

# ACCOUNTS of CHEMICAL RESEARCH®

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## EDITORIAL

### Single-Molecule Spectroscopy

Single-molecule optical spectroscopy (SMS) refers to a set of spectroscopic tools for the investigation of single members of a chemical ensemble of molecules, one molecule at a time. The greater information content of SMS, as compared to the more conventional ensemble methods, offers direct information on the distribution of physical properties (not just their average values). SMS, since its inception in the mid 1980s, has become an increasingly popular tool for the investigation of the structure and dynamics of complex chemical systems. SMS data are offering important insights into many of the most challenging and indeed perplexing issues in molecular biochemistry, cellular biology, and materials chemistry. For example, SMS data has been used to unravel the mechanism of highly heterogeneous biochemical reactions that contain many different chemical species and reaction pathways. Far from simply giving answers to outstanding questions in these fields, the single-molecule spectroscopy revolution is literally changing the fundamental theoretical framework of highly complex physical and chemical processes.

This special issue highlights several of the most active and influential areas in the growing SMS field, which already has more than a hundred research groups and more than a thousand publications to date. Clearly, this special issue is far from comprehensive. Nevertheless, the authors have done an excellent job in describing how SMS is impacting many areas of chemistry and how the recent development of new SMS experimental and theoretical tools have the potential to make an even greater impact. The editors of *Accounts of Chemical Research* thank David A. Vanden Bout at the University of Texas and Xiaowei Zhuang and Xiaoliang Sunney Xie both at Harvard University for their help as Guest Editors for this special issue.

**Paul F. Barbara**

*Senior Editor*

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