

November 20, 2025

Crossed paths paved by metals - some bioinorganic chemistry lessons



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Metal ions are known to provide new “tricks” to (bio)molecules, enabling their smart use by nature as well as for the human development of novel therapeutic approaches. Biological sensors for gases such as NO, O₂, and CO are an exciting niche of the use of metal ions by Nature, where binding and selectivity can be tuned. During the last 30 years, heme-based sensors have stood out among these type of gas sensors. Here, we are going to describe briefly some of our contributions to the understanding of an oxygen sensor from *Mycobacterium tuberculosis* (Mtb). This system is directly associated with bacterial dormancy, and it may have promising roles as a drug target. Our studies have also involved the development of metal-based compounds for therapy. This initial approach, called metal-mediated redox activation, was particularly relevant to activate pro-drugs for Mtb treatment, which led one of these metallocompounds to advance into preclinical trials. Emerging from this approach, hybrid systems were prepared with redox sensitive and light triggered control that opened new horizons. Thus, we expect to illustrate the versatility of metal ions as used by researchers and Nature as a lesson to be learned.

Short Bio

Dr. Eduardo Sousa is Full Professor in the Department of Organic and Inorganic Chemistry at the Federal University of Ceará, Brazil. Dr Sousa earned his PhD in Inorganic Chemistry at the Federal University of Ceará, where he proposed a metal-based strategy for tuberculosis treatment. He was also trained in biochemistry and biophysics of metalloproteins at the San Francisco State University (USA) during his post-graduation studies. From 2004 – 2009, he worked as a post-doctor in the Department of Biochemistry at the University of Texas Southwestern Medical Center – Dallas (USA) with Dr Marie-Alda Gilles-Gonzalez, where he investigated the mechanism of signal transduction of oxygen heme-based sensor proteins. In 2009, he joined the Federal University of Ceará as an assistant professor. He had opportunities to work abroad as a visiting researcher from 2013-2014 (Peter Sadler’s lab at the

University of Warwick, UK) and 2019-2020 (José Moura's lab at FCT – UNL, Portugal), investigating biologically active metallocompounds and metalloproteins (extremophile heme proteins and rubredoxin), respectively. Briefly in 2024, he worked as a visiting professor at the University of Texas Southwestern Medical Center (USA) investigating oxygen sensors. He has delivered talks in a series of scientific meetings in Brazil (Annual SBQ) and abroad (e.g., SPB, ICBIC, LaBIC). Dra Sousa's main research interest has been centered in the development of new metal-based strategies for potential medical application and in the mechanism of function of oxygen sensor heme proteins (among other metalloproteins).

Acknowledgements

This work was financed by INCT-tuberculosis, CNPq and CAPES.

Webinar Host

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