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EDITORIAL

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Theodor Förster: A Giant of Modern Photochemistry

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The year 2011 marks the centenary of the birth of Theodor Förster, one of the giants of modern photochemistry. This issue is a celebration of Förster's scientific achievements, and equally importantly, the science that has been enabled by his discoveries. His contributions are key to the understanding of important problems in excited-state photochemical reactions and the understanding of organic dyes. His legacy lives on in a diverse range of sciences but, undoubtedly, his most famous contribution concerns his seminal work on the electrostatically mediated energy transfer between proximate sensitiser and acceptor molecules. The process, known today as Förster resonance energy transfer (FRET), is key to a vast range of phenomena occurring in nature, including photosynthesis.

Förster would have been aware of the great impact his science had been making already during his lifetime (see the article by H. E. A. Kramer and P. Fischer on p. 555 in this issue), but he could not have foreseen the scientific superstar status to become associated with him in the life sciences. It is quite possible, indeed likely, that more biologists are familiar with Förster's name today than are physicists and chemists. Why is this so? FRET has turned out to be perhaps the most important optical technique to uncover molecular processes in biological systems. The reason for this lies in the fortuitous fact that the length scale over which significant FRET occurs corresponds to the size scale of typical macromolecular complexes. Using specific molecular labelling methods and FRET, details of molecular interactions previously invisible can now be uncovered. Coupled with microscopy techniques, this permits information on the function, conformation, and association of macromolecular complexes to be obtained directly from the natural environment in which such reactions are taking place. Much of what we know about the function and dysfunction of proteins, for example, comes from FRET measurements. Remarkably, this information is gained using light of a wavelength about two orders of magnitude larger in scale than that at which these processes take place. Förster is thus the father of modern optical superresolution methods, literally opening our eyes to the processes occurring on the molecular scale. The literature abounds with publications on the application of FRET and their numbers continue to increase at an explosive rate.

In this issue, Förster's legacy manifests itself in rich variety, ranging from studies of energy transfer in complex molecular systems to the development and application of novel sensors based on the FRET phenomenon. Applications range from studies of individual molecules to clusters containing hundreds of thousands of molecular subunits; from experiments performed in the test tube to studies in living organisms. FRET is used to reveal how proteins assemble into toxic oligomers and Förster's theories form the basis for models of energy transport in complex chromophore systems.

Förster's work was at the crossroads between physics and chemistry. Today, it brings together scientists from numerous disciplines. We believe that the work presented in this issue reflects the great range, diversity and current state-of-the-art in this field. It is proof of Förster's lasting influence and a celebration of his achievements.

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Clemens Kaminski obtained his Ph.D. in Physics from the University of Oxford in 1995. He then spent seven years at the University of Lund in Sweden before accepting his current position at the University of Cambridge, where he heads the Laser Analytics Group at the department of Chemical Engineering and Biotechnology. The research focus of his group lies on the development of modern optical techniques for the study of molecular kinetics in a range of chemical and biological systems. He is director of the CamBridgeSens network and affiliated with the University of Erlangen-Nuremberg, Germany.

Erich Sackmann received his Diploma in Physics in 1961 and did his Ph.D. in Physics 1964 with Professor Theodor Förster from the Technical University of Stuttgart. After two years as Member of Technical Staff at Bell Telephone Laboratories in Murray Hill he worked as research assistant at the Max Planck Institute for Biophysical Chemistry in Göttingen. He did his Habilitation in Physical Chemistry at the University of Göttingen. In 1974 he became Professor of Physics and head of the Biophysics department at the University of Ulm and from 1980 to 2003 held the chair of Biological Physics at the Physics Department of the Technical University Munich. He currently works as Professor Emeritus at the Technical University Munich and the Ludwig Maximilian University Munich.

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