

**Targeted use of Oxygen :
Oxidative stress responses after 60 minutes
of
30% or 100% normobaric hyperoxia**



Clément Lévêque, PT, ICU nurse
Haute Ecole Bruxelles-Brabant
Environmental & Occupational Physiology Lab.
Université Libre de Bruxelles Belgium

1

Elke reproductie, geheel of gedeeltelijk, van deze presentatie mag slechts gebeuren met voorafgaandelijk akkoord van de auteur.

Toute reproduction, partielle ou intégrale, de cet exposé et de ces notes ne peut se faire qu'avec l'accord préalable de l'auteur.

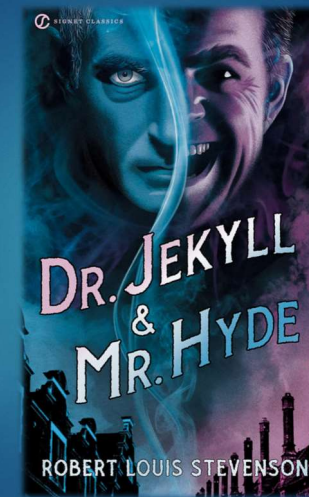
2

Premices

Physical Activity : Intermittent oxygen increase

Overtraining : Non Recovery Syndrome

3



4

medicina **MDPI**

Editorial
Oxygen: A Stimulus, Not "Only" a Drug

Costantino Balestra ¹ and Jacek Kot ² *

¹ Laboratory of Environmental and Occupational (Integrative) Physiology, Haute Ecole Bruxelles-Brabant, Auderghem, 1160 Brussels, Belgium; costantino.balestra@gmail.com
² National Center of Hyperbaric Medicine in Gdynia, Medical University of Gdańsk, 80-210 Gdańsk, Poland
 * Correspondence: jacek.kot@gumed.edu.pl

Abstract: Depending on the oxygen partial pressure in a tissue, the therapeutic effect of oxygenation can vary from simple substance substitution up to hyperbaric oxygenation when breathing hyperbaric oxygen at 2.5–3.0 ATA. Surprisingly, new data showed that it is not only the oxygen supply that matters as even a minimal increase in the partial pressure of oxygen is efficient in triggering cellular reactions by eliciting the production of hypoxia-inducible factors and heat-shock proteins. Moreover, it was shown that extreme environments could also interact with the genome; in fact, epigenetics appears to play a major role in extreme environments and exercise, especially when changes in oxygen partial pressure are involved. Hyperbaric oxygen therapy is, essentially, "intermittent oxygen" exposure. We must investigate hyperbaric oxygen with a new paradigm of treating oxygen as a potent stimulus of the molecular network of reactions.

Keywords: oxygen; hyperbaric oxygen; epigenetics; normobaric oxygen paradox; hyperoxic-hypoxic paradox

Stimulation of cellular mechanisms

Hyperbaric hyperoxia
 $PO_2 > 1$ ATA

Hyperoxia
 $PO_2 > 0.21$ ATA

Normoxia
 $PO_2 = 0.21$ ATA

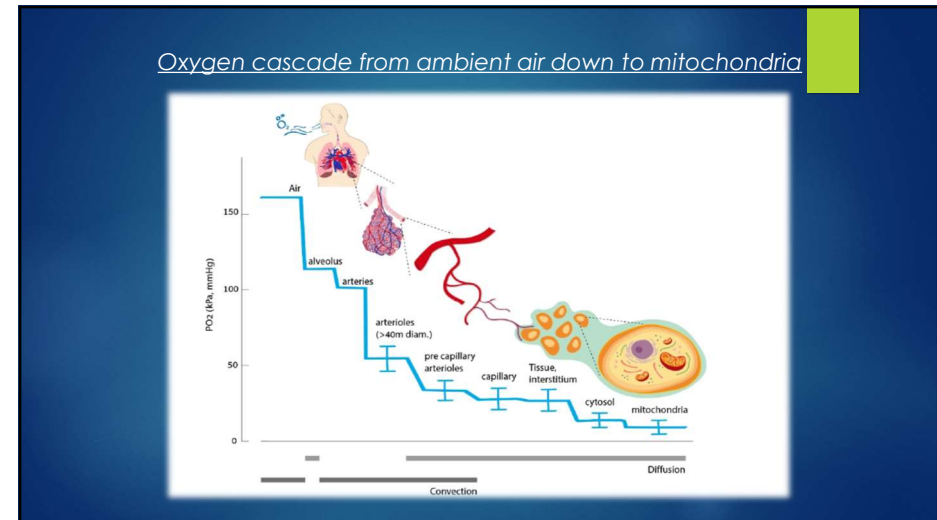
Hypoxia
 $PO_2 < 0.21$ ATA

Treatment

Side effects of O_2 predominate

Substitution of deficiencies

5



6

Serum erythropoietin levels in healthy humans after a short period of normobaric and hyperbaric oxygen breathing: the "normobaric oxygen paradox"

Costantino Balestra, Peter Germonpré, Jacques R. Poortmans and Alessandro Marroni

Journal of Applied Physiology 100:512-518, 2006. First published Oct 20, 2005; doi:10.1152/jappphysiol.00964.2005

You might find this additional information useful...

This article cites 54 articles, 19 of which you can access free at:
<http://jap.physiology.org/cgi/content/full/100/2/512#BIBL>

Updated information and services including high-resolution figures, can be found at:
<http://jap.physiology.org/cgi/content/full/100/2/512>

Additional material and information about *Journal of Applied Physiology* can be found at:
<http://www.the-aps.org/publications/jappl>

This information is current as of February 9, 2006.

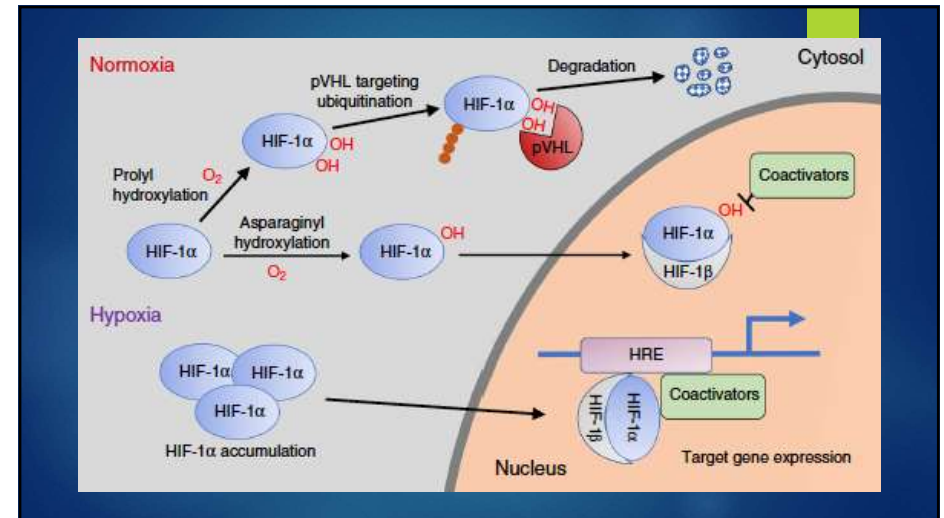
7

1991 Greg Semenza
HIF-1 Alpha

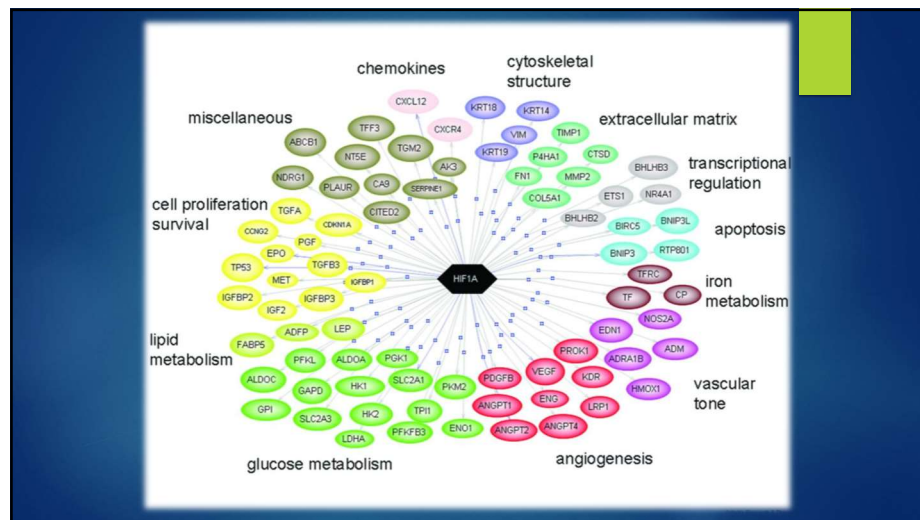
8



9



10



11

Pulsed high oxygen induces a hypoxic-like response in human umbilical endothelial cells and in humans
F. Cimino, C. Balestra, P. Germonpré, D. De Bels, F. Tillmans, A. Saija, A. Speciale and F. Virgili
J Appl Physiol 113:1684-1689, 2012. First published 4 October 2012;
doi: 10.1152/japplphysiol.00922.2012

You might find this additional info useful...

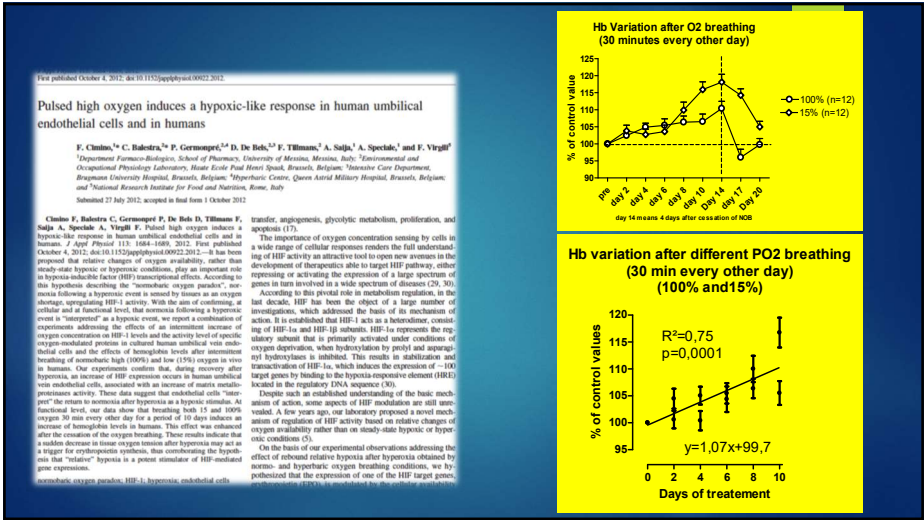
This article cites 34 articles, 9 of which you can access for free at:
<http://jap.physiology.org/content/113/11/1684.full#ref-list-1>

Updated information and services including high resolution figures, can be found at:
<http://jap.physiology.org/content/113/11/1684.full>

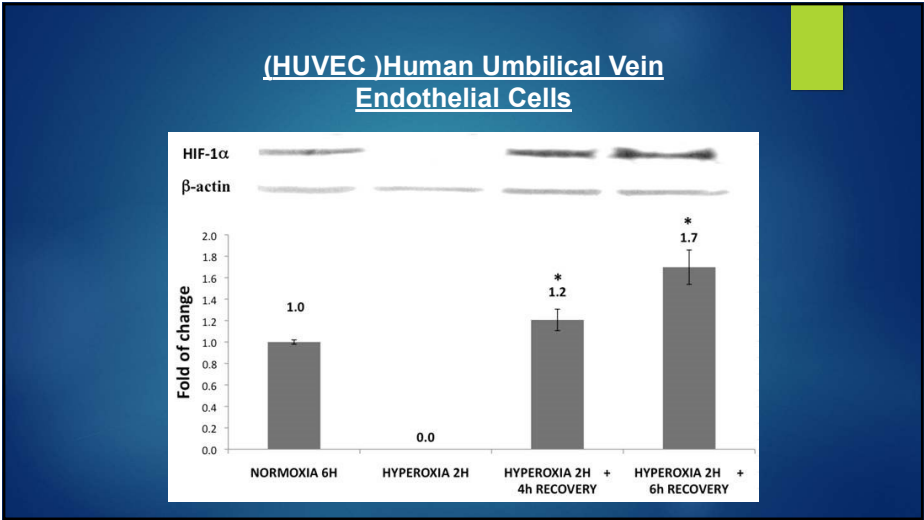
Additional material and information about *Journal of Applied Physiology* can be found at:
<http://www.the-aps.org/publications/jappl>

This information is current as of December 2, 2012.

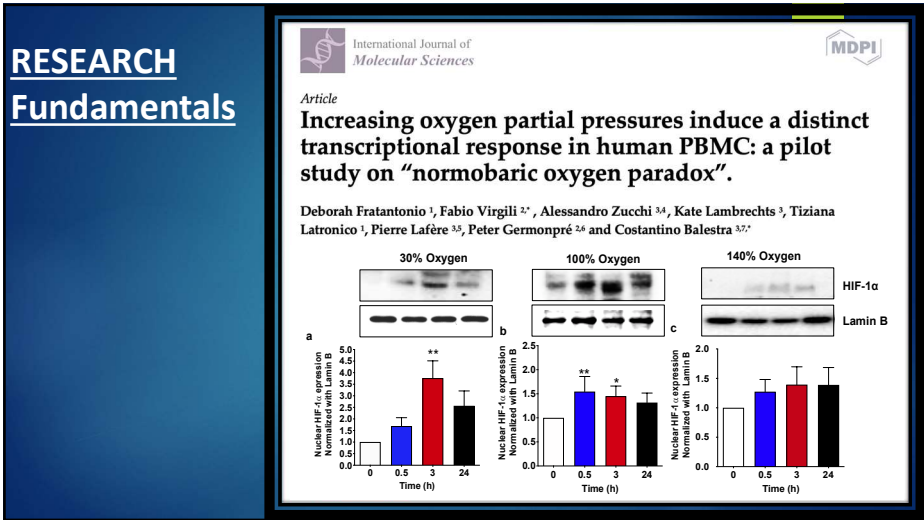
12



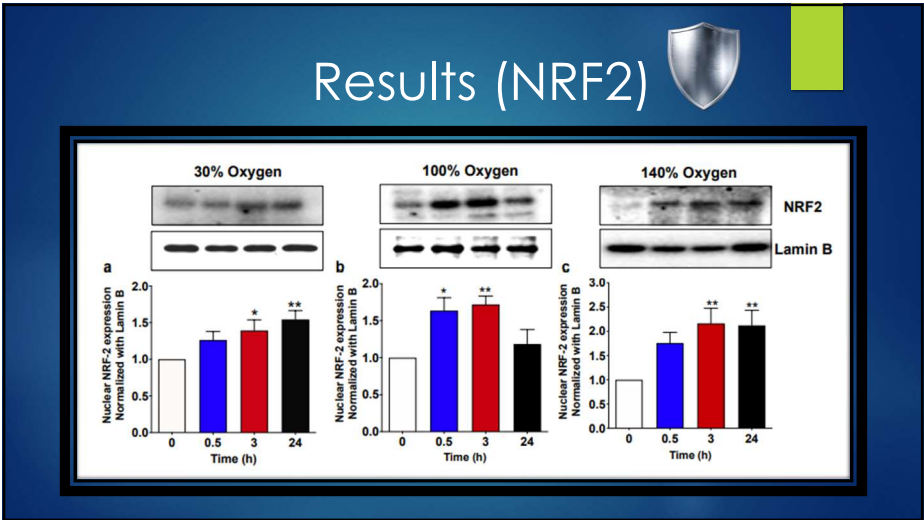
13



14

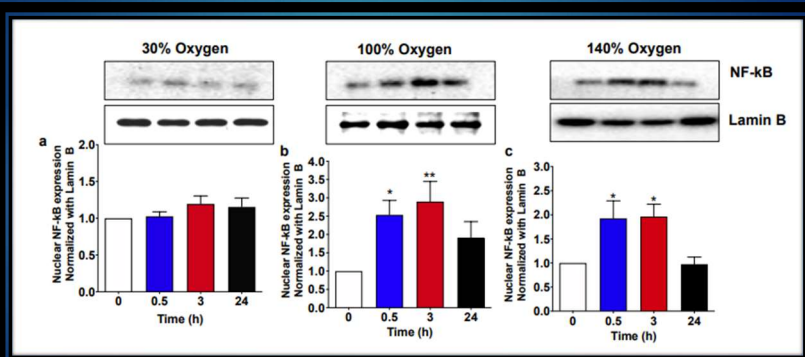


15



16

Results (NFkB)



17

INTER-PLAY...POLYMORPHISM?



NF-KB

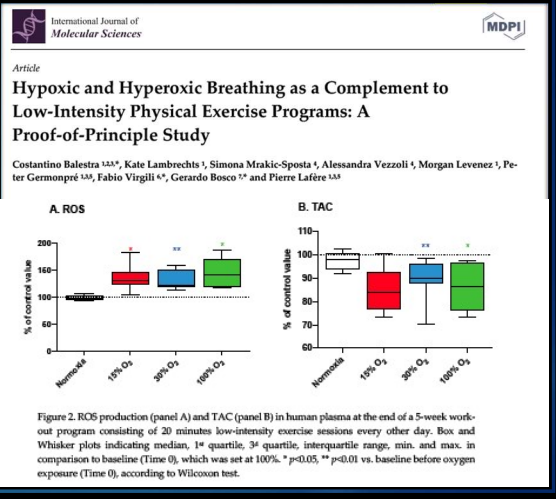
NRF2

DOSE (PRESSURE)....

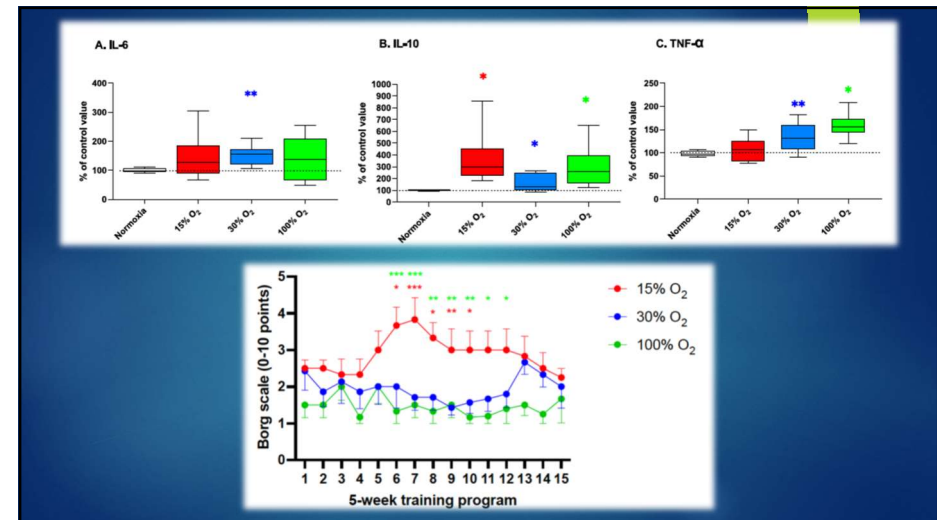
"INTER-DOSE"
(INTERMITTENCY)

18

Deltax and Rehab



19



20



International Journal of
Molecular Sciences



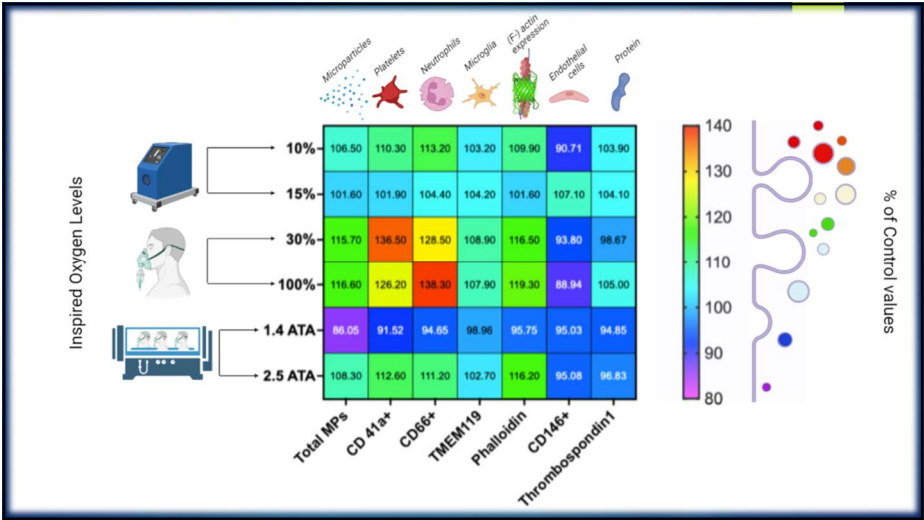
Article

Varying Oxygen Partial Pressure Elicits Blood-Borne Microparticles Expressing Different Cell-Specific Proteins—Toward a Targeted Use of Oxygen?

Costantino Balestra ^{1,2,3,4,*}, Awadhesh K. Arya ⁵, Clément Leveque ¹, Fabio Virgili ⁶, Peter Germonpré ^{1,3,7}, Kate Lambrechts ¹, Pierre Lafère ^{1,3} and Stephen R. Thom ⁵

¹ Environmental, Occupational, Aging (Integrative) Physiology Laboratory, Haute Ecole Bruxelles-Brabant (HE2B), 1180 Brussels, Belgium; clement.levéque.kinepro@gmail.com (C.L.); pgermonpre@gmail.com (P.G.); klambrechts@he2b.be (K.L.); plafere@he2b.be (P.L.)
² Anatomical Research and Clinical Studies, Vrije Universiteit Brussels (VUB), 1090 Brussels, Belgium
³ DAN Europe Research Division (Roseto-Brussels), 1160 Brussels, Belgium
⁴ Motor Sciences Department, Physical Activity Teaching Unit, Université Libre de Bruxelles (ULB), 1050 Brussels, Belgium
⁵ Department of Emergency Medicine, University of Maryland School of Medicine, Baltimore, MD 21201, USA;

21



22



International Journal of
Molecular Sciences



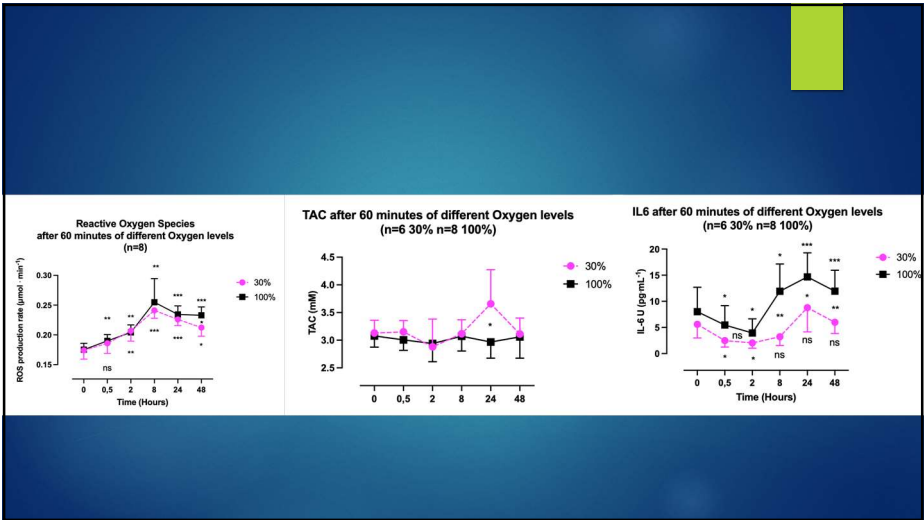
Article

Oxidative stress response's kinetics after 60 minutes at different (30% or 100%) normobaric hyperoxia exposures.

Clément Leveque ^{1,2}, Simona Mrakic-Spota ³, Pierre Lafère ^{1,2}, Alessandra Vezzoli ³, Peter Germonpré ^{1,3}, Alexandre Beer ¹, Stéphane Mievis ¹, Fabio Virgili ¹, Kate Lambrechts ¹, Sigrid Theunissen ¹, François Guerrero ¹, Costantino Balestra ^{1,3,4,*}

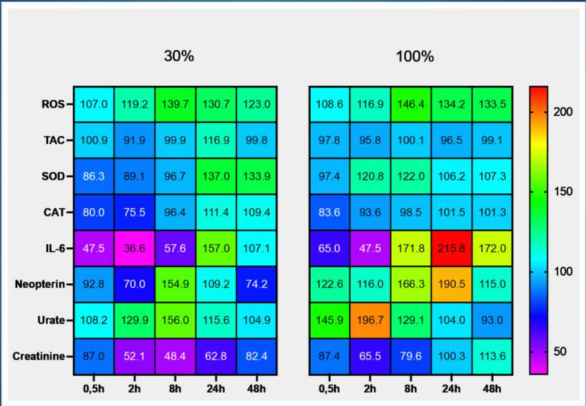
¹ Environmental, Occupational, Aging (Integrative) Physiology Laboratory, Haute Ecole Bruxelles-Brabant (HE2B), Brussels, Belgium; klambrechts@he2b.be; plafere@he2b.be; c.levéque.research@gmail.com; cbalestra@he2b.be
² Institute of Clinical Physiology, National Research Council (CNR), 20162 Milan, Italy; simona.mrakicspota@cnr.it; alessandra.vezzoli@cnr.it
³ Anatomical Research and Clinical Studies, Vrije Universiteit Brussels (VUB), 1090 Brussels, Belgium; costantino.balestra@ulb.be

23

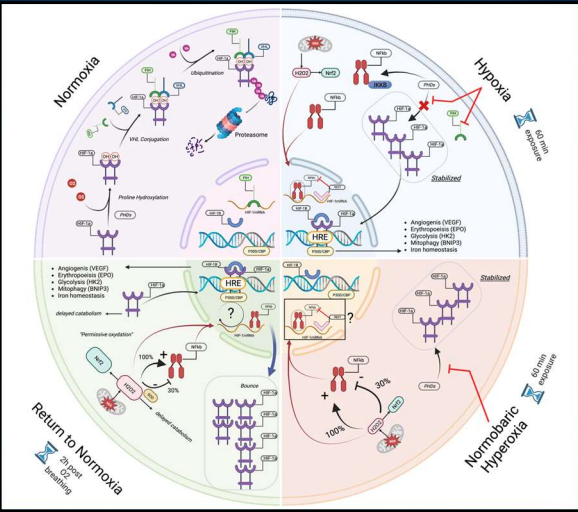


24

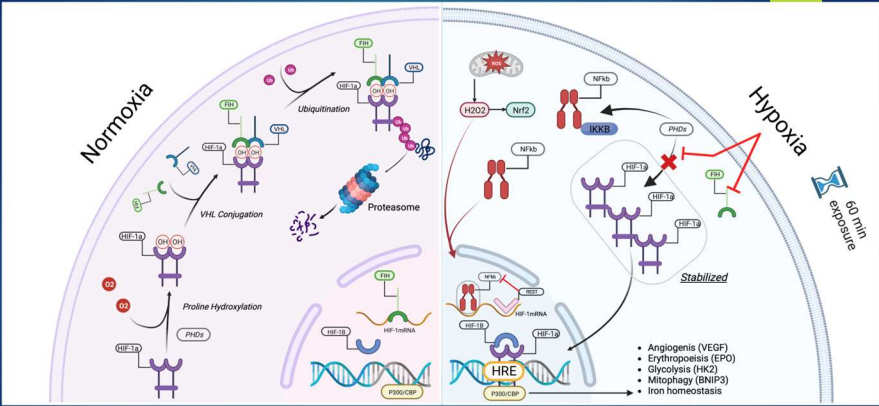
Mean Change 60min of Oxygen Breathing
(% of control values)



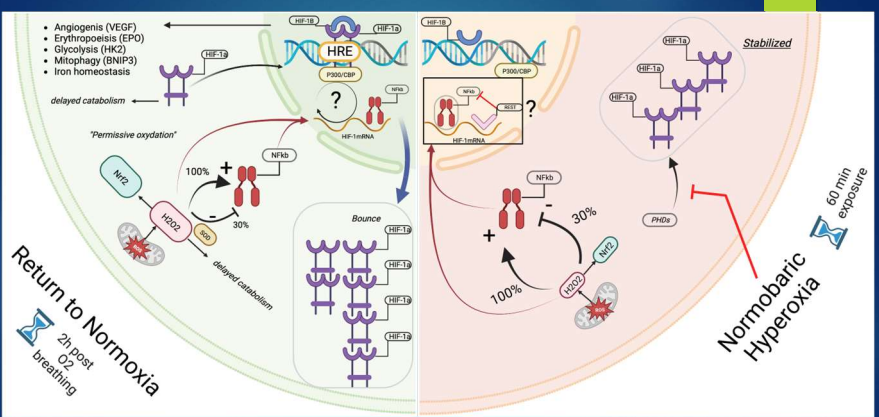
25



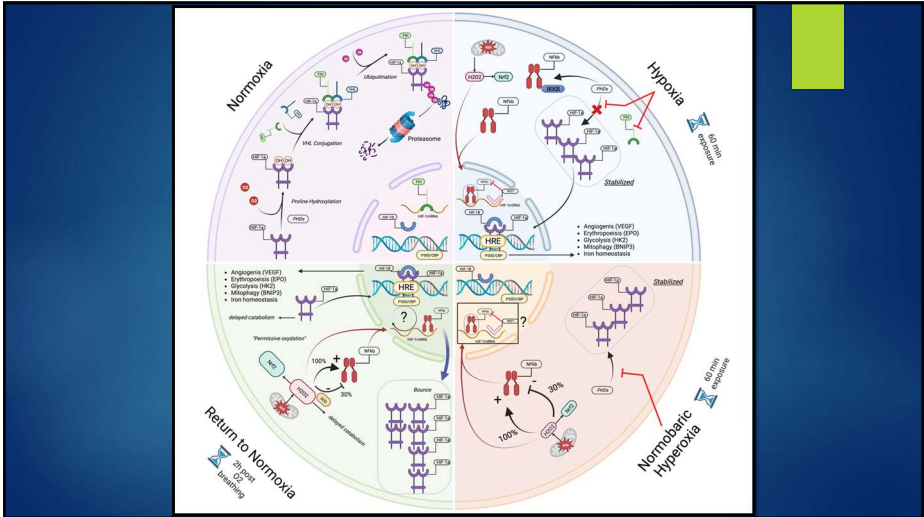
26



27



28



29



30



31