YI LU

WHAT'S IN A NAME?

Whatever you call me, I know being a bioinorganic chemist means enjoying the best of both worlds

I AM A BIOINORGANIC CHEMIST; I WORK at the interface of biology and inorganic chemistry. People often ask me questions such as "Are you a Bio-inorganic chemist with a big 'B' or a bio-Inorganic chemist with a big 'I'?" Where I place the capital letter is not a trivial answer, because I sometimes grapple with it myself in trying to please seminar audiences, grant reviewers, program officers, and even my own questioning.

On one hand, I love the color and magnetic properties that metal ions bring to this world. Like many chemists, I consider being able to make new molecules or to figure out new reaction mechanisms one of the biggest thrills of life. I guess these traits qualify me as a bio-Inorganic chemist.

On the other hand, the more I study biology, the more I am fascinated by how skillful nature is at inorganic chemistry. Rather than striving to make the most stable or the most efficient catalysts all the time, nature seems to be best at making catalysts (enzymes) that can be activated at a specific time and place, regulated with the right efficiency to harmonize with other reactions, and degraded after their mission is accomplished. Nature is also good at using cost-effective and environmentally benign resources (such as oxygen as an oxidant and water as a solvent) to carry out extremely challenging regio- and stereoselective natural product syntheses. The urge to discover nature's secrets and to put them into practice makes me want to be called a Bio-inorganic chemist.

As a chemist, I have gained a profound appreciation for hypothesis-driven research. The rational design approach that builds on knowledge gained by pioneers in the field has been shown to be the key to success. However, given the enormous amount of unexplored matter and information, we may not even be able to scratch the surface of knowledge that we need to be able to face the challenges ahead of us. For example, efforts to sequence the human genome are now complete. To understand the information from the sequences and to design pharmaceutical agents to target human diseases, hypothesis-driven research alone may not be adequate. In this regard, discovery-driven research—using combinatorial, selection, or evolution approaches—is extremely valuable for gaining the knowledge in a reasonable amount of time.

The choice between bio-Inorganic and Bio-inorganic chemistry (or between hypothesis-driven and discovery-driven research) is not easy. However, recent advances in chemistry and biology—especially techniques in the synthesis, purification, and characterization of small molecules and biomolecules—enable the combination of advantages from both fields and approaches. For example, it is now possible to design and synthesize biomimetic models that incorporate many of the features in native enzymes. Much discovery-driven research has resulted in lead molecules with unprecedented new properties. Insights gained from the study of those molecules can lead to accelerated progress in hypothesis-driven research.

These advances are the results of the 125 years of chemical research that are reflected in one of the greatest organizations in the world, the American Chemical Society. Although the subdiscipline of bioinorganic chemistry is less than half the age of the society, it will share many of the same responsibilities of its big brothers and sisters in ACS by taking on future challenges. These challenges include understanding the storage, transportation, and incorporation of metal ions in cells (including those involved in neurological events) and the role of metal ions in catalytic DNA/RNA.

Another test of our ability is the de novo design of functional metallo-enzymes, or model compounds, and their biochemical and industrial application as environmentally benign catalysts or biosensors. Elucidation of the role of metal ions in such processes as photosynthesis, respiration, biomineralization, and marine product formation will result in the synthesis of novel biocompatible and biodegradable materials such as artificial bones, adhesives, and energy transducers that use sunlight.

The most exciting breakthroughs in the next 125 years of bioinorganic chemical research probably will be those that no one can predict or dare to dream right now. However, one thing is clear: The combination of knowledge, experimental approaches, and techniques from different fields is no longer an option but a requirement for facing future challenges in bioinorganic chemical research.

I have decided that the next time I am asked what I call myself, my answer will be, "I am a Bio-Inorganic chemist."

HYBRID Pulling equally from both biology and inorganic chemistry, Lu calls himself a Bio-Inorganic chemist.

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