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ALAN ALDA ON *RADIANCE*

INTERNATIONAL UNION OF
PURE AND APPLIED CHEMISTRY

The Homo Sapiens Report ►

Chemistry and Sustainable Development ►

CHEMISTRY International

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From the Editor

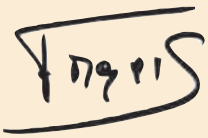
While we have all said farewell to IYC 2011, it is not going to disappear as quickly as turning the page of our calendar. This issue of *Chemistry International* is full of references to IYC, be it in the new Secretary General's column or the feature articles. Although IYC was popular worldwide, one reason it has made such a lasting impression is that it has become for some a starting point, or a commitment that echoes the year's motto: Chemistry—our life, our future.

A commitment for life, a passion, is what the play *Radiance* is all about. Yes, a play, a theatrical performance. It is somewhat unusual for us to think of using a play to reach the public. And yet, the life of Marie Curie, her passion, became a lasting inspiration for American actor and playwright Alan Alda. The timing was fortuitous since the play first premiered in November 2011, right around the 100th anniversary of her 1911 Nobel Prize in Chemistry. In his interview with Paul Weiss, page 4, Alan Alda discusses the origins of the play and other questions that touch scientists today.

Turning back to IYC and key events that it engendered, another feature article in this issue is a version of the Homo Sapiens report that was presented by Michael Wadleigh in San Juan during the IUPAC Congress in August 2011. As charismatic as Michael can be, the message is quite simple and an out-loud cry for sustainability.

The third feature—also heavy on the IYC theme—presents a vision of chemists' responsibilities towards sustainable development. Colin Humphris reports on what the 2011 World Chemistry Leadership Meeting achieved in 2011. The meeting began with a message from UN Secretary General Ban Ki-Moon in which he wished participants great success in "our common quest to solve global problems with chemistry's solutions." The 2011 WCLM was also an outreach experiment of sorts as it hosted a preview of the online forum "The Future of Sustainable Chemistry." You can still view the forum in full at www.futurewecreate.com.

With that said, we hope that you will find this issue of Chemistry International engaging. We are venturing into new territory with the magazine and we invite you to also share your ideas and reactions at facebook.com/ChemistryInternational.



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Cover: A scene from Radiance: The Passion of Marie Curie *with Anna Gunn as Marie Curie and John de Lancie as Pierre Curie, at the Geffen Playhouse in Los Angeles. Photo credit: Michael Lamont. See feature on page 4.*

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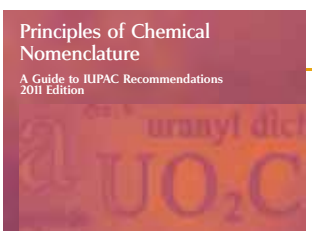

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What Is IUPAC's Place in an Ever-Changing World?

by René Deplanque

This is the first time that I am writing the Secretary General's column. First, I would like to thank all those people who believed in me and elected me to be Secretary General in San Juan, Puerto Rico; to the others, I will do my best to prove that I am the right choice.

At this time, I will offer a few words about how I see my position within IUPAC and about the important issues that we face for which we have to find answers now and in the future.

We are living in an ever-changing world. This is nothing new, but the velocity of change has increased dramatically. Every future has a history; therefore, we have to guard our achievements and continue to improve all this for the future.

IUPAC is the guardian of the language of the chemist. Chemistry is the only science that has defined its own language. This language is understood all over the world and is independent of ethnic and cultural backgrounds.

To guard and to improve the Union, we have to analyze all of IUPAC's organizational and information structures. In the past, IUPAC was very much concentrated on the actual tasks of our divisions. We were internally focused and our interaction with the outside world was mainly through our publications and maybe our members.

We need to open up to the outside world.

This approach began to change in the last few years, as we became heavily involved in organizing the International Year of Chemistry 2011. Even though we were the main organizers and took on the brunt of this task, together with our member societies, it was UNESCO and others who received the praise. This went so far that when our special IYC pin was given away by national societies, they were praised for this generous gift. I am not complaining, it is a great honor to work for our common good with such honorable organizations like UNESCO. However, and this is the question we all have to ask ourselves, where is IUPAC? Having asked this question I will come to my first statement: IUPAC must not be something lost in the clouds, an organization that nobody really understands. Many people know it only as the organization responsible for standardization in chemistry. We have to put IUPAC back on stage, where it belongs.

As I said in my election statement:

- IUPAC is not only the periodic table.
- IUPAC is not only the color books.
- IUPAC is not only all the divisions, the Council, and the General Assembly.
- IUPAC is all of this and more.

On the basis of all our achievements we have to continue to enable the chemist to identify him/herself with the aims of IUPAC. We need to open up to the outside world. We have to prove to all of our members that both our standards and IUPAC as an organization are extremely valuable for their daily professional lives.

To really achieve this, we have to take a very long road. We have to redefine who we are. We have to define what we own. We have to define and assure ourselves that our main aim is to foster science in order to help scientists to achieve their goals in industry and academia and make this known.

To define a standard and have this accepted all over the world is not just a technical process, in which people come together and agree about the procedure. It is a scientific process developed by scientists for use by scientists in industry and academia. It requires a very definite and clear understanding of the whole process of scientific work. To standardize new structures, which were just discovered using the scientific method, requires both credibility and expert knowledge and understanding of the total process. Only scientists of the highest reputation, nominated by their countries and by their professional societies, can be members of this elite group that is charged with defining a world standard.

Naming structures or naming new elements and having those accepted is a great task, because those names will be there for generations to come.

Having said this, I would like come to my second statement: IUPAC must help to spread the use of standards in all parts of industry and science in both devel-

oped and emerging countries. It cannot wait until this is done by others.

We have to implement tools, management structures, and strategies. IUPAC can help show our societies and our chemists in academia and industry what can be done and what should be done. This can be achieved by improving discussions, speeding up information exchange, augmenting awareness, and foremost, helping our divisions and standing committees to do their important work in close cooperation with the IUPAC Bureau. In doing so, we still have to decide whether we want to have a weak and liberal or a strong and effective structure. This choice depends on the financial strength and growth of the Union. At the moment, our central structures are not strong enough to help our divisions spread their results most effectively to those in need. The results are published and there is the hope that they will reach all interested bodies. This is the start of the discussion about what kind of IUPAC we will have in the future. For this dialog, we need the input and commitment of all our members and other groups associated with IUPAC.

We have to redefine who we are. We have to define what we own.

We have to improve and implement our knowledge-transfer lines worldwide to ease communication among chemists everywhere and especially to open new networks with colleagues in emerging regions. Even though this is an important task, we should never forget who founded IUPAC: it was industry. We must strengthen our relationships with industry groups; new lines of communication with industry must be opened. The recently formed InChI Trust is a good example of such a successful collaboration with industry.

As it became evident that IUPAC did not have the resources to speed up the development process of the new InChI standard, a series of major publishing houses came together and founded the InChI Trust. It is fully supported and operated by the scientific publishing houses, but the final decision about what will become a standard is made by the independent InChI subcommittee of IUPAC. This path appears to be a good method for raising the money needed to speed up the process of developing the InChI code while maintaining IUPAC's independence.

Let's explore whether similar arrangements can be used to solve other problems. Under the guidance, and within the framework, of IUPAC, we should try to improve the speed with which our standards and guidelines are transferred to other parts of society. We should start a discussion about industry and academia and the application of standards in chemistry. Following the InChI Trust argument, why not ask the publishing houses to work with us as a group to explore the use of chemistry standards in the scientific publishing process. Structure and strategy would be defined by the user and guided and advised by IUPAC.

Ideas like this can be implemented for any type of process for which chemical standards are needed. We cannot do it immediately, but we can start to think about it. We will need a large improvement in our networks and our lines of communication. We will also need the finances to do so.

I will talk with our divisions about how this could be achieved and I will talk with the key players in the outside world regarding how we can build a partnership of transfer.

Let's see what the future will bring. Samuel Goldwyn Mayer once said "I never make predictions, especially about the future." But I can predict one thing: I will work constructively to ensure that we continue the excellent and important work we have already done, as well as improve communications, build communities, and ensure transfer of knowledge to those in need. I will do my utmost to improve and guard our achievements. With this aim I know that I am in agreement with all our new officers, with our Bureau, and everyone who is working for the good of IUPAC.

I really look forward to working with all of you and all the friends of IUPAC to improve the future of our science and our society.

René Deplanque <rdeplanque@iupac.org> became IUPAC Secretary General on 1 January 2012, following the elections held by the IUPAC Council in August 2011. Deplanque is managing director of the Fachinformationszentrum CHEMIE GmbH in Berlin (FIZ CHEMIE BERLIN; the Chemistry Information Centre). Since 2000, he has been a professor at the Technical University Berlin.

Alan Alda on *Radiance*

The Passion of Marie Curie

by Paul S. Weiss

In the week before the centennial of Marie Curie's Nobel Prize in Chemistry,[1] I spoke with the beloved American actor and science buff Alan Alda[2] in my office at UCLA during the premiere run of his new play *Radiance: The Passion of Marie Curie*[3] at the nearby Geffen Playhouse in Westwood, Los Angeles, California, USA. The play opened on 1 November 2011.

PSW: What was your original interest in Marie Curie?
Alan Alda: My original interest was that everybody knows she was very smart and she worked against difficult odds, but I didn't realize how dramatic her life's story was during this period between the two Nobel prizes. That's what made me start to write the play.

That was four years ago and what kept me writing the play was my growing admiration and, I must say, affection for her because of how strong a person she was intellectually and how courageous she was to never give in. That inspiration from her, that I got from her, kept me going, not only through writing the play, but whenever something comes up now that's really, really tough and discouraging, I think of two things. I think, eight years ago I nearly died on a mountaintop in Chile and now I have a completely different idea about death—it doesn't bother me anymore. I think, "Whatever this problem is I'm facing, it's way easier than dying." And the other thing I think of, and this often comes up first, is whatever I'm going through, it's way easier than what Marie worked her way through, fought her way through. In the discovery of these elements, but also in having to prove herself as having actually done it.

PSW: How did you prepare for writing the script?
Alan Alda: I read a lot of papers by her and biographies about her. Sometimes books that weren't directly about her but referred to her would give me insight. I had to teach myself a lot of things I didn't know about physics and chemistry, which is sort of everything. I knew very, very little. I read for entertainment; I read science all the time. It's mostly what I read, but it's a very disorganized knowledge I have of things; it's hit and miss. I had to be careful here that I didn't say something in the play or have a character say something in the play that was off track. I had them say a lot of stuff that's thick scientific work because they understand each other but the audience isn't always expected to understand it all. Sometimes, there's a scene taking place where the real scene is the sensual attraction that's beginning to happen between Marie and, say, Paul Langevin but they're not talking about sensuality; they're not talking about anything personal. They're talking about diamagnetism and paramagnetism, but their attraction is growing. So, I had to try to make sure that I didn't say anything wrong; I spent a lot of time on that. I'm always asking people if they see any mistakes in it, so please tell me if you do!

PSW: We are coming to the end of the International Year of Chemistry and next week is the centennial of Marie Curie's Nobel Prize in Chemistry. Is it a coincidence that *Radiance* is having its first run now?
Alan Alda: It is a coincidence that this production happened on that anniversary but it's really wonderful. I'm going to be here that day. I'm taking the cast out to dinner and we'll celebrate the anniversary!

PSW: How did you put together the characteristics of the scientists? Many were very familiar, even to the point of identifying them with particular scientists we know.
Alan Alda: Well, I tried to work from what I could determine the facts were from reading biographies. In other words—what their behavior was, what they did. I tried to figure out what that kind of a person would tend to do in that situation and then I would extrapolate from that into what their mannerisms were, their speech, behavior, that kind of thing—what you could expect from them. I've always found that if you know four or five things about a character—and sometimes they're contradictory things because people are not caricatures, people sometimes are in opposition with themselves—then you can imagine how they would behave if they went into a store and bought a pouch of tobacco, and you can build that based on a little information. It's tricky; it's more art than anything else and it takes a lot of intuition, but it's a little bit like an anthropologist finding a piece of a bone and figuring out if that person could walk upright. It just takes a lot of putting pieces together in a puzzle, which is fun.

I gave some characteristics to characters that they may not have had. I mean, I don't know if Émile Borel was like the character I had in the play, but I think he's convincing and I think he's consistent and provides a function. He likes to immerse himself in his equations and this character really doesn't want to get too involved emotionally with the people around him. He

forgets to eat meals; that's somebody that you can imagine having met in your life. It may not actually have been what Émile Borel was like. I started out giving him a couple of characteristics that Jean Perrin actually had. Then, I changed it a little bit to conform more to how I saw Émile. Perrin used to break into song, very robustly and very entertainingly. I have Émile humming mainly because he gets embarrassed and uncomfortable when things get too personal, so it's quite a different thing. I started out with using that characteristic of Perrin because Perrin was once in the play, but I decided that I wanted to concentrate more on Borel and his wife, who was also very smart…a very interesting woman.

One of the things that I tried to do with the play was to underscore the idea that scientists are people; they're not bizarre creatures who are disembodied intellects and white coats. There are a number of reasons that I wanted to do that. First of all, it's true. I've interviewed maybe 700 scientists and they were all people. I never interviewed a machine once. (Well, I did interview a robot once, but that's different.) It's silly to keep showing scientists as caricatures, and it's not helpful to us as a society. How can you encourage young people to be scientists if they think it's not for them because scientists don't seem to have the same longings that they do, the same fallibility and aspirations? They do.

I think it's fascinating to see how somebody like Marie, who accomplished so much, overturned so much received knowledge, was as human as us and had the same passionate personal longings and failures as the rest of us. It's very helpful to see that. In a way, it gives us a wedge. It gives us a way into science for those of us, like *me*, who don't have formal training in science. We can enter a little bit into the world of the scientists and have something to hold onto as we scale the mountain—little toeholds that give us a chance to stay with the intellectual pursuit of the science and scientists as we hang onto the human part of it.

PSW: Were you surprised to hear that the themes and challenges haven't changed much in 100 years?

Alan Alda: I really have been surprised, and it's not only in science. In fact, while I was writing this—this is 100 years later—a man and a woman collaborated on writing a history of baseball. I don't know everything about it because I don't know about baseball, but they had worked together for many years and in fact he was in poor health and she wrote most of the final book that they worked on—mostly her work. They gave *him* a lifetime achievement award and wouldn't include *her*. This is exactly the same story; it's unbelievable!

A scene from Radiance: The Passion of Marie Curie, with Anna Gunn as Marie Curie and John de Lancie as Pierre Curie, at the Geffen Playhouse in Los Angeles. Photo credit: Michael Lamont.

I think it's hard to hear Marie's story without realizing that there's something wrong with that, that we're all suffering—it's not just the women who are let down. But the work that women can contribute—we're eliminating half our work force with half of our intellectual capacity. It's not a feminist tract; it's the fact and you can feel it. There's something about a play that appeals to your emotional understanding of things, an emotional response to things that you can't get from statistics or political arguments. It really isn't a political question; it's a question of rationality. It's so interesting that education of women seems to be the key to so many things: reducing fertility, producing economic viability. With all we know, and everything in every issue of *Nature*, and all the Nobel Prize winning science, we still don't know why people do it. I wonder if we'll ever know.

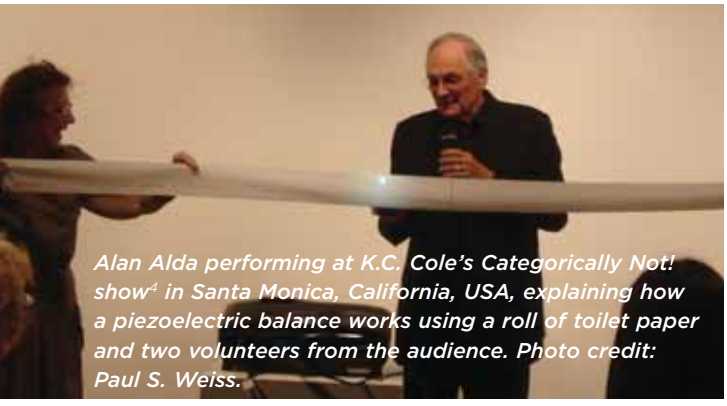
PSW: One of the things that struck me after the play came out was the reviews. Scientists face reviews for their manuscripts and proposals, but those are done anonymously. They still often cut very personally when one puts many years into a project. Reviews of plays are public and signed and not necessarily directed at the people involved in the play. There is an entertainment aspect—appealing to the readership, trying to sell newspapers. How do you deal with reviews and reviewers?

Alan Alda: Since it's something that exists and has existed for a couple of hundred years, it's a little bit like railing against the ocean—if you try to object to it, there's not much you can do. I think [theater] reviews are something that are either useful or ignorable. If there's something you can use to help a production that you've worked years on, then you use it. On the slim chance that something is said in a review that's useful in reworking the material, then you use that, too. But otherwise, they're really best kept under a bandage.

I think what you said— "the greatest purpose is to

sell newspapers"—because otherwise you wouldn't have so many reviewers trying to be entertaining at the expense of the thing they're reviewing.

I can't imagine a situation where a reviewer would come up with a complaint that I hadn't already thought about. But what I had that they're complaining about is the best solution I could find for now for that problem. I could pick 10 for every one that they complain about, and I'm still working on it. So they're not that helpful in saying, "Oh, look what you've done." I know what I've done, to a great extent anyway.



Alan Alda performing at K.C. Cole's Categorically Not! show[4] in Santa Monica, California, USA, explaining how a piezoelectric balance works using a roll of toilet paper and two volunteers from the audience. Photo credit: Paul S. Weiss.

As a consumer, I don't read reviews for entertainment. Well, I do in a way; it's entertaining for me to hate the reviewer when I see them attacking somebody else. It's not helpful to hate the reviewer if he attacks you, because if you keep remembering, then it just burrows deeper into you. But I don't think they're helpful to me as a consumer because I've been sent to too many lousy movies and plays by positive reviews. I'm more upset with them about that than I am with knocking them. I try to read between the lines and often I see that it's something I really would like to see by the way they describe it negatively. I think it's a little bit like putting the *trans* fats in food—it makes you buy the product, but it's not necessarily good for you.

Peer review seems to be very successful in science. If it's some kind of double blind thing where you don't know who wrote it, then it's probably better. But if you have somebody who's trying to grind an axe to benefit their own work, that may not be so good. Certainly, we would really not progress very far if we didn't have some kind of critical analysis. I couldn't write it, if I didn't exercise my own.

PSW: Your wife Arlene is a writer. Do you have feedback for each other?

Alan Alda: Oh yes. We're each the first person that we show any of our work to. She's very honest and open and extremely supportive but very direct, and I am with her. We both try, however, not to show each other something that's still in the idea stage because … it's interesting, when it's in that stage, it's a little bit like a baby that's mewling and puking and it's not that attractive and nobody can understand how it can grow into an adult that you want to keep around. It's better to let it have a little bit of a chance to grow before you show it to anybody, especially if they're going to be honest with you.

PSW: Do you have other people that you rely on?

Alan Alda: I do, especially with this play. I very much respect the work of Peter Parnell who wrote *QED*. After I'd been working on it for a couple years, I sent him a copy and he had some very supportive and interesting thoughts on directions I might explore.

And I've shown it to scientists to try to check the science. That's the part I find a little difficult, because, for instance, I don't think the equipment they used to look for new elements is used anymore. I had to figure out for myself how the piezoelectric balance worked with the electrometer—what was actually going on. I went to her laboratory in Paris and I was shown around. Unfortunately, when I went there I hadn't studied enough of the descriptions by her of how she did it. I saw the equipment but couldn't quite figure out how it worked. But it stayed in my head, the image I had of that equipment, and then when I would go back and read her descriptions of it, I started to get the idea. I think I understand it now. I explained it to a couple of audiences and also to the actors with a roll of toilet paper. I think I have the right idea and at least it gives them a chance to understand they've got these two machines and they're balancing charges.

PSW: You went to Paris and retraced her steps?

Alan Alda: I tried to get as much of a personal feeling for how she lived as I could. I walked from the Sorbonne where she taught to 5 rue du Banquier where she had her affair with Paul Langevin. I really did want to see if I would be out of breath when I got there, because it was a longer trip that I thought. I thought it was just a few blocks, but you had to pick up your pace if you wanted to get there between classes. I never tried to get into the classroom where she taught; it didn't occur to me to try.

I went into her lab at the Curie Institute and the guy showing me around pulled back the glass door behind which was the page from her journal the day she discovered radium and he held up a Geiger counter to it and it was clicking like mad. Well, not like mad, that's

an exaggeration, but any clicks you get off a 100-year-old piece of paper are a little scary to me. You may be more brave about this, but I don't want to get next to things that are radiating.

Maybe you have some insight into this. When she worked in that lab breaking up the slag, boiling it in pots with fumes, dust, coal dust from the stove covering everything and sometimes contaminating their experiments. It would seem to me she would go home with clothing that was contaminated with radiation and then pulled her children on her lap. I don't understand why they all weren't sick. When Irène died of radiation poisoning it was probably because she was doing similar work in her lab. Ève lived to about 102. She never did the work in the lab so she apparently didn't get sick from the clothing. Marie only had two or three dresses during this period, I think. So, they probably were all at one point or another covered with radioactive dust. Why didn't the kids get sick? I don't get that. Is it just that it wouldn't penetrate their own clothing?

Radium does burn skin. I love how the audience has a double reaction when they hear about Pierre experiments with radium on his skin. They're appalled. You hear a gasp when you see the sore on his [Pierre's] arm. But when you see Marie's excitement at the effect it has on skin cells, they laugh.

They knew immediately that if it would kill normal cells, it would probably eradicate tumors. The funny thing is that they saw the effect it had on normal cells. Very soon, doctors were injecting tiny pellets of radium through very small tubes directly to tumors so that they wouldn't affect the healthy cells around the tumors. Knowing that, how could she continue to believe that she wasn't making herself sick with what was relatively unprotected contact with these radioactive elements? She took some precautions, but my impression is that she asked the workers in her lab to take more precautions than she had taken. She just must have been determined to understand at any cost. It's like the explorers who went over the edge of the earth to find the continents. It's really amazing heroism.

PSW: What's next for *Radiance*?

Alan Alda: I know there's an audience that's moved by this. I see them at the theater every night and I want to reach that audience. I want them to have a chance to experience this amazing portion of her life. So, we're exploring the possibilities of productions in Europe, Australia, China, and around the United States.

There may be a production in New York. It's not that important to me that it be in New York; it's not like I gotta have this on Broadway. I'm not sure a big commercial production is the right venue for this play. I think it has wide appeal, but people first have to believe that they're going to want to see it. And there may not be a mass audience right away; we might have to build that. A smaller theater in New York would be terrific and I think we could fill it the way we're filling this theater in LA.

I just want it shown around the world. I *really* want to see what they think of it in France. I don't know if they would appreciate an American writing a play about one of their great heroes, especially because she had a lot of problems from the French culture of the time; they might not care for that. But on the other hand, they might be glad. They revered her before, as soon as she discovered radium, and then they went back to revering her again when she was selflessly devoting herself to the French cause during the First World War. They outfitted a bunch of mobile X-ray units and she drove one of them around the front herself, into danger. Her daughter did the same thing. She even wanted to melt down her two gold medals from the Nobel Prize for the war effort but the government wouldn't do it. They buried her in the Panthéon.

PSW: She was the first woman there for her own work.[5]

Alan Alda: I would imagine, [France] wouldn't mind seeing what one of their great heroes had to go through at a particular point in their history. It would be nice to go hear it in French. If they do it in China, I'm definitely going!

Acknowledgements

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References and Notes

1. www.nobelprize.org/nobel_prizes/chemistry/laureates/1911/
2. P.S. Weiss, *ACS Nano 5*, 6092 (2011)
3. A. Alda, *Radiance: The Passion of Marie Curie* (2011)
4. *Categorically Not!* www.kccole.net
5. Marie Curie was the first woman to be buried in Panthéon on her own merits when her ashes (and Pierre Curie's) were reinterred there in 1995.

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A Science Solution to Closed-Mass System Products*

by Michael Wadleigh and Birgit van Munster

Science is responsible—in whole or in part—for nearly all modern products. The creation of these products is causing the depletion of finite natural resources at an accelerating rate. In our globalized world, 7 billion humans, soon 10 billion, aspire to have the same products, but have (per capita) only 140 x 140 meters of ever-decreasing land resources from which to make products. For these reasons, chemists and other scientists should take a leading role in educating humanity about the fact that we live in a closed-mass system in which the use of finite resources (mass and energy) must be *minimized* and their use in time and space *maximized*. In other words, scientists must help educate the public about the following science principle: "In a closed mass system, make one product that lasts and is shared."

. . . the closed-mass rule for a product is to make one that lasts and is shared.

Infinite vs. Finite

First, some background and perspective on products versus resources and the laws of man versus the laws of nature. Around 230 years ago, King George III of Great Britain was furious. Trailed by a minister, the monarch was striding his battlements glowering at gleaming rods, lightning conductors, spaced at intervals around the ramparts "guarding" his castle.

"Ben was my friend," the King wailed in anguish, "how could he do this to me! The bastard," he bellowed angrily, "insurrectionist, revolutionary, damned blasted rebel! Abolish my former decree!" he ordered the minister. "Franklin's lightning conductors are hereby banished from my kingdom!"

"As you wish," replied the minister with a weary sigh and a grim wag of the head, "but no good will come of it, sire. You cannot repeal the laws of nature."

Around 230 years ago, the multitalented scientist Ben Franklin and other American revolutionaries fought an eight year war and established the first and prototypical modern free-market democracy. From the Greek word δημοκρατία (dēmokratía), meaning "rule of the people," this new democracy was based upon laws of man, which could be made, changed, and repealed. At this same time, a far more momentous change began: the third and present age of Homo Sapiens' development, the age of Industrial Producers. The first age of Hunter Gatherers began 130 000 years ago; the second, of Cultivator Herders began 12 000 years ago. In the present Industrial Age, humans use external energy sources to make Products. Nearly all of these products were created through science.

For a common understanding of Homo Sapiens' development, there are three, and only three, fundamental variables to consider: **H** for Humans and **P** for man-made Products, both of which are exclusively from **R**, natural Resources, which are finite. These variables exist in a closed-mass system in which matter is not increasing, even the solar energy coming in is finite.

+P. Product making, (+P), has massively increased at the expense of Resource depletion (-R). If 230 years ago, total manmade production was 2 "product units," then, by comparison, 40 years ago it was about 55 units, today it is about 220 units, and 40 years from now it is projected to be about 880 units. It could be much more. (Many planet changes, including climate change, are of course direct results of manmade products.)

+H. Human numbers have also increased (+H). Two hundred and thirty years ago there were only 800 million humans, 40 years ago 3.4 billion, today 7 billion,

*The Homo Sapiens report was presented by Michael Wadleigh on 31 July 2011 at the IUPAC Congress in San Juan, Puerto Rico.

and in 40 years there will be 3 billion more. It took 130 000 years to reach a population of 800 million on the planet, currently 800 million are added every 10 years.

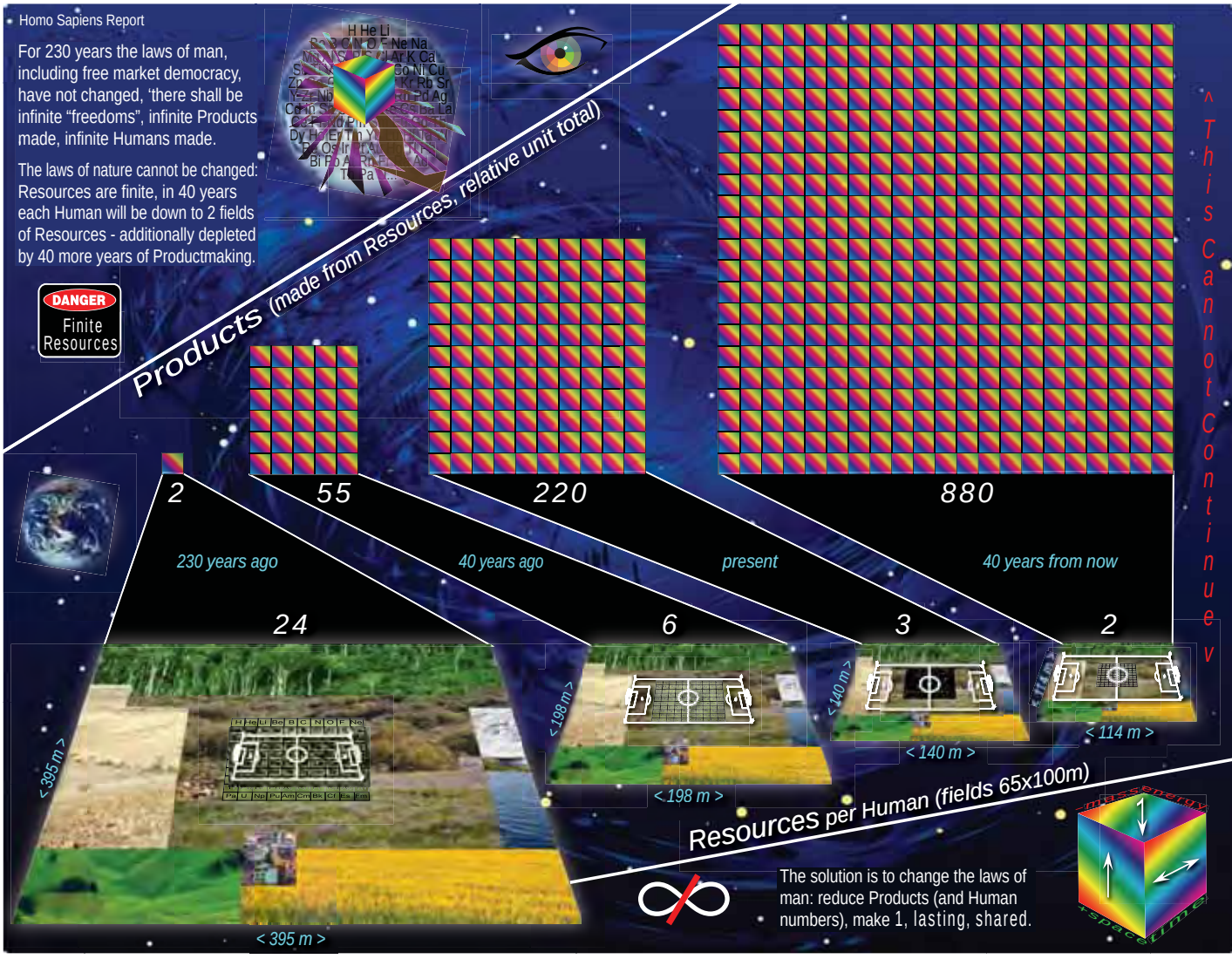
And all of this collides with the laws of nature:

-R. Humanity's planet is a closed-mass system. Therefore, planet resources per human are rapidly and drastically decreasing, **+H = -R/H**. As a resource measure, a standard football/soccer field (65 x 100 meters) will be used because its size is known worldwide:

Two hundred and thirty years ago, each human, per capita, had about 24 football fields of average land and freshwater resources from which to get food, water, and make products (plus about 48 fields of ocean). By 40 years ago, each human's resources had crashed to 6 fields; today each human has 3 fields; in 40 years it will be 2 fields or less.

+P +H = -R. The unbiased conclusion of scientists who have examined resource facts is that in 40 years, when there are 9–10 billion globalized humans all aspiring to and working for the same product-rich good life, these 2 fields—already depleted by 230 years of industrial production—will not be enough for a high standard, quality human life —**if** the laws of man aren't changed.

Extraterrestrial solution. For good manmade closed-mass system rules to follow, humanity can look to



some extraterrestrial examples. In the International Space Station, which is only infrequently re-supplied, or in proposed interplanetary expeditions, which have no re-supply, the closed-mass rule for a product—whether it is a t-shirt, a computer, a guitar, or a whole spacecraft—is to **make one that lasts and is shared** (this ensures minimum mass-energy and maximum space-time).

Nearly everything on the space station is designed to last and be shared. There are few private possessions, and the exclusive possession of products is not thought to be prestigious or esteemed. On earth, as in space, everyone wants the same products. To make this possible with extreme finite resources, everything is made to last and is shared—there are libraries for entertainment, clothing, communication, transportation, everything.

Terrestrial solution. In order to reinforce this lesson here on earth, students are given the information above and asked to imagine that they (and everyone) have only 3 fields of average resources, which in 40 years will be 2 fields or less. Then, they are asked to make rules for their land. The students become conscious that the 3 fields are a "closed-mass system" and they make the same elemental product rules as the people residing in space: **make that one lasting, shared thing** to be the most useful, beautiful, least damaging, etc.

Non-solution. Turning to the "real world" of human rulemaking in earth's closed-mass system, the creation of infinite products from finite resources is not possible, and yet it is tried. The present, universal manmade rule is to make an infinite number and variety of products, "make many that don't last and aren't shared," the inverse of the closed-mass rule. With ever-fewer and depleted resources per human this cannot continue.

Take metals as an example. Metals are one of the most valuable resources upon which industrial production is built. In sweeping generality, proven reserves for global metals average less than 40 years, while recycled content in new products averages less than 20 percent. Both are extremely difficult to increase because of disorder, dispersal, and material and energy requirements. And yet, the global plan to secure the future is to "make many products that don't last and aren't shared with increased efficiency and recycling."

A fundamental law of nature and science is entropy: "usefulness made unavailable, you touch it you lose, there is no something for nothing, no gain without pain, no free lunch." In sustainable development for humanity, the solution is not to be found through increased efficiency and recycling, while leaving the primary action of making ever-more products that aren't shared and that don't last "off the table." Yet, that is the plan.

Nature vs. Nurture

Homo Sapiens are by nature curious, attracted to novelty and to infinities, including "freedoms." For 130 000 years, these were largely satisfied by infinite new experiences, new knowledge, new understandings, by activities and other humans, not by manmade products. Only in the present brief age of massive Industrial Production has humanity been nurtured and taught to seek gratification and prestige in infinite novel products that don't last and aren't shared.

Through laws of men, Homo Sapiens have constructed global political, economic, and educational institutions that promote uninformed, "infinite" behaviors, including the doctrine of "make many that don't last and aren't shared." In a closed-mass system, these behaviors cannot secure a positive future for humanity. Our manmade institutions, such as science academies and institutions, need to help change our nurtured, learned behavior from "infiniteness" to "finiteness." Such a change is entirely possible and is consistent not only with Homo Sapiens' nature, but also with its most worthy characteristics and with the laws of nature.

Conclusion

Until age 91, an American professor, a crotchety, no-nonsense, daughter of the revolution, taught a course on language and culture at Akron University to Ph.D. science students from all over the world. "Science means knowledge," she'd say in a raspy cigarette and whiskey voice, banging her fist on a desk and making students jump. "And you knowledge 'knowers' must be leaders. And as leaders, you must never forget that you owe the people your very best judgment."

Laws of nature cannot be repealed. Laws of man can be changed. While other institutions fail, we leaders, as individuals and organizations, owe humanity our best judgments.

Scientists, governments, and businesses can take the lead on a global initiative in developing and communicating a common understanding of humanity's closed-mass system of product creation in order "to secure the Blessings of liberty for Ourselves, and our Posterity," as Ben Franklin and the revolutionaries 230 years ago timelessly wrote.

View full report at the website below.

Michael Wadleigh is an Oscar-winning film director and co-founder of The Homo Sapiens Foundation with Birgit van Munster who worked for over 20 years in sustainable development in Africa. The Homo Sapiens Foundation <HSfound@gmail.com> is part of a project of UNESCO's education for sustainable development.

www.hsfound.org

Chemistry's Role in Delivering Sustainable Development

A Report from the 2011 World Chemistry Leadership Meeting

by Colin Humphris

In June 2012, the world's leaders—representatives of global institutions, industry, civil society, and science—will meet in Rio for a World Summit. They will celebrate the 20 years of sustainable development since the first Rio Earth Summit that shaped the agenda for improving the health, well-being, and living conditions for all people, without harming future generations. This year, the Summit will set out the key challenges the world continues to face and new ways to address them.

Chemistry has made an immense contribution to the development of the world and will be expected to play a key role, in new ways, for the future. These themes were at the heart of the International Year of Chemistry in 2011 (IYC), which set out to:

- enhance societies' understanding and appreciation of the contributions of chemistry to date
- identify the pivotal role chemistry will play in addressing the profound challenges of sustainability for the future
- stimulate interest in the study of chemistry by the young men and women who want to change the world for the better

Mario J. Molina, winner of the 1995 Nobel Prize in Chemistry (center), with Jung-Il Jin, IUPAC Past President (left) and Nicole J. Moreau, IUPAC President.

The World Chemistry Leadership Meeting (WCLM), held 2 August 2011 in San Juan during the IUPAC General Assembly, attempted to prepare the ground for the debate on the future of chemistry and sustainable development. The discussion was placed in context with a personal message from the UN Secretary General Ban Ki-Moon to the chemistry community (see letter on page 5). He linked the UN agenda and the role of the IYC strongly. His message was a call to arms for the chemistry community to contribute more to the challenges the world faces.

In response, the WCLM was structured to address these questions:

- What is holding chemistry back? Is chemistry taught and structured in ways appropriate to the new societal needs?
- Can chemistry deliver more through collaboration with other sciences and technologies?
- How should IUPAC promote the contribution of chemistry to sustainability?

The meeting comprised plenary lectures from UNESCO, the African Academy of Sciences, the United Nations Environment Protection agency (UNEP), the International Council for Science (ICSU), and the chemical industry. Breakout discussions were organized with the themes of Energy, Water, Agriculture, Health, and Green Chemistry. The plenary speakers and contributors were as follows:

- Nicole Moreau, IUPAC President
- Gretchen Kalonji, UNESCO Assistant Director General for Natural Sciences
- Berhanu Abegaz, African Academy of Sciences Executive Director
- David Piper, UNEP Chemicals Branch, Deputy Branch Head
- Giorgio Squinzi, CEO Mapei snc & President CEFIC
- Mario Molina, 1995 Nobel Prize winner
- Manuel Limonta, ICSU, Director of the Regional Office for Latin America and the Caribbean

- Ferdi Schüth, Max Planck Institut für Kohlenforschung, Mülheim an der Ruhr, Director
- David Evans, Syngenta, Former Research Director
- Simon Campbell, FRS, Senior Vice President Worldwide Discoveries for Pfizer
- Alejandra Palermo, RSC Pan African Chemistry Network
- Philip Jessop, Queen's University, Kingston, ON, and GreenCentre Canada, Technical Director
- Kazuyuki Tatsumi, IUPAC Vice President

Participants of the WCLM and the Congress also took part in a preview of a novel on-line debate entitled "The Future of Sustainable Chemistry" organized by the Dow Chemical Company, one of the IYC2011 Global Partners. This activity, broadcast on the internet on 17 August 2011, attracted 4000 participants, a number greatly amplified through the use of social media for the live debate. Over 10 000 people have subsequently viewed parts of the video.

A number of consistent themes emerged from the WCLM.

1. The Opportunity for Chemistry at the Rio + 20 World Summit

The importance of chemistry was highlighted both as a tool for understanding our world and as a key part of the delivery of solutions to the really big challenges. These challenges relate to the sustainable boundary conditions for the planet; biodiversity; the carbon cycle, and in particular CO_2 and other key greenhouse gases; the nitrogen cycle and efficient nitrogen fixation; land use; freshwater availability; environmental pollution due to human activity; air quality and aerosols; ocean acidification; and the ozone layer. The latter provided a good example of the potential of chemistry to solve problems through the mitigation of the deleterious impacts of CFCs. Understanding the chemistry of ozone depletion eventually enabled policy change, the innovative development of refrigerants gases by industry, and protection of the ozone layer.

The chemistry underpinning most of our current processes and products was developed during a time of cheap, abundant raw materials. Today's petrochemicals industry depends on many millions of years of photosynthesis, and there is pressure to base future industry on complete planetary cycles that return what is used with zero waste. This is particularly true of the carbon cycle, as we seek new ways of providing the world's energy, and the nitrogen cycle, where the pressure to feed a growing population highlights the imperative to replace the energy hungry Haber-Bosch process. Sustainable chemistry focuses on the use of new renewable resources, to use these or more traditional raw materials with increased efficiency and minimal waste, and to manage product life cycles in new and more complete ways.

We were reminded that many UNEP programs are directed at ill-considered uses of chemistry, and of the impacts these have had on local environments and the people who live there. Often those who benefited least

UNITED NATIONS NATIONS UNIES

THE SECRETARY-GENERAL

MESSAGE TO THE WORLD CHEMISTRY LEADERSHIP MEETING
San Juan, 31 July - 6 August 2011

I am pleased to send greetings to this distinguished gathering of chemists and other scientists, government representatives, leaders of non-governmental organizations and officials from industry.

Your activities can give greater meaning to our commemoration of 2011 as the International Year of Chemistry, and your collective knowledge can contribute to reaching many of the goals of the United Nations.

This observation, which coincides with the centenary of the awarding of the Nobel Peace Prize in Chemistry to Marie Curie, has special significance to the United Nations family. Marie Curie's daughter, Eve Curie Labouisse, was an avid humanitarian who supported the United Nations throughout her life. Known as the "First Lady of UNICEF," she travelled extensively to promote UNICEF's work.

This personal connection between the United Nations and the daughter of one of the world's greatest chemists is emblematic of the larger link between chemistry and our work. Discoveries in the field of chemistry have paved the way for major global progress in United Nations campaigns, covering the full spectrum from personal health to sustainable development.

Advances in chemistry are helping the United Nations tackle the challenges of climate change, water management and energy production, conservation and use. Chemistry produced most of the world's life-saving therapeutic innovations. And chemistry holds tremendous potential for further progress on all of these fronts.

That is why the United Nations is proudly promoting the International Year of Chemistry. The United Nations Educational, Scientific and Cultural Organization (UNESCO) is working with the International Union of Pure and Applied Chemistry to organize hands-on activities, exhibits and other multimedia events to promote the Year. The aim is to showcase chemistry's potential to make our world a better place.

All of you have the expertise and passion to contribute to this effort. By collaborating on chemistry breakthroughs that benefit humanity, you can improve people's lives and inspire a new generation to carry forward this valuable work.

I wish you great success at this meeting and in our common quest to solve global problems with chemistry's solutions.

Ki Moon Ban

BAN Ki-moon

from the advances in science and technology and economic development, suffered most from environmental degradation in many of the poorest regions of the world. Chemistry needs to pay attention to such situations to ensure that the science is represented objectively and in ways that allow society to appreciate its full potential. Chemists must be prepared to speak out when chemical technologies are used irresponsibly.

There were some blunt messages from visitors to the meeting—"you need to get out more" (and talk with those struggling with the real issues), and "go dating" (chemistry needs the right partners).

The science forum at Rio+20, which is being organized by ICSU and UNESCO, will provide a wonderful opportunity for chemistry's voice to be heard in this way and to be viewed in the context of the contributions of the other science disciplines, engineering, and the social sciences. IUPAC was invited to facilitate the chemistry contribution.

2. Focusing chemistry effectively on the really big challenges

The challenges of sustainable development are much broader than those for chemistry alone. Chemistry will clearly be important but the delivery of solutions will only be possible in collaboration with other scientific disciplines, engineering and technology, and the social sciences. Examination of effective innovations shows that these typically involve more than technology change alone. Behaviors must change if energy is to be used more efficiently; we need to build African analytical capability to manage water resources more effectively in Africa; and we have to address the skills of the rural poor if we are to increase agricultural productivity sustainably. But can chemists work in such collaborative ways? There were some blunt messages from visitors to the meeting—"you need to get out more" (and talk with those struggling with the real issues), and "go dating" (chemistry needs the right partners).

Many suggestions were made to increase the contributions of chemistry:

- Young people want to make a difference and work on the world's big challenges. Chemistry needs to be seen as relevant to their communities, with more emphasis on solving practical problems. This point was made particularly strongly for Africa, where chemistry research is changing to be more relevant to local needs.
- A shift in teaching and academic research is required to emphasize inquiry-based learning, teaching young people to think and to solve problems through teamwork. Students need to develop the skills to work in collaborative environments. Industry made clear that it needs scientists capable of working with engineers, down the value chain to the eventual customers, and with governments and others who represent society.
- Chemistry courses should attune students to possible impacts on people and the environment (toxicology and eco-toxicology).
- From society's perspective, the big wins for academic chemistry lie increasingly in relevant applied science.
- The landscape of corporate industrial research has changed dramatically. The pharmaceutical industry is striving for completely new approaches to drug discovery and development, most probably involving new forms of public-private partnership among universities, governments, and industry.
- Most participants felt that chemistry needs to regain its reputation as a positive driver of innovation and to shed associations with "pollution" and "poisons."
- Much of the discussion focused on the benefits of working with others and the recognition that chemistry could deliver so much more if effectively aligned with partners: the funding agencies, those with policy responsibility in governments and UN agencies, the industries that apply new chemistry knowledge, and the civil society, the ultimate consumer. We just need to learn how to communicate better with them all.

3. Life Cycle Analysis

One particular difficulty is to know whether new developments or policy changes actually improve sustainability. Objective measures of the impacts are required. Today the benefit or impact of many proposed "green" technologies are often far from clear—arising from incomplete life-cycle understanding, the

complexities and distortions of subsidies, or the views of narrow interest groups. Chemists can bring much-needed objectivity (e.g., through thermodynamics, and the nomenclature and standards that are required). During the Energy breakout, it was possible to rank the favored alternatives by their overall energy benefit, to show the limiting conditions where there is agricultural competition between food and energy production, while highlighting the importance of efficient storage and conservation technologies.

Time for Change?

"Chemistry needs an overhaul if it is to solve big global problems and advance fundamental understanding" was the challenge to the community from George Whitesides and John Deutch at the beginning of the International Year of Chemistry.[1] There were few dissenters at the WCLM, and indeed there was strong support from our guest speakers. Many of the issues related to the existing educational and research structures, and the processes and funding of applied research, as well as the ways research is changing in governments and in industry. There must be an emphasis on the often forgotten "A" in IUPAC. Herein lies the heritage and challenge of IYC. It is clear that chemistry's best is not behind it, but there is a need to refocus on the practical issues faced by society to realize its full potential; on drug discovery certainly, but also on other challenges such as harnessing solar energy, storing energy, the supply and management of freshwater, low-energy routes to nitrogen fixation and agricultural productivity. This should be a core debate for the chemistry community as it seeks to build on the momentum of IYC. It is also directly relevant to the strategic debate about the roles, priorities, and structure of IUPAC, which is just starting in the wake of IYC.[2] Key issues will be the role of IUPAC in addressing public perceptions of chemistry and the influence it can have as an NGO at the international level. It is all chemistry whether we call it green or sustainable.

My personal view is that the biggest challenge is to ensure effective ongoing innovation; a term I am using in the business sense of turning ideas into profitable, sustainable, and relevant business. Chemists need to maintain or even regain a "license to innovate" from society—what we do has to be acceptable. Delivery will be best through active collaboration with the engineers, product designers, those with influence over policy, and those who own the problems. This will involve new forms of public-private partnerships with industry. Building upon IYC, all chemists need to work much harder on society's perceptions, understanding, and appreciation of chemistry. We need to convince the young people who want to change the world for the better, that chemistry is an excellent place to start! A good place for chemistry to start would be Rio.

Attendees to the WCLM participate in "The Future of Sustainable Chemistry," the online forum organized by the Dow Chemical Company and part of the Future We Create series.

Colin Humphris <cjhumphris@btinternet.com> FRSC, was chair of the 2011 WCLM Organising Committee. He is member of the IUPAC Bureau since 2010 and IUPAC Committee on Chemistry Industry since 2004.

IUPAC members closely involved with Colin Humphris in the planning of the 2011 WCLM included Mark Cesa, Doug Templeton, Michael Droescher, Bernard West, and David Evans.

References

1. George M. Whitesides and John Deutch, *Nature* January 6 2011, Vol 469 p. 21.
2. Jung-Il Jin, *Chemistry International* Nov-Dec 2011, Vol 33 No 6, p. 2

www.chemistry2011.org/participate/activities/show?id=198

Analytical Chemistry

by Brynn Hibbert, division secretary

The Analytical Chemistry Division (Division V) Committee duly convened in the steamy Caribbean island of Puerto Rico. The Spanish colony that had resisted the Dutch and British for 400 years, finally succumbed in the Spanish-American war of 1899. It now hosts cruise ships and international conferences in its purpose-built congress center. Eleven members of the Analytical Chemistry Division Committee came together, under its President Aleš Fajgelj, to plan its activities for the following biennium. Division V tends to be at the heart of collaborations—making chemical measurements is an indispensable part of every activity of every division, and so much of the work of the committee revolves around meeting and greeting friends from across the organization. IUPAC President Nicole Moreau spent time with the group, listening and contributing to the discussions.

Division V has two major subcommittees, the Subcommittee on Solubility and Equilibrium Data (SSED), and the Interdivisional Working Party on Harmonization of Quality Assurance (WPHQA). These bodies turn out a vast number of reports and recommendations, and have contributed to the prominence of the division. The SSED critically evaluates solubility and equilibrium data that have been published in the scientific literature, and produces the majority of the division's published output. In a collaboration with the National Institute for Standards and Technology, the division publishes the IUPAC-NIST Solubility Data Series in the American Institute of Physics's *Journal of Physical and Chemical Reference Data*. Clara Magalhães, the subcommittee chair, reported that the 100th issue of the series will soon be published–a stunning achievement considering each volume is comprised of many parts.

The WPHQA is the focus for metrology in chemistry, an expanding and increasingly important aspect of our work, impacting as it does on decisions made in healthcare, the environment, forensics and all aspects of trade. The IUPAC Technical Report "Metrological Traceability of Measurement Results in Chemistry: Concepts and Implementation" was first published online in June 2011 after 10 years of continuous work by the four authors (P. de Bièvre, R. Dybkaer, A. Fajgelj, D. B. Hibbert. *Pure Appl. Chem.* 2011, Vol. 83, No. 10, pp. 1873–1935; http://dx.doi.org/10.1351/PAC-REP-07-09-39). This is an example par excellence of the long-term view that is often taken by IUPAC in order to prepare thoughtful and important works for the world of chemistry.

The central effort of the division, started in Glasgow in 2009, is the revision of the Orange Book under the editorship of the Division Secretary. *The Compendium of Analytical Nomenclature, 3rd Edition*, the so-called Orange Book, was published in 1997 and—apart from a pioneering online version prepared by David Moore www.iupac.org/publications/analytical_compendium (and interestingly a Catalan version of the second edition in 1987)—has grown old gracefully while seeing the rise of the IUPAC online Gold Book, and enormous changes in the practice of analytical chemistry. The 4th edition of the Orange Book will have a new title, and 11 new and completely revised chapters. Each chapter is being coordinated by an active member of the division and is funded through the project system. If you are interested in this work and think you can help, please contact the appropriate team leader, or the editor (Brynn Hibbert).

The Analytical Division Committee at the San Juan General Assembly (photo Boguslaw Buszewski)

Chapter	Title	Chair
Chapter 1	Fundamental concepts and terms (metrology), chemometrics (and statistics), quality assurance.	Paul De Bièvre
Chapter 2	Sampling and sample preparation	Zoltan Mester
Chapter 3	Methods of analysis depending on measurements of mass and volume	Maria F. Camões
Chapter 4	Separation	Tatyana Maryutina
Chapter 5	Spectroscopic methods of analysis	Yngvar Thomassen
Chapter 6	Mass spectrometry	Zoltan Mester
Chapter 7	Electrochemical methods of analysis	José M. Pingarrón
Chapter 8	Radioanalytical methods	Zhifang Chai
Chapter 9	Surface analysis	Luisa Maria Abrantes
Chapter 10	Thermal methods of analysis	Carlos Castro
Chapter 11	Immuno- and bio-analytical methods of analysis	Jan Labuda

The International Year of Chemistry has seen many contributions from analytical chemistry. Pertinently, we heard of the many activities of our Polish colleagues celebrating the work of Maria Sklodowska-Curie.

The Analytical Division is active on many fronts and is looking forward to the current biennium. It meets in Europe in February 2012 and invites anyone who can contribute to our activities to contact the president.

Organic and Biomolecular Chemistry

by Gerrit Koomen, division president

The mission of the Organic and Biomolecular Chemistry Division (Division III) is to promote the goals of IUPAC in the field of organic and biomolecular chemistry in the broadest sense. To this end, the division consists of a Division Committee and six subcommittees. Together, these promote the formulation and execution of projects on relevant chemical problems, the staging of chemical conferences on important areas of chemistry, the education and professional development of chemists worldwide, the advancement of chemical industry, and the application of chemistry to meet the world's needs. The division is committed to utilizing the talents of chemists from around the world in these activities, and promoting diversity in our membership.

Division elections for the biennium 2012–2013 were held by e-mail in February 2011. The 2012–2013 membership is available on the IUPAC website. During its meeting in San Juan, the division reviewed proposals and assessed progress on current projects. Updates are reported online and are regularly featured in *CI*.

The heart of the division consists of six subcommittees, each of which, in addition to conducting IUPAC projects, is concerned with organizing major international conferences, such as those listed below.

Green Chemistry

The first CHEMRAWN VII prize for Atmospheric and Green Chemistry was awarded to Noureddine Yassaa from Algeria. He received the prize during the 3rd International Conference on Green Chemistry (ICGC-3) in Ottawa, Canada, 15–19 August 2010. ICGC-4 will be held in Foz do Iguacu, 25–29 August 2012 (see calendar, inside back cover)

Organic Synthesis

The 18th International Conference on Organic Synthesis (ICOS 18), 1–6 August 2010, Bergen, Norway, was very well organized and very successful. The Thieme prize in Synthetic Organic Chemistry was awarded to Phil Baran, who presented an excellent lecture and showed how organic synthetic schemes might change drastically in the future. ICOS 19 will he held in Melbourne, Australia, 1–6 July 2012.

Biomolecular Chemistry

The 27th International Symposium on the Chemistry of Natural Products (27ISCNP), held jointly with the 7th International Conference on Biodiversity (ICOB-7), took place in Brisbane, Australia, 10–14 July 2011, under the co-chairmanship of Ron Quinn (Griffith University) and Mary Garson (University of Queensland). The symposium saw an attendance of 180 delegates from over 20 countries. Topics included isolation/discovery, synthesis, chemical ecology, phytochemistry, and biosynthesis.

Photochemistry

The 23rd IUPAC Symposium on Photochemistry was held in Ferrara, Italy, from 11–16 July 2010 under the chairmanship of Franco Scandola. The next meeting (24th in series) is scheduled for Coimbra, Portugal, 15–20 July 2012. The scientific chair is Hugh Burrows.

Structural and Mechanistic Chemistry

The 20th International Conference on Physical Organic Chemistry was held in Busan, Korea, from 22–28 August 2010, under the chairmanship of Dae-Dong Sung. ICPOC21 will be held in Durham, UK, 9–12 September 2012.

Biotechnology

The 14th International Biotechnology Symposium was held in Rimini, Italy, between 14–18 September 2010 under the chairmanship of Fabio Fava and Francesco Nicotra. IBS 2010 hosted over 50 invited speakers and 2200 scientific papers from 84 different nations. The 15th IBS 2012 will take place in Daegu, Korea, 16–21 September, under the chairmanship of Young Tae Yoo.

Chemical Nomenclature and Structure Representation

by Ture Damhus, division secretary and Richard Hartshorn, division president

The Chemical Nomenclature and Structure Representation (Division VIII) met, together with a number of observers, during the General Assembly in San Juan. There were also meetings in various project groups just before and just after the division committee meeting. A list of some of the new and ongoing projects provides an impression of the breadth of the division's work:

- Organic and inorganic preferred IUPAC names (PINs)
- basic guidelines for organic, inorganic, and polymer nomenclature (colloquially, the *Essentials*)
- nomenclature of flavonoids
- glossary of small molecules of biological interest
- a number of polymer-related projects, often designated as joint projects between Division VIII and Division IV (Sub-Committee on Polymer Terminology)
- contact to ISO working group on nanotechnology terminology and nomenclature
- new project on inorganic polymer nomenclature
- participating in workshop arranged by the European Commission's Taxation and Customs Union on the use of chemical names in customs declarations and translation of such names into all the EU languages
- a number of projects on the IUPAC International Chemical Identifier

One project distinguished itself by being very close to completion when we met in San Juan: the *Principles of Chemical Nomenclature* book, edited by division committee member Jeff Leigh. The book was published in November 2011, see the Jan-Feb 2012 *CI*, p. 26 or <www.rsc.org/shop/books/2011/9781849730075.asp>. Jeff Leigh was applauded by the division committee for his significant work in pulling together a volume written by a team of 10 authors with initially very different views and styles!

The planned 4-page *Essentials* flyers, intended for a very broad audience, had been designated a 2011 IYC activity, and we noted that the projects were moving, although completion in 2011 will not be feasible.

The committee also noted that planning was underway for a workshop on chemical nomenclature in conjunction with the EU customs organization. This workshop was held in November 2011 as part of IYC activities and will be described in a separate article in *CI*.

During the Division VIII meeting, the committee had discussions with visitors from the Division IV Subcommittee on Polymer Terminology about coordinating the many polymer nomenclature and terminology projects. Other visitors included representatives from the IUPAC Committees on Chemistry Education (CCE) and on Chemistry and Industry (COCI), who gave updates on the work of those two committees. Division VIII also sent representatives to attend the meetings of CCE and COCI as well as other IUPAC bodies. Indeed, the Division VIII meeting was scheduled in such a way to allow representatives to attend at least some of the meetings of other divisions.

Division VIII has a very large Advisory Subcommittee. The name is misleading; it is really not a *sub*commit-

tee, but a separate group of interested individuals that the division committee can use as a sounding board. It is a forum where questions and comments are often exchanged. The division welcomes anyone interested in the ongoing discussions to join the Advisory group webboard.

Chemistry and the Environment

by Willie Peijnenburg, division secretary

As usual, the biannual meeting of the IUPAC Division on Chemistry and the Environment (Division VI) was devoted mainly to monitoring progress of the projects carried out within the umbrella of the division, to review incoming project proposals, to exchange information on issues of relevance to the division and to its sub-committees, as well as to discuss division business issues in terms of budget, representation, planning of future activities like division meetings and conferences, and modification of the division rules in order to have them in agreement with the bylaws of IUPAC. Sixteen division members attended the meeting; three apologies for absence were received. In addition, three enthusiastic Young Observers attended, two of whom will be actively involved in future division activities.

The biggest change in the future composition of the division is that Titular Member Keiji Kanaka (Japan) after many years of faithful service to IUPAC will be replaced by Guibin Jiang (China), as Kanaka's maximum term of service expired in 2011. Ten new national representatives will be part of the division in the 2012–2013 biennium.

Following the division meeting, two symposia were organized by division members Laura McConnell and Hemda Garelick as part of the 43rd IUPAC World Congress.

Subcommittees

At the moment, three subcommittees are operational:

- Subcommittee on Environmental Compartments
- Subcommittee on Biophysical Processes
- Subcommittee on Crop Protection Chemistry

A fourth subcommittee (Food Chemistry) is operational at a rather low profile. As the topic of food chemistry is of relevance to IUPAC, it was decided that the incoming president of the division (Laura McConnell) will make a last effort to revitalize the subcommittee. Unless within a period of about one year an active group of scientists is found that are willing to serve, the subcommittee will officially be terminated. Another option that will be investigated is to include the topic of food chemistry in the Subcommittee on Crop Protection Chemistry.

A new topic that was raised while discussing the activities of each subcommittee was "Green Chemistry." IUPAC is considering how to revive the topic of Green Chemistry, which would likely involve the active participation of the division. One of the considerations for the division is whether or not to establish a new subcommittee on sustainable chemistry, possibly replacing one of the existing subcommittees.

Projects

Currently, 10 projects are running, eight have been completed successfully, and two projects had to be terminated because of lack of progress. Thereupon, eight proposals for new projects are under consideration by the division committee. One of the highlights of the activities of the division is the publication of a series of books within the framework of the IUPAC-Wiley Book Series on "Biophysico-Chemical Processes in Environmental Systems." Unfortunately, the senior co-editor on this series, Prof. Huang, passed away two years ago. The division committee supported the proposal to appoint Prof. Xing (University of Massachusetts, Amherst) as the new co-editor.

Detailed information on the various projects may be found at the IUPAC website.

Recently Published

The 3rd volume in the series "Biophysico-Chemical Processes in Environmental Systems" was published in May 2011: *Biophysico-Chemical Processes of Anthropogenic Organic Compounds in Environmental Systems,* Baoshan Xing, Nicola Senesi, and Pan Ming Huang (eds.) John Wiley & Sons, 2011, ISBN: 978-0-470-53963-7. see www.wiley.com/WileyCDA/WileyTitle/productCd-0470539631.html. This book is the outcome of IUPAC project 2008-001-1-600

www.iupac.org/web/ins/2008-001-1-600

Engineered Nanoparticles and the Environment: Physicochemical Processes and Biotoxicity

Engineered nanoparticles (ENPs, 1-100 nm) are found in an increasing number of daily products (such as lotions, shampoos, socks, and toys) and applications (e.g., biomedical, electronic, and environmental) due to the rapid development and use of nanotechnology. Nanotechnology is one of the most promising new technologies of the 21st century and will have dramatic impacts across all scientific fields. Due to their anticipated high-volume production and widespread use, ENPs will be introduced into the environment from intentional application, accidental release, and disposal at the end of the life-cycle of ENP-containing products. As a matter of fact, it has been reported that ENPs have already entered the environment as a result of ENP-containing paints.

Presently, the development of ENPs and their applications have outpaced the research on their potential health and environmental risks. Recent toxicological data do raise concerns over the environmental and health impacts of ENPs, which will be largely determined by their fate, mobility, and bioavailability. There is a urgent need for a comprehensive and updated book to systematically collect and integrate all the latest information, data, and knowledge on the source, release, exposure, bioavailability, transport, transformation, and fate and modeling of ENPs in the environment.

With a systematic and interdisciplinary approach, this project will bring together world-renowned international scientists to integrate the latest discoveries, development, and future prospects of ENPs in the environment and various ecosystems. The book that is envisioned as this project outcome will be useful for the sustainable development of nanotechnology, and it will be a valuable resource for students, professors, scientists, engineers, and professional consultants. It should also inspire talented young people to take part in this important area of research.

For more information, contact Task Group Chair Baoshan Xing <bx@pssci.umass.edu>.

www.iupac.org/web/ins/2011-019-1-600

Terminology and Nomenclature of Inorganic and Coordination Polymers

IUPAC Chemical Nomenclature and Structure Representation Division (Division VIII) is tasked with the development of unambiguous structure-based chemical nomenclature for a scientific community, which, by habit, establishes its own naming conventions as the need arises. Accordingly, the division's work has to be conducted against a background of names, the usage of which is entrenched in the literature and which in many instances will be retained regardless of IUPAC recommendations. Nowhere is this more evident than in the naming of polymers, for which structure-based nomenclature has limited applicability such that the polymer community has long-preferred source-based over structure-based nomenclature.

By working in cooperation with the Polymer Division, source-based nomenclature of organic polymers has been systematized such that the two systems now sit comfortably side-by-side. However, the same cannot be said of the nomenclature of inorganic and coordination polymers for which only a structure-based system has been elaborated. To date, the recommended nomenclature of regular single-strand inorganic and quasi-single-strand inorganic and coordination polymers is governed for the most part by the same fundamental principles as those of single-strand organic polymers. The names are those of constitutional repeating units (CRU) prefixed by 'poly', but also by catena for linear chains, and where necessary with other structural descriptors and designations for end groups. Quite properly, the CRUs are named by the nomenclature rules for inorganic and coordination chemistry, which differ from those of organic chemistry. However, the catena prefix is redundant and has been rarely if ever used by the polymer community. In the 1985 document there are also names such as oxo, chloro, and bromo which in the 2005 edition of the Red Book have been superseded.

There are new metallocene-based polymers, particularly those of ferrocene, which have by custom been accorded source-based names [e.g., poly(ferrocenyldimethylsilane)], thereby using one of the methods of organic polymer nomenclature. Likewise, there are new inorganic-organic hybrid polymers for which nomenclature rules have never been elaborated. In addition, the inconsistencies that arise from the preferences of the polymer community set against the rigorous requirements of an exclusively structure-based nomenclature system are abundant and evi-

dent. By way of illustration, the polymer—$[Si(CH_3)_2O]_n$—would now be named by inorganic chemists as catena-poly[(dimethylsilicon)-μ-oxido], by polymer chemists familiar with organic structure-based nomenclature as poly[oxy(dimethylsilanediyl)], and in accordance with tradition as poly(dimethylsiloxane). Thus, notwithstanding the need to update the 1985 document (*Pure Appl. Chem.* 57, 149–168 (1985); doi:10.1351/pac198557010149) and given the very significant advances in the subject area that have been made since that date, this is the right time to start rethinking the recommended nomenclature of tractable inorganic and coordination polymers that addresses the practices of the polymer community while respecting the concerns and requirements of inorganic chemists, whose interests in such macromolecules often stem from a quite different perspective.

For more information contact Task Group Chair Richard G. Jones <kapitimana@googlemail.com>.

www.iupac.org/web/ins/2011-035-1-800

Definitions of Transfer Coefficient and of Partial Charge Transfer Coefficient in Electrode Kinetic

In the first two editions of the IUPAC Green Book, the transfer coefficient for an electroreduction reaction, denoted by α_c, was defined as $-(\nu/n)\ (RT/F)\partial \ln I_c/\partial E$, where I_c is the cathodic current at constant reactant concentration on the electrode surface, E is the applied potential, n is the number of electrons involved in the overall reaction, and ν is "the number of identical activated complexes formed and destroyed in the completion of the reaction." While the dimensionless quantity $(RT/F)\partial \ln I_c/\partial E$ is a directly measurable experimental quantity, the estimate of the two quantities n and ν requires some mechanistic considerations; this explains why this definition has been almost never used in the literature. In the third and most recent edition of the Green Book, the quantity ν was removed from the definition of the transfer coefficient, to comply with a definition adopted in many textbooks and dating back to the pioneering work of Butler and of Erdey-Gruz and Volmer. However, the deletion of the correlation between n and ν makes the significance of n ambiguous. This ambiguity has led to misinterpretations and erroneous mechanistic conclusions by many inexperienced researchers. A different school of thought, pioneered by Bockris and Gileadi, has identified the transfer coefficient with the directly measurable quantity $-(RT/F)\partial \ln I_c/\partial E$, independent of any mechanistic consideration. The present collaborative effort is aimed at critically evaluating the concept of transfer coefficient, proposing that its definition be based entirely on measurable quantities, and indicating correct procedures to exploit the experimental value of α_c for the elucidation of electrode reaction mechanisms.

The partial charge transfer coefficient, denoted by λ, is commonly regarded as the positive or negative fraction of the electronic charge $|e|$ that a molecule transfers to the electrode upon its adsorption on it. This is clearly an extrathermodynamic quantity, in that it cannot be estimated without having recourse to some modelistic assumption. In fact, the division of the bonding electrons into parts pertaining to the adsorbate and to the electrode is somewhat arbitrary. λ is often estimated by measuring the thermodynamic quantity $l \equiv -(\partial\sigma_M/\partial\Gamma)_E\partial/F\partial$ called "electrosorption valency", where $\partial\ \sigma_M$ is the charge density on the metal and Γ is the adsorbate surface excess; l includes contributions other than λ that must be estimated and subtracted from l in order to estimate λ. The partial charge transfer coefficient can also be estimated by measuring the dipole moment of the metal-adsorbate bond (e.g., the Me-S bond for thiol adsorption on a metal Me), since λ is expected to increase with the covalent nature of this bond, and hence with a decrease in its polarity. A further goal of this project is the definition of the partial charge transfer coefficient and a critical evaluation of the extrathermodynamic procedures adopted for its estimate.

For more information, contact the task group chair Rolando Guidelli <guidelli@unifi.it>.

www.iupac.org/web/ins/2011-038-1-100

IUPAC Provisional Recommendations are available for review online

http://media.iupac.org/reports/provisional

The Chemical Element—Chemistry's Contribution to Our Global Future

Javier Garcia-Martinez
and Elena Serrano-Torregrosa (editors)
ISBN: 978-3-527-32880-2, 396 pages, June 2011

reviewed by Julia Hasler, ex-UNESCO Programme Specialist, currently consultant in International Scientific Development and Cooperation, UK

The recently concluded International Year of Chemistry (IYC) successfully engaged scientists, educators, students, industry, and others in a wide range of chemistry activities across the world. The IYC focused attention on the importance of policies, practices, and attitudes to chemistry and chemistry education in the context of the role of chemistry for our global future. The Year was designed to promote excitement about chemistry and its possibilities, but it was also intended to have an impact far into the future. The success of IYC, therefore, must be measured in terms of how the wider professional chemistry community in science, education and industry takes up the challenges presented during the Year.

The Chemical Element—Chemistry's Contribution to Our Global Future provides the intellectual basis for the future of chemistry in meeting these challenges. The book was launched during IYC with the patronage of UNESCO and of IUPAC and covers topics critically relevant for sustainable development. From international development issues to chemistry's role in contributing solutions to the challenges of water and climate change, editors Javier Garcia-Martinez and Elena Serrano-Torregrosa have overseen nine interesting and inspiring chapters written by contributors eminent in their respective fields.

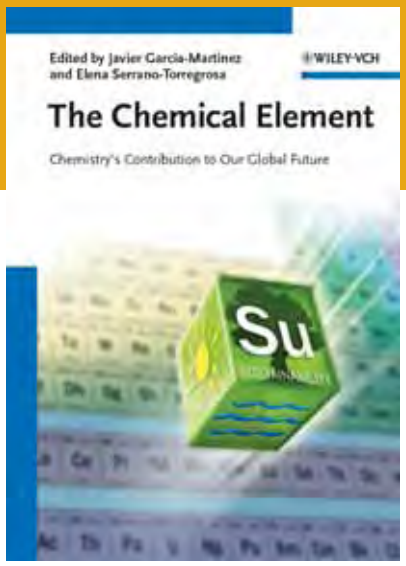
Chapter 1 on "Chemistry for Development" by Stephen Matlin and Berhanu Abegaz provides the framework for the following 8 chapters with a comprehensive review of the importance of science, technology, and innovation for national and international development. The chapter covers the UN Millennium Development Goals (MDGs) agreed by the world's governments in 2000; overviews some NGOs that contribute to these goals through capacity building; illustrates disparities in development, research output, and funding in the world; and finally introduces the main global challenges where chemistry has a critical role to play. The chapter includes over 240 useful references.

Chapters 2 and 3 address the first MDG, which is to eradicate extreme hunger and poverty. Chapter 2, on "The Role of Chemistry in Addressing Hunger and Food Security," by Jessica Fanzo, Roseline Remans and Pedro Sanchez illustrates how chemistry has been the backbone of knowledge in nutrition and food science. The chapter describes the issues and complexities of global hunger, nutrition, and food security and links these to chemistry's influence on the determinants of food security. The authors identify as a challenge the need for chemists to work in an interdisciplinary manner and ". . . highlight the importance of integrating technical interventions with broader approaches to address underlying causes of food insecurity—incorporating perspectives from agriculture, health, water, and sanitation, infrastructure, gender, and education—many rooted in the core science of chemistry."

Chapter 3 on "Poverty" by Mari-Carmen Gomez-Cabrera, Cecilia Martinez-Costa and Juan Sastre, gives a good summary of the concept and historical evolution of poverty, its asymmetry in the world, its causes, the effects on malnutrition and life expectancy, and strategies against poverty. The final section of this chapter addresses the essential role for chemistry in poverty alleviation.

"The Human Element: Chemistry Education's Contribution to our Global Future," chapter 4, by Peter Mahaffy starts with a quote from the UN Resolution declaring 2011 as the International Year of Chemistry: ". . . education in and about chemistry is critical in addressing challenges such as global climate change, in providing sustainable sources of clean water, food and energy, and in maintaining a wholesome environment for the well-being of all people . . ." The chapter focuses on the questions of whether current education in chemistry is equipping the next generation of scientists and citizens to meet the challenges, and what might be done to make this education better. The quotation from Jeffrey Sachs in the epilogue to the book speaks for the importance of this chapter which addresses an area critical for the future: "Professor Peter Mahaffy is compelling in advocating a new way to teach science, one that grips the students through the drama of the human condition. I was convinced and entranced."

The following five chapters cover specific areas of chemistry and their role in sustainable development. Health is addressed by René Roy in a chapter entitled "The Impacts of Synthetic Chemistry on Human Health," which starts with a short historical approach to medicinal chemistry and a summary of the status of present day drug discovery, manufacturing, and usage. The next sections focus on general concepts of drug



design, patent protection issues, drug metabolism, and drug resistance. By way of specific examples, the final sections of the chapter cover antibacterial agents, antiviral agents, Viagra, and vaccines for humans. The reader is left with no doubt of the importance of chemistry for disease prevention and treatment.

Pietro Tundo, Fabio Aricò, and Con Robert McElroy present "The Greening of Chemistry," starting with the history of Green Chemistry, its place in the economy, with China as the example, and a section on awards that support Green research. The chapter continues with an exposition on the different applications of Green Chemistry, such as alternative feedstocks, innocuous reagents, natural processes, alternative solvents, safer chemicals, alternative reaction conditions, energy conservation. This chapter should inspire many a young chemist to greener pastures!

The important topic of water is covered by Maya Trotz, James Mihelcic, Omatoyo Dalrymple, Arlin Briley, Ken Thomas and Joniqua Howard in a chapter on "Water: Foundation for a Sustainable Future." Their introduction provides some basic concepts about global water (e.g, the location of the totality of fresh water on Earth, the range of concentrations of chemicals found in natural waters, and water footprints around the world). The topics of water pollution and water quality, and water treatment technologies comprise the major part of the rest of this interesting review.

Next comes "Facing the Energy Challenges through Chemistry in a Changing World" by Gabriele Centi and Siglinda Perathoner. In the introduction, the authors develop the theme of chemistry as the core science "making possible . . . sustainable use of energy, although this role is often hidden." Illustrating the complexities of providing sustainable energy, further sections in this chapter address chemistry and the role for development of society, chemistry and sustainable energy, sustainable energy scenarios and climate changes, nanomaterials for sustainable energy, biofuels, and solar fuels. The authors tellingly end their review with the words: "This will also require improving educational effort in training chemists for the interdisciplinary approach needed to provide creative and scalable solutions to the energy issues."

The last chapter on "Ozone Depletion and Climate Change" by Glenn Carver gives an overview of the fascinating discovery of the Antarctic Ozone Hole, the chemistry and role of ozone in the atmosphere, its depletion by man-made chlorofluorocarbons, and how governments responded through the Montreal Protocol to the scientific data in the 80s. Ozone, a radiatively important gas exerting a control on the behavior of the stratosphere, is also a greenhouse gas itself and so the final section of this chapter provides a summary of current ideas about the complex processes controlling ozone changes and global warming and how they can link together. While "The way in which the ozone hole problem was tackled might be considered as a model for solving the issues of man-made climate change . . . sadly the same is not true for climate change; the science is more complex, the impacts take longer to appear, the solution will involve significant lifestyle changes, and public perception is nowhere near as clear."

Professor Jeffrey Sachs, director of the Earth Institute at Columbia University and director of the UN Millennium Project group (2002–2006) as special advisor to United Nations Secretary-General Kofi Annan on the Millennium Development Goals, has written a two-page epilogue which is a most important contribution to this book. He comments "As a policy strategist, I was riveted page by page, as the technological possibilities for the future were authoritatively conveyed. Each chapter offers remarkable clarity, breadth, technical precision, and a deep sense of humanity. If there is a theme that runs in common, it is that the highest flights of science are bound up intimately with the highest human aspirations." He end with "I personally would like to express my profound appreciation to the editors and authors of this book for this important contribution."

In summary, the book makes for fascinating reading and is highly recommended not only to the chemistry community but to a wide readership including individuals concerned with sustainable development, politicians, young people, teachers, and global strategists. It is a must for every chemistry educator who can use it as a tool in teaching students or in informing non-scientists about the possibilities of this fundamental science. This book is an excellent antidote to criticism of the relevance and usefulness of chemistry for sustainable development. It is also a concrete legacy of IYC 2011.

www.thechemicalelement.com

What is IUPAC Nomenclature?

This series, written by Jeffery Leigh, will provide short notes and briefs about Principles of Chemical Nomenclature. Each column will address a specific topic such as systematic nomenclature, the constructing of names, or the use of abbreviations. Questions, suggestions, and reactions (critical or complimentary) are welcome: edit.ci@iupac.org.

by Jeffery Leigh

Nobody, except a few pedants, enjoys working on chemical nomenclature. However, accurate and widely accepted nomenclature is a vital need for communication amongst more than academic chemists. For example, politicians writing treaties and customs officers inspecting trade goods need to know exactly what materials they are dealing with. It is now generally accepted that IUPAC should be responsible for providing this kind of nomenclature for the world to use. IUPAC chemical nomenclature is widely regarded as the world standard. When a nomenclature question arises, the first reaction is often: what is the name that IUPAC gives? *Principles of Chemical Nomenclature* is an attempt to show people how to find the name they require, but it also explains the misunderstandings that may arise before such a process is complete.

In the first place, there is no monolithic construction called IUPAC Nomenclature. Nomenclature is a subject that has grown and changed over the years. The first widely accepted systematic nomenclature proposals arose in France amongst Lavoisier and his colleagues in the 1780s, and they were dealing with what today we recognise as inorganic compounds. Internationally accepted systematic nomenclature may be reckoned to stem from the Geneva Congress of 1892. These nomenclatures attempted, and still attempt, to be systematic, but the systems they use are different. Consequently the methodologies employed in deriving the names of inorganic and organic compounds are generally different. [See box for examples.]

In the second place, there are more systems sheltered under the IUPAC umbrella, such as that for polymers and also systems to deal with newer materials such as organometallic compounds, which may be regarded as falling into more than one category of compound, and may require the use of more than one system, or even a specially modified system, to name them satisfactorily.

In the third place, studies related to chemistry, such as biochemistry, pharmacy, and cosmetics, have developed their own specific nomenclatures, which may be abbreviated and modified for commercial purposes, and these can also produce unequivocal names but not names which necessarily convey the complete structural information usually required by IUPAC nomenclatures. However, IUPAC is usually involved jointly with other international bodies in the elaboration of these systems.

Examples of changes over time are many, and some are cited here. It sometimes takes time for such changes to be assimilated!

—The nitroprusside ion should now be called systematically pentacyanidonitrosylferrate(2–).

—Ferric, ferrous and stannic and similar forms should be replaced by iron(II), iron(III) and tin(IV), and so on.

—Propylene is no longer a recommended name for C_3H_4, which is now simply propene.

—*n*-butane should now be called just butane, though isobutane is still allowed.

—Butanol is the name for an alcohol with the OH group bound to an end carbon atom of a linear saturated four-carbon chain, but isobutanol is not an allowed name when the OH group is bound to a terminal carbon of the parent isobutane. Then the molecule should be called 2-methylpropan-1-ol.

The current edition of *Principles* provides a detailed guide to the principal areas of IUPAC nomenclature but it also introduces several other different systems of nomenclature, with specific references for those who wish to study them in more detail.

Jeffery Leigh is the editor and contributing author of *Principles of Chemical Nomenclature—A Guide to IUPAC Recommendations, 2011 Edition* (RSC 2011, ISBN 978-1-84973-007-5). Leigh is emeritus professor at the University of Sussex and has been active in IUPAC nomenclature since 1973.

Next in this series will be a review of the contents of *Principles*.

www.iupac.org/web/ins/2006-029-1-800

Challenges in Modern Analytical Chemistry

by Slavica Ražić

In the International Year of Chemistry, Belgrade was the meeting place for analytical chemists from 57 countries from all over Europe and overseas. The **16th European Conference on Analytical Chemistry** was held 11–15 September 2011. Organized by the Divisions of Analytical Chemistry of the Serbian Chemical Society and the European Association for Chemical and Molecular Sciences, the conference had as its theme "Challenges in Modern Analytical Chemistry."

The event attracted almost 600 participants from academic, industrial, and governmental backgrounds. The Congress Centre SAVA in Belgrade, located in one of the modern quarters in New Belgrade but still very close to the old historic and charming city center, appeared to be an excellent venue for the conference as it enabled networking on both a scientific and social level.

Ten plenary lectures built the framework of the conference:

- Jonas Bergquist (Uppsala, Sweden), "Diving Deep into the Chemistry of the Human Brain"
- Gareth Brenton (Swansea, UK), "The Role of Accurate Mass Measurement in Chemical, Analytical and Medical Mass Spectrometry"
- Jana Hajslova (Prague, Czech Republic) "Metabolomic Fingerprinting/Profiling Employing High Resolution Mass Spectrometry: a Challenging Strategy in Food Analysis"
- Gary Hieftje (Bloomington, Indiana, USA), "New Tools for the Analytical Laboratory"
- Wolfgang Lindner (Vienna, Austria), "The Power of Selectivity in Chromatography"
- Ryszard Lobinski (Pau, France), "Biological Trace Element Analysis, Speciation and Metallomics"
- Marco Mascini (Sesto Fiorentino, Italy), "Peptide and Oligonucleotides Aptamers as New Ligands for Analytical Chemistry"
- Boris Mizaikoff (Ulm, Germany), "Miniaturized Mid-Infrared Sensors—How Small is Still Useful?"
- Alfredo Sanz-Medel (Oviedo, Spain), "The Expanding Scope of Analytical Atomic Spectrometry: Isotopes, Elements, Molecules and Nanoparticles via Mass Spectrometry"
- Luisa Torsi (Bari, Italy), "Bio-Electronic Device as Ultra-Sensitive Analytical Sensors"

The plenary sessions were complemented by 21 keynote sessions and 3 poster sessions. All in all, 135 oral and 560 poster presentations were delivered, featuring core topic areas of analytical chemistry. The impressive number of young scientists created an excellent atmosphere for enthusiastic discussions of cutting-edge analytical chemistry.

A special issue devoted to Euroanalysis 2011, with full research papers, will appear in *Analytical and Bioanalytical Chemistry*.

Poster sessions offered an excellent networking opportunity.

Two prestigious awards were presented at the conference: the Robert Kellner award went to Jonas Berquist (sponsored by Springer) and the EuCheMS award went to Alfredo Sanz-Medel. Six posters were selected as the best in terms of scientific originality and overall presentation, which were awarded by Springer. Sixty-six students received grants for their participation, of which, 16 were awarded by IUPAC and 50 by the Serbian Chemical Society. EUROanalysis 17, with the theme "Analytical Chemistry for Human Well-Being and Sustainable Development," is scheduled for 25–29 August 2013 in Warsaw, Poland. See more details at euroanalysis2013.pl.

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www.euroanalysis2011.rs

MacroMolecular Complexes

by Heikki Tenhu

The biannual **14th IUPAC International Symposium on MacroMolecular Complexes**, MMC-14, took place 14–17 August 2011 at the Department of Chemistry, University of Helsinki, Finland. This marked the first time that a symposium of the MMC series took place in a Nordic country.

MMC symposia aim to promote and propagate science of polymeric and organic-inorganic hybrids at all levels. MMC brings together leading scientists and engineers to discuss the latest advances in research on complexes formed between macromolecules and other compounds such as metals, ions, nanoparticles etc. Syntheses and characterization of those materials, their physicochemical properties, functions, and application are included for discussions.

Poster Prize winner Szymon Wiktorowicz (right) . Photo by Sami-Pekka Hirvonen.

MMC-14 was dedicated to the memory of Eishun Tsuchida (1930–2010), the founder of the MMC Symposium series. Special words in memory of Tsuchida were given by Hiroyuki Nishide from Waseda University, Japan. The IUPAC Polymer Division was represented by Kalle Levon from the Polytechnic Institute of New York University, USA.

The scientific program of the MMC-14 Symposium was focused on the following topics:

- Macromolecule-Metal Complexes and Capped Metal Nanoparticles
- Organic-Inorganic Hybrids
- Self-Assembly and Supramolecular Complexes
- Polyelectrolytes and Conductivity Properties
- Catalysis and Photocatalysis
- Functions and Applications (Electronic, Optical, Magnetic)
- Biological Applications
- Coordination Programming

The symposium was based on plenary and invited lectures and oral and poster presentations. There were about 167 participants including 8 plenary and 14 invited speakers, as well as 70 oral and 82 poster contributions. Over one-third of participants were women.

The MMC symposia have always provided a relaxing atmosphere for networking among those who already established in the field and newcomers. Thus, it is worth nothing that students comprised about 36 percents of participants at the symposium. To attract young scientists, the organizers and the Department of Chemistry arranged a Summer School in Polymer Chemistry, which enabled participants to meet world-known scientists to exchange experiences, make contacts, and present their results to the scientific community. The School also offered an opportunity for students from the European Union to receive additional credit units.

Three Poster Prizes sponsored by the IUPAC Polymer Division were awarded. Prize winners were selected by the International Advisory Board of MMC-14. The Prize recipients received a certificate signed by the IUPAC president, a copy of the Green Book, and a two-year subscription to *Chemistry International*. The following posters received the IUPAC awards:

- Anna Yurishcheva, "Formulation of Coating Iron Oxides Magnetic Nanoparticles with Humics," Moscow Aviation Institute and the State University of Aerospace Technologies, Russia
- Szymon Wiktorowicz, "Calix[4]arenes as Templates for Novel Stimuli-Responsive Polymeric Systems," University of Helsinki, Finland
- Takuya Nakabayashi, "Electrochemical Properties in Multilayer Films of Ru/Os Dinuclear Complexes Having a Strong Metal-Metal Interaction on a Surface," Chuo University, Tokyo, Japan

A Special Diploma of Distinction was awarded by the Organizing Committee to Ludmila Bogdanova from the Institute of Problems of Chemical Physics, RAS, Chernogolovka, Russia, for her excellent scientific achievements, patience, and optimism.

On behalf of the Organizing Committee of MMC-14 we would like to acknowledge the assistance of all parties involved in the organization of the symposium. The conference was financially supported by the Department of Chemistry, University of Helsinki, Finland, Postnova Analytics, Norlab, and TA Instruments.

Symposium Chair Heikki Tenhu <Heikki.Tenhu@helsinki.fi> is head of the Laboratory of Polymer Chemistry, Department of Chemistry, University of Helsinki, Finland.

www.helsinki.fi/polymeerikemia/MMC2011/

Translating Food Chemistry into Health Benefits

by Agnieszka Bartoszek and Mariusz Piskula

The **EuroFoodChem XVI** conference, 6–8 July 2011, on "Translating Food Chemistry into Health Benefits" stressed the significant role of science and the technology of food in our daily life. For the first time in its 30-year history, the flagship conference of the Food Chemistry Division of EuCheMS took place in Poland (Gdańsk). It was co-organized by the Chemical Faculty of Gdansk University of Technology (GUT) and the Institute of Animal Reproduction and Food Research of the Polish Academy of Sciences in Olsztyn with the support from the European REFRESH project and IUPAC.

The event attracted nearly 300 participants from 33 countries who attended five sessions of plenary lectures and oral presentations, complemented by two poster sessions, two workshops, and a number of exhibitions. The conference covered several areas of food chemistry, from broad subjects such as lipids, meat products or nutrigenomics, to those more specifically focused on phytochemicals as glucosinolates or antoxidants. The participants were also the first recipients of the application FoodSci Companion for iPad designed by the GUT team to provide food scientists with a convenient access to useful data.

Since 2011 was the International Year of Chemistry and the 100th anniversary of Maria Sklodowska-Curie's Nobel Prize in chemistry, both occasions were recognized during the meeting. The special session "A Tribute to the International Year of Chemistry" was supported by the Polish Chemical Society and addressed the general public. It showed chemistry and chemists in roles other than research, with entertaining aspects including travel, music, magic, and molecular gastronomy. A selection of the talks presented during this session will be published on the webpage of the Chemical Faculty of GUT <www.chem.pg.gda.pl>.

Group photo of EuroFoodChem participants.

Agnieszka Bartoszek <agnieszka.bartoszek@pg.gda.pl> of Gdansk University of Technology and Mariusz Piskuła <m.piskula@pan.olsztyn.pl> of the Institute of Animal Reproduction & Food Research chaired the local Organizing Committee and also served on the Scientific Committee.

www.eurofoodchemxvi.eu

Novel Materials and their Synthesis

by Yuping Wu

The **IUPAC International Conference on Novel Materials and Synthesis** (NMS), initiated in 2005 in Shanghai, took place 16–21 October 2011 at Fudan University, Shanghai, China. This marked the seventh time that this conference was held jointly with the International Symposium on Fine Chemistry and Functional Polymers (FCFP), which began in 1987 in China and has been held on an almost annual basis ever since.

The NMS-VII & FCFP-XXI were sponsored by IUPAC, The National Natural Science Foundation of China, Science and Technology Commission of Shanghai Municipality, Shanghai Key Laboratory of Molecular Catalysis and Innovative Materials, and National Basic Research Program of China. Stanislaw Penczek (IUPAC representative), Xingao Gong (head of the division of Science and Technology, Fudan University), Yi Tang (head of the Department of Chemistry, Fudan University) and two cochairs delivered welcome and opening addresses.

The conference brought together 410 participants from 40 countries and regions, including some from industry. For the first time in the NMS series, more than 400 abstracts were submitted. The conference mainly discussed innovative catalytic and other synthetic methods, bio- and biobased materials or composites, innovative polymer materials, energy systems, nanomaterials, ceramic materials, other novel materials and synthesis related to environment, medicine and analysis, and neutron scattering technologies.

The following eminent scientists delivered lectures on their research: Klaus Muellen (Germany), Hiroyuki Nishide (Japan), Huijun Zhao (Australia), Stanislaw Penczek (Poland), Gang Wei (Australia), Yury Shchipunov (Russia), Jean-Pol Dodelet (Canada), Hsin-Chiao Daniel Ouyang (USA), and Shinji Inagaki (Japan).

Stanislaw Penczek delivers a welcome from IUPAC.

For the first time, the IUPAC—Prof. Jiang Novel Materials Youth Prize was awarded. The winners were Zhibo Li from the Institute of Chemistry, Chinese Academy of Sciences, China, and Jr-Hau He from National Taiwan University, Taiwan, China. Each winner received a cash prize of USD 1000 and travel expenses. The winners's biographies can be found on the IUPAC website at <www.iupac.org/web/nt/2011-10-26_jiang_novel_prize>.

Three participants from Japan, Poland, and USA won the IUPAC Poster Prize. In addition, the Distinguished Award 2011 for Novel Materials and their Synthesis was granted to Guoxiu Wang (Australia), Fusayoshi Masuda (Japan), André-Jean Attias (France) and Bao-Lian Su (Belgium).

The conference proved to be a high-level forum for participants to exchange ideas about novel materials and synthesis. Many participants strongly recommended that it be held every odd year in Shanghai.

The social activities of the conference included a night cruise along Pujiang River, an acrobatic performance, and a one-day tour of Fudan University and Shanghai.

The next symposium in the series will be held in Xi'An, China, 14–19 October 2012.

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Stamps International

See also www.iupac.org/publications/ci/indexes/stamps.html

Is the Future of Paper Money . . . Plastic?

Synthetic polymers have an extraordinary range of physical properties and applications—from textiles and contact lenses to paints and food containers—and, thus, play a key role in daily life. Biaxially-oriented polypropylene (BOPP) film is a versatile polymeric material that has been widely used in the packaging and labeling industries due to its strength, flexibility, transparency, and printability. BOPP has also been the substrate of choice for the so-called polymer banknotes. First introduced as legal tender Down Under in 1988, they were jointly developed by the Reserve Bank of Australia and the Commonwealth Scientific and Industrial Research Organization. Although a majority of currencies in the world are still printed on high-quality cotton paper, polymer banknotes exhibit an enhanced resistance to wear and tear and tend to be cleaner since they repel dirt and are completely waterproof. In addition, polymer banknotes possess a number of unique security features, such as see-through windows with embedded holograms or diffraction gratings, which makes them very difficult to replicate with modern color photocopiers or scanners and thereby help to thwart counterfeiting.

The stamp illustrated here commemorates the seminal release of the first polymer banknote in Australia (1988) and is part of a set of five issued in 2004 to highlight Australian contributions to technological innovations, which also include ultrasound imaging equipment, flight data recorders, and race car video cameras. Several other countries, including Indonesia, Thailand, Brunei, Sri Lanka, Malaysia, New Zealand, Romania, Bangladesh, Nepal, Zambia, Vietnam, Chile, Mexico, Guatemala, Israel, Bermuda, and Nicaragua, have released their own polymer banknotes during the past two decades.

The latest country to "go plastic" is Canada, where a polymer banknote was issued for the first time last November. The front side of the new $100 bill features a portrait of Sir Robert Borden, Canadian Prime Minister from 1911 to 1920, while the back pays tribute to Canadian achievements in medicine and depicts a researcher using a microscope, a strand of DNA, an electrocardiogram, and a bottle of insulin to honor the discovery of the vital hormone by Frederick Banting and Charles Best.

While the debate between the cost of production versus durability of polymer banknotes remains to be settled, it may not be long before dollars, euros, and other currencies become "synthetic" in nature too.

Written by Daniel Rabinovich <drabinov@uncc.edu>.

Chemistry Education

ICCE-ECRICE 2012 PreConference Virtual Colloquium, May and June 2012

Now that the International Year of Chemistry 2011 is over, it is important to reflect upon IYC projects in a way that allows us to learn from and sustain these initiatives into the future. In advance of the 22nd International Conference on Chemistry Education and the 11th European Conference on Research in Chemical Education, a **Virtual Colloquium** will be held during May and June 2012. This online event will allow global participants to share, learn from, and discuss IYC experiences. There will be two formats to the presentations: formal project papers and national initiative sessions; both of which can be discussed through the colloquium website. A follow-up session will be held at the ICCE-ECRICE 2012 conference, July 2012 in Rome.

www.ccce.divched.org/2012spring

Heteroatom Chemistry

20–25 May 2012, Uji City, Kyoto, Japan

The **10th International Conference on Heteroatom Chemistry** will be held in the Uji Obaku Plaza on Kyoto University's campus, Uji City, Japan, 20–25 May 2012. Continuing the successful ICHAC series, ICHAC-10 will cover many areas around the central topic of heteroatom chemistry. Following the long tradition of these conferences, ICHAC-10 will be a major scientific event, bringing together organic and inorganic chemists from all over the world to share their interests in synthesis, structure, reactivity (including catalysis), theoretical methods, and material aspects. The conference program will consist of plenary and invited lectures, as well as short communications and poster presentations.

The call for abstracts is open from 1 February 2012 to 16 March 2012.

Although ICHAC-10 was originally planned for the summer of 2011, it was postponed because of the disaster in the northeastern Tohoku area of Japan. Even though the Tohoku area has not fully recovered, the situation in the rest of Japan can be considered fairly stable and safe. The conference organizers are expecting the situation to have stabilized/normalized even further by the early summer of 2012.

http://oec.kuicr.kyoto-u.ac.jp/~ichac10/

Coordination Chemistry

9–13 September 2012, Valencia, Spain

The **40 International Conference on Coordination Chemistry** (ICCC40) will be held 9–13 September 2012 at the Congress Palace in Valencia, Spain. ICCC is the longest-running conference series in the field of coordination chemistry. It started in 1950 and has now become a premiere venue for discussion of the latest developments in this area of chemistry.

The ICCC is coming back to Europe for the first time since 2002 (the most recent editions took place in Heidelberg, Germany, 2002; Merida, Mexico, 2004; Cape Town, South Africa, 2006; Jerusalem, Israel, 2008; and Adelaide, Australia, 2010). ICCC40 is expected to attract more than a thousand participants from all over the world to discuss the use of coordination chemistry to design new functional molecules and supramolecular materials exhibiting useful chemical, physical or biological properties. Some key topics include the design and applications of metal-organic frameworks; the crystal engineering of supramolecular functional materials; the molecular design of homogeneous and heterogeneous catalysts; the design of coordination compounds for energy and environmental applications; the molecular nanoscience; and the use of metals in medicine and protein design.

Eight plenary speakers will present their latest research along with 72 invited speakers. The program will also include some 150 contributed short talks and four poster sessions, which will provide participants the opportunity to highlight their recent work.

www.iccc40.com

Pesticide Chemistry

10–14 August 2014, San Francisco, CA

The **13th IUPAC International Congress of Pesticide Chemistry** will be held in San Francisco, 10–14 August 2014. Hosted by the Agrochemicals Division of the American Chemical Society, the congress is being organized by co-chairs Laura McConnell of the USDA Agriculture Research Service and Ken Racke of Dow AgroSciences.

The program will encompass both traditional chemical pesticides and biotechnology-based crop protection approaches. Furthermore, the theme "Crop, Environment, and Public Health protection: Technologies for a Changing World" recognizes a need for greater emphasis on public health protection. A focus on technology will widen the umbrella for a host of activities that are interdisciplinary. One of the objectives in choosing the Congress theme is to attract attendees interested in non-traditional "pesticides" including disinfectants and veterinary drugs, emerging environmental contaminant issues (such as consumer products and drugs in water), and technologies for application of products and implementation of nonchemical pest management strategies.

A report on the 2010 meeting has been published in *Outlooks on Pest Management*, Dec. 2010, p. 288 <http://dx.doi.org/10.1564/21dec10> and <www.iupac.org/web/act/Melbourne_2010-07-04>.

www.iupac2014.org

Catalysis in Organic Synthesis

15–20 September 2012, Moscow, Russia

The **International Conference on Catalysis in Organic Synthesis** (ICCOS-2012) will be held 15–20 September 2012 in Moscow, Russia. The main goal of the scientific program is to highlight the state of the art in catalysis and exchange ideas toward further development.

Major topics are as follows:

- Transition metal complexes and nanoparticles as efficient and selective catalysts for organic transformations
- Organocatalysis
- Catalysis for development of new synthetic methods
- Enantioselective catalysis
- Catalytic activation and functionalization of organic molecules
- Catalysis for green chemistry and sustainable development
- Mechanisms of catalytic reactions, theoretical and experimental studies, bonding, and reactivity of catalytic species

A number of distinguished scientists have confirmed their participation, including Matthias Beller, Christian Bruneau, Robert Grubbs, Burkhard Koenig, Ei-ichi Negishi, Helmut Schwarz, Michinori Suginome, Alexandre Alexakis, Albrecht Berkessel, Karl A. Jorgensen, Benjamin List, Andrei Malkov, Keiji Maruoka, Paolo Melchiorre, and Yoshiji Takemoto.

Early-bird registration is open until 31 April 2012. Participants are invited to submit abstracts for oral communications (deadline is 1 May) or poster presentations (deadline is 15 July).

www.ioc.ac.ru/iccos-2012

Nanostructured and Biorelated Materials

9–12 May 2012, Kathmandu, Nepal

The **Kathmandu Symposia on Advanced Materials** (KaSAM-2012) will provide a platform for presentation of innovations in Materials Science and Engineering from academia and industries. The conference will be accompanied by a one day Short Course (targeted to the students and young researchers): Recent Trends in Materials Science and a one day special Workshop: All about Bamboo.

The idea behind the Bamboo Workshop is to bring the experts involved in agriculture, environmental issues, economy and technological aspects of this nature's wonder material together in a common platform in order to discuss the issues such as advancements in the bamboo science including potential utilization in fabrication of new materials, impacts on environment.

www.nepalpolymer.org/welcome.htm

Analytical Chemistry for the Environment, Health, and Water

8–11 July 2012, Maputo, Mozambique

The African Network of Analytical Chemists (SEANAC), in collaboration with the Department of Chemistry, Eduardo Mondlane University and the Academy of Sciences of Mozambique, will be hosting the **4th SEANAC International Conference** on Analytical Chemistry for the Environment, Health and Water. The conference will be held at the Joaquim Chissano International Conference Center in Maputo, Mozambique; 8–11 July 2012.

Like other SEANAC conferences, previously held in Botswana and Swaziland, this fourth conference will continue to offer an excellent platform for networking as well as exposure to regional and international analytical chemists. The conference will also form part of SEANAC's 10-year anniversary as a network whose aim is to (a) promote analytical chemistry through collaboration, research, research training, teaching, and information sharing; (b) facilitate inventory, access, operation, maintenance, and repairs of analytical equipment; and (c) collaborate with organizations with similar aims.

The conference will offer a pre-symposium workshop on Gas Chromatography (Dr. Peter Apps) and Sample Preparation (Dr. Ron Majors). It will have a full range of plenary, invited lectures, and oral and poster contributions. The organizers consider oral and poster presentations to be equivalent. Confirmed plenary speakers include Lo Gorton (Sweden); Eduardo Ferreira da Silva (Portugal); Jean-Marie Dimandja, Emanuelle Boselli, and Federica Fiori (USA); Jailson B. de Andrade (Brazil); Roger Smith (UK); Manuel Miro (Spain); and Charlotta Turner (Sweden).

Papers are invited on all aspects of analytical chemistry with application in the thematic areas of environment, health, and water. Other novel findings and applications that seek to advance analytical chemistry are also welcome.

The conference will be held in Maputo, which is famous for its sea food, in particular the very very large prawns. Maputo has a range of hotels from bed and breakfast to 5 star. Most of the hotels in Maputo are rather new as Mozambique is experiencing rapid economic growth.

www.seanac.org

IUPAC General Assembly and World Congress

In 2011, IUPAC completed a very successful General Assembly and World Chemistry Congress in San Juan, Puerto Rico. For 2013, the IUPAC GA and Congress will be held in Istanbul, Turkey. For 2015, plans are progressing to organize the event in Seoul, Korea.

IUPAC is seeking Expressions of Intent to Host a General Assembly and World Chemistry Congress for the years 2017 and 2019. The year 2019 will also mark the 100th anniversary of IUPAC's birth.

If your National Adhering Organization would like to host one of these events in either 2017 or 2019, please indicate your intention by communicating directly with the IUPAC Secretariat <secretariat@iupac.org> as soon as possible. Final decisions to accept proposals for 2017 and 2019 will be taken by the IUPAC Council at its next meeting in 2013 during the 47th General Assembly in Istanbul, Turkey.

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

Mark Your Calendar

Upcoming IUPAC-sponsored events
See also http://www.iupac.org/indexes/Conferences for links to specific event websites

2012 (after 15 March)

26–30 March 2012 • Polymer Characterization • Dubrovnik, Croatia
20th International Conference on Polymer Characterization - World Forum on Advanced Materials
Dr Vera Kovacevic, University of Zagreb, Department of Chemical Engineering & Technology, Marulicev Trg., 19, HR-10000 Zagreb, Croatia, Tel.: +385 1 459 7188, Fax: +385 1 459 7260, E-mail: polychar20@fkit.hr

16–21 April 2012 • Chemical Sciences • Corfu, Greece
12th Eurasia Conference on Chemical Sciences
Prof Nick Hadjiliadis, University of Ioannina, Dept. of Chemistry, GR-45110 Ioannina, Greece
Tel.: +30 2 651 008 420, Fax: +30 2 651 008 786, E-mail: nhadjis@uoi.gr

20–25 May 2012 • Heteroatom Chemistry • Kyoto, Japan
10th International Conference on Heteroatom Chemistry
Prof. Norohiro Tokitoh, Kyoto University, Institute of Chemical Research, Gokasho, Uji, Kyoto 611-0011, Japan
Tel.: +81 774 38 3200, Fax: +81 774 38 3209, E-mail: tokitoh@boc.kuicr.kyoto-u.ac.jp

20–22 June 2012 • Role of Chemistry Research in National Development • Colombo, Sri Lanka
International Conference on Chemical Sciences 2012
Professor Subramaniam Sotheeswaran, Institute of Chemistry Ceylon, Adamantane House, 341/22 Kotte Road, Welikada, Rajagiriya, Sri Lanka, Tel.: +94 11 286 3154, Fax: +94 11 286 1653, E-mail: sotheeswaran@hotmail.com

24–29 June 2012 • Macromolecules • Blacksburg, Virginia, USA
44th International Symposium on Macromolecules—IUPAC World Polymer Congress
Prof Timothy E. Long, Virginia Polytechnic University, Chemistry Dpt, VA 24061, USA
Tel.: +1 540 231 2480, Fax: +1 540 231 8517, E-mail: telong@vtu.edu

1–6 July 2012 • Organic Synthesis • Melbourne, Australia
19th International Conference on Organic Synthesis
Prof Mark Rizzacasa, University of Melbourne, School of Chemistry, The Bio21 Institute, Melbourne, Victoria 3010, Australia, Tel.: +61 3 3844 2397, Fax: +61 3 3947 8396, E-mail: masr@unimelb.edu.au

1–5 July 2012 • Macromolecules • Prague, Czech Republic
76th Prague Meeting on Macromolecules: Polymers in Medicine
Dr. Tomáš Etrych, Academy of Sciences of the Czech Republic, Institute of Macromolecular Chemistry, Heyrovsky Square, 2, CZ-162 06 Prague 6, Tel.: +420 296 809 224, Fax: +420 296 809 410, E-mail: etrych@imc.cas.cz

8–11 July 2012 • African Network of Analytical Chemists • Maputo, Mozambique
African Network of Analytical Chemists Analytical Chemistry Conference
Prof. Carvalho Madivate, University of Eduardo Mondlane, Department of Chemistry, Campus Universitario, Maputo 257, Mozambique, Tel.: +258 21 430 239, Fax: +258 21 304 405, E-mail: cmadivate@yahoo.com

15–20 July 2012 • Photochemistry • Coimbra, Portugal
XXIVth IUPAC Symposium on Photochemistry
Prof Hugh D. Burrows, University of Coimbra, Dept. of Chemistry, P-3004 535 Coimbra, Portugal
Tel.: +351 239 854 482, Fax: +351 239 827 703, E-mail: burrows@ci.uc.pt

15–20 July 2012 • Change in Chemistry Education • Rome, Italy
22nd International Conference on Chemical Education (ICCE) and 11th European Conference on Research In Chemical Education—Stimulating Reflection and Catalysing Change in Chemistry Education
Prof. Luigi Campanella, Conference Chair; Agency YES Meet, organizing secretariat
Tel: + 39 081 8770604, Fax: + 39 081 8770258, E-mail: info@iccecrice2012.org

22–27 July 2012 • Solubility Phenomenon • Xining, China
15th International Symposium on Solubility Phenomena and Related Equilibrium Processes
Prof. Dewen Zeng, Qinghai Institute of Salt Lakes, Xining Road, # 18, Xining 810008, China
Tel.: +86 13 618 496 806, Fax: +86 971 630 6002, E-mail: dewen_zeng@hotmail.com

22–27 July 2012 • Carbohydrate • Madrid, Spain
XVIth International Carbohydrate Symposium
Prof. Jesús Jiménez-Barbero, Centro de Investigaciones Biológicas, Consejo Superior de Investigaciones Ciencias, Ramiro de Maeztu 9, E-28040 Madrid, Spain
Tel.: +34 91 837 3112, Fax: +34 91 536 0432, E-mail: jjbarbero@cib.csic.es

5–10 August 2012 • Chemical Thermodynamics • Búzios, Brazil
22nd International Conference on Chemical Thermodynamics and 67th Calorimetry Conference
Prof. Watson Loh, Universidade de Estadual de Campinas, Instituto de Química, Caixa Postal 6154, Campinas, São Paulo 13083-970, Brazil, Tel.: +55 193 521 3001, Fax: +55 193 521 3023, E-mail: wloh@iqm.unicamp.br

25–29 August 2012 • Biomolecular Chemistry • Beijing, China
9th International Conference on Biomolecular Chemistry
Prof. Liangren Zhang, School of Pharmaceutical Sciences, Peking University Health Science Center, 38 Xueyuan Road, Beijing 100083, China, Tel.: +86 10 82 802 491, Fax: +86 10 82 802 638, E-mail: liangren@bjmu.edu.cn

25–29 August 2012 • Green Chemistry • Foz do Iguacu, Brazil
4th International IUPAC Conference on Green Chemistry
Prof. Vania Gomes Zuin, Federal University of Sao Carlos, Department of Chemistry, Rodovia Washington Luis, Sao Carlos, 1365-905, Brazil, Tel.: +55 163 361 8096, Fax: +55 163 361 8350, E-mail: vaniaz@ufscar.br

9–13 September 2012 • Coordination Chemistry • Valencia, Spain
40th International Conference on Coordination Chemistry
Prof. Eugenio Coronado, University of Valencia, Institute of Molecular Sciences, C/ Catedrático José Beltrán 2 E-46980 Paterna, Valencia, Tel.: +34 963 544 4415, Fax: +34 963 543 273, E-mail: eugenio.coronado@uv.es

9–13 September 2012 • Physical Organic Chemistry • Durham, United Kingdom
21st International Conference on Physical Organic Chemistry
Professor Ian H. Williams, Department of Chemistry, University of Bath, Claverton Down, Bath BA2 7AY, United Kingdom, Tel.: + 44 1225 386 625, Fax: + 44 1225 386 231, E-mail: i.h.williams@bath.ac.uk

11–14 September 2012 • Polymer-Solvent Complexes • Kiev, Ukraine
9th International Conference on Polymer-Solvent Complexes and Intercalates
Professor L. Bulavin, Kiev National Taras Shevchenko University, Department of Physics, Volodymyrska, 60, UA-01610 Kiev, Ukraine, Tel.: +380 044 526 45 37, Fax: +380 044 526 44 77, E-mail: bulavin221@gmail.com

15–20 September 2012 • Pesticide and Environmental Safety • Beijing, China
4th International Symposium on Pesticide and Environmental Safety & 8th International Workshop on Crop Protection Chemistry and Regulatory Harmonization
Prof. Zhang Jing, China Agricultural University, Centre for Chemicals Applications Technology, Yuanmingyuan West Road, Beijing 100193, China, Tel.: +86 10 6273 1456, Fax: +86 10 6273 3688, E-mail: zj810515@163.com

15–20 September 2012 • Catalysis in Organic Synthesis • Moscow, Russia
International Conference on Catalysis in Organic Synthesis
Prof. Mikhail P. Egorov, Russian Academy of Sciences, Zelinsky Institute of Organic Chemistry, 47 Leninsky Prospekt, B-334, RF-119991 Moscow, Russia, Tel.: +7 095 135 5309, Fax: +7 095 135 5328, E-mail: mpe@ioc.ac.ru

16–21 September 2012 • Biotechnology • Daegu, Korea
15th International Biotechnology Symposium and Exhibition
IBS 2012 Secretariat, 6F, Sunghwa B/D, 1356-51 Manchon, 1-Dong, Suseong-Gu, Daegu 706-803, Korea
Tel.: +82 53 742 5557, Fax: +82 53 742 9007, E-mail: info@ibs2012.org

14–19 October 2012 • Novel Materials • Xian, China
8th International Conference on Novel Materials and their Synthesis
Prof. Yuping Wu, Fudan University, Department of Chemistry, New Energy & Materials Laboratory, Shanghai, 200433, China, Tel.: +86 21 55 664 223, Fax: +86 21 55 664 223, E-mail: wuyp@fudan.edu.cn

5–9 November 2012 • Mycotoxin • Rotterdam, Netherlands
7th World Mycotoxin Forum and XIIIth International IUPAC Symposium on Mycotoxins & Phycotoxins
Ms. Helena B. Bastiaanse (Program Coordinator), Bastiaanse Communication, P.O. Box 179, NL-3720 AD Bilthoven, Netherlands, Tel.: +31 302 294 247, Fax: +31 302 252 910, E-mail: helena@bastiaanse-communication.com

IUPAC

ADVANCING THE WORLDWIDE ROLE OF CHEMISTRY FOR THE BENEFIT OF MANKIND

MISSION

IUPAC is a non-governmental organization of member countries that encompasses more than 85% of the world's chemical sciences and industries. IUPAC addresses international issues in the chemical sciences utilizing expert volunteers from its member countries. IUPAC provides leadership, facilitation, and encouragement of chemistry and promotes the norms, values, standards, and ethics of science and the free exchange of scientific information. Scientists have unimpeded access to IUPAC activities and reports. In fulfilling this mission, IUPAC effectively contributes to the worldwide understanding and application of the chemical sciences, to the betterment of the human condition.

NATIONAL ADHERING ORGANIZATIONS

Australian Academy of Science *(Australia)*
Österreichische Akademie der Wissenschaften *(Austria)*
Bangladesh Chemical Society *(Bangladesh)*
The Royal Academies for the Sciences and Arts of Belgium *(Belgium)*
Brazilian Chemical Society *(Brazil)*
Bulgarian Academy of Sciences *(Bulgaria)*
National Research Council of Canada *(Canada)*
Sociedad Chilena de Química *(Chile)*
Chinese Chemical Society *(China)*
Chemical Society located in Taipei *(China)*
Croatian Chemical Society *(Croatia)*
Sociedad Cubana de Química *(Cuba)*
Pancyprian Union of Chemists *(Cyprus)*
Czech National Committee for Chemistry *(Czech Republic)*
Det Kongelige Danske Videnskabernes Selskab *(Denmark)*
National Committee for IUPAC *(Egypt)*
Chemical Society of Ethiopia *(Ethiopia)*
Suomen Kemian Seura—Kemiska Sällskapet i Finland *(Finland)*
Comité National Français de la Chimie *(France)*
Deutscher Zentralausschuss für Chemie *(Germany)*
Association of Greek Chemists *(Greece)*
Hungarian Academy of Sciences *(Hungary)*
Indian National Science Academy *(India)*
Royal Irish Academy *(Ireland)*
Israel Academy of Sciences and Humanities *(Israel)*
Consiglio Nazionale delle Ricerche *(Italy)*
Caribbean Academy of Sciences—Jamaica Chapter *(Jamaica)*
Science Council of Japan *(Japan)*
Jordanian Chemical Society *(Jordan)*
Korean Chemical Society *(Korea)*
Kuwait Chemical Society *(Kuwait)*
Fonds National de la Recherche *(Luxembourg)*
Institut Kimia Malaysia *(Malaysia)*
Koninklijke Nederlandse Chemische Vereniging *(Netherlands)*
Royal Society of New Zealand *(New Zealand)*
Chemical Society of Nigeria *(Nigeria)*
Norsk Kjemisk Selskap *(Norway)*
Chemical Society of Pakistan *(Pakistan)*
Polska Akademia Nauk *(Poland)*
Sociedade Portuguesa de Química *(Portugal)*
Colegio de Químicos de Puerto Rico *(Puerto Rico)*
Russian Academy of Sciences *(Russia)*
Serbian Chemical Society *(Serbia)*
Slovak Chemical Society *(Slovakia)*
Slovenian Chemical Society *(Slovenia)*
National Research Foundation *(South Africa)*
Ministerio de Educación y Ciencia *(Spain)*
Institute of Chemistry, Ceylon *(Sri Lanka)*
Svenska Nationalkommittén för Kemi *(Sweden)*
Swiss Chemical Society *(Switzerland)*
Tanzania Chemical Society *(Tanzania)*
Chemical Society of Thailand *(Thailand)*
Société Chimique de Tunisie *(Tunisia)*
Türkiye Kimya Dernegi *(Turkey)*
National Academy of Sciences of Ukraine *(Ukraine)*
Royal Society of Chemistry *(United Kingdom)*
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