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From the Editor

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If what IUPAC does, or tries to do, is of interest to you, or if you ever ask yourself "How does IUPAC achieve consensus on a particular issue?" please take note: The call for nominations for the 2014–2015 elections has been issued, with a deadline of 31 July 2012 (see p. 20).

The opportunity to present yourself as a candidate for a specific committee only comes about once every two years. So, you might ask "What is the role of a member on a so-called division, commission, or committee?" The Statutes of IUPAC say that: "The scientific work of the Union shall be undertaken by the Divisions . . . which shall represent within the Union the branches of chemistry . . . ." Practically, each committee is somewhat different, but members can expect to assist with strategy development, help formulate and solicit new projects, identify task groups, evaluate new proposals, and review and disseminate project outcomes. All these tasks, and more, are shared by committee members. Members also monitor current trends and emerging needs in chemistry, providing valuable feedback to the Union. Now, the best way to find out for yourself is simply to ask a member what he/she does and how well that fits with his/her career.

Becoming a member of IUPAC means that you become part of an international community. As a member, you have the opportunity to engage in a dialogue with the national organization that represents your country within IUPAC, called National Adhering Organizations (NAOs). Because of IUPAC's international nature, national diversity among and within IUPAC committees is a key ingredient for success. Your participation in IUPAC committees can strengthen your NAO; likewise, active NAOs strengthen IUPAC. In addition, as a committee member you might have the opportunity to become a representative for the NAO for your country.

In the May 2011 Officer's Column,[1] former Secretary General David StC. Black wrote about how the Union needs members who can proactively contribute ideas and help IUPAC fulfill its global goals. This is a recurring challenge and each biennium, the elections provide an opportunity to engage new members in sharing their views. So, at this time, let the title of Black's column resonate loud and clear: "Go Forth and Nominate!"

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1. www.iupac.org/publications/ci/2011/3303/oc.html

Cover: Chemistry's future takes center stage at the IYC closing ceremony in Brussels on 1 December 2011. The International Year of Chemistry Young Leaders Team presents its vision of chemistry and how it will help shape the world in 2050—see feature on page 4. Photo by Vivian Hertz. For more, see www.chemistry2011.org/about-iyc/news/Chemistrysfuture.

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For IUPAC, It's Now or Never

by Nicole Moreau

For every member of IUPAC—whether a national representative, a division or standing committee member, a member of the Bureau or Executive Committee, staff, or an officer—life in the Union is punctuated by several events, among them the General Assembly and Congress, which impose a certain rhythm with their two-year cycle. This two-year cadence is particularly obvious for the president, because he or she is vice president in years one and two, then president in year three and four, and, finally, past president in years five and six. For me, it is now year five, and behind me are four years on which I can look back and recapitulate. Although the heavy workload of IYC is behind me, I still have projects to complete.

The vice president's years are somewhat blurred and indistinct. Of course, as an officer, you participate in every important step of the biennium (i.e., every Bureau and Executive Committee meeting). Then, depending on where you live, you may have to attend important external events: as a European, with a Korean president and a Canadian past president, I did not attend meetings in America nor in Asia, but I did attend one International Chemistry Olympiad in the UK in 2009 and every General Assembly of the European Association for Chemical and Molecular Science (EuCheMS). These I attended "on behalf of" IUPAC or its president. Of course, when you are alone in front of an audience, you are the one speaking and no one can dictate your speech, but you cannot present your own ideas, only those of IUPAC. The one exception of course is the Vice President's Critical Assessment, in which you present to the IUPAC Council your own ideas for the future of the Union, taking care not to upset the officers with your criticisms or comments. Yet, you must also avoid creating the perception among Council delegates that you will be too soft a leader without any desire for change.

When you become president, things do naturally change. And not in the way you thought: there are many things you were not aware of to look at, to endorse, to sign, to accept, and of course to understand. Generally, when there is something embarrassing, the job of dealing with it falls to the president or the secretary general. On these occasions, you are happy to discover how helpful the other officers and the executive director can be.

Things also change in ways you anticipate once you become president. Although it may be tempting to justify your travel to important events and workshops, care should be taken to avoid crossing the planet to represent IUPAC since money does not flow liberally to the Union. However, if you are too shy, you could, as a European, be bound to Helsinki in February, to the UK in the most humid period, to Madrid in the middle of August, and several times each year to Paris because you live there. Anyway, you will have the pleasure, and the difficulty, to speak about and for IUPAC and for yourself, and work to make the Union better known.

While I already held IUPAC in high regard, when I became president it really became my child. And I was fortunate to care for this child during a very special year. In 2011, I was invited to more than 30 countries to celebrate the International Year of Chemistry!

Now, in year five as you add the prefix "past" to your title, it feels weightier, even more so than "vice," since the latter is full of promises of duties and responsibilities. First, you are four-years older so you must answer to those who are not aware that "no, I am not yet retired from IUPAC. I still have two more years to serve. Yes, you can ask me a question and I can explain the answer to you, and, if necessary, I can refer it to the Executive Committee." This false commiseration is irritating, but after four years you will have become very strong and stainless, and things will flow off your "siliconized" shell.

Now that "the IYC feast" is finished, it is time to think of the image of our Union.

I can really say that I have been a frustrated president, and that I have been unable to enjoy the advantages the position is supposed to offer. This is in part because of IYC. Terrible IYC, which ate up the life of many active people in IUPAC. I'll not explain the angst of organizing the launch ceremony, nor the difficulty of being a permanent traveller during 2011, although in the end it was a great pleasure to see how so many countries devoted themselves to "their" IYC activities. In most countries, IYC was a great success and was met with great enthusiasm. I sincerely think that IYC will benefit our science, provided that countries maintain the momentum it created.

Now that “the IYC feast” is finished, it is time to think of the image of our Union. The president will probably have more important matters to deal with, so I volunteer to lead the charge. Perhaps, life after the presidency is not so empty. After all, the past president has three committees to chair: the IUPAC Prize, Chemistry Research Funding, and the Membership Relations Committees. All three are important to the Union’s image.

The IUPAC Prize for Young Chemists, established to encourage outstanding young research scientists at the beginning of their careers, is awarded to the most-outstanding Ph.D. thesis in the general area of the chemical sciences, as described in a 1000-word essay. IUPAC awards up to five prizes annually. This year, there are 42 candidates, and the competition promises to be tough.

The Committee on Chemistry Research Funding (CCRF), established in December 2007 and reporting directly to the Bureau, explores how organizations and agencies responsible for funding chemistry research in various countries might, under the umbrella of IUPAC, initiate transnational research. A first call for projects in polymer science was successfully launched in October 2009. The recipients of that funding will present an update on their research in June 2012, the midpoint of the project, at the 44th IUPAC World Polymer Congress in Blacksburg, Virginia, USA. Given the success of this first call, a second call will be launched by end of the year for funding sustainable chemistry research. By the way, dear IUPAC members, could you help and find name other than “sustainable” or “green” chemistry? One colleague correctly asserted that it is not the chemistry that is sustainable, but rather the environment in which it is used. As for “green,” this conjures for some people the notion that it is chemistry derived from plants. And for some cultures, “green” has no association with the environment at all. So, why not “benign chemistry,” or even “creatively benign chemistry”? I’m waiting for ideas. Anyway, green, sustainable, or benign, CCRF is an excellent initiative, and I am looking forward to working with this committee.

I kept the best until last, which is the Membership Relations Committee. Because of my intense commitments and extensive travels related to IYC, I developed many contacts with both NAOs and nonmember countries. I’ll continue to make our NAOs more aware of IUPAC and will do my best to increase the number of NAOs. As previous IUPAC presidents have suggested, why not attain 100 NAOs by the 100th anniversary of IUPAC in 2019?

Nicole J. Moreau <nj.moreau@free.fr> was IUPAC vice president in 2008–2009, president in 2010–2011, and is now past president for 2012–2013. She has been a member of the Bureau since 2000 and a member of the Executive Committee since 2006. She is also general secretary of the French National Committee for Chemistry. Since January 2012, she is a member of the Executive Board of ICSU, the International Council for Science.

A Vision of Chemistry for 2050

The International Year of Chemistry Young Leaders Team

How can chemistry tackle global challenges by the year 2050? This is the question the Young Leaders Team set out to answer during the International Year of Chemistry. Here we find the results of their deliberations, and time-travel to 2050 for sneak-peek interviews with future winners of Nobel Prizes in Chemistry.

Under the auspices of the International Year of Chemistry, 13 young professionals working in the chemical sciences came together as the Young Leaders Team to reflect on the theme of the Year: **Chemistry—our life, our future**. In December 2011, our team presented the results of this deliberation at the Closing Ceremony of the International Year of Chemistry. This article summarizes the vision of how chemistry will tackle our global challenges between now and the year 2050.

Before focusing on the future of chemistry, it is helpful to ask "Where is chemistry in our life today?" Chemistry constitutes the basis of life and all nature. Although chemistry is often associated with chemical factories and with products such as paint and oil, chemistry also encompasses everything in nature, the cooking of food, and the metabolic processes in our body. Chemistry ensures that we have sufficient food that has a long shelf-life and is safe; that we have medicines to prevent and treat everyday illnesses and serious diseases; that we have heat and power; that we can buy personal-care products and clothing; and that we have continual access to telecommunication, media, and music wherever we are.

Young Leaders Lucie Garreau-Iles (France, above) and Albert Sugiharto (Indonesia/Germany), at the IYC Closing Ceremony in Brussels.

Where will chemistry be in our life tomorrow? Answering this question led us to envision ourselves in 2050. Global, sustained and macro-economic forces of development, commonly called "megatrends," will impact businesses, economies, societies, cultures, and our personal lives in our future. What do we know about this future?

We know that global population will increase from 7 to 9 billion people and that 75 percent of people will be living in cities, up from 50 percent today. This will translate into an explosion of consumption, accelerating the usage of energy and finite resources, with severe consequences for the health of our planet. Higher density may cause pandemic health risks to rise, while the level of chronic disease among an aging and ever-more-mobile population is expected to grow.

Whilst these megatrends will clearly affect humankind, they will not do so uniformly. Below, we illustrate how the developed, developing, and least-developed parts of the world will experience these megatrends in different ways, and how chemistry will address some of the fundamental impacts during the next 40 years. Despite the magnitude and differential effects of these changes, we all firmly share the common vision that **by 2050, everyone on the planet must have access to a healthy, safe, and fulfilled life in symbiosis with our planet.** We also believe that chemistry, along with other sciences, will play a leading role in fulfilling this vision.

Our team quickly focused on the key issues where the innovative power of chemistry is most needed and potentially impactful in the next 40 years: food and water, urban habitat, energy and resources, and health. We suggested not only some of the technological breakthroughs, but also the right policies, that will lead to Nobel Prizes in Chemistry being awarded in 2050 to the following three collaborative projects.

Chemistry for Food and Water

Photograph: KIKETXO / Shutterstock.com

The nexus between food and water is important. It is estimated that nearly 1 billion people went hungry in 2010.[1] It is anticipated that if the world's population grows to 9 billion by 2050, at least a 70 percent growth in global food production will be required. Agriculture currently accounts for 70 percent of fresh water use.[2] As global food production increases, demand for fresh water will increase. Increasing the efficiency of water for agricultural use will provide two benefits.

The first is "more crop per drop of water." Minimizing water use for food also frees up fresh water supplies for drinking and other uses such as energy. This is critical, as currently 1 in 8 people do not have access to safe, clean drinking water.[3] Chemistry can enable the development of technologies such as new drought-resistant crops and seeds in addition to fertilizers that use less water in farming.

In parallel, we also see the role of chemistry in producing fresh water. Chemistry will be critical in developing inexpensive water purification techniques such as filtration and disinfection. An example would be a low-cost and robust membrane for filtration. While water purification technology exists today, many of these technologies are not accessible to all global markets, and a chemistry breakthrough is needed to provide a solution that is readily scalable and accessible to all.

Beyond purification, chemistry can also aid in the development of robust piping materials for highly efficient transport of water to multiple regions, in particular those in which water is scarce and unsuitable for farming.

Without the proper mechanism for technology deployment, these solutions will not be impactful. Successful implementation of these improvements in agrotechnologies and water is critical and will require three steps. First, industry and academic research institutes must be committed to developing better agricultural production systems and water-purification techniques. Second, governments must provide support for fundamental research and new technology development. Infrastructure development is key in order for these technologies to be sustainable, and efforts must be integrated at national and international levels. Third, local farmers and communities must be well-educated and informed of new technologies and the latest irrigation techniques.

Through collaboration and commitment, industrial, academic, and government sectors can implement chemical breakthroughs to meet future demands for food and water.

Chemistry for the Urban Habitat

The urban habitat is the epicenter of several critical challenges, encompassing urban infrastructure, mobility, and consumption patterns. These are all areas where innovation in chemistry will be needed.

More than 3 billion additional city-dwellers, all aspiring to a modern lifestyle, are expected to emerge in the next 40 years,[4] driving up demand for a whole range of resources. This soaring demand and resource usage will occur at a time when finding new natural resources and extracting them will become increasingly challenging, and when humankind will have to reduce its carbon emissions to manage climate change within a sustainable level. So, both of the following are needed: an increase in the supply of resources; and a step change in the way that resources are extracted, converted, and used.

Photograph: ssguy / Shutterstock.com

Interview with Mr. Al-Amal, Director of Nigeria AgroChem, Nobel Prize in Chemistry 2050

Mr. Al-Amal, congratulations on your Nobel Prize. As the director of the Nigerian AgroChemical Corporation, you are the first industrial leader ever to be awarded the Nobel Prize. How does it feel?

It is a great honor to receive the Nobel Prize for helping meet the world's growing needs for food and water. The low-cost water purification unit my team developed over the last decades is the result of close cooperation between academia, government, and industry. The technology has now been implemented globally. My work was dedicated to finding chemical solutions to the water problem—I never dreamed of winning the Nobel Prize.

You graduated in 2016 as a chemical engineer. How did you first get into the water problem?

After graduating in my home country of Egypt, I joined a major agrochemical company. I was involved in several projects to develop drought-resistant seeds with better crop yield. These seeds required less fresh water to irrigate, and the resulting crops had a higher chance to survive without irrigation. We were very successful in the crop market. I thought I had found a solution to the food problems we had in Africa; however, I had yet to grasp the full challenge or see the big picture.

"The big picture"—what do you mean?

In 2019, I was tasked with increasing the sales of chemically enhanced seeds across Africa. I was, therefore, transferred from Egypt to Nigeria where I quickly made friends with the local farmers. I learned that enhanced seeds could help increase the crop yield in their fields. There was, however, a major problem to be solved: The lack of clean water for irrigation. The River Niger could provide enough water, but that water was spoiled by oil spills. The use of Niger water for irrigation would mean that the farmland would be polluted and the crops would be spoiled.

What was your approach to solving the irrigation problem? I recall that, in the 2020s, water filtration technology was still too expensive for a place like Nigeria.

That's exactly the point. Our company held patents in membrane-based water filtration technologies, but they were much too expensive to commercialize in these target markets. We could not solve the problem alone. This was upsetting to me, as I felt the urgent need to help my farming friends by providing a solution to their local irrigation problem.

The development of technology that is cost-prohibitive is an experience many industrial chemists encounter. How did you overcome this roadblock? Did chemistry play a role?

A turning point came in 2024, when the Nigerian government started a number of research initiatives for water purification technologies. Together with the Nigerian government, my company engaged in a public-private partnership. Our goal was to create a water purification technology that was affordable to Nigerian farmers, and easy for them to maintain themselves.

Our breakthrough came in 2027, when I was working on a new kind of filter. My vision was to find a material that could filter out dirt from the water, while neutralizing microbes in a reaction catalyzed by the filter material itself. While conducting my own research, I discovered that one of the local plants had the right germicidal effect. It was possible to use the plant fiber as a filter material. Based on this discovery, we developed a low-cost, self-contained water treatment unit which could be easily cleaned by any farmer in the field.

The Nigerian government quickly adopted the technology and provided it at no cost to the local farmers. At the same time, the government constructed a new pipeline infrastructure made of self-sealing polymer material. This new, robust pipeline allowed the transport of water over long distances, with almost no loss. After this first success, I worked hard to spread this water filtration technology around the world. Beginning in Africa, we set up cooperation projects all over the world. As you can see, in both purification and transport of water, chemistry played a key role.

Thank you for these insights. Could you summarize the most relevant factors behind this success?

Let me point out three components that were crucial. Our success was based on chemical innovations that are supported by other sciences. To bring them into use, we needed people with sound academic and practical education. This was made possible only through close cooperation among partners in industry, government, and academia. The outcome shows that when all three sectors come together, success is inevitable.

Rui Vogt Alves da Cruz (Brazil), Young Leader, makes a point at the Closing Ceremony.

The scope of the challenge is enormous. Cities will have to try to attain a zero-carbon footprint, and ideally a zero-resource footprint as well. Towards this goal, building energy efficiency and fuel efficiency will be the highest priorities.

If captured in full, raising the energy efficiency of buildings would reduce energy demand by 20 percent more than the global use of energy by shipping and air transportation combined.[5] Such an improvement represents 30 percent of the team's proposal for energy reduction. Chemistry will play a key role in this process by enabling:

- insulation, such as phase-change material and energy-efficient glazing, for passive regulation of indoor temperatures in buildings
- electronic materials, such as photonic chips, for intelligent communication systems
- zero-emission technologies for decentralized and renewable power generation, which can be integrated into buildings (e.g., resins and composite materials for wind turbine blades, structural and electro-active materials for solar photovoltaic cells)

Second, the potential for increasing fuel efficiency in the transportation sector, particularly for internal combustion engines, is phenomenal. Since it is likely that 75 percent of all vehicles will still have this type of engine by 2030,[6] improving their fuel efficiency is critical. Chemistry can help to make cars lighter and it will be essential for scaling-up of the third-generation of algae-based biofuels. Chemistry will also enable the mass deployment of electric and hybrid vehicles by providing advanced materials for the new batteries and energy management systems.

But chemical innovation will not solve these challenges alone. Business can drive the innovation, but only if governments and policymakers adopt the following measures:

- friendly policies to accelerate the deployment of less resource-intensive innovation (e.g., solar feed-in-tariffs, direct capital investment in existing building retrofits, new building codes) and mitigate the negative effects on stakeholders from the transition process
- enforcement of a cradle-to-cradle lifecycle impact assessment on existing products and technologies to take into account their full environmental cost (e.g., carbon tax, total carbon footprint accounting)
- long-term investment in education—not only in the sciences, but also through consumer and business awareness—that encourages and accelerates changes in personal behavior that will lead to lower resource use
- long-term funding commitment to fundamental research so the seeds of tomorrow's innovation will sprout

Photograph: Darren Baker/Shutterstock.com

Chemistry for Health

Chemistry plays a major role in managing our health. It is projected that, by 2020, the USA will spend 685 billion USD per year in direct medical costs for people with chronic diseases. By 2050, this figure

Interview with the Mayor of Xi'an, Nobel Prize in Chemistry 2050

Hello Mayor, congratulations on your Nobel Prize. Xi'an today is one of the first self-sufficient, zero-footprint cities in China. It was quite a big transformation.

Yes, as the Mayor of Xi'an, I am very proud to say that Xi'an is now the eco-city model for the rest of China and for the world.

We will come back to Xi'an later. Maybe we can start to talk a little bit about you, where do you come from in China and how did you get into chemistry?

I was born in Xi'an in 1990. This was how my interest in chemistry was piqued: When I visited the world-famous Terracotta Army in Xi'an at the age of 15, I could not believe that these sculptures were over 2000 years old. But then I learned the method of age determination by ^{14}C. There and then, I decided to become a chemist to discover this amazing field of science.

You graduated in 2011 as a chemist and started to work for the Dongtan project. Tell us a little bit about this project?

During the first decade of the 21st century, China was enjoying an economic miracle. But to enable this miracle, one coal power plant was opening almost every week. By the end of the decade, China became the biggest CO_2 emitter in the world. China realized the serious environmental damage caused by this development and started to invest in projects to reduce its intense energy and carbon usage. The most ambitious one was the Dongtan site, the first eco-city development in China.

So you started to work as a chemist for the Dongtan project, but in 2020 you joined the Xi'an municipal authority, what made you change your career from a chemist to a politician?

When I was involved in the Dongtan project, my job was to bring the chemical industry and academia together to work on a long-term "cross-seasonal" thermal-energy storage system. In this project, I realized the essential role of the Chinese government in completing the project. If chemistry is key, the government puts the key into the door. Then, in 2020, I learned that my home town of Xi'an was to become one of the planned eco-cities in the Vision 2050 established by the Chinese government. This is why I decided to work in the municipal authority.

As we know, a Nobel Prize in Chemistry was awarded to you for your contribution to promoting the chemistry in the Eco-Xi'an project. Could you please explain in more detail the role of chemistry in the realization of Eco-Xi'an?

Over 30 years, the transformation of Xi'an was impressive. Chemistry was key to this development, but it did not act alone. There were three important pillars: innovation, lifestyle, and governance. Chemistry was a main contributor to the first two pillars. Let me mention some examples:

Innovation in chemistry played a key role in the development of Xi'an as an eco-city: a sponge, based on nanotechnology, is used on the top of the buildings to absorb the pollutant particles; artificial photosynthesis systems are used to produce the biofuel and energy by converting CO_2 and light; cross-seasonal thermal storage is used to keep the summer heat for use in winter; and efficient chemical processes are used to produce the materials, which makes everything I just mentioned affordable.

As for the urban lifestyle, we pioneered a smart infrastructure that combines high-purity chemical compounds and information technology, connecting electromobility in the city. We developed a symbiosis between chemical plants and habitat, with safety management systems. And we optimized the recycling process, allowing the reuse of over 90 percent of the waste created in Xi'an.

Good governance means the right mix of incentive- and eco-based fiscal policies. It also means education programs encouraging the younger generation to embrace science and engineering. Dedicated public communication programs are indispensible if we want to change the mindset and lifestyle of citizens.

So chemistry plays a key role, but chemistry cannot do it all alone. To end this interview, would you describe in one sentence the most important factor in the achievement of Eco-Xi'an?

I want to say that we have succeeded because government, academia, industry, as well as citizens bonded together.

may become as high as USD 906 billion.[7] For example, as many as 16 million people could be affected by Alzheimer's disease by 2050.[8]

The early detection of the onset of chronic diseases such as Alzheimer's or Parkinson's by using innovative technologies could have an enormous impact, especially if integrated with systems that are able to produce and release the vital compounds that are lacking in these life-debilitating pathologies. A similar solution could be applied to infectious diseases as they account for EUR 1.5 billion in healthcare costs per year.

A joint effort between chemistry and the life sciences could enable the development of technologies such as a bacterium that produces and delivers biomolecules to compensate for a patient's deficiency (e.g., in stopping cancer propagation, in delivering dopamine against Parkinson's disease). This could expand further to predictive medicine, ensuring that timely, targeted treatment is delivered to the right patient. In this area, an example would be to develop a biomaterial that monitors the full protein expression pattern before the onset of the disease.

There is a need to move from a medical approach, primarily based on disease treatment, to an integrated approach in which prevention, cure, and disease management are merged into one personalized healthcare continuum. Such a transformation would trigger a revolution of health policy and reimbursement strategies. It would also require a change in the way that patient data is handled, to ensure privacy. While allowing the use of patient data for preventative actions, a personalized healthcare approach would have to guard against misuse (e.g., using to determine a person's eligibility for insurance, jobs, housing, and social benefits). To enable such a change, education for public understanding and cross-sector collaboration are essential.

The Young Leaders Team

The Young Leaders Team includes Guillaume Baxter (France), Sacha Debleds (France), Jacqueline Dias (Portugal/Sweden), Lucie Garreau-Iles (France), Nahrain Kamber (USA), Parag Kulkarni (India), Laetitia Malphettes (France), Hisham K. Mubarak (Egypt/Germany), Jean-Etienne Poirrier (Belgium), Albert Sugiharto (Indonesia/Germany), Kaihsu Tai (Taiwan/UK), Rui Vogt Alves da Cruz (Brazil), and Jingyi Zhong (China). Any views presented herein are solely those of the Young Leaders and do not necessarily represent those of their respective companies or organizations.

Young Leader Jacqueline Dias (Portugal/Sweden) at the IYC Closing Ceremony.

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Unless otherwise noted, all photographs are by Vivian Hertz.

Supporting Innovation in Chemistry

by Guillaume Minnoye and Nataša Doslik

With the world population set to grow by 50 percent by 2050, innovative solutions will be needed to tackle global challenges such as access to drinkable water, food, health, and clean and safe energy. Research in chemistry-related fields—and its application in industry—holds great potential for finding answers to many of these problems. But the success of any innovative effort very much depends on having a solid system of patent protection.

Patents give inventors the exclusive right to prevent others from exploiting their invention for a limited time, in exchange for disclosing the details of the invention. This acts as a strong incentive to innovate. Indeed, many important inventions might not have seen the light of day without the patent system.

Roots in Europe

The patent system has come a long way since the first patent law was established in Europe in the 15th century. Recognizing the need for closer cooperation on patent protection, 16 countries signed the European Patent Convention in 1973, setting up an international organization, the European Patent Organisation with its executive body, the European Patent Office (EPO). Today, the organization has 38 member states and three associated states. Together they cover a territory with a population of almost 600 million people, which outnumbers that of the USA, Japan, and Korea combined. With nearly 7 000 staff, the office is one of the largest European institutions and has an entirely self-financed annual budget of EUR 1.8 billion. The EPO has its headquarters in Munich, and offices in The Hague, Berlin, Vienna, and Brussels.

European Patents and the Grant Procedure: In a Nutshell

The EPO provides a central one-stop service to innovators—whether individual inventors, universities, research institutes, or companies—from Europe and around the world. It enables them to obtain patent protection in up to 40 European countries concurrently by filing a single patent application in one of the EPO's three official languages (English, French, or German). This makes it the largest transnational patent system in the world. Since no unitary EU-wide patent yet exists, patent applicants need to select the countries in which they would like protection. The patent granted by the EPO has the same legal effects as a national patent does in each of these countries.

Patents are granted by the EPO only for inventions that are new, involve an inventive step (i.e., are not obvious to a person "skilled in the art") and are industrially applicable. While the patent system is generally open to all technologies, there are a number of exceptions to patentability under European patent law, such as scientific discoveries, mathematical formulae, aesthetic creations, and methods of doing business, to name a few. Other restrictions are found in the area of biotechnology. For example, European patents cannot be granted for human embryos, plant and animal varieties, or essentially biological processes for the production of plants and animals (e.g., breeding methods involving conventional steps such as crossing and selection).

From Regional Office to Global Player

The EPO's growth reflects the success and economic importance of the European patent: the number of European patent applications filed in 2011—243 000—was more than eight times higher than the originally predicted maximum of 30 000, and the figures are still growing. The office has a worldwide user base, with most filings (about 60 percent) coming from outside Europe. The EPO has witnessed a considerable growth in filings by Chinese, Korean, and Japanese firms over the past two years. These companies often choose to file international applications at the EPO under the Patent Cooperation Treaty, an agreement that makes it possible to file for patent protection in more than 140 countries on the basis of a single application. The EPO acts as International Searching Authority in more than 40 percent of all Patent Cooperation Treaty procedures, making it a nerve center of the global patent system and a central pillar of not only European, but also global innovation.

Chemistry and European Patents

The importance of chemistry for global research and industry is mirrored in chemistry-related patents at the EPO. Of the office's 4000 patent examiners, nearly 1200 of them examine patents in chemistry-related fields, including inorganic chemistry, organic chemistry, polymer chemistry and biotechnology. The EPO receives patent applications for inventions covering a hugely diverse range of technical areas: from artificial skin and biomarkers for tumors to Alzheimer's drugs; from cosmetics and detergents to paints; from solar and fuel cells and batteries to sensors; from baby and functional food to water treatment, just to name a few. The chemistry-related technical fields are not only very diverse, but are constantly undergoing developments, thereby leading to new, emerging technologies, as well as causing established technologies to lose importance. Take the example of chemical processes used in analogue photography: this is a technical field which is disappearing and making room for digital photography. This change in technology has resulted in a shift in patent applications filed in new technical fields, many of which are no longer chemistry-related. The EPO is thus at the cutting-edge of technological trends.

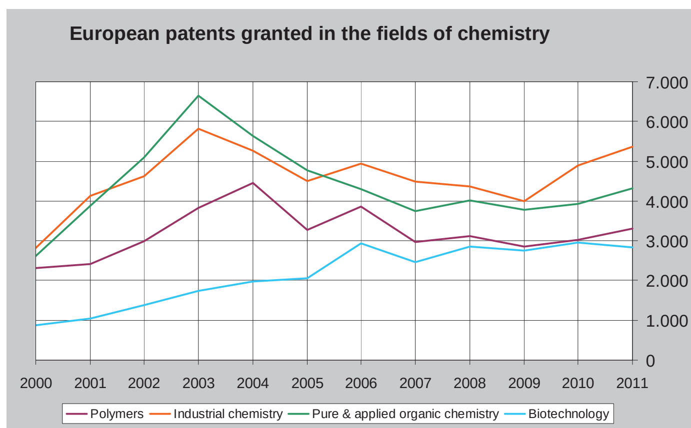
Meanwhile there are also some stalwart technologies, which have been important over long periods of time. One example is cement. This material has been known, produced, and used for 2000 years, so it may come as a surprise that a large number of patent applications are still filed in this technical field. This has many reasons: cement's applications include a vast range of different possibilities, and research for improved characteristics of cement for different usage is ongoing, as it is still among the most frequently used building materials worldwide. And even in such a seemingly "old" technical field, new features can emerge. It is now acknowledged that the cement industry is a vast producer of carbon dioxide, so new production processes are being sought. As a result, the EPO receives an increasing number of patent applications which focus on carbon dioxide reduction, or the recycling of waste material (e.g., combustion residues such as fly ash originating from coal gasification) using cement.

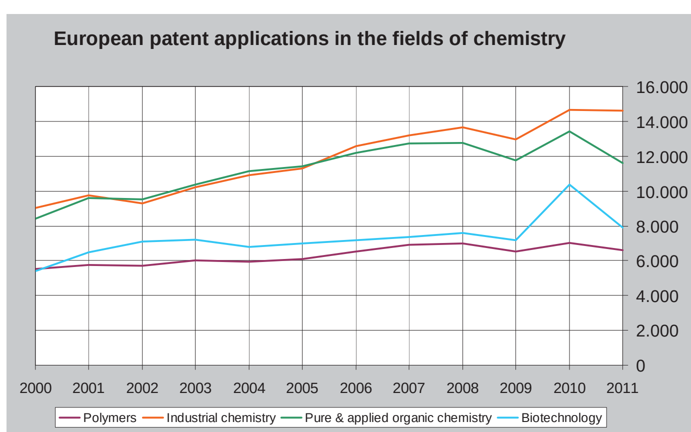
The EPO's latest filing figures (see graphs) show a steady growth in patent applications in all areas of chemistry over the past 10 years, notwithstanding certain dips which can be attributed to the recent financial and economic downturns. Industrial chemistry and biotechnology, in particular, have seen very fast growth since 2000: with growth rates of 62 percent and 47 percent, respectively, for patent applications filed; and +223 percent and +90 percent for patents granted.

Patents: Their Benefits

A growing number of individual inventors and businesses are realizing the commercial impact of patenting their inventions. Patents give companies the possibility to reap the rewards of their investment and recoup development costs. They have also become an important tool for measuring a company's R&D performance, as well as a trading and bargaining chip for cross-licensing and technology alliances. And many companies now consider it important to have a large patent portfolio to be recognized as a serious business partner and to raise capital.

Increasingly, patents are also moving on to the radar of academia. More and more public research institutions and universities are now patenting their inventions. Research institutions can start a company





to commercialize their patent, or have it licensed by others, which in turn funds university research and opens up new possibilities for innovation.

The knowledge-transfer function of patents is not to be underestimated. In return for patent protection, the inventor has to disclose the details of the invention, which are published in the patent document. A large proportion of the world's applied technical knowledge can therefore be found in patent documents. The availability of this information inspires further inventions and at the same time helps prevent the duplication of R&D work. The EPO's public databases—containing more than 70 million documents and accessible on its website free-of-charge—are one of, if not the largest and most pertinent sources of information about state-of-the-art technology available anywhere in the world. In addition, in order to ensure maximum accessibility of these documents to inventors and researchers, the EPO has made the development of machine translation technology one of its top priorities.

Last year, the EPO broke new ground in removing the language barriers in the way of patent information by teaming up with Google to provide a free machine translation service to the public. The new service, called Patent Translate, can be expected eventually to cover the 28 languages of the EPO's member states, plus Chinese, Japanese, Korean, and Russian. It will be of huge benefit to companies, inventors, and scientists all across the globe, who will be able to easily access up-to-date information about the latest technologies, including those coming out of Asia, in their own language. A first set of seven languages (English, German, French, Italian, Portuguese, Spanish, and Swedish) covering about 90 percent of all patents issued in Europe, has just been made available, a second batch covering another six languages is expected in 2013, and the rest will follow by the end of 2014.

Patents: Quality, Efficiency, and Transparency

The success of the European patent boils down, in essence, to three things: First of all, the EPO's grant procedure, which rigorously aims for high patent quality, provides the highest legal certainty for innovation on the technology market. Before a European patent can be granted, every application at the EPO is subject to a thorough search and rigorous examination process by an examining division consisting of three highly qualified and trained patent examiners who have a university degree in the technology in question and are able to work in the three official languages of the EPO. This results in patents which are enforceable and stand up well to legal challenges. Only around 45 percent of all applications result in a patent, and almost all of the successful applications are modified or restricted during the examination process. In order to uphold its high level of quality, the EPO maintains the most comprehensive collection of patent and patent-related literature in the world, containing more than 600 million records in over 120 databases, updated daily, as well as over 70 million patent documents from all industrialized countries. The office has also developed expert tools for patent examiners to conduct a state-of-the-art search. The outstanding quality of European patents has been acknowledged time and time again by experts in independent surveys.

Secondly, owing to the efficiency and transparency of the European procedure, information on the patentability of an invention is publicly available at an early stage: the office releases a first estimate on patentability as early as six months after filing of the application with the EPO. Few other offices with an international remit are able to provide information so quickly and reliably.

Finally, the harmonizing nature of the European patent system proves useful in integrating new member states into the European innovation process and is conducive to a prompt dissemination of new technologies. That is why associate status is so attractive to neighboring non-European countries, as is shown by an agreement with Morocco, and why more and more aspiring regions, like ASEAN, see the European patent system as a suitable model for developing their own intellectual property systems.

What's Next: A Unitary Patent for Europe and International Harmonization

Despite its resounding economic success, the current system of patent protection in Europe is still structurally incomplete: Today, a patent holder choosing to have EPO-wide protection ends up with a bundle of 38 national patents. A true supranational patent for Europe has been discussed for decades, and the decision last year of 25 EU member states to introduce a unitary patent amounted to a political breakthrough in this respect. The creation of a unitary patent and a centralized, specialized European patent court will be an important step towards further supporting innovation by simplifying procedures and dramatically cutting the costs for anyone seeking patent protection in Europe. The office is proud to have been designated by the EU as the body which will grant the unitary patent and centrally administer it on behalf of the participating EU member states.

The positive developments in Europe and reforms of the patent system in the USA, in turn, have given fresh impetus to the efforts to harmonize the patent systems of the largest economic regions. Such alignment is needed in view of the growing interdependence of technology markets and the ever-greater influence this has on businesses' global IP strategies, leading them to file parallel patent applications for the same invention in multiple countries. Businesses need to find comparable conditions in all markets if their innovation strategies are to succeed.

The EPO is working closely with the other major patent offices, especially those of China, Japan, Korea, and the USA in order to reduce unnecessary duplication of work in the global patent system, while at the same time guaranteeing the quality of patents granted.

One important milestone in cooperation was the agreement between the EPO and the U.S. Patent and Trademark Office to develop a joint system for the classification of inventions. The new Cooperative Patent Classification is based essentially on the European approach, and is a promising start to creating a worldwide standard, especially now that Japan and China are also considering adopting it.

Oral Proceedings in examination and opposition, part of the examiners' work profile, are one of the pilars to ensure legal certainty.

Making the Patent System Work for Society

Patents are increasingly in the public spotlight, in the concerns of citizens, and on the agenda of policymakers in Europe and worldwide. What was once an arcane legal instrument is now a much-talked about right of unprecedented economic importance in our current innovation- and information-driven global society. The EPO is actively participating in the debate about how the patent system should be reshaped to better serve the needs of society and industry, create jobs and economic growth, and promote the development of new technologies that will help us to tackle global problems such as climate change, disease, food and water shortages, and environmental pollution.

In the field of climate change mitigation technologies, for example, the EPO conducted a joint project with the United Nations Environment Programme and International Centre for Trade and Sustainable Development, a Geneva-based NGO, to gain a better understanding of the role played by patents in the deployment and dissemination of these technologies in developing countries. The study's final report, published in September 2010, included the findings from a comprehensive mapping of clean energy technologies, an in-depth analysis of the patent landscape for these technologies, and a survey of licensing activities in this field. The technologies covered a wide range of areas including renewable energy sources (e.g., geothermal, hydro, solar, and wind), efficient operation of power networks, biofuels, energy storage, and hydrogen technology. One groundbreaking result of the project has been the creation of a dedicated classification scheme for patent documents relating to clean-energy technologies, which is now online. Using a searchable database, this new scheme gives users access to up-to-the-minute, accurate, and user-friendly patent information.

The EPO will make every effort to play its part in the development of sustainable and efficient patent system which responds to the needs of the economy and society both in Europe and beyond. In this perspective, its true potential and capacities as facilitator for innovation are only just about to unfold.

Guillaume Minnoye is the vice president of Directorate-General Operations at the EPO, which is responsible for search and examination of European patent applications and conducting of opposition proceedings in relation to European patents. Nataša Doslik <ndoslik@epo.org> holds a Ph.D. in inorganic chemistry and is senior examiner in Industrial Chemistry in Directorate-General Operations at the EPO.

www.epo.org

The Global Experiment of the International Year of Chemistry

Water: A Chemical Solution

by Javier Garcia Martinez and Rovani Sigamoney

Shortly after the UN declaration of 2011 as the International Year of Chemistry,[1] IUPAC and UNESCO established a working group to devise a global project focused on promoting interest in chemistry among young people. Already in 2009, during the IUPAC General Assembly in Glasgow, it was suggested that this activity would be a collection of simple experiments related to water and that the results would be shared online. The central idea behind the project was that the kids would be the main actors of their own learning by having them leave the classroom for simple experiments related to daily activities, and then enabling them to share their experiences, pictures, and results on the web.

The various experiments were designed to require minimal equipment and resources, and the protocols drafted by an international team of educators.[2] A dedicated website for the Global Experiment[3] was created so that one could download the instructions for performing the experiments, upload the results, and view the data obtained by other students from around the world. The interactive site—available in English, French, Spanish, Russian, and Chinese—also served as a clearinghouse for teachers and affiliated centers. It was designed for young people to actively participate in IYC and learn about the relationship between water and many of the world's current problems—from food shortages to climate change—and how chemistry plays a fundamental role in understanding and resolving these challenges.

In the past, similar projects that focused on educating students about the role of water were highly informative and raised awareness. However, for this IYC project, it was decided that by encouraging students to conduct simple hands-on experiments, they would learn why water is so unique and the central role of chemistry in providing clean safe water. In particular, they would discover water's chemical and physical properties, the importance of chemical measurement to test water quality, and how to purify it. By participating in the Global Experiment, students learned important chemical concepts such as salinity, solubility, and pH.

This initiative directly addressed key objectives of IYC, namely to increase public understanding about how chemistry provides solutions to contemporary challenges and to promote interest among young people in science and chemistry in particular.

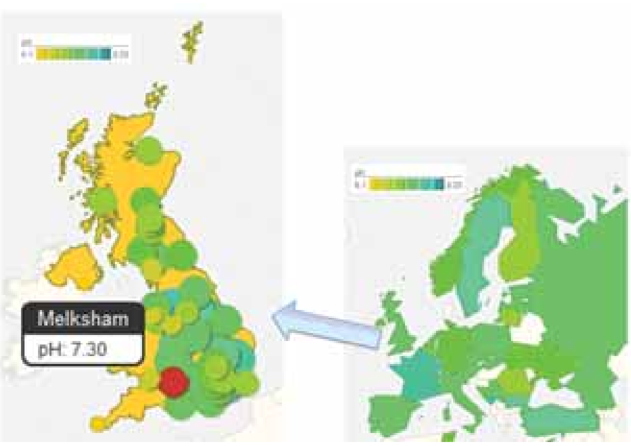
When all of the results of the experiment were posted by students, an impressive map began to emerge that illustrated the contributions from all schools, colleges, or institutions involved around the world.

The experiments were designed so they could be performed with a minimum of resources and so that the level of sophistication could easily be increased. The protocols were provided with additional educational materials to enable teachers of every level to implement the experiment at the appropriate educational level of his/her class or group of students. To make the experiments as widely accessible as possible, the instructions were translated into 11 languages.

The four experiments comprising the Global Experiment were divided into two groups:

Activities related to the measurement of water quality:

- **Acidity:** Students learned to take measurements of local water pH using various indicators. Next, they were taught to use techniques for checking the reliability of the results obtained.
- **Salinity:** The salinity experiment enabled students to measure the salt content of water samples by evaporation until the sample is dried to constant weight.



Data collected by students are displayed on colorful maps that display the reported values, the location where the experiments were conducted, and the number of participants.

Activities related to water purification:

- **Filtration:** In this activity the students constructed a filtration unit and evaluated its efficiency and capacity using a sample of local water. As with other activities, the data generated contributed to a global map of the results.
- **Distillation:** During this activity, students investigated an alternative way of purifying water using solar energy and the process of distillation. Additionally, students had an opportunity to design and build their own distillation system.

These experiments were designed for a wide variety of educational settings. However, for the Global Experiment to be truly global, even children in regions with little to no resources needed to be able to participate. In order to include some students from these regions, the project task group arranged to send 150 free school kits, each consisting of 10 minilabs to 30 developing countries. This allowed the Global Experiment to reach 50 000 students who otherwise would not have been able to participate.

The project has afforded an enormous amount of quality water data from around the planet. Since launching the Global Experiment on World Water Day in March 2011 in South Africa, 128 330 students and 2354 teachers (as of 1 April 2012) from over 80 countries

The Global Experiment of the IYC

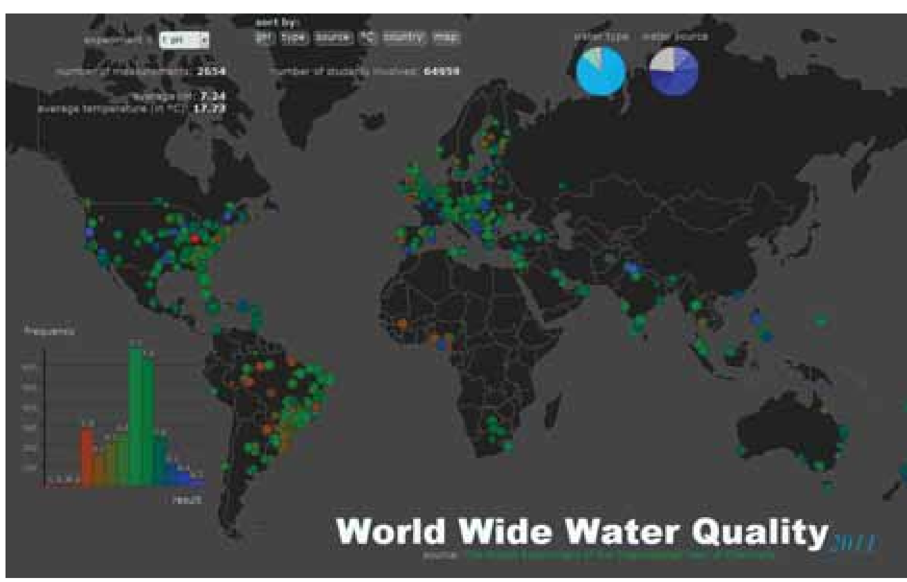
Scheme of the minilabs experimental set, which also includes a scale and the necessary reagents to carry out all activities of the Global Experiment.

have shared their results on the website. However, the actual number of people who have taken part in the Global Experiment is much higher, since not all have shared their results online. In Brazil for example, it is estimated that more than 1.5 million students participated in this activity; support by the Brazilian government was instrumental in providing 30 000 kits for schools to participate. Similarly, in the United Kingdom where the Royal Society of Chemistry organized the Global Experiment Day on 22 June 2011, thousands of students participated in this activity. We may never know the exact number of students who participated, but the most important thing is that that through the Global Experiment thousands of young people around the world have discovered an interest in science and enjoyed doing simple experiments while learning about chemistry and water.

Social media is a powerful tool embraced by the youth and which offers new opportunities and challenges for educators to engage their students. Central to the success of the Global Experiment was the use of social networks, which allowed students to shared experiences, photos, and results in real time through Facebook, Twitter, YouTube, or Flickr. Using these social tools, they were able to create their own communities of friends who shared their interest in chemistry.[4]

From the beginning, the Global Experiment was intended not just as an activity for youth. Instead, with the tools that social media provided, the experiment quickly evolved to become an activity by youth—a student-driven initiative allowing interaction through virtual communities. Both the students and the teachers are to be thanked, and each school that participated in this activity received a certificate of participation.

From the BBC to the *Washington Post*, a number of media outlets gave very favorable coverage of the Global Experiment, emphasizing its educational value and the fact that, overall, this was likely the largest chemistry experiment ever, given the huge number of participants. Perhaps just as important, the experiment showed how crowdsourcing can be used to acquire a large amount of scientific data that would otherwise be very difficult to obtain.



Special software was developed for the Global Experiment to enable viewing, comparison, and analysis of the results. The program was created collaboratively by programmers around the world through a competition organized by Visualizing.org.

But how can we visualize the massive amount of data collected in a way that anyone can analyze, compare, and extract conclusions from the thousands of measurements reported? Recently, the Global Experiment was part of a competition organized by Visualizing.org, in which computer programmers worldwide were asked to develop software that could view, compare, and analyze the vast amount of information we gathered over the past year.[5] In the spirit of the Global Experiment, this challenge was developed in a collaborative way so that from an initial design, programmers could create a more effective tool together than any individual programmer. The end result is an interactive map that displays all data sorted by type of experiment, the source of the water sample, and location.

On 14 March 2012, Colin Humphris and Javier Garcia Martinez, representing IUPAC, presented at the World Water Forum in Marseille, the results of this activity, the enormous amount of data reported, and the interest the experiment has generated for thousands of students. Although the Global Experiment has ended exactly one year after it began on World Water Day, IUPAC and UNESCO are starting to plan for the next activity that will promote interest in science and respect for the environment among young people.

In gratitude to the thousands of people who made the Global Experiment possible, IUPAC and UNESCO have released a video of this activity (produced by Casual Films).[6] The video, which explains the objectives, the experiments, and the main conclusions of this activity, is a tribute to the thousands of students who collected and analyzed local water samples and shared their results online.

Press conference at the 6th World Water Forum in Marseilles at which UNESCO and IUPAC presented the most relevant results of the activity.

The year-long Global Experiment—Water: A Chemical Solution has been quite remarkable both educationally and socially. All of us in IUPAC and UNESCO are very grateful to everyone from around the world, who worked so hard to make it possible, but most importantly, we'd like to thank all the teachers and students who embraced the Global Experiment—they were the ones who made it truly global and made it such a success.

Javier Garcia Martinez <j.garcia@ua.es> is a professor at the University of Alicante, a member of the IUPAC Bureau and the coordinator of the Global Experiment of the International Year of Chemistry. Rovani Sigamoney, <r.sigamoney@unesco.org> is UNESCO representative for IYC, from the UNESCO Division of Basic and Engineering Science. The Global Experiment executive team also included Colin Humphris (UK), Mark Cesa (USA), Peter Mahaffy (Canada), and Tony Wright (Australia). Several members from the IUPAC Committee on Chemistry Education and of the Analytical Chemistry Division were also involved, especially at the beginning during the experiments development phase; the group is presented in ref [2]; their valuable contribution is greatly acknowledged.

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Klavs F. Jensen Wins First IUPAC-ThalesNano Prize in Flow Chemistry

MIT professor Klavs F. Jensen (Cambridge, USA) is the first recipient of the newly created IUPAC-ThalesNano Prize in Flow Chemistry. The award was presented on 13 March 2012 at the Select Biosciences Conference in Munich by IUPAC Committee on Chemistry and Industry (COCI) Chair Michael Droescher and Ferenc Darvas for ThalesNano and for the Flow Chemical Society.

This award was established by a generous gift from the Hungarian Technology company ThalesNano Inc. to acknowledge the key role that flow chemistry plays toward improving chemical processes. The biannual prize of USD 7500 goes to an internationally recognized scientist whose activities or published accounts have made an outstanding contribution to the practice of flow chemistry. ThalesNano also provides travel support to the prize winner. ThalesNano has committed to funding the award for the next 10 years.

Dr. Ferenc Darvas (left), chairman of ThalesNano Inc. and Flow Chemistry Society, Prof. Klavs Jensen, and Michael Droescher, COCI chair.

Jensen was selected by a jury as the winner out of a list of highly respectable scientists who were nominated and recommended by leading scientists in the field. The jury comprises the chair of COCI, a representative of the Flow Chemistry Society, and two more international experts.

Jensen was selected for being one of the pioneers of flow chemistry, particularly in the areas of microreactor technology, multistep synthesis and purification, and automated reaction discovery and optimization. He has demonstrated that microsystems provide fundamental insight and offer new approaches to synthesis that are difficult to realize with conventional equipment.

His research is outstanding in combining in-line monitoring with chemical and biological transformations. By choosing a silicon microfabrication platform, devices can be made chemically compatible and be integrated with sensors and actuators. Moreover, the ability to operate these devices at high temperatures and pressures opens up opportunities to explore new chemistry and conditions that are otherwise difficult to establish safely in the laboratory. The large, established infrastructure for silicon microfabrication means that his techniques ultimately can be manufactured and potentially be used throughout the chemical engineering and chemical community.

Jensen is among the most broadly influential engineers and scientists. He has impacted diverse areas such as chemical synthesis, biotechnology, nanotechnology, and chemical engineering. In his career he has edited eight books and contributed as author or coauthor to more than 300 refereed papers and many conference proceedings. He has already received 19 prestigious awards and 16 lectureships.

The next prize will be awarded in 2014.

Third Polymer International-IUPAC Prize Awarded to Ali Khademhosseini

In March 2012, the Executive Editorial Board of *Polymer International* and the IUPAC Polymer Division announced that Ali Khademhosseini (MIT and Harvard) was the third winner of the *Polymer International*-IUPAC Award for Creativity in Applied Polymer Science or Polymer Technology. Khademhosseini's research has opened up new ways of using biomaterials to make tissues with controlled vascularization as well as tissue architecture.

Ali Khademhosseini.

Khademhosseini, formerly a Ph.D. student at MIT with Robert Langer, has emerged as one of the leaders in the field of micro- and nanoscale manufacturing technologies and biomaterials with substantial contributions at the interface of engineering, materials science, and biomedicine. In addition, he has been internationally recognized and was chosen as a Jr. PI at the Japan's World Premier International-Advanced Institute for Materials Research at Tohoku University where he directs a satellite laboratory. Over the past few years, he has made a number of seminal contributions in applying engineered biomaterials and microfluidic approaches to micro- and nanotechnology for biomedical and biological applications.

The winner was selected by members of the scientific committee representing *Polymer International* and the IUPAC Polymer Division:

- Kurt Geckeler (editor in chief of *Polymer International*)
- Greg Russell (IUPAC, Australasia)
- Jiasong He (*Polymer International*/IUPAC, Far East)
- Dick Dijkstra (*Polymer International*/IUPAC, Western Europe)
- Michael Buback (President of IUPAC Polymer Division, Western Europe)
- Pavel Kratochvil (*Polymer International*/IUPAC, Eastern Europe)
- Chris Ober (IUPAC, The Americas)

As the winner of the *Polymer International*-IUPAC Award, Khademhosseini receives USD 5000 and will deliver a keynote lecture at MACRO 2012. For more information, visit the *Polymer International* homepage.

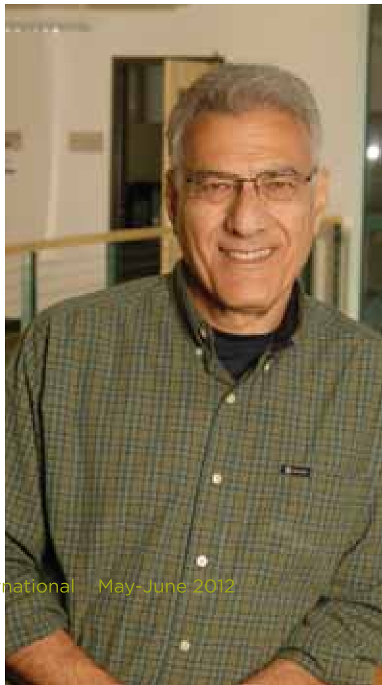
http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1097-0126

Stephen Hanessian to Receive 2012 IUPAC-Richter Prize in Medicinal Chemistry

In March 2012, it was announced that Stephen Hanessian had won the 2012 IUPAC-Richter Prize in Medicinal Chemistry. Hanessian was chosen for his outstanding achievements in natural product chemistry, his chiron approach to chiral compound synthesis, and his many seminal contributions that have facilitated the synthesis and discovery of medicinally active compounds and novel drug prototypes.

Hanessian has been a full professor since 1969 in the Chemistry Department at the University of Montreal and currently holds their Isis Pharmaceutical Research Chair. He also holds faculty positions in the Departments of Chemistry, Pharmaceutical Sciences, and Pharmacology at the University of California, Irvine, where he is also director of the Medicinal Chemistry and Pharmacology Graduate Program.

Stephen Hanessian.



He will receive the award, which includes USD 10 000, and present a lecture at the 33rd ACS National Medicinal Chemistry Meeting in Tucson, Arizona, on 21 May 2012. He will also lecture at the XXIInd EFMC International Symposium on Medicinal Chemistry to be held in Berlin, Germany, 2–6 September 2012.

Hanessian is a fellow of the Royal Society of Canada (1988) and has received the

Canada Gold Medal for Science and Engineering (1996) and was appointed Officer of the Order of Canada (1998). Among his many awards, he has received the Bernard Belleau Award in Medicinal Chemistry (Canadian Society for Chemistry in 2001) and this year will receive the 2012 Ernest Guenther Award in the Chemistry of Natural Products.

Stephen Hanessian obtained his Ph.D. at Ohio State University in 1960 and then spent seven years as a research chemist at the Parke-Davis Research Laboratories in Ann Arbor, Michigan, before moving to the University of Montreal. He has collaborated for research with many pharmaceutical companies and has around 500 research publications.

http://osiris.corg.umontreal.ca

IUPAC Elections for the 2014–2015 Term

Every two years, IUPAC holds an election for its officers and committee members. About 120 individuals are to be elected or reelected either as Titular Members, Associate Members, or National Representatives. Information concerning the voting process and the role of each kind of member is contained in the Union bylaws.

Any qualified individual who is interested in being nominated is invited to contact his/her National Adhering Organization (NAO) and/or the current committee officers. The next election will cover a two- or four-year term that will start in 2014.

The following division committees and standing committees will all have vacancies: Physical and Biophysical Chemistry, Inorganic Chemistry, Organic and Biomolecular Chemistry, Polymer, Analytical Chemistry, Chemistry and the Environment, Chemistry and Human Health, Chemical Nomenclature and Structure Representation, CHEMRAWN, Chemistry and Industry, Chemistry Education, Interdivisional Committee on Terminology, Nomenclature and Symbols, and Committee on Printed and Electronic Publications.

As part of the nomination procedure, NAOs are invited to submit curriculum vitae for each nominee to the IUPAC Secretariat no later than **31 July 2012**.

Elections for each division committee will then take place during the first half of 2013. The 2014–2015 memberships for all committees will be finalized during the next General Assembly in August 2013. Individuals interested in becoming officers on the IUPAC Bureau should contact their NAOs. Nominations for officers have a different timeline and can only be made by an NAO. Elections will take place at the Council Meeting during the next General Assembly.

Contact information for all NAOs and division and standing committee officers is available on the IUPAC website, or upon request at the IUPAC Secretariat (e-mail <secretariat@iupac.org>; tel.: +1 919 485 8700; fax +1 919 485 8706).

www.iupac.org

Metrology for Safety

Every year on 20 May, the World Metrology Day celebrates the signature by representatives of 17 nations of the Metre Convention on 20 May 1875. The Convention set the framework for global collaboration in the science of measurement and in its industrial, commercial, and societal application.

The original aim of the Metre Convention—the worldwide uniformity of measurement—remains as important today as it was in 1875. This year, the theme is "Metrology for Safety"—a wide-ranging topic but one which concerns everyone in a multitude of situations. The World Metrology Day project is currently realized jointly by the BIPM and the OIML together with PTB International Technical Cooperation.

www.worldmetrologyday.org

In Memoriam—Professor Herbert D. Kaesz

Herbert D. Kaesz, professor emeritus of chemistry and biochemistry, died 26 February 2012 of cancer in Los Angeles. He was 79.

He was born in Alexandria, Egypt, to Austrian parents. His father, a chemist, was asked to join his wife's family business, Kurz Optical, to run the branch in Alexandria. Later, the family immigrated to the United States when the younger Kaesz was seven. After receiving his AB from New York University, Herb went on to graduate studies at Harvard University, receiving his Ph.D. in 1959 under the mentorship of F. Gordon A. Stone. He joined the UCLA faculty in 1960 as a member of the inorganic division. He retired in 2003, but remained an active emeritus right up until his death.

His research focus was in the synthesis and applications of organometallic compounds, with a particular interest in metal carbonyls. Herb was one of the first to accomplish the synthesis of a technetium carbonyl complex, one of the last such complexes to be discovered. Later in his career, he pioneered the development of pyrolytic and photolytic methods of metal film deposition for electronic applications. Herb was also a dedicated teacher. His principal teaching assignments were in chemistry for non-majors, general chemistry, and structural inorganic and organometallic chemistry. Since his retirement he developed and taught a popular "Fiat Lux" seminar for non-majors at UCLA entitled "Serendipity in Science."

Kaesz was president of the Inorganic Syntheses Organization, which publishes the Inorganic Syntheses book series (He served as editor of volume 26 in this series.) and served for over 30 years as associate editor of the ACS journal Inorganic Chemistry. His accomplishments were honored by the scientific community many times over the course of his career. In 1980, he received the Tolman Medal from the Southern California Section of the ACS and in 1981 he was elected a Fellow of the AAAS. In 1998, Herb received the ACS Award for Distinguished Service in the Advancement of Inorganic Chemistry and was elected a Fellow in 2009. Herb was also a member of RCS and Alpha Chi Sigma.

Kaesz performed vital service for the chemistry community. In IUPAC, he was chairman of the Commission on the Nomenclature of Inorganic Chemistry from 1998 to 2001—and a member since 1994. He was also a member of the Inorganic Chemistry Division, the Chemical Nomenclature and Structure Representation Division, and the Committee on Chemistry Education. He became an IUPAC Fellow in 2006. Herb served on the U.S. National Committee for IUPAC in various capacities for 11 years and as chair of the committee from 2007 to 2009. As a member and Fellow of IUPAC, he served the international scientific community by bringing his expertise in inorganic chemistry to bear on a variety of projects, though he had a particular interest in chemical nomenclature. As a scientist, he supported and developed international collaborations through visiting professorships in France and New Zealand, and was recognized with a fellowship from the Japan Society for the Promotion of Science (1978). In 1988, he was a winner of the U.S. Senior Scientist Award from the Alexander von Humboldt Foundation, sponsored by the German government (1988).

Herb Kaesz at a fairly recent initiation ceremony of the Phi Beta Kappa UCLA Chapter.

As a member of USNC/IUPAC, Kaesz brought his commitment to global science and to the value of collaboration to the activities of the group, along with a warmth and kindness that made him a pleasure to work with. His vision to engage young Americans in the global chemical enterprise by providing them opportunities to dialog and exchange ideas will be forever championed. His skill, talent, dedication, vision, and passion for our chemistry community will be truly missed. We, in IUPAC, were very fortunate that he chose to get involved with the international community the way he did. Herb, you did chemistry and chemists a great service.

Joan Kaesz, Herb's adored wife of over 51 years (who worked with Herb for 30 years as his assistant in his capacity as journal editor), passed away in January 2010. In addition to his daughters, Susan and Judy, Herb is survived by his grandchildren Dylan Kaesz, Erin Murray, and James Murray.

Regional Water Quality Assessment and Regional Cooperation in the Middle East

The task group that is to assess the quality of the drinking water supplied to the population in the area including the Palestinian Authority, Jordan, and Israel (IUPAC project 2008-003-3-600) led a workshop during the recent Malta V conference. The Malta V Conference, held at UNESCO headquarters in Paris, France, 4–9 December 2011, brought together 75 scientists from 14 nations of the Middle East and elsewhere, including Egypt, England, France, Iraq, Israel, Jordan, Lebanon, Libya, Norway, Palestinian Authority, Saudi Arabia, Syria, Turkey, and USA.

The Environment, Air, Soil, and Water Quality Workshop included 3 sessions: Environmental Chemistry, chaired by Charles E. Kolb; Water Resources Management, chaired by Alfred Abed Rabo; and Collaborative Research Progress & Opportunities, chaired by Miriam Waldman and Heinz Hoetzl. A detailed program is available on the project webpage at <www.iupac.org/project/2008-003-3-600>.

The project task group includes members from Egypt, Germany, Israel, Jordan, Kuwait, Palestine, UK, USA. The results of their collaborative work were presented at the workshop. With an emphasis on the acute crisis of water and drinking-water quality in the region, the workshop dealt with the following topics:

- water resources and water quality management strategy and technology options
- the state of water resources, as well as the treatment and reuse of waste water
- drinking-water quality issues and evaluation of specific case studies
- practical solutions, enabling a safe and adequate drinking-water supply, water-quality control strategies as applied to the drinking-water supply and wastewater management
- standardization of data and databases, allowing comparison and validation across the region
- institutionalizing a network and alliance of regional and international experts working and contributing to water issues of regional importance
- contribution to regional coexistence and peace

In the context of the Israeli-Palestinian and Jordanian conflict, available water resources are fast reaching a state of irreversible damage. The crisis is affecting ecosystems as well as the livelihoods of residents and the related food security and poverty issues. However, the task group considers that the crisis could help to positively shape the water policies within and among countries, despite the different levels of economic development, giving rise to serious cooperation.

Water conservation and efficient demand management options, recycling of wastewater, and sea water desalination have emerged as the major options to fill the widening gap between demand and supply. Harnessing wastewater and seawater desalination to solve long-term water shortages could be a spring board for tangible regional cooperation, which at the same time would help to strengthen the basis for peace.

Wastewater reuse has become a valued, viable, and preferred resource where climatic and geographical features are suitable. In regions in which water is scarce, the urban population is fast growing, and demand for irrigation water is high, trade-offs between fresh water and treated effluent can allow an adequate supply of drinking water for domestic consumption. In parallel, the proper collection, treatment, and reuse of wastewater effluents would provide ample water for irrigation and restoration of aquatic ecosystems. For the long term, the reuse of wastewater effluents would be supplemented by large-scale sea water desalination, amounting to about 2000 million cubic meters per year by 2040. This option is facilitated by the breakthrough in reverse osmosis technology and the reduced cost of seawater desalination.

The availability of ample water from wastewater reuse and seawater desalination would allow the development and allocation of water based on technical and economic feasibility and not on water rights. This would also make possible the implementation of the most feasible projects, regardless of location within the region. Other instruments would include appropriate agricultural and trade policies, efficient management of water utilities, improved cost recovery, and targeted subsidies to poorer residents.

In terms of expansion and prospects, the task group foresees the need for the following potential environmental research projects:

- Environmental Impacts of Intense Desalination Activities
- Ground Water Remediation Technology Development and Demonstration
- Aquifer Recharging with Treated Waste Water
- Vision for a Sustainable Middle East and North Africa
- Equally important is the establishment of a regional alliance of Arab and Israeli scientists and engineers to address shared water resources and related health and environmental issues.

Several Research Model Options could be explored:

- Regional Team with Extra-Regional Advisors—International Sponsor(s)
- Regional Team—International Sponsor(s)
- Regional Team with Extra-Regional Collaborator(s)—International and Regional Sponsors

Lastly, several potential International Research Sponsors could be considered:

- Partnerships for Enhanced Engagement in Research—U.S. National Research Council (NSF + USAID)
- U.S. Agency for International Development
- BMBF and GTZ
- Middle East Desalination Research Center
- United Nations Environmental Program
- IUPAC—CHEMRAWN
- CRDF Global and ONR Global

For more information contact Task Group Chair Yehuda Shevah <ysheva@gmail.com>

www.iupac.org/project/2008-003-3-600

Provisional Recommendations

Provisional Recommendations are drafts of IUPAC recommendations on terminology, nomenclature, and symbols made widely available to allow interested parties to comment before the recommendations are finally revised and published in Pure and Applied Chemistry. *Full text is available online.*

Terminology for Self-Assembly and Aggregation of Polymers Polymer Division

In the past, aggregation and self-assembly have been associated principally with micellar and colloidal systems of molecules; however, with the advent of supramolecular chemistry, molecular self-assembly has been opened to a much wider understanding that has facilitated access to a variety of different shapes and sizes, along with the construction of new and fascinating molecular topologies. This document aims at defining more than 150 terms related to the self-assembly and aggregation in the particular case of macromolecules. The list is restricted to the most commonly encountered terms.

Comments by 31 August 2012
Richard G. Jones <kapitimana@gmail.com>
Christopher K. Ober <cko3@cornell.edu>

www.iupac.org/project/2005-043-2-400

Glossary of Terms Relating to Thermal and Thermo-mechanical Properties of Polymers

This document gives definitions of terms related to the thermal and thermomechanical properties of polymers prior to thermal decomposition. The terms which have been selected are those met in the conventional thermal, thermomechanical characterization of polymeric materials. The terms are arranged in alphabetical order and cover definitions of relevant terms from physical chemistry, polymer science, and experimental techniques. The document considers earlier reports related to the terminology of thermal analysis, e.g. those published by the International Confederation for Thermal Analysis and Calorimetry (ICTAC). IUPAC Recommendations covered by the *Compendium of Chemical Terminology*, the so-called "Gold Book," and the 2nd edition of the Compendium of Polymer Nomenclature and Terminology, the so-called "Purple Book," were followed as far as possible. Other publications consulted include Standards such as ISO and ASTM Standards. In particular the recently (2011) published document 'Definition of Terms Relating to Crystalline Polymers' [*Pure Appl. Chem*. 83, 1831 (2011)], a revision of a superseded IUPAC recommendation published under the same title in 1989 has necessitated modifications of some older definitions.

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www.iupac.org/project/2006-041-1-400

Liquid Intrusion and Alternative Methods for the Characterization of Macroporous Materials (IUPAC Technical Report)

Jean Rouquerol, et al.

Pure and Applied Chemistry 2012
Vol. 84, No. 1, pp. 107–136

This document deals with the characterization of porous materials having pore widths in the macropore range of 50 nm to 500 μm. In recent years, the development of advanced adsorbents and catalysts (e.g., monoliths having hierarchical pore networks) has brought about a renewed interest in macropore structures. Mercury intrusion–extrusion porosimetry is a well-established method, which is at present the most widely used for determining the macropore size distribution. However, because of the reservations raised by the use of mercury, it is now evident that the principles involved in the application of mercury porosimetry require reappraisal and that alternative methods are worth being listed and evaluated. The reliability of mercury porosimetry is discussed in the first part of the report along with the conditions required for its safe use. Other procedures for macropore size analysis, which are critically examined, include the intrusion of other non-wetting liquids and certain wetting liquids, capillary condensation, liquid permeation, imaging, and image analysis. The statistical reconstruction of porous materials and the use of macroporous reference materials are also examined. Finally, the future of macropore analysis is discussed.

http://dx.doi.org/10.1351/PAC-REP-10-11-19

Properties and Units in the Clinical Laboratory Sciences. Part XXIII. The NPU Terminology, Principles, and Implementation: A User's Guide (IUPAC Technical Report)

Ulla Magdal Petersen, René Dybkær, and Henrik Olesen

Pure and Applied Chemistry 2012
Vol. 84, No. 1, pp. 137–165

This document describes the application of the syntax, semantic rules, and format of the Nomenclature for Properties and Units terminology for coded dedicated kinds-of-property in the various subject fields of the clinical laboratory sciences. The document sums up considerations and reasoning by the Committee and Subcommittee on Nomenclature for Properties and Units and collects the experience with the system through some eight years of application in electronic health communication. Access to the NPU terminology in English is currently at <www.labterm.dk>, via the English download files from the Danish Release Centre under the National Board of Health.

http://dx.doi.org/10.1351/PAC-REP-11-05-03

Remote Sensing in Coastal Water Monitoring: Applications in the Eastern Mediterranean Sea (IUPAC Technical Report)

Manos Dassenakis, et al.

Pure and Applied Chemistry 2012
Vol. 84, No. 2, pp. 335–375

Remote sensing/satellite observation of land and oceans is a field of research that was developed during the second half of the 20th century, and its importance is widely recognized because of the amount of information it can provide to the scientific community and the general public. The outcomes of remote sensing/satellite observation can be used to address and study significant aspects of environmental concern, such as habitat destruction, environmental degradation, forest fires, oil spills, and climate change. There is continuous improvement of the methods and means of remote sensing observations in order to achieve more accurate and useful information. The main advantage is the possibility of observing large areas, and the main disadvantage is that it can observe only the water and land surface. The present paper is an effort to review the technologies used in remote sensing and the general applications in a comprehensive manner for scientists who do not specialize in this area of research. Furthermore, this paper reviews case studies/applications in the Mediterranean Sea, an area affected by various polluting activities that should be continuously monitored so that the coastal countries are able to successfully manage this sensitive environment.

http://dx.doi.org/10.1351/PAC-REP-11-01-11

Terminology for Biorelated Polymers and Applications (IUPAC Recommendations 2012)

Michel Vert, et al.

Pure and Applied Chemistry 2012
Vol. 84, No. 2, pp. 377–410

Like most of the materials used by humans, polymeric materials are proposed in the literature and occasionally exploited clinically, as such, as devices or as part of devices, by surgeons, dentists, and pharmacists to treat traumata and diseases. Applications have in common the fact that polymers function in contact with animal and human cells, tissues, and/or organs. More recently, people have realized that polymers that are used as plastics in packaging, as colloidal suspension in paints, and under many other forms in the environment, are also in contact with living systems and raise problems related to sustainability, delivery of chemicals or pollutants, and elimination of wastes. These problems are basically comparable to those found in therapy. Last but not least, biotechnology and renewable resources are regarded as attractive sources of polymers. In all cases, water, ions, biopolymers, cells, and tissues are involved. Polymer scientists, therapists, biologists, and ecologists should thus use the same terminology to reflect similar properties, phenomena, and mechanisms. Of particular interest is the domain of the so-called "degradable or biodegradable polymers" that are aimed at providing materials with specific time-limited applications in medicine and in the environment where the respect of living systems, the elimination, and/or the bio-recycling are mandatory, at least ideally.

http://dx.doi.org/10.1351/PAC-REC-10-12-04

Did you Know that *PAC* Does Conferences?

As the official monthly journal of IUPAC, *Pure and Applied Chemistry* also inlcudes papers based on presentations made at IUPAC–sponsored international scientific events. Browse the index and see conferences by year or by topics: **www.iupac.org/publications/pac/conferences/**

Following are recent examples:

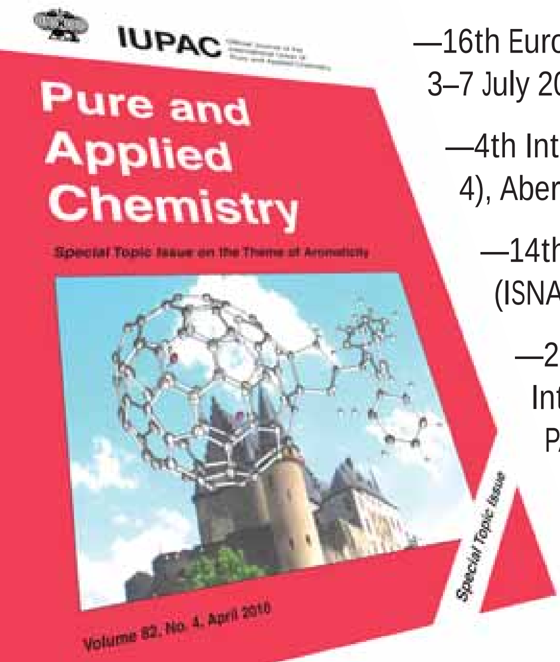
—16th European Carbohydrate Symposium (Eurocarb-16), Sorrento, Italy, 3–7 July 2011, PAC Vol. 84, No. 1, 2012

—4th International IUPAC Symposium on Trace Elements in Food (TEF-4), Aberdeen, UK, 19–22 June 2011, PAC Vol. 84, No. 2, 2012

—14th International Symposium on Novel Aromatic Compounds (ISNA-14), PAC ASAP

—27th International Symposium on Natural Products and the 7th International Conference on Biodiversity (ISCNP-27 & ICOB-7), PAC ASAP

—16th International Symposium on Organometallic Chemistry Directed Towards Organic Synthesis (OMCOS-16), PAC ASAP



The 2012 International Vocabulary of Metrology: "VIM"*

by Paul De Bièvre

One of the most important events in the last decade for the future of measurement is without doubt the third edition of the *International Vocabulary of Metrology*, commonly called "VIM" (from the French title "Vocabulaire International de Métrologie").[1] It was developed in Working Group 2 (WG 2) of the Joint Committee for Guides on Metrology (JCGM) that consists of the following:

- BIPM, International Bureau for Weights and Measures
- IEC, International Electrotechnical Committee
- IFCC, International Federation for Clinical Chemistry and Laboratory Medicine
- ILAC, International Laboratory Accreditation Cooperation
- ISO, International Organization for Standardization
- IUPAC, International Union for Pure and Applied Chemistry
- IUPAP, International Union for Pure and Applied Physics
- OIML, International Organization for Legal Metrology

The formal structure of the membership was intended to guarantee that the resulting "Guides for Metrology" VIM and GUM (guide to the expression of uncertainty in measurement)[2] would be formally examined, approved, and formally backed up by international organizations and, therefore, be internationally representative. It was also expected that the presence of international professional associations such as IEC, IFCC, IUPAC, and IUPAP would promote its implementation on the worldwide scene.

The first VIM sometimes called "VIM 1," was released in 1984.[3] The second edition, sometimes called "VIM 2," was published in 1993/1995.[4] The VIM that is now available is the third version, called "VIM 3." It was first released in 2008 and re-issued with editorial corrections on 16 February 2012.[1]

VIM 1 and VIM 2 were mainly conceived by physicists and engineers for measurements in physics and engineering. Chemical measurement was considered to some degree in VIM 2, thanks to the presence of an IFCC representative and by the fact that clinical chemistry—possibly through its active Clinical Chemistry Division in the IUPAC—had already made considerable progress in the introduction of metrological principles in clinical measurement. In general, the growth of more metrological insight in "measurement" in chemistry evolved considerably in the period 1970–2010 and is still in full development.[5]

A first feature of VIM 3 is the change of title: "International Vocabulary of Metrology—Basic and general *concepts* and associated terms" whereas the title of VIM 1 and VIM 2 was very different: "International vocabulary of basic and general *terms* in metrology" (emphasis by the author). Stressing that concepts, not terms, are to be defined is one of the basic clarifications of VIM 3. Without commonly defined concepts, there is no possibility of validly translating the term associated with this concept from one language into a similarly understood term in another language. That had to be a justification in its own right for any successor of VIM 2. Introducing this in VIM 3 required considerable study and discussions.

A second feature of VIM 3 is the concept "measurement uncertainty" (entry 2.26 in ref. 1).[2] That change of thinking was formally initiated by the International Committee on Weights and Measures (known in French as "Comite´ International des Poids et Mesures," CIPM) in 1981.[6] This change has been addressed elsewhere[7] and will not be further elaborated here. Be it sufficient to note that new concepts used in the GUM were included in the VIM and sometimes vice versa. The aim is to achieve full consistency between VIM and GUM in the future.

A third feature of VIM 3 is the need to cover chemical (including bio-chemical) measurement. That was very much needed because of the explosive development of analytical chemical measurement in the last decades, caused by its use in international trade and commerce, environmental and food pollution monitoring, and in medical diagnosis of patients. The various chemical "matrices" in which a substance must be measured in these fields require some form of chemical sample preparation before the instrumental measurement. This sample preparation is an unavoidable part of the total measurement procedure (see entry 2.6 in ref. 1). Therefore, the uncertainty associated with this chemical operation, automatically becomes a component of the final measurement uncertainty

*The updated release of VIM 3 on 16 Feb 2012 triggers this publication, reprinted with permission from *Accreditation and Quality Assurance* published online 9 March 2012; DOI 10.1007/s00769-012-0885-3 of the measurement result. The frequent omission of this component may be one (possible) reason for the fact that so many measurement results for the same measurand in the same material matrix do not seem to be equivalent: the stated measurement uncertainties are too small.

A fourth feature was the introduction of the "intention" of the analyst when measuring, reflected in the basic redefinition of the concept 'measurand': quantity *intended* to be measured. A consequence of this definition is that the analyst must think clearly about what (s)he is going to measure (and announce that in the beginning of any subsequent publication of the ensuing measurement result).

A fifth feature of VIM 3 is the definition of 'metrology' as "science of measurement and its application" stating explicitly that "metrology includes all theoretical and practical aspects of measurement whatever the measurement uncertainty and field of application". The VIM therefore is applicable from a measurement of time (with 10^{-13} relative measurement uncertainty or less) to the measurement of ultra-low trace levels of dioxin in chicken where a relative measurement uncertainty of 100% would be fully appropriate for the intended use of the measurement result.

Last but not least, a sixth feature of VIM 3, is fulfilling the need for common concepts and associated terms:

- for future ISO Guides and Standards
- for any future SI brochure[8]
- for future Directives and Regulations in legal frameworks
- for future legal texts involving OIML
- for future WTO (World Trade Organization) settlement of disputes
- for CIPM-MRAs (Multilateral Recognition Arrangements)
- for ILAC-MLAs (Multi-lateral Arrangements)
- for description of (old and new) quantities
- for re-definitions of units

The ISO Technical Management Board (TMB) decided some years ago (2001) to install a (renewed) Technical Advisory Group "ISO-TAG 4" and requested it to draft scope and objectives of its work by 2002. The TAG 4 formulated these as follows:

> "to promote and coordinate the use of Guide to the Expression of Uncertainty in Measurement (GUM) and International Vocabulary of Basic and General Terms in Metrology (VIM) in the work of TAGs, TCs and their SCs, and other ISO bodies involved in or affected by metrology and metrology-related activities".

The 2012 VIM is an essential tool to arrive at a common language on measurement results on the intercontinental scene for use in the above described contexts.

Paul De Bièvre <paul.de.bievre@skynet.be> is a member of the Joint Committee on Guides for Metrology (JCGM), Working Group 2 (VIM). The opinions expressed in this column do not necessarily represent the view of the Working Group.

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On the Various Nomenclature Systems

by Jeffery Leigh

In the first "Nomenclature Notes" (March-April 2012 *CI*), it was stated that IUPAC nomenclature is composed of a set of different nomenclatures, which do not necessarily use the same conventions and methods. IUPAC bodies such as the Interdivisional Committee on Terminology, Nomenclature and Symbols (ICTNS) are trying to remove these inconsistencies, but, nevertheless if you are trying to decipher an IUPAC name, or to construct one, it is necessary to realize which type of nomenclature is being used, which means recognizing the type of compound that is being treated. An ideal IUPAC name should be unique, but should also convey the structure of a given compound.

At the lowest level, **compositional nomenclature** simply lists the constituents of a compound in some prescribed order, generally alphabetical, and says nothing about the structure. It is really another way of presenting an entry in a formula index. **Substitutive nomenclature** is a principal IUPAC nomenclature system and the preferred method for naming organic compounds. This relies on selecting a suitable unsubstituted parent compound from which the compound at issue can be considered as ultimately derived, and then modifying the parent name in a series of formal operations. For example, a compound such as C_2H_5Cl would be considered to be derived from the parent compound, ethane, C_2H_6, which is then substituted by removing a hydrogen atom to produce $C_2H_5^{\bullet}$, an ethyl radical, and then adding a chlorine atom to yield C_2H_5Cl, called chloroethane.

This is a particularly simple case, but the principles used for naming in this way are all very similar, though as the complexity of the compound being treated increases, more and more complex parent compounds and many more rules are required.

An alternative name for chloroethane is ethyl chloride, and this is an example of **binary nomenclature** which developed from inorganic chemistry and its original systematization by Lavoisier and his colleagues. Binary nomenclature groups constituents of compounds into two classes, positive and negative. This works well for salts, such as sodium chloride, but more complex organic materials may require the employment of at least two classes of nomenclature, for example, substitutive to name a formal cation such as chloroethyl, and binary to name the related ester, chloroethyl acetate. **Functional class nomenclature** is a system used for organic compounds when substitutive nomenclature is less appropriate, for example with organic acids and anhydrides.

A more recent, though similarly historical, system is **additive nomenclature**, a second principal IUPAC nomenclature system, with its origins in inorganic coordination chemistry. In this approach, the name of a compound considered to be a coordination complex, such as $Na_3[CoCl_6]$, is derived by identifying the three cations and the single anion from which it is composed. The latter is a complex anion, and it is then divided formally into its constituent central cation and its associated six chloride anions or ligands. Finally, the individual names are then assembled to give the compound name trisodium hexachloridocobaltate. In this system, organic ligands would receive substitutive names. Then, to be used in an additive context, organometallic compounds almost always require such a nomenclature mixture. The additive system may be used to name some compounds which would not usually be considered to be coordination complexes.

The third major class of IUPAC nomenclature is polymer nomenclature. It is generally impossible to specify a polymer molecule exactly, as we attempt to do in the cases treated so far, because the chain lengths and end groups are rarely accurately known. One approach is to use a **source-based** system, because one generally knows the monomer from which the polymer was produced. This gives names such as poly(buta-1,3-diene), but it lacks structural information. A **structure-based** name for this material might be poly(1-vinylethane-1,2-diyl), but this represents only the units of the polymer chain, not the end groups, so it may be equally incomplete.

The 2011 edition of *Principles of Chemical Nomenclature* includes full descriptions of all these nomenclature systems, and of several others which are not necessarily due to IUPAC, with details of how to apply them. It also contains instructions for how to decipher IUPAC names to identify the structures that such names are intended to convey. *Principles of Chemical Nomenclature* also introduces what gives the promise of being a unique class of identifier applicable to a wide class of compound, the IUPAC International Chemical Identifier, or InChI.

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 non-IUPAC nomenclatures.

Recent Advances in Natural Products Chemistry

by Minoru Isobe

M. Isobe (left), S. Kanokmethakul, and K. Suwanborilux.

An **IUPAC-ACC Joint Workshop on Recent Advances of Natural Product Chemistry** was held at Queen Sirikit Convention Center in Bangkok, Thailand, on 5 September 2011. Organized by Supa Hannongbua (Kasetsart University), Somdej Kanokmedhakul (Khon Kaen University), and Minoru Isobe (National Tsing Hua University), the workshop was part of IUPAC project 2011-041-1-300, Strategic Planning for a New East and Southeast Asian Network for Organic Chemistry.

Natural product chemistry includes many basic sciences comprising structural studies, chromatography, spectroscopy, medicinal chemistry, synthetic chemistry, drug discovery, computational chemistry, chemical biology, NMR, mass spectroscopy, CD, molecular chirality, molecular binding, and molecular assembly. The main objective of this workshop was to highlight the importance of multidisciplinal sciences for natural product chemistry—starting with the graduate student level—in order to foster cooperation among young researchers. The audience of about 100 consisted of Ph.D. students or younger as well as academics who were interested in expanding their research into this field.

The first speaker was Thomas Franz, Max Plank Institute for Biology of Ageing, Köln, Germany, who presented on "Advanced Analysis of Chemical Modifications of Proteins by Mass Spectrometry." He introduced explosive developments in the use of mass spectrometry for bioanalytical purposes. The clear application to *Moya-moya* disease was demonstrated by trace detection of the modified proteins. The second speaker was Zhen Yang from the College of Chemistry, Peking University, China, who discussed "The Total Synthesis of Micrandilactones," which are very complex nortriterpenoids. He invited the audience to become familiar with Pd-catalyzed cross coupling, annulation, ring cyclization metathesis, etc. and utilize them for daily experiments. The third lecture, by Yoshiko Murata of the Suntory Institute for Bioorganic Research, Osaka, Japan, was on "Iron Acquisition Mechanism of Barley as Explored by Mugineic Acids." He told the whole story, from finding the active compound, elucidation and synthesis of M-acid, and molecular- and gene-level analysis and control for the plant to uptake the iron from the soil. The last speaker was Ya-Ching Shen from the College of Medicine, National Taiwan University, Taiwan, who discussed several new compounds found in Taiwanese Marine sponges and soft corals that have anti-tumor activity. Many analogs of macrocyclic taxol analogs were also introduced.

Workshop participants were treated to four lectures of convergent molecular science involving natural products. These projects were developed on the basis of multidisciplinary organic chemistry of biomolecules.

iupac.org/project/2011-041-1-300

Physico-Chemical Methods in Drug Discovery and Development

by Vladislav Tomišić and Zoran Mandić

The **2nd World Conference on Physico-Chemical Methods in Drug Discovery and Development** was organized by the International Association of Physical Chemists. It was held in Zadar, Croatia, 18–22 September 2011. More than 130 scientists from 27 countries attended. The diverse and well-balanced scientific program of the conference consisted of lectures and poster presentations. It encompassed the following topics:

- physico-chemical profiling of drug substances
- permeability of drugs
- solubility
- polymorphism
- solid-state analysis
- bio-molecular interactions
- enzyme reactions
- chiral separations

The topics and relevant presentations were grouped together and dealt with in half-day sessions. Altogether, 35 lectures were held, of which 15 were delivered by invited speakers and the rest were selected high-quality contributions from the participants. The invited speakers were eminent scientists, well known in their particular fields of contemporary pharmaceutical research. The poster session consisted of 33 presentations.

Within the framework of the conference, three courses were organized for students wishing to expand their knowledge of a particular topic. The courses were run by Rolf Hilfiker (Solvias AG), Nelu Grinberg (Boehringer Ingelheim), and Stefan Dove (University of Regensburg).

The relaxing and warm atmosphere at the conference enabled a free flow of scientific information among the participants. The interaction among scientists from academic institutions and those from the industry was particularly encouraged. Valuable contacts were made and various aspects of cooperation discussed and agreed upon as a result of the conference.

The social events included a welcome reception, a social dinner, an excursion to the Krka waterfalls national park, and a visit to the famous St. Jacob's cathedral in Šibenik, which is on the UNESCO cultural heritage list.

Vladislav Tomišić <vtomisic@chem.pmf.hr> is a professor in the Faculty of Science, University of Zagreb, Croatia. Zoran Mandić <zmandic@fkit.hr>, chair of the Organizing Committee, is a professor in the Faculty of Chemical Engineering and Technology, University of Zagreb.

Contemporary Chemistry for Sustainability and Economic Sufficiency

by Supa Hannongbua

The **14th Asian Chemical Congress 2011** (14ACC), which took place in Bangkok, Thailand, 5–8 September 2011, was the largest chemical congress in Asia celebrating the International Year of Chemistry. Hosted by the Chemical Society of Thailand under the Patronage of Professor Dr. Her Royal Highness Princess Chulabhorn, the Congress was a unique and exciting forum for meeting the challenge put forth by the event's theme: "Contempary Chemistry for Sustainability and Economic Sufficiency." With 1965 attendees from 48 countries, 1262 scientific papers, 2 Nobel laureates, 23 Symposia, 5 workshops, a scientific exhibition, and many special events, the Congress was the largest chemical conference ever held in Bangkok.

The Asian Chemical Congress is the biannual congress traditionally hosted by the members of the Federation of Asian Chemical Societies (FACS), which comprises 28 chemical societies of countries and territories in the Asia Pacific. The Congress featured two Nobel laureates in chemistry: Yuan Tseh Lee (1986, Chinese Taipei) and Ada Yonath (2009, Israel) and four distinguished chemists: Yongyuth Yuthavong (Thailand), Minoru Isobe (Japan), Keiji Morokuma (Japan) and Niyazi Serdar Sariciftci (Austria), as the Plenary Lecturers.

The scientific program featured four FACS Awards Lectures:

- Foundation Lectureship Award 2011 in Inorganic Chemistry (Shie-Ming Peng, Chinese Taipei)
- FACS Distinguished Contribution to Economic Advancement Award 2011 (Pailin Chuchottaworn, Thailand)
- FACS Distinguished Contribution to Chemical Education Award 2011 (Kazuko Ogino, Japan)
- FACS Distinguished Young Chemist Award 2011 in Inorganic Chemistry (Wai-Yeung Wong, Hong Kong)

Following is a sampling from the 23 symposia, held in 45 concurrent sessions:

- Separation, Storage, and Utilization of CO_2
- Recent Advances in Functional Materials II
- Flow Techniques and Downscaling for Analytical Sciences
- Membranes for Molecular Separation
- Medical Applications of Nano Materials
- Recent Progresses in Lab on a Chip and Its Applications
- Medicinal Chemistry
- Elsevier Symposium "General Synthetic Chemistry"
- Renewable Energy III: Artificial Photosynthesis and Hydrogen Production
- Recent Trends in Heterocyclic Compounds
- Novel Synthesis of Nano Materials and Applications

Five workshops were held in collaboration with international organizations:

- IUPAC Workshop on Recent Advances of Natural Products (see this issue of *CI*, page 29)
- Joint Thai–UK Workshop on Frontiers in Drug Discovery Research, supported by Royal Society of Chemistry
- FACS workshop on Small Scale Chemistry
- UNIDO workshop on Green Industry, Organic Pollutant and Persistent Organic Pollutants
- Sandia National Laboratory workshop on Chemical Security Engagement

The scientific papers were organized in the following areas:

- Analytical and Environmental Chemistry
- Materials and Polymer Chemistry
- Physical and Theoretical Chemistry
- Organic Chemistry and Green Chemistry
- Chemical Education
- Chemistry, Nanochemistry and Catalysis
- Natural Products, Chemical Biology and Medicinal Chemistry
- Industrial Chemistry & Innovation

A selection of the 85 papers published in the conference proceedings will be published in a special issue of *Pure and Applied Chemistry* on "Novelty in Green Analytical Chemistry."

The Congress offered special activities and events that celebrated IYC 2011:

- a half-day symposium on "Future Chemical Perspectives in Asia" organized by David Black featured internationally prominent chemists: Yasuhiro Uozumi (Japan), Anjali Rahatgaonkar (India), Tientong Thongpanchang (Thailand), and Zhixiang Yu (China).
- 16 IUPAC Young Chemist Awards were given out, providing partial travel support
- 2 RSC young Chemists in Analytical Chemistry were supported
- Bangkok Bank sponsored the registration fees for 100 young Thai chemists

During the 14ACC, three important meetings were held: 16th FACS General Assembly, 60th FACS Executive Committee meeting, and the 7th Asian Chemical Editorial Societies meeting. Some memorable social activities gave attendees a taste of Thai culture. The welcome reception and banquet, organized by Rajamangala University of Technology Thanyaburi, included traditional dance, music, and delicious food.

The 14ACC was made possible by the financial support and collaboration of the Thailand Convention and Exhibition Bureau, the Federation of Asian Chemical Societies, IUPAC, The Elsevier Properties SA, Kavli Foundation, and Royal Society of Chemistry. The conference was also supported by the departments of chemistry of seven local universities, Chulalongkorn University, Kasetsart University, Chiang Mai University, Khon Kaen University, Mahidol University, Prince of Songkla University and Rajamangala University of Technology Thanyaburi. In addition, a number of private companies, including IRPC Public Company Limited, Bangkok Bank Public Company Limited, the Siam Cement Group, Mettler-Toledo (Thailand) Limited, L'OREAL (Thailand) Limited, and others made important contributions to the Congress.

Supa Hannongbua <fscisph@ku.ac.th>, chair of the program committee, is head of the Chemistry Department at Kasetsart University in Bangkok, Thailand.

www.14acc.org

High Temperature Materials Chemistry

9–13 September 2012, Beijing, China

The **International IUPAC Conference on High Temperature Materials Chemistry** (HTMC-XIV) will be the 14th meeting in a series of conferences that are held every three years, the last occurred in Davis, California, USA in 2009. The focus of the meeting is to bring together people from the fields of chemistry, materials science, earth and planetary science, metallurgy who are working in the area of high temperature phenomena in solid and liquid materials.

Main topics include:

- high-temperature thermodynamic measurement
- interplay of theory and modeling with experiment in high temperature materials
- materials for nuclear energy applications
- transport, ionic and electronic conduction, densification, grain boundaries, interfaces and surfaces
- melts, glasses and amorphous materials
- phase structure and metallurgic process
- earth and planetary materials at high pressure and temperature
- materials for aerospace applications

For detailed information, contact conference chair Xianran Xing <xing@ustb.edu.cn>.

http://htmc14.ustb.edu.cn

Inspiring Youth in Chemistry—An Exhibit

March–June 2012, Pennsylvania, USA

When the United Nations designated 2011 as the International Year of Chemistry, organizations with missions related to chemistry eagerly joined forces to celebrate this central science and its impact on our world. This exhibit at the Chemical Heritage Foundation explores three programs that reached out to the world's youth to encourage them to become more engaged with science and their chemical world: the Global Chemistry Experiment; Our Children on Water, an exhibition of paintings by children in Africa and Europe; and It's Elemental, a periodic table full of videos created by U.S. high school students.

The Global Chemistry Experiment

This project, developed by IUPAC and UNESCO, included a set of four basic chemistry experiments designed to entice students around the world to learn about how chemistry contributes to one of the most essential resources in their daily lives—water. See feature on page 14.

Our Children on Water

Children from three countries in Africa and six countries in Europe were invited to create art based on the title "Water: Refreshment or Responsibility?" The result was Our Children on Water, an art exhibition developed by the Royal Society of Chemistry. The works of art show in some cases incredible imagination; others are extraordinarily thought-provoking and reveal varying cultural perspectives on the meaning of water. Over 1500 students aged 8 to 18 participated in the project, and a final selection of 54 pieces are included in this exhibition. The exhibit was first presented at the RSC in the United Kingdom and later traveled to Spain, Germany, Italy, and the Czech Republic.

It Is Only a Gesture by Laura Valladares Salgado, 16. "In my family, we collect "the brown coins" (those of one, two, or five cents) . . . We used to undervalue them. However, with a little effort we had a can full of money. I think it happens the same way with water."

It's Elemental!

Science, history, art, and technology unite in *It's Elemental!*, a video competition created for high-school students by CHF. More than 2000 students from across the United States produced the 689 videos that populate an online, interactive periodic table. The three winning videos, selected by a distinguished panel of judges, are showcased in this exhibit.

www.chemheritage.org/visit/museum/exhibits/inspiring-youth-in-chemistry.aspx

The Periodic Table

14–16 August 2012, Cusco, Peru

The **Third International Conference on the Periodic Table** will be held from 14–16 August in Peru, at the Center of Conventions of the Provincial Municipality of Cusco. The conference is being sponsored by San Antonio Abad Tricentennial National University, the Global University of Cusco, the Chemical College of Peru—Cusco and Academy of Sciences of Cusco.

Why a third conference on the periodic table? There have been surprisingly few international conferences on the central icon of chemistry and indeed one of the most central icons in all of science—the Periodic Table. The first was held in 1969 in the Vatican as a celebration of the 100th anniversary of Mendeleev's first Periodic Table. Participants included such luminaries as the physicist John Wheeler. The proceedings were published in, Verde (ed), Atti del Convegno Mendeleeviano, Accademia delle Scienze di Torino, Accademia Nazionale dei Lincei, Torino, Roma, 15-21 Settembre, 1969, Torino, Vincenzo Bona, 1971.

The second was held in Banff, Canada, in 2003. The proceedings were published as two books edited by Rouvray and King: *The Periodic Table: Into the 21st Century*, Research Studies Press, Baldock, England, 2004 and *The Mathematics of the Periodic Table*, Nova Science Publishers, New York, 2006.

The meeting in Cusco, Peru, will be the third such meeting. Articles will be published either as a book or as a special issue of the journal *Foundations of Chemistry*. The conference will be to honor the memory of Dr. Oswaldo Baca Mendoza (Cusco, 1908 - 1962), author of a remarkable study and mathematical interpretation of the Periodic System (1953).

http://3icpt-cusco2012.uglobalcusco.edu.pe

Philosophy of Chemistry

7–10 August 2012, Leuven, Belgium

The **International Society for the Philosophy of Chemistry** (ISPC)—Summer Symposium 2012 will be held from 7–10 August 2012 at the campus of the Katholieke Universiteit Leuven, Belgium.

The symposium aims to provide a forum for discussion about foundational, epistemological, methodological, and ontological problems of chemistry and its subfields by bringing together leading researchers and young scholars from all over the world.

Issues debated in the philosophy of chemistry emerge from three communities: the chemists reflecting on the foundations of their science, the philosophers of science investigating the nature and specifics of chemistry, and the historian of chemistry making sense of the pathways to discoveries and the practices of chemistry in the past.

At this stage, the general framework of the conference and the session topics include:

- Atoms in Molecules
- Reflections on Symmetry in Chemistry
- The Nature of the Chemical Bond
- The Role of Structure in Chemistry
- Ethical Aspects of Chemistry
- Philosophical Attitudes of Past Chemists
- Sustainable Chemistry
- The Social Perception and Understanding of Chemistry

Since the International Conference on the Periodic Table will be held four days after this symposium, no sessions will be devoted to the periodic system.

https://sites.google.com/site/ispc2012/

Internal Quality Control

9–11 October 2012, Berlin, Germany

The **Eurachem Education and Training Working Group** will be held in Berlin, Germany, 10–11 October 2012. The event will be hosted by the German member of Eurachem, EUROLAB Germany. The workshop will cover analytical results from a range of sectors and disciplines including chemical analysis, testing, laboratory medicine and microbiology. The main focus will be on internal quality control performed in the laboratory for the continuous monitoring of operations and results of measurements, in order to decide whether results are reliable enough to be released.

The workshop will include invited lectures, short communications, posters and break-out sessions. A training course on internal quality control will be held at the same venue the day before the workshop, Tuesday 9 October.

Contact Bertil Magnusson <Bertil.magnusson@sp.se> for more details.

www.eurachem.org

Mark Your Calendar

Upcoming IUPAC-sponsored events
See also www.iupac.org/home/conferences.html for links to specific event websites

2012 (after 1 May)

9–12 May 2012 • Advanced Materials • Katmandu
Kathmandu Symposium on Advanced Materials
Prof. Rameshwar Adhikari, Tribhuvan University, Central Department of Chemistry, P.O. Box 24411, Katmandu, Nepal, Tel.: +977 14 332 034, E-mail: nepalpolymer@yahoo.com

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

1 June 2012 • Sustainable Supply Chains • Toronto, Ontario, Canada
The Chemistry of Sustainable Supply Chains—Chemical Industry and IUPAC Workshop
Michael J. Dröscher, IUPAC Committee on Chemistry and Industry, chair, m.droescher@t-online.de
www.iupac.org/project/2011-053-1-022

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 • Polymers in Medicine • 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 (SEANAC) 4th 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
XXVIth 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

2013

17–22 February 2013 • Scanning Electrochemical Microscopy • Ein Gedi, Israel
7th Workshop on Scanning Electrochemical Microscopy
Prof. Daniel Mandler, The Hebrew University of Jerusalem, Department of Inorganic and Analytical Chemistry, Safra Campus, IL-91904 Jerusalem, Israel,
Tel.: +972 2 658 5831, Fax: +972 2 658 5319, E-mail: mandler@vms.huji.ac.il

2011: A Stamp Odyssey

by Daniel Rabinovich

A myriad of events took place in 2011 to celebrate the International Year of Chemistry (IYC), including thematic conferences, special exhibitions, worldwide experiments, public demonstrations, and many other outreach activities. The achievements of chemistry and its contributions to the well-being of humankind were featured in dozens of magazine articles, newspaper reports, and YouTube videos. It was also an eventful year for chemical philatelists since more than 20 countries, proud perhaps of their industrial or academic heritage, deemed appropriate to release commemorative postage stamps that underscored the value and importance of chemistry to society. This article highlights a selection of those chemistry-related stamps and provides an overview of the "IYC Postage Stamp Central" web page (www.chemistry2011.org/participate/activities/show?id=533), an IUPAC activity that strived (and continues) to keep chemical educators and stamp enthusiasts informed about this subject.

The first two IYC-themed stamps of 2011, issued in Israel on 4 January, feature the molecular structures of vital biomolecules involved in the synthesis and degradation of proteins and honor the Israeli scientists that contributed to the elucidation of their structures and function. One of the stamps [1] shows the structure of ubiquitin, a relatively small protein made up of 76 amino acids and whose main function is to bind to or "tag" unneeded or damaged proteins, which are subsequently broken down into small peptides by the proteasome. It recognizes Aaron Ciechanover and Avram Hershko, both from the Technion–Israel Institute of Technology, who received the 2004 Nobel Prize in Chemistry together with Irwin Rose from the University of California–Irvine "for the discovery of ubiquitin-mediated protein degradation." The other stamp [2] presents the structure of the ribosome, the complex biological entity that synthesizes proteins starting from simple amino acid building blocks. It pays tribute to Ada Yonath from the Weizmann Institute of Science, who shared with Venkatraman Ramakrishnan (MRC Laboratory of Molecular Biology, Cambridge, UK) and Thomas Steitz (Yale University) the 2009 Nobel Prize in Chemistry for these fundamental studies.

Belgium [3] and Slovakia [4] jointly issued on 17 January 2011 a pair of stamps that depict the chemical formulae or space-filling diagrams of water and carbon dioxide, the two key molecules involved in the formation of carbohydrates during photosynthesis. Many IYC activities emphasized the vital role that chemistry plays in human health and the environment and these two stamps are clearly connected to the IYC's unifying theme "Chemistry–Our Life, Our Future". It is worth noting that the Belgian stamp also honors the centennial of the First Solvay Conference, which was held in Brussels in 1911 and was mainly devoted to the theory of radiation and the quanta. A group picture of the conference attendees, which included prominent scientists such as Max Planck, Marie Curie, Albert Einstein, and Ernest Rutherford, is shown on the selvage of the sheet of 10 stamps together with a few pieces of glassware, a bottle of hydrogen peroxide, and a couple of chemistry textbooks.

Three stamps featuring Marie Curie, who was awarded the 1911 Nobel Prize in Chemistry for her discovery of the elements radium and polonium, provided a unique opportunity to celebrate the contributions of women to science. A French stamp issued on 27 January 2011 (#14, p. 44, Nov-Dec 2011 *CI*) depicts a classic image of the celebrated physicist at work in her laboratory in Paris, whereas the stamp from Sri Lanka, [5] issued three days later, shows small portraits of Marie Curie and M.U.S. Sultanbawa, one of the country's most distinguished chemists and a former president of the Chemical Society of Ceylon (now the Institute of Chemistry Ceylon). Also featured on the Sri Lankan stamp are a blue star sapphire, the country's national gemstone, and the structure of

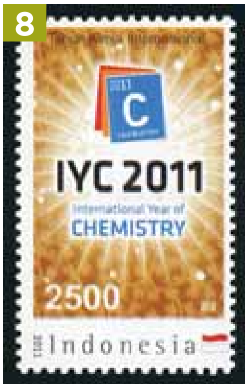
7

corundum (Al_2O_3), its main constituent mineral. In turn, the design of a Spanish stamp released on 7 February [6] is based on a previously unpublished photograph of Marie Curie taken during her second visit to Madrid in 1931.

9

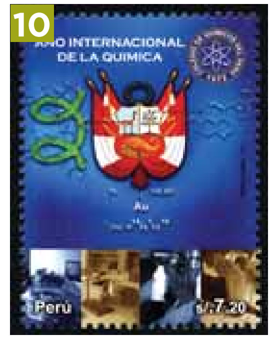
Indonesia issued in early March a pair of colorful stamps showing a "stick" diagram of Artoindonesianin C, a xanthone natural product isolated from an evergreen tree endemic to the Indonesian Islands [7] and the IYC logo [8].

8



Bosnia and Herzegovina and the British Crown Dependency of Jersey, a small island off the coast of Normandy in France, issued their own stamps featuring Marie Curie on 8 March (International Women's Day!) but unfortunately neither one mentions explicitly the IYC (see stamps 12–13, p. 44, Nov-Dec 2011 *CI*). That is not the case of Macedonia, which released on 13 April an IYC stamp [9] showcasing laboratory equipment (a magnetic stirrer, flasks, condensers, etc.) in front of a periodic table.

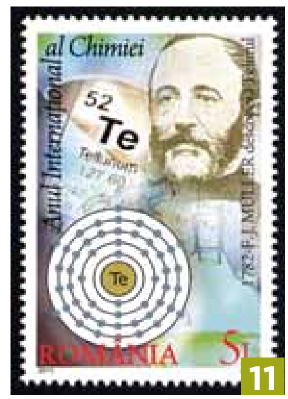
10



On 9 May 2011, Paraguay became the first Latin American country to issue a stamp for the IYC (#16, p. 45, Nov-Dec 2011 *CI*). In addition to a portrait of Marie Curie, evidently a source of inspiration for budding scientists all over the world, the stamp also features the IYC logo and the symbol used for the country's Independence Bicentennial celebrations, which took place six days later. The Democratic People's Republic of Korea also issued an IYC stamp (#15, p. 45, Nov-Dec 2011 *CI*) portraying Marie Curie, accompanied by Ri Sung Gi, the polymer chemist who invented Vinalon, a synthetic fiber produced from polyvinyl alcohol and widely used for clothing in North Korea.

12

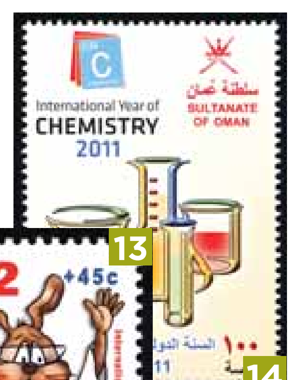
A unique stamp crammed with chemical imagery representing the multiple links between chemistry and the Peruvian coat of arms was released in Peru on 1 August 2011 [10]. The stamp's design elements include the helical structure of keratin, the main polymeric material that makes up the wool of the vicuña and other camelids, and the molecular structure of quinine, the antimalarial drug originally extracted from the bark of a Peruvian cinchona tree. Also shown on the stamp, but hard to see because of their small size and the blue background, are the chemical symbol, the atomic and mass numbers, and the electronic configuration of gold, a reference to the cornucopia spilling coins of the noble metal that appears in the lower panel of the coat of arms and symbolizes the country's abundance of mineral resources.



11

One of my favorite stamps of the year was issued in Romania on 26 September [11]. It features the chemical symbol and electronic configuration of tellurium, the only element discovered in Romanian territory, and a portrait of Franz-Joseph Müller von Reichenstein, the Austrian mineralogist and mining engineer (1742–1826) who discovered it in Transylvania in 1782. A few days later, Canada honored the IYC and John Polanyi, who received the Nobel Prize in Chemistry in 1986 together with Dudley Herschbach and Yuan T. Lee for their studies of reaction dynamics [12].

Curaçao, a small island off the coast of Venezuela, issued in October a set of four stamps featuring cartoon characters performing all sorts of scientific experiments [13], a commendable effort to appeal to a younger audience, which hopefully does not rely exclusively these days on e-mail and cellular phones to communicate with friends and family! Last but not least, the Sultanate of Oman released on 27 December a stamp displaying laboratory glassware [14].



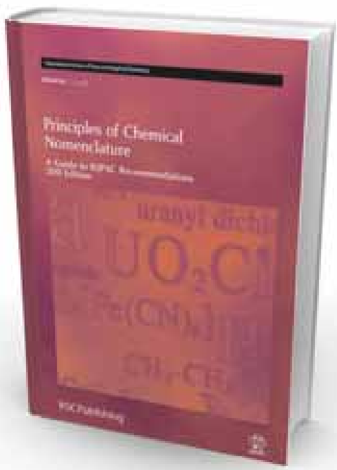
13

14

All in all, a very good year for the promotion of chemistry, and I am certainly glad that many postal authorities did their part to add to the celebrations. Let's only hope that the momentum is not lost and that many of the activities that got started this year continue reaching out to the community and the younger generations for many years to come.

Daniel Rabinovich <drabinov@uncc.edu> is a professor of chemistry at The University of North Carolina at Charlotte and his research interests are in synthetic and structural inorganic, bioinorganic, and organometallic chemistry. He is also the editor of *Philatelia Chimica et Physica*, a quarterly publication dedicated to the study of postage stamps related to chemistry and physics.

IUPAC and RSC Publishing



Principles of Chemical Nomenclature

A Guide to IUPAC Recommendations 2011 Edition

Written by leading world authorities, this book enables teachers and students to obtain a sound training in IUPAC nomenclature. It outlines IUPAC recommendations for application in the principal branches of chemistry: organic, inorganic, organometallic, and polymer. The book also includes some basic biochemical nomenclature, clearly explaining the fundamental principles of nomenclature methods.

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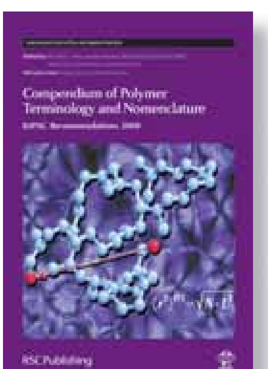

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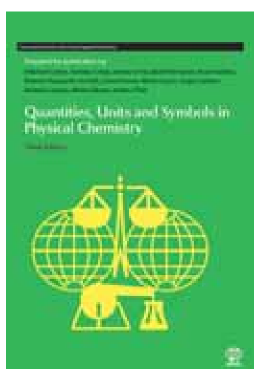

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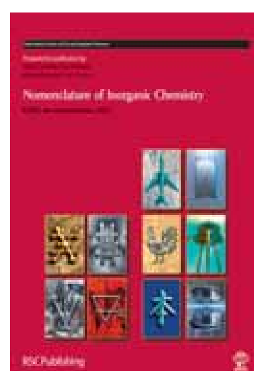

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