



Medicina Termale oggi

Marco Vitale

Università Vita-Salute San Raffaele – Milano
Fondazione per la Ricerca Scientifica Termale – Roma
Coordinatore Scientifico COTER



Section of Balneology and Climatology.

President—Dr. G. L. PARDINGTON.

PRESIDENT'S ADDRESS:

Advancing Years and Balneo-therapy.¹

By G. L. PARDINGTON, M.D. (President).



The ROYAL
SOCIETY of
MEDICINE

During considerable experience of balneotherapy I have necessarily been brought into contact with many cases well advanced in life, some of them quite old patients ; and I have been repeatedly struck by the unusual vitality displayed by those who had always made it a practice to avail themselves regularly of a systematic course of treatment.

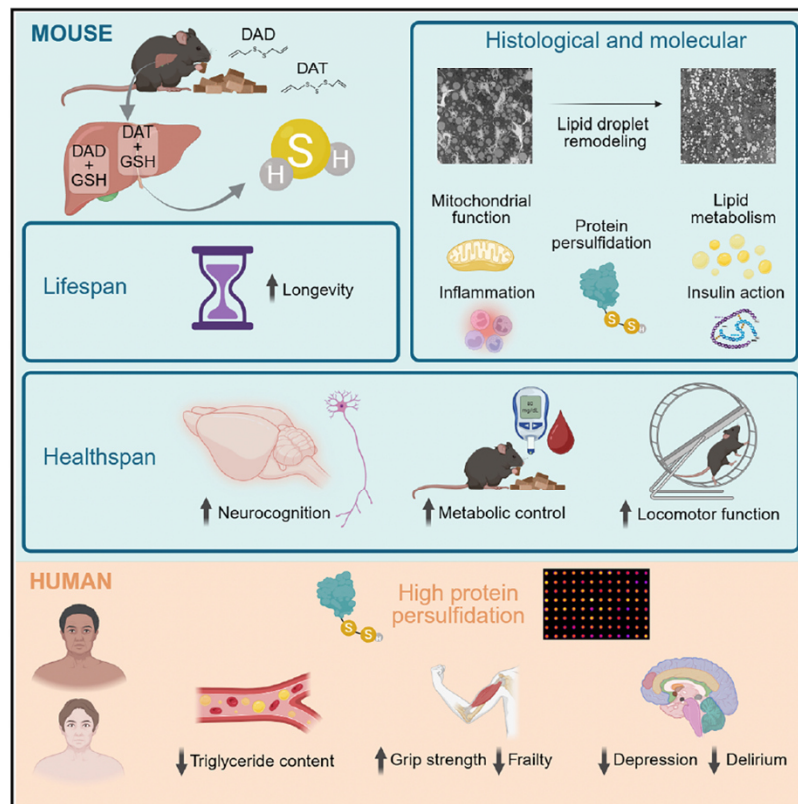
I have been forced to the conclusion that their habits so far as balneotherapy was concerned played no mean part in the maintenance of their high standard of health and in retarding the development of those inevitable changes which old age brings in its train



Cell Metabolism

Enhanced non-enzymatic H₂S generation extends lifespan and healthspan in male mice

Graphical abstract



Authors

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Cáliz-Molina et al., 2026, Cell Metabolism 38, 1–20
February 3, 2026 © 2025 The Authors. Published by Elsevier Inc.
<https://doi.org/10.1016/j.cmet.2025.11.012>



JAMA 100 YEARS AGO

MAY 17, 1913

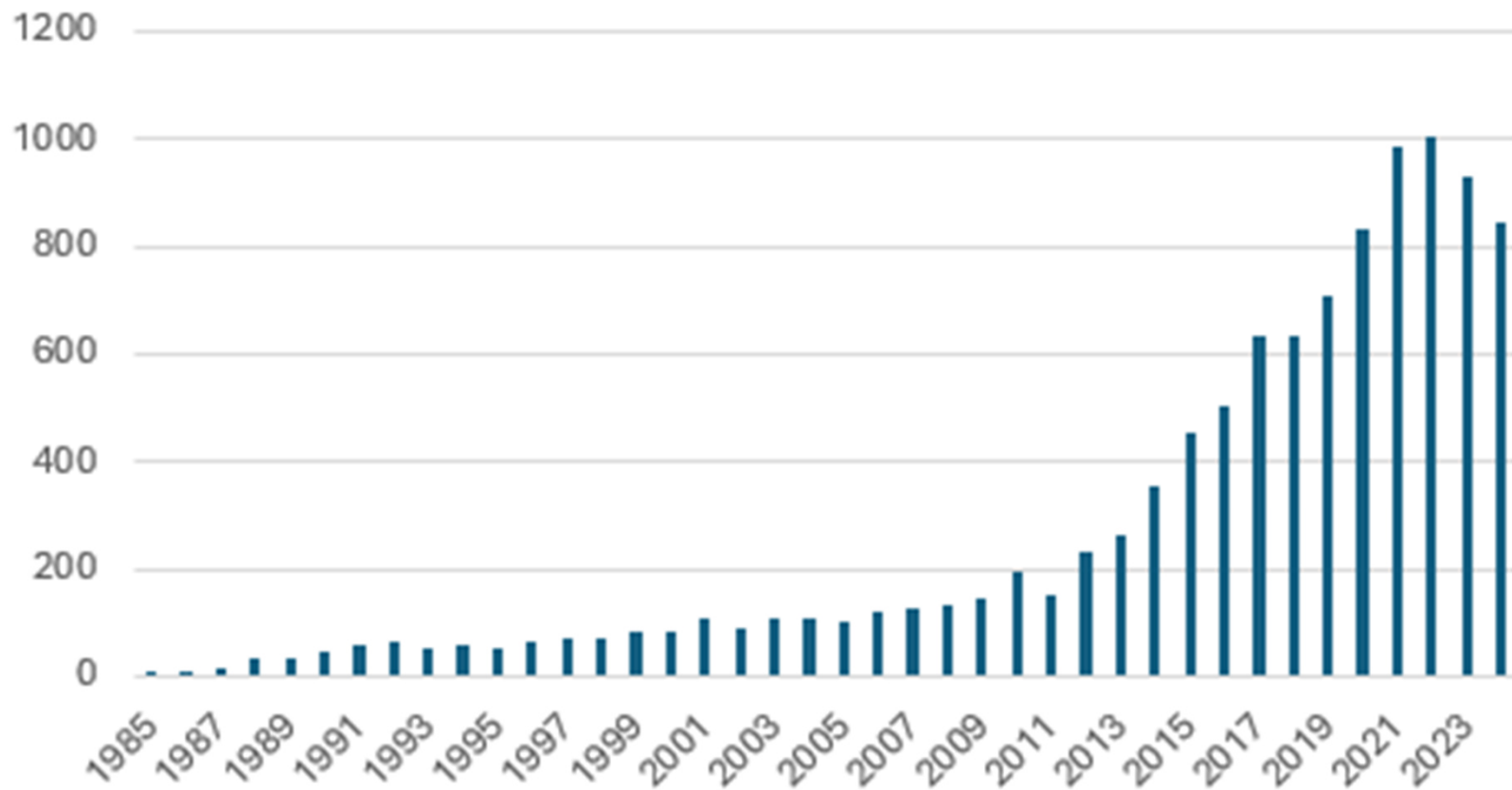
NEW ANALYSES OF HOT SPRING WATERS

Hot springs are found in many parts of the world. Where they are reasonably accessible they are frequently made a part of a “health resort” established to exploit the curative properties of the waters.

The use of the waters is, however, combined with so many other features of hydrotherapy, thermotherapy, dietary supervision and hygienic living that it must remain an open question whether in truth the waters *per se* have any specific curative virtues.



PubMed frequency of «medical spa» papers





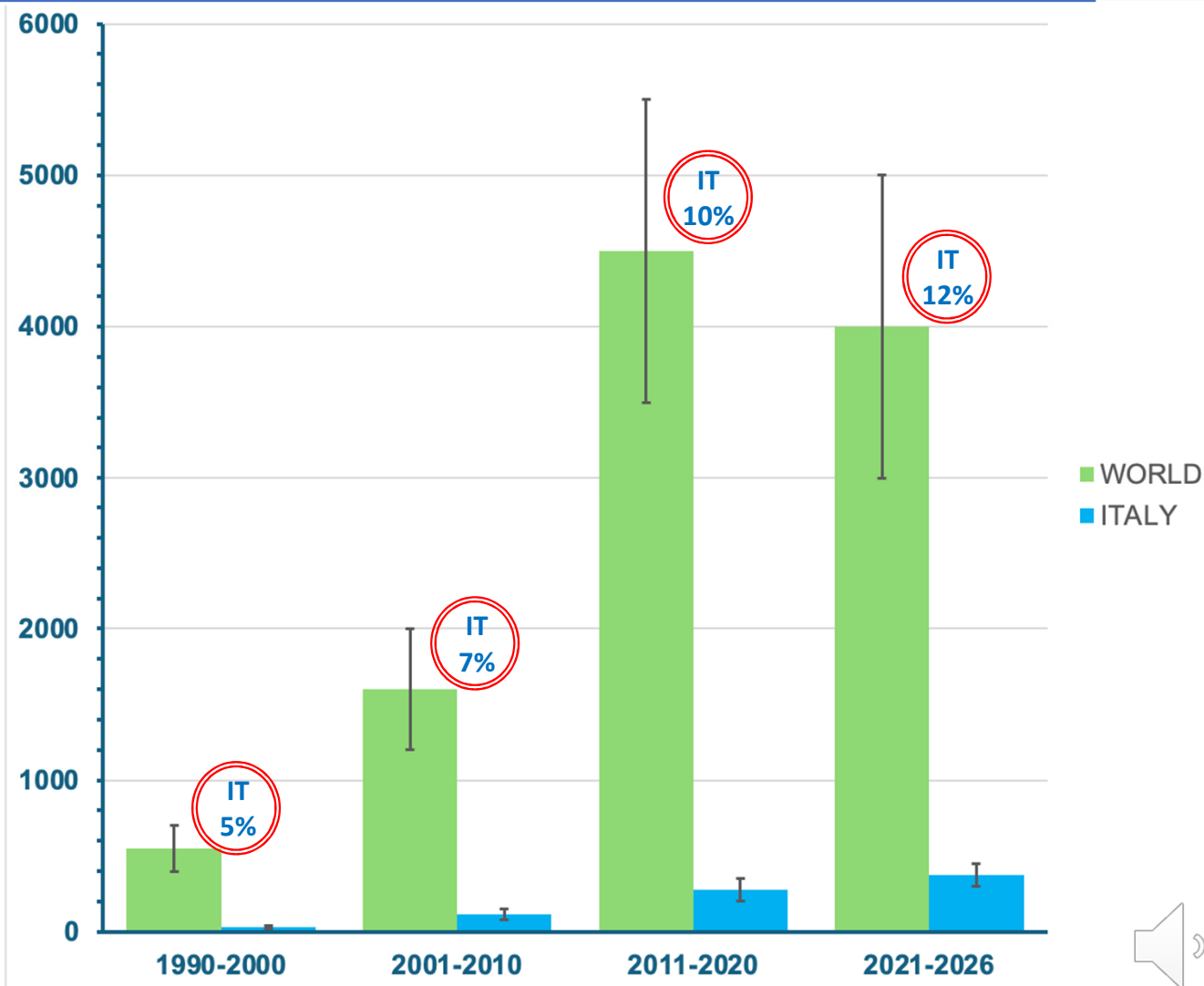
Foundation for Scientific Research in Balneology

PubMed

"balneology" OR
 "balneotherapy" OR
 "medical hydrology" OR
 "spa therapy" OR
 "medical spa"

papers

YRS	ITALY	s.dev	WORLD	s.dev	ITALIAN %
1990-2000	30	10	550	150	5
2001-2010	115	35	1600	400	7
2011-2020	275	75	4500	1000	10
2021-2026	375	75	4000	1000	12



Evoluzione del concetto di salute

Sanità → Salute

Qualità della vita intesa come una stima appropriata dello stato di benessere e salute delle persone.

Il passaggio da sanità a salute cambia la prospettiva del target di riferimento

- Fruitore delle politiche sanitarie: il malato (*reattivo*)
- Fruttori delle politiche della salute: il malato e il sano (*proattivo*) che desidera mantenere/migliorare il proprio stato di salute.



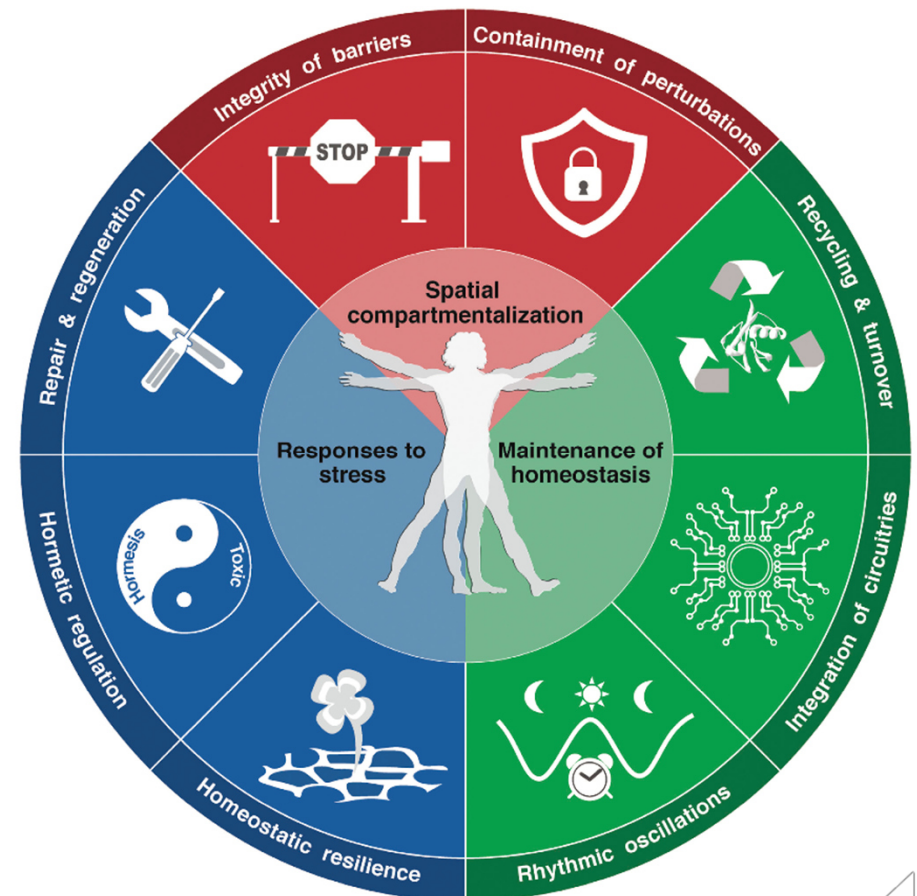
Determinanti di Salute

Salute come insieme di caratteristiche organizzative e dinamiche che mantengono l'omeostasi

I marcatori biologici di salute includono:

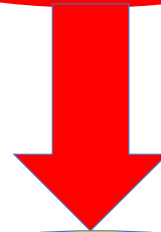
- Integrità delle barriere e contenimento delle perturbazioni locali
- Mantenimento dell'omeostasi nel tempo
- Risposte adeguate allo stress

La rottura di qualsiasi di questi sistemi interconnessi (deterioramento dell'integrità fisiologica) genera patologia



From: Carlos-Lopez Otin et al, **Cell** 2021

Health
PREVENTION
CURE
REHABILITATION



SCIENCE



Science per Aquam

La ricerca Traslazionale in Medicina Termale



- Immunologia/difese
- Dermo: microbiota/cute
- Condizioni metaboliche: diabete T2; NAFLD
- Insufficienza Venosa Cronica
- Riabilitazione (muscolo-scheletrica)
- Osteoartrosi
- Fibromialgia
- Patologia respiratoria
- Qualità del sonno
- Salute Pubblica
- Invecchiamento
- Sostenibilità



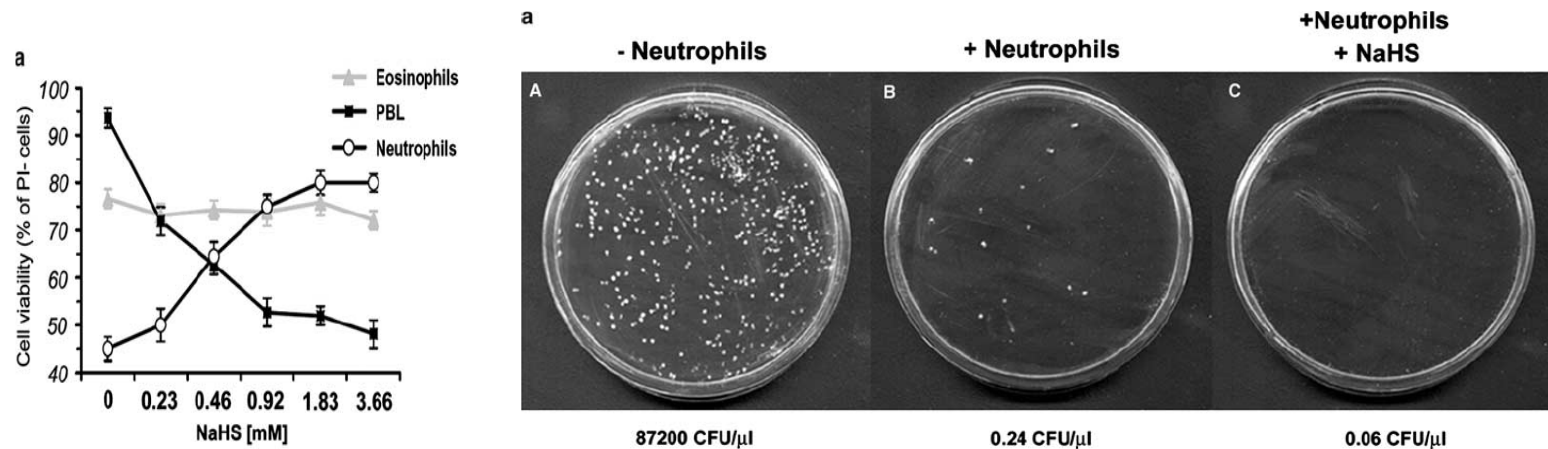
Immunologia/difese

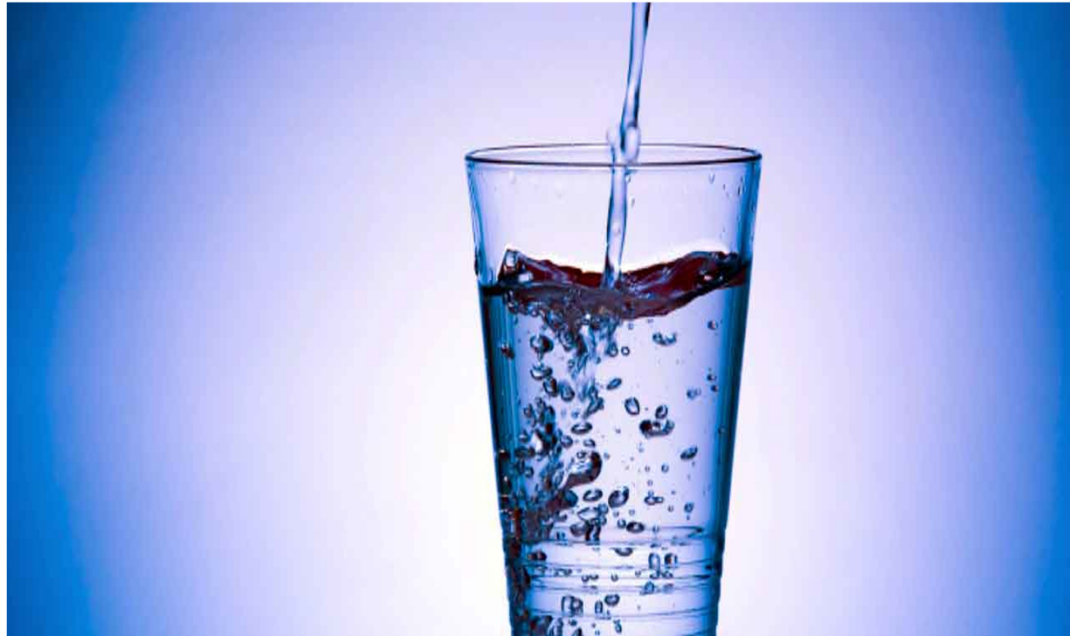


Hydrogen sulfide prevents apoptosis of human PMN via inhibition of p38 and caspase 3

Laura Rinaldi¹, Giuliana Gobbi¹, Maurizia Pambianco², Cristina Micheloni¹, Prisco Mirandola¹ and Marco Vitale^{1,3}

¹Department of Anatomy, Pharmacology & Forensic Medicine, Human Anatomy Section, University of Parma, Ospedale Maggiore, Parma, Italy; ²Terme di Sirmione, Cell Biology Laboratory, Terme di Sirmione, Brescia, Italy and ³ITOI-CNR, Bologna Unit, c/o Research Institute 'Codivilla-Putti', IOR, Bologna, Italy





Condizioni metaboliche:
NAFLD; diabete T2

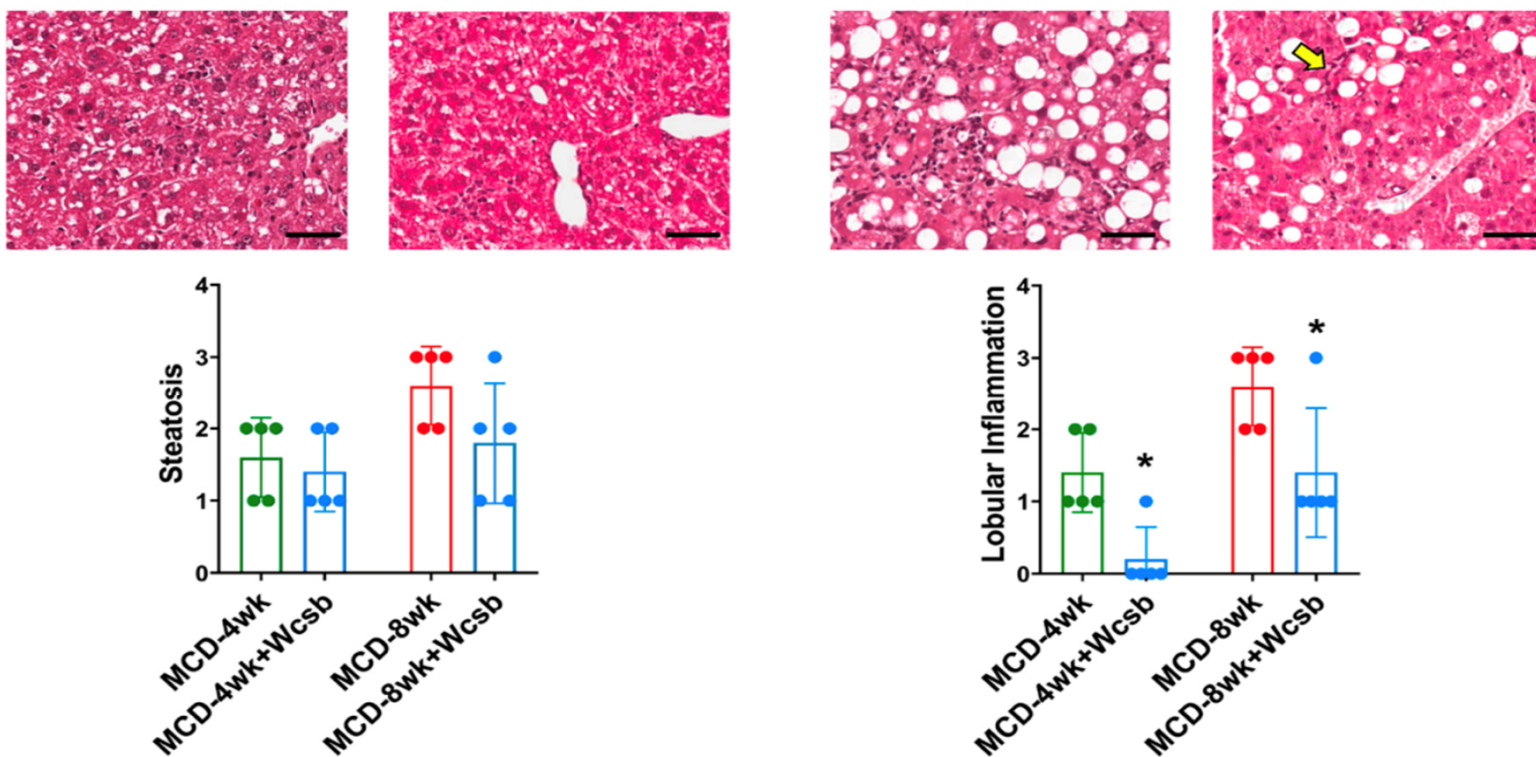




Article

Effect of Calcium-Sulphate-Bicarbonate Water in a Murine Model of Non-Alcoholic Fatty Liver Disease: A Histopathology Study

Guido Carpino ^{1,*},[†], Diletta Overi ^{2,†}, Paolo Onori ², Antonio Franchitto ², Vincenzo Cardinale ³, Domenico Alvaro ⁴ and Eugenio Gaudio ²

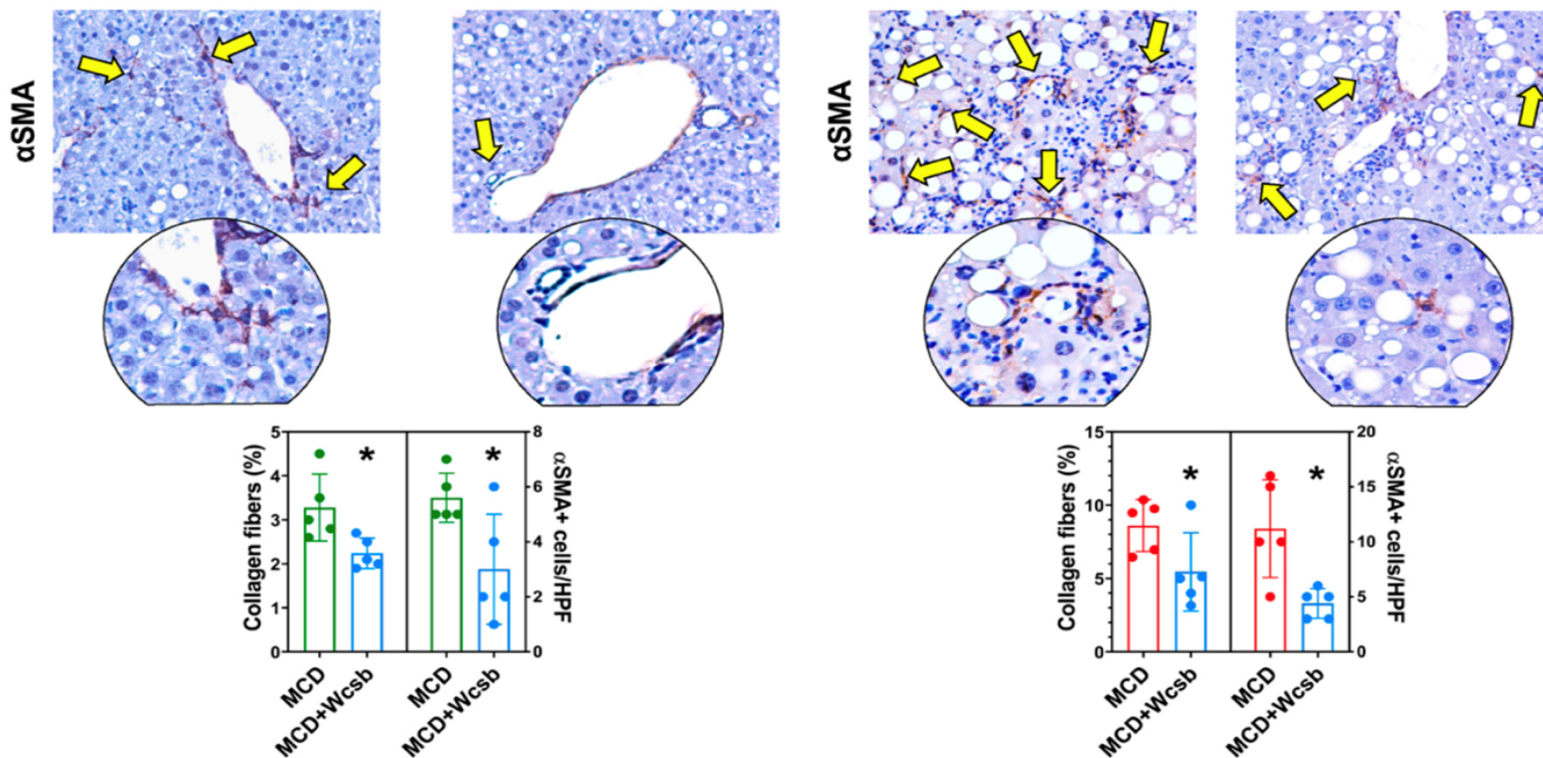




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Guido Carpino ^{1,*},[†], Diletta Overi ^{2,†}, Paolo Onori ², Antonio Franchitto ², Vincenzo Cardinale ³, Domenico Alvaro ⁴ and Eugenio Gaudio ²



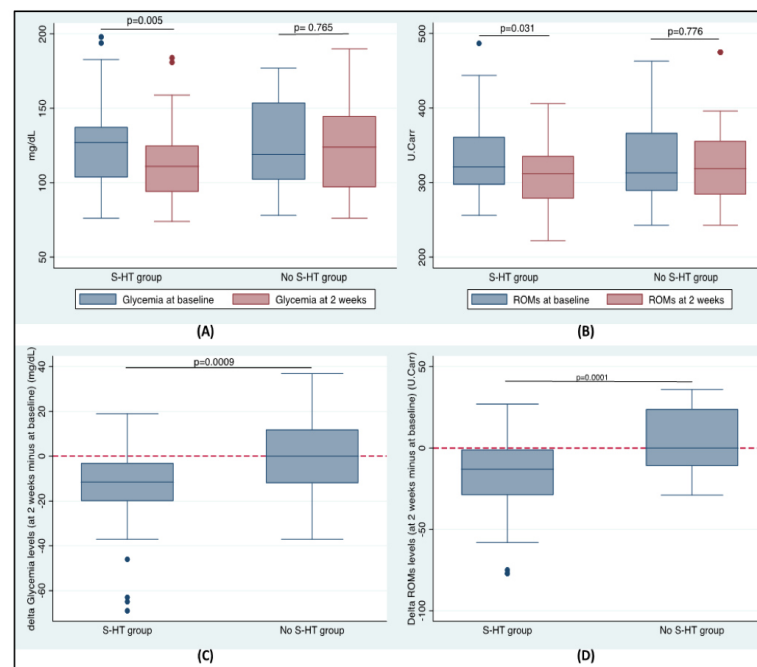


Article

Hydropinotherapy with Sulphurous Mineral Water as Complementary Treatment to Improve Glucose Metabolism, Oxidative Status, and Quality of Life

Maria Costantino ^{1,2,*}, Valeria Conti ^{1,†}, Graziamaria Corbi ³ and Amelia Filippelli ^{1,2}

Diabetes T2 Glycaemia and Reactive Oxygen Metab



Riabilitazione muscolo-scheletrica



Rieducazione motoria in acqua termale



- Reazione viscosa
- Pressione idrostatica
- Temperatura
- Benefici dell'acqua termale

RIABILITAZIONE IN ACQUA: peso acquatico in relazione al livello di immersione

ALTEZZA ACQUA	PESO ACQUATICO
Immersione totale	3% del peso terrestre
Fino al collo	7% del peso terrestre
Alle spalle	20% del peso terrestre
Al petto	33% del peso terrestre
All'ombelico	50% del peso terrestre
Al bacino	66% del peso terrestre
A metà coscia	80% del peso terrestre
Al polpaccio	95% del peso terrestre



Appropriateness and efficacy of Spa therapy for musculoskeletal disorders. A Delphi method consensus initiative among experts in Italy

Marco Paoloni¹, Andrea Bernetti¹, Ovidio Brignoli², Daniela Coclite³, Antonio Fraioli⁴, Stefano Masiero⁵, Antonello Napoletano³, Nicola Quirino⁶, Franco Rengo⁷, Carlo Ruosi⁸, Ugo Viora⁹, Marco Vitale¹⁰ and Valter Santilli¹

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⁵Rehabilitation Unit, Dipartimento di Neuroscienze, Università degli Studi di Padova, Padua, Italy

⁶Università LUISS, Rome, Italy

⁷Dipartimento di Chirurgia Generale, Geriatrica, Oncologica e Tecnologie Avanzate, Università degli Studi di Napoli "Federico II", Naples, Italy

⁸Dipartimento di Ortopedia, Università degli Studi di Napoli "Federico II", Naples, Italy

⁹ANMAR - Associazione Nazionale Malati Reumatici Onlus, Turin, Italy

¹⁰Dipartimento di Scienze Biomediche, Biotecnologiche e Traslazionali, Unità di Anatomia e Istologia, Università degli Studi di Parma, Parma, Italy



Article

Effect of Intensive Rehabilitation Program in Thermal Water on a Group of People with Parkinson's Disease: A Retrospective Longitudinal Study

Roberto Di Marco ^{1,2,3,*} , Francesca Pistonesi ¹, Valeria Cianci ¹, Roberta Biundo ^{1,4} , Luca Weis ¹ ,
Lucrezia Tognolo ^{2,3} , Alfonc Baba ³ , Maria Rubega ² , Giovanni Gentile ¹ , Chiara Tedesco ¹,
Miryam Carecchio ¹ , Angelo Antonini ¹  and Stefano Masiero ^{2,3} 

Thermal aquatic exercise may represent a promising rehabilitation tool to prevent the impact of motor symptoms on daily-life activities of people with PD. PDQ-39 improvement foreshows good effects of the intervention on quality of life and psychological well-being.



Osteoartrosi



REVIEW ARTICLE

Open Access



Italian Orthopaedic and Traumatology Society (SIOT) position statement on the non-surgical management of knee osteoarthritis

Elisa Pesare¹, Giovanni Vicenti^{1*} , Elisaveta Kon^{2,3}, Massimo Berruto⁴, Roberto Caporali⁵, Biagio Moretti¹ and Pietro S. Randelli^{6,7,8}

Balneotherapy/spa therapy

Balneotherapy represents a conservative treatment that may have beneficial effects on pain and stiffness, with a tolerable economic profile. It consists of the use of thermal waters that are therapeutically active by virtue of mineral composition, mud and natural gas. In numerous papers, balneotherapy is described as a treatment with favourable results.

Conclusions. For non-surgical management of knee OA, the recommended first step is to bring about lifestyle changes, particularly management of body weight combined with physical exercise and/or hydrotherapy.

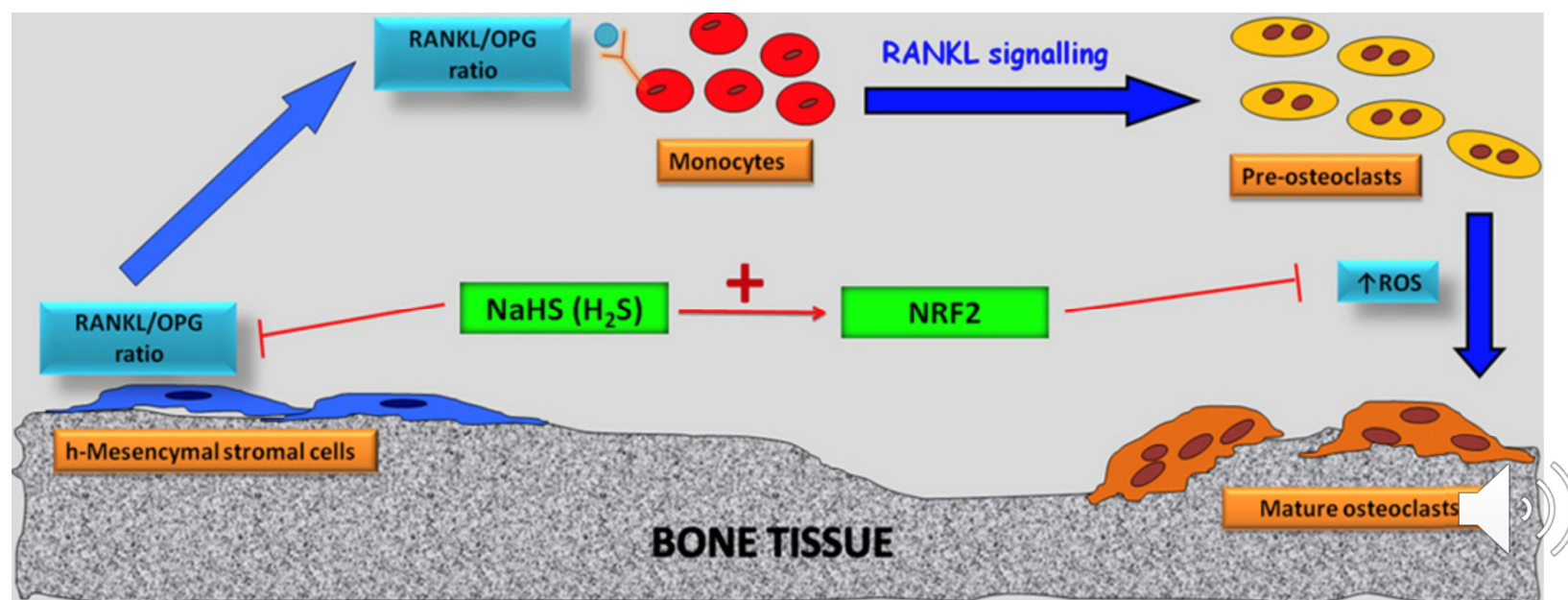


Metabolismo osseo / Osteoporosi



Sodium hydrosulfide inhibits the differentiation of osteoclast progenitor cells *via* NRF2-dependent mechanism ☆

Laura Gambari ^a, Gina Lisignoli ^{a, b, 1}, Luca Cattini ^{a, b}, Cristina Manfredini ^{a, b}, Andrea Facchini ^{a, b, c}, Francesco Grassi ^b  





Article

Optimization of a Monobromobimane (MBB) Derivatization and RP-HPLC-FLD Detection Method for Sulfur Species Measurement in Human Serum after Sulfur Inhalation Treatment

Barbara Roda ^{1,2,*}, Nan Zhang ¹, Laura Gambari ³, Brunella Grigolo ³, Cristina Eller-Vainicher ⁴, Luigi Gennari ⁵, Alessandro Zappi ¹, Stefano Giordani ¹, Valentina Marassi ^{1,2}, Andrea Zattoni ^{1,2}, Pierluigi Reschiglian ^{1,2} and Francesco Grassi ^{3,*}

These data show that an exogenous source of gaseous H₂S affected the serum levels of the different H₂S pools.

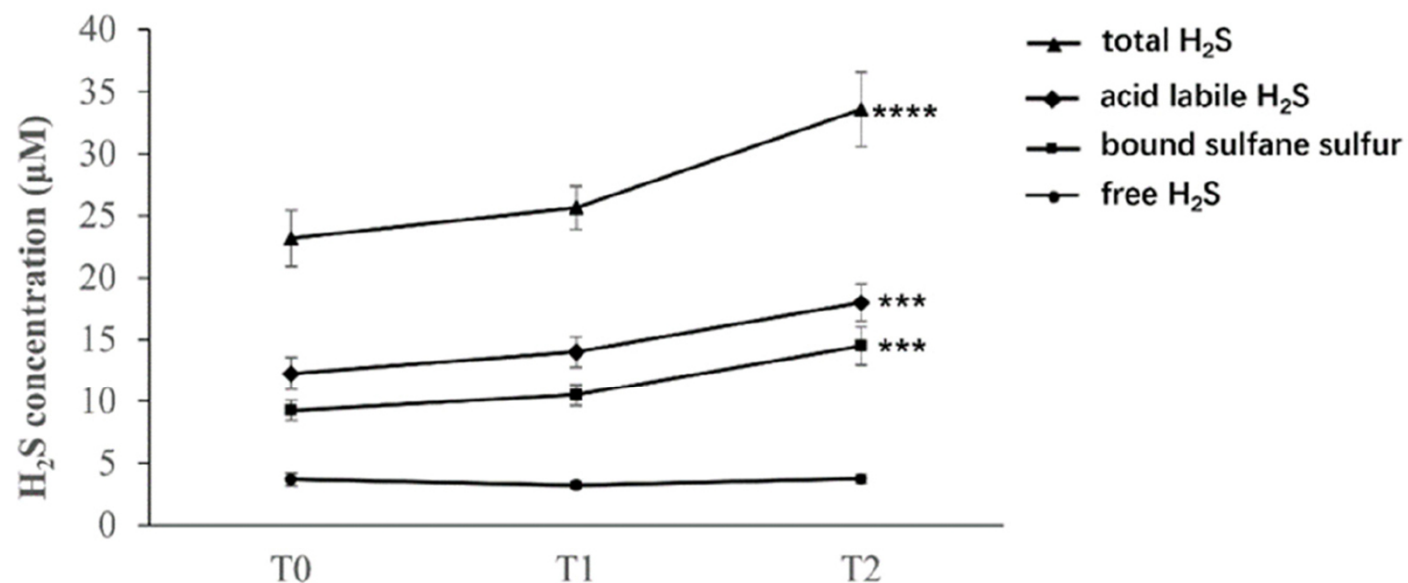


Figure 7. H₂S levels in serum samples collected before the treatment (T0), immediately after the 12-day treatment (T1), and three days after completion of the treatment (T2). **** = $p < 0.0001$ vs. values at baseline (T0); *** = $p < 0.005$ vs. values at baseline (T0).





Sodium hydrosulfide inhibits the differentiation of osteoclast progenitor cells via NRF2-dependent mechanism[☆]

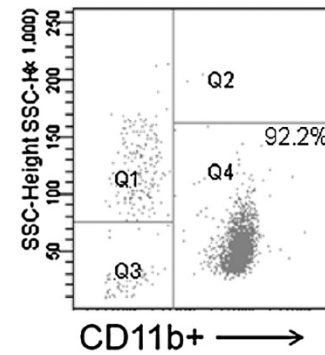
Laura Gambari^a, Gina Lisignoli^{a,b,1}, Luca Cattini^{a,b}, Cristina Manferdini^{a,b},
Andrea Facchini^{a,b,c}, Francesco Grassi^{b,*,1}

^a S.C. Laboratorio di Immunoreumatologia e Rigenerazione Tissutale, Istituto Ortopedico Rizzoli, Via di Barbiano 1/10, 40136 Bologna, Italy

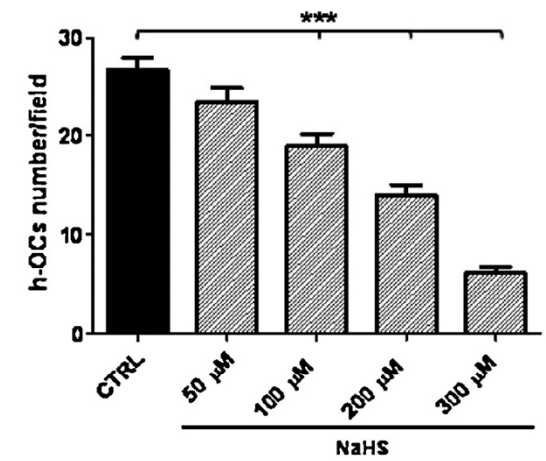
^b Laboratorio RAMSES, Istituto Ortopedico Rizzoli, Via di Barbiano 1/10, 40136 Bologna, Italy

^c Dipartimento di Scienze Mediche e Chirurgiche, Università di Bologna, Italy

A

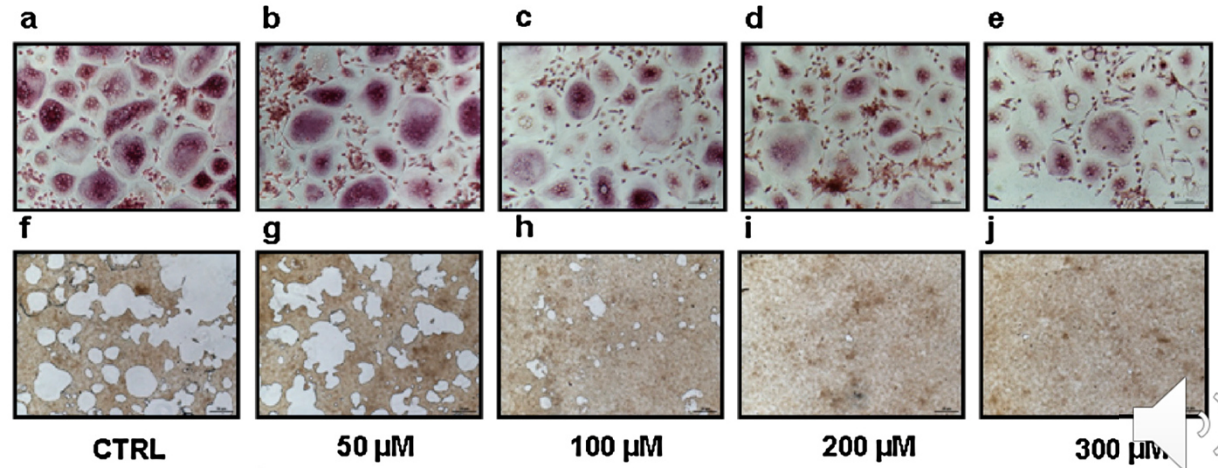


B



C

TRAP staining



NaHS



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Biomedicine & Pharmacotherapy

journal homepage: www.elsevier.com/locate/biopharm



Sulfurous thermal waters stimulate the osteogenic differentiation of human mesenchymal stromal cells – An *in vitro* study

Laura Gambari^a, Brunella Grigolo^a, Giuseppe Filardo^b, Francesco Grassi^{a,*}

^a Laboratorio RAMSES, IRCCS Istituto Ortopedico Rizzoli, Via di Barbiano 1/10, 40136, Bologna, Italy

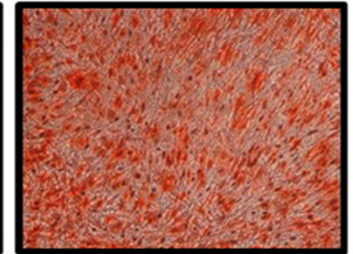
^b Applied and Translational Research Center (ATRC), IRCCS Istituto Ortopedico Rizzoli, Via di Barbiano 1/10, 40136, Bologna, Italy



CTRL



1-STW_{high}



Sulphurous Thermal Waters (STW) increased intracellular H₂S levels and the osteogenic differentiation of hMSCs. STWs treatment, even at the lower H₂S and ion content, induced a marked increase in mineral apposition.

By showing direct regulation of the anabolic function in bone cells, these findings open up new perspectives on clinical applications of STWs in complementary medicine of bone wasting diseases.





Article

Changes in Oxidative Stress, Inflammatory and Bone Metabolism Biomarkers Following Sulfurous Water Inhalation in Osteopenic Women

Laura Gambari ¹, Emanuela Amore ¹, Livia Roseti ¹, Sara Carpentieri ¹, Claudio Ripamonti ², Lucia Lisi ², Paolo Spinnato ³, Giuliana Nervuti ⁴, Antonietta Gesuele ⁵, Susanna Naldi ², Brunella Grigolo ¹ and Francesco Grassi ^{1,*}

www.clinicaltrials.gov (Identifier NCT06095349)

Sulfurous water inhalation induced a marked change in oxidative stress, with malondialdehyde levels declining by up to 37% from baseline. Pro-inflammatory cytokines, particularly IL-8 and MIP-1 α , were significantly decreased (up to 50–70%) at the end of the treatment.





Article

Changes in Oxidative Stress, Inflammatory and Bone Metabolism Biomarkers Following Sulfurous Water Inhalation in Osteopenic Women

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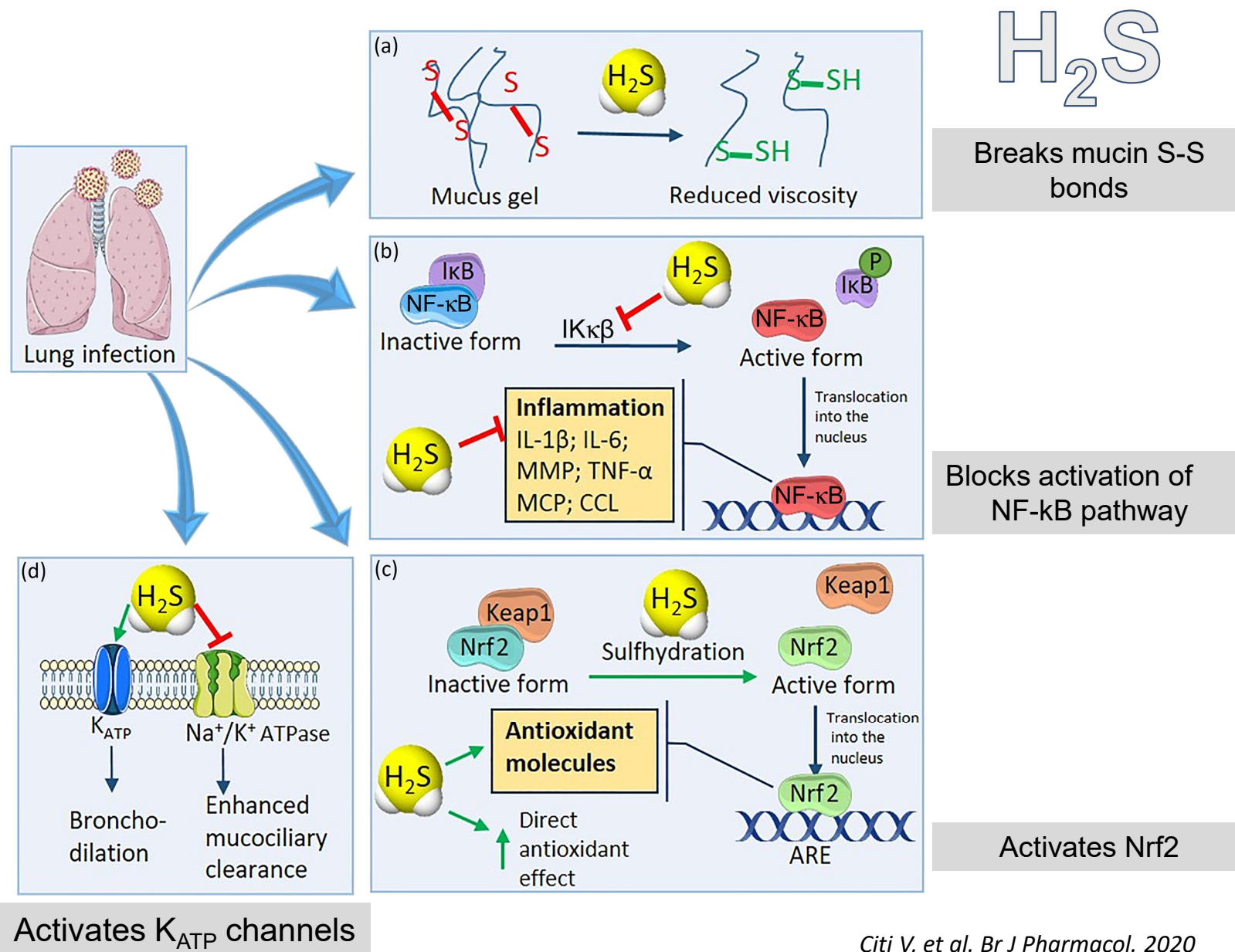
www.clinicaltrials.gov (Identifier NCT06095349)

These findings provide preliminary human evidence that inhaled sulfurous waters enhance systemic H₂S bioavailability and modulate redox and inflammatory pathways associated with bone remodeling in osteopenic women [...]



Patologia respiratoria







Biological Effects of Thermal Water-Associated Hydrogen Sulfide on Human Airways and Associated Immune Cells: Implications for Respiratory Diseases

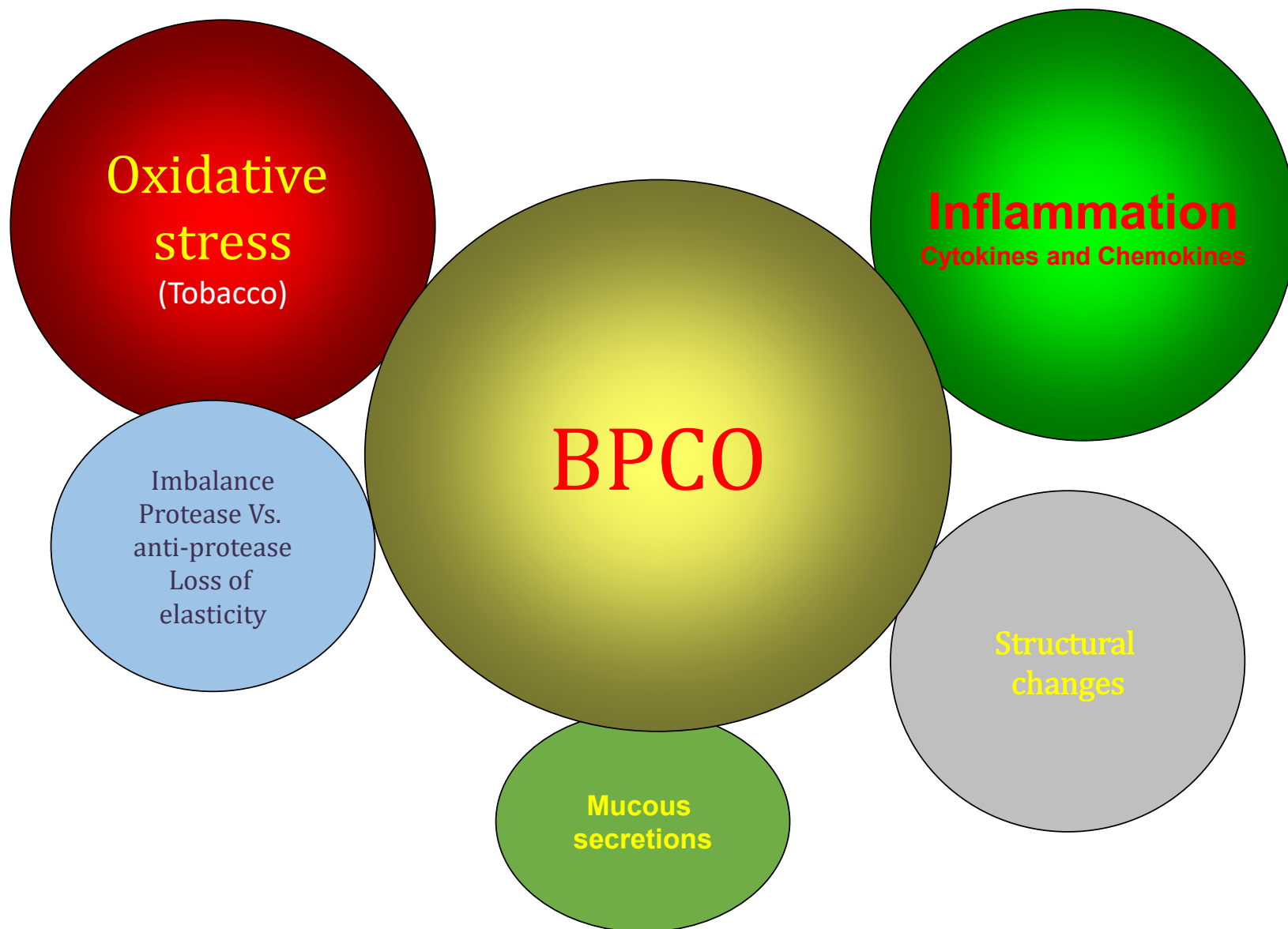
Joana Viegas¹, Ana Filipa Esteves¹, Elsa M. Cardoso^{1,2,3}, Fernando A. Arosa^{1,2}, Marco Vitale^{4,5} and Luis Taborda-Barata^{1,6,7*}

TABLE 1 | Major beneficial effects induced by sulfurous thermal waters.

		References
Prophylactic	• Preventive role in the progression of inflammatory states or subsequent superinfection	(11, 22, 23)
Therapeutic	• Nasal resistance and flow amelioration • Reduction of mucocilliary clearance time • Reduction of inflammatory influx • Reduction of drug intake	(18, 19) (19) (23, 24) (18, 19)
Socio-economic	• Reduction of school and work absenteeism • Decrease of hospitalization and other disease-related healthcare costs	• Possible in respiratory diseases, but still needs to be addressed in cost-effectiveness studies

STW inhalation can have either a prophylactic or a therapeutic role, which may be associated with potential socio-economic benefits.





Systematic Review

The Impact of Thermal Water in Asthma and COPD: A Systematic Review According to the PRISMA Statement

Luigino Calzetta ^{1,*}, Nicola Di Daniele ^{2,3}, Alfredo Chetta ^{1,4}, Marco Vitale ^{5,6}, Shima Gholamalishahi ⁷, Mario Cazzola ⁷ and Paola Rogliani ⁷

Concerning RCTs carried out in **COPD** patients, TW treatment by salt-bromide-iodine not only decreased pH and provided anti-inflammatory effects on the airways, but also improved the overall health-related QoL . Additionally, sulfurous TW exhibited a positive impact on reducing O₂- production, with no effect on total sputum inflammatory cell counts and FEV₁. The mud bath therapy demonstrated its positive influence on enhancing tolerance and endurance time, oxygen expenditure, and effectively addressing moderate IRB challenges.



Successful Ageing



SUCCESSFUL AGEING



The Hallmarks of Aging

Primary Hallmarks

- Genomic instability
- Telomere attrition
- Epigenetic alterations
- Loss of proteostasis

Antagonistic Hallmarks

- Deregulated nutrient sensing
- Mitochondrial dysfunction
- Cellular senescence

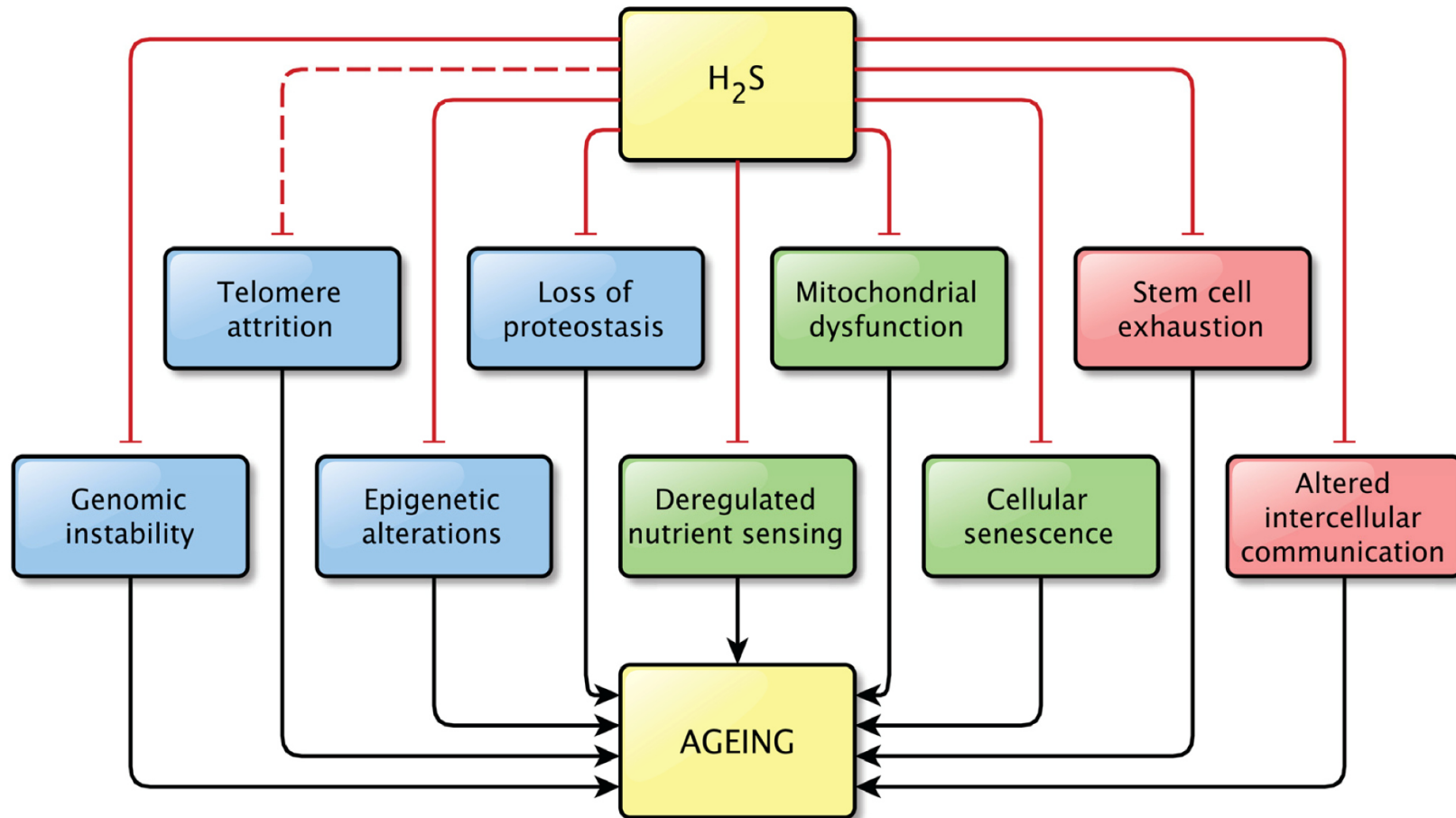
Integrative Hallmarks

- Stem cell exhaustion
- Altered intercellular communication



Case Study: l'idrogeno solforato termale

The effects of H₂S on the Hallmarks of Aging



IDENTIFYING FRAILTY IN THERMAL/SPA CLINICAL SETTING: A CROSS-SECTIONAL STUDY

C. Jeandel¹, T. Hanh²

Conclusion: Frailty is very prevalent in older patients of spa facilities. Such facilities may constitute an interesting clinical setting for screening for frailty through the implementation of geriatric assessments.



Review

The Potential Role of Spa Therapy in Managing Frailty in Rheumatic Patients: A Scoping Review

Maria Chiara Maccarone ^{1,*} , Anna Scanu ^{2,3} , Daniele Coraci ²  and Stefano Masiero ^{1,2} 

Conclusions

In conclusion, by contributing to the body of knowledge on non-pharmacological treatments for frailty, this review provided a comprehensive understanding of the effectiveness of spa therapies in managing frailty in rheumatic patients.

Furthermore, the health resort setting's unique benefits make it an ideal environment to develop specific exercise programs for patients with frailty, rheumatic diseases, and comorbidities.



La medicina termale rientra negli obiettivi dell'OMS



**World Health
Organization**



HydroGlobe
**Definition of a global framework
for hydrotherapy**

A FEMTEC – FoRST joint project
with the cooperation of ISMH and the support of WHO



Pathologies recognized by Italian SSN for medical spa therapy

Rheumatic Diseases

- Osteoarthritis and other degenerative forms
- Extra-articular rheumatisms

Respiratory Diseases

- Chronic rhino-sinusitis
- Chronic bronchitis (w or w/o obstruction)

Skin Diseases

- Psoriasis
- Eczema
- Atopic dermatitis

E.N.T. conditions

- Allergic rhinitis
- Chronic pharyngo-laryngitis
- Chronic sinusitis
- Tubaric stenosis
- Chronic otitis

Urinary conditions

- Kidney stones

Vascular diseases

- Chronic phlebitis

Gastrointestinal diseases

- Gastroenteric and biliary dyspepsia
- Irritable bowel disease (IBD)
- Chronic constipation

Gynecological conditions

- Pelvic sclerosis
- Persistent leucorrhoea





La Medicina Termale oggi

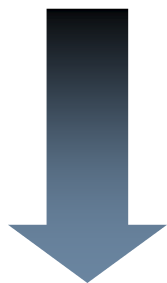
Salus per Aquam unisce Cura/ Prevenzione

Science per Aquam: sempre più EB

Il Sistema termale italiano connette
Cura + QoL + Prevenzione + Risparmio sanitario



And so.....what??



PIU' SOLIDA (e
fiduciosa!)
COLLABORAZIONE
CON LA MEDICINA DI
BASE E SPECIALISTICA

