chemistry

Editorial

Chemistry: A Place to Publish Your Creative Multidisciplinary Research

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It is my pleasure to welcome you to *Chemistry* (ISSN: 2624-8549), an open access peer-reviewed journal that publishes both primary reports and reviews highlighting important advances in fundamental areas of chemistry and/or illustrating the central role of chemistry in bridging the physical and life sciences. *Chemistry* is a young journal (established in 2019), but has had an excellent start under the leadership of Edwin C. Constable (University of Basel).

If you are reading this article, you are likely a chemist! I also hope that this means that you have recently discovered something new and important, and are looking for the right venue to publish your work. I invite you to choose *Chemistry.* If you are a chemist, submitting your best work to *Chemistry* simply makes sense!

Allow me to outline the key points of the journal's scope and philosophy to help you to decide if *Chemistry* is the right venue for your work.

Why Do We Need a Journal Named "*Chemistry*"?

Our goal is to showcase research that highlights the uniqueness of chemistry among the natural sciences, illustrates its broad appeal and the central role it often plays in multidisciplinary research. However, we will embrace novelty, even when if it is the result of serendipity. If you have discovered something truly new and unexpected, submit it to *Chemistry*, even if you are unsure what the future impact of this work may be.

Chemistry is a journal for chemists. Its mission is to provide a home for papers of high quality and interest to the broad scientific community. The journal welcomes both fundamental and applied multidisciplinary research. Contributions that describe connections between chemistry and energy, chemistry and the environment, chemistry and health, chemistry and artificial intelligence, and chemistry and information storage/processing are welcome.

Chemistry is often called a "central science", as it connects basic sciences, from physics to biology, and enables advances in applied disciplines such as medicine and engineering. Modern chemistry also takes advantage of advances in mathematics, computer science, and artificial intelligence. Furthermore, chemistry is central as it is positioned at the intersection of the molecular world and the world perceptible to humans. It provides a foundation for research in materials science and opens the doors for new technologies. Chemistry connects humans with the universe, as all carbon atoms in our bodies were forged in stars from smaller elements via nuclear fusion. Chemistry is the foundation of biology and astrobiology.

The mission of *Chemistry* is reflected in the journal's philosophy and our view of chemistry as a special science with a unique combination of scientific rigor and creativity. Chemists do not only study nature as it exists, but they also expand nature by creating their own objects of study.

Chemistry Is a Unique Science

Although chemistry is an ancient science, chemistry stays "modern" by continuously reinventing itself. This is inevitable as the world of known molecules, reactions, processes,

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and concepts continues to expand. Such expansion is intrinsically limitless, propelling chemists to continue to dig deeper and look further in their research. The number of isomers, even for relatively small molecules of just 167 carbon atoms, already exceeds the number of particles in the universe [1] because chemistry is inherently self-propagating in its expansion. Unlike for other sciences, chemists routinely create previously unknown substances, each with its own unique microcosm of properties, which may reveal a new bonding pattern and unexpected emerging behavior. Of course, chemistry is full of surprises, so serendipity often helps make an unexpected discovery.

There are many challenges as chemistry continues to conquer space and time, reaches new depths in the intricacies of molecular structure, and expands to the new areas. For example, even complex molecules can "solve" their own Schrodinger equation instantaneously and precisely, just because they are real objects which, by the mere fact of their existence, have the exact energy and all of the other properties encoded in this equation. However, our advanced computers are still not capable of this task, apart from the rather small systems. Do we need new ways of thinking that would take us beyond the current paradigms instead of creating hundreds of new DFT potentials? Will new tools, such as quantum computing and artificial intelligence, lead to breakthroughs?

Theory aside, are there new paradigms that can be used for the experimental control of reactivity? What new knowledge can come from the ability to manipulate individual molecules and get their electronic "signatures" by directly analyzing their molecular orbitals? We are able to direct the motion of individual atoms, creating and breaking individual bonds at will on the surface [2,3], and observe the atomic picture in the course of chemical reactions in a liquid medium [4]. Time-resolved spectroscopy can provide direct information about species that live less than a vibration; not only the transition states, but even more subtle details of energy landscapes stop being experimental "terra incognita" [5]. At the same time, the interaction of molecules with photons (i.e., molecular spectroscopy) allows chemists to search for unusual molecules in interstellar space [6,7].

Of course, the interaction of photons with molecules can achieve much more than molecular fingerprinting. Electronically excited states are "electronic isomers" with properties and reactivity that are drastically different from their common ground-state counterparts, where even a benzene ring can become antiaromatic [8,9]! The renaissance of photochemical [10–13] and electrochemical [14–16] methods illustrates how creativity can rejuvenate classic approaches to the control of reactivity. Combining photochemistry and electron transfer ("photoredox") leads to the generation of highly reactive intermediates under mild conditions where they can be tamed and employed in catalytic cycles [17–20]. Even an electron [21] or a hole [22] can be catalysts capable carrying multiple catalytic cycles!

With the deeper understanding of molecular structure, even "unstable functional groups", such as organic peroxides, become incorporated into drug design and open new regions of the molecular universe to medicinal chemists [23]. Unusual activation approaches such as chemistry in crystals [24,25]) or mechanochemistry [26] can sometimes lead to striking results. Limitless opportunities come from understanding this complexity and emerging behavior [27]. The origin of life and astrobiology find their foundation in chemistry, but take chemistry far beyond the simple grid of the periodic table.

However, are chemists using all of the tools that nature has provided us? Will new paradigms emerge for making impossible reactions possible? Most likely! For example, why should atoms be built only from the three elementary particles (proton, neutron, and electron) when many other elementary particles exist? How many chemists know that one can build a "hydrogen atom" that is with a mass that is only one-ninth of the mass of a regular hydrogen atom? Such atoms (called muonium atoms, as they are made of an electron and a positively charged muon) can initiate classic radical reactions [28]. One can integrate them into organic chemistry! An even more intriguing concept of muon-catalyzed nuclear fusion remains a tantalizing possibility for energy production [29].

Because molecules can organize matter and quantize energy in the sub-nanospace, they can serve as essential tools for exploring and understanding the universe. It is not surprising that molecular design provides a key to the studies of a variety of conceptually intriguing phenomena, from quantum entanglement [30] to photon [31] and electron [32] up-conversion. Furthermore, molecules are intrinsically delocalized and spatially anisotropic quantum objects. Hence, understanding molecules requires one to interface human thinking with quantum realities. Doing that will expand the human mind and provide fertile grounds for philosophical analysis.

What Makes a Great *Chemistry* Paper?

To answer this question, allow me to highlight a few papers recently published in this journal.

Often, the computational exploration of molecules with unusual electronic properties has the potential to uncover new chemical phenomena. For example, Hashimoto and Tahara use thiophene analogues of anti-kekulene to get fresh insights into the tug-of-war between aromaticity and anti-aromaticity [33]. Changes in the electronic structure of polycyclic aromatic hydrocarbons (PAHs) upon photochemical excitation reveal a switch from aromaticity to antiaromaticity and provide an important step in consolidating varying viewpoints of electronically excited states.

The interface between chemistry and medicine provides a fertile ground for molecular design that leads to interesting properties. This is illustrated by biomedical applications of gold nanoparticles (AuNPs) as sensors, diagnostic tools, and therapy [34], and the controlled delivery of bioactive materials via magnetic nanoparticles (MNPs) [35].

Connections between chemistry and the environment are becoming increasingly important. An example of a broadly useful analysis is illustrated by the work of Reina and coworkers [36], who demonstrate how the understanding of chemical kinetics pertaining to three-way catalytic converters provides insights in accompanying environmental issues.

It is also helpful to compare the roles of *Chemistry* and other chemistry-related MDPI journals such as *Molecules* (ISSN 1420-3049) and *International Journal of Molecular Sciences* (IJMS) (ISSN 1422-0067). *Molecules* covers mainly the topics of synthetic organic and natural product chemistry, while *IJMS* encompasses molecular biology as the main field of research. *Chemistry* will publish high-quality papers of any chemistry-related topic. We invite authors to take advantage of this opportunity!

In summary, we hope to see papers in *Chemistry* that introduce fresh perspectives of chemical structure, develop new approaches for controlling chemical reactivity, and highlight the multidisciplinary impact of chemistry! We are looking for articles of high quality, breadth, and significance. Because *Chemistry* is an open access journal, these articles will be broadly available to the public.

There are many chemical journals, but only one with the simple name, "Chemistry". I am honored to be associated with a journal that is named after my favorite science! I hope that chemistry is your favorite science too and that you will support it by publishing your creative and innovative work in *Chemistry*!

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