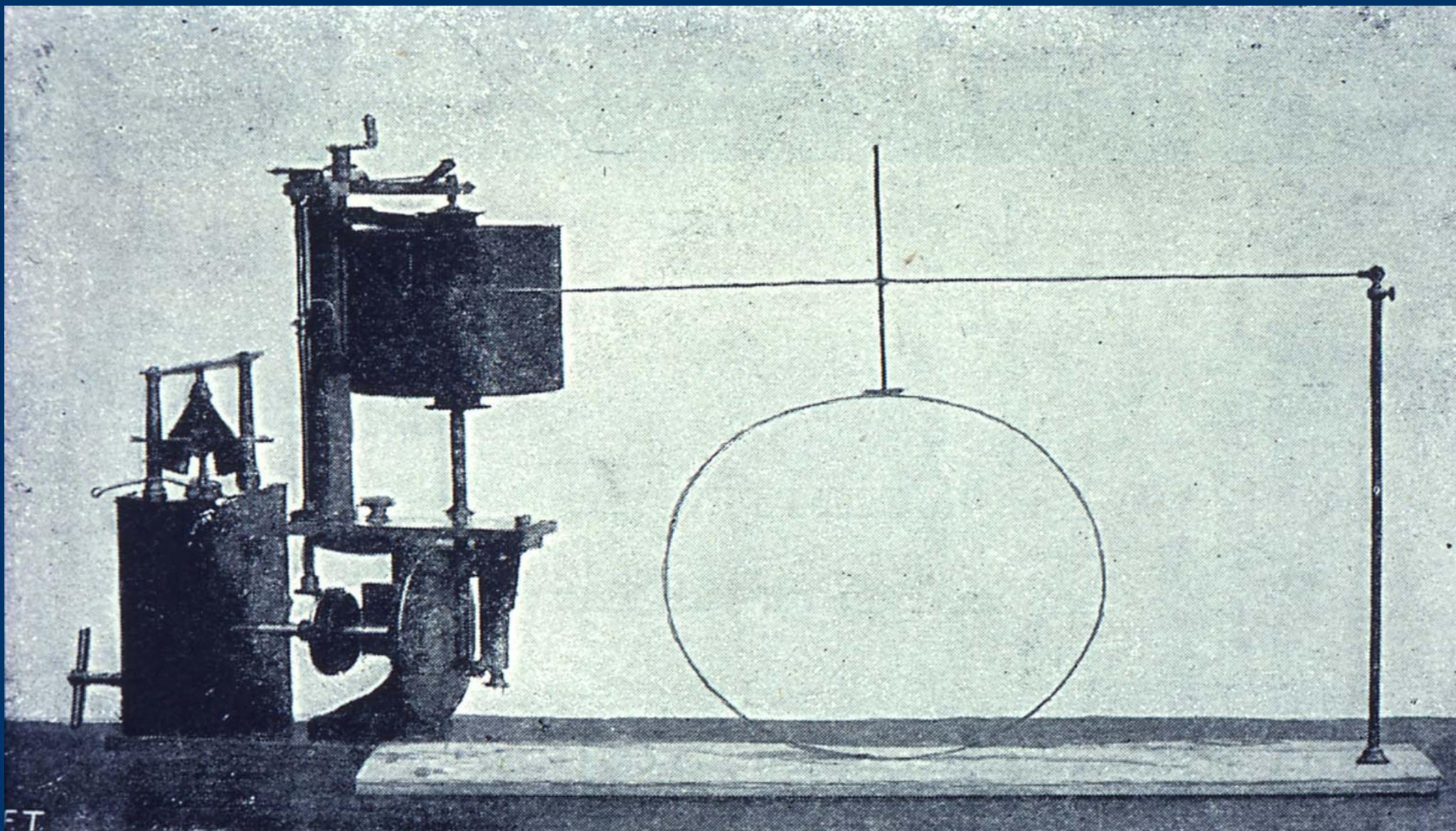


Messung der Atmung, Registrierung des Pulses
und der Atembewegungen.

Aereas of Research

- ventilation and gas exchange
- blood
- systemic circulation
- nutrition
- metabolism
- muscle strength
- mountain sickness

Registration of Thorax Movements



Periodic Breathing at High Altitude

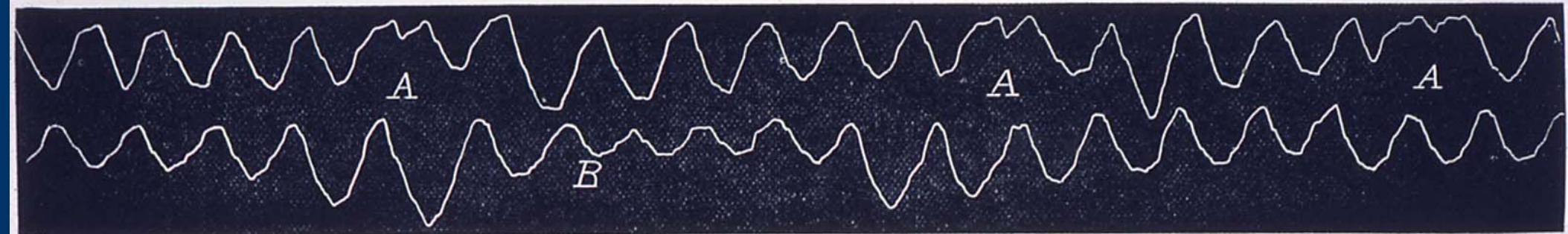


FIG. 19.—Ugolino Mosso. Thoracic respiration with periods, taken during sleep (Gnifetti Hut, alt., 3,620 metres).

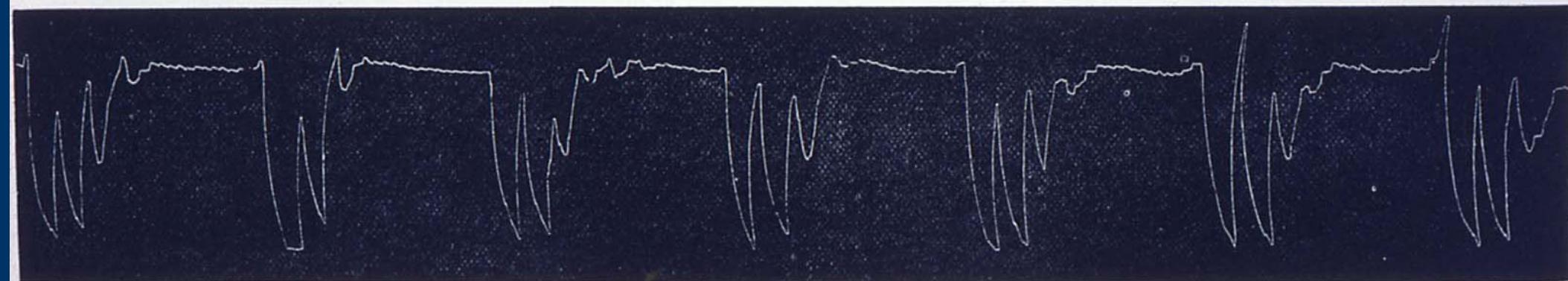


FIG. 20.—Ugolino Mosso. Periodic respiration during sleep at the Regina Margherita Hut. The periods of arrest last twelve seconds.

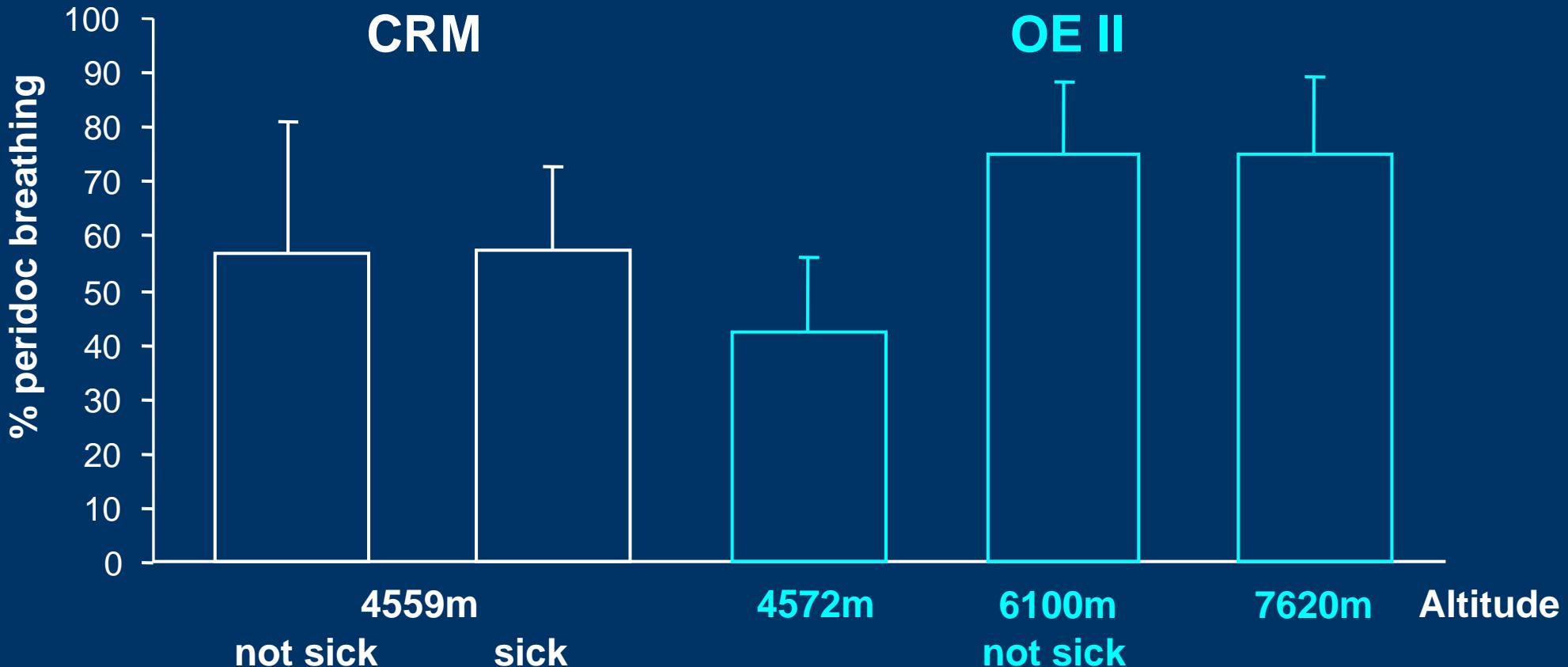
• Il momento scelto accende le luci in camera.
• È di assoluta forbidenza lo spogliarsi nei camere vicine alla hall.
• Tra i letti sono vietate le riviste.
• È del tutto vietato in mare bere alcolici.
• È del tutto vietato d'assalto dei richieste se dedica da la brava.

Uscita di emergenza

SOGNA SPOSTARSI
PER APPAGNARSI ALLA
MENTOLAT



Sleep Studies



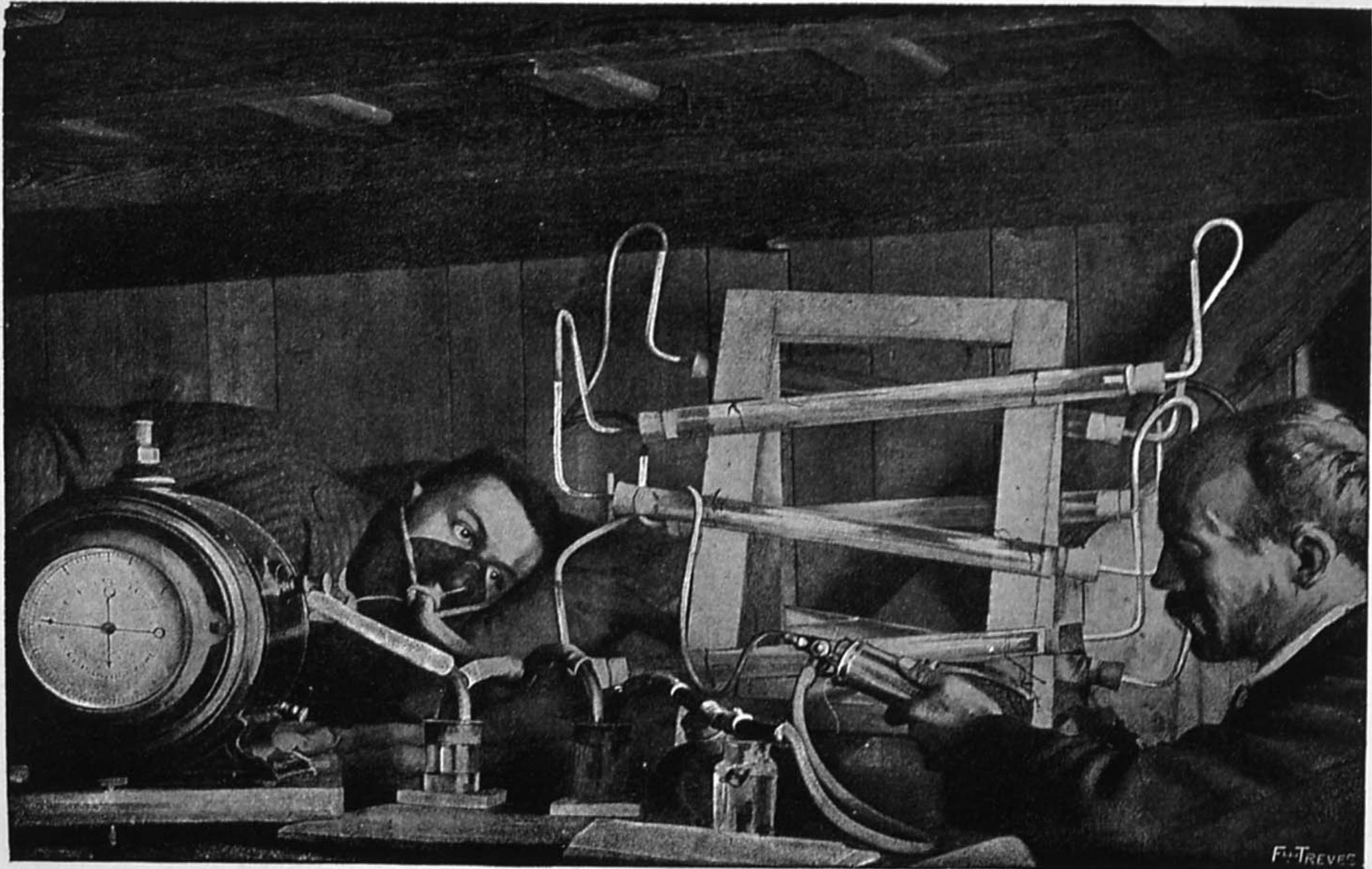


FIG. 48.—Experiment performed by Professor U. Mosso in the Regina Margherita|Hut in order to measure the quantity of carbonic acid eliminated in half an hour by Beno Bizzozero.

F. TREVES

EFFECT OF CARBON DIOXIDE IN ACUTE MOUNTAIN SICKNESS: A REDISCOVERY

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M. E. RAICHLE²

M. H. WINTERBORN¹

J. JENSEN³

N. A. LASSEN³

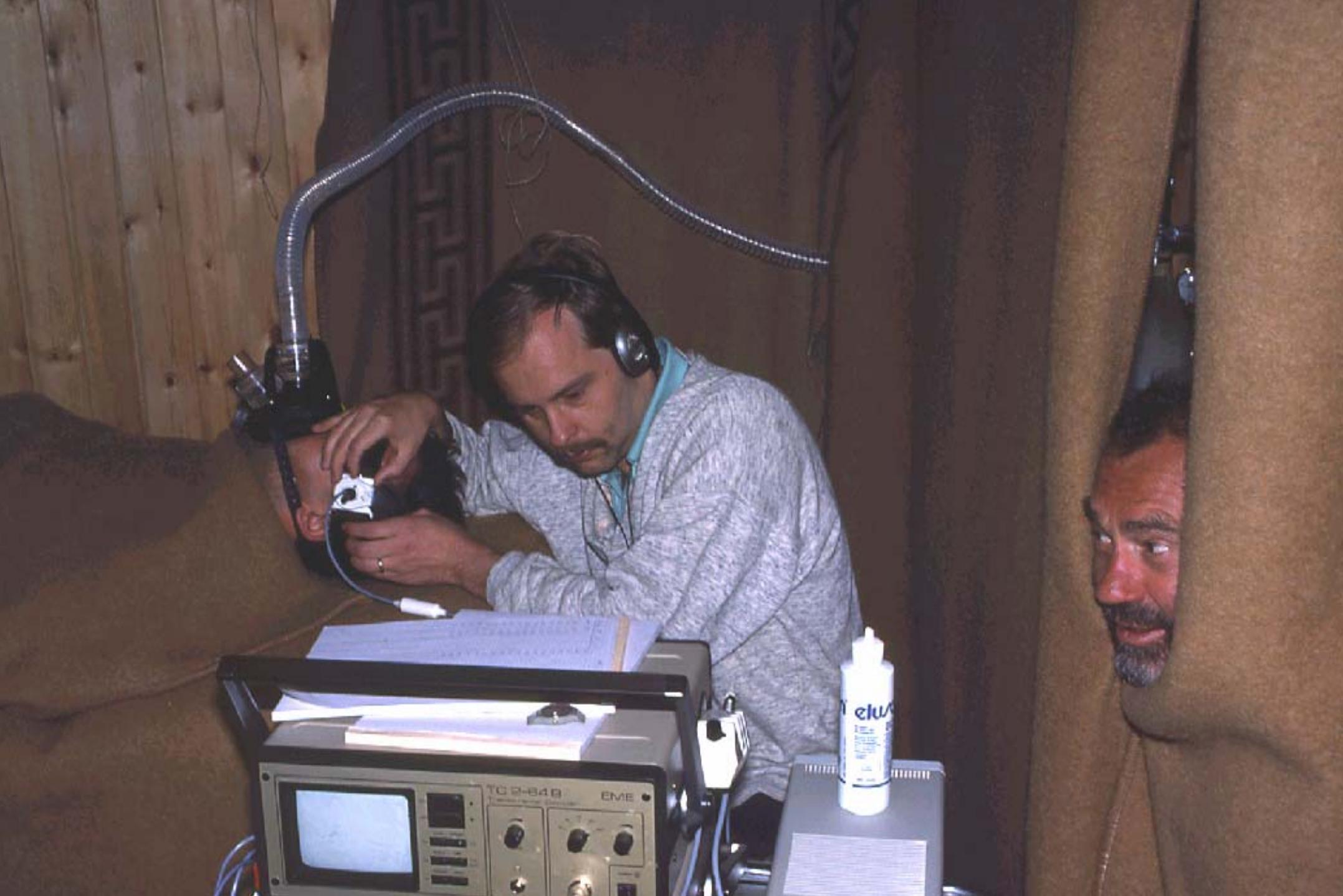
N. V. RICHARDSON⁴

A. R. BRADWELL¹

Birmingham Medical Research Expeditionary Society (BMRES)

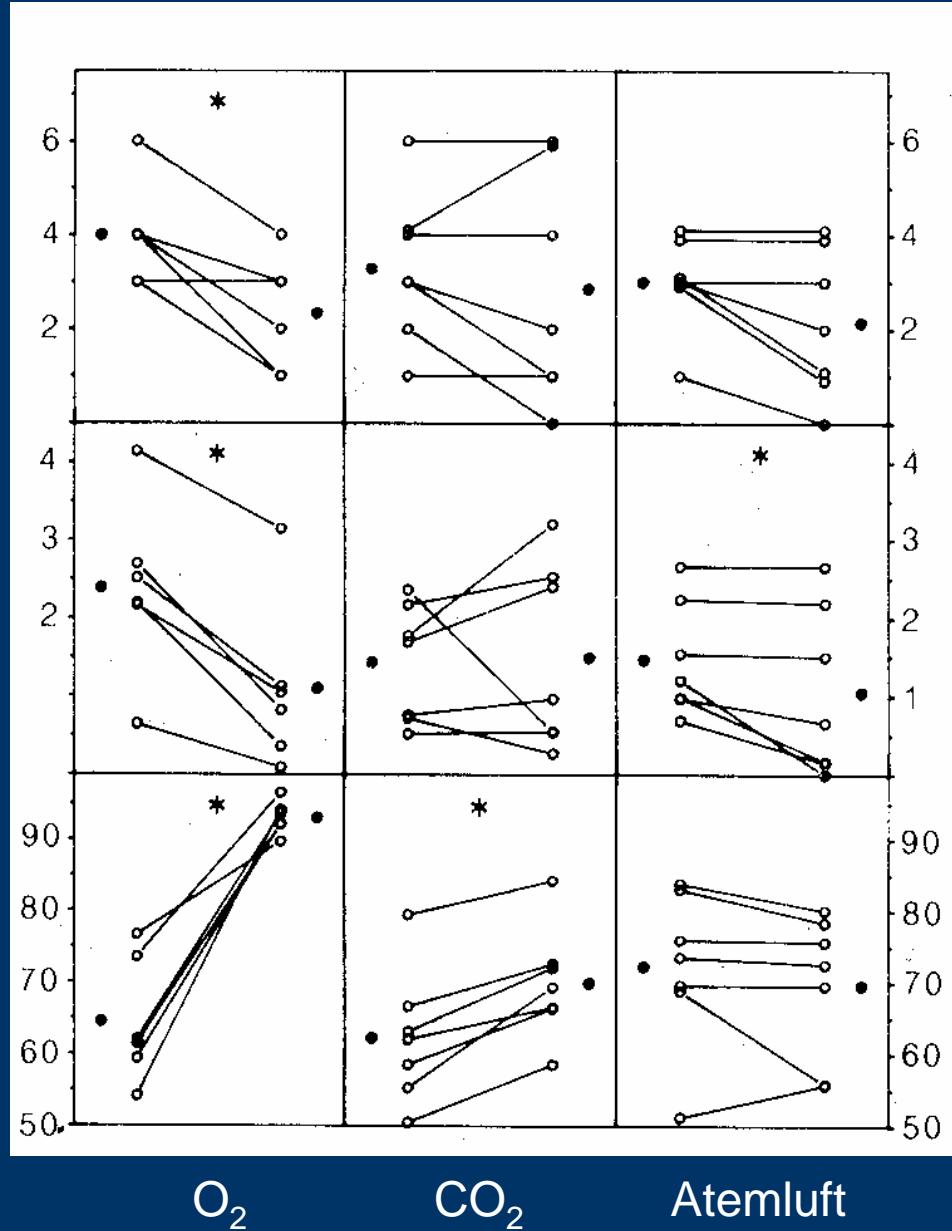


Lancet ii: 639-641, 1988



CO_2 hilft nicht gegen akute Bergkrankheit

O₂-Sättigung(%) ABK-C Score Klinischer Score



Bärtsch et al.,
Lancet ii: 772 - 775, 1990

LIFE
OF
MAN
ON THE
HIGH
ALPS

ANGELO MOSSO

LIFE OF MAN
ON THE
HIGH ALPS

N. ZUNTZ
A. LOEWY
FRANZ MULLER
W. CASPARI

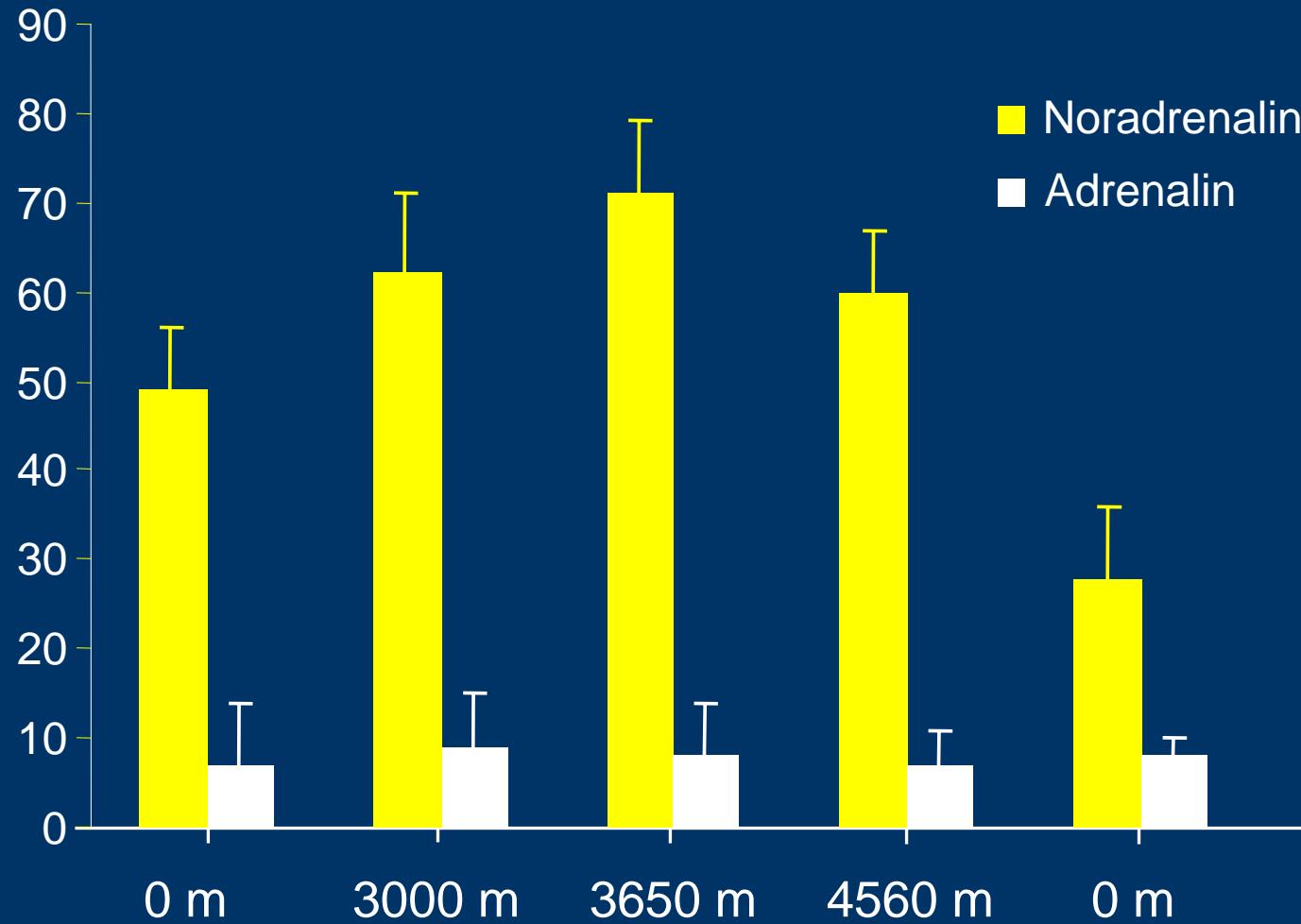
HÖHEN KLIMA
UND
BERGWANDERUNGEN

N. ZUNTZ - A. LOEWY
FRANZ MULLER
HÖHEN KLIMA
BERGWANDERUNGEN

Old Hut: Kreuzer Expedition 1963



Katecholamine im Urin während einer Monte-Rosa-Expedition



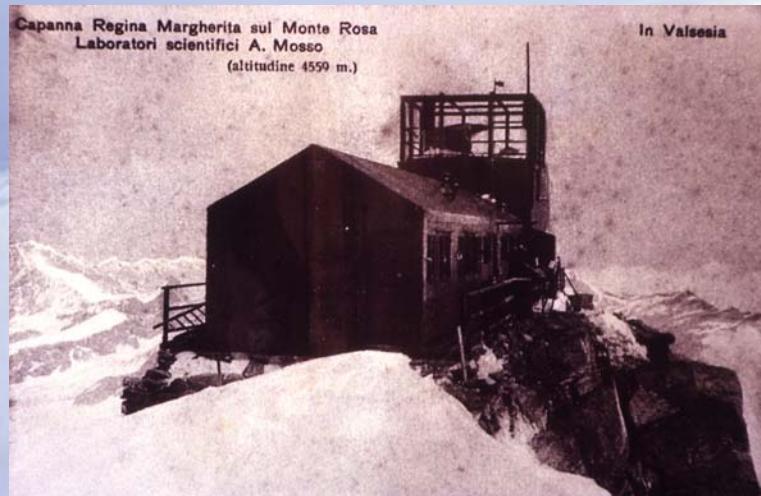
Cunningham WL et al., JAP 20:607-610, 1965

1978 - 1980



Capanna Regina Margherita sul Monte Rosa
Laboratori scientifici A. Mosso
(altitudine 4559 m.)

In Valsesia









Flight to Capanna Regina Margherita (4559 m)





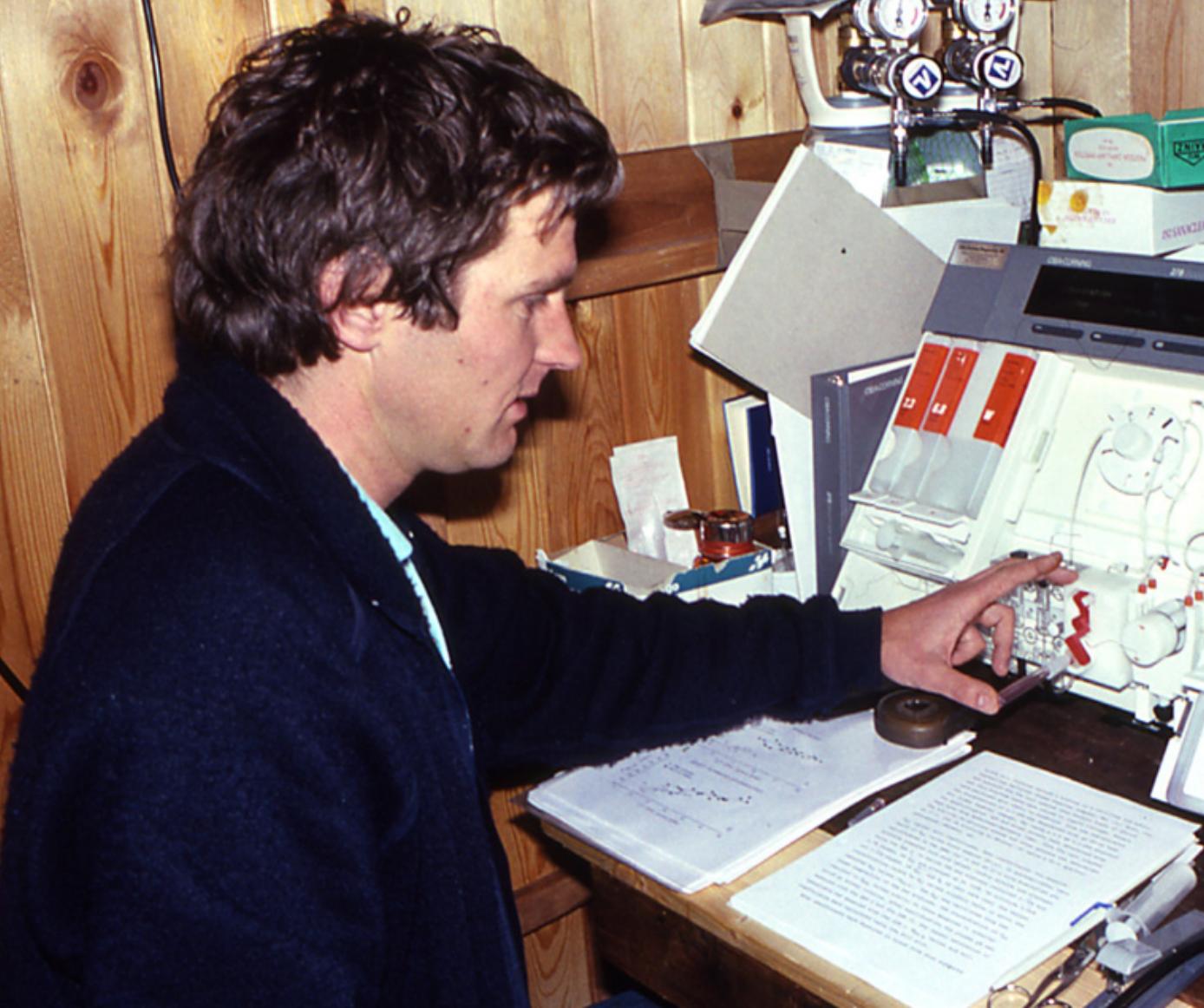












1 2 3 4

5 6 7 8 9













Symptoms of Acute Mountain Sickness (AMS)

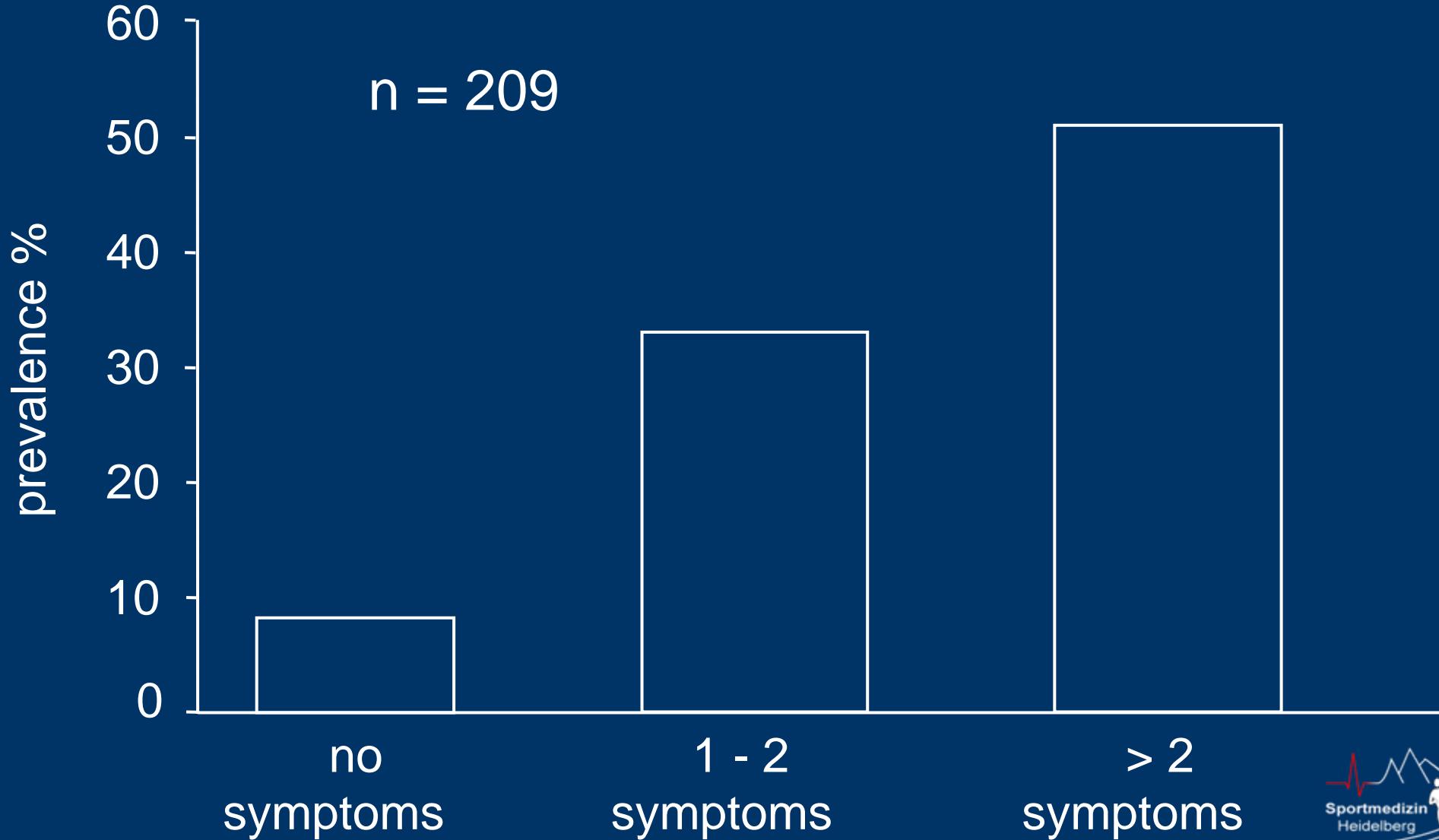
„Usual“ Symptoms

- headache
- loss of appetite/nausea
- insomnia
- dizziness
- peripheral oedema

Warning Symptoms

- headache resistant to analgesics
- vomiting
- ataxia
- apathy / somnolence
- neglect, dissimulation

Prevalence of AMS at CRM



Maggiorini; BMJ 301 1990

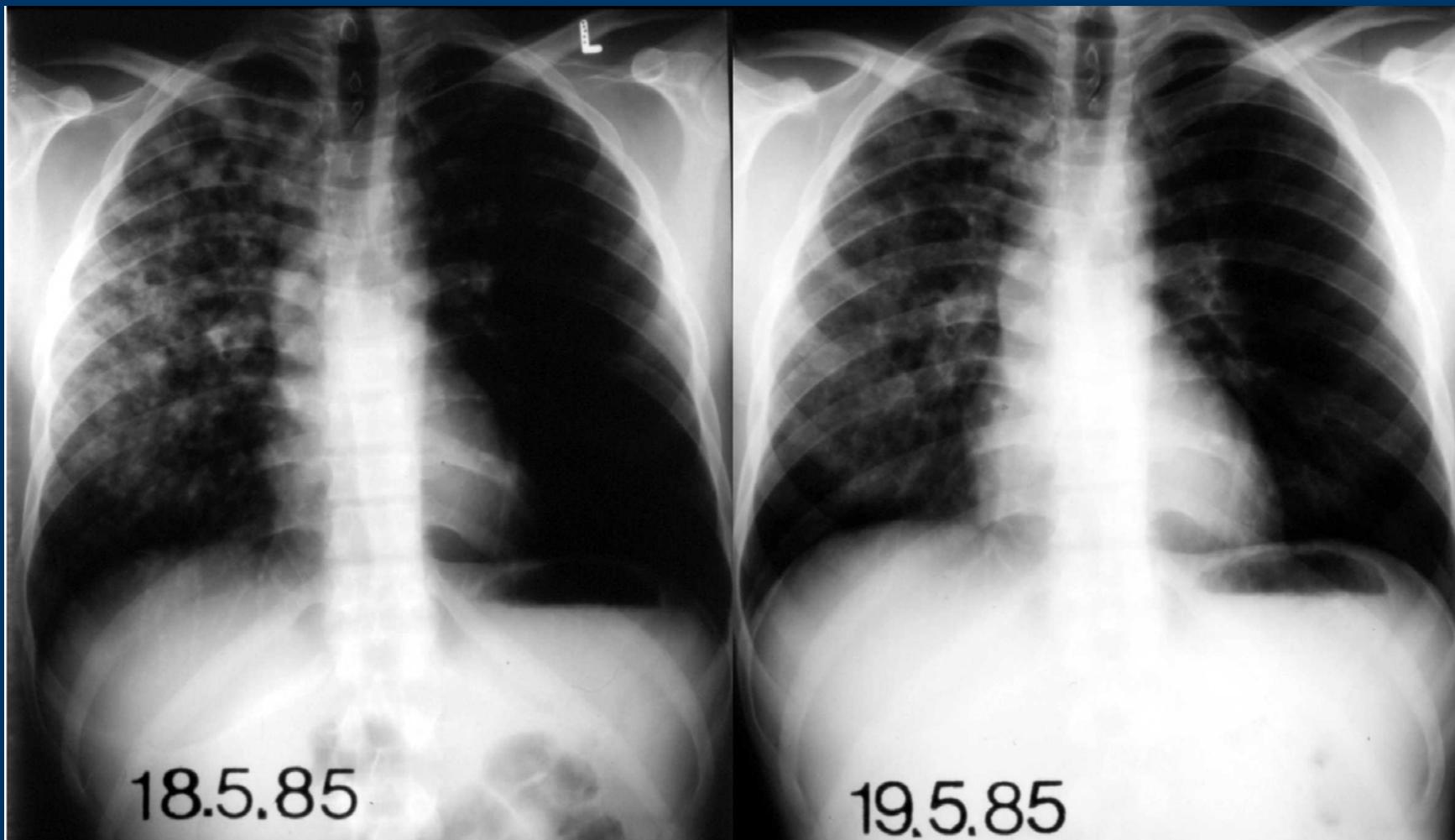








High altitude pulmonary edema (HAPE)



25 year-old healthy mountaineer



High altitude pulmonary edema (HAPE)

- Setting: - rapid ascent above 3000 - 4000 m
- Symptoms: - often preceded by AMS
 - dyspnea, decreased exercise performance, cough
 - orthopnea, gurgling, pink frothy sputum
 - ataxia, decreased consciousness
- Prognosis: - rapid complete resolution after descent
 - high mortality without treatment
- Incidence: - variable, individual susceptibility



Prevalence of HAPE in the Capanna Margherita (4559 m)

	ascent	prevalence
overall	2 - 5 days	< 0,2 %
without a history of HAPE	22 hours	6 %
with a history of HAPE	22 hours	60 %

Bärtsch, Lancet 390:571, 2002





Research at the Margherita Hut since 1983

Affiliations of first and last authors

- Austria: Innsbruck
- Belgium: Brussels
- Denmark: Copenhagen
- Germany: Heidelberg, Munich
- Italy: Milano, Ferrara, Padova
- Switzerland: Bern, Geneva, Lausanne, Zurich
- USA: Seattle, San Diego



Scientific Publications of Research Performed at the Margeritha Hut from 1983 to 2005

- 71 original research papers in Medline
- 40 papers published in leading journals of:

General Medicine

NEJM 3

JAMA 1

Lancet 7 (3 RL)

BMJ 4

Total 15

Specialized Area

Circulation 4

AJCCM 3

Radiology 1

Total 8

Physiology

J Physiol 1

AJP 3

JAP 12

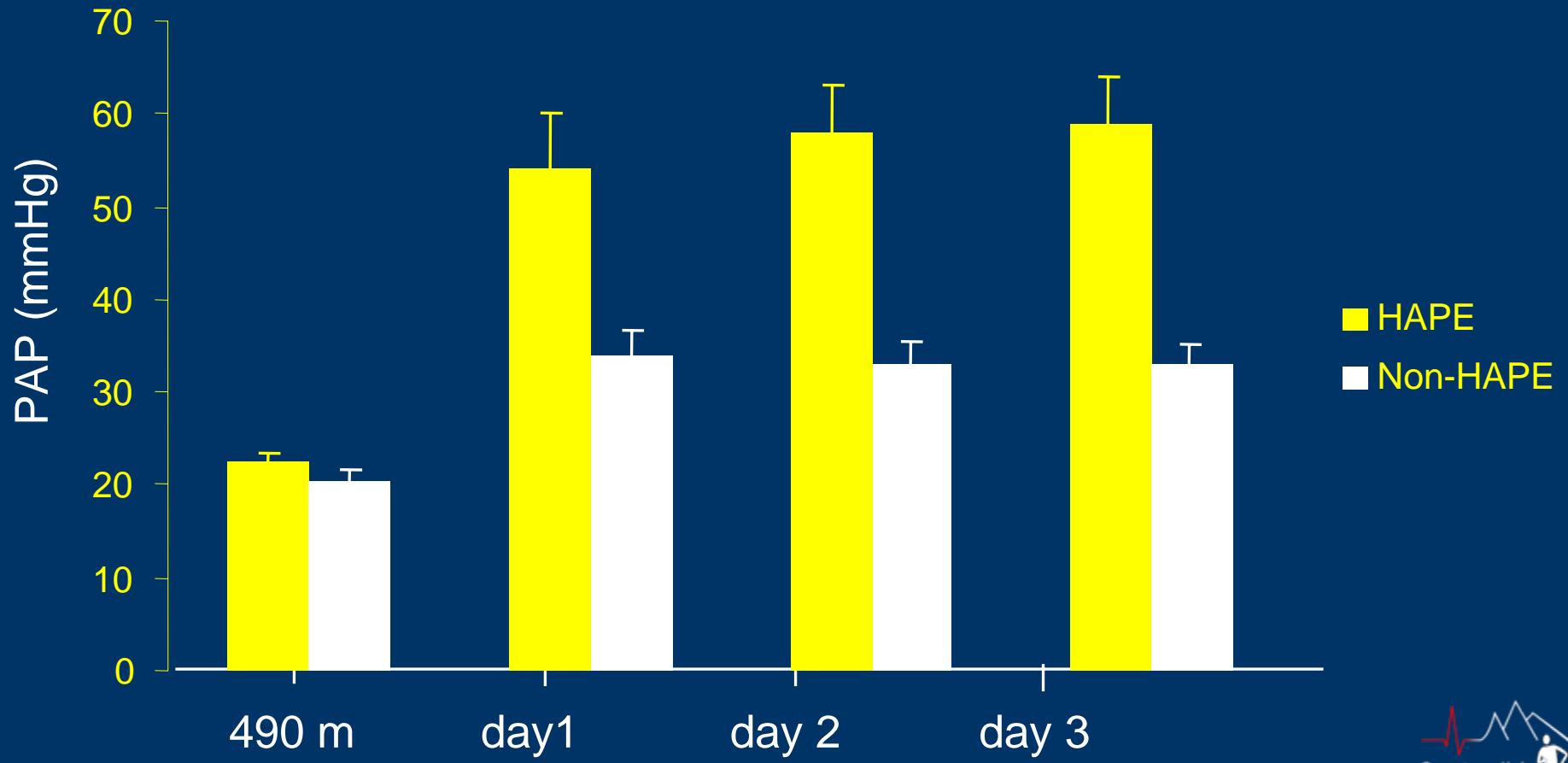
Total 17

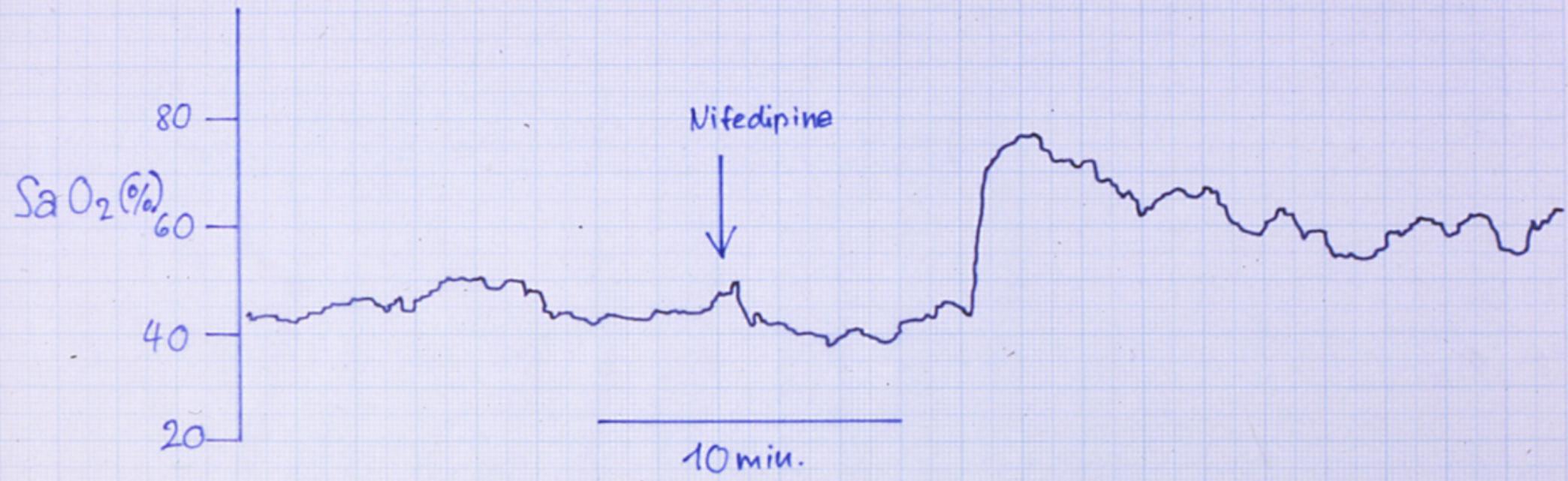


Examples of Research Performed at the Capanna Regina Margherita

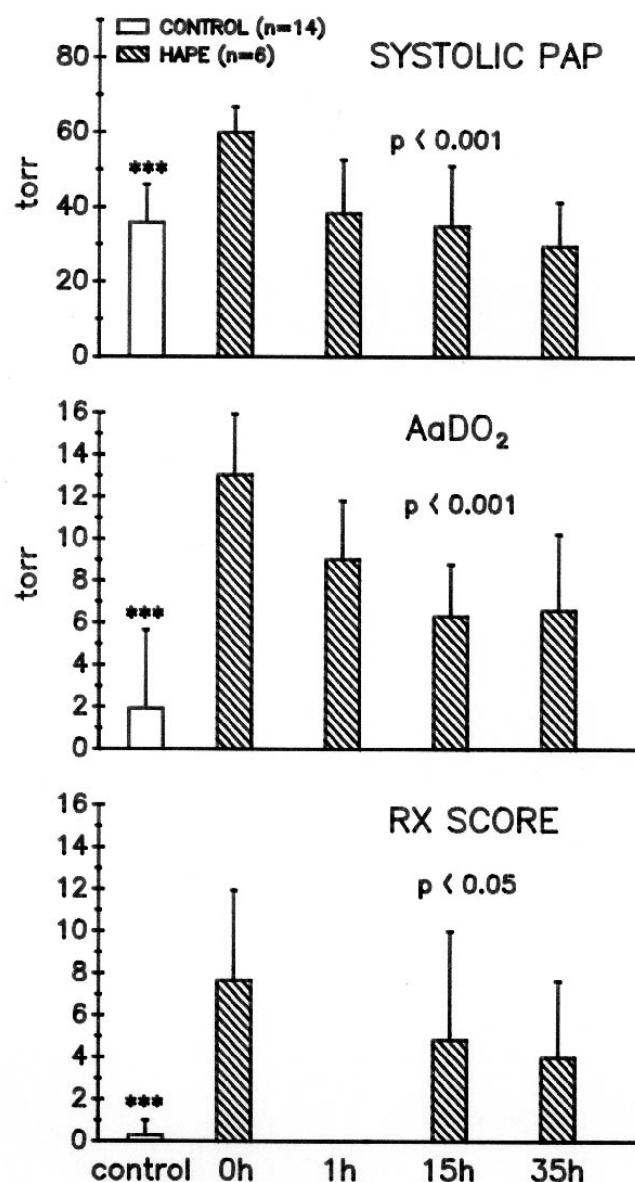
1. High Altitude Pulmonary Edema
 - Prevention and Treatment
 - Pathophysiology
2. Environmental Physics

Pulmonary Artery Pressure at an Altitude of 4559 m



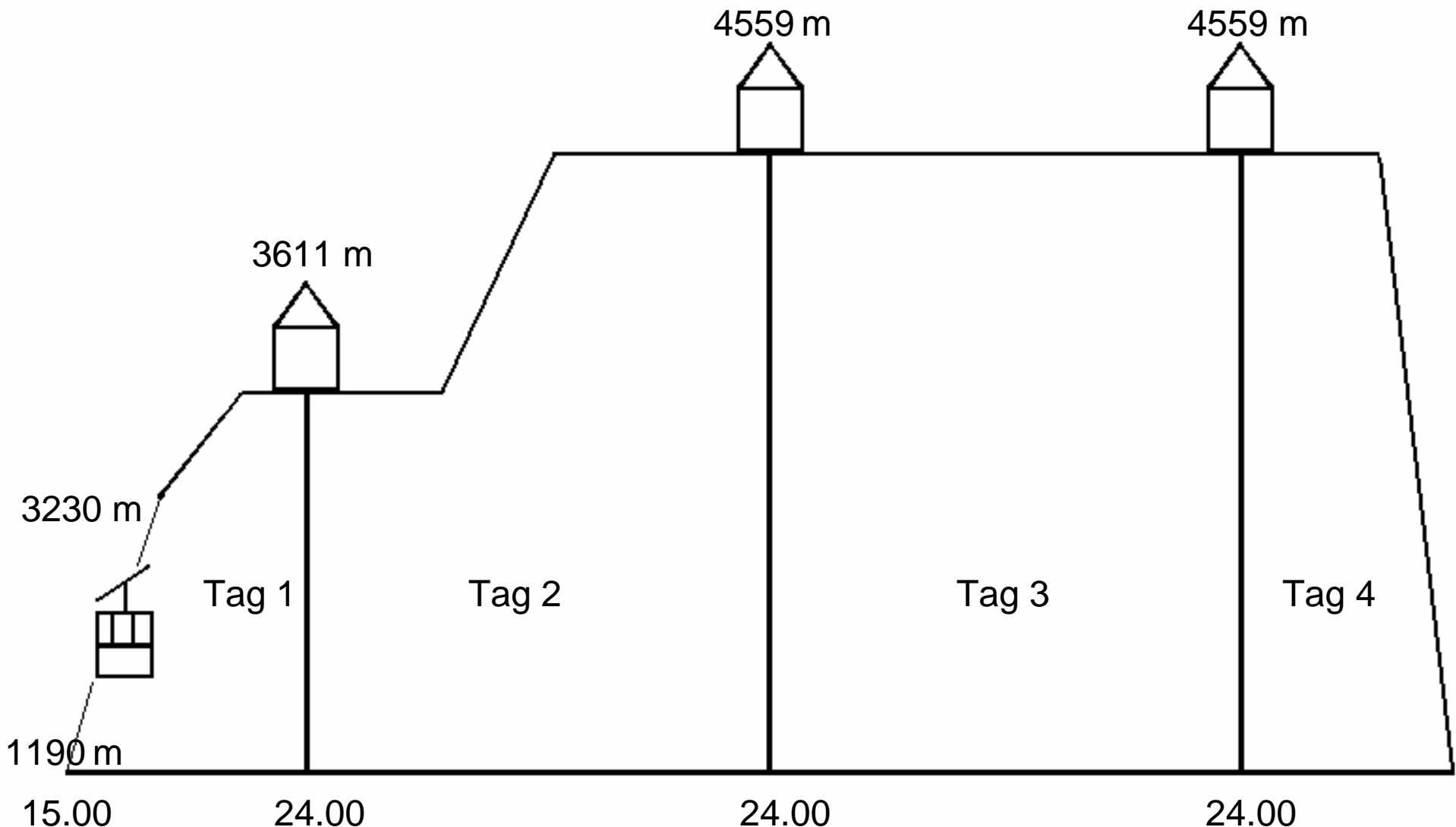


Nifedipine for treatment of HAPE



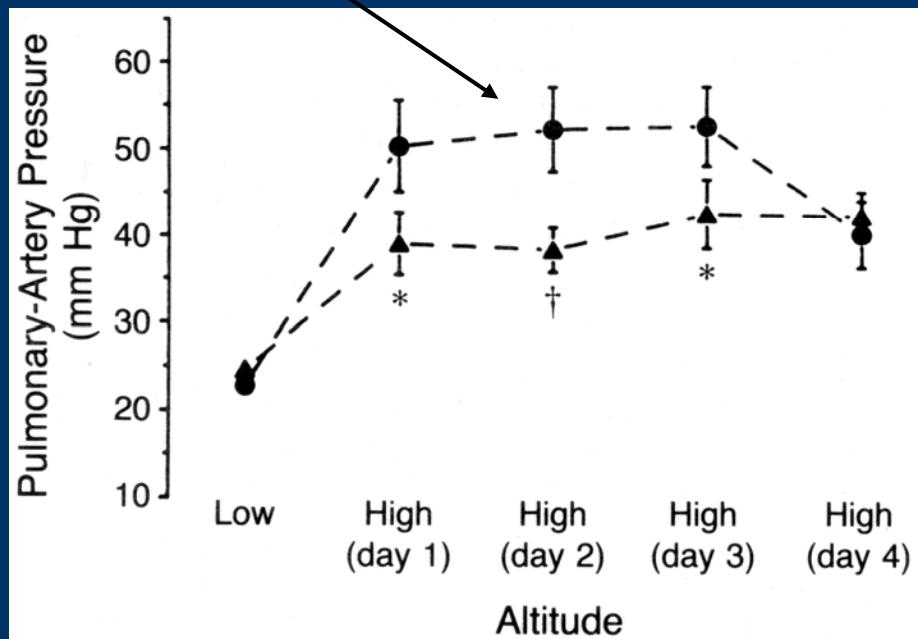
Oelz, Lancet ii:1241-44, 1989

Study Design



Pulmonary Vasodilators Prevent HAPE

Nifedipine 3x20 mg



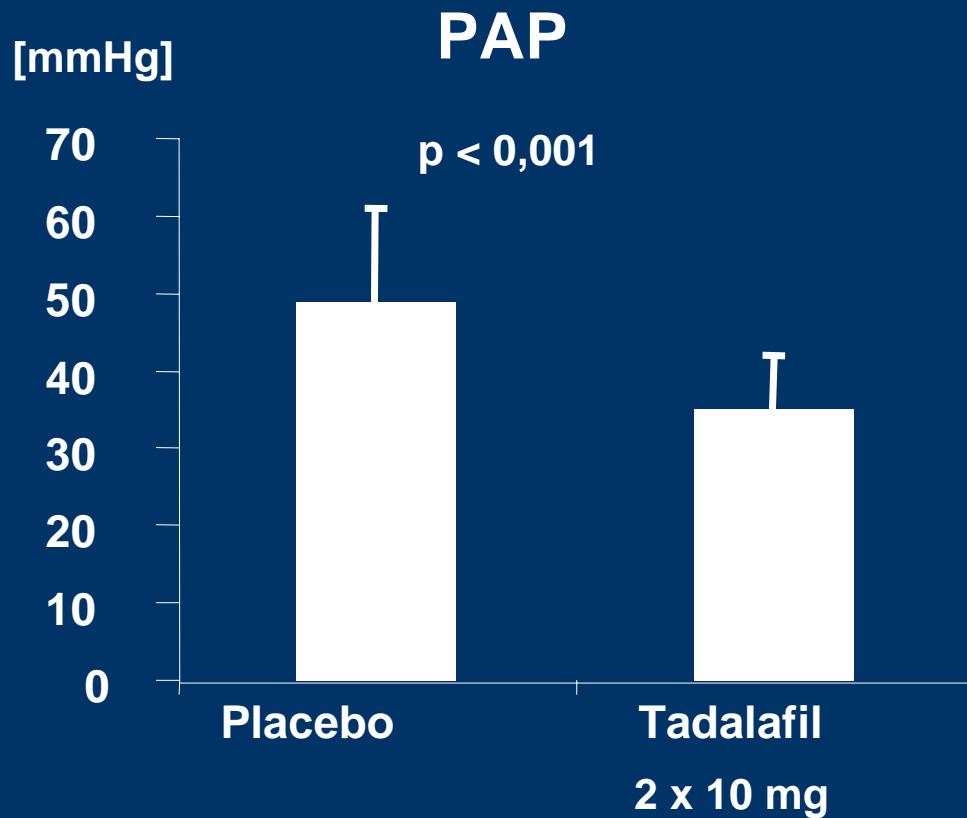
Radiographic endpoint: HAPE

Nifedipine 1 of 10 (= 10%)

Placebo 7 of 11 (= 64%)

Bärtsch, N Engl J Med 1991

Pulmonary Vasodilators Prevent HAPE



Radiographic endpoint: HAPE

Tadalafil	1 of 8 (= 13%)
Placebo	7 of 9 (= 78%)

Maggiorini et al., HAMB 2004 (Abstract)

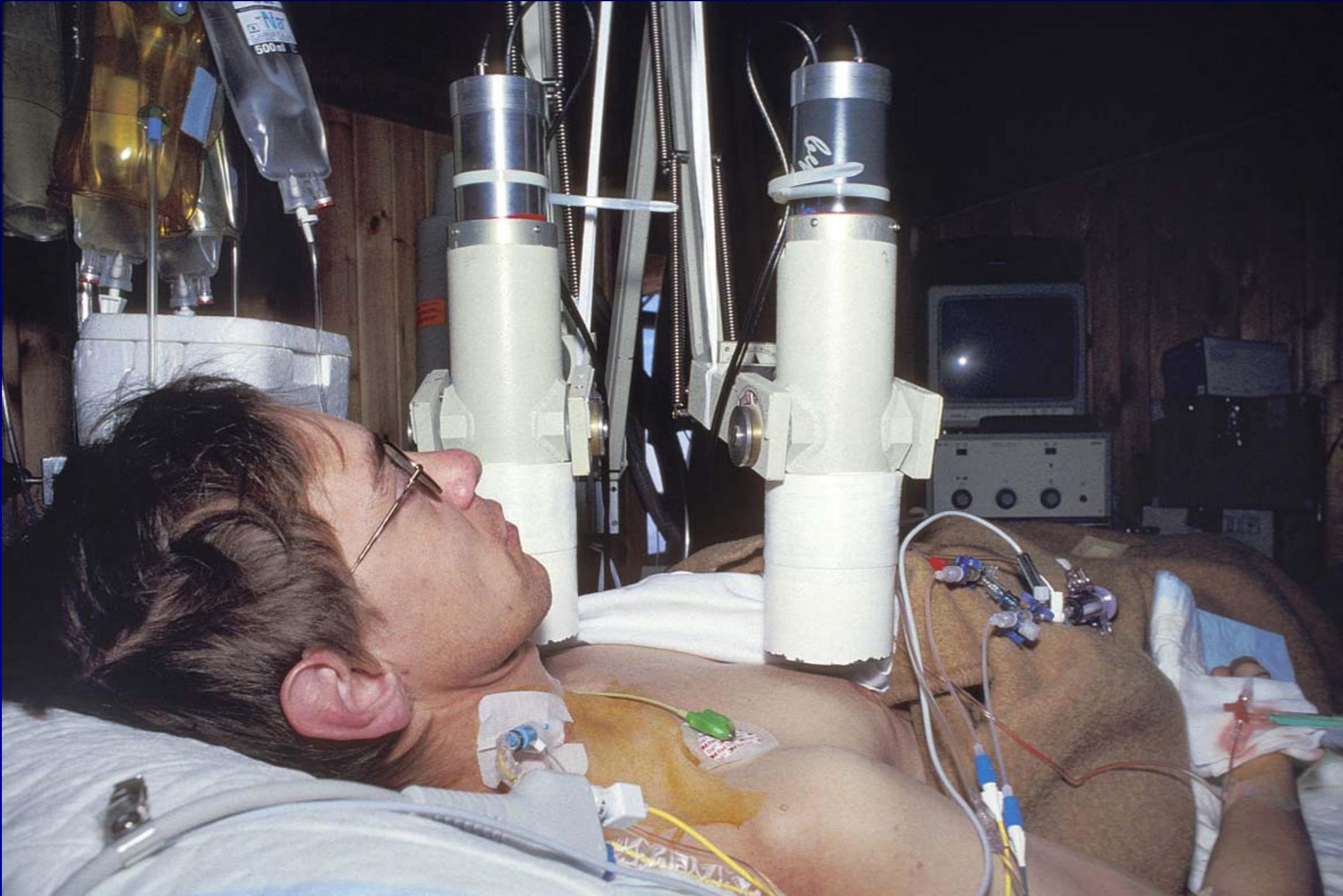


Examples of Research Performed at the Capanna Regina Margherita

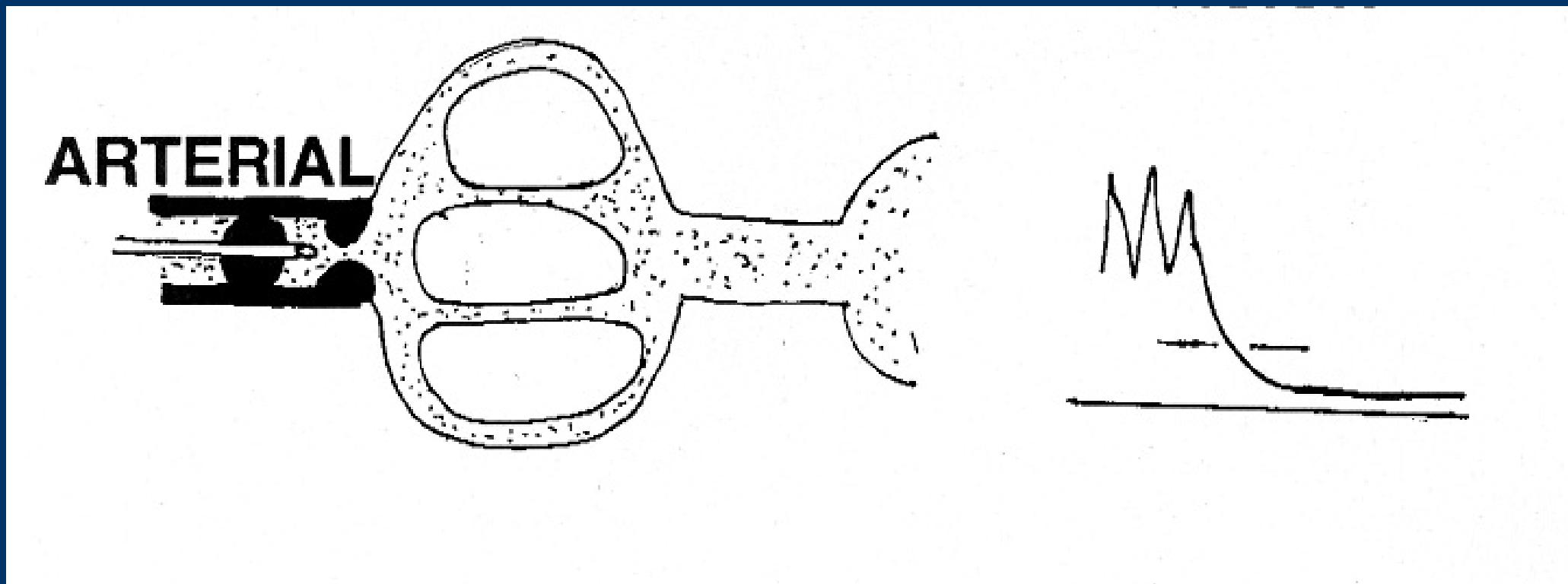
1. High Altitude Pulmonary Edema

- Prevention and treatment
- Pathophysiology:
 - Type of leak
 - Cause of exaggerated hypoxic vasoconstriction

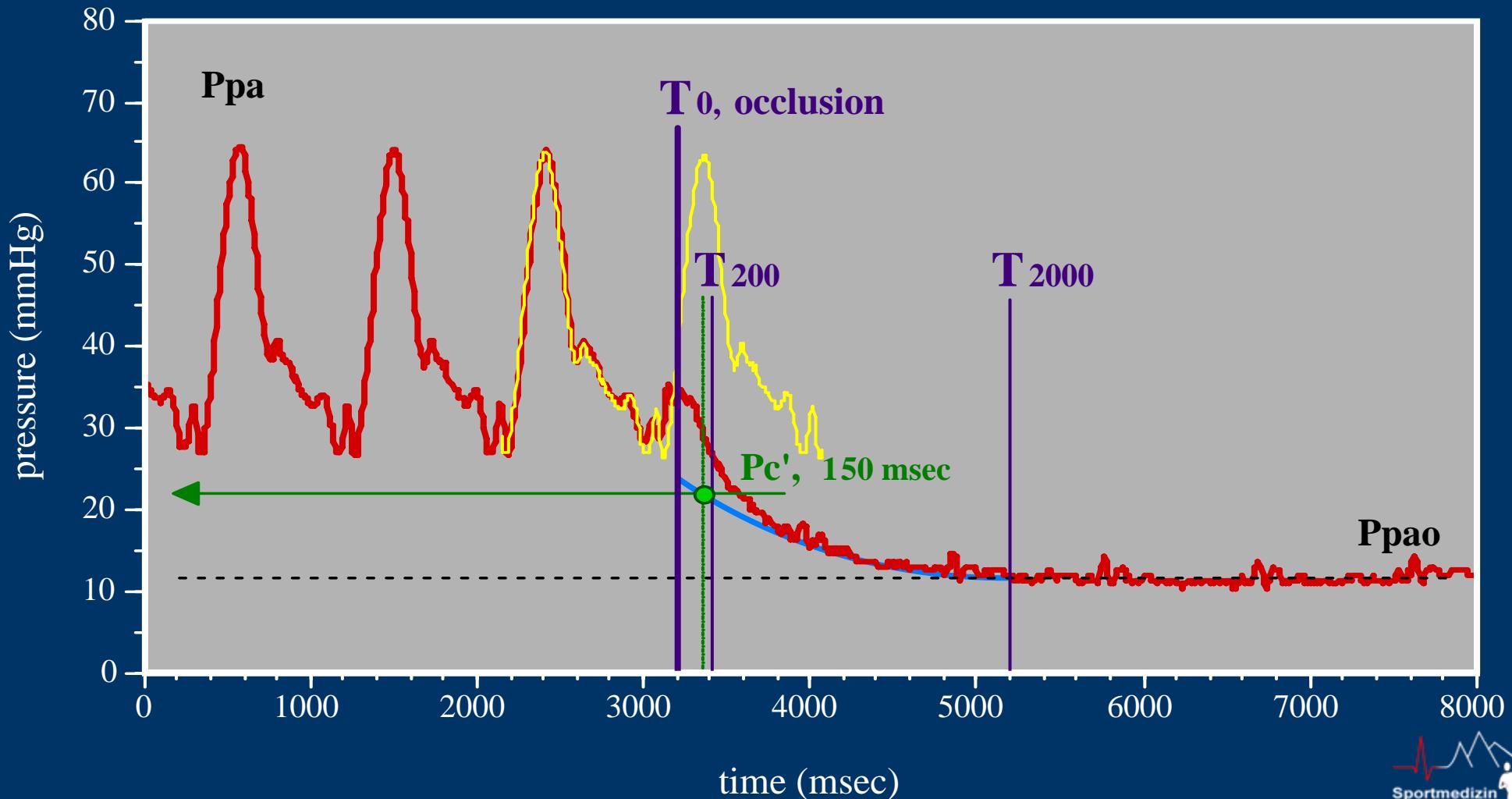
2. Environmental physics



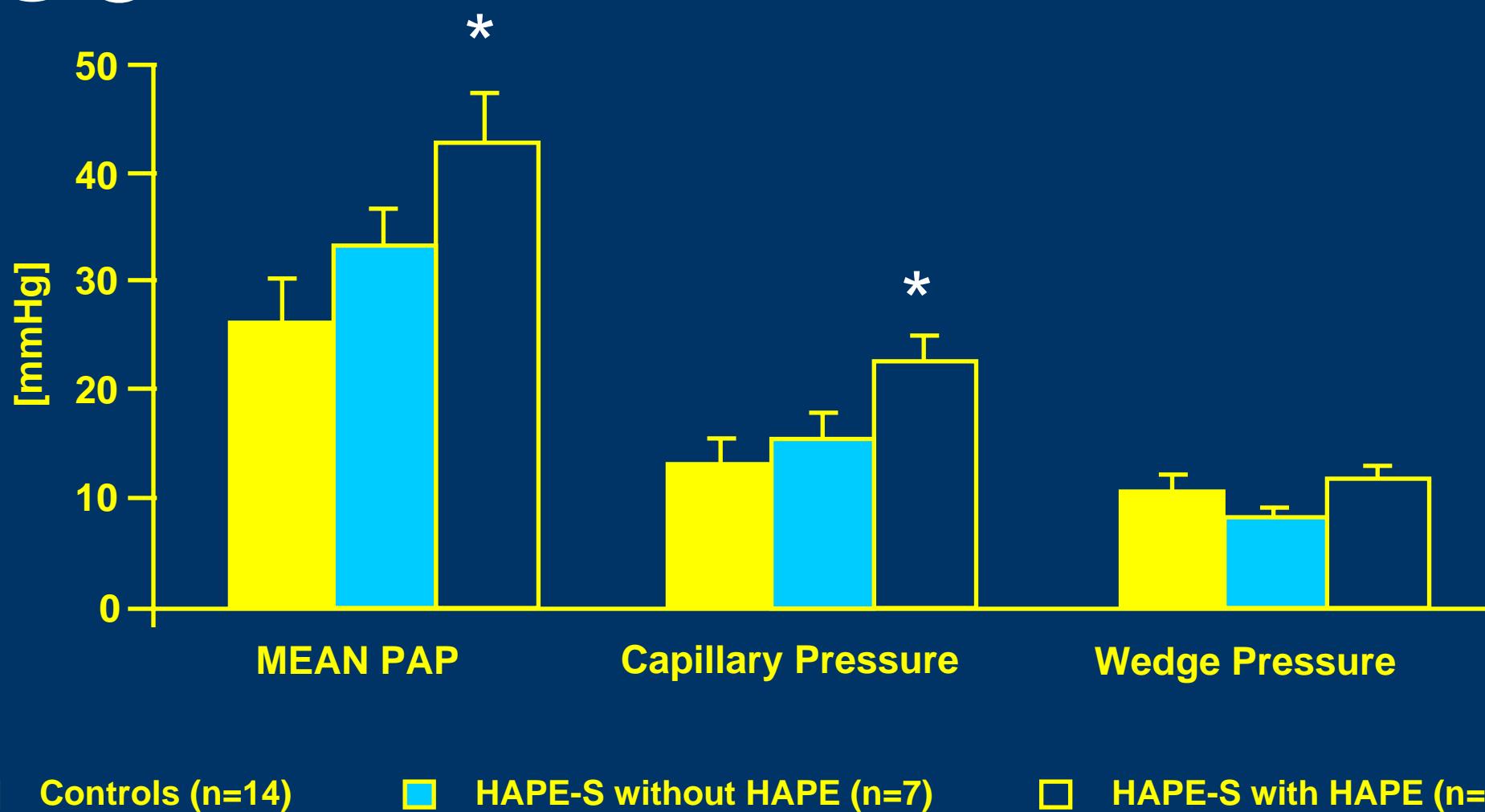
Measurement of pressure in lung capillaries



Measurement of effective pulmonary capillary pressure at 4559 m



Pressure in Pulmonary Vessels at 4559 m



■ Controls (n=14)

□ HAPE-S without HAPE (n=7)

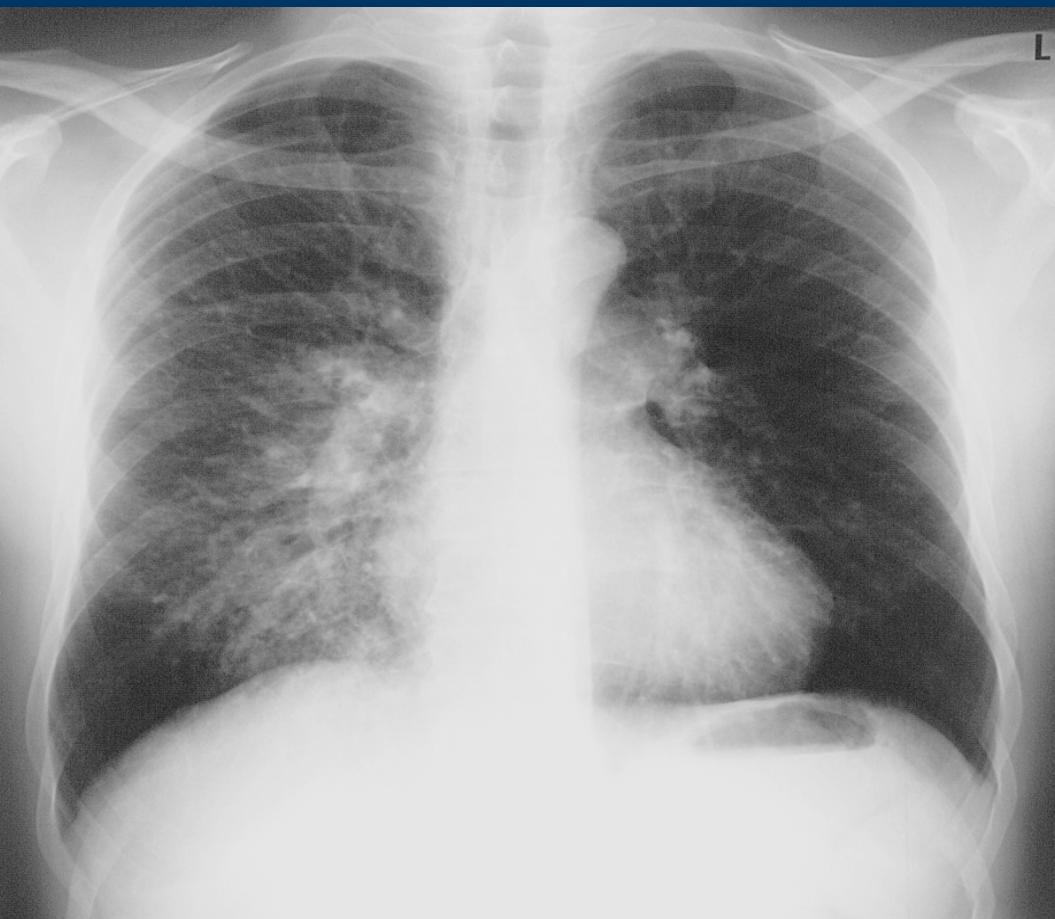
□ HAPE-S with HAPE (n=9)



Bronchoalveolar Lavage at 4559 m



Bronchoalveolar Lavage at 4559 m



Swenson, JAMA 287: 2228-2235, 2002

Conclusion from these studies

Early HAPE is a *non cardiogenic hydrostatic* pulmonary edema characterized by:

- a leak of red cells and plasma proteins
- without neutrophil recruitment
- without inflammatory or chemotactic mediators



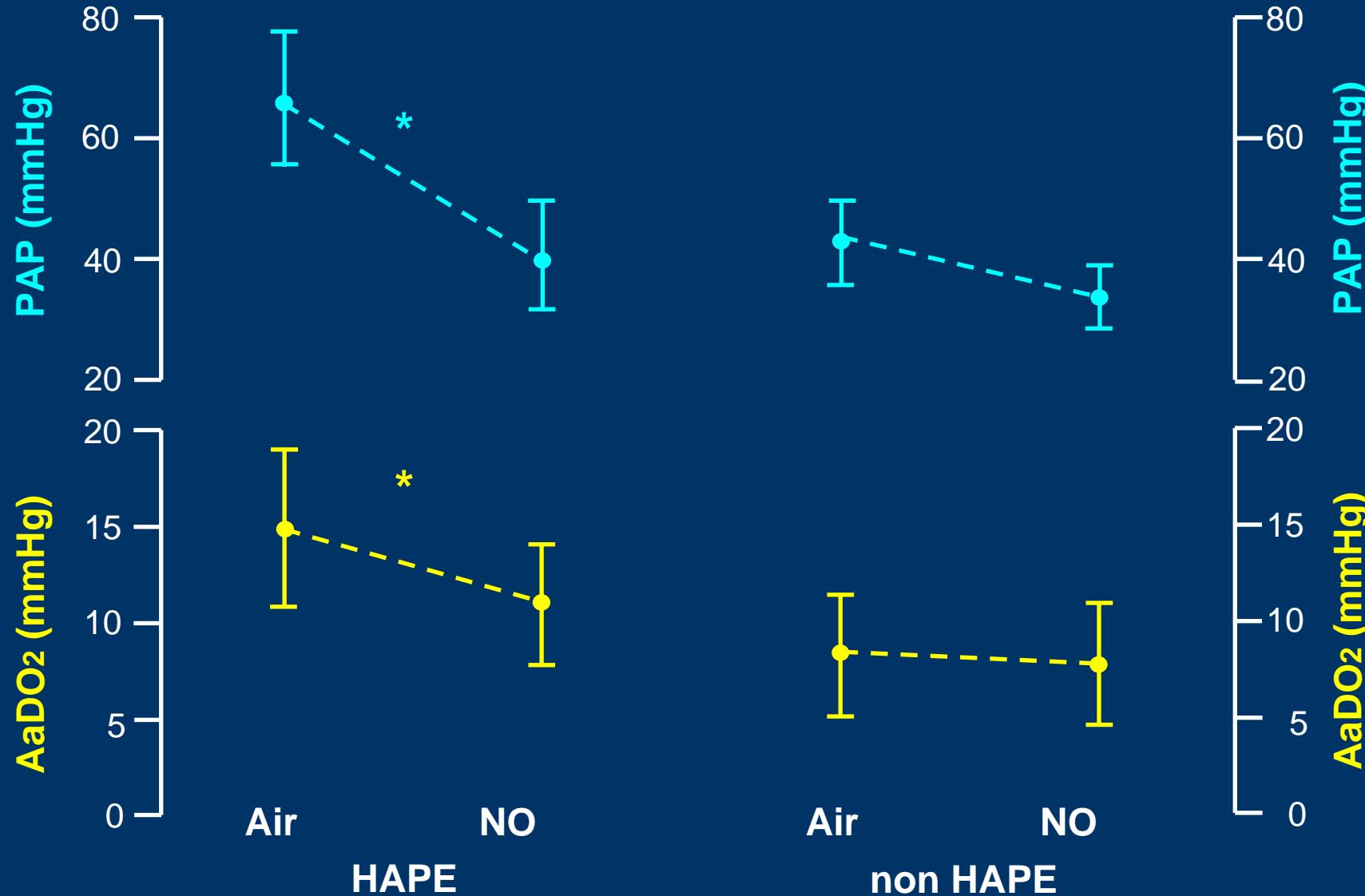
Examples of Research Performed at the Capanna Regina Margherita

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2. Environmental physics

Effect of NO inhalation (40ppm) in HAPE

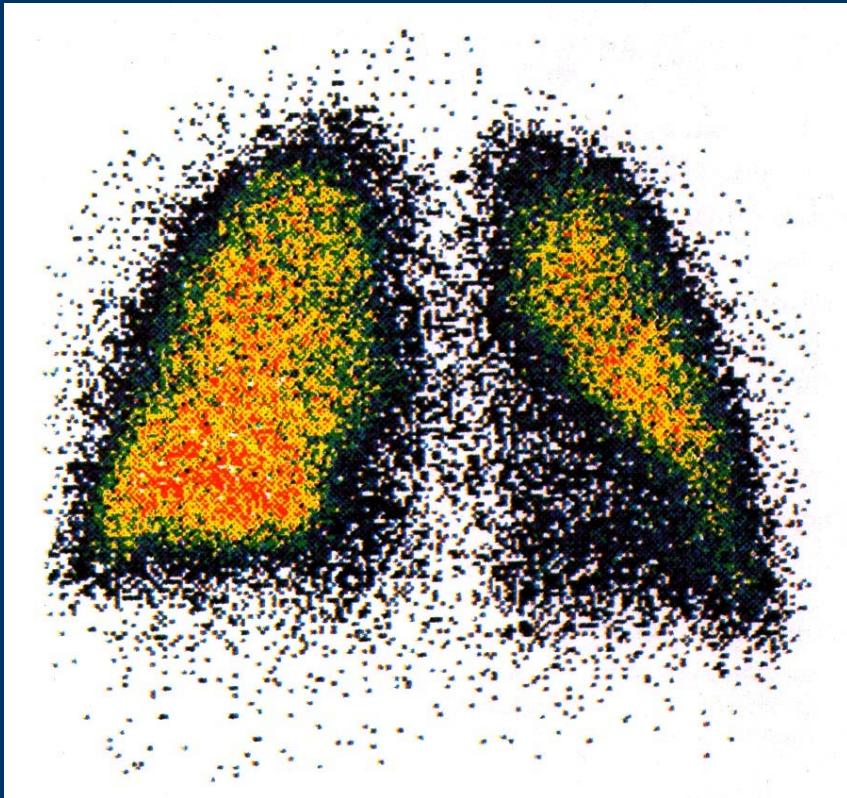


Scherer et al; NEJM 1996

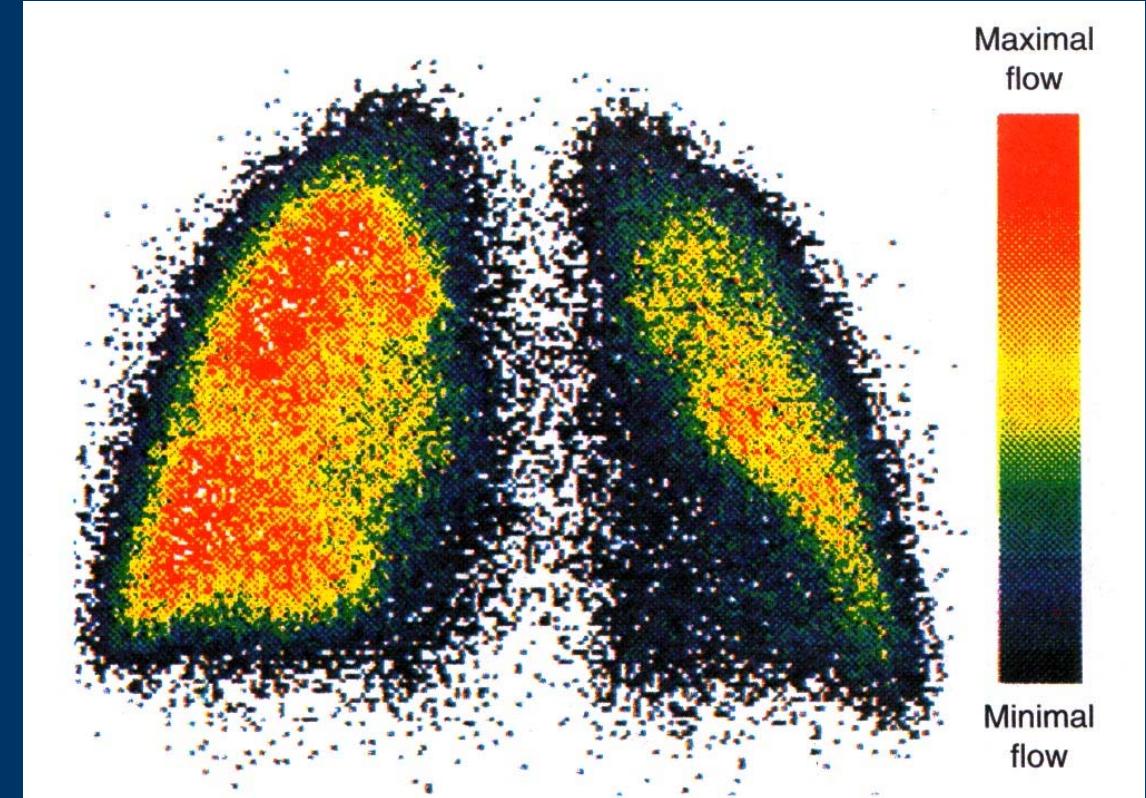




Perfusion scans in an individual with HAPE in the left middle and lower lungfield



before NO



during NO (40 ppm)

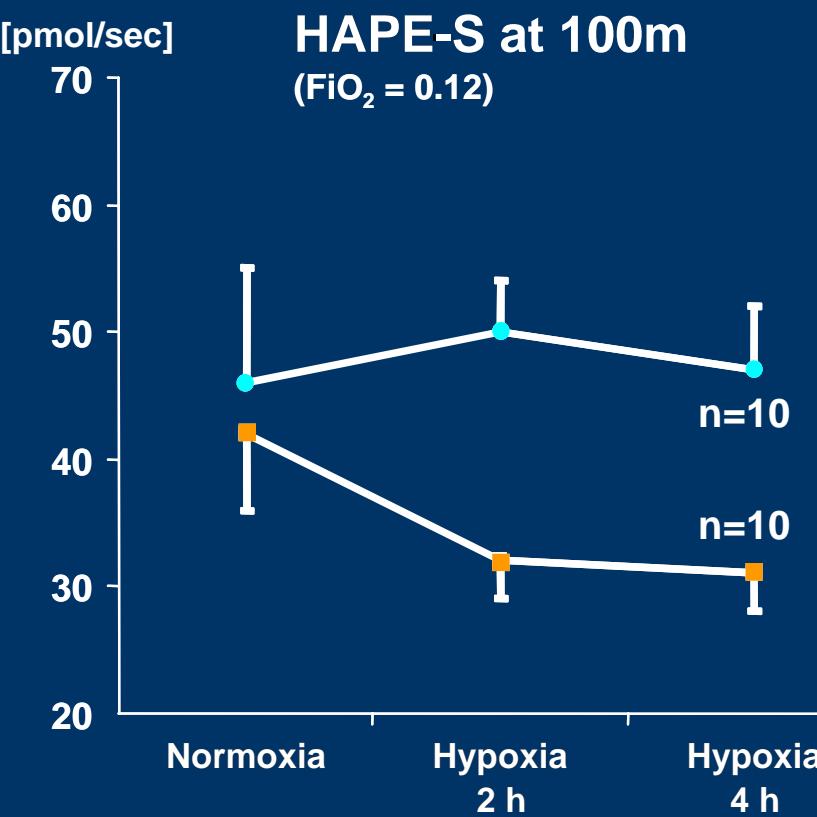
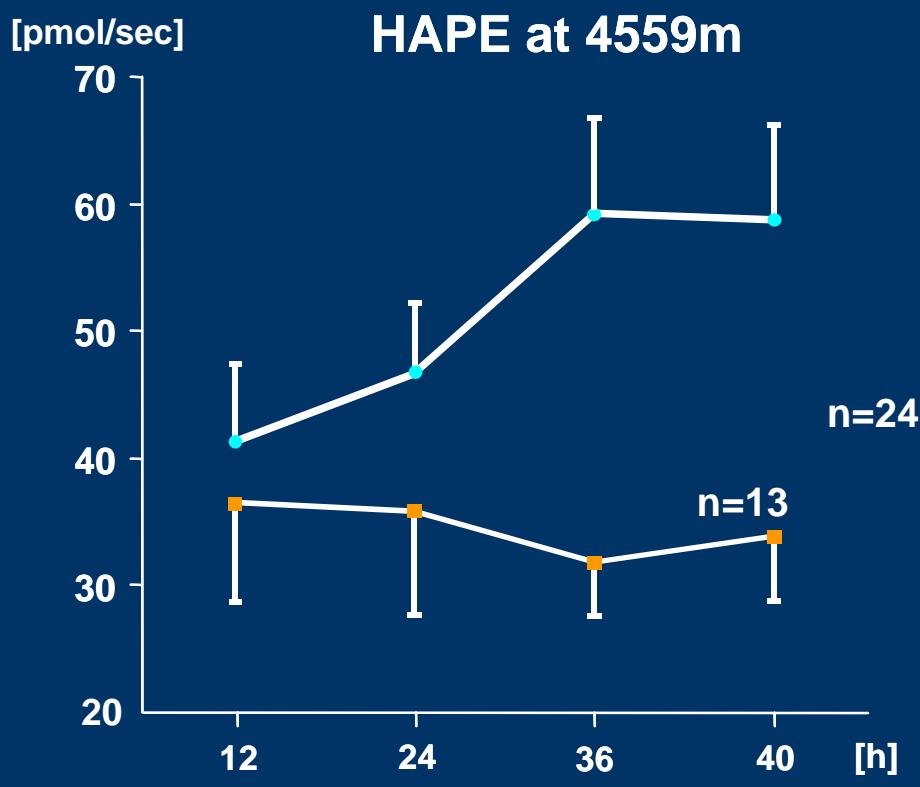
Scherrer, New Engl J Med 334:624-629, 1996

Exhaled Nitric Oxide

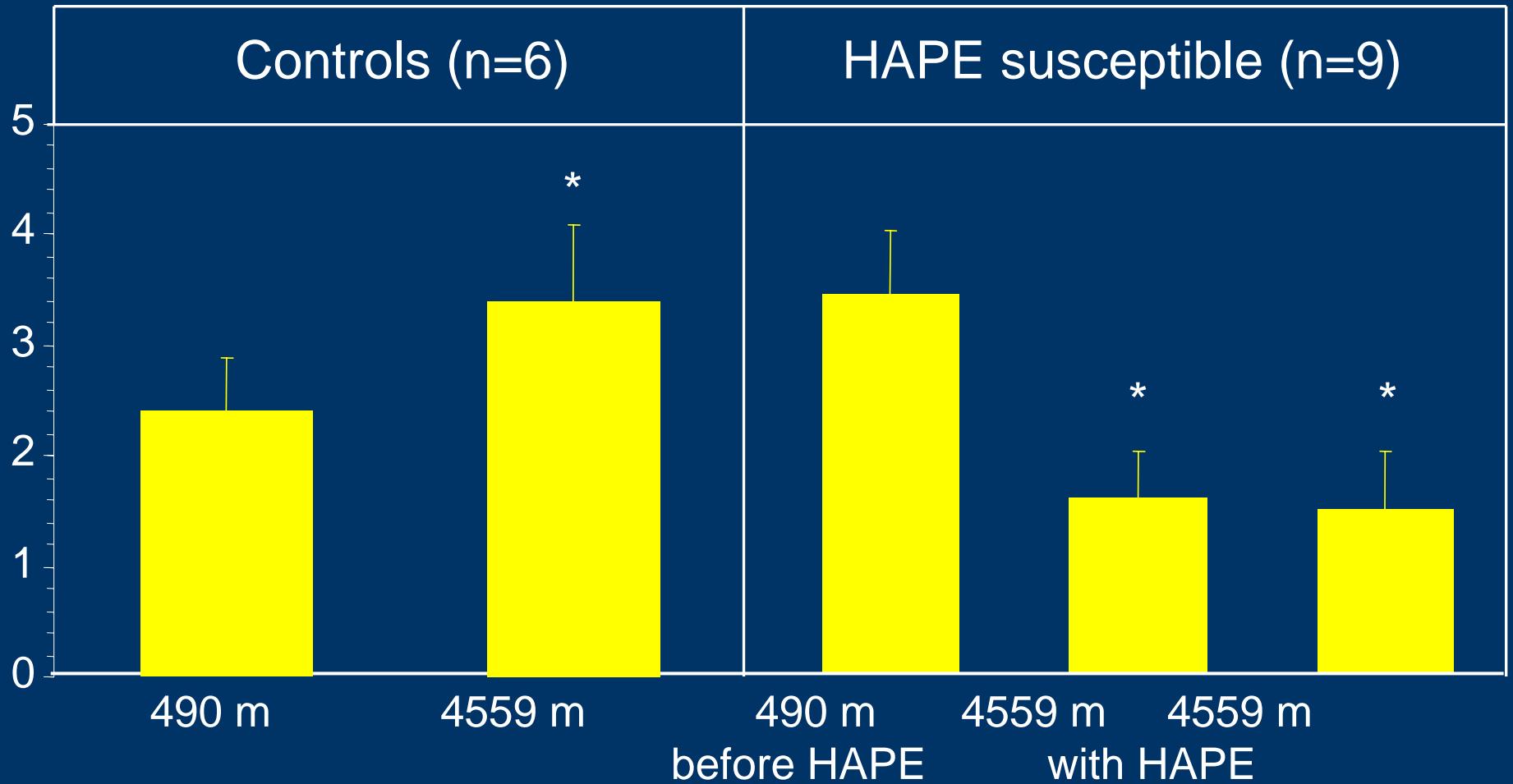


● HAPE-R

■ HAPE



Nitrate and nitrite in BAL fluid



Mean \pm SE, * p<0.05 vs. 490 m

Swenson, JAMA 2002



















Colle Gnifetti (4500 m)

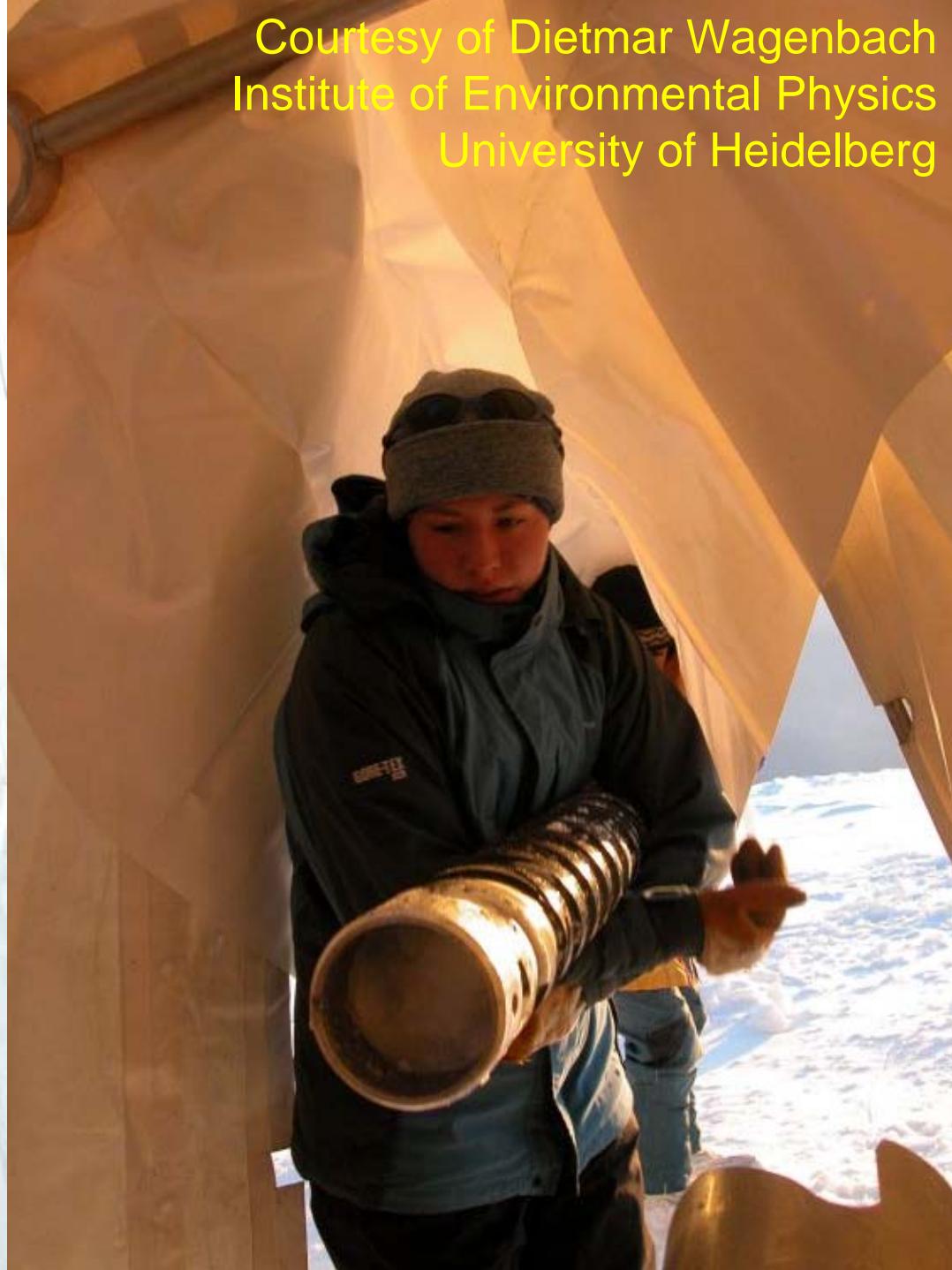




Courtesy of Dietmar Wagenbach
Institute of Environmental Physics
University of Heidelberg



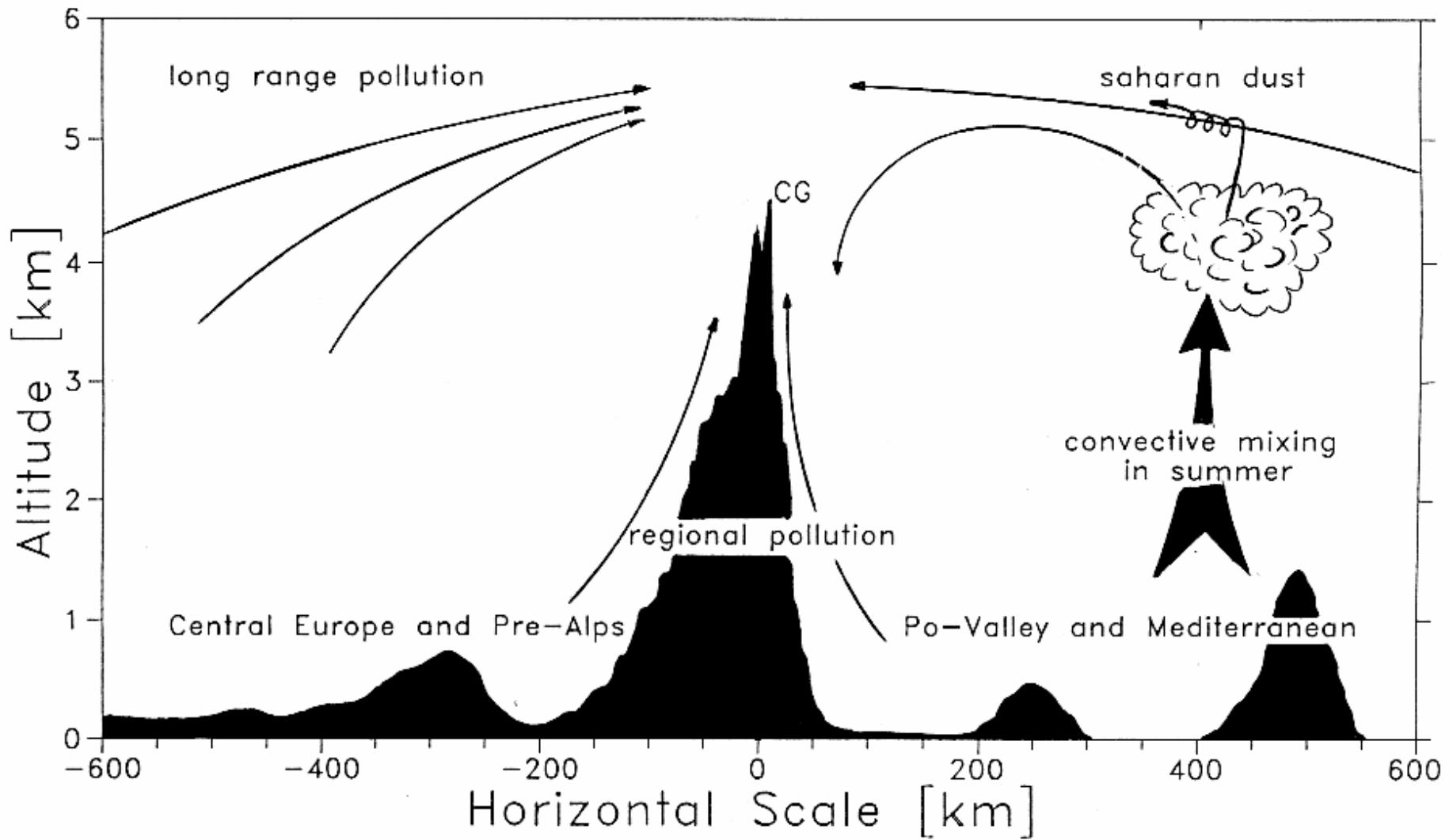
Courtesy of Dietmar Wagenbach
Institute of Environmental Physics
University of Heidelberg



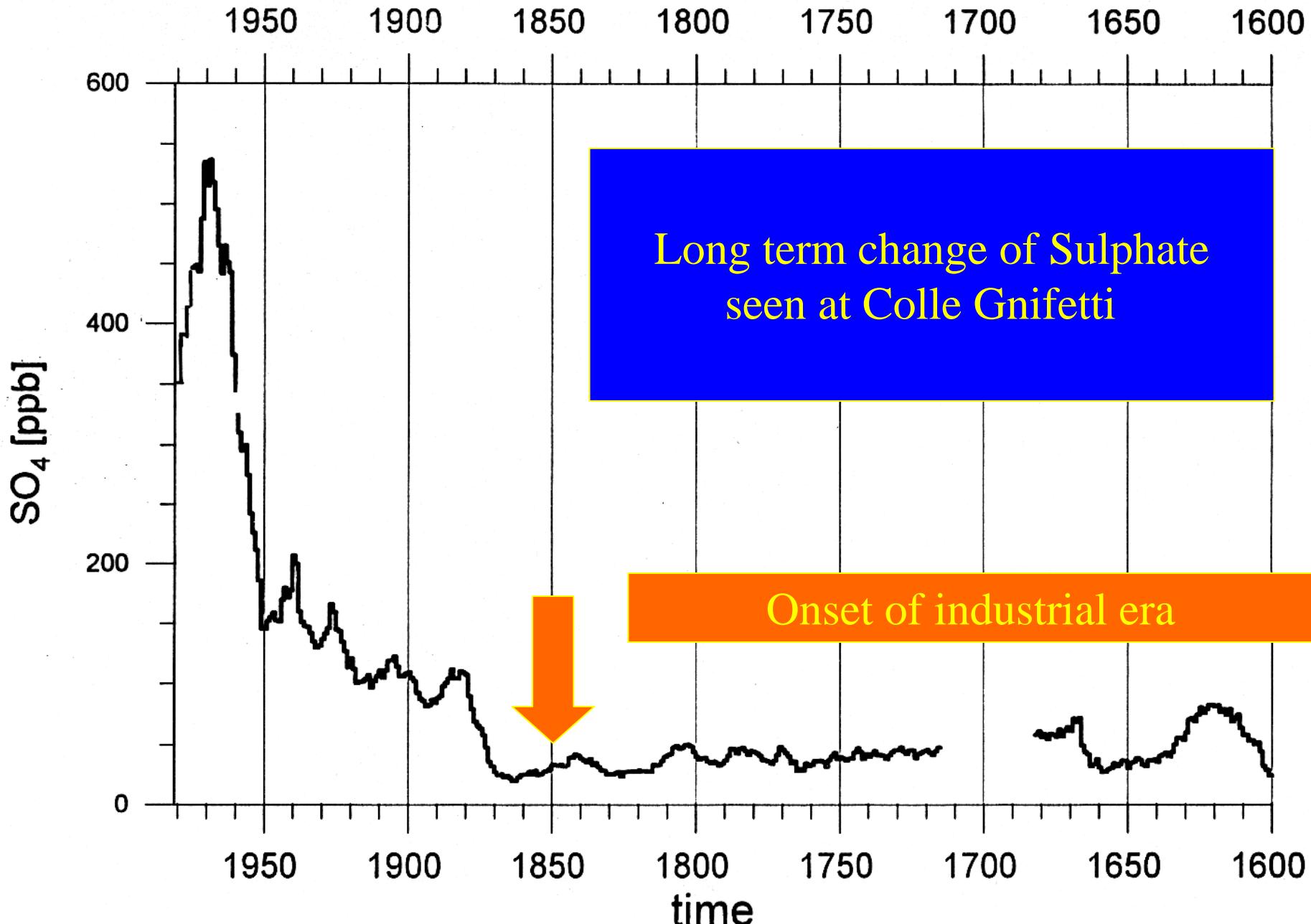


Courtesy of Dietmar Wagenbach
Institute of Environmental Physics
University of Heidelberg

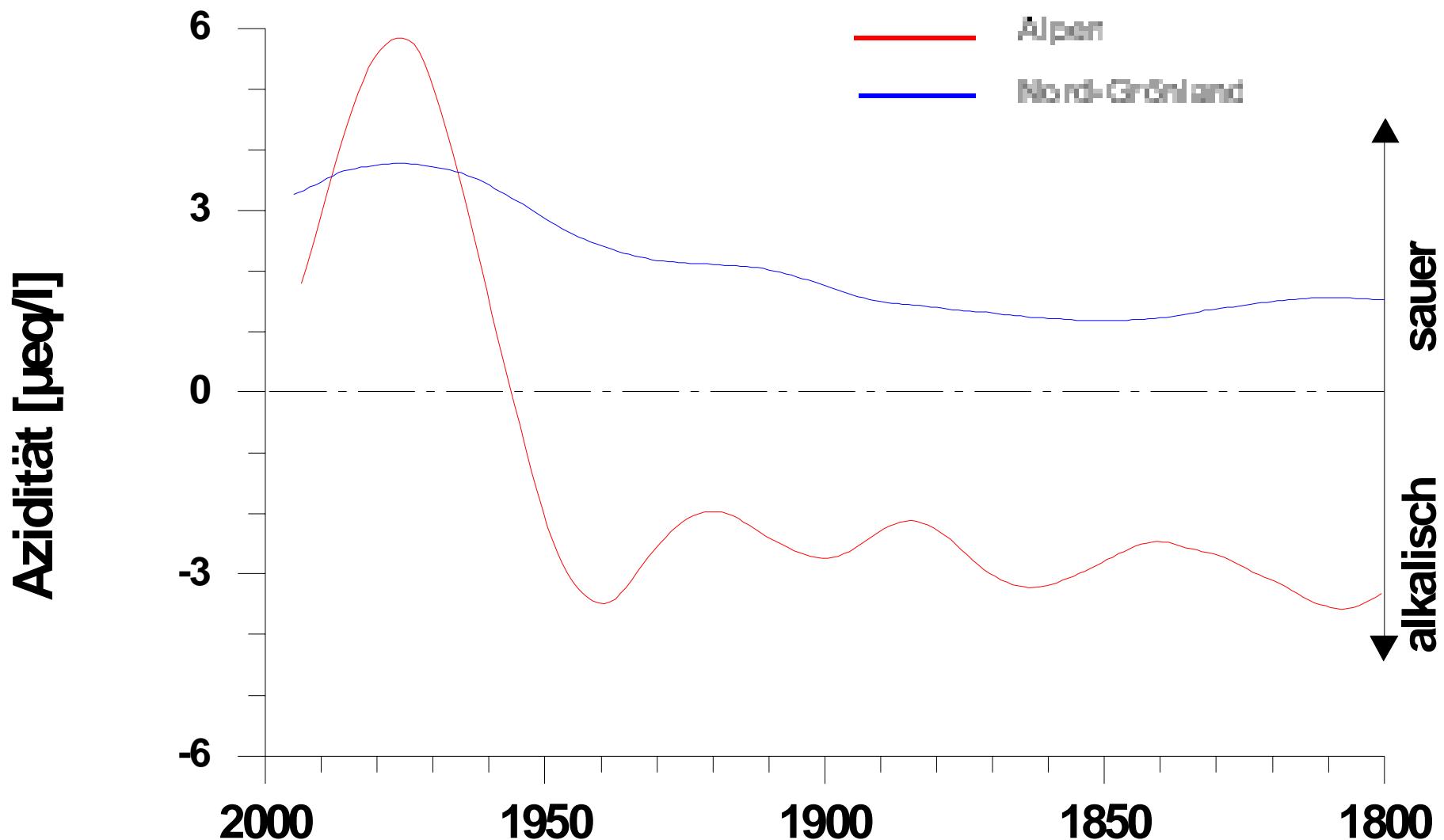
Principal Modes of Impurity Advection

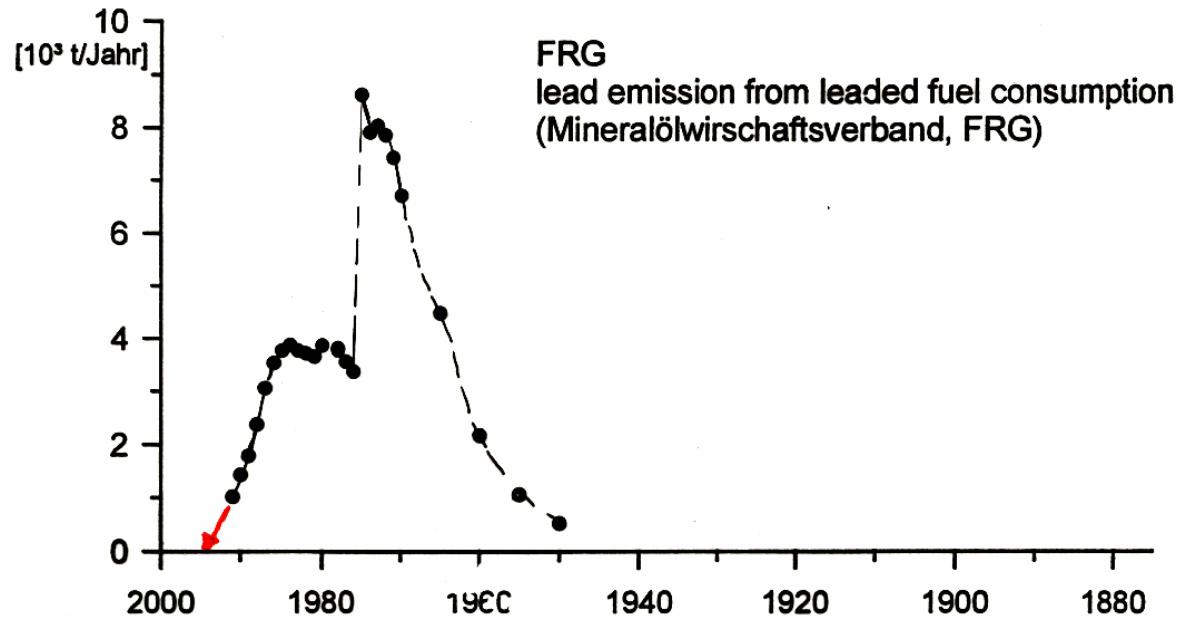
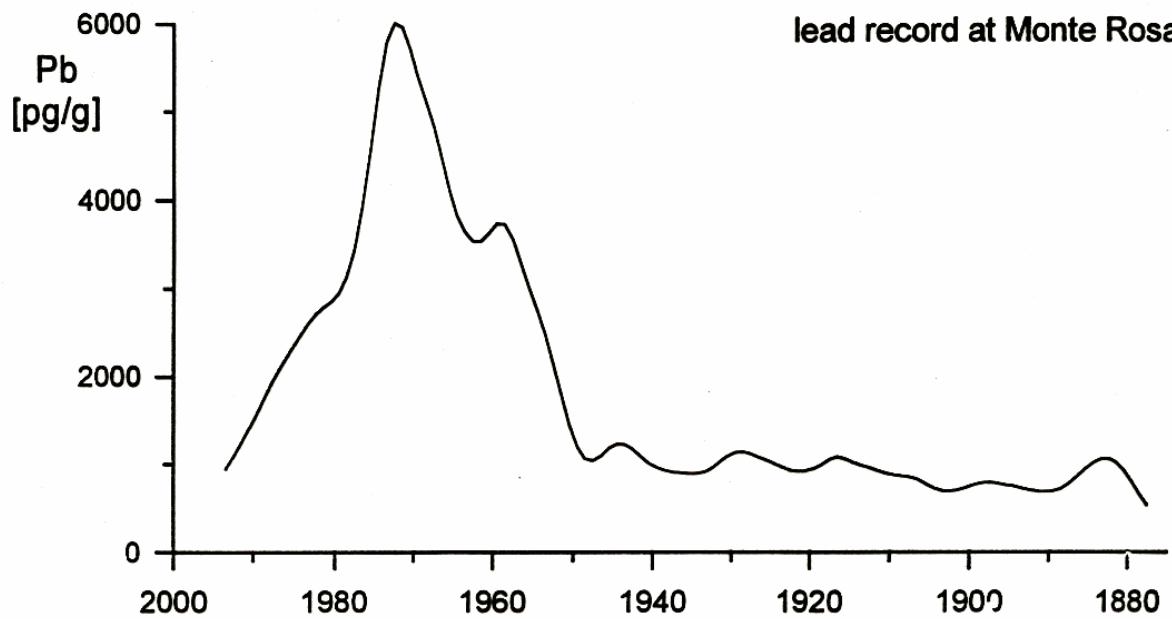


D. Wagenbach, Institute of Environmental Physics, Heidelberg

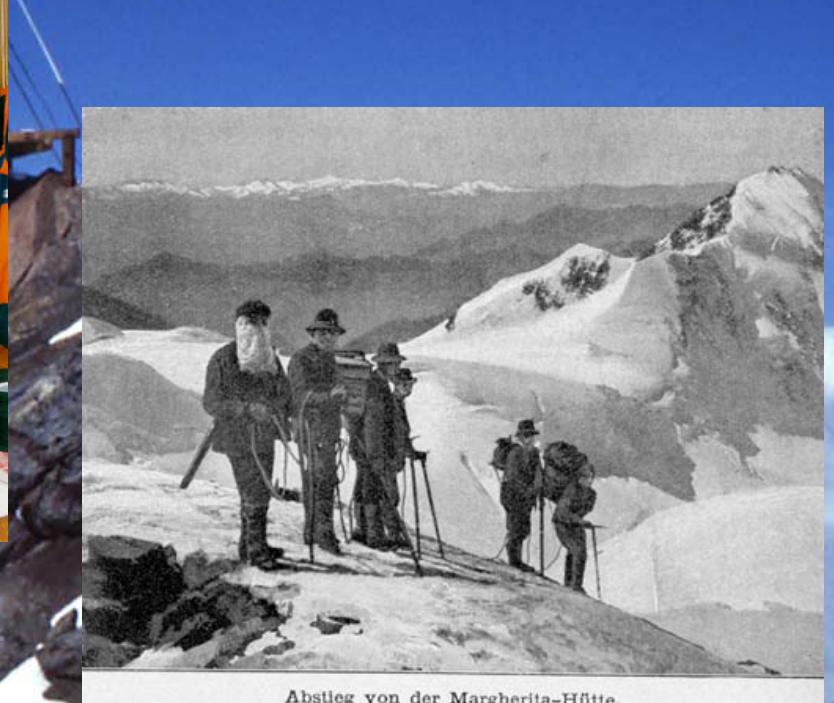


Rezente Azidität





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Heidelberg



1893 - 2005

Abstieg von der Margherita-Hütte.



















