

Preface: Forum on Biomedical Applications of Colloidal Photoluminescent Quantum Dots

This issue of *ACS Applied Materials & Interfaces* features a forum that is focused on Biomedical Applications of Colloidal Photoluminescent (PL) Quantum Dots (QDs). The development of PL QDs for molecular diagnostics to allow treatment at early stages of the evolution of diseases has been an attractive research area eliciting considerable efforts from a broad spectrum of researchers including inorganic and organic chemists, physicists, engineers, biologists, and medical doctors. Via a multidisciplinary approach with notable and well-appreciated cooperation, this area of research has been advancing slowly but steadily, overcoming challenges in the synthesis of strongly luminescent QDs with enhanced synthetic reproducibility and particle yield at low temperature, and in surface modification such as bioconjugation for targets of interest and for improved detection sensitivity.

To achieve the goal of improving the health and quality of our lives with novel functional nanomaterials such as PL QDs, researchers have come a long way in the past 30 years to develop appropriate chemistries leading to bright PL QDs with desired targeting ligands on their surface for biomedical applications. The discovery of colloidal PL QDs can be tracked back to the early 1980s work by Dr. Louis Brus and Professor Arnim Henglein.^{1,2} The first research articles on the use of PL QDs as fluorescent contrast agents for biological labeling and imaging appeared in *Science* in 1998,^{3,4} stimulating much curiosity with enduring efforts towards the development of QD-based biomedical applications.

We organized this forum to commemorate the 30th anniversary of the discovery of colloidal PL QDs and the 15th anniversary of the initiation of targeted research toward QD-based bioapplications. The forum consists of 11 articles contributed from leading research groups in academia, industry, and government laboratories. Four of the articles are reviews of selected research areas relevant to the biomedical application of PL QDs, one of which is a Spotlight focusing on the author's own work. The reviews cover the areas of in vitro and in vivo bioimaging, photoelectrochemical sensing, and toxicity concerns. There are seven primary research articles, four of which deal with the synthesis of Cd-based alloyed QDs and their photophysics, low-temperature approaches to bright Cd-free and Pb-free QDs, surface modification with photoligation to conjugate compact QDs with high colloidal stability, and QD encapsulation by a triblock copolymer for siRNA delivery. The remaining three research articles tackle the development of bioassays based on time-resolved Forster resonance energy transfer (FRET), assays for quantitative and multiplexed tissue staining, and barcode assays for point of care detection with the assistance of microfluidics and magnetism.

Although the objective of this forum is to present to our readership a dedicated collection of articles relevant to the latest advances in the development of PL QDs for biomedical applications, it is not intended to comprehensively cover each distinct topic in the field. The challenging issues described in these forum articles have been among the central concerns of

the community. It is our intention that this forum will inform the community of recent key advances, highlight ongoing challenges, and allow us to press forward with confidence toward the realization of QD-based molecular diagnostics.

Kui Yu, Associate Editor

Kirk S. Schanze, Editor-in-Chief

AUTHOR INFORMATION

Notes

Views expressed in this editorial are those of the authors and not necessarily the views of the ACS.

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