

The Use of Ozone in Medicine

Mechanisms of Action

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Ozone Treatment in Surgery



- 1915 A. Wolff
- 1935 E. Payr
- 1937 P. Aubourg

- 1977 O. Rokitansky
- 1981 H. Werkmeister,
- 1987 H.G. Knoch,
- 2002 Calderon, N.A.
Kauffmann, T

Mechanism of Action in Topical Applications

- 1.** Microbicidal effects
ie bactericidal, fungicidal
virustatic
- 2.** Wound cleansing effect
- 3.** Wound healing effect

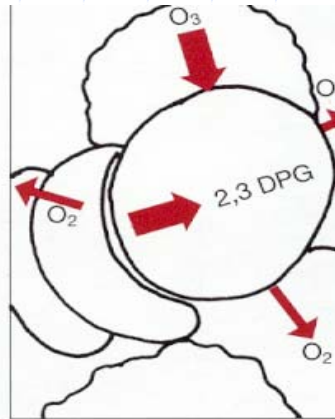
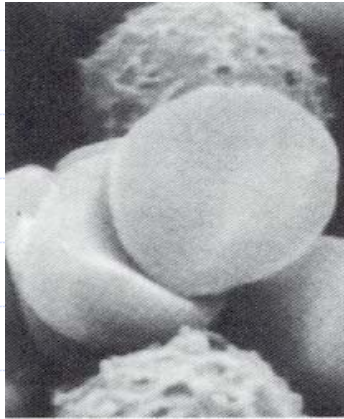
Mechanisms of Action of Ozone in Systemic Applications

1. Activation of Red Blood Cell Metabolism
2. Activation of Immunocompetent Cells
3. Activation and Induction of Biological Antioxydants and Radical Scavengers

Indications of Ozonetherapy Today and the Pharmacological Background

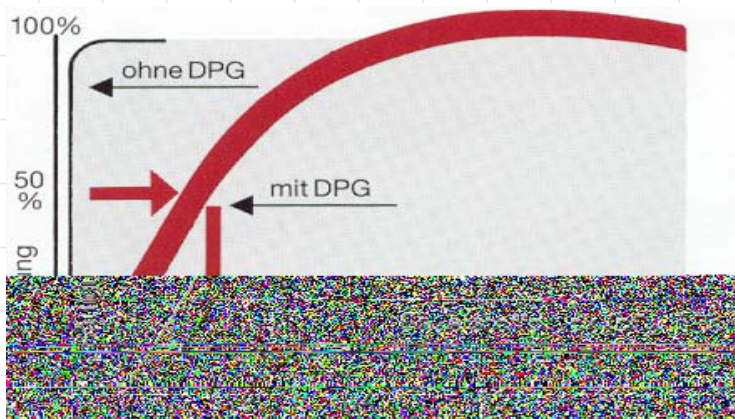
Indications	Mechanism of Action
<ul style="list-style-type: none">■ External ulcers and skin lesions■ Arterial circulatory disorders■ Immunodeficiency and immunodisbalance■ Inflammatory conditions■ Dental Medicine	<ul style="list-style-type: none">■ Disinfection, wound cleansing■ Activation of RBC-metabolism■ Activation of immunocompetent cells■ Activation of antioxidants and radical scavengers■ Disinfection, wound healing

Pharmacological Effects 1: Red Blood Cells



- 1975 Buckley et al.
- 1979 Freeman, Miller et al.
- 1977-1986 Washüttl et al.
- 2001 Lell, Viebahn et al.
- 2002 Hoffmann, Viebahn

Oxygen saturation



- Peroxide formation and activation of the RBC-metabolism via the glutathion system with improvement of oxygen release

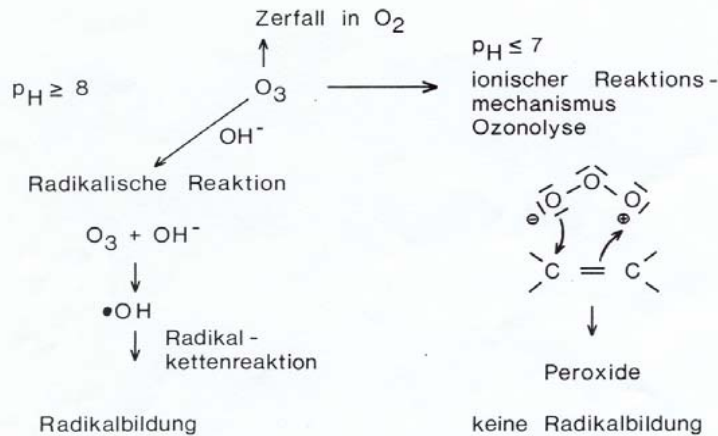
Mechanisms of Ozone Reactions

a.



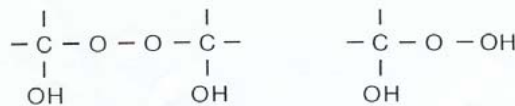
■ a. structure of the ozone-molecule

b.



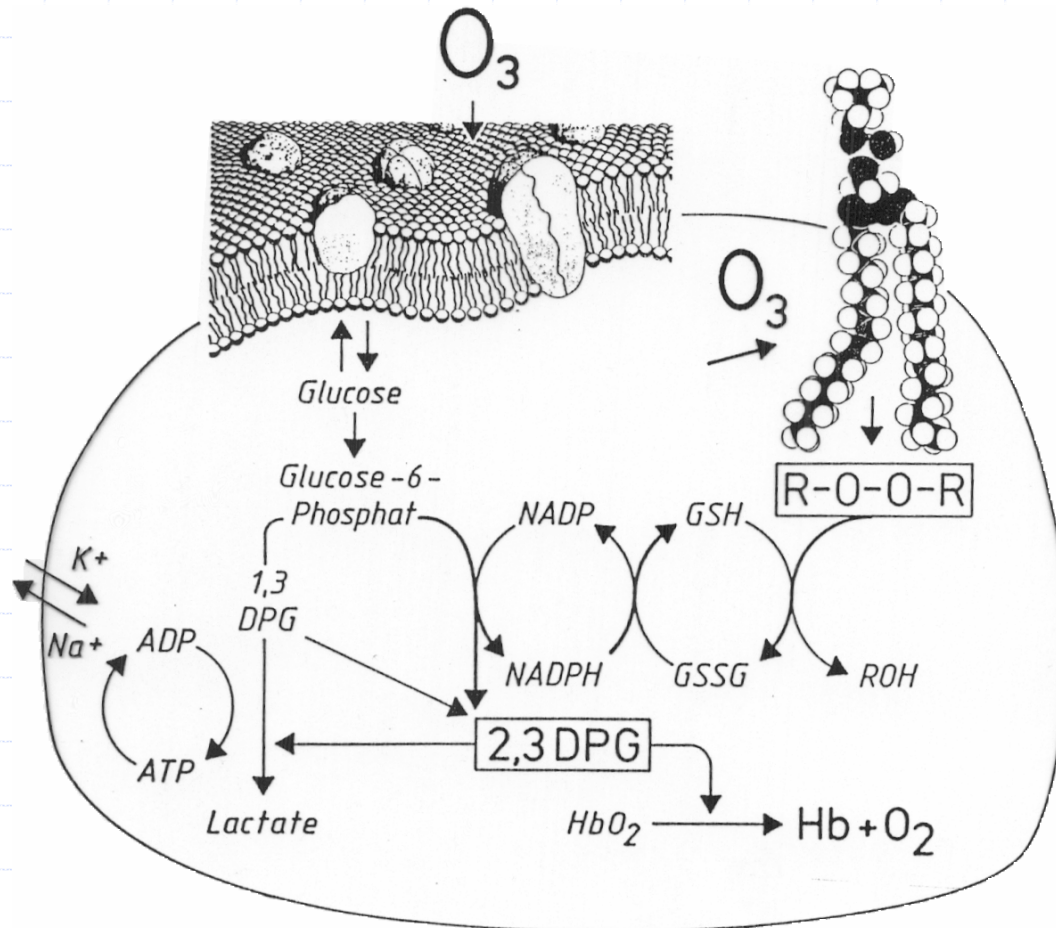
■ b. mechanisms of ozone-reactions

c.



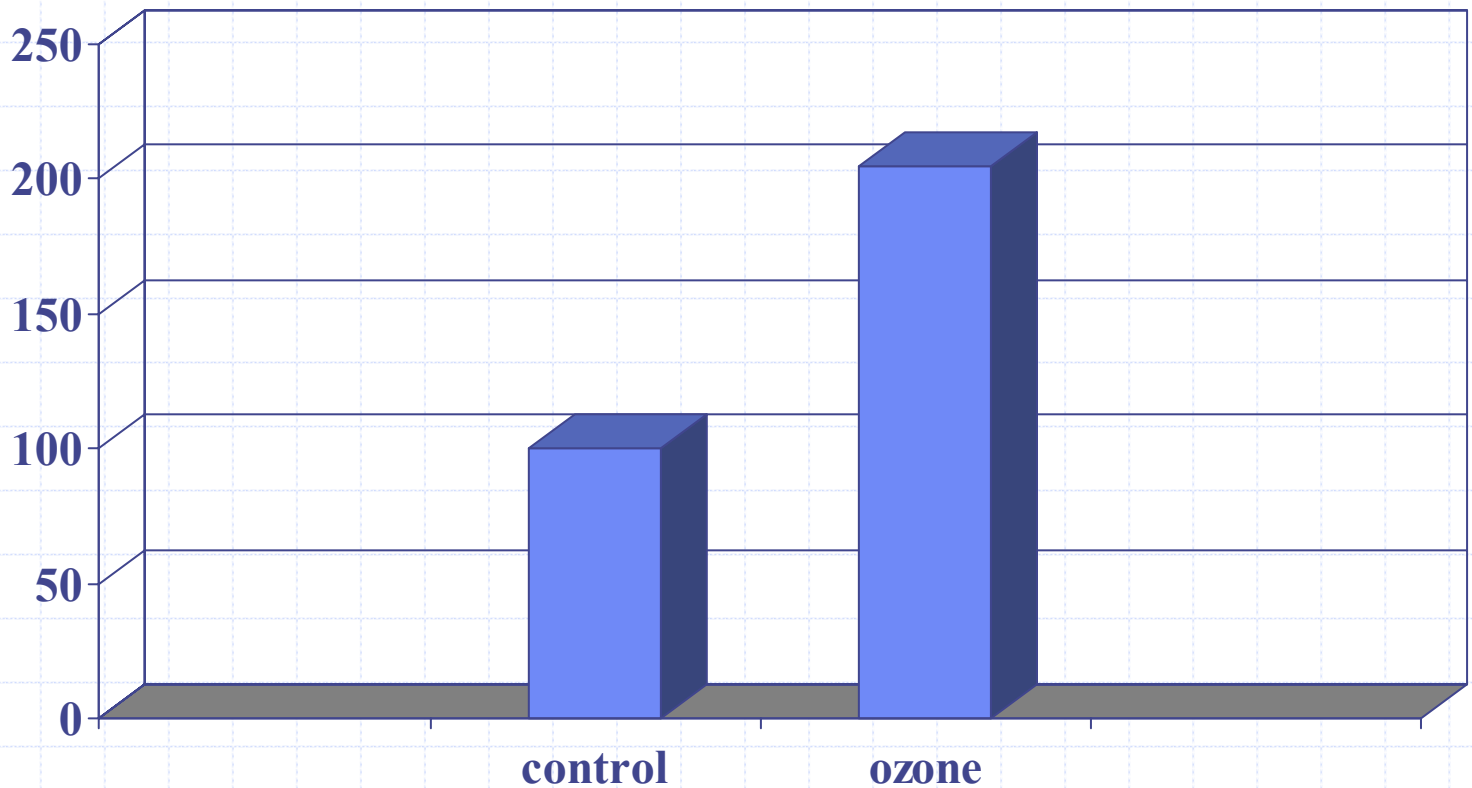
■ c. „ozone-peroxides“

The Action of Ozone on the Red Blood Cell Metabolism



2,3-DPG (in %) in vivo:

Arterial Circulatory Disorders, stage III +IV. (Rokitansky et al. 1981)

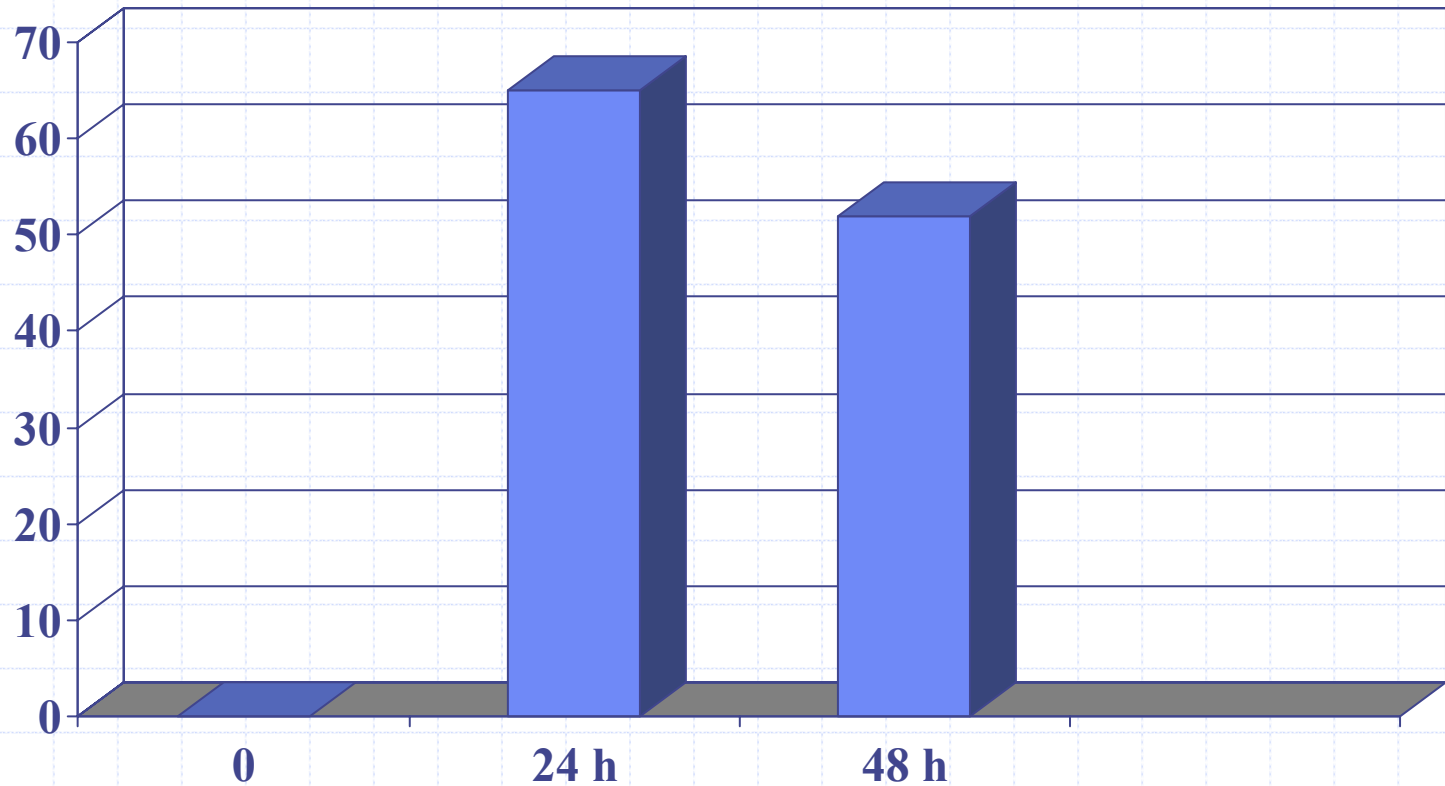


Mechanism of Action 1

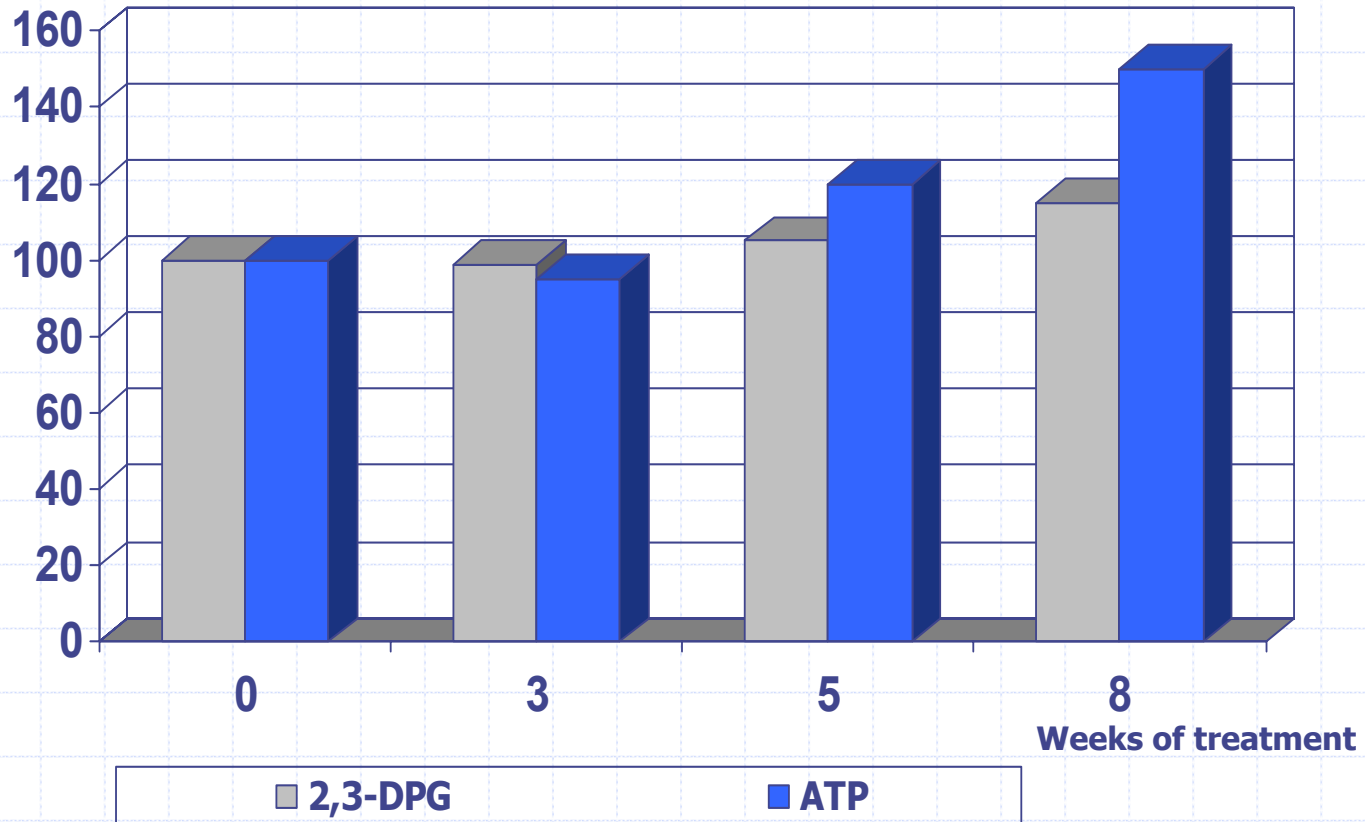
Activation of Red Blood Cell Metabolism

- increase in ATP and 2,3-DPG
- Shift of HbO₂/Hb-balance to the right and
- Improvement of oxygen-release

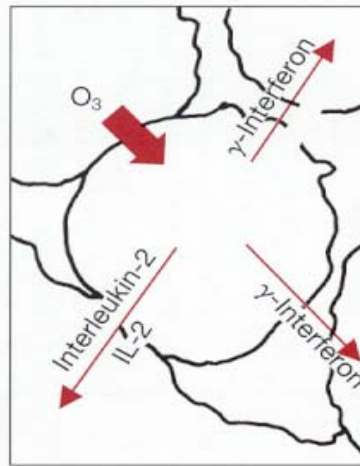
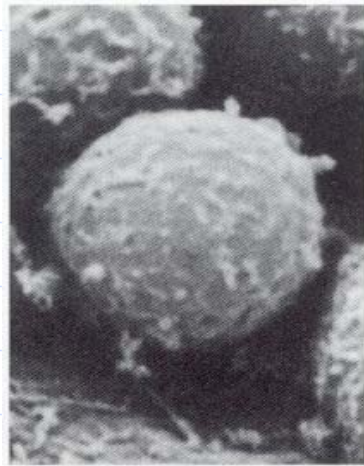
2,3-DPG in Blood Preserves in mg/L Serum (N = 5)



ATP and 2,3-DPG in % as Measure for Activation of Cell Metabolism in Elderlies

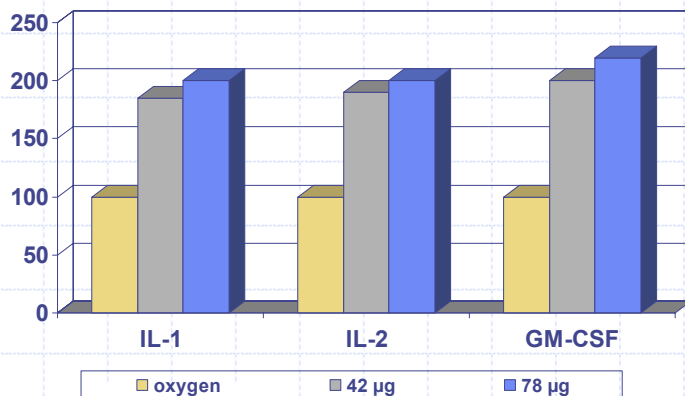


Pharmacological Effects 2: immunocompetent cells



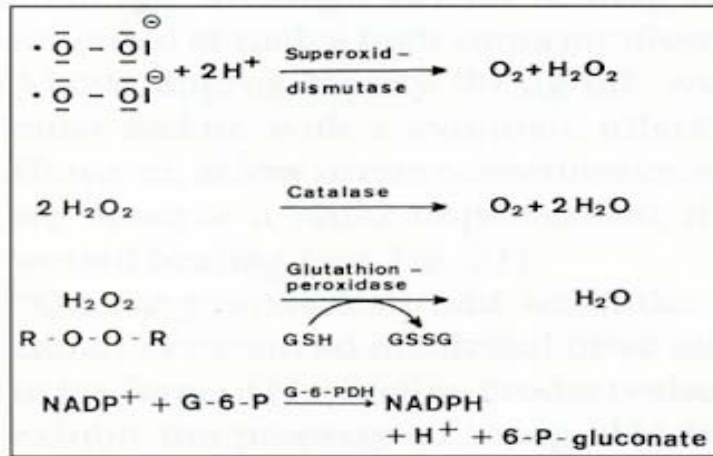
- 1990-2002
Bocci et al.

Cytokine induction in % dep.on O₃-conc.



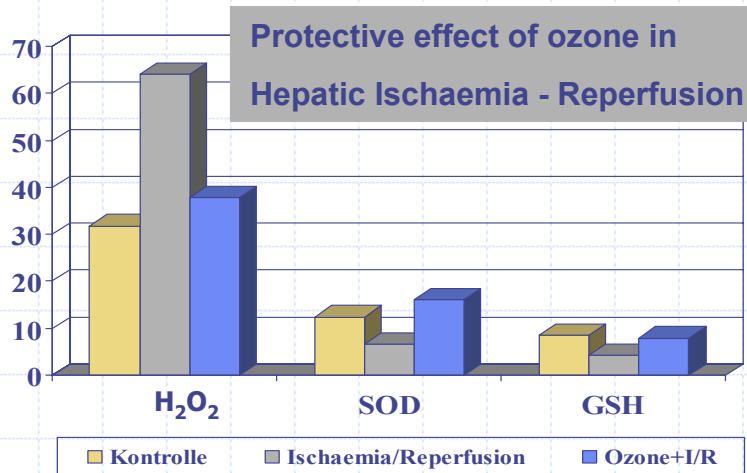
- Induction of cytokines such as interferons, interleukins and growth factors

Pharmacological Effects 3: Radical Scavengers

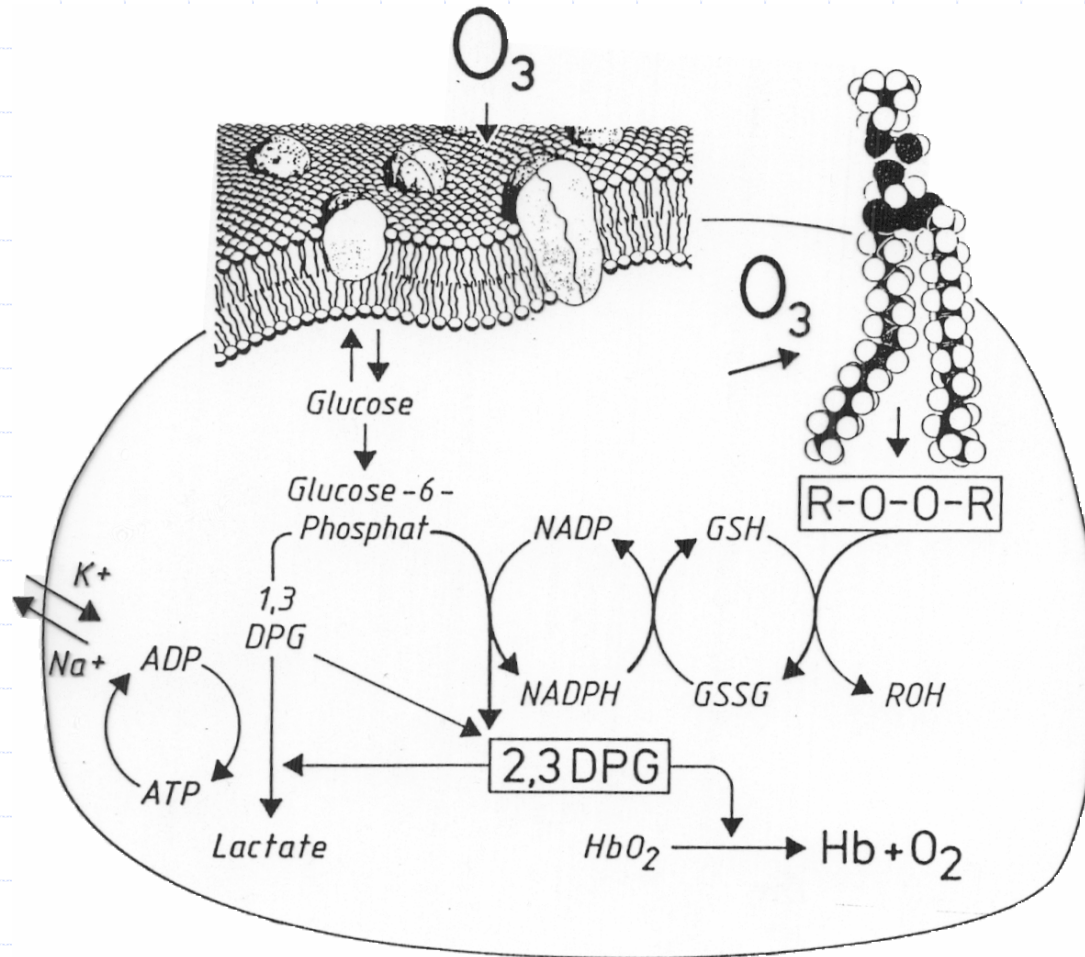


- 1998 León et al.
- 1999 Peralta et al.

- Activation of antioxidative enzymes and radical scavengers as protective effect in damage by free radicals



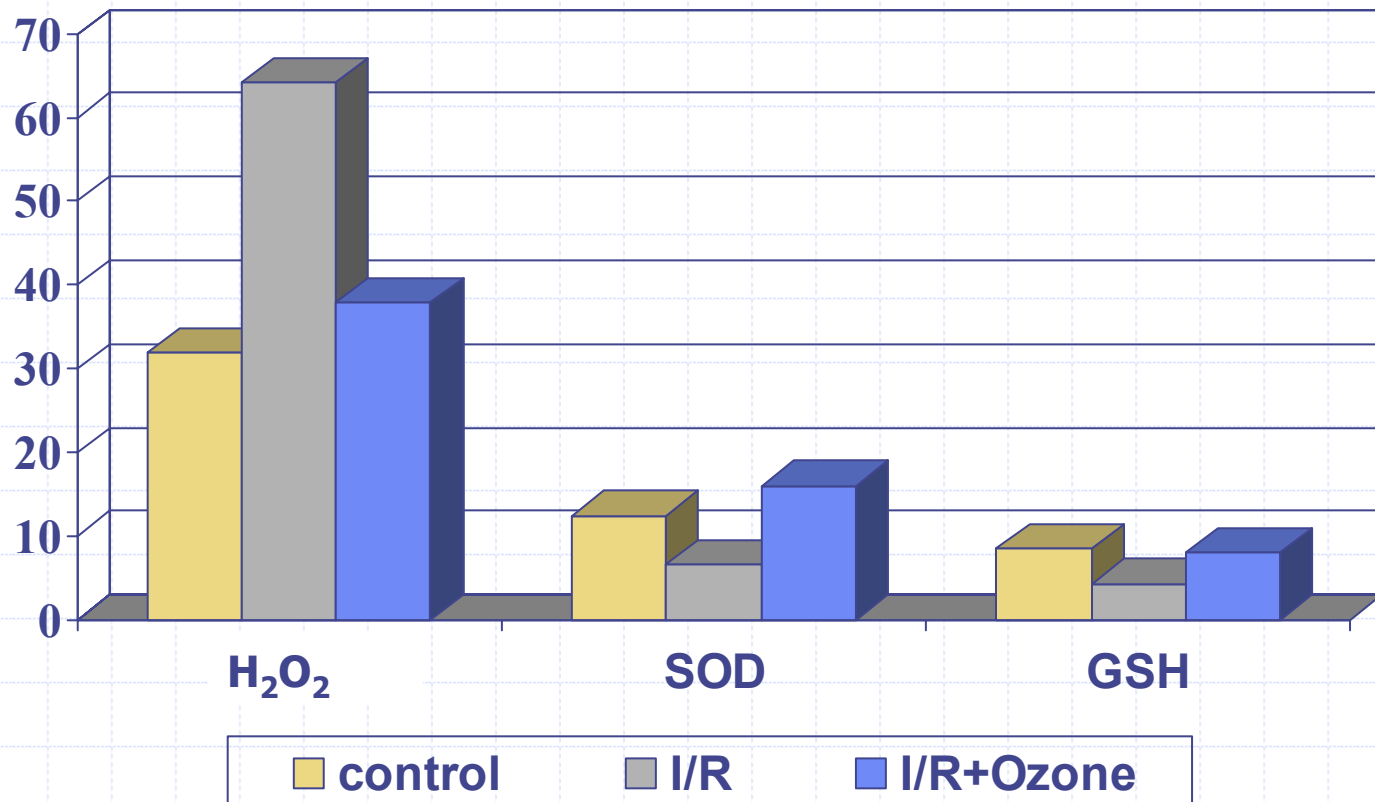
The Action of Ozone on the Red Blood Cell Metabolism



Hepatic Ischemia/Reperfusion Damage

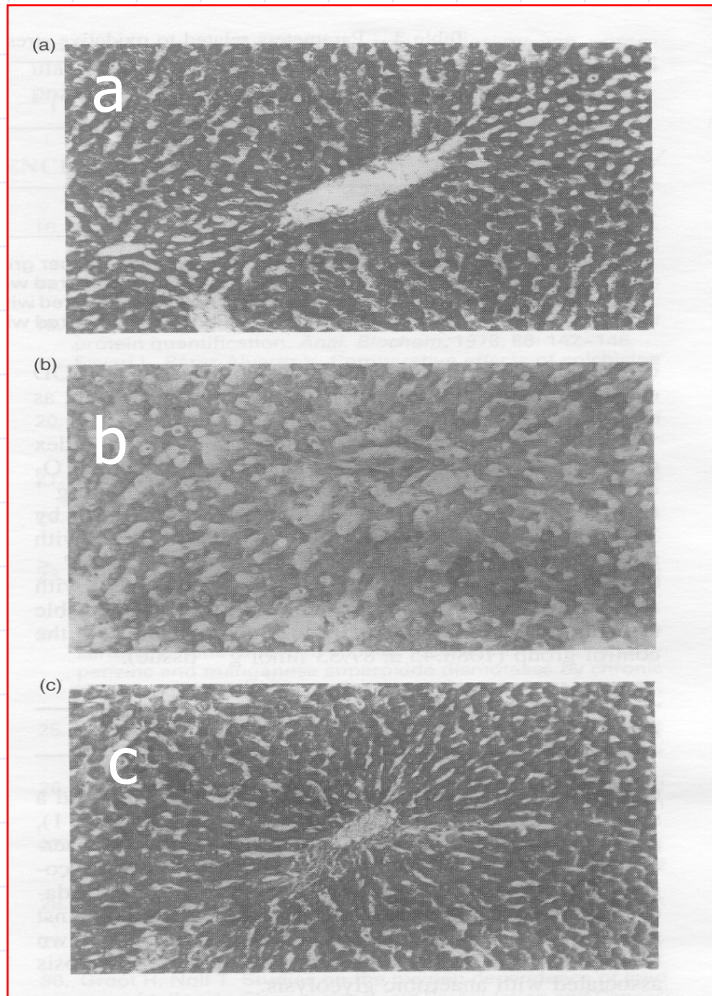
(Peralta et al 1999)

H₂O₂ (μmol/g); SOD (u/mg Protein);
GSH (nmol/mg Protein)



OZONE and Prevention (León et al. 2002)

Histological results correspond completely to biochemical measurements



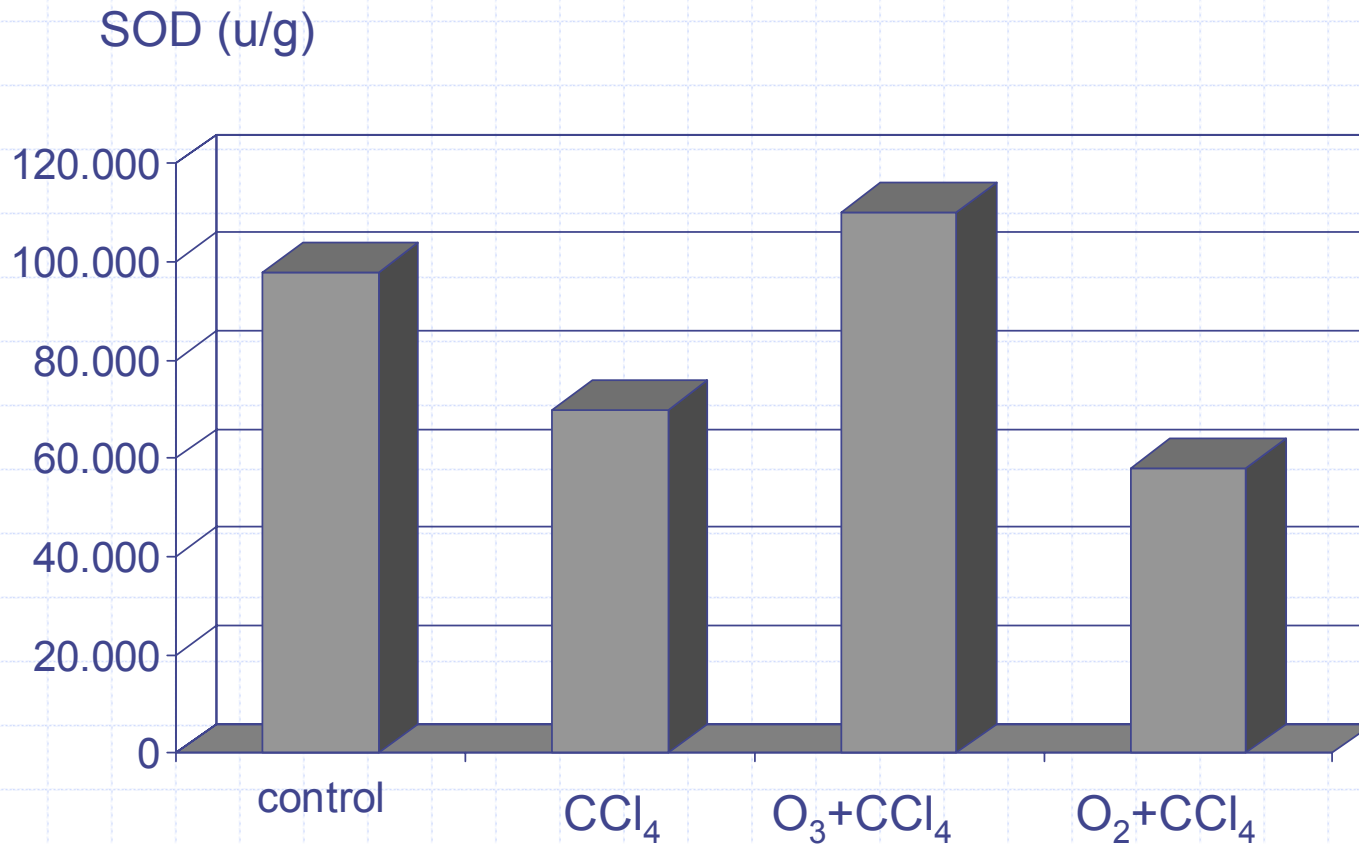
Rectal Ozone Insufflation
in an animal model.
Glycogen Depletion in
Liver Cells.

a) Control

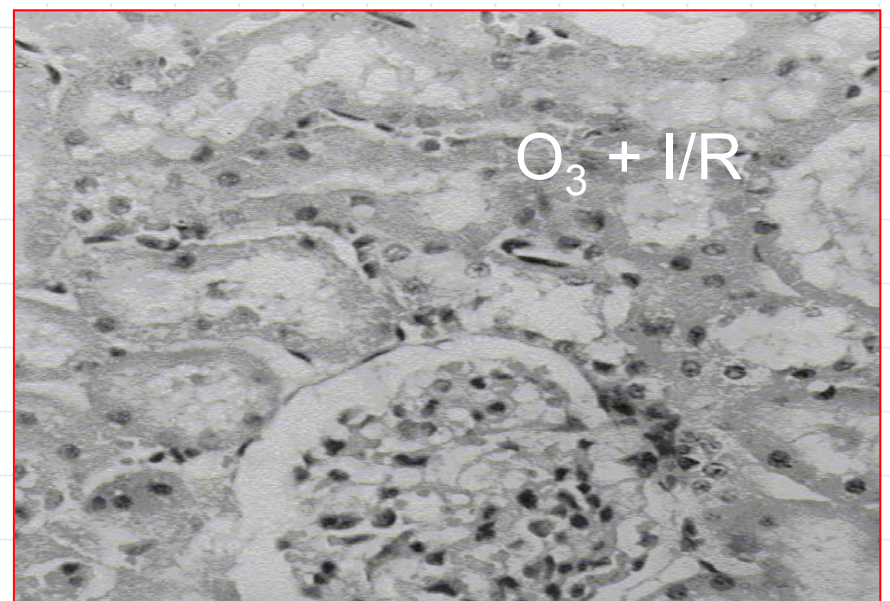
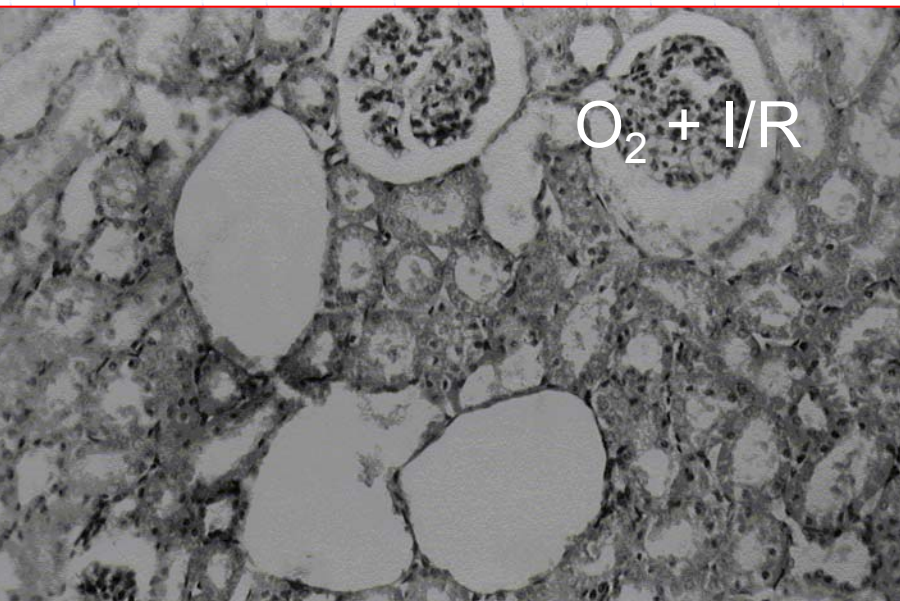
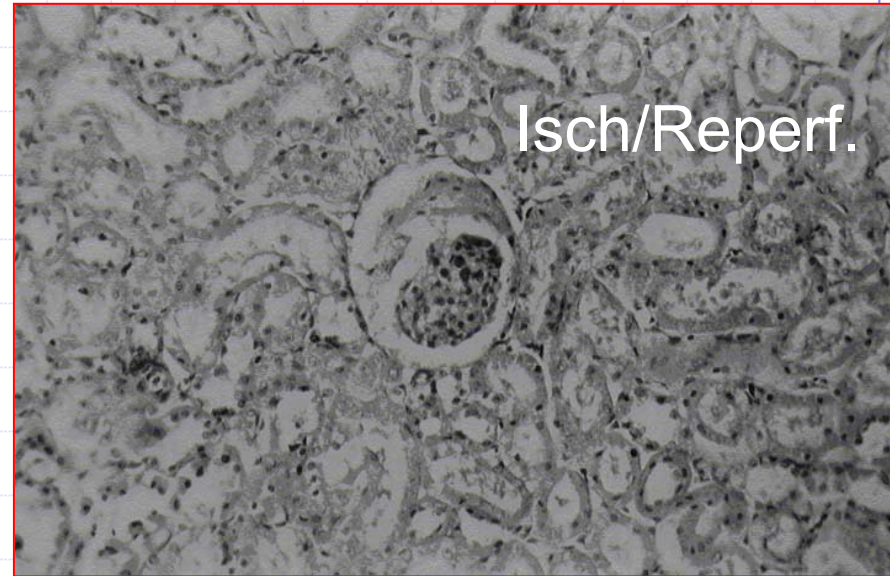
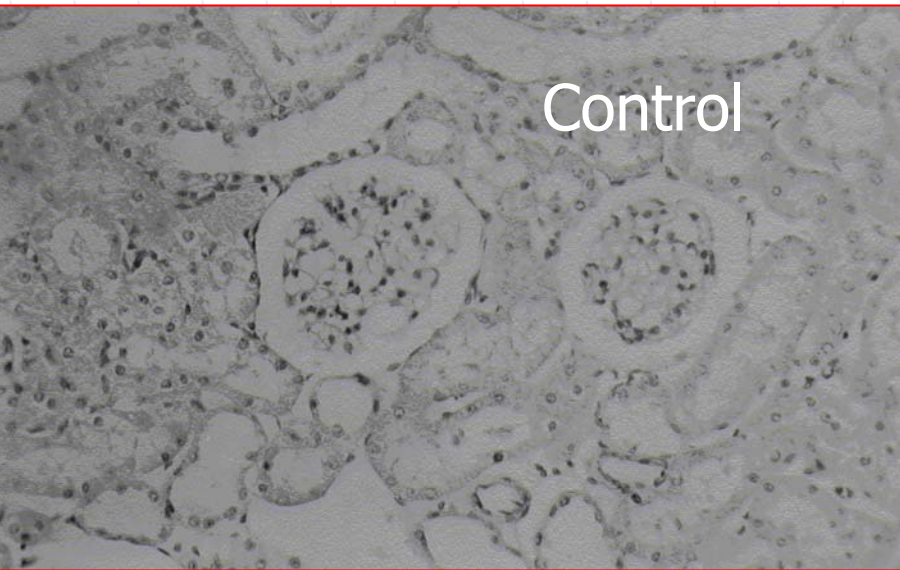
b) CCl₄-induced
Glycogen-Depletion

c) 15 preventive Ozone
Application

Protection Against Hepatic Cellular Damage induced by Carbontetrachloride in an Animal Model through 10 rectal Insufflations before CCl_4 -Application. (León et al. 1998)

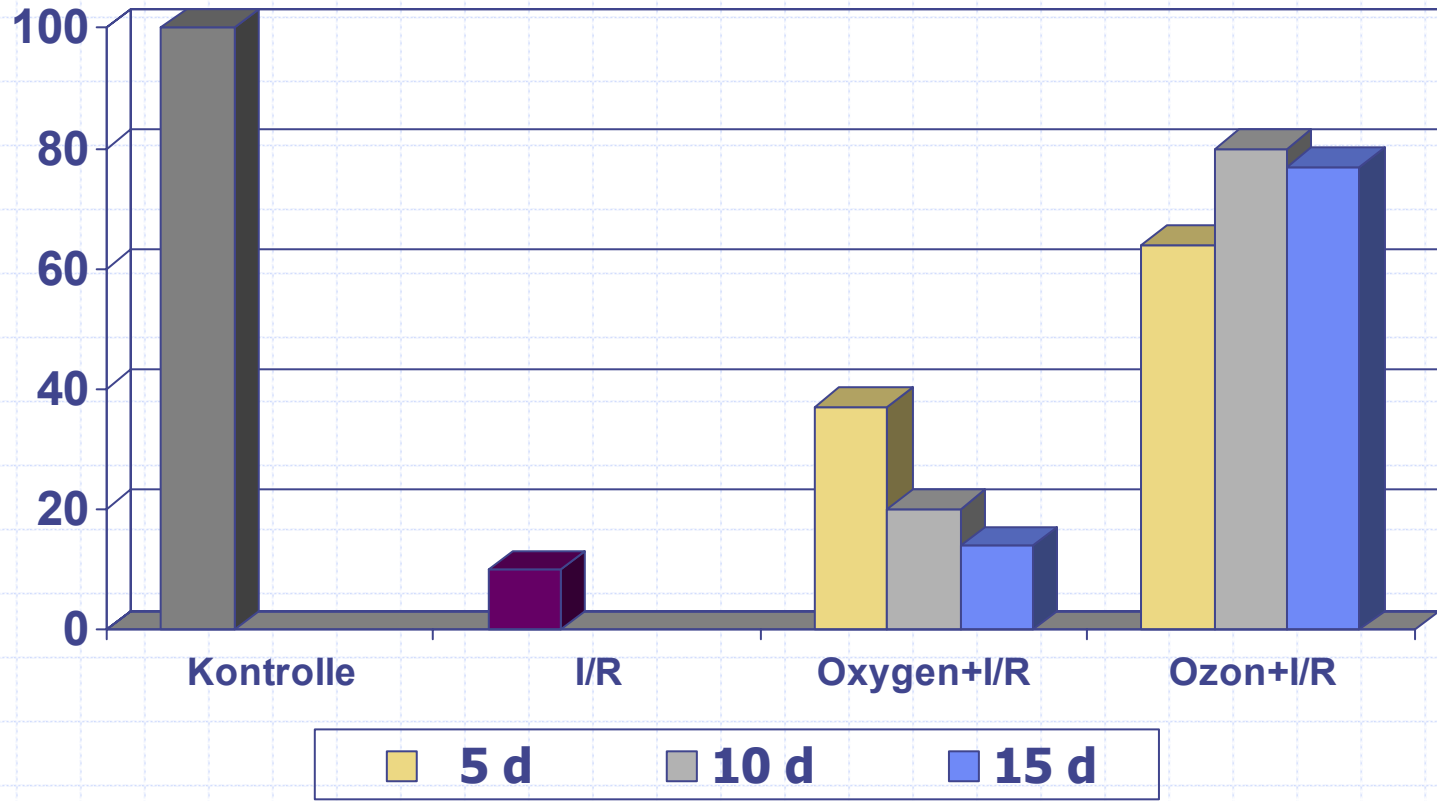


Reperfusion Damage in Renal Cells (Calunga et al.2001)



Reperfusion Damage in Kidneys in an Animal Model following rectal ozone application compared to pure oxygen

Histological results: % without lesion, N=10/group. (Calunga et al. 2002)



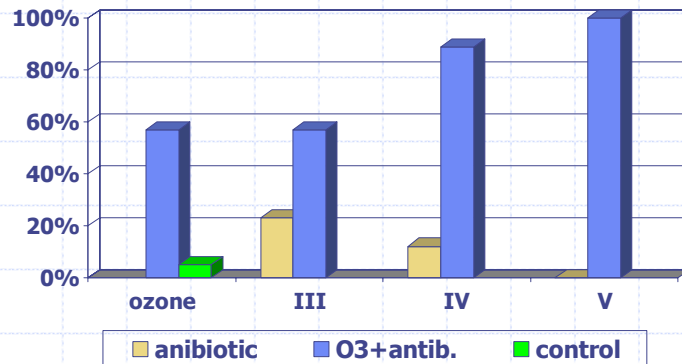
Mechanism of Action 3

Enzymatic Antioxydants and Radical Scavengers

- -such as SOD, GSH-peroxidase and GSH - reductase ...-
- are induced and activated by Ozone-formed peroxides,
- thus increasing the organism`s antioxydative capacity.

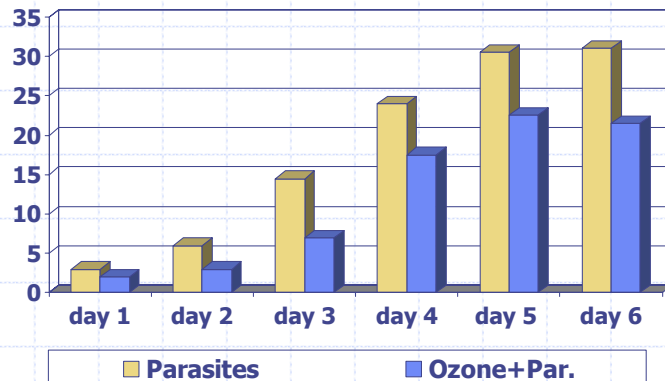
Pharmacological Effects 4: Ozone and Prevention

Survival rate in lethal septic peritonitis



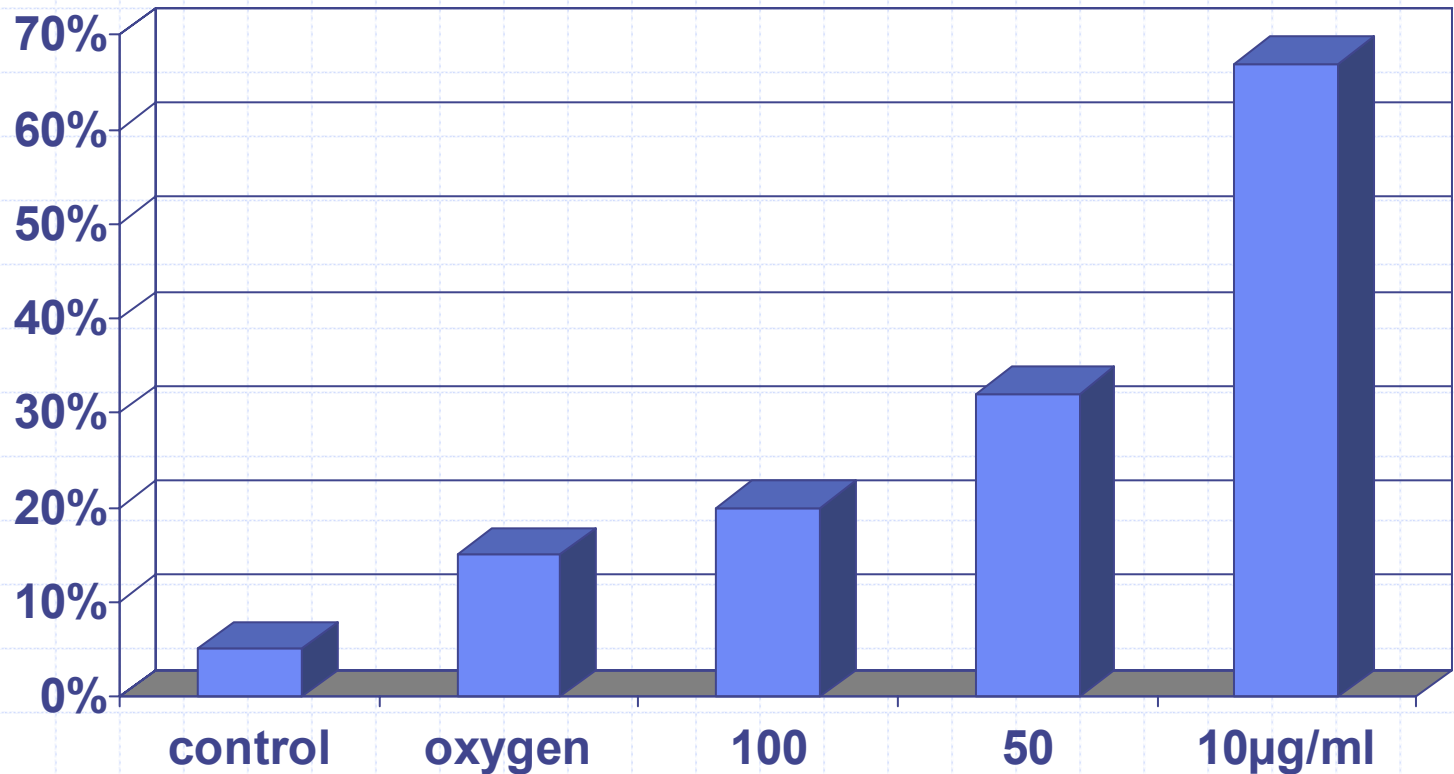
- 1999 Schulz et al.
- Improvement of survival rate in septic peritonitis in an animal model by pretreatment with ozone.
- Synergistic effect with antibiotics.

Parasitemia in %



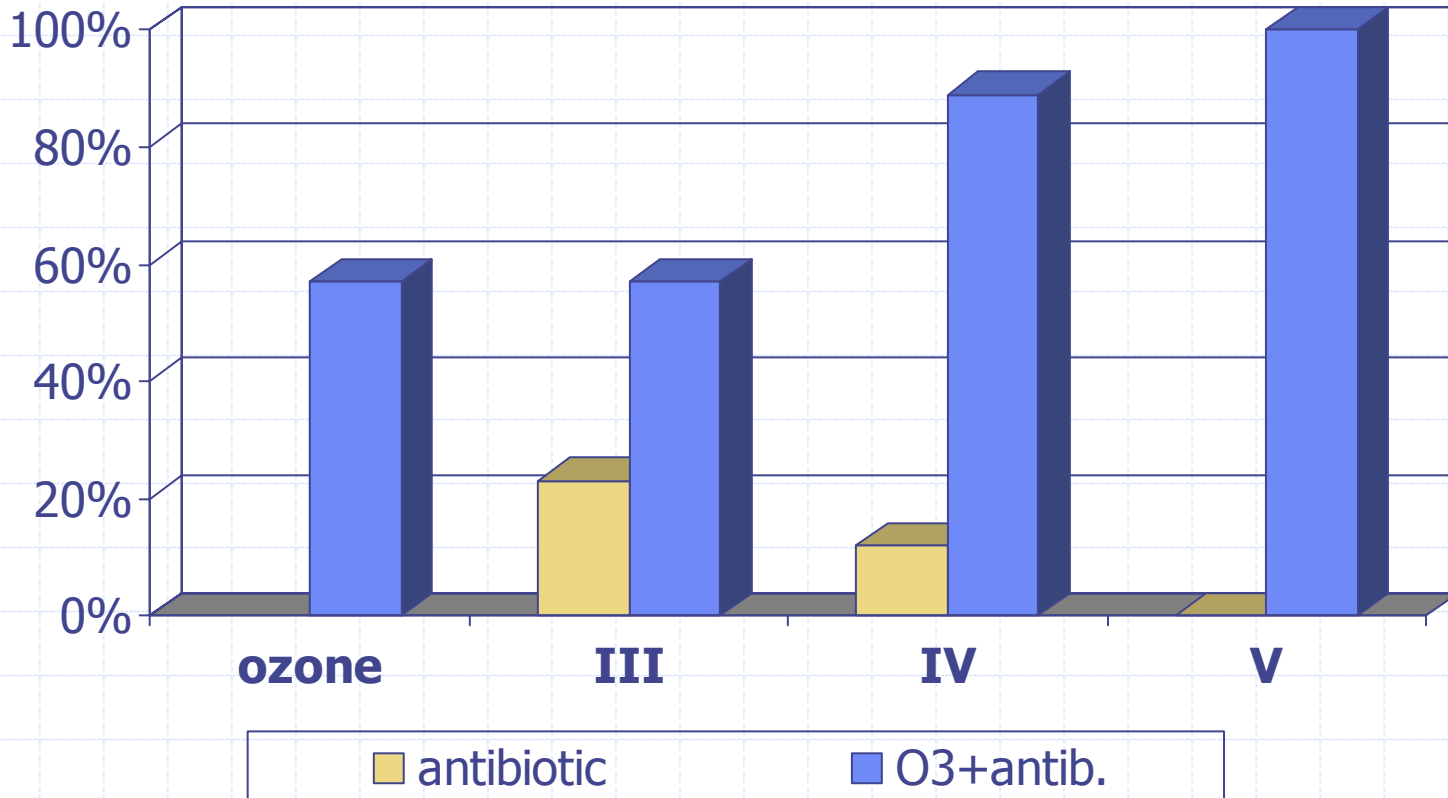
- 2001 Lell, Viebahn et al.
- Growth inhibitory effect of plasmodium in infected RBC's by pretreatment with ozone.

Peritonitis Model in Rats. Survival Rate with Ozone in % (Schulz et al.1999)



Peritonitis Model in Rats. Survival Rate in %

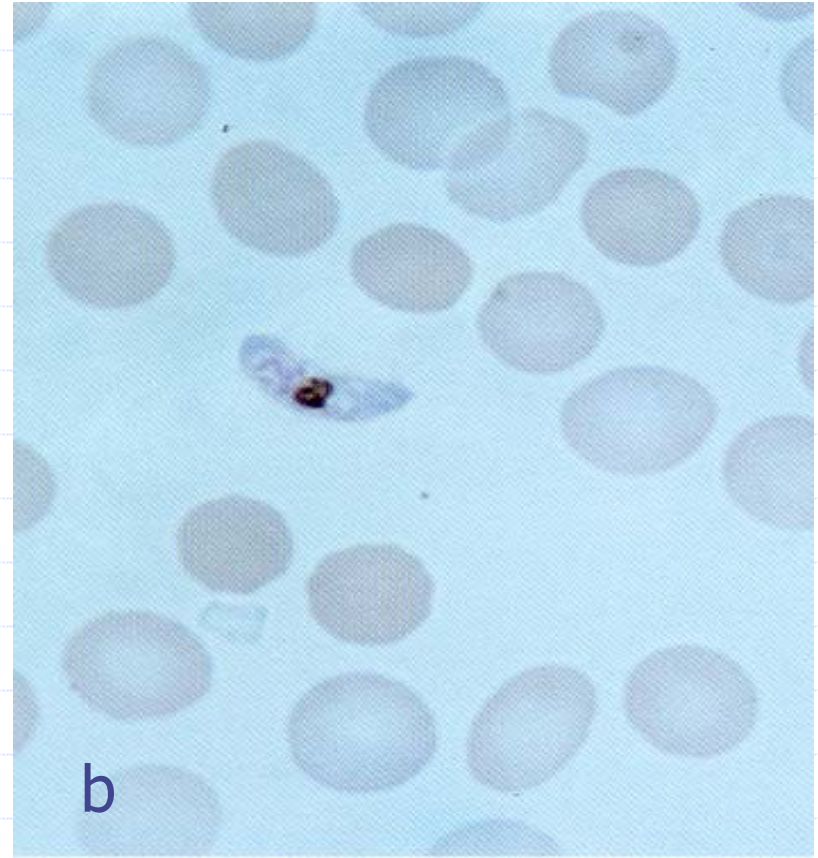
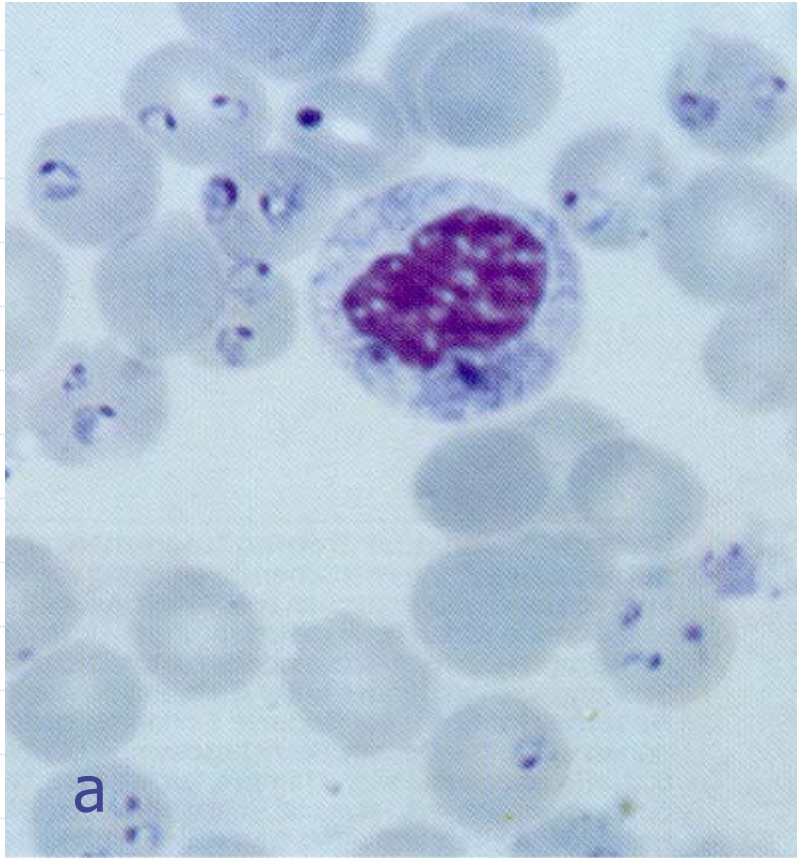
Treatment: III Claforan. IV Tavanic. V Tazobac.



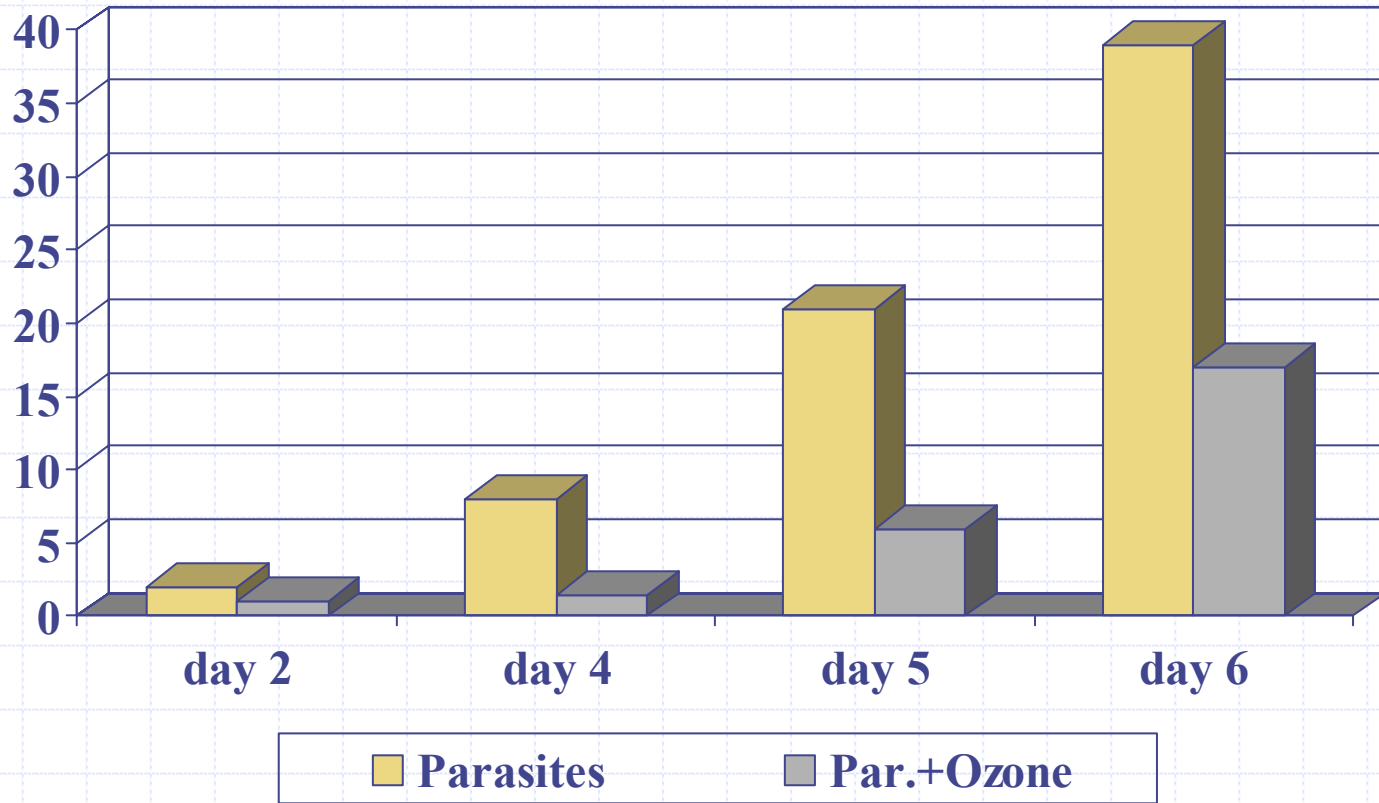
a. Ring Shaped Plasmodia and Mature Schizonts

b. Female Plasmodia falciparum Gametes

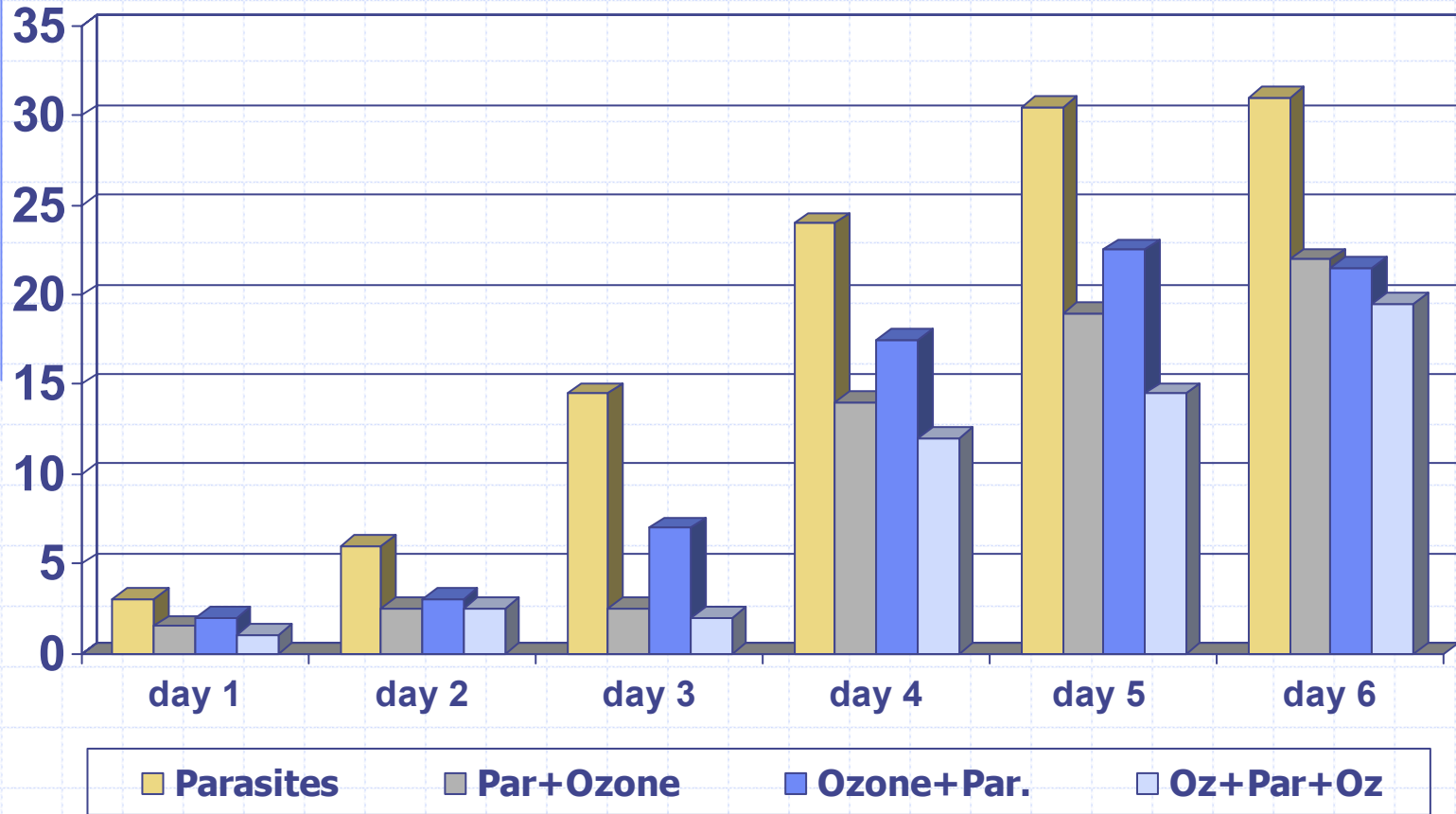
(acc. Lieske et al. 1991)



Plasmodium falciparum infected Red Blood Cells + Ozone. Parasitemia in % (Lell, Viebahn, Kremsner 2001)



P.falciparum infected Red Blood Cells+Ozone : pre and post infection. Parasitemia in %



Ozone and Prevention

Indications , Applications and Dosages

- Herpes
(post Zoster Neuralgia)
- **Susceptibility to Infections**
- General Immunoactivation
and Revitalization
- **Presurgical measure**
- Preventive Application in
Chemotherapie and
Radiation
- **Allergies**

Major Autohemotherapy
with 800 to 2000 μ g Ozone
per treatment (50 ml with 16-
40 μ g/ml)

Rectal Insufflation with 10-
20 μ g/ml and a Volume of
150-300 ml, in children 30-
50 ml

Minor Autohemotherapy
with 220 μ g Ozone in 3-5 ml
Patient's Own Blood