Prof. Javier García Martinez (left), current IUPAC President, Prof. Nicole Moreau (center), former IUPAC President, and Prof. Chris Brett, IUPAC Past President at the UNESCO Headquarters during the IYBSSD Opening Ceremony.

IYBSSD2022
International Year of Basic Sciences for Sustainable Development

International Year of Basic Sciences for Sustainable Development

by Chris Brett

The International Year of Basic Sciences for Sustainable Development (IYBSSD) Opening Ceremony took place in UNESCO headquarters in Paris, France on 8 July 2022 in hybrid (in-person and virtual) format. After the official opening talks, panels and talks included the role of basic sciences in decision making, strengthening science, technology, engineering and mathematics education, the role of basic sciences in developing societies, basic sciences and the Sustainable Development Goals and around the Globe. Recording of the opening is available on IYBSSD YouTube channel. IUPAC was represented by the IUPAC President, Javier Garcia-Martinez, IUPAC Past President Christopher Brett and IUPAC former President Nicole Moreau (2010-11). The IUPAC Global Women Breakfast 2023 was announced in the Opening Ceremony exhibition, and recognized as a flagship IYBSSD event (see below for further information)

IYBSSD background

The IYBSSD was proclaimed by the United Nations on 2 December 2021, and is taking place from July 2022 until the beginning of October 2023. The UN resolution was submitted by the Republic of Honduras, seconded by Vietnam, and supported by a number of other nations; the vote for proclamation by the UN General Assembly was unanimously in favour.

The purpose of IYBSSD is to emphasise the crucial role of the basic sciences in underpinning key technological achievements that address and will continue to address the sustainable development goals and contribute to making our world a better place. Such objectives mirror closely IUPAC's strategic plan, vision and mission and objectives. An improved understanding of the basic sciences by society at all levels, all ages and in all countries, should be a significant aid in enabling a better inclusion of science in public decision-making processes.

There have been various international years related to chemistry in the past decade since the International Year of Chemistry (IYC) in 2011, a celebration of chemistry which was coordinated by IUPAC. The last of these was the International Year of the Periodic Table of the Chemical Elements, IYPT (2019), organized by IUPAC with the collaboration of several other international unions and was a huge success with many events worldwide. The aim was to demonstrate the importance of and benefits arising from the chemical elements and their properties in our society and also celebrating the 150th anniversary of Mendeleev's

Ms Shamila Nair-Bedouelle, Assistant Director-General for Natural Sciences, UNESCO, gives her welcome address.

Periodic Table. The enthusiasm demonstrated by all sectors of society, especially young people, demonstrated that basic sciences are indeed appreciated by all. Other International Years since 2011 have included the International Year of Crystallography (2014), of Light (2015) and of Glass (2022).

IYBSSD proposal and proclamation

The proposal for IYBSSD was led by the International Union of Pure and Applied Physics (IUPAP). The year 2022 was chosen to coincide with IUPAP centenary and the proposal led by Michel Spiro, at that time president designate, and now IUPAP President. IUPAP and IUPAC have strong collaborations, the most widely known being the confirmation and naming of new elements in the Periodic Table of the Chemical Elements. IUPAC is a founder partner of the IYBSSD. An IYBSSD Steering Committee was formed with representatives of all International Unions and Organisations that are partners, and as of August 2022, there are 50 Partners and 112 science academies and networks.

As with all International Years, a process had to be followed and which included the submission of a proposal for an International Year to the UNESCO Conference of States Parties in 2019. The premise for the International Year was that science is needed to achieve the Sustainable Development goals, their transformation into innovations, and its methods of cooperation. There are many examples of how basic sciences have contributed to making our current world better. Just a few are the Web that was invented owing to the need for global collaboration for experiments in fundamental physics, discovery of DNA structure that has led to

revolutionary advances in medicine (genome project, vaccine development, HIV and AIDS treatments etc.), GPS, the invention of the transistor, statistical methods for artificial intelligence, green chemistry and methods for reducing environmental impact.

There was also important support from UNESCO International Basic Sciences Programme (IBSP) and its Scientific Board, whose chair in 2019 was Nicole Moreau (IUPAC President 2010-11), to convince the member states of the importance of an International Year. IBSP emphasized science as a global public good in all countries, developing and developed, looking towards more harmonious development and recognizing that to solve the world's challenges everybody is needed. The resolution for the proclamation of an International Year of Basic Sciences for Sustainable Development in 2022 was unanimously adopted by the UNESCO Executive Board in October 2019 and by the UNESCO General Conference in November 2019, and then submitted to the UN General Assembly.

The role of basic sciences

The commonly accepted meaning of basic sciences, such as mathematics, physics, chemistry, life and social sciences, are that they are curiosity-driven but that have also fundamental roles in our lives. They are the base for understanding that leads to the development of the necessary means and tools to address global socio-economic and environmental challenges that we hear about almost every day: climate change, extreme events, the water crisis, depletion of natural resources and loss of biodiversity. The basic sciences are a source of disruptive innovations.

There are many stakeholders that need to be convinced of the crucial role of basic sciences who include policy-makers, business and industry, international organizations, philanthropic foundations, universities, teachers and students, media, and the broader public. One of the important tasks is educating the younger generations to enable them to take the right decisions, informed by science and undertaking capacity building. UNESCO's *Recommendation on Science and Scientific Researchers*, revised in 2017, embodies the importance of such education. The challenges are likely to get harder.

Cross-cutting themes for IYBSSD have been identified by the steering committee as:

- Basic Sciences and Multicultural Dialogue
- Basic Sciences, Education and Human Development
- Basic Sciences and Women (figures, empowering women, role models)
- Basic Sciences, Innovation and Economy
- Basic Sciences, Health and Life Sciences
- Basic Sciences and Global Challenges

IYBSSD events and IUPAC

Key IUPAC engagement activities with the IYBSSD themes are described on the webpage https://iupac.org/iybssd2022/ a summary of which is

- Strengthening the presence and the visibility of women > *GWB Global Women's Breakfast*
- Basic sciences as sources of international dialogue and peace > *Hands-on capacity building of chemistry instructors*
- Science as a global public good > *Systems Thinking: linking sustainability goals to chemistry education through the Planetary Boundaries framework*
- Innovation and economic development > *annual Top10 Emerging Technologies in Chemistry*
- Education and human development > *Periodic Table Challenge*
- Meeting global challenges > *Global Conversation to raise awareness*

They illustrate fully how ongoing and planned IUPAC activities are involved in the themes of IYBSSD. It is no accident that many of these are legacy activities from IYPT and demonstrate the clear connection between the chemical elements, the basic sciences and sustainable development.

In 2023, the GWB, Global Women's Breakfast is being organised by IUPAC as an IYBSSD flagship event. The reach of the annual GWB will widen into a global event across all the basic sciences at the world level with the theme "Breaking Barriers in Science". It will take place on 14 February 2023, just a few days after the International Day of Women in Science (11 Feb), and is open to all, regardless of gender; registration is already open, see https://iupac.org/gwb/.

IYBSSD worldwide

Other IYBSSD flagship events are being organised, approximately one per continent, the first two of these took place in Vietnam and in Serbia, in September 2022 on "Science, Ethics and Human Development" and on "Basic Sciences for Sustainable Development," respectively. Next year, 2023, will see flagship events in Africa, in Rwanda in May 2023 in Arab countries, and on "Open Science" in the Honduras, programmed for June 2023.

Several characteristics of the basic sciences illustrate why they are necessary and need to be promoted. Basic sciences are the foundations of science producing a pool of knowledge that can be used by future generations in applications, often as yet unknown. Research is curiosity driven, a source of disruptive knowledge and innovations.

IYBSSD events register and the future

The legacy from the International Year needs to continue after its end and plans for a decade of the basic sciences as follow-up are already being discussed.

All are invited to take the opportunity to organise events that show the importance of basic sciences at the forefront of research and training in the basic sciences at an international, national, regional or local level. Please register your events, chemistry or basic sciences that may already be scheduled to take place during the year on https://www.iybssd2022.org/en/add-an-event/ or https://www.iybssd2022.org/en/your-proposal-for-the-program/

Please take the opportunity to initiate and foment

collaborations with physicists, mathematicians and biologists that will last beyond the International Year. The planet faces many problems and we can all contribute to attenuating the impact that we have on the planet and educating the younger generation to be better equipped with full support from knowledge of the basic sciences to deal with the challenges that we are facing and will continue to face.

The closing ceremony of IYBSSD will be at CERN in Geneva, Switzerland on 6 October 2023.

https://www.iybssd2022.org/en/about-us/
https://www.unesco.org/en/year-basic-sciences/launch

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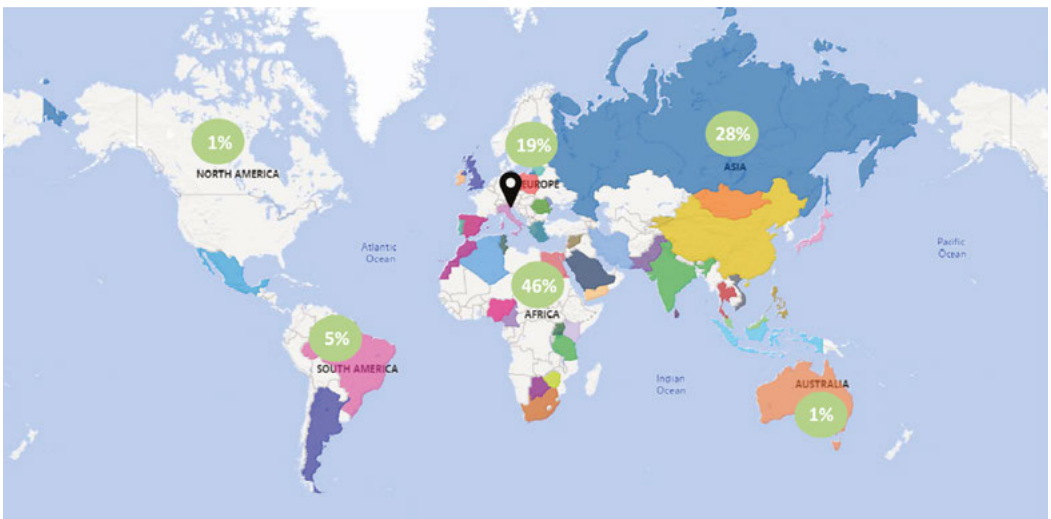
Making Global Green Connections: The Importance of Green Chemistry Summer School for Sustainable Development

by Akwaowo Inyangudoh, Beatriz Chícharo, Giovanna Mazzi, Seyyed Emad Hooshmand, Gizelle van Niekerk, Lyvia Menezes, Fábio G. Delolo, Amy Naylor Randles, Fabrizio Politano, María Luz Tibaldi Bollati, Zikhona Tywabi-Ngeva, and Zikhona Tshemese

The chemical industry, backed by chemistry research has always played a vital role in economic development through problem-solving and the provision of societal needs. In tackling today's climate change, energy, food, and water crises, the role of chemistry can be re-vitalized based on green chemistry principles [1]. The birth of green chemistry has over the years challenged and opened up new opportunities to chemists globally both in academia and industry. These opportunities include capacity building and education in Green Chemistry. The brightest example is the formation of the Green Chemistry Postgraduate Summer School (GCPSS) which has been actively promoting Green Chemistry Education and training young green chemists from around the globe. The contributors of this report were all attendees in the 2022 Summer School.

The very first edition of the GCPSS was held at the San Servolo island in Venice (Italy) and organized by the *Consorzio Interuniversitario Nazionale "La Chimica per L'Ambiente"* (Interuniversity Consortium "Chemistry for the Environment", INCA) in 1998 [2]. The GCPSS targeted young chemists (under the age of 35) from Europe and was funded by the European Commission's IV Framework Program, United Nations Educational, Scientific and Cultural Organization (UNESCO), the North Atlantic Treaty Organization - Advanced Science Institute (NATO-ASI) as well as the Training and Mobility of Researchers (TMR) program [3-5]. Nine editions that followed after this (until 2008) were all organized and managed by the INCA [2,3]. The 11th edition of the GCPSS was taken to the African continent (Dar es Salaam, Tanzania) and was organized by the IUPAC Interdivisional Committee on Green Chemistry for Sustainable Development (ICGCSD) [6]. In 2020, the world was impacted by COVID-19 pandemic and as a result, the 12th edition was held online for the first time. The online program had a total of 180 participants from 42 countries; the highest number recorded in the history of the GCPSS. This 12th edition was held in collaboration with ICGCSD and organized by the Green Sciences for Sustainable Development Foundation



Demographic distribution of students at the 14th GCPSS.