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Frontiers in Chemistry

Chemistry, the most central of scientific disciplines, continues to show the promise, excitement, and possibilities set out 2 years ago in *Opportunities in Chemistry*, the Pimentel Report. Much of this promise is already being realized: better understanding of chemical properties and reactions, improved instrumentation, increased computational ability, advances in theory, and novel experimental approaches to synthetic challenges are all having serious consequences for the field. Readers will recognize from individual articles in previous issues of *Science* that significant advances in this field are continually occurring—creating new intellectual opportunities as well as solidifying earlier ones.

In this issue are highlighted a few of the exciting developments in chemistry, chosen to expose some of the breadth and depth of the field. As is usually the case in these field-organized issues with only a limited number of papers, it is not possible to cover the entire area; readers will continue to see other important and interesting work in future issues.

Many of the advances in modern chemistry have come from superior methods of analysis, improved both in sensitivity and specificity. Wightman describes some extraordinary developments in microelectrodes that give microsecond time resolution and micrometer spatial resolution. Potential applications in many areas, including brain chemistry, are pointed out.

Synthetic chemistry lies at the heart of chemical science. New molecules and new ways of making them are critical. Evans describes new advances in stereoselective synthesis, which involves the rational construction of molecules whose complex structures involve the specific geometrical relations of ring connections and functional groups. Schultz describes the design and construction of efficient highly selective catalysts that are catalytic antibodies and hybrid enzymes. In this work we see major breakthroughs in the modification of naturally occurring molecules to perform new and different chemistries.

An understanding of naturally occurring complex chemical systems is crucial to understanding life itself as well as in designing new chemistry. Dawson describes structure and function in the bioinorganic chemistry of heme-containing oxidases and peroxidases. This important work depends significantly on synthetic models that are capable of doing much of the chemistry of the natural systems. Closs and Miller describe studies of long-distance intramolecular electron transfer, an extremely fundamental and key chemical process. Invention and synthesis of models and studies of their chemistry provide critical insight and tests of theories.

Some of the most interesting and important chemical interactions occur when molecules interact only very weakly. Sophisticated measurements and interpretation of spectra allow us to understand how molecules behave in this limit. Miller describes some of the insights obtained from near-infrared studies of van der Waals and hydrogen-bonded molecules.

Dunning and his coauthors describe theoretical studies of the dynamics of chemical reactions. These illustrate some of the important advances in computational chemistry and its applicability to solutions of real problems.

As our understanding progresses, it is becoming possible to deal with complex systems that contain many exciting possibilities for nonlinear behavior seen in living as well as in other real-world systems. Ross, Müller, and Vidal describe chemical waves, an example of spatial structures that can occur in nonlinear systems far from equilibrium.

The plate of chemistry is a full one; the menu is extremely rich and varied. We expect to see continuing insights, imaginative breakthroughs, and useful applications. The combination of understanding, insight, and technological power makes it clear that much is yet to come. The promise of the Pimentel Report is indeed being realized.—JOHN I. BRAUMAN, *Department of Chemistry, Stanford University, Stanford, CA 94305*