John P. Toscano is a Professor of Chemistry and Vice Dean for Natural Sciences in the Krieger School of Arts and Sciences at John Hopkins University. He received his baccalaureate degree in 1987 from Princeton University and his Ph.D. in organic chemistry from Yale University in 1993. After completing a National Institutes of Health postdoctoral fellowship at Ohio State University, he joined the Johns Hopkins University Department of Chemistry as an Assistant Professor in 1995. He became a full professor in 2003, Vice-Chair of the Department in 2004, and served as Department Chair from 2005 to 2011 and again from 2013 to 2014. In 2014, he was appointed Vice Dean for Natural Sciences. Dr. Toscano’s research has involved the application of time-resolved spectroscopy to the study of very short-lived reactive intermediates and the development novel photochemical precursors to nitric oxide (NO). In addition, his laboratory has investigated the fundamental chemistry and biochemistry of nitroxy (HNO). HNO has been shown to have biological activity distinct from that of its redox cousin, NO, but many mechanistic questions remain. Interest in HNO has been catalyzed by research suggesting that it may be a novel therapeutic for the treatment of heart failure. More recently, his laboratory has turned its attention to the chemistry and biology of hydrogen sulfide (H2S) and related hydropersulfides (RSSH).

Chemistry and Biology of Hydrogen Sulfide (H2S) and Related Hydropersulfides (RSSH)

For over 20 years the physiological signaling associated with the endogenous generation of hydrogen sulfide (H2S) has been of significant interest. Nonetheless, the biochemical mechanisms associated with its physiological actions are still not clear. Recently, it has been found that H2S-related or derived species are highly prevalent in mammalian systems and that these species may be responsible for some, if not the majority, of the biological actions attributed to H2S. Among the most prevalent and intriguing species are hydropersulfides (RSSH), which can be present at significant levels. Indeed, it appears that H2S and RSSH may be intimately linked in biological systems. The fact that H2S and polysulfides such as RSSH are present simultaneously suggests that biological actions previously assigned to H2S may instead be due to RSSH (or other polysulfides). Addressing this possibility will to a large extent rely on understanding the biologically relevant chemistry of these species.
\[ \text{H}_2\text{S} + \text{RSSR} \rightleftharpoons \text{RSSH} + \text{RSH} \]

**Thiol**  
RS / RSH  
nucleophilic

**Disulfide**  
RSSR  
electrophilic

**Persulfide**  
RSSR / RSSH  
nucleophilic/electrophilic