The year of the chemist

The year 2011 has been designated the International Year of Chemistry. *Nature Methods* joins in the celebration with a special feature in this issue.

In honor of the 100th anniversary of Marie Curie's Nobel Prize in Chemistry, awarded for her discoveries of the elements radium and polonium, and also the 100th anniversary of the founding of the International Association of Chemical Societies, the United Nations has designated 2011 as the International Year of Chemistry. This year, the many significant achievements in chemistry and their impact on the well-being of humankind are being celebrated in many forms across the globe in an effort to encourage young people to take an interest in chemistry and generate enthusiasm for the future of the discipline.

Chemistry has been long called the 'central science' because of its unique position in connecting the physical sciences with the biological sciences. As such, it can be hard to define the boundaries of modern chemistry: no longer is it simply focused on atoms, ionic compounds and small molecules. Interdisciplinary fields such as materials science, nanotechnology, environmental science and, of course, biology are firmly rooted in chemistry but can hardly be considered traditional. Some chemists may lament the broadening of the chemistry discipline and feel slighted when the Nobel Prize in Chemistry and other prominent prizes are awarded for advances that have made major impacts in areas outside the boundaries of traditional chemistry. The many important advances in chemistry certainly should not be ignored. But rather, the broadening of the definition of chemistry should be seen as positive, demonstrating the central importance of chemical principles and chemistry methods and tools across scientific research.

We celebrate the International Year of Chemistry with a special feature in this issue, highlighting several exemplary contributions of chemistry to the development of methods and tools for biology. In a Historical Commentary on page 633, John Yates discusses the history of mass spectrometry, from its beginnings as an analytical technique to examine atomic structure, to its heyday as a tool for characterizing small organic molecules, to its current incarnation as the most powerful technique for analyzing the proteomes of biological specimens. Carolyn Bertozzi and Michael Boyce, in a Commentary on page 638, discuss bioorthogonal chemistry approaches for labeling specific biomolecules in living cells and whole organisms. And in a Commentary on page 642, Tetsuo Nagano and Tasuku Ueno discuss the history and diversity of small molecule–based fluorescent probes used in cellular experiments and for imaging in organisms.

Additionally, in the Technology Feature (p. 623) we focus on protein engineering—the modification of intrinsic protein chemistry to develop proteins with useful new or improved properties. Engineered proteins help chemists carry out difficult syntheses and make production processes more efficient and less wasteful. Protein engineering has been used to develop many fluorescent protein variants such that a rainbow of colors for cell and tissue imaging is now available to biologists. And engineered proteins applied in the rapidly advancing field of optogenetics are allowing researchers to precisely control cellular behavior using light.

Of course, there are many other interesting and important biological methods and tools with their roots in chemistry, but unfortunately we do not have the space to feature them all. Some of these methods and tools are briefly featured in our Chemistry *Methods* spread on page 646, where we highlight past papers published in the journal, reflecting the diversity of biological methods and tools with their basis in chemistry. For example, a large area of research in chemical biology is focused on finding small-molecule probes for controlling molecular processes in the cell, such as by inhibiting protein function or allowing protein function to be selectively activated. The increasing availability of large compound libraries and improved screening and selection approaches are resulting in a wide variety of small molecules to probe specific cellular processes.

Another field in which chemistry has made a decidedly important impact is DNA sequencing. From capillary electrophoresis, an analytical technology that had a crucial role in sequencing the human genome more than ten years ago, to the wide array of next-generation sequencing methods now available, the work of chemists has been invaluable for making genome sequencing now nearly routine.

In this age of the kit and black-box analytical instrumentation, it is easy to forget the vital contributions of chemistry to biology research. Arguably, countless biological insights have only been made possible by standing on the shoulders of chemists, and certainly much remains to be discovered that will require the foresight and expertise of traditional chemists to develop new methods and tools. The contributions of chemists to methods development in biological research certainly deserve some celebration. We hope you enjoy this special issue.