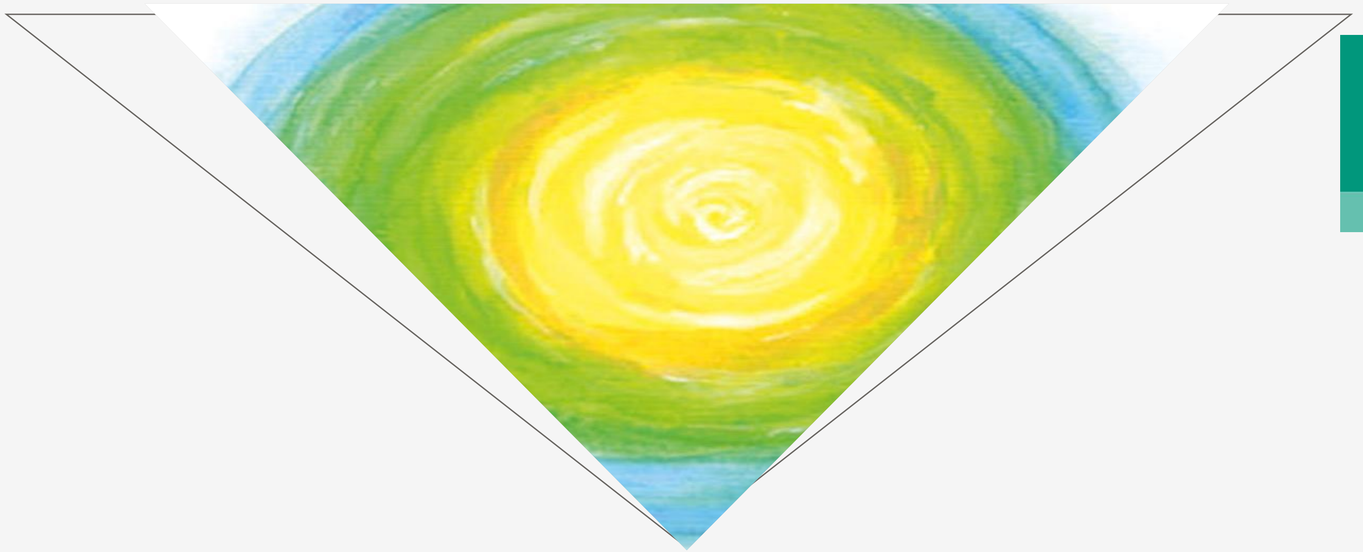
Swiss Paraplegic Centre



Centre for Pain Medicine

6th International Symposium
Invasive Procedures in Motion 2018

2/3 March 2018, Nottwil/Lucerne/Switzerland

EFFECTS OF PRF IN A STANDARDIZED TRAUMA MODEL IN RATS

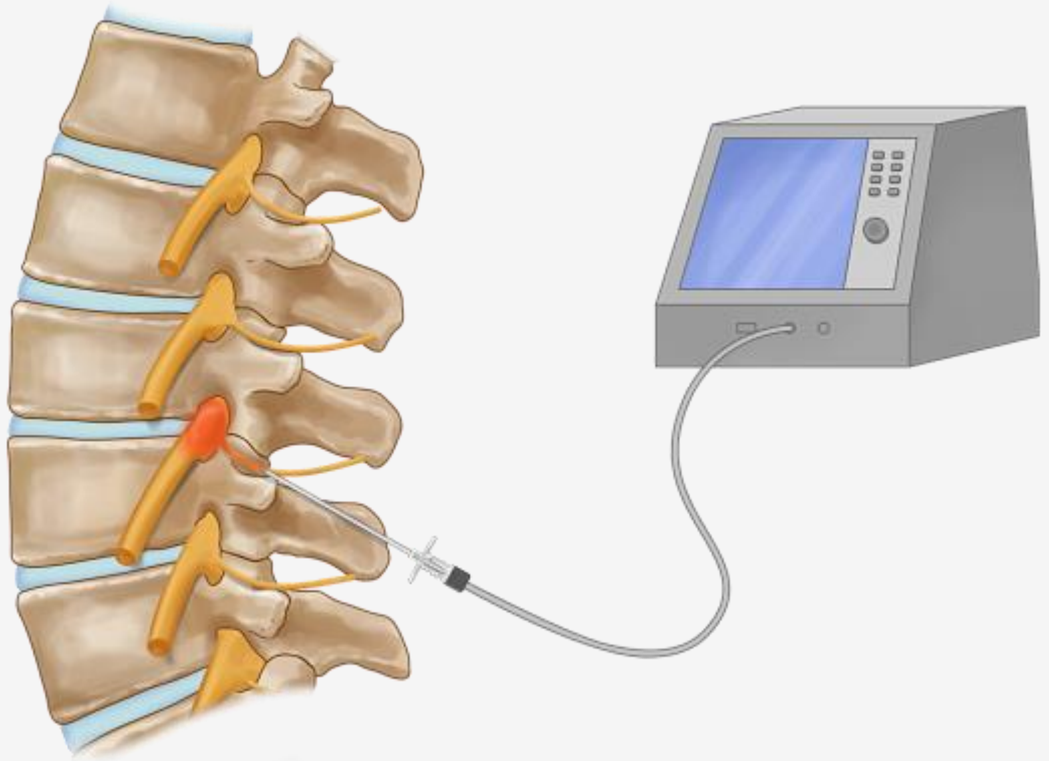
UFCSPA
Universidade Federal de Ciências da Saúde de Porto Alegre

Prof. Luís Josino Brasil MD Msc Phd

ljbrasil@yahoo.es

THE ORIGIN OF THE RESEARCH QUESTION

I CONGRESSO
DA SOCIEDADE BRASILEIRA
DE MÉDICOS
INTERVENCIONISTAS EM DOR
"O ESTADO DA ARTE DA RADIOFREQUÊNCIA"



THE ROLE OF HEAT

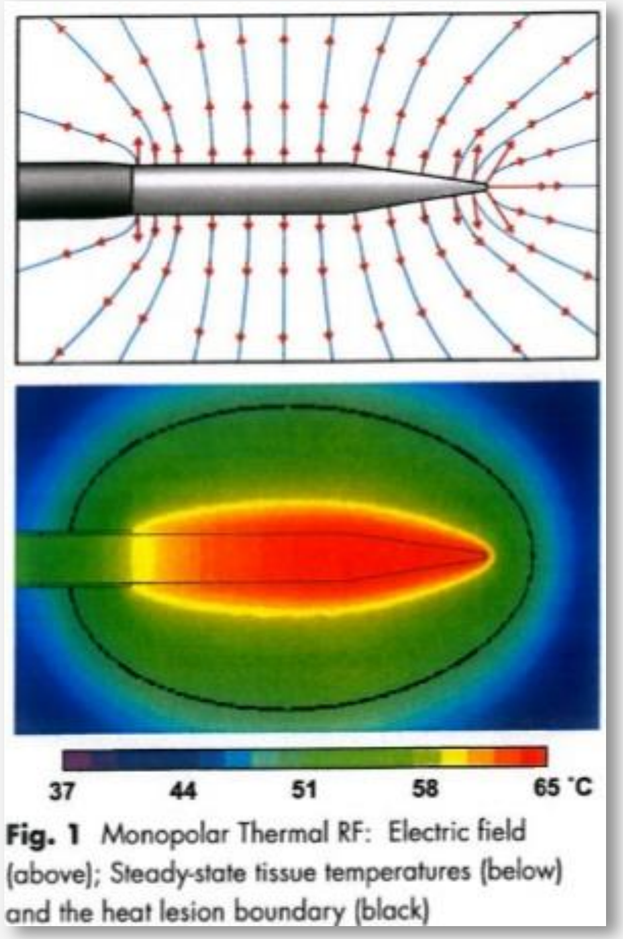
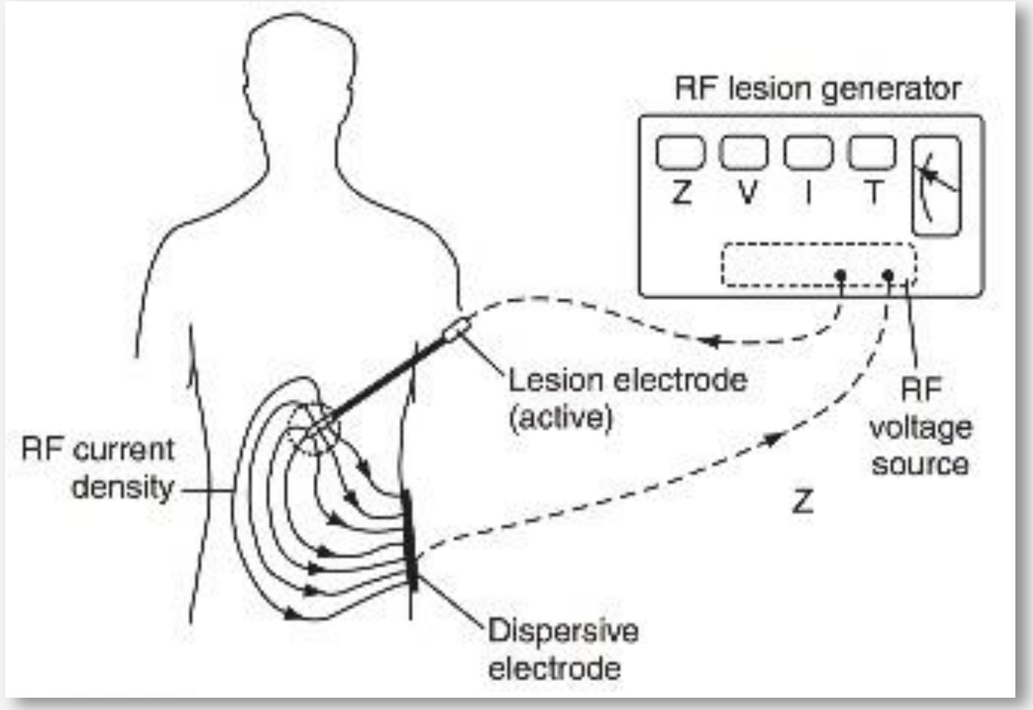
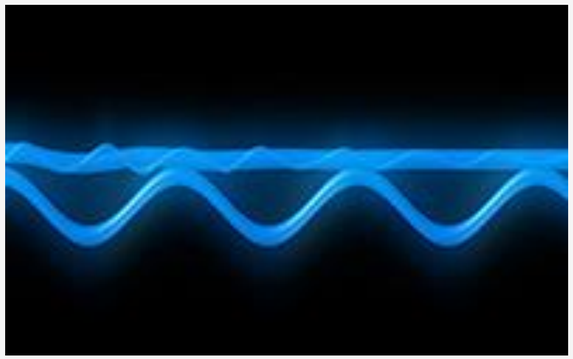


Fig. 1 Monopolar Thermal RF: Electric field (above); Steady-state tissue temperatures (below) and the heat lesion boundary (black)

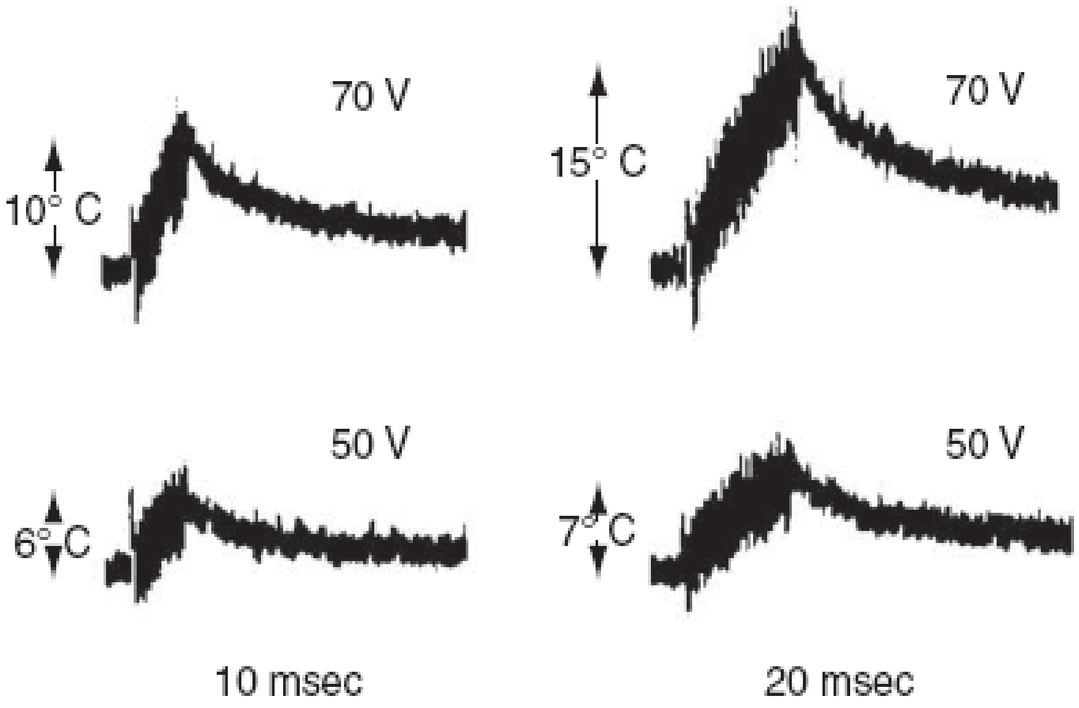


PRF THERMAL EFFECTS



RF Ablation

PRF

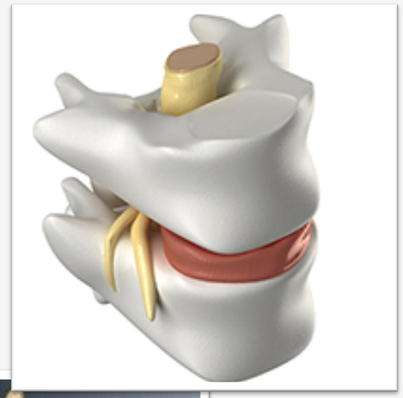


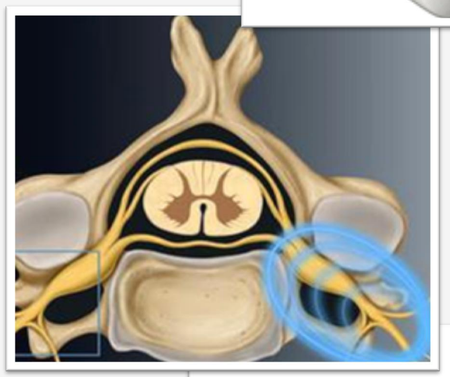
Measured temperature bursts during pulsed radiofrequencv pulses in liver at 70 V and 50 V (peak) settings: on the left for duration of 10 millisec- onds and on the right for duration of 20 milliseconds. (Adapted from Cosman ER Jr, Cosman ER Sr: Electrical and thermal field effects in tissue around radiofrequencv electrodes. Pain Med 6(6):405-424, 2005, with permission.)

Radiofrequency Wave

Reflection of the trees minimalism art
Wallhaven.cc 2018.

NEUROCENTRIC THEORY





TECHNICAL COMMUNICATION

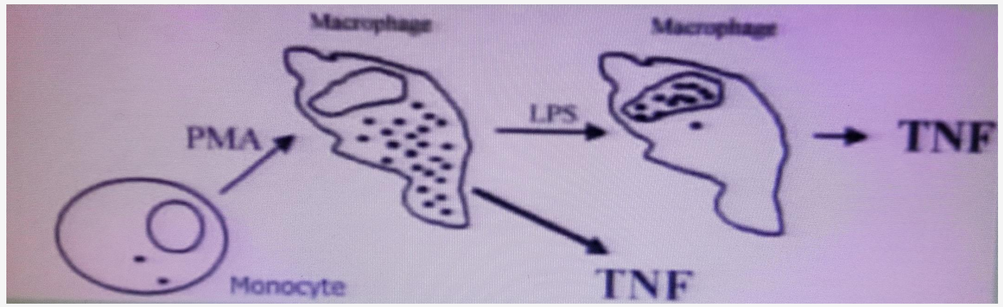
Intra-articular Application of Pulsed Radiofrequency for Arthrogenic Pain—Report of Six Cases

Menno E. Sluijter, MD, PhD, FIPP*; Alexandre Teixeira, MD, FIPP†; Vicente Serra, MD‡; Susan Balogh, MD*; Pietro Schianchi, MD, FIPP§

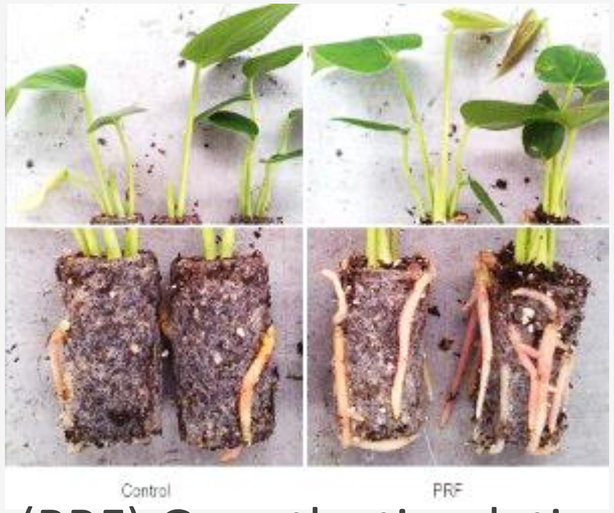
*Institute for Anesthesiology and Pain Clinic, Swiss Paraplegic Center, Nottwil, Switzerland; †Clinica de Dor, Porto, Portugal; ‡Umivale (MATEPPS nr 15), Valencia, Spain; §St. Anna Hospital, Lugano, Switzerland

Does PRF affects the neuroimmune system ?

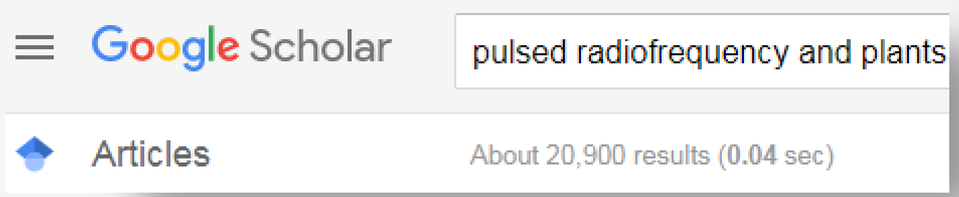
EFFECTS IN ANOTHER TISSUES

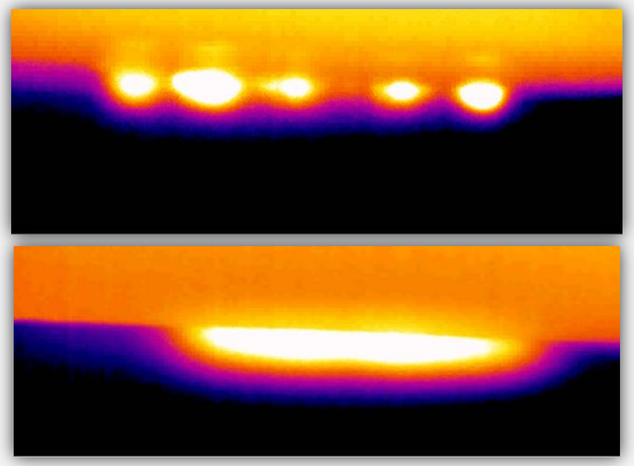


Bert Van Duijin-Fleur Sluijter 2013



(PRF) Growth stimulation





Case Report

Successful Use of Stellate Ganglion Block and Pulsed Radiofrequency in the Treatment of Posttraumatic Stress Disorder: A Case Report

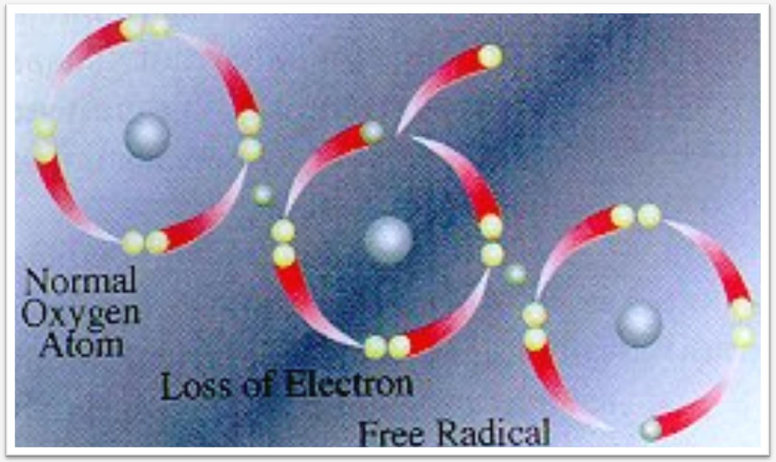
Pain Research and Treatment 2010

PRF ablative phase and volumetric phase, Jcds2012

Reactive Species and Antioxidants. Redox Biology Is a Fundamental Theme of Aerobic Life

Plant Physiology, June 2006, Vol. 141, pp. 312–322,

Magnetic field



Single theory → All effects?

GENERAL OBJECTIVE OF THE STUDY

Evaluate the effects of PRF in a standardized trauma model in rats.

24 male Wistar rats randomly divided into **4 equal groups ➔ n = 6**

Groups:

- Control (CO)
- Control + pulsed radiofrequency (CO + PRF)
- Trauma (T)
- Trauma+ pulsed radiofrequency (T+PRF).

On day 7 of the experiment, the animals **were killed by anesthetic overdose**, and then the quadriceps muscle was removed.

After dissection, the muscle was **placed in 10% buffered** formal in and included in paraffin blocks. **Next step ➔** they were fixed to the Microtome (Leitz®1512) where the cuts were performed. The remainder frozen at -80°C for further analysis.

1th day	3th day	6th day	7 days
Trauma	PRF	PRF	Sacrifice

SPECIFIC OBJECTIVES

1

Produce a model of inflammatory lesion induced by musculoskeletal trauma capable of causing significant muscle damage documented by evaluation on the activity of IL-1β, IL-6, TNF-α and histological analysis.

2

Evaluate the effects of trauma on musculoskeletal lipoperoxidation through measurement of TBARS, SOD and CAT.

SPECIFIC OBJECTIVES

3

Observe the effects of PRF on muscular tissue injury, through activity of IL-1β, IL-6, TNF-α and histological analysis.

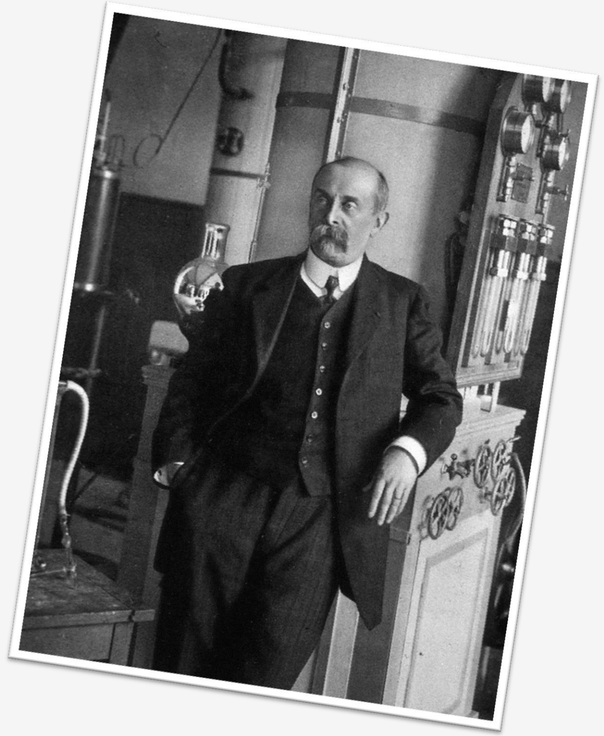
4

Evaluate the effects of PRF on musculoskeletal lipoperoxidation through measurement of TBARS, SOD and CAT

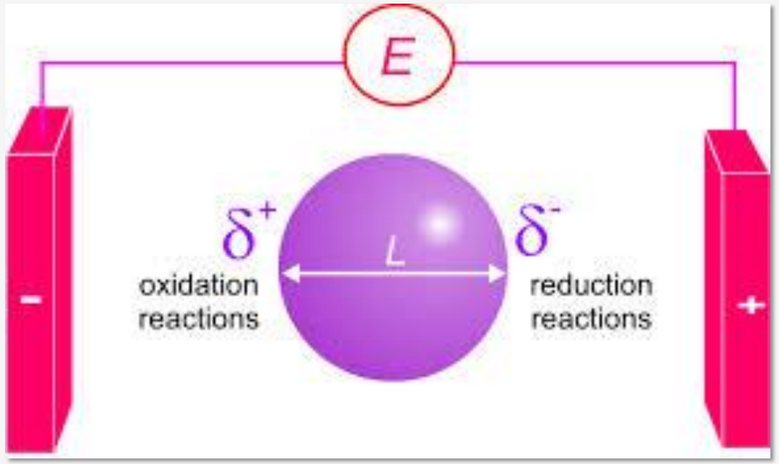
ELECTROCHEMISTRY?

Michael Faraday

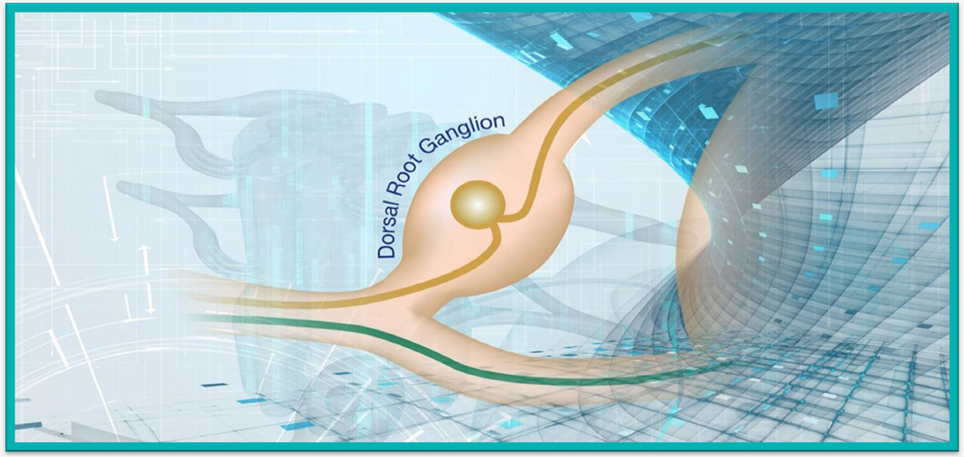
John Daniell

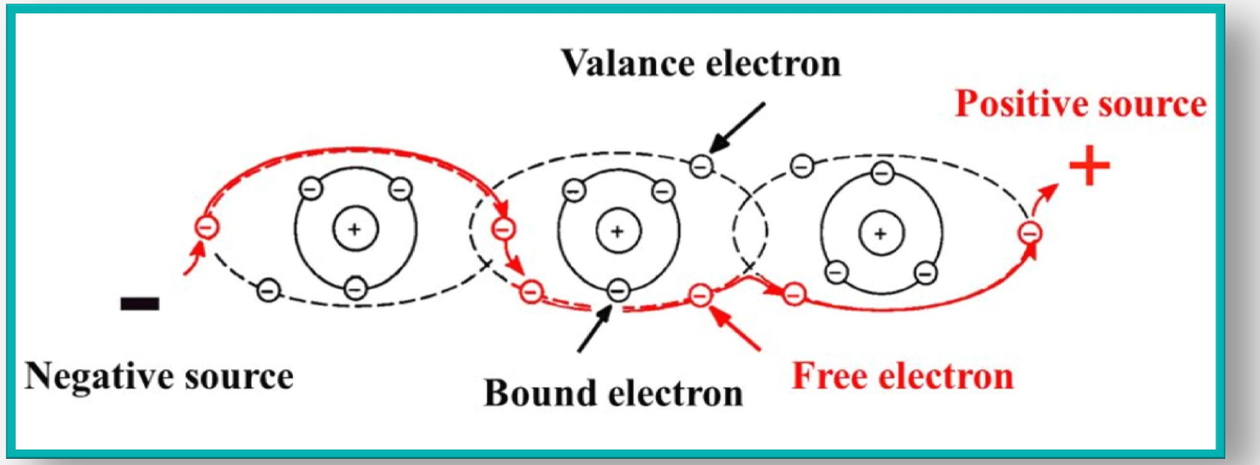


d'Arsonval



Electrolytic processes: Reactions in which chemical changes occur on the passage of an electrical current





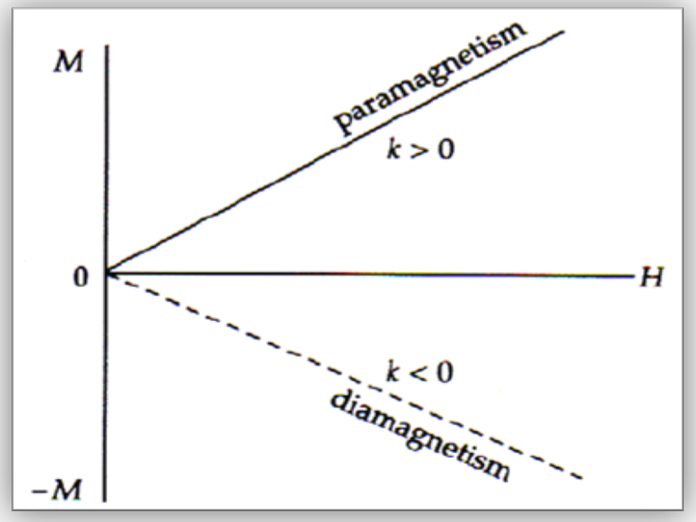


Fig. 1- Variation of magnetization M as a function of the applied field H in diamagnetic and paramagnetic materials (Lowrie, 1997).

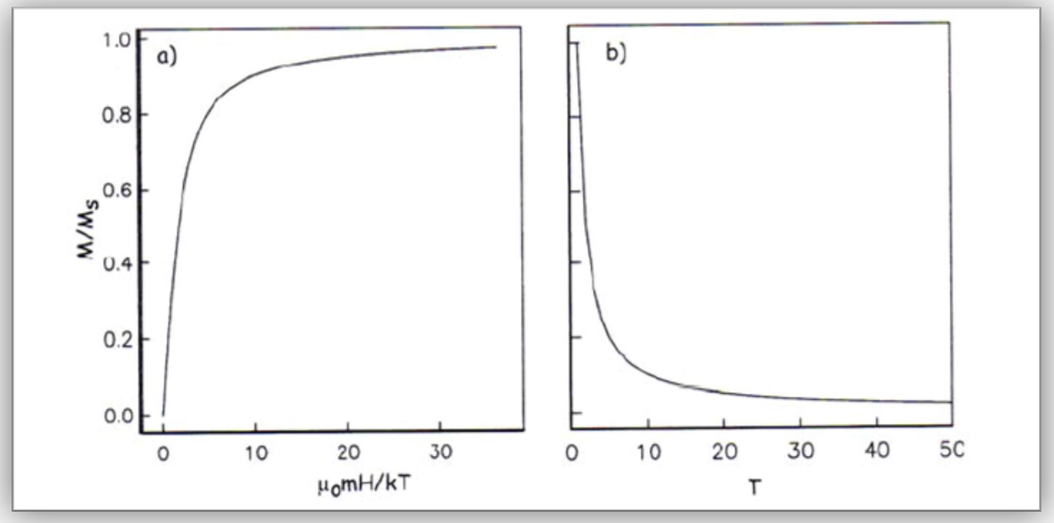
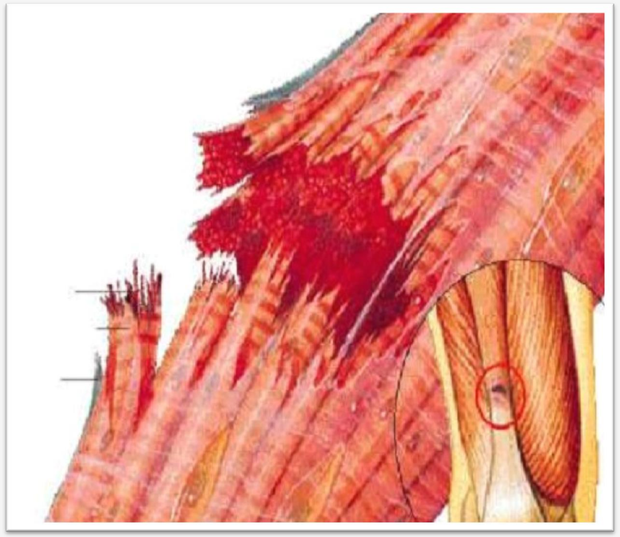
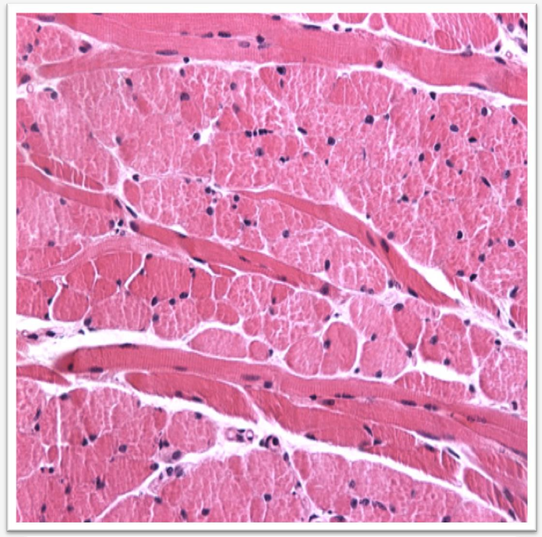


Fig. 2 - (a) Paramagnetic magnetization (obtained from the Langevin function) (b) Paramagnetic magnetization as a function of temperature T (Curie law).

SKELETAL MUSCLE TISSUE

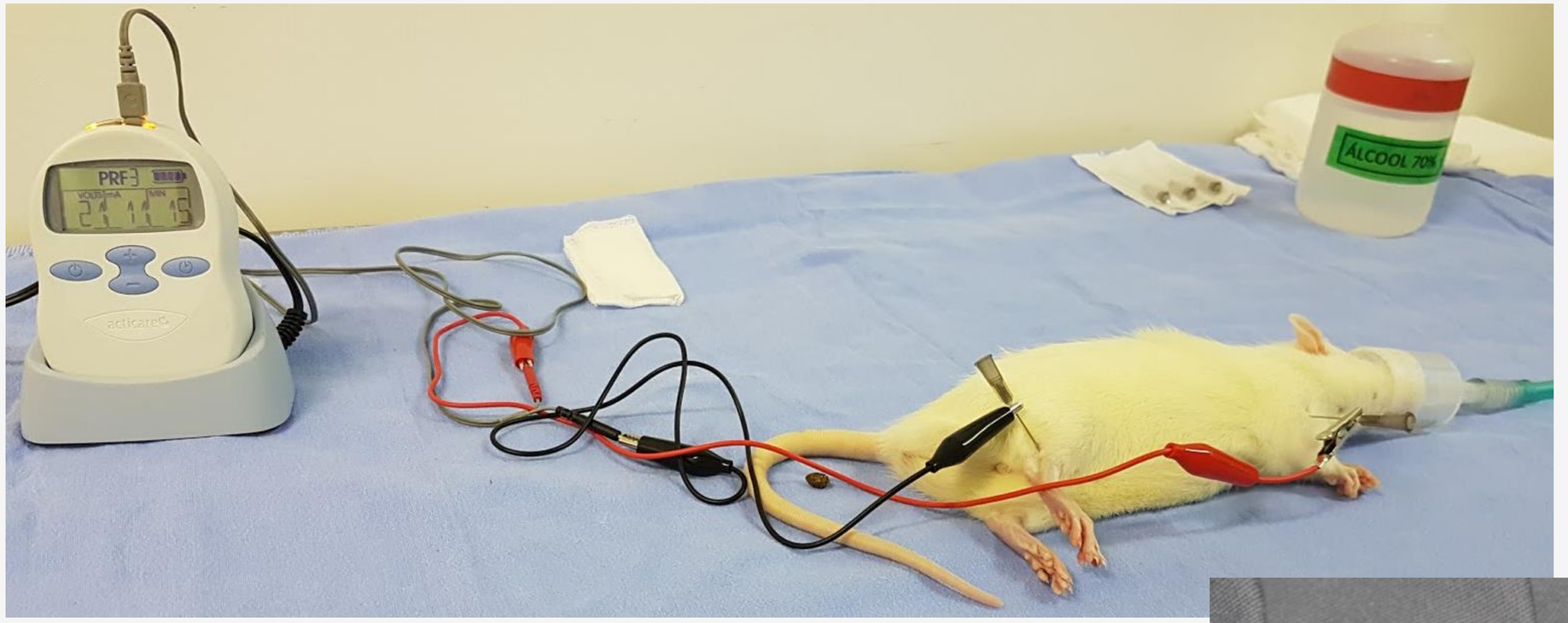


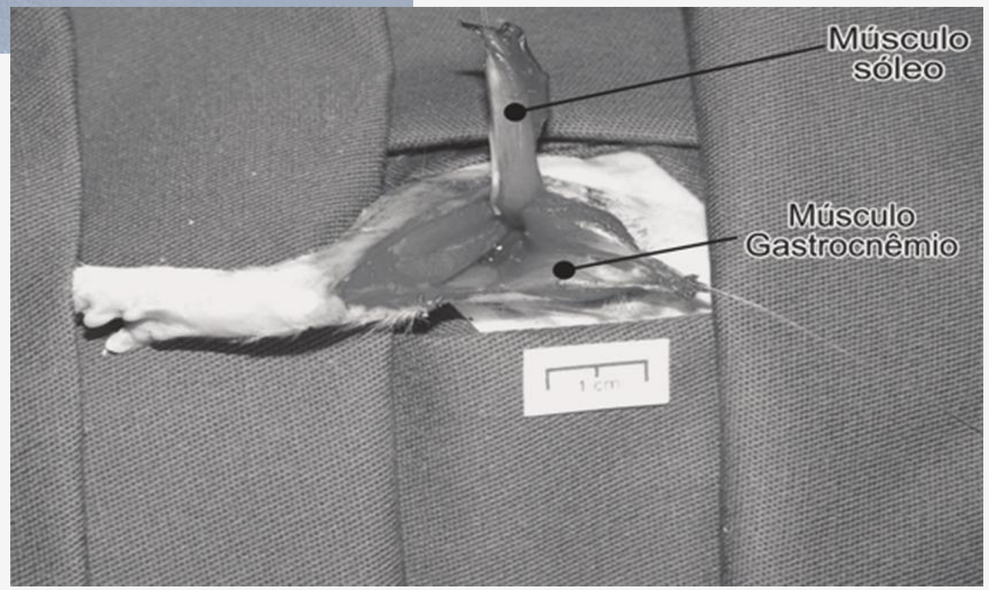
Muscle Injury



Increase in ERO and EO markers

Industrial Center of Equipment of Teaching and Research

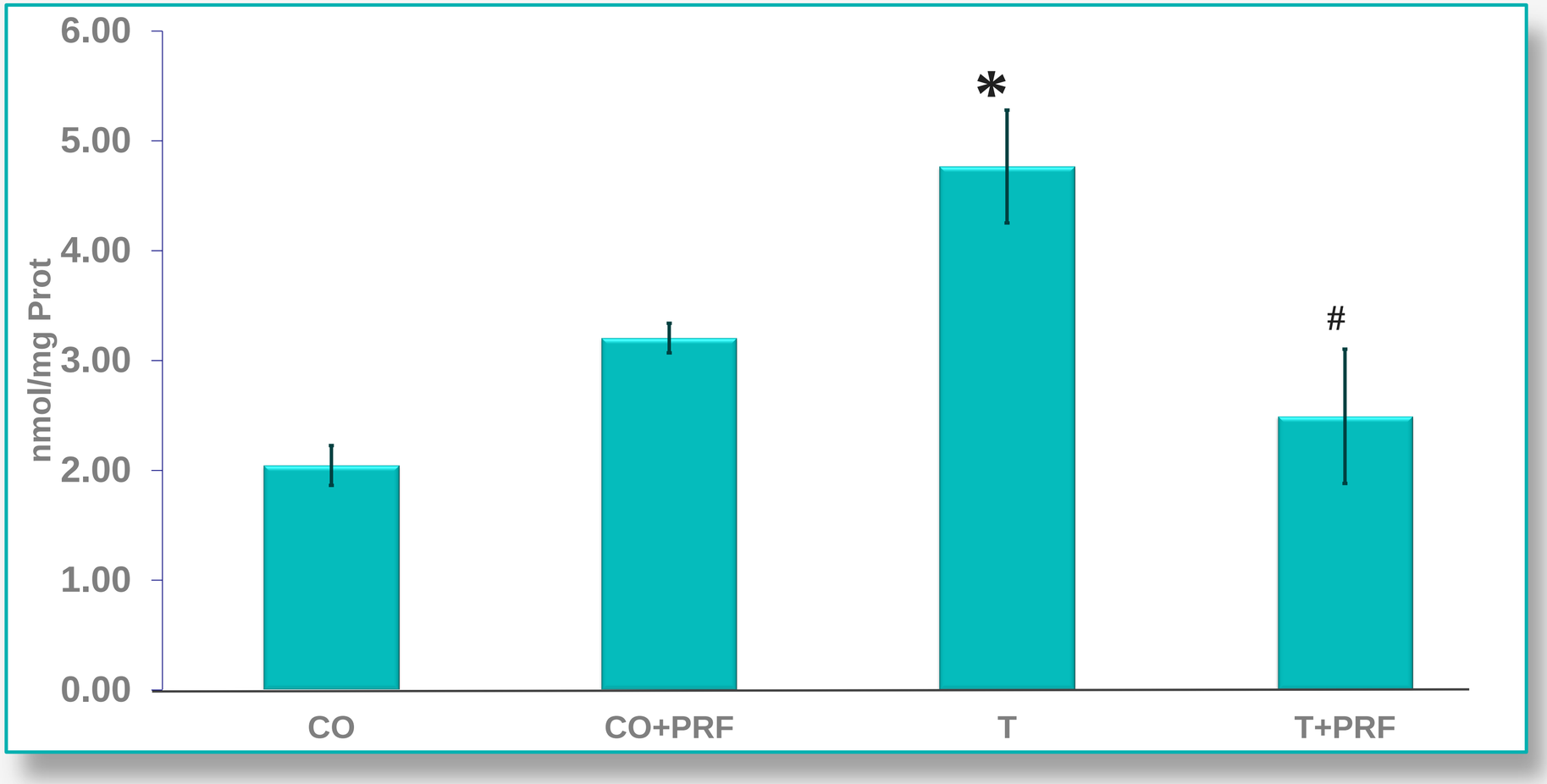

PRF
ÁLCOOL 70%


Músculo sóleo
Músculo Gastrocnêmio
1 cm

OXIDATIVE STRESS

We used TBARS as a marker...

TBARS



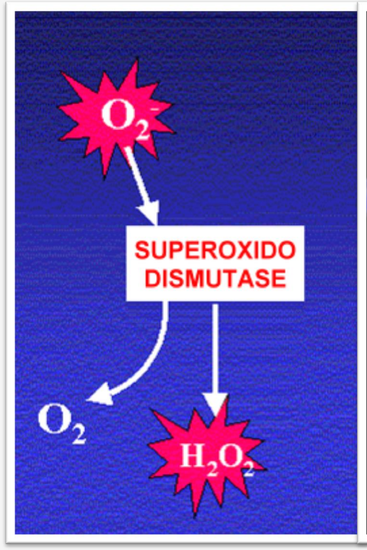
* Significantly different from group CO

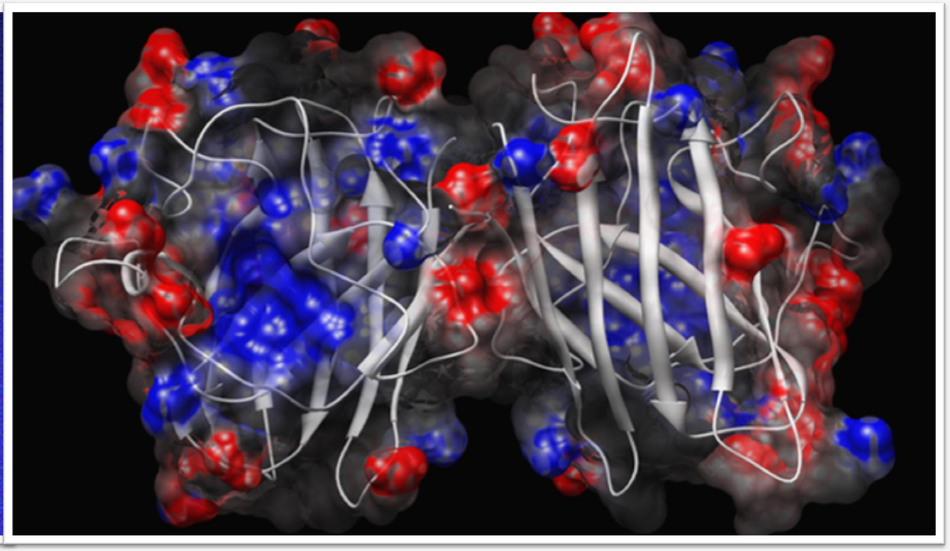
Significantly different from group T

ANTIOXIDANT DEFENSE SYSTEM

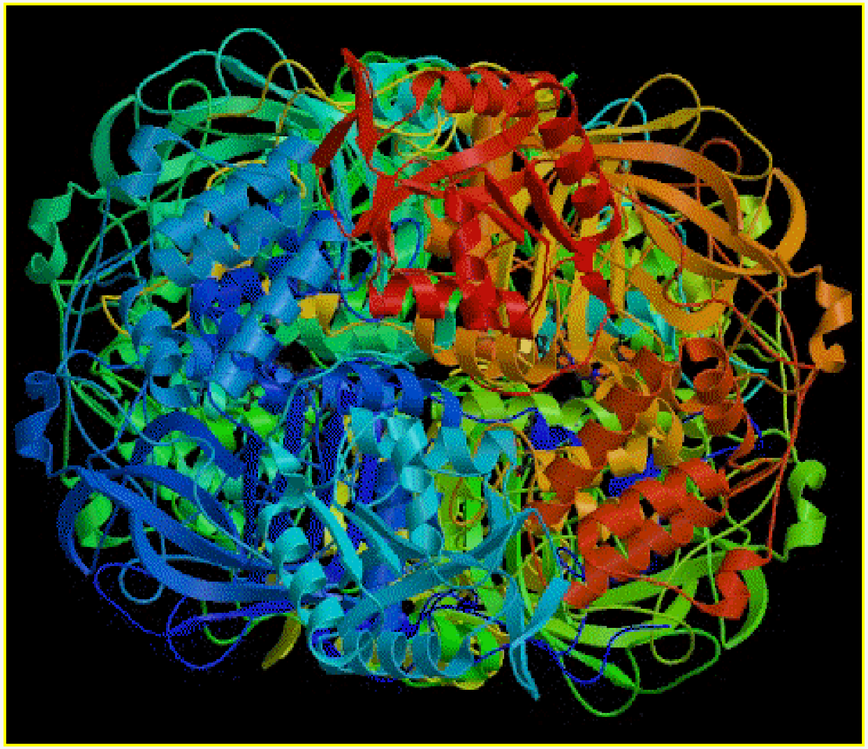
SOD disrupts $O^{\bullet -}$ and forms H_2O_2

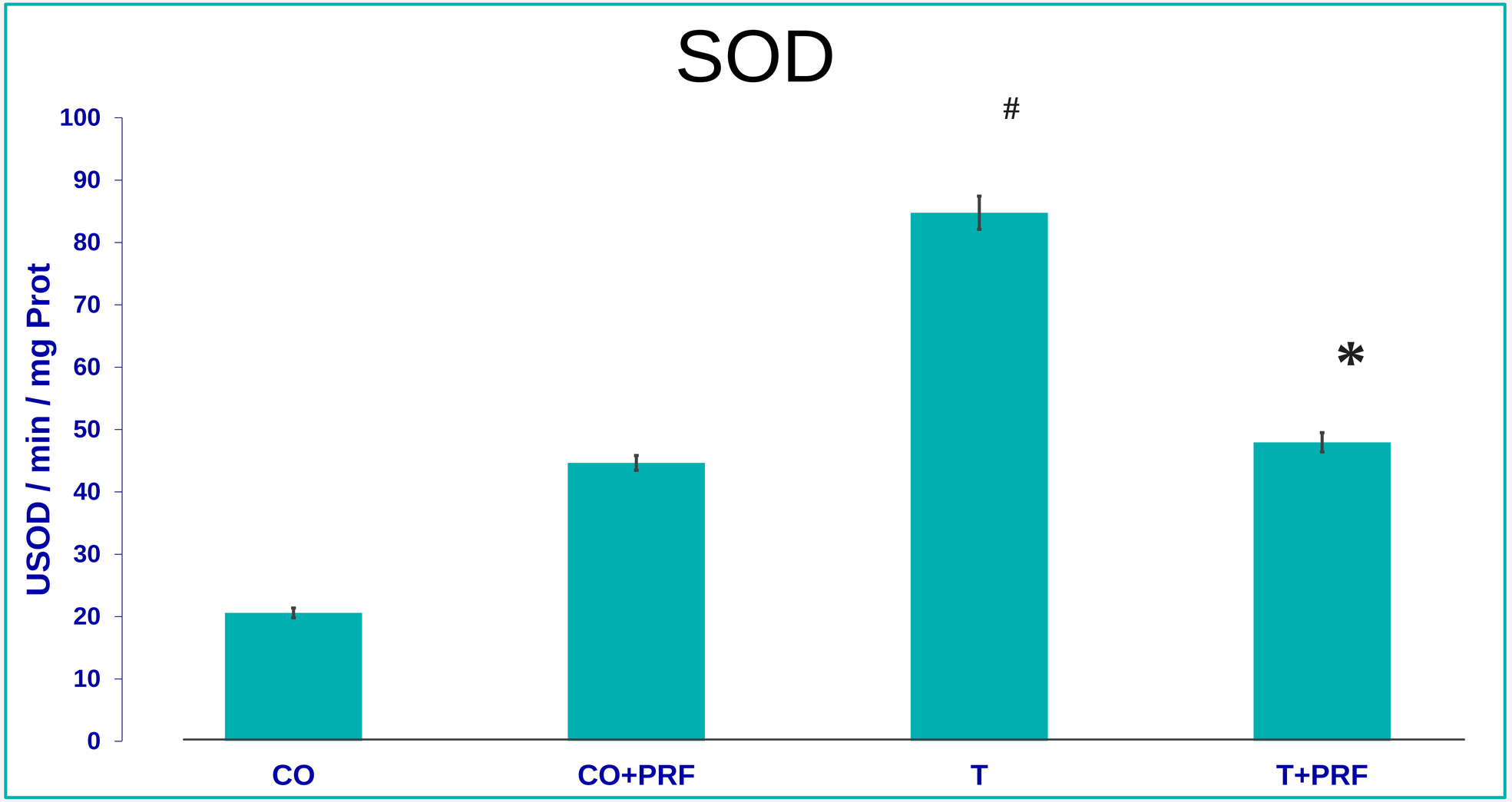
- Oxidation and reduction processes
- Controls the steady state of O_2
- First line of Defense



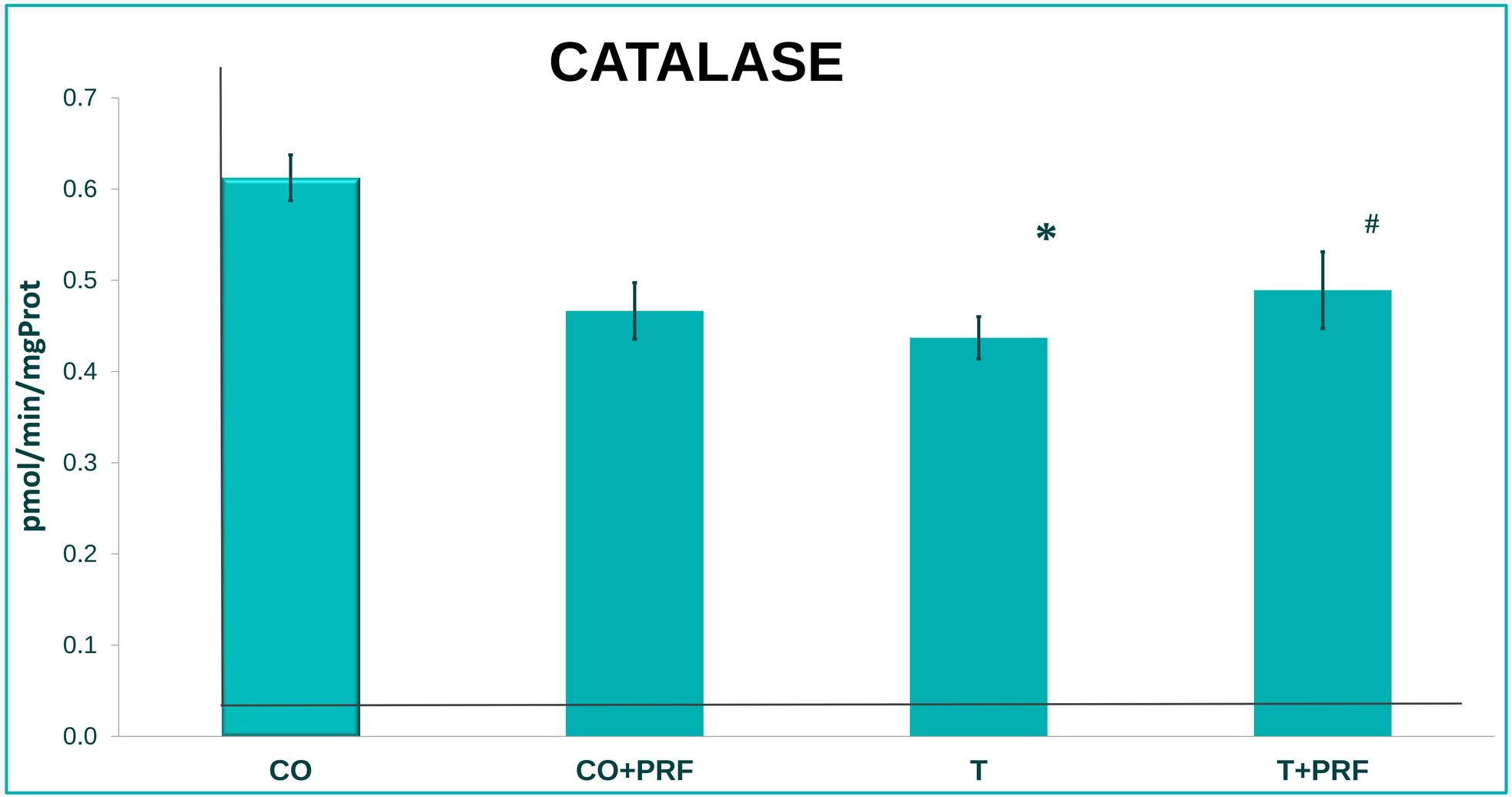


$$2H_2O_2 \xrightarrow{\text{CATALASE}} O_2 + H_2O$$





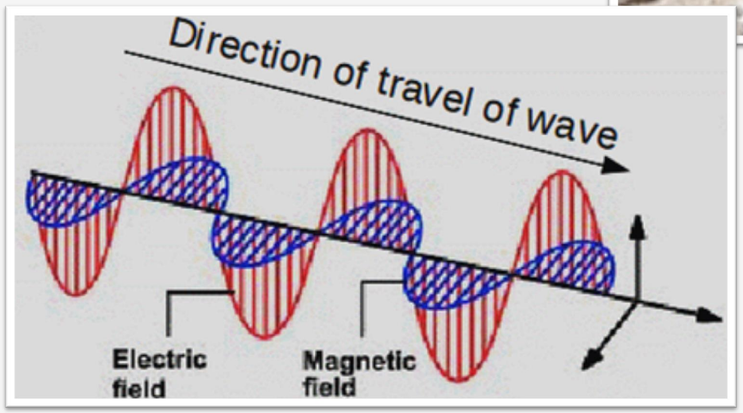
- Significantly different from group CO
- # Significantly different from group T

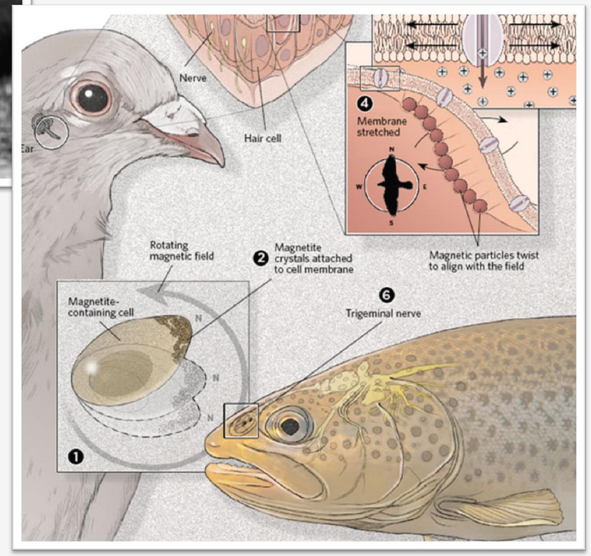


* Significantly different from group CO

Significantly different from group T

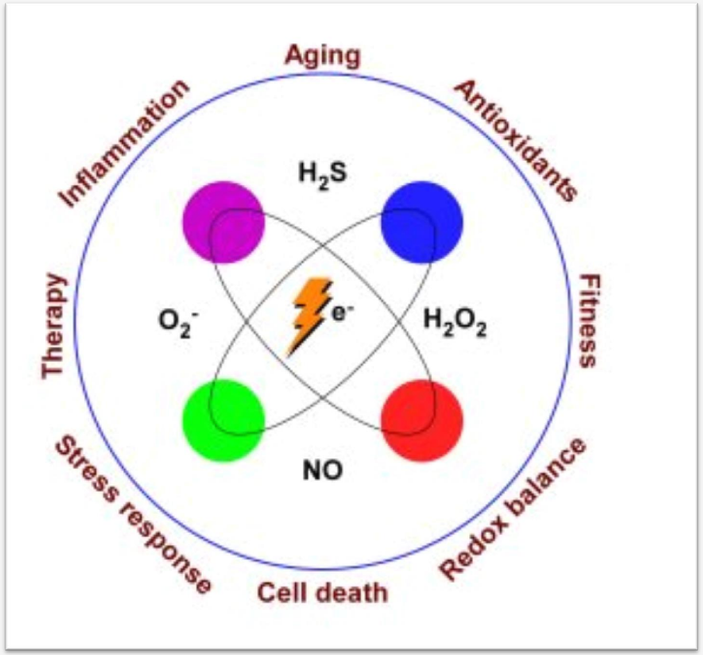
LIFE STILL CARRIES A BRAND OF ITS ORIGIN



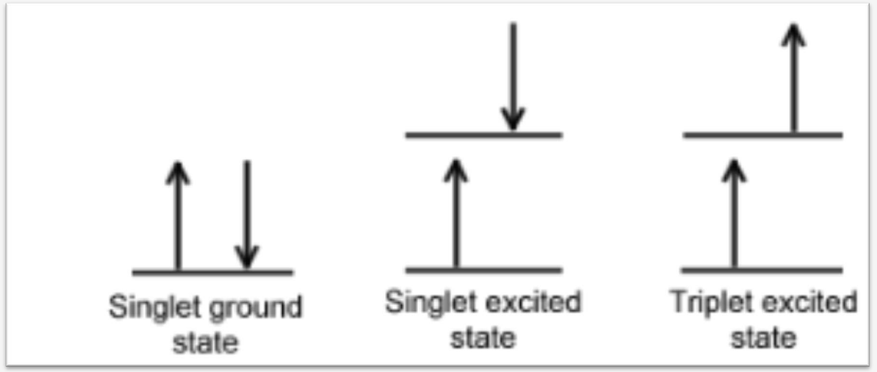


RADICAL PAIR MECHANISM

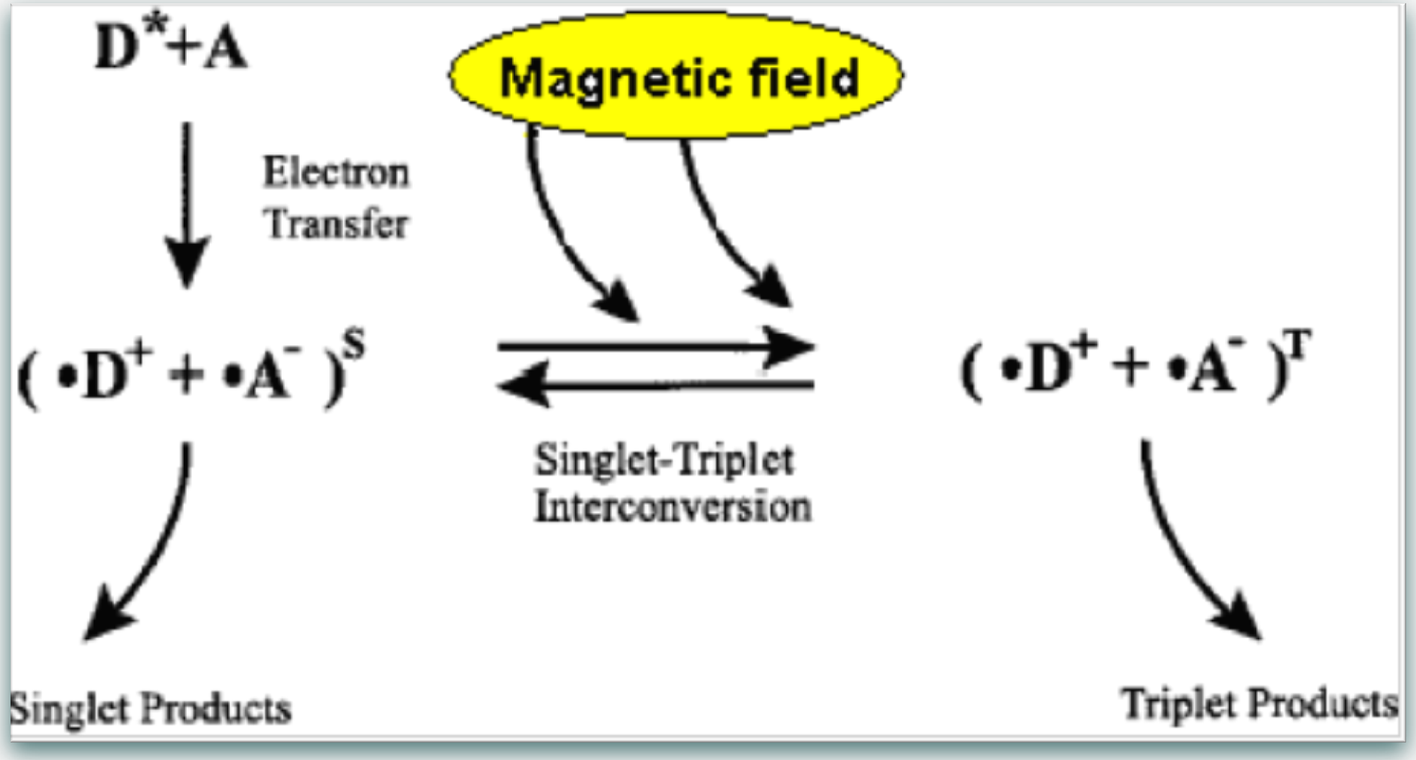
MARY- Magnetically Affected Reaction Yields



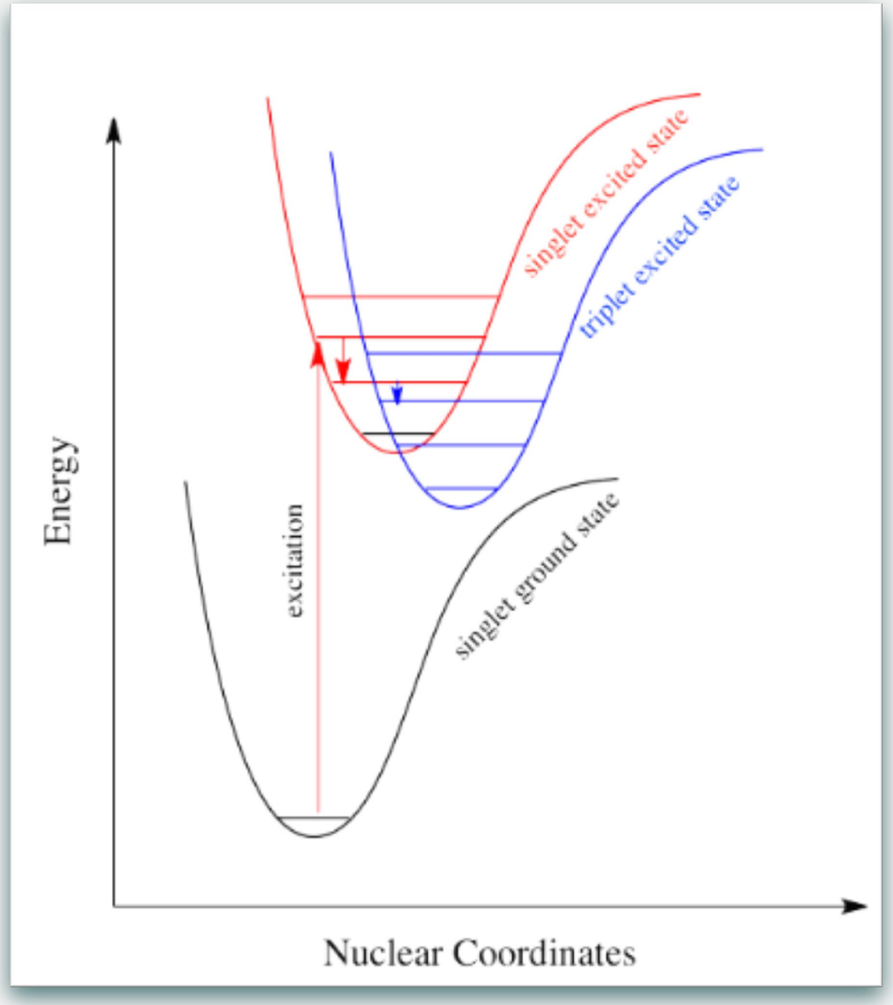
UCIrvine
University of California, Irvine
physics and astronomy



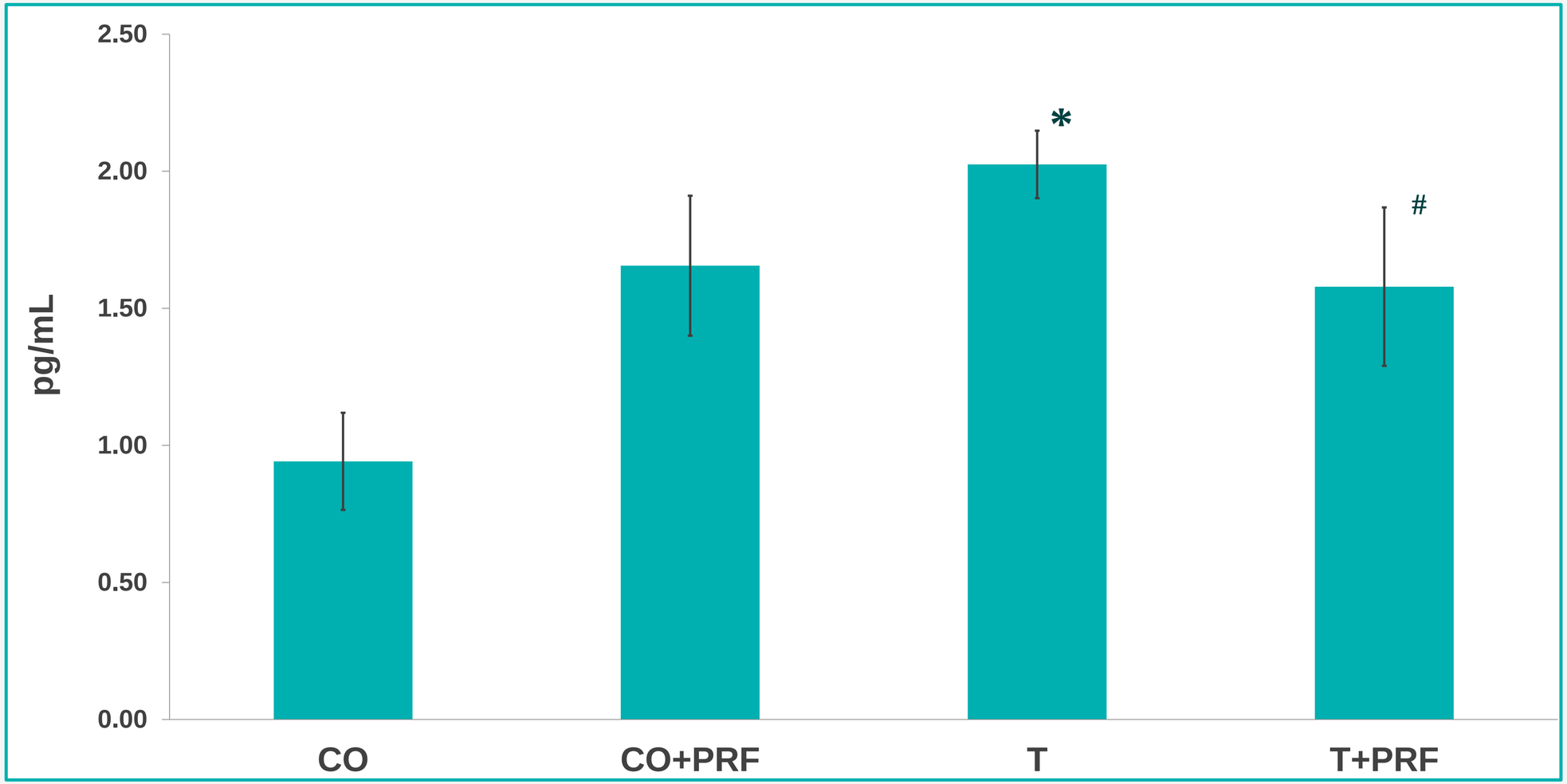
RADICAL PAIR MECHANISM



Wiltschko R, Wiltschko W, 2005

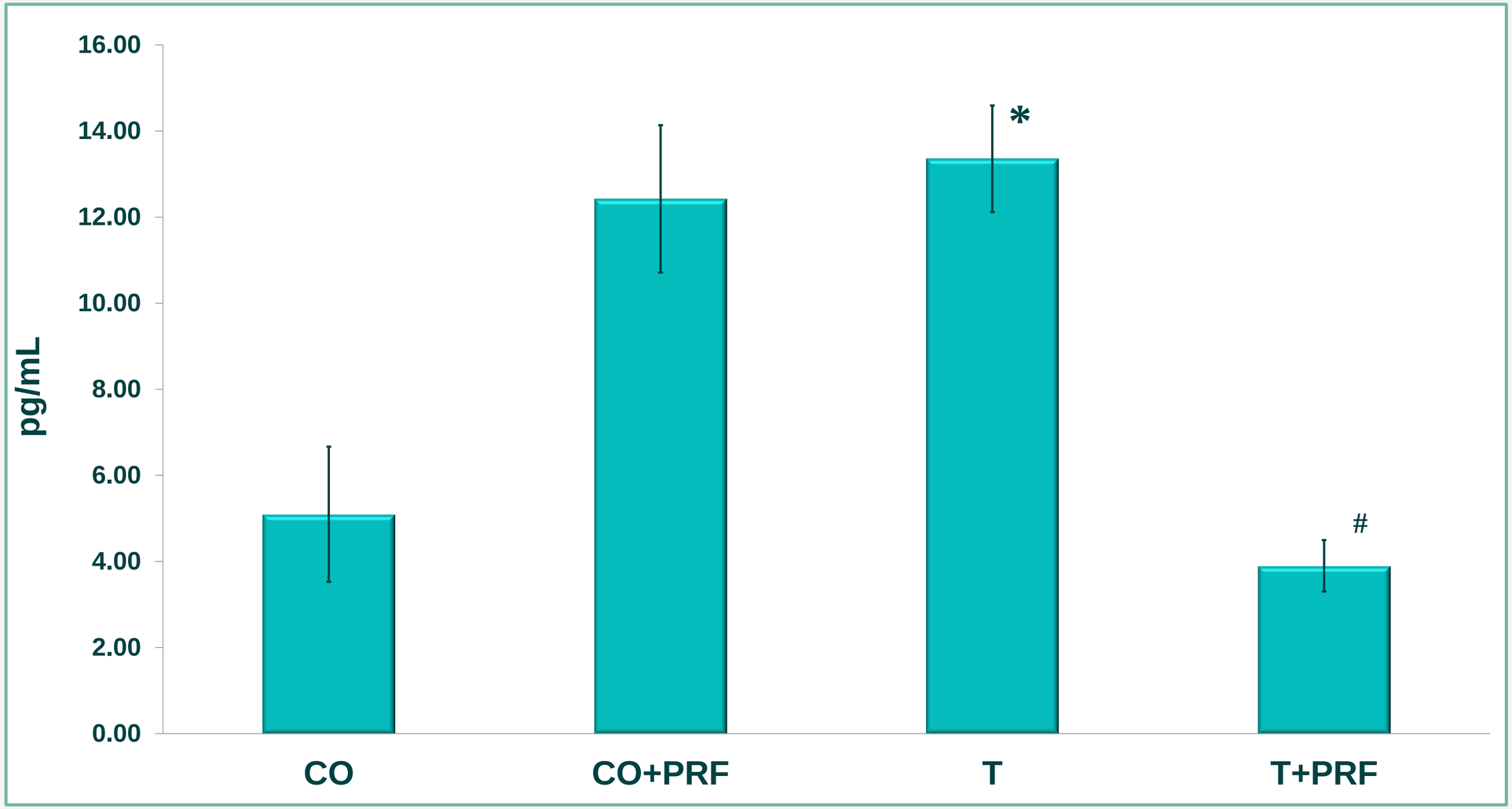


TNF- ALPHA



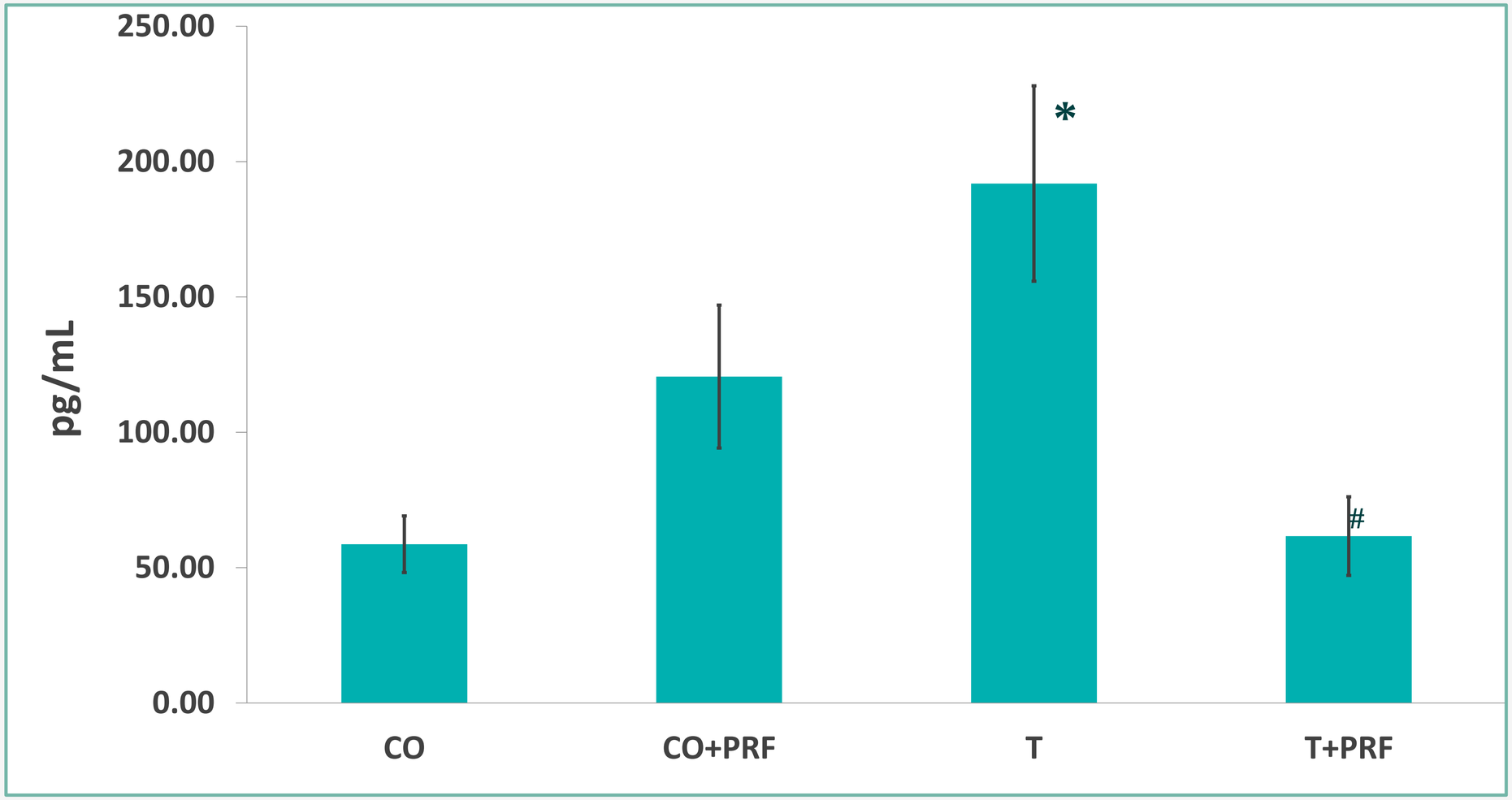
* Significantly different from group CO
# Significantly different from group T

INTERLEUKIN 1B



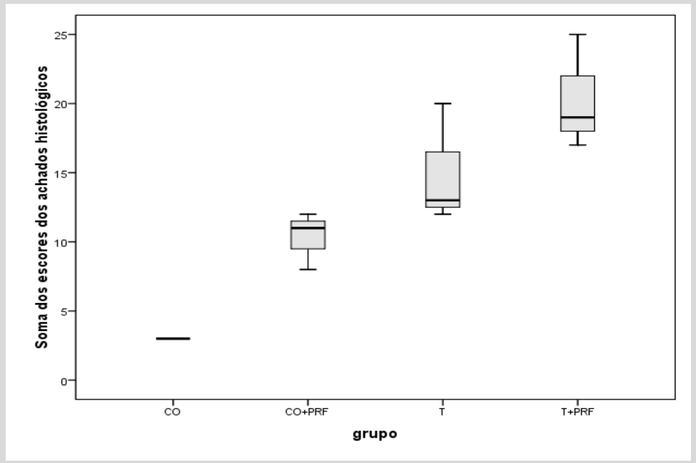
* Significantly different from group CO
# Significantly different from group T

INTERLEUKIN 6

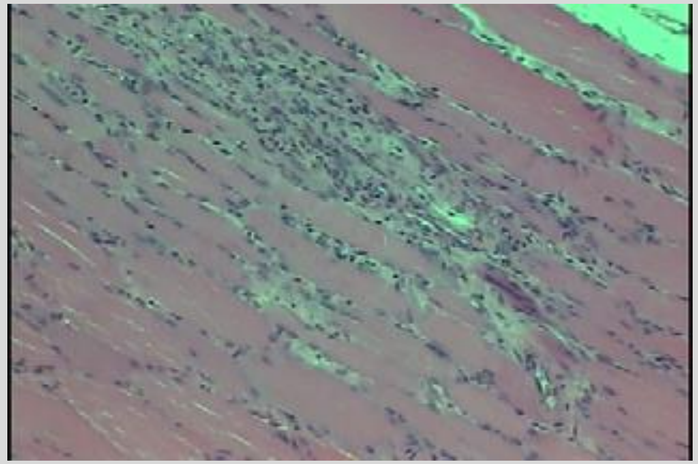


* Significantly different from group CO
# Significantly different from group T

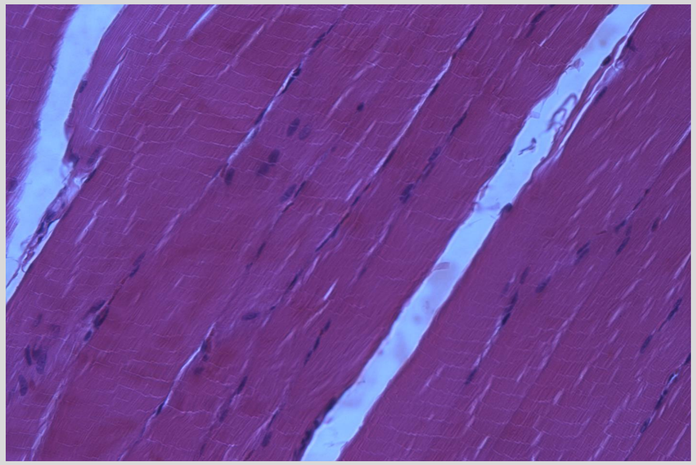
HISTOLOGY



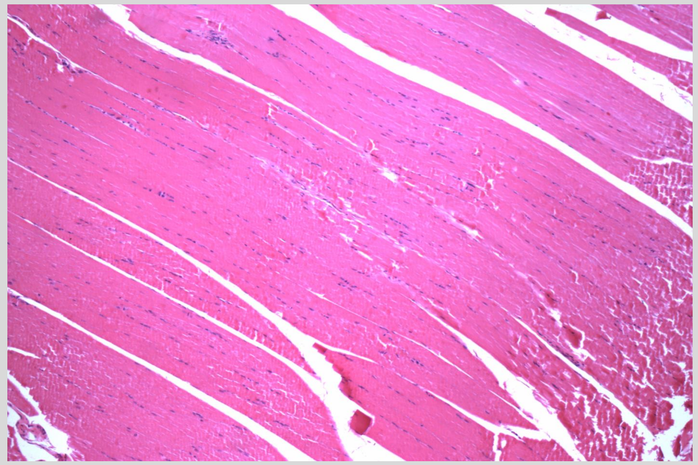
Histology



Trauma



Trauma + PRF



Control +PRF

Determination of Muscle Damage:
Histological analysis

Determination of Oxidative Damage:
Quantification of TBARS

Determination of Antioxidant Defense:
Activity Quantification of SOD and CAT

Inflammatory Response:
Determination of Interleukins 1β, IL-6 and TNF-α

Specific Objectives:

Produce a model of inflammatory lesion induced by musculoskeletal trauma capable of causing significant inflamatory damage documented by evaluation on the activity of IL-1β, IL-6, TNF-α and histological analysis.

1

It was possible to produce a model of lesion induced by musculoskeletal trauma capable of causing significant inflammatory damage documented by increase on the activity of IL-1β, IL-6, TNF-α and significant histological modifications.

Specific Objectives:

To evaluate the effects of trauma on musculoskeletal lipoperoxidation and antioxidant defense through the measurement of TBARS, SOD and CAT.

2

The trauma induced musculoskeletal lipoperoxidation and modification in antioxidant defense documented by diferent on markers: TBARS, SOD and CAT

Specific Objectives:

To identify the effects of PRF on muscular tissue injury, through on the activity of TNF IL-1β, IL-6 and histological analysis.

3

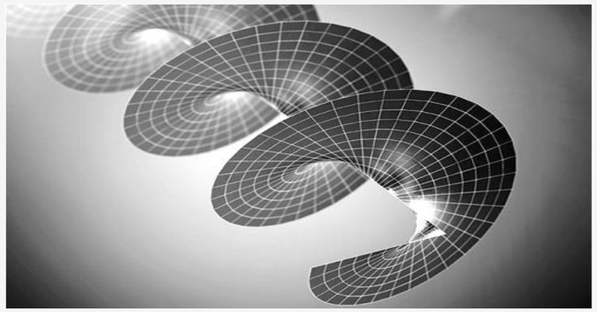
PRF was able to reverse muscular injury documented by return to the interleukines values to near to control, but only partially reversed the histopathological changes.

Specific Objectives:

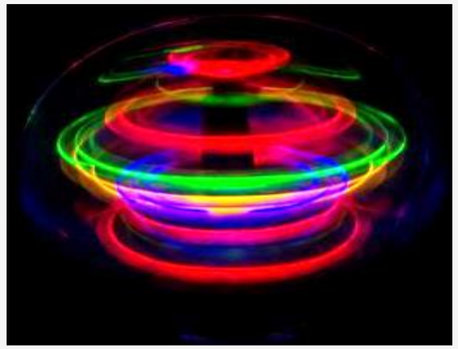
Identify the effects of PRF on muscle-induced oxidative stress induced by trauma, as well as on the activity of antioxidant defenses.

4

PRF was able to reverse muscular oxidative stress and changes in antioxidant defenses induced by trauma.



Magnetic field



- **Paramagnetic Species: reactive and short half-life**

O_2 $^1O_2$ *Singlet* $O_2^{\cdot -}$ H_2O_2

“We hypothesized that eletric field modulates orbital momentum, and by electrical control of single spins decreases production of reactive species”

It is possible that the PRF acts on radical pair magnetic sensors affecting singlet-triplet transitions and thus exerting its effects as a stabilizer of the redox balance.

However more studies need to be done to better elucidate the relationship between the events described here.

Thank you!