Two Decades of Selenium-Based Redox Catalysis: New Horizons in Green and Biological Chemistry

Claudio Santi

University of Perugia.
claudio.santi@unipg.it

In the last twenty years, our research has significantly contributed to establishing selenium-based redox catalysis as a valuable tool in both sustainable synthetic chemistry and biological applications. Through the design and development of novel organoselenium catalysts, we have demonstrated their efficiency in promoting oxidative transformations under mild, environmentally benign conditions. Our work has also elucidated key mechanistic aspects of selenium redox cycles, providing a deeper understanding of their catalytic behavior and reactivity. More recently, we have extended these findings to biological systems, developing selenium-containing compounds capable of mimicking native antioxidant enzymes and modulating cellular redox balance. These results open new perspectives for the application of selenium catalysis not only in green chemistry but also in redox medicine and chemical biology. This presentation will showcase the evolution of our approach, key milestones, and future directions in this rapidly advancing field.

Short Biography:
https://www.unipg.it/personale/claudio.santi
Prof. Claudio Santi obtained his PhD in Chemical Sciences in 1996 under the supervision of Prof. Marcello Tiecco. In 1998, he spent a postdoctoral period in the group of Prof. Thomas Wirth at Basel University. Since 2013, he has been an Associate Professor of Organic Chemistry, leading the Catalysis, Synthesis and Organic Green Chemistryresearch group. As part of the Italian National Scientific Habilitation (ASN) process, he was qualified as Full Professor of Organic Chemistry on December 11, 2013.
He has been invited as Visiting Professor at several institutions, including:
Jan Dlugosz University of Czestochowa, Poland (2013 and 2021),
Universidade Federal de Pelotas, Brazil (2014),
Universidade Federal de Minas Gerais, Brazil (2020).
Under the Erasmus+ program, he has taught Organic Chemistry at:
Jagiellonian University, Krakow (1997),
Cardiff University (1999),
Universidad Complutense de Madrid (2016).
In 2012, he co-founded and currently coordinates the international research network on Selenium, Sulfur, Redox, and Catalysis (SeSRedCat).
He is the author of more than 220 peer-reviewed articles, 6 book chapters, 2 books, and has edited several special issues. His current H-index is 52. He serves on the editorial and scientific boards of various journals, including:
International Journal of Molecular Sciences (MDPI) – Associate Editor,
Phosphorus, Sulfur, Silicon and Related Elements (Taylor & Francis) – Review Editor.
He has received numerous honors and awards, including:
Listed among the Top 10% of highly cited authors by the Royal Society of Chemistry (2016),
Elected Fellow of the Royal Society of Chemistry (FRSC) in 2017,

Included in the list of Top Italian Scientists by Via-Academy since 2018,
Appointed Honorary Professor at Jan Dlugosz University of Czestochowa in 2018,
Featured in the Stanford University list of the Top 2% most influential scientists in the world for the past three years.
An internationally recognized expert in organoselenium chemistry, Prof. Santi pioneered the use of optically pure diselenides in asymmetric synthesis. He was the first to propose selenium-based catalysts for Green Chemistry and developed the first class of bench-stable nucleophilic zinc selenates, including PhSeZnCl, now commercially available as “Santi’s Reagent”.
His current research also explores the biological activity of organoselenium compounds and the catalytic mechanisms of naturally occurring selenoproteins.
Prof. Santi has supervised or co-supervised 14 PhD students and more than 130 Master's students in Chemistry and Medicinal Chemistry.