UCLA College | Physical Sciences Chemistry & Biochemistry

PHYSICAL CHEMISTRY SEMINAR

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4:00 PM
via Zoom

"Aggregology: Science beyond Molecules"

To understand the Nature, scientists have viewed the world from different angles and built various research frameworks according to the level of inquiry, e.g., macro and micro sciences for studying bulk substances and molecular species, respectively. A philosophical linkage here is the reductionism conjecture, assuming that the former (i.e., a bulk substance) is reducible to the latter (i.e., simpler molecules). The reductionism approach has harvested great success but does not always work well. For example, when molecules are aggregated, the aggregate may show totally different behaviors or properties from its molecular constituents. Some luminogens, for instance, do not emit light upon UV excitation as molecular species, but their aggregates luminescence efficiently. This photophysical effect is known as aggregation-induced emission, which manifests that a new property can emerge at aggregate level. In contrast to reductionism, properties of an aggregate are not necessarily a simple, linear addition of those of its molecular components, but affected in a convoluted fashion by different factors, such as quantity (number of constituents), geometry (size, shape and dimension), morphology (amorphous or crystalline) and interaction (attraction or repulsion). Decipherment of such a complex system calls for the development of aggregology, a new scientific framework for aggregate study. Understanding the operations and interplays of antagonism, synergism, emergentism, multiplicity, etc. in an aggregate system is of great scientific value and has far-reaching technological implications. Aggregology study will generate new laws, rules, models, hypotheses, diagrams, etc. and create new knowledge to boost our comprehension of natural processes and to solve the issues and problems unsolvable by the traditional reductionism approach. The establishment of new fundamental principles and working mechanisms at the aggregate level will enable rational design of novel aggregate systems and judicious development of new advanced materials. It is envisioned that aggregology study will lead to a paradigm shift in research epistemology and methodology and open up new avenues for exploration and innovation at higher levels of structural hierarchy and system complexity.1,2

(1) Tang, B. Z. Aggregate **2020**, 1, 4; Liu, B.; Tang, B. Z. Angew. Chem. Int. Ed. **2020**, 59, 9788.
(2) Zhao, Z.; Zhang, H.; Lam, J. W. Y.; Tang, B. Z. Angew. Chem. Int. Ed. **2020**, 59, 9888.

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