



FEMTEC

WORLD FEDERATION OF HYDROTHERAPY AND CLIMATOTHERAPY
NGO IN OFFICIAL RELATION WITH WHO (WORLD HEALTH ORGANIZATION)

THERMAL CLUSTERS

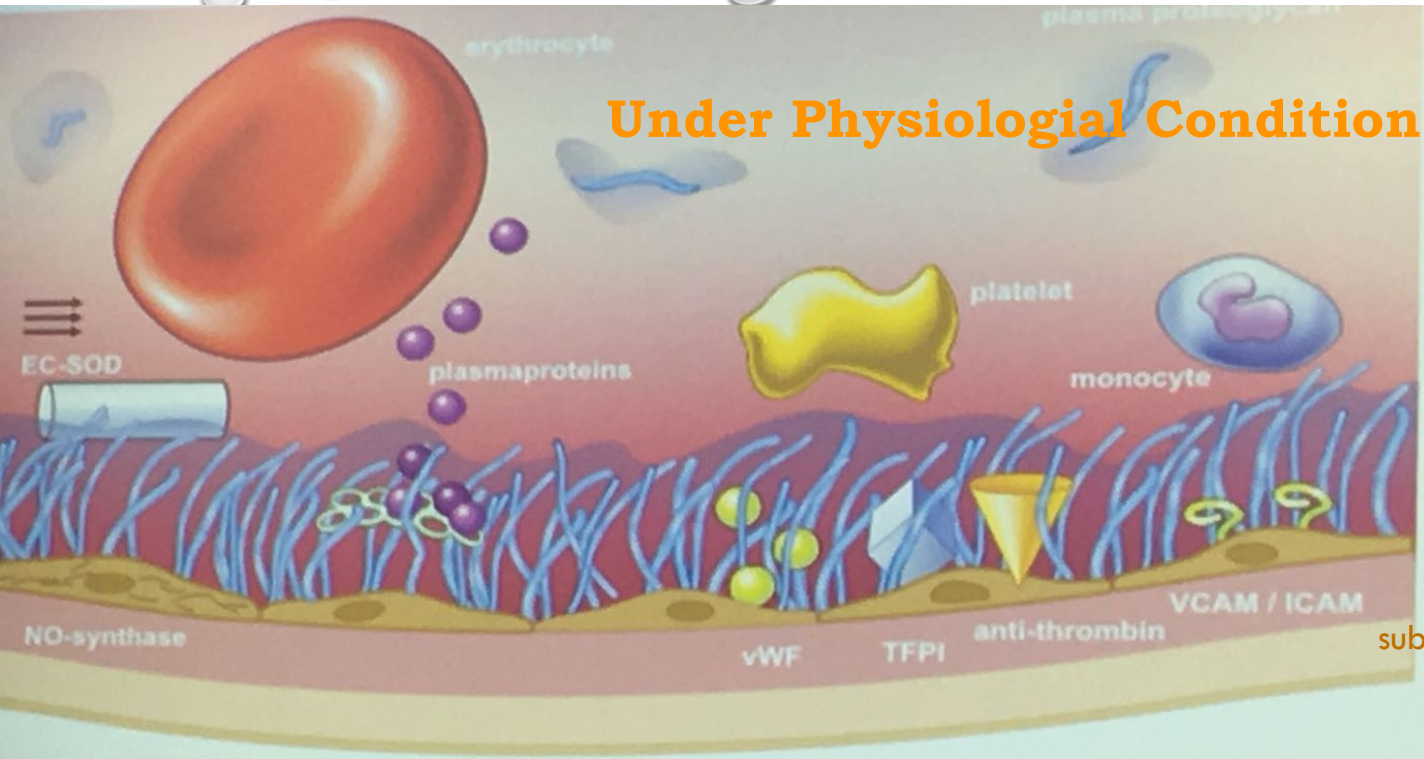
**Status, proposals, and strategies
for health care and local development**

Sulphurous mineral water and its peloids. Applications for health.

JM Carbajo¹, F. Maraver^{1,2}

1. Research Group UCM-911757 (Complutense University of Madrid, Medical Hydrology)
Professional School of Medical Hydrology, Faculty of Medicine, Universidad Complutense de Madrid, 28040 Madrid, Spain.
2. Department of Physical Medicine and Rehabilitation. Medical Hydrology, Faculty of Medicine, Universidad Complutense de Madrid, 28040 Madrid, Spain.

The healthy Endo-Protective Membrane (Glycocalyx)



Glycocalyx

endothelium

subendothelial
space

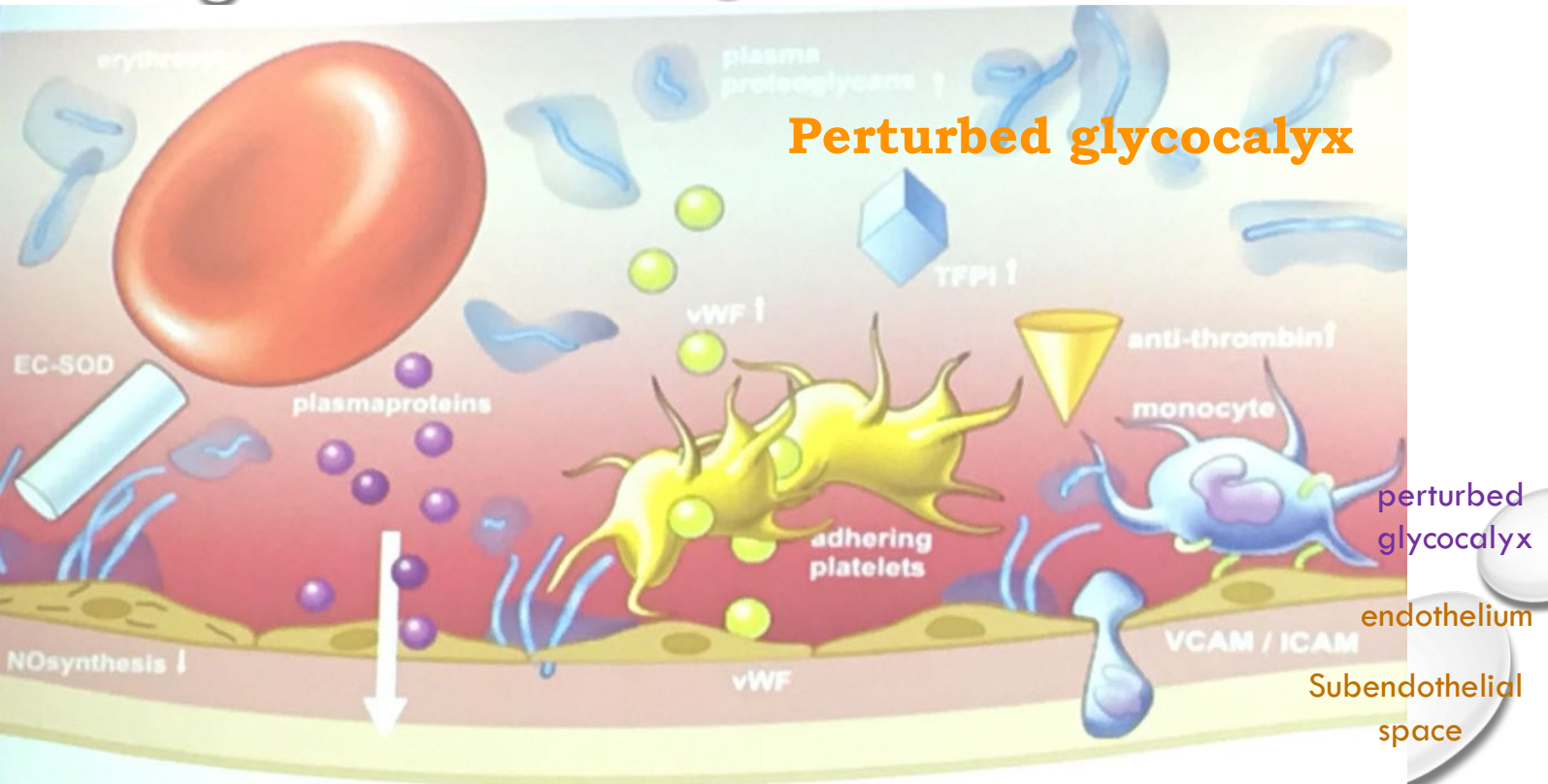
Endothelial function
shear induced
NO-Synthesis
superoxide dysmutation

Permeability
“sieving barrier”

Coagulation
inhibition of platelet adherence
coagulation regulatory factors

Inflammation
prevention of
leukocyte
adhesion

Endo-Protective Membrane (Glycocalyx) in disease



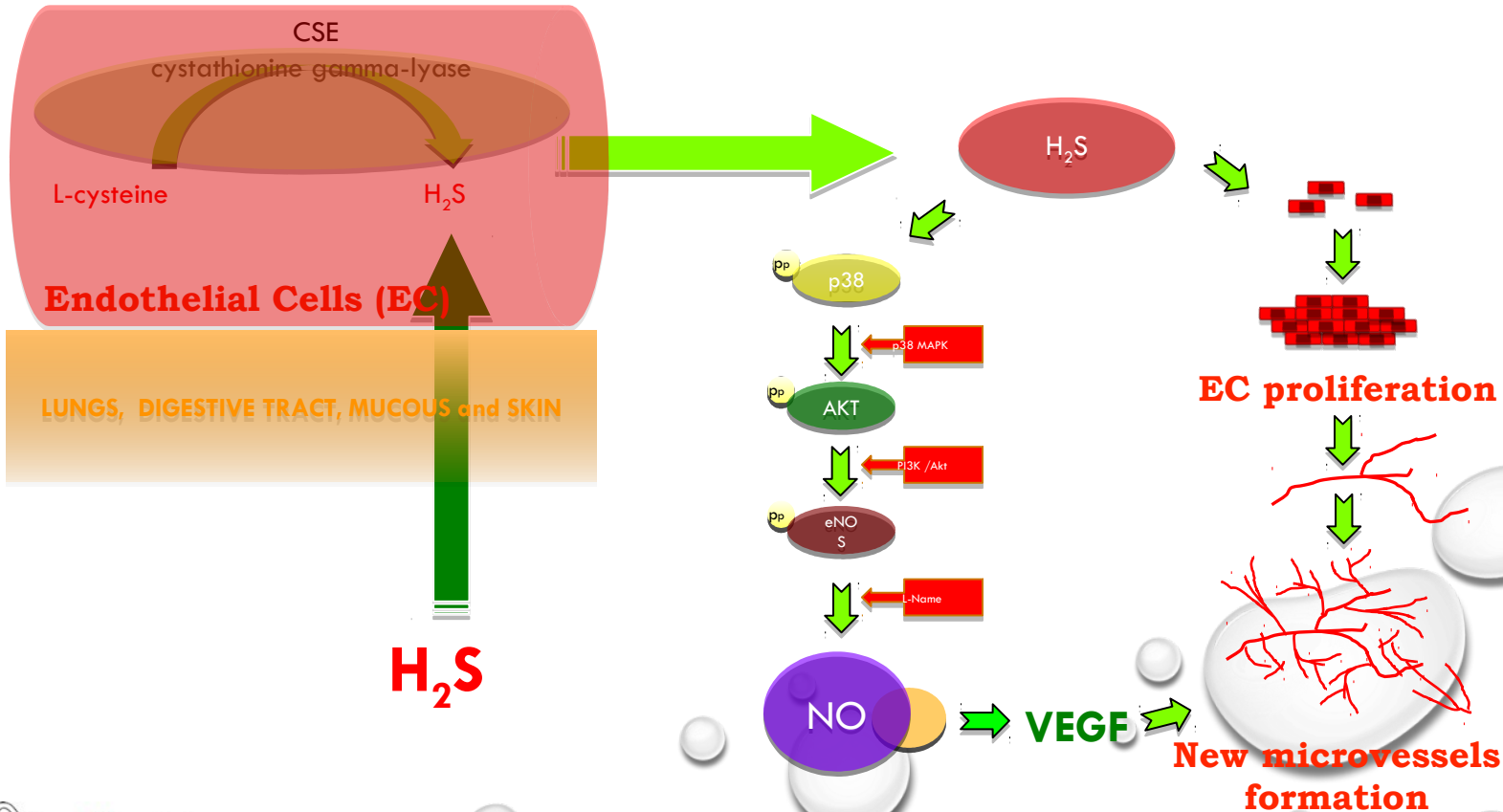
NO availability ↓
Oxidative stress ↑

leakage of
macromolecules ↑

platelet adherence ↑
thrombin generation ↑

leukocyte adhesion ↑
and diapedesis

H₂S as gasotransmitters



Universidad

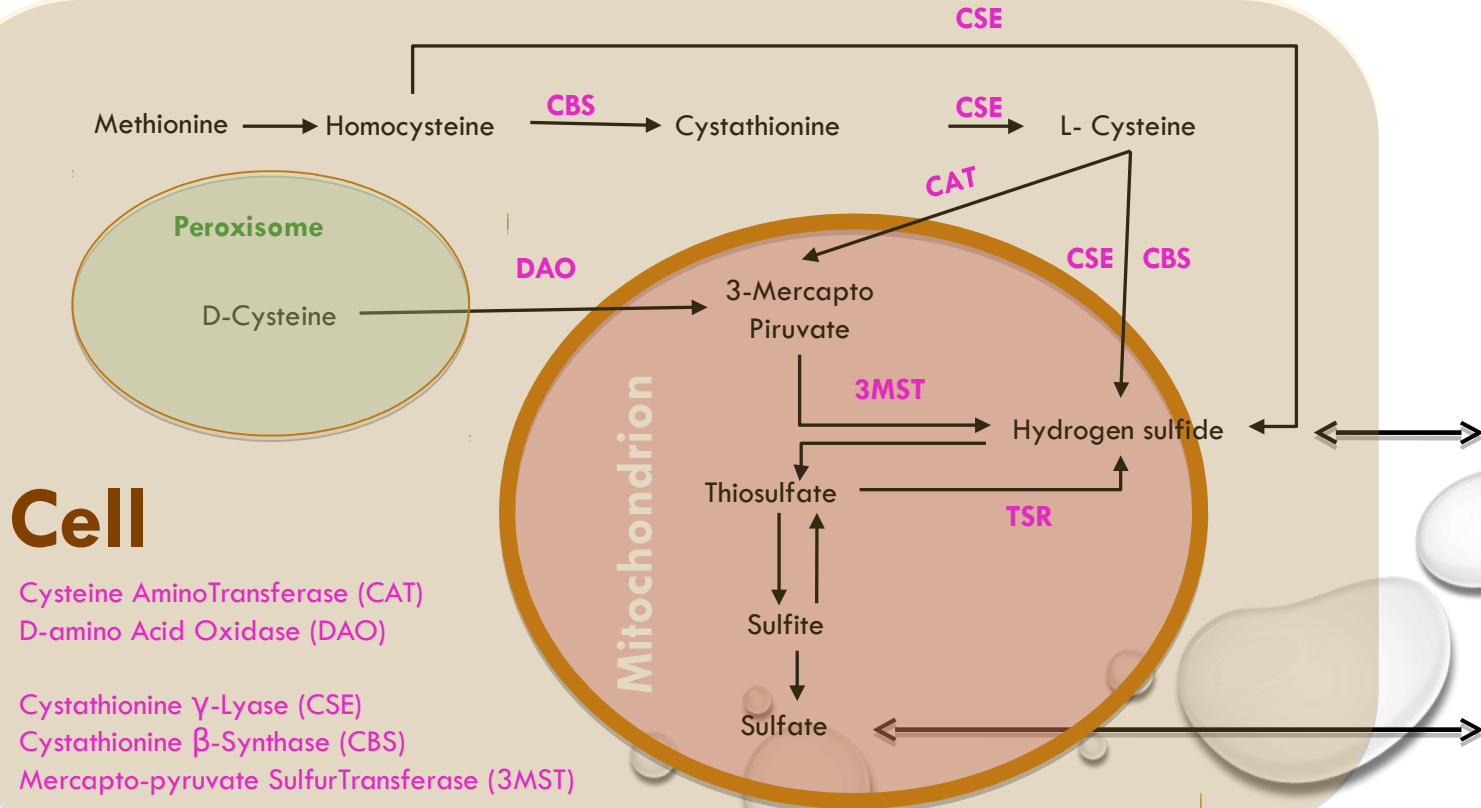
Complutense

Madrid

Almasy Z et al. Schematic representation of proposed pathways of H₂S-induced NO production and angiogenesis.

Cell Mol Med 2013; 17(7): 879-888

Cellular production



Cell

Cysteine AminoTransferase (CAT)
D-amino Acid Oxidase (DAO)

Cystathionine γ -Lyase (CSE)
Cystathionine β -Synthase (CBS)
Mercapto-pyruvate SulfurTransferase (3MST)

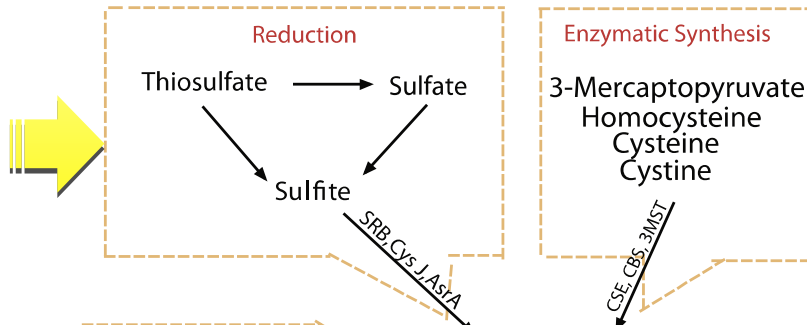


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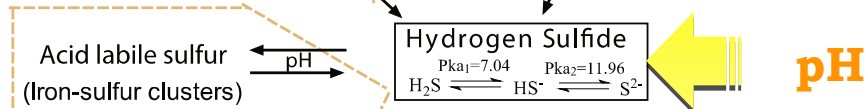
Perridon BW, Leuvenink HGD, Hillebrands J-L, Goor HvG, Bos EM. The role of hydrogen sulfide in aging and age-related pathologies. AGING 2016, Vol. 8, Advance

Storage and release of H₂S

**Sulphates
reducing
bacteria's
(SRB)**

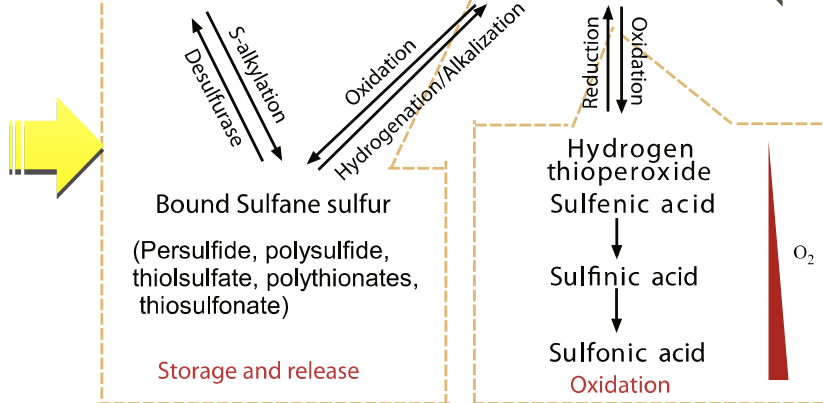


Enzymes



pH

**Thiols
molecules**



Presence O₂

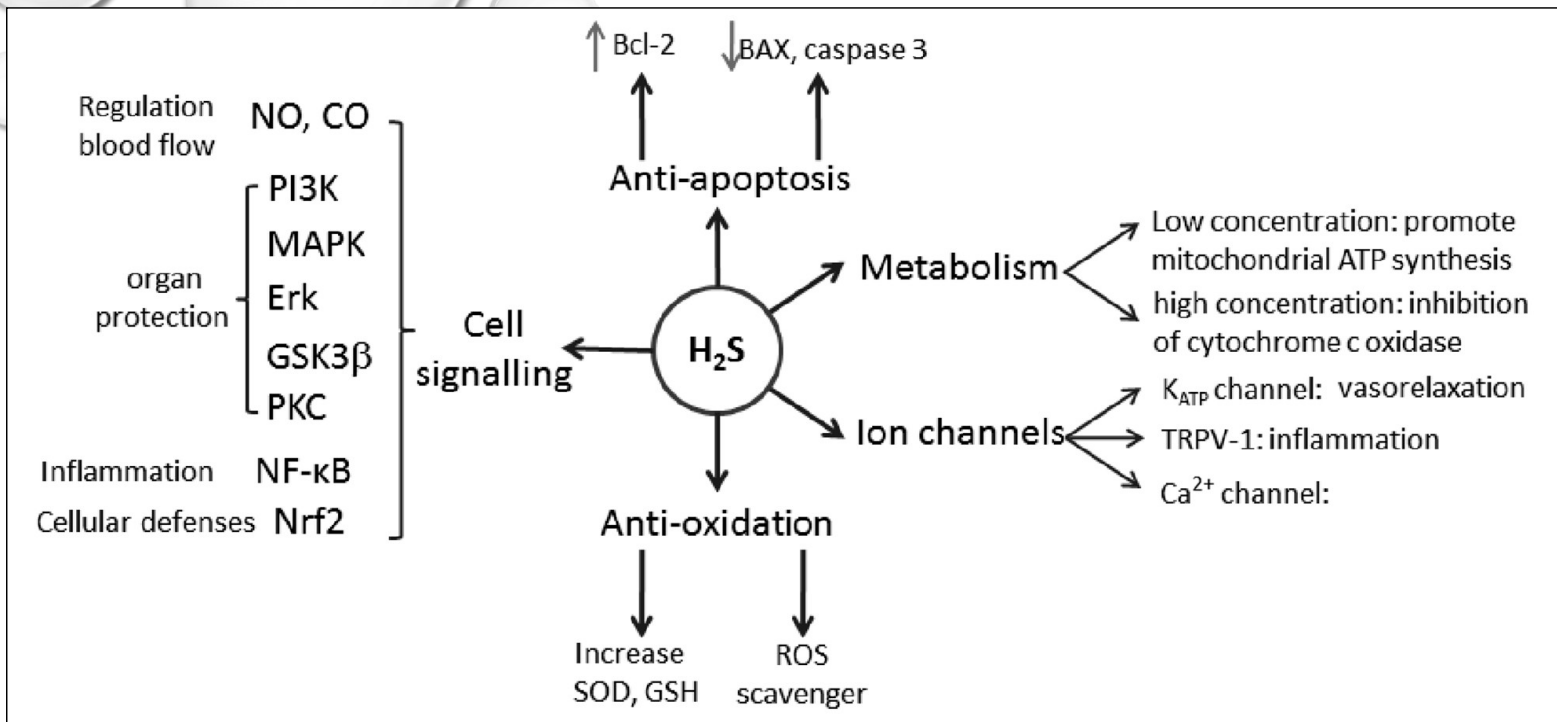


Fig. 2. General ‘pharmacological’ functions of hydrogen sulfide.

BAX, Bcl-2 associated X protein; CO, carbon monoxide; ERK, extracellular-signal-regulated kinase; GSH, glutathione; GSK3b, glycogen synthase kinase 3 beta; H_2S , hydrogen sulfide; MAPK, mitogen-activated protein kinase; PI3K, phosphoinositide 3-kinase; PKC, protein kinase C; NF- κ B, nuclear factor kappa beta; Nrf2, NF-E2 p45-related factor 2; ROS, reactive oxygen species; SOD, superoxide dismutase; TRPV-1, transient receptor potential cation channel subfamily V member 1.

H₂S properties

- ⊙ **Regulation of blood flow**
- ⊙ **Organs protection (ischemia)**
- ⊙ **Cellular defences**
- ⊙ **Against inflammation**
- ⊙ **Anti-apoptosis**
- ⊙ **Cellular metabolism**
- ⊙ **Anti-oxidation**

H₂S Chemicals Properties

Gas very soluble in water: ≈ 80 mM (37°C)

➔ pH

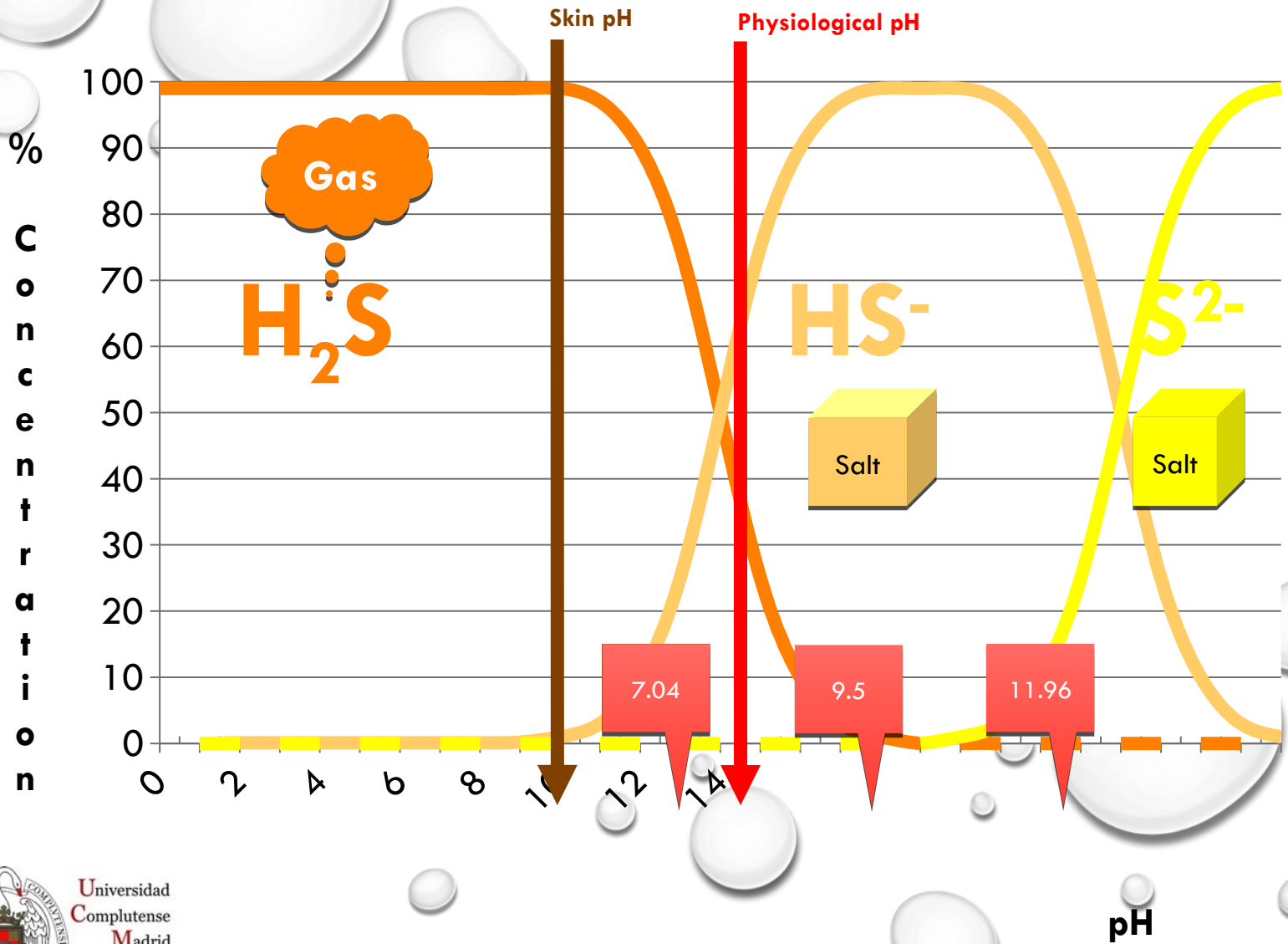


Physiological pH (7.4): H₂S / HS⁻ is $\approx 1:3$

➔ Temperature

At 37°C ➔ 20% H₂S 25°C ➔ 40% H₂S

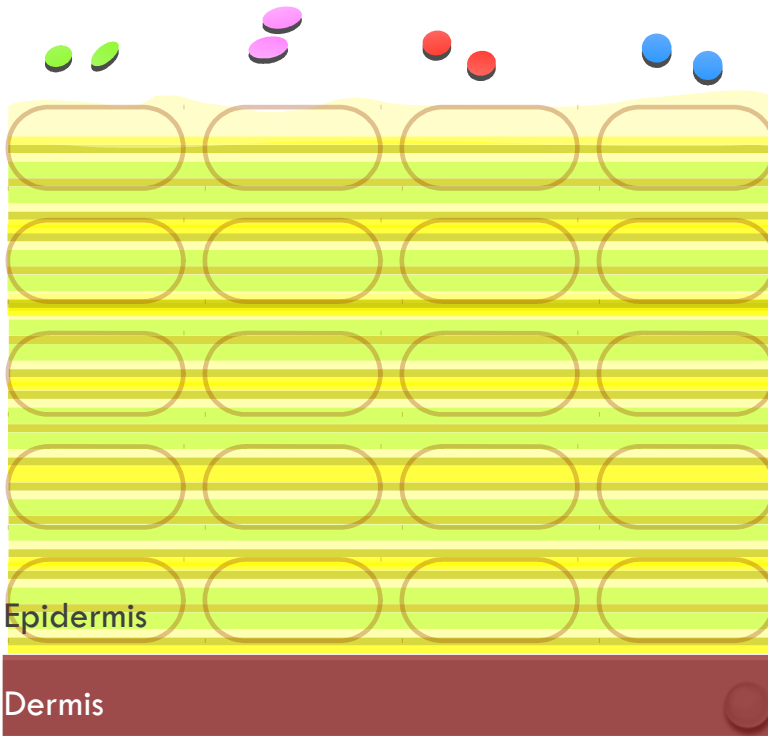
➔ Oxygen: H₂S ➔ H₂SO₄



What's about hydrophilic solutes?

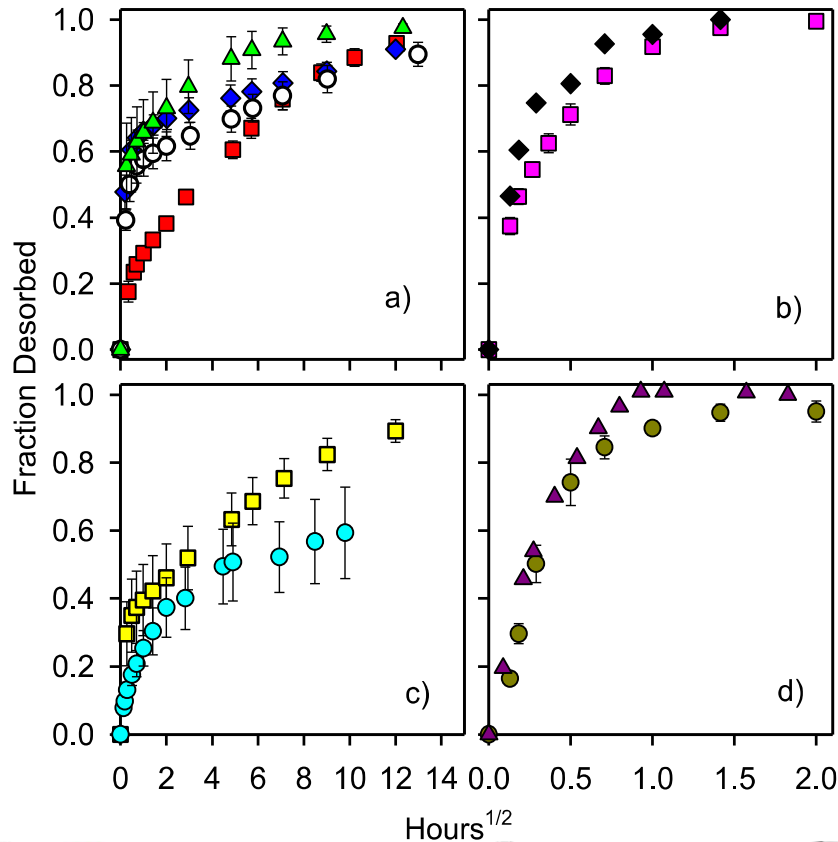
(Chen L, 2013)

Hydrophilic solutes enter into the SC corneocytes



- **Adsorption**
 - (Colloidal sulphur)
- **Adsorption/Penetration**
 - Hydrosulphide anion
- **Penetration /Absorption**
 - Hydrogen Sulphide
- **Cellular absorption**
 - Most salts

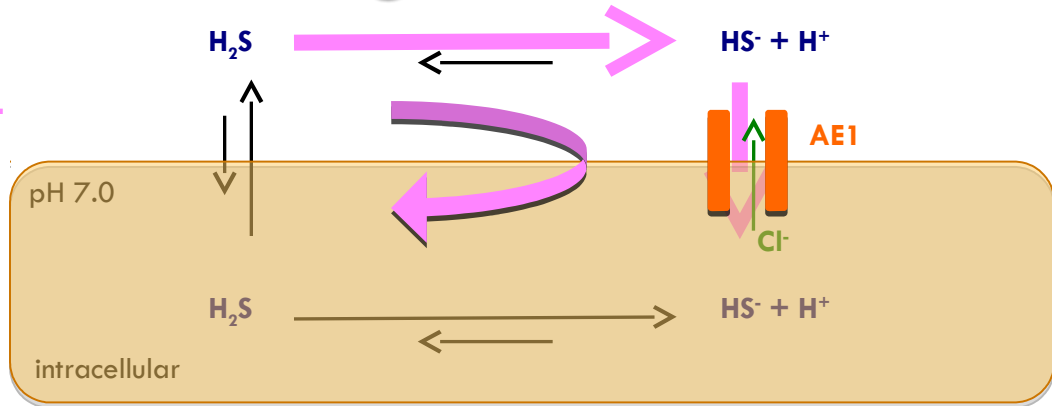
Desorption of substances



- Chlorine (Cl⁻)
- TEA⁺
- Sodium (Na⁺)
- Glycerine
- Niacinamide
- Sucrose
- Water
- 1-propanol
- Testosterone

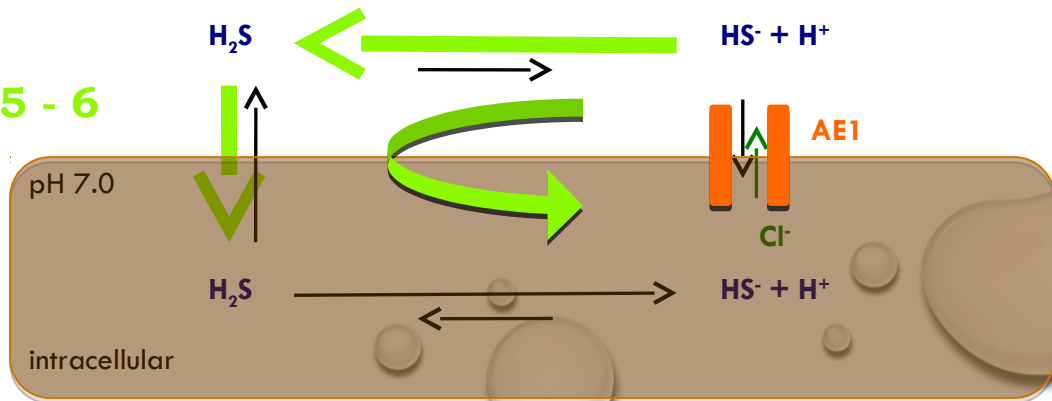
pH 7.4

Mammalian (37°C)



pH 4.5 - 6

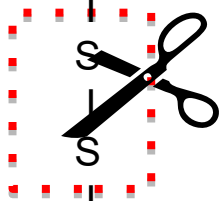
Skin
($\approx 35^{\circ}\text{C}$)



CORNEOCYTE

- CO - CH - NH -

|
CH₂



|
CH₂

- CO - CH - NH -

CORNEOCYTE

Oxidation



Cystine + 2H⁺ + 2e⁻ → Cysteine

Reduction



CORNEOCYTE

- CO - CH - NH -

|
CH₂
|
SH

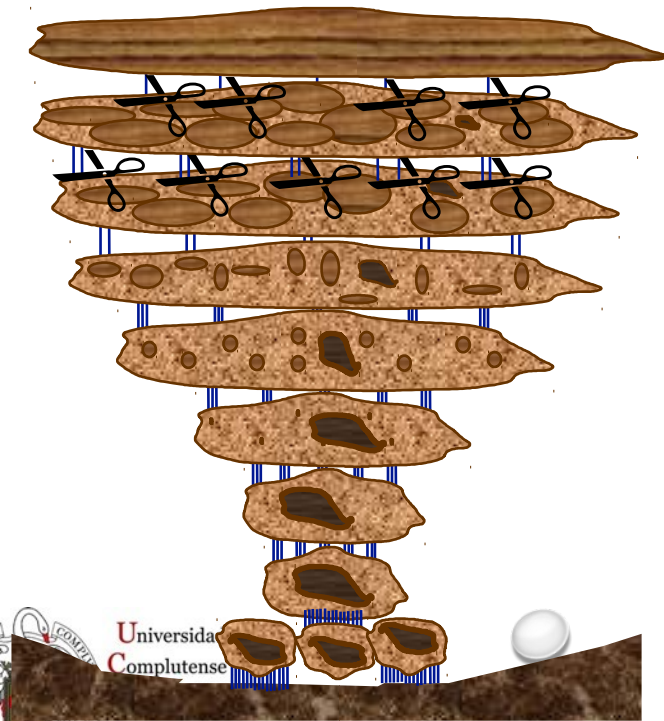
SH
|
CH₂

- CO - CH - NH -

CORNEOCYTE

Keratoplastic effect: Apoptosis

Keratolytic effect



TGF- β stimulation

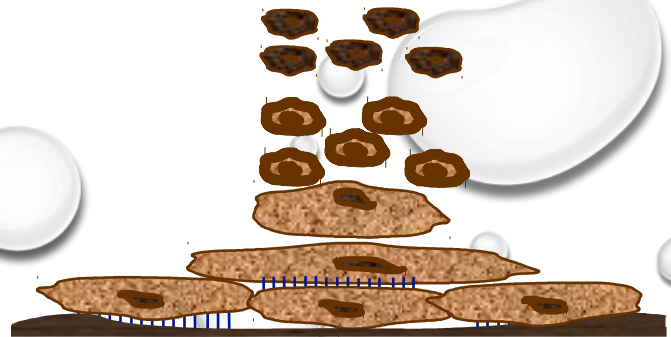
bcl2 gene

β c-myc gene?

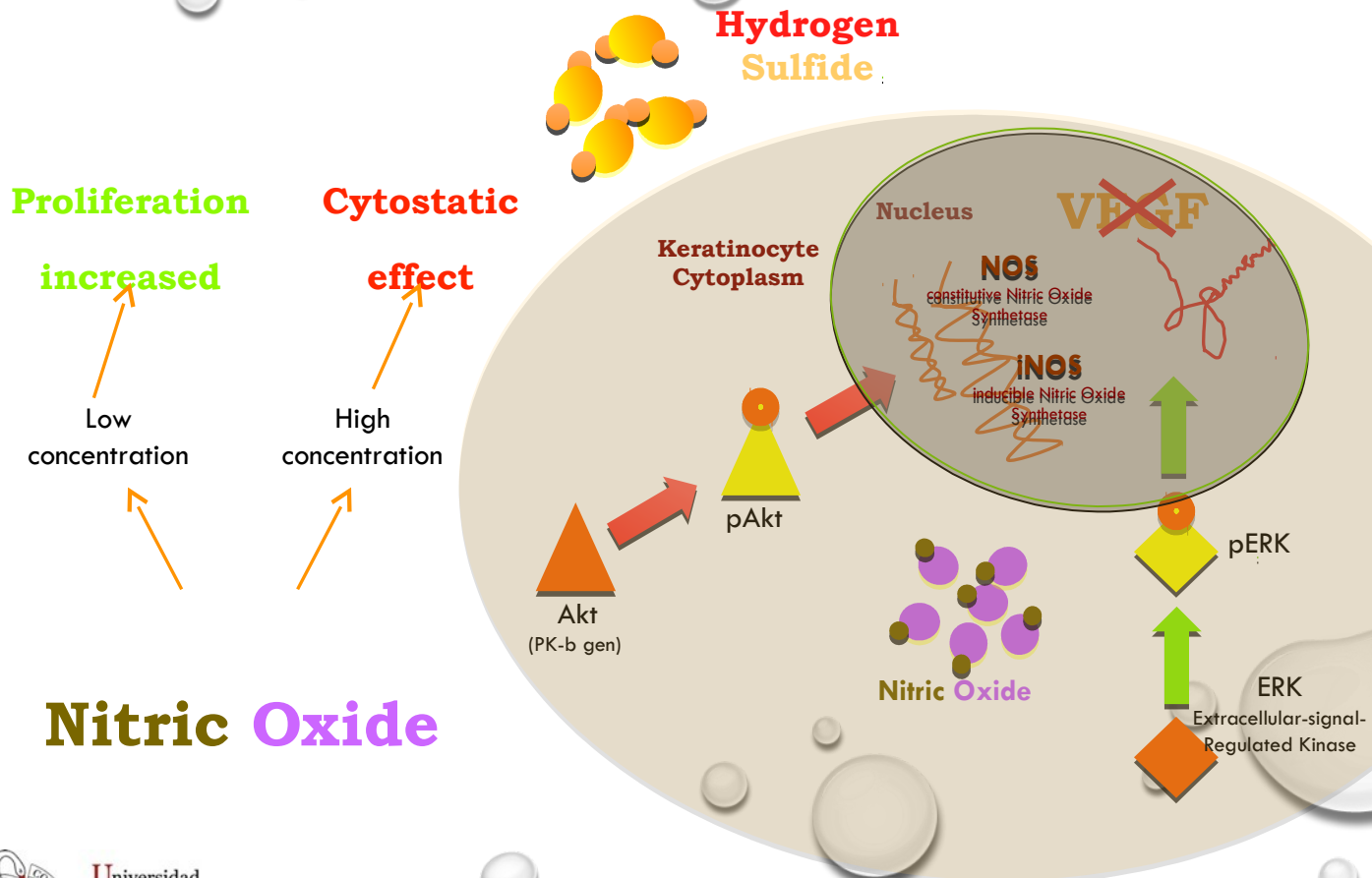
NO



YES



H₂S keratinocyte inside



Skin behaviour to H₂S

- ◉ **Low concentration:**
 - ◉ **Keratinocytes proliferation (anti-apoptotic)**
 - ◉ **Vasodilation**
 - ◉ **Pro-angiogenesis**
- ◉ **High concentration:**
 - ◉ **Keratinocytes differentiation - Cytostatic (pro-apoptotic)**
 - ◉ **Less vasodilation**
 - ◉ **“Anti”-angiogenesis**



Hydrogen sulphide absorption (I)



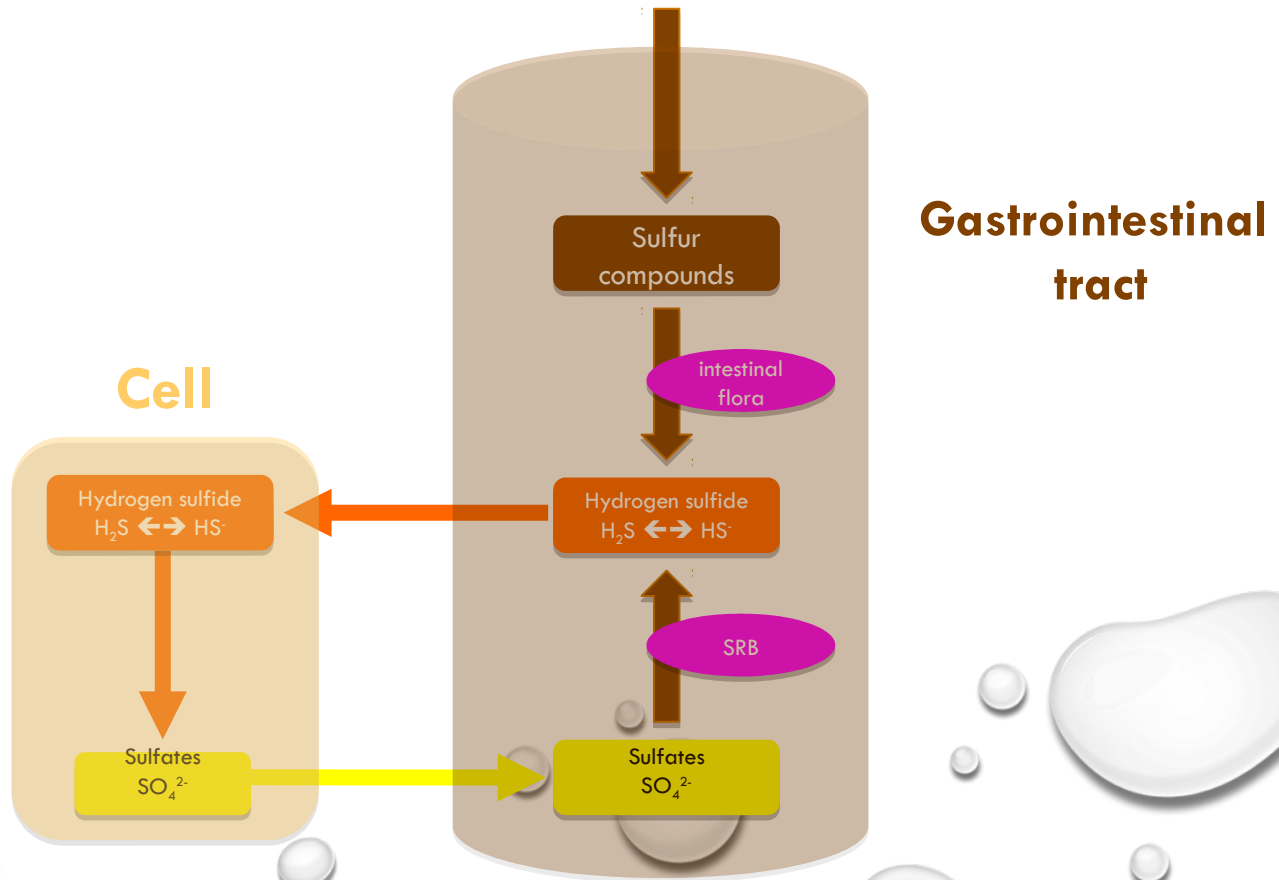
Respiratory healing Techirghiol-Romenia



Hydrogen sulphide absorption (II)



Gastrointestinal absorption



Hydrogen sulphide absorption (III)



Bathtub Techirghiol-Romania



Bath Haapsalu-Estonia



Poll Hévíz-Hungary



Wrappings

Techirghiol-Romania



Wrapper Haapsalu-Estonia





Grazie mille per la tua attenzione!