Preface

This issue of *Pure and Applied Chemistry* (*PAC*) is special for several reasons. It is an opportunity for IUPAC to celebrate the inauguration of the International Year of Chemistry 2011 (IYC 2011), so the content departs from the usual conference papers, technical reports, or recommendations, in favor of a collection of articles by past winners of the IUPAC Prize for Young Chemists, from inception of this annual competition in 2000 up to 2009.[1] This Prize was created "to encourage outstanding young research scientists at the beginning of their careers", and has richly fulfilled its founding objectives to recognize young talent, with the award of no less than 46 prizes over the years and honorable mention of many competitors whose excellent contributions did not receive the highest accolade.

The declared goals of IYC 2011 are to "increase public appreciation of chemistry in meeting world needs, to encourage an interest in chemistry among young people, and to generate enthusiasm for the creative future of chemistry". By happy coincidence, 2011 is the 100th anniversary of the Nobel Prize awarded to Marie Curie, and is thus also an opportunity to celebrate the contributions of women to science, and recognize the ongoing challenge of ensuring equal opportunity for all in career development. Most importantly, Marie Curie is an inspirational role model, not only to women but to all young students, and it is altogether fitting that the coming generation of scientists should be closely identified with IYC 2011, since enthusiasm is a defining characteristic of youth.

IUPAC recognizes and wholeheartedly undertakes its duty to encourage and support young scientists throughout the world. As a global, scientific, nongovernmental organization, it contributes in a variety of distinctive ways to inspiring and helping young scientists to study and embark upon careers in chemistry. The Prize for Young Chemists is merely one such regular activity which, apart from monetary reward, enables recipients to attend an IUPAC Congress and the opportunity to showcase their achievements in an annual *PAC* Special Topic collection of invited, peer-reviewed articles, which has generated an outstanding published record since 2002.[2]

In a more recent initiative commencing 2008, IUPAC has allocated a grant to enable economically disadvantaged countries to participate in the annual International Chemistry Olympiad. More generally, IUPAC operates a Financial Support for Conferences program to promote opportunities for young scientists and advanced students, particularly from scientifically emerging regions, to attend selected international conferences. The Young Ambassadors for Chemistry program was established as a partnership between the IUPAC Committee on Chemistry Education and Science Across the World, to facilitate interaction with teachers and students to increase public appreciation for and understanding of chemistry.

An important feature of ongoing IUPAC strategy is to familiarize younger scientists with Union activities, and attendant opportunities for service to the international community. The Affiliate Membership Program was established in the 1980s to encourage individuals with an interest in IUPAC activities to sustain a direct relationship with the Union. Additional incentives to developing and economically disadvantaged countries include certain numbers of free affiliate memberships for young chemists. In a complementary initiative, the Young Observers Program sponsors young scientists to attend IUPAC General Assemblies and to participate as observers in selected activities and deliberations by invitation.

The passage of IYC 2011 will be marked by a rich international program of activities, in which IUPAC features prominently in three cornerstone events, namely, the formal launch and closing, and the

[1]The works of the 2010 winners feature in the December 2010 issue of *PAC*, <http://www.iupac.org/publications/pac/82/12/>.
[2]The full archival record of the Young Chemists' Prize Collections can be accessed at <http://www.iupac.org/publications/pac/special/>.

43rd IUPAC Congress. The latter event will take place in San Juan, Puerto Rico on 30 July to 7 August 2011,[3] and offers additional incentives for young scientists to attend and participate in a unique international celebration of chemistry.[4] The winners of the 2010 and 2011 Prize for Young Chemists will attend as active delegates, and the award ceremony will have special significance in perpetuating a tradition that recognizes the hand of youth in shaping the future of chemistry.

This issue of *PAC* pays its own tribute to the many brilliant young scientists who have been recognized by the Prize for Young Chemists jury over the past 10 years. We are grateful to those who accepted the invitation to contribute to this special collection, fittingly subtitled "Perspectives and Challenges for the International Year of Chemistry".[5] It is hoped that the contents will inspire and enthuse readers with fascinating insights into new and emerging aspects of chemical sciences. I am very honored to have had the opportunity to write this Preface, and thereby to congratulate all prize winners, past and present, and wish them fulfilling and successful careers, driven by enthusiasm and belief in the great future of our discipline.

Nicole Moreau
IUPAC President

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[3]Consult <http://www.iupac2011.org/> for details about the 43rd IUPAC Congress.

[4]Details of award programs targeted to encourage young chemist's participation at the 43rd IUPAC Congress in Puerto Rico are available at <http://www.iupac.org/web/nt/2010-11-05_43_Congress>.

[5]**The cover illustrates a few graphical images arising from the richly varied and topical content of this special issue:** From left to right:

1. From "Graphene oxide as surfactant sheets", by Laura J. Cote, Jaemyung Kim, Vincent C. Tung, Jiayan Luo, Franklin Kim, and Jiaxing Huang, p. 95
   Graphene oxide sheets, the chemical exfoliation product of graphite powders and precursor for the bulk production of graphene based materials, are found to be amphiphilic, and can act as surfactant to disperse insoluble materials or emulsify organic solvents (shown here).
2. From "Reaction dynamics in the formidable gap", by Roman Boulatov, p. 25
   Most reactions studied and exploited by chemists can be viewed as concerted motions of only a few atoms within 1 nm, i.e., these reactions are confined to the molecular scale. Yet many chemically driven processes around us (motion of limbs, failure of materials) involve correlated motion of objects across many length scales, from molecular (<1 nm) to macroscopic (>50 nm). Rates at the molecular scale (i.e., chemical reactions) are governed by activation energies (e.g., Eyring theory), while those at the macroscopic scale (>50 nm) are determined by the balance of forces (e.g., Newton laws). In between lies the formidable gap, where neither theory alone seems to apply. One of the most interesting challenges in the 21st century is to understand how to bridge this gap and how to create new molecules and reactions that exploit dynamic coupling across multiple length scales to power autonomous nanomechanical devices, to store energy, and to control cellular events.
3. From "Biomimetic synthesis of inorganic materials and their applications", Yujing Li, Chin-Yi Chiu, and Yu Huang, p. 111
   Crystallization of biominerals involves the association of inorganic materials and organic molecules. Macromolecules, such as polypeptides and proteins, control the nucleation, structure, morphology, and phase of biominerals. The example shown here is a scanning electron micrograph (SEM) of a mature sea urchin spine with highly evolved morphology, mainly composed of organic macromolecules and single-crystalline CaCO3 (calcite) [T. Douglas. Science 299, 1192 (2003)], illustrating the capability of proteins in morphology and phase control of inorganic materials. The biomineralization study renders fundamental knowledge on the formation of biominerals under the influence of biomolecules and inspires the biomimetic approach of inorganic material synthesis.