United Nations
Educational, Scientific and
Cultural Organization

International Year
of the Periodic Table
of Chemical Elements

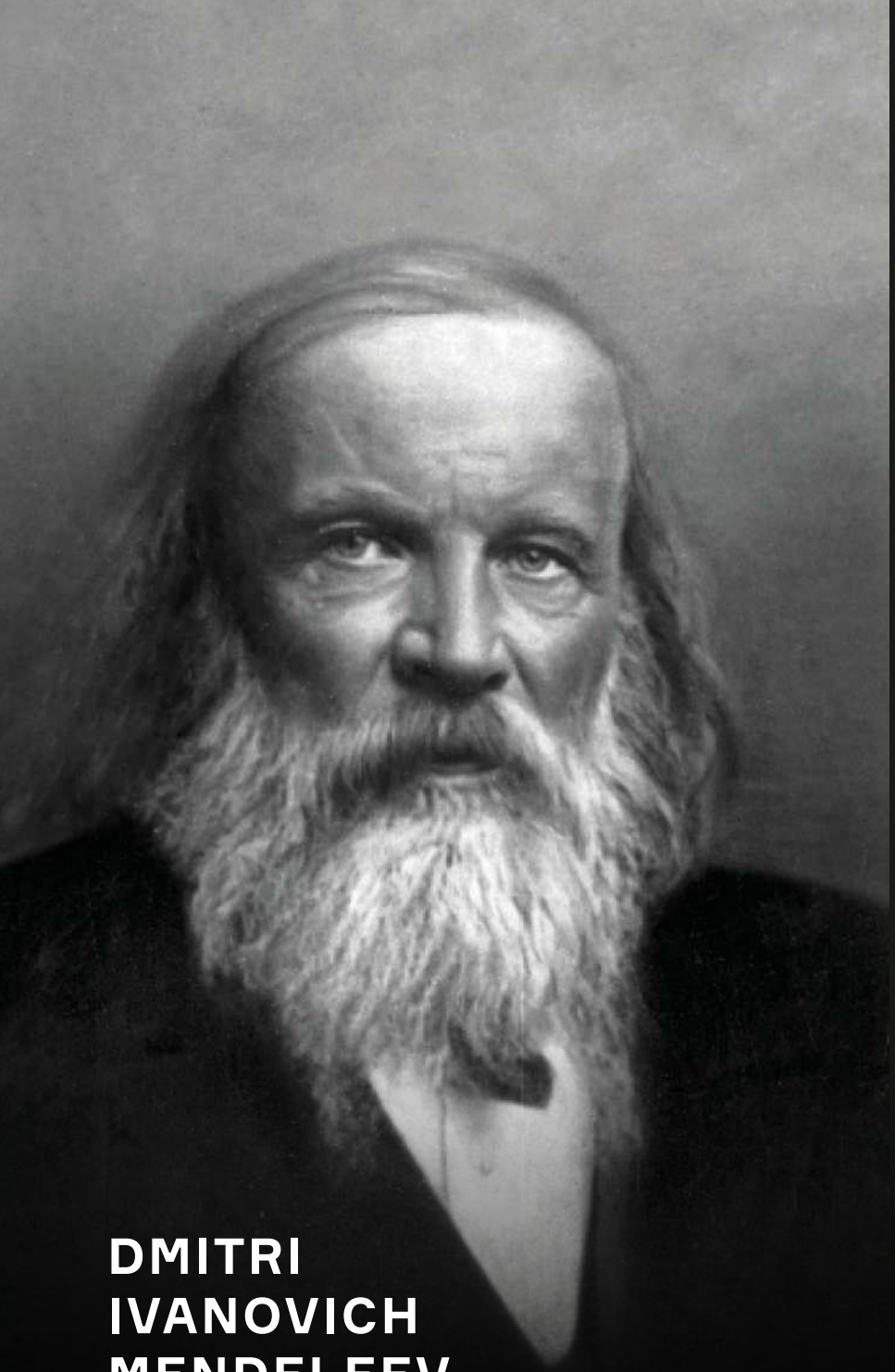
IYPT

THE INTERNATIONAL YEAR OF THE PERIODIC TABLE OF CHEMICAL ELEMENTS

2019

COMMON LANGUAGE
FOR SCIENCE

GLOBAL REPORT 2019



DMITRI IVANOVICH MENDELEEV 1834–1907

The law formulated by Dmitry Mendeleev established the periodic dependence of the properties of chemical elements on the charge of their atomic nucleus. This discovery made a great contribution to science, defining the principles of the relationships between the properties of various elements.

The periodic law gave scientists the key to unraveling the principles of the structure of matter, leading to the rapid development of chemistry and other sciences.

In February 1869, Mendeleev formulated the idea that the properties of various chemical elements are repeated at certain periods.

A month later, a presentation was made at the Russian Chemical Society, entitled "Dependence of the properties of the atomic masses of elements," containing the following main points:

- *Elements, if arranged according to their atomic weight, have obvious periodicity of properties.*
- *Elements that are similar in their chemical properties either have the same atomic masses (for example Ir, Pt, Os), or their atomic masses regularly increase (for example K, Rb, Cs).*

> Apparently the future does not threaten the Periodic Law by its destruction and on the contrary it promises the superstructure and its further development
>
> *Dmitri Mendeleev, 1905*

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International Year
of the Periodic Table
of Chemical Elements

The International Year of the Periodic Table of Chemical Elements 2019

Common language for Science

GLOBAL REPORT 2019

The International Year of the Periodic Table of Chemical Elements 2019 (IYPT2019) has been celebrated during the year in over 130 countries, with well over a thousand events and festivities, reaching millions of young and old people, scientists and non-scientists. The event as a whole has been very successful, as illustrated in the report.

With the Periodic Table being crucial for chemists, physicists, astronomers and many more, the celebrations have brought together a large variety of participants, starting with a grand opening at UNESCO Headquarters in Paris, France and ending with a fabulous closing ceremony in Tokyo, Prince Hotel, Japan. Worldwide many scientists and educators have been working on these events, with a high degree of dedication and commitment to show scientists, the public and children the history and relevance of the Periodic Table. The Periodic Table is and will be used in high-tech research to generate new ideas and solutions for the many challenges of modern society.

Final Report of the International Year of the Periodic Table 2019, IYPT2019

This overall report on the planning and celebrations of the International Year of the Periodic Table of Chemical Elements (IYPT2019) has been assembled from information, photographs and data provided by a large number of teachers and scientists from all over the world, and by the IYPT2019 partners.

This final report was compiled and edited by the Editorial Team:
Frank Sekeris, office manager
Natalia Tarasova, co-chair of the IYPT Interunion International Management Committee
Jan Reedijk, co-chair of the IYPT Interunion International Management Committee
Page editing: All-Russian Science Festival

The Editorial Team has collected the material with the assistance of several IYPT Interunion International Management Committee (MC) members and professional partners. We have done our best to strive to a high degree of accuracy, completeness and reliability of the information provided, but 100% accuracy cannot be guaranteed.

Finally, any ideas or opinions expressed are those of the report contributors and do not necessarily reflect the position of the Editorial Team or their employers, the International Year of the Periodic Table Management Committee, UNESCO, or any of the other IYPT2019 partners or organizations involved.

Website: www.iypt2019.org

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International Year
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Preface by Audrey Azoulay, Director-General of UNESCO, for the final report on the International Year of the Periodic Table

September 2020

Today, the Periodic Table of Chemical Elements contains 118 substances, each of which tells a story. Carbon, for instance, was discovered in ancient times, when charcoal, a carbon residue, was produced after burning wood. Scientists have since discovered that carbon is essential for all life on Earth – human bodies, for example, are primarily composed of carbon, hydrogen and oxygen. Yet carbon also has a darker side: when it takes the form of carbon dioxide, it threatens our very existence, by collecting in the atmosphere and accelerating climate change. The story of carbon is not unusual in the Periodic Table: each element is a new chapter in a scientific journey through time and space.

Indeed, the Periodic Table is a reflection of our universal quest for knowledge, a quest that began thousands of years ago and continues to the present day. It spans all continents, from the first documented lead-smelting techniques in Africa some 9,000 years ago, to the isolation of arsenic and antimony by Arab polymath Jabir ibn Hayyan in the 8th century. It is one of the most significant achievements in science, enabling scientists to predict the appearance and properties of matter on Earth and in the Universe. The continual quest for elements has resulted in powerful quantum predictive methods, which not only lead to new materials, but also uncover novel chemical phenomena, revealing the limitations of existing chemistry rules and extending the boundaries of the known world. Modern nuclear medicine is one of the results of this quest.

At a time when we need science to rise to major global challenges, we must build on the achievements of humankind. The Periodic table is one of these achievements – and one of the most important. This is why UNESCO endorsed 2019 as the International Year of the Periodic Table, to raise awareness of the basic sciences and their interdisciplinarity. In addition to promoting education in this field, especially in developing countries, this Year highlighted the importance of chemistry in developing solutions to international issues, including climate change and the preservation of natural resources.

To rise to these challenges, however, inclusivity is essential. This is why the International Year placed special emphasis on achievements by women scientists. Marie Skłodowska Curie, for example, was awarded Nobel Prizes in 1903 and 1911 for the discovery of radium (Ra) and polonium (Po). One of her students, Marguerite Perey, discovered francium (Fr) while working in Curie's lab. Berta Karlik was credited with discovering astatine (At), Lise Meitner identified an isotope of protactinium (Pa) and Ida Noddack discovered rhenium (Re). At a time when women account for less than 30% of all researchers, these breakthroughs show what we can achieve when we all work towards the same goal.

This not only means encouraging women to take up scientific careers, it also means facilitating access to scientific information – within and across borders. For this reason, the International Year paid tribute to the international scientific cooperation that led to the discovery and naming of four super-heavy elements in the Periodic Table: the atomic numbers 113 (nihonium), 115 (moscovium), 117 (tennessine), and 118 (oganesson).

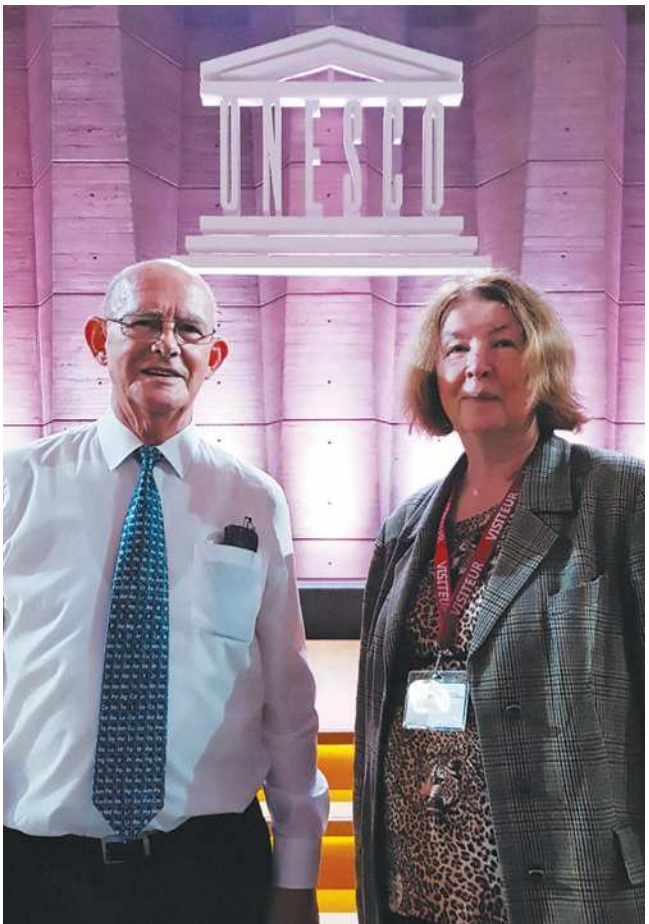
To support further discoveries in this field, the UNESCO-Russia Mendeleev International Prize in the Basic Sciences was established by UNESCO in October 2019, as part of the Year's legacy. This Prize rewards excellence in this discipline and recognizes that progress in science, technology and innovation is indispensable to sustainable development.

These achievements, and many more, are described in this report on the International Year of the Periodic Table of Chemical Elements. Every page reveals the importance of this unique tool in humanity's tireless quest for knowledge – and is an invitation to discover more.

Foreword

The International Year of the Periodic Table of Chemical Elements 2019 (IYPT 2019) was proclaimed by the United Nations General Assembly during its 74th Plenary Meeting, at the 72nd Session on December 20th, 2017, following the resolution of UNESCO General Conference, adopted at its 39th Session, on November 2nd, 2017. In proclaiming an International Year focusing on the Periodic Table of Chemical Elements and its applications, the United Nations has recognized the importance of raising global awareness of how chemistry promotes sustainable development and provides solutions to global challenges in energy, education, agriculture and health. Indeed, the resolution was adopted as part of a more general Agenda item on Science and Technology for Development. This International Year was to bring together many different stakeholders including UNESCO, scientific societies and unions, educational and research institutions, technology platforms, non-profit organizations and private sector partners to promote and celebrate the significance of the Periodic Table of Elements and its applications to society, in particular during 2019. An International Year of the Periodic Table of Chemical Elements in 2019 aimed to celebrate the 150th anniversary of the establishment of the Periodic Table of Chemical Elements by the Russian scientist Dmitri I. Mendeleev, who is regarded as one of the fathers of modern chemistry.

IYPT2019 saw thousands of events take place with an impact that reached over 130 countries. The diversity of events was remarkable. The Opening Ceremony in Paris on January 29, 2019 set the scene, and throughout the year we saw and enjoyed activities including: education and outreach for students and the public; specialist workshops in science and industry; forums on the historical development of the Periodic Table of Chemical Elements; conferences on the role of chemistry and the Periodic Table in sustainable development; public chemical festivals and displays; works of art, music, and literature. Events were targeted at all levels—from preschool children learning science for the first time, to politicians, and diplomats, convening high-level meetings discussing the importance of the Periodic Table and science and technology for the future.



When discussions of IYPT2019 first began in 2016 within the scientific community, we do not think that anyone could have foreseen the extent of the worldwide enthusiasm around the theme of the Periodic Table of Chemical Elements, and neither did we anticipate the many new links that would appear between the Periodic Table and art and culture. We feel personally that a major contributor to the success of IYPT2019 has been the fact that the IYPT2019 partners reached out beyond their traditional memberships and audiences to engage more broadly and to make new connections. We would like to thank UNESCO and all our partners and supporters worldwide for their commitment and efforts. And a special word of thanks is due to all our student volunteers who brought their passion and energy to the IYPT2019 organization.

This report aims to give a synthetic account of IYPT2019, first describing its origins and goals, and then providing a summary of the many events and activities that took place worldwide. The report also contains information on organization and communications, and it is hoped that these details may provide guidance for others who may wish to organize a similar global outreach initiative in the future.

We believe that everyone involved in IYPT2019 can feel immensely proud of what has been achieved. We can also feel confident that many of the partnerships established during IYPT2019 will continue. It is sometimes difficult to see how we as individuals can contribute to solving issues of global importance, but we believe that the International Year of the Periodic Table of Chemical Elements has provided a timely reminder that through our commitment to education and outreach, we can really make a difference. It is now up to all of us to build on what we have learned and what we have accomplished during 2019 to continue to work together for the betterment of all.

Natalia Tarasova and
Jan Reedijk

Co-Chairs of the IYPT2019
Interunion International
Management Committee

Moscow/Leiden,
April 2020

Executive Summary

I. BACKGROUND AND PLANNING

1. Following a request of the Russian Academy of Sciences, IUPAC took the initiative and necessary actions to request for the proclamation of 2019 as the United Nations International Year of the Periodic Table to be included in the United Nations agenda for December 2017. Subsequently, the United Nations General Assembly proclaimed IYPT2019 during its 74th Plenary Meeting, at the 72nd Session on December 20th, 2017, following the resolution of UNESCO General Conference, adopted at its 39th Session, on November 2nd, 2017.

   In proclaiming an International Year focusing on the Periodic Table of Chemical Elements and its applications, the United Nations has recognized the importance of raising global awareness of how chemistry and related natural sciences promote sustainable development and provides solutions to global challenges in energy, education, agriculture and health. Indeed, the resolution was adopted as part of a more general UN Agenda item on Science and Technology for Development. This International Year has brought together many different stakeholders including UNESCO, scientific societies and unions, educational and research institutions, technology platforms, non-profit organizations and private sector partners to promote and celebrate during 2019 the significance of the Periodic Table of Elements and its applications to society.

2. The development of the Periodic Table of the Elements is one of the most significant achievements in science and a unifying scientific concept, with broad implications in Astronomy, Chemistry, Physics, Biology and other natural sciences. The International Year of the Periodic Table of Chemical Elements in 2019 coincided with the 150th anniversary of the discovery of the Periodic System by Dmitry Mendeleev in 1869. The Periodic Table is a unique tool enabling scientists to predict the appearance and properties of matter on Earth and in the Universe. Many chemical elements are crucial to enhance the value and performance of products necessary for humankind, our planet, and industrial endeavors. The four most recently generated elements were all added into the Periodic Table, with the approval of their names and symbols, on November 28, 2016.

   The International Year of the Periodic Table of the Chemical Elements also coincided with the Centenary of IUPAC (IUPAC100), and with the Centenary of the International Astronomical Union (IAU100).

3. Chemical Elements play a vital role in our daily lives and are crucial for humankind, our planet, and for industry. The International Year of the Periodic Table of Chemical Elements has provided an excellent opportunity to show how the Elements are central to linking cultural, economic and political aspects of the global society through a common language, whilst also celebrating the genesis and development of the Periodic Table over the last 150 years. It is critical that the brightest young minds continue to be attracted to chemistry and physics in order to ensure the next generation of scientists, engineers, and innovators in this field. Some areas where the Periodic Table and its understanding have recently had a revolutionary impact are in nuclear medicine, the study of chemical elements and compounds in space and the prediction of novel materials. No doubt, IYPT2019 has provided an unparalleled opportunity to demonstrate the importance of the Periodic Table, in Science, Education and for the worldwide community. Also, its applications and contributions to the United Nations 2030 Agenda for Sustainable Development obtained major attention. A central aim of IYPT2019 has been to raise global awareness of the importance of the Periodic Table and the importance of research in the basic sciences and engineering.

4. The IYPT2019 was endorsed by a number of international Scientific Unions and the International Council for Science (ICS), coordinated by International Union of Pure and Applied Chemistry (IUPAC). The Year was also supported by the International Union of Pure and Applied Physics (IUPAP), the European Chemical Society (EuChemS), the International Astronomical Union (IAU) and the International Union of History and Philosophy of Science and Technology (IUHPST). The IYPT2019 application and start-up in 2016 and 2017 was administered by the International Steering Committee in collaboration with the UNESCO International Basic Sciences Program (IBSP). An Inter-Union Management Committee and an International Secretariat started to operate in early 2018.

II. ADMINISTRATIVE ISSUES

5. Governance of IYPT2019 started via the Steering Committee that prepared the UNESCO application brochure, provided overall direction for planning of activities, and also acted as an Advisory Board that facilitated worldwide interactions with a range of international partners. The composition of the Steering Committee is listed at the end of the present report.

6. Although the organization of IYPT2019 was initiated through the UNESCO International Basic Sciences Program (IBSP) it was operated independently by an Inter-Union Management Committee, with representatives of the founding organizations, scientific societies and unions, educational and research institutions, technology platforms, non-profit organizations and private sector partners. The choice for this structure originated from the global coverage of chemists, physicists, astronomers, historians and include proper representations of sponsors for the several events. The composition of the Management Committee is listed at the end of the report. Whilst clear governance was necessary to provide a framework to guide international actions, interested citizens from around the world were encouraged to participate in the International Year, and could do so directly via the website www.iypt2019.org and via social media.

7. Financially, IYPT2019 was dependent on donations, coming from the founding partners (IUPAC, IUPAP, IAU, EuCheMS, IUHPST), industrial sponsors and large (inter)national chemical societies/organizations. After a starting fund from IUPAC, the search for external sponsors began in early 2018 and continued until December 2019 for the Closing Ceremony. The majority of the funding at the opening ceremony in January came from UNESCO (in kind), two large industrial sponsors (PhosAgro and Solvay), and our major communication partners 1001inventions and the All Russian Science Festival. Funding for the closing ceremony came for a very large part from Japanese Governmental and Industrial sources. Sponsorship contributions from scientific organizations and from industry ranged from €1,000 to €100,000. At the end of 2019, IYPT2019 had received financial support from sixteen sponsors reaching a total of €190,000 (excluding in-kind from communication partners and closing ceremony sponsors), which was used for opening, closure and running costs, website maintenance and archiving, social media, secretariat, travel costs, music performances and auditing control. Global Fund accounts were kept inside IUPAC (in a dollar account) and in the KNCV Secretariat (run by Royal Netherlands Chemical Society, in a Euro account). A global fund budget oversight was provided by KNCV office administration which approved all Euro expenditures from the fund and audited by an external professional company (Cijferz). Similarly, the dollar account oversight was done and audited by the IUPAC administration.

8. An indicative overall breakdown of expenditure from the IYPT2019 Global Fund is difficult to estimate due to the in-kind contributions of UNESCO, 1001inventions, Science Festival and late sponsors from Japanese Industry and Government to the closing ceremony. But the following is an attempt: Opening and Closing Ceremonies (60%); Support for Worldwide Events (10%); Administration and Communications (15%); Legacy Actions and Final Report (10%); controlling/auditing (5%).

   Some Founding Partners and sponsors donated considerable staff time to organize the international program of IYPT2019, allowing the administrative costs to be kept very low. As mentioned, the global sponsorship, however, was only a very small fraction of the total budget. Estimates provided by partners for fundraising by national committees, as well as in-kind contributions and volunteer time, suggest a total cost of IYPT2019 approaching €10 M€.

III. ACTIVITIES AND IMPACT

9. IYPT 2019 involved a total of at least 10,000 activities of various types in some 136 countries, on all continents including Antarctica. Specific events (e.g. outreach, conferences) were carried out in 129 countries and in addition the philatelic program in nine countries celebrated IYPT2019 commemorative in launching a special stamp, i.e. Algeria, Bulgaria, Hungary, Kyrgyzstan, Moldavia, North Macedonia, Portugal, Russia and Spain.

10. An indicative breakdown of the distribution of activities is hard to give, but an estimate is as follows: Multi-day scientific conferences (30%); Periodic Table-based exhibitions and festivals (25%); One day conferences and special events (20%); Activities in schools (10%); Art and music shows (5%); Citizen Science activities (5%); Other e.g. Periodic Table competitions, Open Days, Launch Events, Stamps and Coins, etc. (5%).

11. The communication strategy of IYPT2019 employed a website (www.IYPT2019.org), as well as social media accounts on Twitter, Facebook , and Instagram (@IYPT2019) and a webpage link on the UNESCO website. News dissemination started via UNESCO's Sector for External Relations and Public Information followed by several media partners but later went via www.IYPT2019.org. Furthermore, IYPT2019 participants used all other media such as blogs, radio, television and YouTube. Key summary statistics are: Over 2 million website visits from 200,000 visitors from close to 200 countries from 1 January 2019 to 31 January 2019; more than 160,000 mentions on Twitter, resulting in 100 million impressions. Media influence was reported as: 3,000 distinct media mentions (newspapers, online, TV) from a minimum of 73 different countries. The potential audience (Comscore) of these media mentions is 5.2 billion, with an equivalent value in terms of paid advertising of USD $49 million.

12. An important item during IYPT2019 was to help promoting the objectives of the 2030 Agenda for Sustainable Development: education for girls and boys (related to SDG 4); capacity building for innovation with local benefit (related to SDG 9); promoting gender equality in science (related to SDG 5); contributing to means to combat climate change (related to SDG 13), both in terms of developing new technologies to guide policy decision-making. Emphasis was also placed on awareness raising of how the periodic table can improve societies and help them harness the full possibilities of a sustainable life (related to SDG 11) and the importance of chemistry-based technologies in achieving poverty alleviation (related to SDG 1).

13. Another significant measure of the impact of IYPT2019 can be seen in the number and the diversity of the stakeholders involved, which include representatives of the public and private sectors, actors of civil society as well as scientific academies and research institutions. Reinforcing partnerships across the globe (related to SDG 17) has been a central objective and outcome of the Year. These new collaborations put into place during 2019 have enhanced global knowledge of the importance of science as a central pillar for development, and the particular role of the periodic table and chemistry as a multidisciplinary theme working together with other disciplines.

IV. DESCRIPTIONS OF HIGH-LEVEL EVENTS AND WITH HIGH-LEVEL SUPPORT

14. The IYPT2019 Opening Ceremony took place on January 29 at UNESCO Headquarters in Paris. The 35 speakers included UNESCO leadership, a Nobel laureate, distinguished international scientists, students, representatives of founding organizations, and industry CEOs. The speaker program was complemented by cultural performances, displays of educational resources, art and music, and a large exhibition on the periodic table and it history, as well as by the 1001 Inventions children's show. The attendance was close to 1,000 persons.

15. The IYPT2019 Closing Ceremony took place on December 5 in the Tokyo Prince Hotel, Japan. The 56 speakers included distinguished international scientists, young students, representatives of founding organizations, industry CEOs and high level officials. The Closing Ceremony looked back on the activities during the year and forward to the legacy of IYPT2019. The event was accompanied by art events, a high school outreach program and a large exhibition on the periodic table including merchandise. The attendance was close to 500 persons.

16. Other high-level events included celebrations from IAU100, IUPAC100, Mendeleev150. Special attention was provided to these anniversaries in relation to the Periodic Table. IAU organized events focused on elements in space for their centenary. IUPAC organized among other activities the Periodic Table Challenge and the Periodic Table of Younger Chemists. Mendeleev150 was celebrated throughout the world, but most directly during the Russian Opening Ceremony and the XXI Mendeleev Congress on General and Applied Chemistry.

17. National significant events of this type also included: ChemFest (London, UK), Setting their Table: Women and the Periodic Table of Elements (Murcia, Spain), IUPAC for Africa (Dar es Salaam, Tanzania), the International Science and Technology Festival (Mumbai, India), the XXI Mendeleev Congress on General and Applied Chemistry (St. Petersburg, Russia).and the educational course "Journey from Alchemy to Chemistry" by 1001 Inventions in France, China, Germany, Montenegro, Russia, the UK and Egypt.

18. Several countries at their IYPT2019 celebrations obtained high-level support and patronage from Figures of State. Such support included: Prime Minister Dmitry Medvedev (Russia) at the IYPT Opening ceremony in Moscow and King Willem Alexander (the Netherlands) at the meeting about cosmic origins of the chemical elements. Several countries and parliaments were also involved in the official IYPT2019 celebrations both nationally and internationally, such as China, Russia, Japan, France and Spain.

V. LEGACY AND CONTINUING ACTIONS

19. IYPT2019 no doubt initiated many new links and collaborations between decision makers, industry leaders, scientists, artists, social businesses, International Scientific Unions, and of course the public at large. The IYPT2019 Steering Committee and Management Committee are committed to working together and make sure that the website and its major links will be kept alive for future generations. IUPAC will host this site at www.IYPT2019.org.

A FEW LEGACIES ARE MENTIONED BELOW:

Dmitry Mendeleev Prize for the Basic Sciences.

In the framework of follow up to the International Year of the Periodic Table of Chemical Elements (IYPT2019), the Government of the Russian Federation proposed to establish and fund the joint UNESCO/Russian Federation International Prize in the name of the Russian chemist Dmitry Mendeleev for the Basic Sciences.
The initiative was presented as a follow up and outcome to the International Year of the Periodic Table of Chemical Elements (IYPT2019) to provide further support to the UNESCO's International Basic Sciences Program (IBSP).
On October 21, 2019 in Paris at the 207th session of the UNESCO Executive Board it was decided to establish the D.I. Mendeleev UNESCO-Russia International Prize for Achievements in the Basic Sciences. The UNESCO Executive Board adopted the decision by acclamation, without a vote, supporting the establishment of the Prize by applause. The total value of the Prize is $850,000 per year.

Periodic Table Challenge

At the website https://iupac.org/100/pt-challenge-entry/ a continuous project will be maintained dealing with an online quiz about all 118 chemical elements. This online competition was played over 60,000 times throughout the year 2019. Due to this great success IUPAC decided to keep the Periodic Table Challenge beyond 2019 as a permanent feature on the IUPAC website (www.iupac.org). The Challenge will thus become one of the outreach activities of IUPAC and a wonderful legacy of IYPT2019. Many individuals, including IUPAC staff and volunteers, as well as the participants contributed to the success of this initiative, and to a celebration of the Periodic Table which reached every corner of the world.

#PeriodicPlayoffs (ACS)

The American Chemical Society (ACS) ran a March Madness style tournament for the elements of the periodic table where people voted on Social Media for their top 64 elements, then these elements were matched head to head each week leading up to the National Meeting in Orlando where Silver was declared the winner. With an impact of nearly 500,000 social impressions, 8,900 votes from 7,800 unique visitors, over 14,000 page visits, and over 1,000 downloads of the printable playoff bracket it was a very successful event and will be repeated in the future.

Congressional Element Slam

On the 19th of November 2019 the ACS organized the Element Slam. Early career scientists from six U.S. Department of Energy National Labs presented in a poetry slam style competition at the U.S. Capitol. Each participant gave a 5-minute «lightning talk» about their favorite element in celebration of IYPT. The winning element was Titanium as presented by Dr. Teresa Palazzo from PNNL. This event will be continued in the future.

Periodic Table of Videos (PTOV)

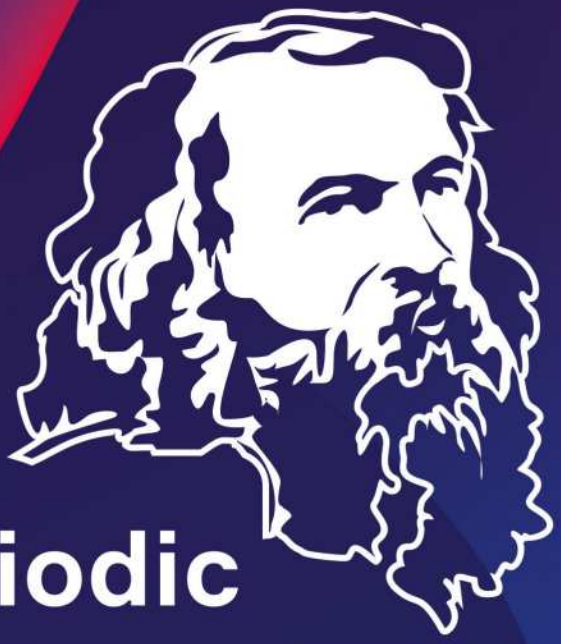
Although existing for some years already it is perhaps not surprising that PTOV became an integral part of many IYPT2019 celebrations and activities worldwide. Sir Martyn Poliakoff (Nottingham University, UK) and his team no doubt will continue expanding and promoting this project for use by future generations of chemists and chemistry students and will be as active as ever planning new videos to continue exciting the public about the Periodic Table and promoting the legacy of IYPT2019.

The EuChemS Video Game

In the beginning of 2019 the EuChemS launched a Periodic Table adventure game, named "Elemental Escapades! A Periodic Table Adventure" The game is a short 2D puzzle platform game in which you play as Jan, a janitor inadvertently transported across time and space! In your journey home you will learn about basic chemical elements and combine them to make useful compounds to help navigate the strange alien world you find yourself in. A Periodic Table Adventures will continue to be available and be promoted.

EYCN Video Competition

The theme of the competition was 'In their Element'. The competition had over 250 entries and the winning videos can be found on the EYCN YouTube channel.



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ПЕРИОДИЧЕСКАЯ ТАБЛИЦА ХИМИЧЕСКИХ ЭЛЕМЕНТОВ

TABLEAU PÉRIODIQUE DES ÉLÉMENTS CHIMIQUES

TABLA PERIÓDICA DE ELEMENTOS QUÍMICOS

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PART 1:
OVERALL

Origin

The first idea for an International Year of the Periodic Table of Chemical Elements dates back to July 28th, 2016, when Professor Natalia Tarasova, at that time the President of the International Union of Pure and Applied Chemistry, received the following message from Sir Martyn Poliakoff, Professor at Nottingham University, UK, Foreign Member of the Russian Academy of Sciences.

He wrote:

«Dear Natalia,

I hope that you are well. I have realized that 2019 will be the 150th anniversary of Mendeleev's publication of the Periodic Table. Therefore, I was wondering whether IUPAC might lead a request to make 2019 the International Year of the Periodic Table. I feel that this proposal might get a lot of support. What do you think?

Best Wishes

Martyn».

As Natalia Tarasova had previously been involved into the activities of the International Year of Chemistry Management Committee (IYC 2011), the algorithm of the procedure was clear to her. International Years are part of the United Nations (UN) declared observances that promote awareness of issues relevant to its aims and international programs. The first step to successfully achieve the proclamation of the International Year was to work through UNESCO to prepare and submit a resolution to the UN General Assembly. The key element at the initial stage is to identify the country which will be willing, through its National Delegation to UNESCO, to promote the idea of the IYPT, so that UNESCO, as the UN body, could recommend the UN General Assembly to proclaim the year 2019 as the IYPT. In fact, the time to move the idea forward was quite limited. According to the UN rules, the decision must be taken two years in advance, that is in the year 2017. The IUPAC Executive Committee supported the idea of the IYPT in principle, though with healthy skepticism, based on the memories of the proclamation of the International Year of Chemistry in 2011. Russia was chosen to lead the initiative through UNESCO as the motherland of Dmitry Mendeleev. On September 30th, 2016, 3000 participants of the 20th Mendeleev Congress, held in Ekaterinburg, Russia, unanimously voted for the proclamation of the IYPT in 2019. The resolution was supported by the Mendeleev Russian Chemical Society and the Russian Academy of Sciences. Based on this resolution, academician Vladimir Fortov, at that time the President of the Russian Academy of Sciences, sent a letter to the Minister for Foreign Affairs of the Russian Federation Sergey Lavrov, asking him for the support of the IYPT initiative in UNESCO. Simultaneously, the letter from the Russian Academy of Sciences (the Russian National Adhering Organization for IUPAC) came to the IUPAC Secretariat. The Russian Academy of Sciences invited IUPAC to be the leading union for the IYPT, as the identification of the leading international science union is a compulsory part of the UNESCO procedure. Based on this request, on December 18, 2016, Natalia Tarasova sent a letter to Professor Irina Bokova, at that time the Director General of UNESCO. "It is with great pleasure that the International Union of Pure and Applied Chemistry (IUPAC) accepts the invitation from the Russian Academy of Sciences to be the main sponsoring organization for the application to UNESCO that 2019 be designated as the International Year of the Periodic Table of Chemical Elements, celebrating the 150th Anniversary of the Mendeleev Periodic Table... The periodic table is strongly linked to IUPAC's mission. The chemical elements are crucial for humankind and our planet, and for industry. At the same time, it is important that whilst they are used to give added value and products necessary for our civilization, that this is done in a sustainable way. In particular, awareness is needed of the sustainability of the use of scarcer elements, which are often either diluted in the earth's crust or only available in very specific locations. An International Year of the Periodic Table of Chemical Elements would give an opportunity to draw the attention of children through to senior adults to these aspects that are important for the future of our planet, whilst also celebrating the genesis and development of the periodic table over the last 150 years. Other activities will also be organized making full use of the extensive network of IUPAC members.

We very much hope that UNESCO will grant the request for the International Year of the Periodic Table of Chemical Elements and IUPAC is very proud and honored to be the main sponsoring organization for the application".

The end of the year 2016 was very rich in events linked to the Periodic Table of Chemical Elements. On 28 November 2016, the IUPAC approved the names and symbols for four elements: nihonium (Nh), moscovium (Mc), tennessine (Ts), and oganesson

(Og), respectively for element 113, 115, 117, and 118. This event was widely covered by the mass media. In the beginning of the year 2017, the inauguration ceremonies took place in the Oak Ridge National Laboratory (ORNL, USA), in Moscow and at the Joint Institute for Nuclear Research, Dubna (Russia) and in Tokyo (Japan). During the inauguration ceremony in Moscow a letter to UNESCO was signed by the director of the ORNL Thomas Mason, director of the Lawrence Livermore National Laboratory (LLNL, USA) William Goldstein and the director the Joint Institute of Nuclear Research (Dubna, Russia) academician Victor Matveev. In this letter they supported the IUPAC appeal to UNESCO on the declaration of the year 2019 as the International Year of the Periodic Table of Chemical Elements.

They wrote:

"Dear Prof. Bokova,

One of the greatest scientific achievements of the XIXth century was the discovery made by D.I. Mendeleev. He was the first to notice that the properties of chemicale elements are periodic in their nature. In 2019 the world scientific community will celebrate the 150th anniversary of the Periodic Table of chemical elements. Today, for the first time in its entire history, the Table looks most complete: all the elements of its 7 periods are discovered and have acquired their final names.

Over the past 100 years, humankind has made a giant leap in the understanding of how elements found in nature are formed. This has allowed, among other things, conducting laboratory synthesis and studies of the properties of more than twenty transuranic elements. Over the past 16 years, scientists from the Joint Institute for Nuclear Research (JINR, Dubna) in collaboration with their colleagues from the leading US nuclear centres: the Lawrence Livermore and Oak Ridge National Laboratories, as well as Vanderbilt University and the University of Tennessee at Knoxville, have become the first to synthesize five superheavy elements completing the seventh row of the Periodic Table.

In 2012, IUPAC named element 114 as Flerovium (Fl) and element 116 as Livermorium (Lv). On November 28, 2016 IUPAC made a final decision to assign the following names to elements 113, 115, 117, and 118:

Nihonium (Nh) for element 113;
Moscovium (Mc) for element 115;
Tennessine (Ts) for element 117;
Oganesson (Og) for element 118.

The Periodic Table of elements truly is the province of all humankind. All the leading countries of the world have made their invaluable contribution, completing the Table with new elements, studying and specifying the properties of the discovered ones. The international colloquium dedicated to the naming of the three superheavy elements with numbers 115, 117, and 118 was held in Moscow on March 2, 2016. The par-rticipants of the colloquium were over 200 delegates from 112 countries, among them, representative delegations of JINR (Dubna, Russia), ORNL (USA), LLNL (USA), Vanderbilt University and University of Tennessee at Knoxville (USA), RIKEN (Japan), GSI (Germany), PSI (Switzerland), GANIL (France), IUPAC and IUPAP, Russian Academy of Sciences, as well as the leading scientists who made significant contributions to this field of nuclear physics.

We, the undersigned, on behalf of the participants of the colloquium, taking into account the importance of D.I.Mendeleev's discovery, support the IUPAC appeal to UNESCO on declaration of the year 2019 as the Interrnational Year of the Periodic Table of Elements".

In the next few months, the initiative of the IYPT was supported by the International Union of Pure and Applied Physics (IUPAP), European Association for Chemical and Molecular Sciences (now European Chemical Society, EuChemS), the International Astronomical Union, The International Union of History and Philosophy of Science and Technology (IUHPS), and by more than 80 IUPAC National Adhering Organizations, Academies of Sciences, chemical societies, research institutions (tremendous work done by the IUPAC Secretariat led by Dr. Lynn Soby). Following the recommendations of UNESCO International Basic Science Program (Natalia Tarasova presented the concept of the IYPT at the 10th meeting of its' Scientific Board at UNESCO Headquarters in Paris on 24th January 2017), the International Steering Committee was

formed. 13 famous scientists from all over the world, together with the Working Group of the Russian Academy of Sciences (scientific secretary- member of the RAS professor Julia Gorbunova) produced 15 pages' Prospectus on the IYPT. Many volunteers from all over the world helped with pictures, ideas, sometimes with criticism. The Prospectus and the concept were presented at the IUPAC 49th General Assembly (July 7-13, 2017, São Paulo, Brazil). The Russian Permanent Delegation to UNESCO and Commission of the Russian Federation for UNESCO worked very effectively to get support among the UNESCO member-countries, and UNESCO General Conference, at its' 39th Session, on November 2nd, 2017, adopted the resolution, that recommended that the United Nations General Assembly, at its 72nd session, adopt a resolution declaring 2019 as the United Nations International Year of the Periodic Table of Chemical Elements.

On December 20th , 2017, the United Nations General Assembly during its 74th Plenary Meeting, at the 72nd Session proclaimed 2019 as the International Year of the Periodic Table of Chemical Elements (IYPT 2019). In proclaiming an International Year focusing on the Periodic Table of Chemical Elements and its applications, the United Nations has recognized the importance of raising global awareness of how chemistry promotes sustainable development and provides solutions to global challenges in energy, education, agriculture and health. Indeed, the resolution was adopted as part of a more general Agenda item on Science and Technology for Development. This International Year has brought together many different stakeholders including UNESCO, scientific societies and unions, educational and research institutions, technology platforms, non-profit organizations and private sector partners to promote and celebrate the significance of the Periodic Table of Elements and its applications to society during the year 2019.

PARTNERS OF THE INTERNATIONAL YEAR OF THE PERIODIC TABLE 2019

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The History of the Discovery

The Periodic Table of Chemical Elements is one of the most significant achievements in science, capturing the essence, not only of chemistry, but also of other science areas, like physics and biology. It is a unique tool, enabling scientists to predict the appearance and properties of matter on Earth and in the rest of the Universe.

The International Year of the Periodic Table of Chemical Elements in 2019 commemorated a remarkable series of important milestones in the history of the periodic table of chemical elements dating back 2800, 350, 230, 190, 150, and 80 years. Indeed, around 800 BC, an Arab alchemist named Jabir ibn Hayyan first isolated the chemical elements arsenic and antimony. In 1669, phosphorus was the first element to be chemically discovered by Hennig Brandt (German). In 1789, Antoine Lavoisier (French) published a list of 33 chemical elements grouped into gases, metals, nonmetals, and earths. In 1829, Johann Wolfgang Döbereiner (German) observed that when many of the elements were grouped in three (triads) based on their chemical properties and arranged by atomic weight, the second member of each triad was approximately the average of the first and the third (Law of Triads). In 1869, Dmitry Mendeleev (Russian) developed the modern periodic table as it is known today. In 1939, a French woman scientist, Marguerite Perey, discovered element francium based on filling gaps in Mendeleev's periodic table. It is also believed that lead smelting began at least 9,000 years ago in Africa, and the oldest known artifact of lead is a statuette found at the temple of Osiris on the site of Abydos (Egypt) dated circa 3800 BC.

March 1, 1869 is considered as the date of the discovery of the Periodic Law. That day Dmitry Mendeleev completed his work on «The experience of a system of elements based on their atomic weight and chemical similarity». This event was preceded by a huge body of work by the most outstanding chemists in the world. By March 1 1869, 63 chemical elements were already discovered, and attempts to find regularities in this set had been made repeatedly. In 1829, Döbereiner published the «Law of Triads»: the atomic mass of many elements is close to the arithmetic mean of two other elements close to the original one in chemical properties (strontium, calcium and barium; chlorine, bromine and iodine, etc.). The first attempt to arrange the elements in order of increasing atomic weights was undertaken by Alexandre-Émile Béguyer de Chancourtois (1862), who placed the elements along the helix and noted the frequent cyclic recurrence of their chemical properties along the vertical axis. Neither of these models attracted the attention of the scientific community.

In 1866, chemist and musician John Alexander Reina Newlands suggested his version of the periodic system «Law of Octaves» that looked a bit like Mendeleev's one. However, it was compromised by the author's persistent attempts to find mystical musical harmony in the table. In the same decade, several more attempts were made to systematize chemical elements. Julius Lothar Meyer was very close to the final version (1864). He published a table containing 28 of the 56 know elements using valency as the basis for periodicity. Dmitry Mendeleev published his first diagram of the periodic table in 1869 in the article «The Correlation of Properties with the Atomic Weight of Elements» (in the Journal of the Russian Chemical Society). A bit earlier he sent a scientific announcement of the discovery to the leading chemists of the world. This table included all the 63 known elements and allowed chemical properties/valency to dominate over atomic weight. He challenged some of the known atomic weights and predicted that there were certain elements still to be discovered.

As has been mentioned above, March 1, 1869 is considered as the day of the discovery of the Periodic Law. That day Dmitry Mendeleev completed his work on «The experience of a system of elements based on their atomic weight and chemical similarity.». Meyer published an updated version of his table, which was very similar to that of Mendeleev, in December 1869. In the early days, both Mendeleev and Meyer were honored for their discovery of the "periodic relations of the atomic weights", sharing the Davy Medal of the Royal Society in 1882. Nowadays, Mendeleev is almost universally accepted as the originator of the Periodic Table of Chemical Elements, perhaps because he included all known elements and because he used the Table predictively.

The great Russian scientist Dmitry Mendeleev is now regarded as the pioneer of the Periodic Table. By 1860, only 60 elements had been discovered (we now know 118) and indeed some of the information about these 60 was wrong. It was as if Mendeleev were doing a jigsaw with one third of the pieces missing, and other pieces bent! Mendeleev had written the properties of elements on pieces of card, and tradition has it that after organizing the cards while playing patience, he suddenly realized that, by arranging the element cards in order of increasing atomic weight, certain types of element regularly occurred.

The greatness of Mendeleev was that not only did he leave spaces for elements that were not yet discovered, but he predicted properties of five of these missing-elements and their compounds. Three of these missing elements were discovered, by others within 15 years (i.e. within his lifetime).

1869 is considered as the year of discovery of the Periodic System by Dmitry Mendeleev. 2019 is the 150th anniversary of the Periodic Table of Chemical Elements. The International Year of the Periodic Table of Chemical Elements has been a worldwide initiative to highlight the importance of the Periodic Table in science, technology, and sustainable development of humankind.

This International Year brought together many different stakeholders including UNESCO, scientific societies and unions, educational and research institutions, technology platforms, non-profit organizations and private sector partners to promote and celebrate the significance of the Periodic Table of Elements and its applications to society during 2019. The International Year of the Periodic Table of Chemical Elements gave a greater resonance to the celebration of the International Day of Women and Girls in Science on 11 February 2019 ("Setting their Table: Women and the Periodic Table of Elements", International Symposium at the University of Murcia (Spain) 11-12 February 2019) by highlighting female role models who contributed significantly to the discovery of elements of the Periodic Table. The examples of Marie Skłodowska Curie, who was awarded Nobel Prizes in 1903 and 1911 for the discovery of radium (Ra) and polonium (Po), Berta Karlik for the discovery of astatine (At), Lise Meitner, who identified an isotope of protactinium (Pa), Ida Noddack for the discovery of rhenium (Re), and Marguerite Perey, who discovered francium (Fr), were celebrated in line with the gender equality priority of UNESCO in view of the advancement of the 2030 Agenda for Sustainable Development. In addition, a book entitled "Women in their Element: Selected Women's Contributions to the Periodic System" edited by Annette Lykknes and Brigitte van Tiggelen also highlighted the role of women in the development of the Periodic Table.

The International Year of the Periodic Table of Chemical Elements enhanced international cooperation by coordinating activities between learned societies, educational establishments and industry, focusing specifically on new partnerships and initiatives in the developing world and establish durable partnerships to ensure that these activities, goals and achievements continue in the future beyond the year 2019.

UNESCO – Science to Empower Society

The United Nations Educational, Scientific and Cultural Organization (UNESCO) is the only United Nations specialized agency with an explicit focus on science. Since UNESCO's creation in 1945, science, the "S" in UNESCO, has always been a vitally important part of the Organization's mandate. Within the context of its intergovernmental mandate and universal membership it has focused its work in science on issues of global concern requiring multinational collaboration such as in the fields of freshwater resource management, ocean health, natural disaster reduction, biodiversity loss, and capacity building in science, technology and innovation. The relationship between science and society has been interpreted in various ways over UNESCO's history. Science, to build peace and to respond to international development goals, continues to be of key concern.

The United Nations designates International Years to draw attention to issues affecting mankind throughout the world and to encourage international cooperation and action to address issues of global importance. The General Assembly of the United Nations proclaimed the year 2019 as the International Year of the Periodic table of Chemical Elements (IYPT 2019) in recognition of the important role that science can play at the individual, community, national and global levels to promote education, health, development and peace and invited UNESCO to serve as the lead agency for the IYPT 2019. The International Year of the Periodic Table of Chemical Elements follows in the footsteps of numerous international years led by UNESCO, such as 2011 the International Year of Chemistry, 2014 the International Year of Crystallography and 2015 the International Year of Light.

UNESCO's leadership of IYPT 2019 was through its International Basic Sciences Program (IBSP) that was developed with the intent of strengthening national capacities in science, sharing scientific knowledge, promoting science education and reducing the divide in the basic sciences between rich and poor nations. The IBSP is the only international platform, which puts forward recommendations to the UNESCO governing board on how to improve the status of basic sciences around the globe. IBSP's defining role in IYPT 2019 has clearly contributed to achieving the goals of the UNESCO in strengthening science, technology, and innovation (STI) systems and policies, as well as in the advancement of science and technology for sustainable development. It also played a major role in harnessing international cooperation of science and technology capacity-building.

UNESCO Headquarters in Paris, France

Goals, Vision and Objectives

Throughout 2019 thousands of activities and events were organized all over the world related to the Celebrations of the International Year of the Periodic Table of Chemical Elements 2019 (IYPT2019). The major goals were related to highlighting the importance of one of the greatest achievements of humankind to the general public, as well as to experts. The Periodic Table knows no boundaries, sees no color and does not distinguish between young and old. It simply makes up everything in the world.

In the 2017 UNESCO application, the following Goals were listed:

An International Year of the Periodic Table of Chemical Elements will:

- serve as a focal point for activities by national and international chemical societies and unions, educational institutions and non-governmental and intergovernmental organizations;
- build worldwide educational capacities through basic sciences activities for young people, such as the IBSP's Microscience Program, that helps to address issues of gender balance and focus in particular on developing countries and emerging economies;
- create opportunities for human and institutional capacity-development in the basic sciences for African countries, in line with the UNESCO Global priority for Africa;
- give a greater resonance to the celebration of the International Day of Women and Girls in Science on 11 February 2019 by highlighting women role models who substantially contributed significantly to the discovery of elements of the Periodic Table. The examples of Marie Curie, who was awarded Nobel Prizes in 1903 and 1911 for the discovery of Radium (Ra) and Polonium (Po), Berta Karlik for the discovery of Astatine (At), Lise Meitner, who identified an isotope of Protactinium (Pa), Ida Noddack for the discovery of Rhenium (Re), and Marguerite Perey, who discovered Francium (Fr), will be celebrated in line with the gender equality priority of UNESCO in view of the advancement of the 2030 Agenda for sustainable development;
- enhance the understanding and appreciation of Periodic Law and chemistry in general among the public;
- promote the role of chemistry in contributing to solutions to many global problems, such as climate change and the preservation of natural resources;
- promote awareness of the interdisciplinary nature of twenty-first century science, and emphasize how interactions between different thematic areas of the basic sciences will be increasingly needed in future research and education, and in the achievement of the 2030 Agenda for sustainable development;
- enhance international cooperation by coordinating activities between learned societies, educational establishments and industry, focusing specifically on new partnerships and initiatives in the developing world;
- establish durable partnerships to ensure that these activities, goals and achievements continue in the future beyond the International Year of Periodic Table of Chemical Elements.

After the agreement by UN to have the IYPT2019, the Steering Committee mentioned in the UNESCO application, decided to place the operations in the hands of a Interunion International Management Committee, consisting of delegates from the founding Unions and other partners, as well as from major chemical societies and unions worldwide. The compositions of the Steering Committee and the Management Committee as per ultimo 2019, are listed at the end of the report.

The coincidence of IYPT2019 and the fact that Mendeleev published his first table 150 years previously, is not just a coincidence. All planning and the official application to UNESCO to have the year 2019 officially recognized as “the International Year of the Periodic Table of Chemical Elements” were of course synchronized, and large parts of the report are primarily focused on “Mendeleev 150”. Another milestone, reached in 2017, was the official naming of the last 4 elements of row 7 of the Periodic Table. This event was accompanied by many speculations about the possible discoveries in the next decade of more new elements which would start the filling of row 8.

Finally, and perhaps most importantly, the worldwide promotion of (school) teaching of the Periodic Table was a major objective. Perhaps most strongly advocated by a Japanese activity devoted to: “The Periodic Table in every home”. No chemistry, no medicine, no pharmacy, no physics, no astronomy, no geology, no materials, no biology etc. without (knowledge of) the Periodic Table.

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Finances and Legacy

Financially, IYPT2019 was dependent on donations, coming from the founding partners (IUPAC, IUPAP, IAU, EuChemS, IUHPST), industrial sponsors and a few large (inter)national chemical societies and organizations. After a starting fund from IUPAC, the search for external sponsors began in early 2018 and continued until December 2019 for the Closing Ceremony. The majority of the funding at the opening ceremony in January came from UNESCO (in kind), two large industrial sponsors (PhosAgro and Solvay), and our major communication partners 1001inventions and the All Russian Science Festival. Funding for the closing ceremony came for a very large part from Japanese Governmental and industrial sources.

Sponsorship contributions from scientific organizations and from industry ranged from €1,000 to €100,000. At the end of 2019, IYPT2019 had received financial support from sixteen sponsors reaching a total of €190,000 (excluding in-kind from communication partners and closing ceremony sponsors), which was used for opening, closure and running costs, website maintenance and archiving, social media, secretariat, travel costs, music performances and auditing control.

Global Fund accounts were kept inside IUPAC (in a dollar account) and in the KNCV Secretariat (run by Royal Netherlands Chemical Society, in a Euro account). A global fund budget oversight was provided by KNCV office administration which approved all Euro expenditures from the fund and audited by an external professional company (Cijferz). Similarly, the dollar account oversight was done and audited by the IUPAC administration.

An indicative overall breakdown of expenditure from the IYPT2019 Global Fund is difficult to estimate due to the in-kind contributions of UNESCO, 1001inventions, Science Festival and late sponsors from Japanese Industry and Government to the closing ceremony. But the following is an attempt: Opening and Closing Ceremonies (60%); Support for Worldwide Events (10%); Administration and Communications (15%); Legacy Actions and Final Report (10%); controlling/auditing (5%).

Some Founding Partners and sponsors donated considerable staff time to organize the international program of IYPT2019, allowing the administrative costs to be kept very low. As mentioned, the global sponsorship, however, was only a very small fraction of the total budget. Estimates provided by partners for fundraising by national committees, as well as in-kind contributions and volunteer time, suggest a total cost of IYPT2019 approaching €10 M€.

Regarding Legacy:

IYPT2019 no doubt initiated many new links and collaborations between decision makers, industry leaders, scientists, artists, social businesses, International Scientific Unions, and of course the public at large. The IYPT2019 Steering Committee and Management Committee are committed to keep working together and make sure that the website and its major links will be kept alive for future generations. IUPAC will host this site at www.IYPT2019.org. A selection of legacy items is given below. Others are listed in the reports in section 3 below, arranged by country.

In the framework of follow up to the International Year of the Periodic Table of chemical elements (IYPT2019), the Government of the Russian Federation proposed establishing and funding the joint UNESCO/Russian Federation International Prize for the Basic Sciences in the name of the Russian chemist Dmitry Mendeleev. The initiative was presented as a follow up and outcome to the International Year of the Periodic Table of chemical elements (IYPT2019) to provide further support to the UNESCO's International Basic Sciences Program (IBSP).

Dmitry Mendeleev Prize for the Basic Sciences

On October 21, 2019 in Paris at the 207th session of the UNESCO Executive Board it was decided to establish the D.I. Mendeleev UNESCO-Russia International Prize for Achievements in the Basic Sciences. The UNESCO Executive Board adopted the decision by acclamation, without a vote, supporting the establishment of the Prize by applause. The total value of the Prize is $500,000 per year.

Periodic Table Challenge

At the website https://www.iupac.org/periodic-table-challenge a continuous project will be maintained dealing with an online quiz about all 118 chemical elements. This online competition was played over 60,000 times throughout the year 2019. Due to this great success IUPAC decided to keep the Periodic Table Challenge beyond 2019 as a permanent feature on the IUPAC website (www.iupac.org). The Challenge will thus become one of the outreach activities of IUPAC and a wonderful legacy of IYPT2019. Many individuals, including IUPAC staff and volunteers, as well as the participants contributed to the success of this initiative, and to a celebration of the Periodic Table which reached every corner of the world.

Periodic Tables of Videos (PTOV)

Although existing for some years already it is perhaps not surprising that PTOV became an integral part of many IYPT2019 celebrations and activities worldwide. Sir Martyn Poliakoff (Nottingham University, UK) and his team no doubt will continue expanding and promoting this project for use by future generations of chemists and chemistry students and will be as active as ever planning new videos to continue exciting the public about the Periodic Table and promoting the legacy of IYPT2019. **Full details are given in Part II.**

IYPT2019 facts and figures

IYPT2019 involved a total of at least 10,000 activities of various types reaching 136 countries, on all continents including Antarctica. Specific events (e.g. outreach, conferences) were carried out in 129 countries and in addition the philatelic program in nine countries celebrated IYPT2019 commemorative in launching a special stamp, i.e. Algeria, Bulgaria, Hungary, Kyrgyzstan, Moldavia, North Macedonia, Portugal, Russia and Spain.

Multi-day scientific conferences (30%); Periodic Table-based exhibitions and festivals (25%); One day conferences and special events (20%); Activities in schools (10%); Art and music shows (5%); Citizen Science activities (5%); Other e.g. Periodic Table competitions, Open Days, Launch Events, Stamps and Coins, etc. (5%)

Budget

Sponsorship contributions from scientific organizations and from industry ranged from €1,000 to €100,000. At the end of 2019, IYPT2019 had received financial support from sixteen sponsors reaching a total of €190,000 (excluding in-kind from communication partners and closing ceremony sponsors), which was used for opening, closure and running costs, website maintenance and archiving, social media, secretariat, travel costs, music performances and auditing control.

Estimates provided by partners for fundraising by national committees, as well as in-kind contributions and volunteer time, suggest a total cost of IYPT2019 approaching €10 M€.

Periodic Table and the UN Sustainable Development Goals

The International Year of the Periodic Table of Chemical Elements (IYPT 2019) contributes significantly to fulfilling the missions of UNESCO to sustainable development and intercultural dialogue through education, science, culture, and communication.

In this context, the goals of IYPT 2019 align with the 17 Sustainable Development Goals which were adopted by the United Nations General Assembly in 2015. The Sustainable Development Goals, officially known as "Transforming our world: the 2030 Agenda for Sustainable Development," are an intergovernmental set of goals and targets developed by the United Nations that cover a broad range of sustainable development issues.

We describe below the many fields where the Periodic Table of Chemical Elements makes a fundamental contribution to help accomplish these goals. Communicating these messages was a key component of many activities during the IYPT 2019.

An important item during IYPT2019 was to help promoting the objectives of the 2030 Agenda for Sustainable Development:

The IYPT2019 programme intended to add to the quality of primary education by providing access to basic sciences to teachers and pupils all over the world.

SDG4
Education for girls and boys – Help to achieve universal primary education

SDG 13

Contributing to means to combat climate change, both in terms of developing new technologies to guide policy decision-making.

SDG 9
Capacity building for innovation with local benefit

SDG 17
Partnerships

EMPHASIS WAS ALSO PLACED ON AWARENESS RAISING OF HOW THE PERIODIC TABLE CAN IMPROVE SOCIETIES AND HELP THEM HARNESS THE FULL POSSIBILITIES OF A SUSTAINABLE LIFE:

SDG3
GOOD HEALTH AND WELL-BEING: Radiochemistry - Nuclear Medicine

At the end of the 19th and the beginning of the 20th century, apart from the discovery of the Periodic Law of chemical elements by Dmitry Mendeleev, there was another equally important discovery that determined to a large extent the development of humanity: the discovery of the phenomenon of radioactivity, as well as new, previously unknown radioactive elements.

The sources based on these elements, primarily radium, were used by Marie Skłodowska Curie and Irene Curie to conduct the first diagnostic procedures for wounded and shell-shocked soldiers in mobile front-line hospitals. In fact, this was the first medical application of radiation. Since then, many new radioactive elements and radionuclides have been discovered, some of which have found application in nuclear medicine. Modern nuclear medicine involves first of all an effective and personalized diagnosis and therapy of socially significant diseases. Other applications of nuclear medicine include targeted delivery of diagnostic or therapeutic radiopharmaceuticals to pathological organs and tissues. This, on the one hand, makes it possible to carry out a molecular visualization of these drugs in the lesions, and on the other hand, to carry out the local irradiation of the lesions without affecting healthy tissues. Nuclear medicine today is a modern interdisciplinary field related to the development of methods for obtaining and isolating radionuclides, analytical chemistry, biochemistry, cellular biology, and medicine.

SDG 1
Show up the importance of chemistry-based technologies in achieving poverty alleviation

SDG 11
Sustainable Cities and Communities

Grand Challenge: Prediction of Novel Materials

Throughout the 20th century , physicists worked out theories to calculate properties of materials, knowing only their crystal structures. Armed with these theories, today's researchers can predict many properties of a material, real or hypothetical, just from the knowledge of atomic positions and from the fundamental laws of physics. Later, in the 21st century, methods for predicting crystal structures were developed, enabling screening for novel materials on the computer and thus accelerating the path to materials discovery.

To spur these efforts and link theory, experiment and industry, the USA President's Administration has announced in 2011 the Materials Genome Initiative, which soon thereafter was replicated by the Chinese government. Within several years, many exciting discoveries were made – both of new materials and new phenomena, hitherto unsuspected. For example, computational prediction has paved the way to the new record of high-temperature superconductivity – exotic material H_3S, defying standard rules of chemistry and formed under pressure, was experimentally shown to be a near-room-temperature superconductor (Tc=203 K). Novel polymers, magnets, thermoelectrics, etc. are now predicted and experimentally studied at an unprecedented pace. Such predictive methods open new chapters of science, enabling matter and extreme conditions of high pressure (such as those that reign in planetary and stellar interiors) and nanomaterials to be more systematically explored. Little by little, the nature of unexpected carcinogenicity of many nanoparticles is becoming clear. We also learn about the matter of the Universe and chemical processes inside heavenly bodies and our own Earth. Helium, the second most abundant element in the Universe, was thought to be chemically inert – but recently shown to have a chemistry of its own under pressure. While classical chemistry does not foresee such compounds as Mg_3O_2 or FeO_2, these turn out to be stable, and may play a role in planetary evolution (e.g. cyclic "great oxygen events" that played a pivotal role in the evolution of life and mass extinctions). The simple alkali metal sodium, Na, under planetary pressures turns out not to be simple, alkali, or metallic – for example, becoming transparent and forming such "forbidden" compounds as Na_3Cl and $NaCl_3$.

The continual quest for new materials has resulted in powerful quantum predictive methods, which not only lead to new materials, but also uncover novel chemical phenomena, pointing to the limitations of the existing rules of chemistry and extending the boundaries of the known ones.

SDG 5
Promoting gender equality in science

GENDER EQUALITY

The IYPT 2019 gave a greater resonance to the celebration of the International Day of Women and Girls in Science on 11 February 2019 by highlighting women role models who substantially contributed to the discovery of elements of the Periodic Table. The examples of Marie Curie, who was awarded Nobel Prizes in 1903 and 1911 for the discovery of Radium (Ra) and Polonium (Po), Berta Karlik for the discovery of Astatine (At), Lise Meitner, who identified an isotope of Protactinium (Pa), Ida Noddack for the discovery of Rhenium (Re), and Marguerite Perey, who discovered Francium (Fr), was celebrated in line with the gender equality priority of UNESCO in view of the advancement of the 2030 Agenda for Sustainable Development. Finally, the book entitled "Setting their Table: Women and the Periodic Table of Elements": Selected Women Contributions to the Periodic System (edited by Annette Lykknes and Brigitte van Tiggelen) is mentioned again as highlighted the role of women in the development of the Periodic Table.

Anniversaries celebrated during 2019

Apart from the celebrations of IYPT2019, during this year there were 3 other related celebrations worthy of mention, i.e. the periodic Table 150 years, IUPAC100 and IAU100. They are mentioned below.

Mendeleev 150

The celebration of Mendeleev 150 was completely integrated with celebrations of IYPT2019 in the Russian Federation and worldwide. It is not relevant to list specific items here. Most of the mixed celebrations took place during the celebrations in the Russian Federation, see section 3 of this report.

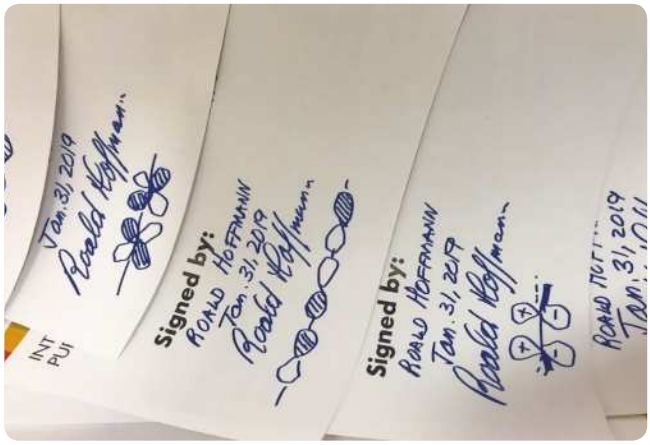
IUPAC100

In 2019, IUPAC also celebrated its centenary (IUPAC100). This happy coincidence offered a unique opportunity to reflect on the value and work that is carried out by IUPAC in a range of activities, including chemistry awareness, appreciation, and education. Although IUPAC curates the Periodic Table and oversees regular additions and changes, this icon of science belongs to the world. With this in mind, we wanted to create an opportunity for students and the general public to participate in this global celebration. The objective was to create an online global competition centered on the Periodic Table and IUPAC to raise awareness of the importance of chemistry in our daily lives, the richness of the chemical elements, and the key role of IUPAC in promoting chemistry worldwide. The Periodic Table Challenge and the Periodic Table of Younger Chemists were the result of this effort.

Periodic Table Challenge

The Periodic Table Challenge was designed as an online quiz about all 118 chemical elements with an objective to allow students to participate in the IYPT2019 without requiring large amounts of effort. After correctly answering 60% of the 15 multiple choice questions about the chemical elements in round 1, participants qualified to take part in the second round of the PT Challenge which was dubbed the 'Nobelium Contest'.

The name 'Nobelium contest' derives from the fact that we asked chemistry Nobel laureates to sign Periodic Table posters to be given out as prizes (Figure below). Thirteen chemistry Nobel Laureates joined the Nobelium Contest! We would like to use this opportunity to heartily thank Roald Hoffmann (1981), Jean-Marie Lehn (1987), Barry Sharpless (2001), Kurt Wüthrich (2002), Peter Agre (2003), Robert H. Grubbs (2005), Martin Chalfie (2008), Ada Yonath (2009), Robert J. Lefkowitz (2012), Ben Feringa (2016), Sir Fraser Stoddart (2016), Joachim Frank (2017), and Frances Arnold (2018) for their support! They made the Nobelium Contest possible.



(left) Periodic Tables beautifully signed by Roald Hoffmann (Nobel laureate, 1981) and (right) Joachim Frank (Nobel laureate, 2017) signing them.

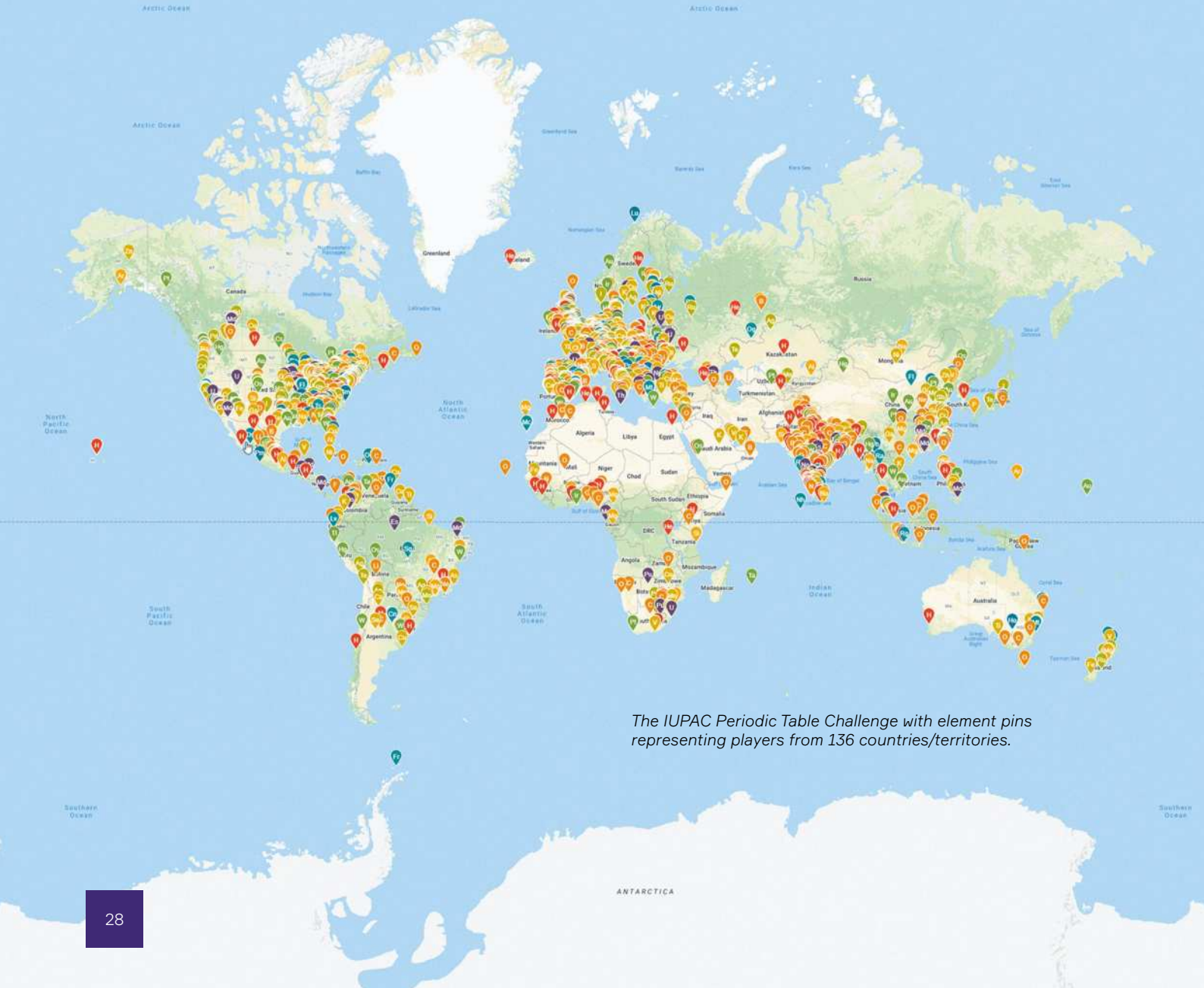
Number of participants in the first round

Over the course of the year, more than 8,000 players joined in to celebrate the IYPT2019 from every continent and 136 countries/territories. Over 60,000 tests were taken, and 8,000 certificates earned. In some cases, whole school classes took part in the challenge. These figures send a clear message that online activities such as this, can make a global impact to promote science education worldwide.

By the end of 2019, India led the country rankings (most correct answers) followed by Canada and USA. We also managed to get participants playing while in Antarctica and from Vatican City. However, we were most proud of the geographical diversity we achieved, which included more than 20 countries in Africa and every single country in South America.

One of the features of the PT Challenge was that players had to choose an element as their avatar. Throughout the year, a leaderboard indicated the element ranking which participants used as avatar. It is not surprising that among the four most popular elements chosen as avatars, you can find elements most closely related to life – hydrogen, carbon, and oxygen. But the hands-down winner, the most popular element of them all, has been mendelevium; a very appropriate recognition of the contribution of this great Russian chemist to the development of the Periodic Table.

IUPAC INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY



The IUPAC Periodic Table Challenge with element pins representing players from 136 countries/territories.

Nobelium contest

One of the reasons to celebrate the Periodic Table was to provide a platform to show the enthusiasm and pride we all have about the Periodic Table and use this excitement as an opportunity to promote creativity in science. We received all kinds of submissions which varied from educational videos about an element, to poems, songs, and paintings. Some of the most inspiring entries highlighted the outreach and community service in chemistry and chemistry education.

Several entries were music videos created to highlight the periodic table. Sometimes they were related to festivities, like Christmas. In other cases, very young students were reciting Tom Lehrer's famous element song. Other entries linked the elements to musical notes, making it possible to play the periodic table as a musical instrument. In another case a special periodic table in Morse code was made. We received several stories from Italy some of which were most appropriately inspired from Primo Levi's book The Periodic Table. In other cases, sport analogies were made by linking the Periodic Table with basketball or soccer. Of course, the Table was also baked in one way or another. Over the course of the year, we received over 160 submissions from 30 countries, all of which were hosted online and can be found on the IUPAC100 PT Challenge website. 30 submissions were selected as Nobelium Contest Winners and further 9 were selected for People's Choice award based on their popularity. The Nobelium Contest entries were viewed over 80,000 times throughout the year and these winners were all sent the Nobel-autographed IUPAC Periodic Table.

This success motivated IUPAC to keep the Periodic Table Challenge beyond 2019 as a permanent feature on the IUPAC website. The Challenge will thus become one of the outreach activities of IUPAC and a wonderful legacy of 2019. Many individuals, including IUPAC staff and volunteers, as well as the participants contributed to the success of this initiative, and to a celebration of the Periodic Table which reached every corner of the world.

Periodic Table of Younger Chemists

This project was conceived by members of the International Young Chemists Network (IYCN) during the IUPAC General Assembly in Brazil in August 2017. Their aim was to highlight early career chemists (from high school to established career scientists) by linking them to an interactive Periodic Table. The intended outcomes were to show the diversity of chemistry (country, language and career), to increase the visibility of IYCN and of IUPAC, as well as to engage countries outside the National Adhering Organizations belonging to IUPAC in order to encourage participation in future IUPAC World Chemistry Congresses/General Assemblies. It was also planned that the project would raise awareness of STEM educational issues.

Beginning in July 2018 and ending in July 2019 at the World Chemistry Congress and IUPAC General Assembly, a diverse group of 118 outstanding chemists under 40 years of age from around the world who embodied the mission and values of IUPAC were individually awarded an element of the Periodic Table. The resulting periodic table highlighted the diversity of careers, creativity, and dedication of the young chemists leading us into the next century. The elements were revealed over time in order of scientific discovery. For each element, a profile of the selected chemist was uploaded along with links to additional scientific information on each element. Winners were profiled on the IUPAC100 website and received a certificate from the IUPAC.

Nominees were required to be under the age of 40, either pursuing an undergraduate or graduate degree, or holding an undergraduate/graduate degree, or working within the field of chemistry or a related field. Nominees were encouraged to provided evidence that they were actively working to increase the public appreciation and understanding of chemistry, to foster diversity in the chemical enterprise, or to improve chemistry or science education for students. Alternatively, nominees were asked to demonstrate that they were advancing interdisciplinary or international collaboration in science or that they were actively working on scientific topics related to the United Nations Sustainable Development Goals.

During 2018, announcements were made at international meetings in Australia (July), Japan (August), USA (August), Thailand (September), Italy (September), Botswana (October), Cuba (October), and Greece (November), The December and January winners were announced from the IUPAC Secretariat as preview events for 2019, while the February winners were announced at the international symposium on Women and the Periodic Table held in Murcia, Spain

on February 11-12, an activity linked to the UNESCO International Day for Women and Girls in Science. The next groups of winners were announced at the ACS meeting in Orlando (March), as a webinar (April), at the 14th International Conference on Crop Protection and Pesticides (Belgium, May), the Canadian Chemical Society Congress (June), and the 14th International Symposium on Macromolecular and Supramolecular Chemistry (Italy, June). The final six winners, representing elements 113 - 118, were presented with their awards at ceremony held on July 8 at the Paris 2019 Congress/General Assembly of IUPAC. Individual winners received certificates, letters, paperweights, pins and stickers.

The winners ranged from undergraduate students to full professors and industry researchers. There were equal numbers of male and female winners, representing over 50 different countries from all parts of the world. The IYCN group made videos about the Periodic Table of Younger Chemists, and also about how individual young chemists got involved with IUPAC. The videos were posted on a YouTube channel. The completed Periodic Table is available at the IUPAC100 website and a list of the winners is available on request.

At the conclusion of the announcements, there was general agreement among many of the winners that they would like to continue informal networking. A small team is developing proposals for a webinar series, hosted by IUPAC, in which each month two winners will describe their research or interest in chemistry.

This project has been admirably led by a team from the International Young Chemists Network (IYCN) led by Dr. Christine Dunne (USA) with participation by Leonardo Scarabelli (USA), Irene Rodriguez Meizoso (Sweden), and Nnanake-Abasi Offiong (Nigeria). They were assisted by IUPAC volunteers Dr. Laura McConnell, and Professors Hemda Garelick and Mary Garson, as well as by Dr. Fabienne Meyers from the IUPAC Secretariat.

Global Breakfast and Women in Chemistry

Setting their Tables: Women and the Periodic Table, and the Global Breakfast in Murcia

On the 11th and 12th of February the International Symposium on “Setting their Table: Women and the Periodic Table of Elements” took place. Co-Chairs were Pedro Lozano, University of Murcia, Dean of the Faculty of Chemistry, and Brigitte Van Tiggelen, EuCheMS-WPHCh / IUHPST-CHCMS.

A Univerisity of Murcia building facade displays a huge periodic table.

The Symposium was set in the frame of the International Year of the Periodic Table and did indeed start on the International Day for Women and Girls in Sciences (Feb 11). The symposium opened on a festive note with high-end guests, and a roundtable presentation. Following this, there has been a day and a half of parallel sessions exploring specific aspects of the work of women chemists in the connection with the PT and the elements. The review of women’s contribution dealt with both past and present as well as a number of initiatives to ensure gender balance for the future, such as the ‘Gender Gap in STEM’ project to which several stakeholders of the IYPT are participating. An innovative feature of the conference was that all chairs were selected among young students at graduate and master level.

The morning of the second day of this symposium, was devoted to a roundtable conversation in the frame of the IUPAC100 Global Women’s Breakfast and a special video is still visible at: https://tv.um.es/video?id=130631

The IAU 100th Centenary Celebrations

In 2019, the IAU commemorated its 100th anniversary with a year-long celebration (IAU100, see www.iau-100.org) to increase awareness of a century of astronomical discoveries as well as to support and improve the use of astronomy as a tool for education, development and diplomacy under the central theme «Under One Sky».

Building on the successful experience of the International Year of Astronomy 2009 (IYA2009), the IAU100 initiative exceeded initial expectations with over 5000 registered activities in 143 countries/regions that involved a direct participation of 5 to 10 million people. Furthermore, the estimated reach through media actions is over 100 million people.

Many impactful events and activities were conducted throughout the IAU100 celebrations. In addition to the aforementioned open-source exhibition, some of the initiatives to highlight include:

- The project with the greatest worldwide impact was the IAU100 NameExoWorlds initiative that gave countries around the world the opportunity to organize national campaigns to name a star and an exoplanet. More than 780,000 people selected the names of 113 sets of exoplanets and host stars. The collection of winning names reflects the diversity and cultural richness of our global society;

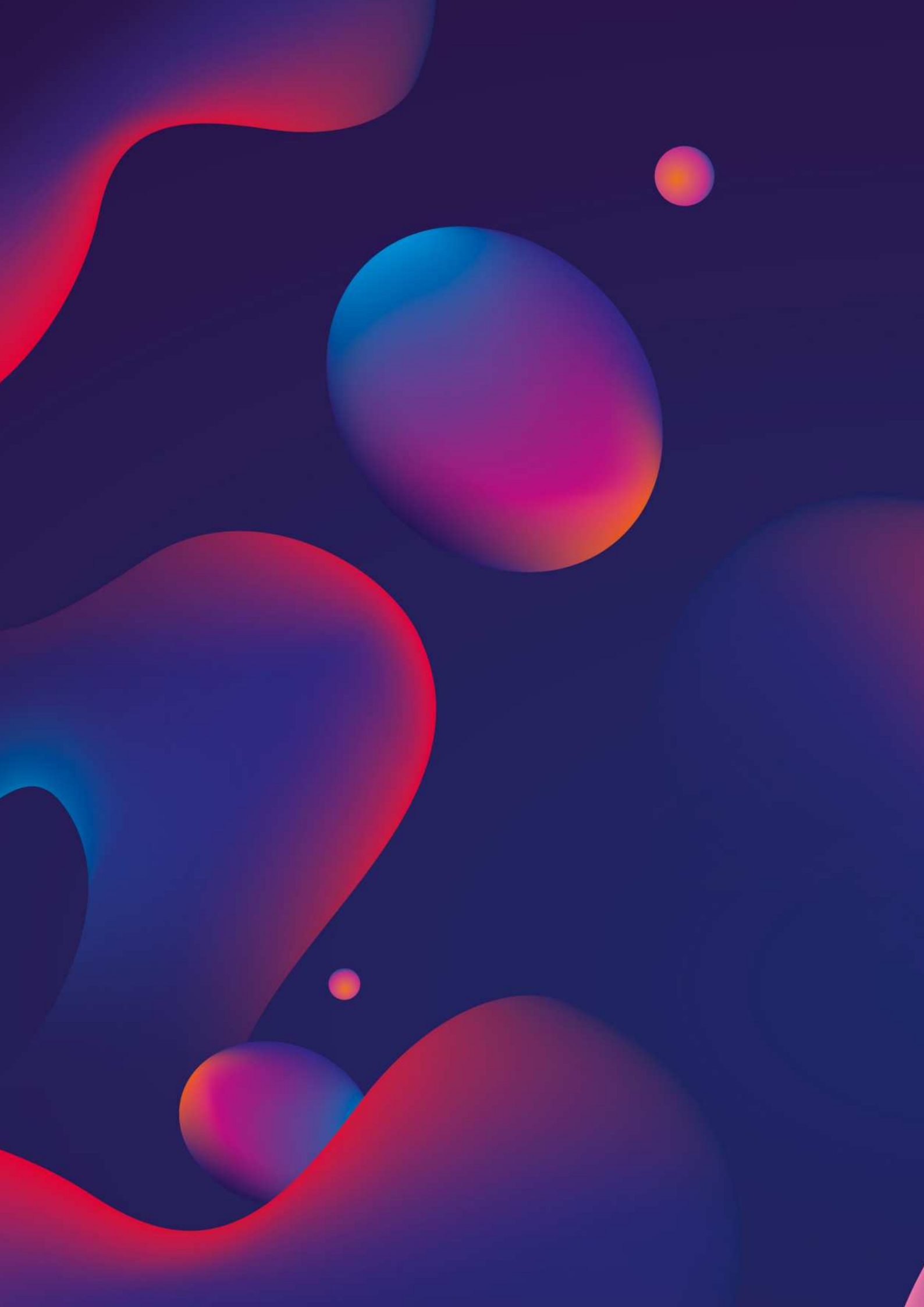
- The IAU100 Moon Landing 50 project was the largest coordinated action in the world celebrating the 50th Anniversary of the Moon Landing with more than 1 million people actively participating in over 1000 events in 128 countries and regions;

- On 11-12 April 2019, the IAU 1919-2019: 100 Years Under One Sky Celebration Flagship Ceremony, which took place at the Palace of the Academies in Brussels (Belgium) brought together 250 participants from 67 different countries to reflect about the past century in astronomy and to discuss the future of the field. The program consisted of the relation of astronomy to other sciences, technology, culture, development, education, inclusion and diplomacy. Notable speakers at the event included Nobel Prize Laureates Brian Schmidt (Australian National University) and Ben Feringa (Center for Systems Chemistry, University of Groningen), Chiaki Mukai (JAXA Astronaut and Vice President of the Tokyo University of Science), John Grunsfeld (NASA Astronaut), Phil Mjwara (Director General of the Department of Science and Technology of South Africa) and Maria Popova (author, BrainPickings.org);

- The Inspiring Stars project is an itinerant international exhibition to highlight world initiatives that address the concept of inclusion in outreach, didactic, and professional aspects, using astronomy, which organized 17 activities in 10 countries, reaching out to over 5000 people. Visitors to the Inspiring Stars exhibition were able to engage with interactive displays that showcased various resources for multisensorial exploration in astronomy from around the world. These include tactile planets, books, and posters, a multisensorial optical telescope, a tactile telescope model, software that translates astronomical data into audio, and many more.

- The IAU100 Global actions concluded with the IAU100 Pale Blue Dot Global Project. After one year of looking back at one hundred years of astronomy with IAU100, this initiative encouraged everyone to look back at us, Planet Earth. With the themes of environmental awareness and global citizenship in mind, this project celebrated the 30th anniversary of the iconic Pale Blue Dot image with over 500 activities conducted in 51 countries worldwide on 13-20 February 2020.

IAU President Ewine van Dishoeck discusses the cosmic origins of the chemical elements with King Willem-Alexander of the Netherlands.
Credit: Bob Bronshoff/NOVA.



PART 2: COMMUNICATIONS

Because of the need to reach as broad an international audience as possible, one of the most important tasks of the IYPT2019 Secretariat was to set up and deploy a wide range of communication tools. Furthermore, IYPT2019 had intense collaboration with two main media partnerships namely All-Russian Science Festival and 1001 Inventions.

VISUAL IDENTITY

Since the elements in the Periodic Table make up everything, it was clear that IYPT2019 required an attractive logo that appealed to everyone around the world. Since the contribution of Mendeleev to the foundation of the Periodic Table is beyond any doubt, it was decided to use his face, in a design by Dr. Natalia Tsivadze. Furthermore, 2019 was 150 years after his first publications in 1869.

United Nations
Educational, Scientific and
Cultural Organization

International Year
of the Periodic Table
of Chemical Elements

IYPT2019 official logo

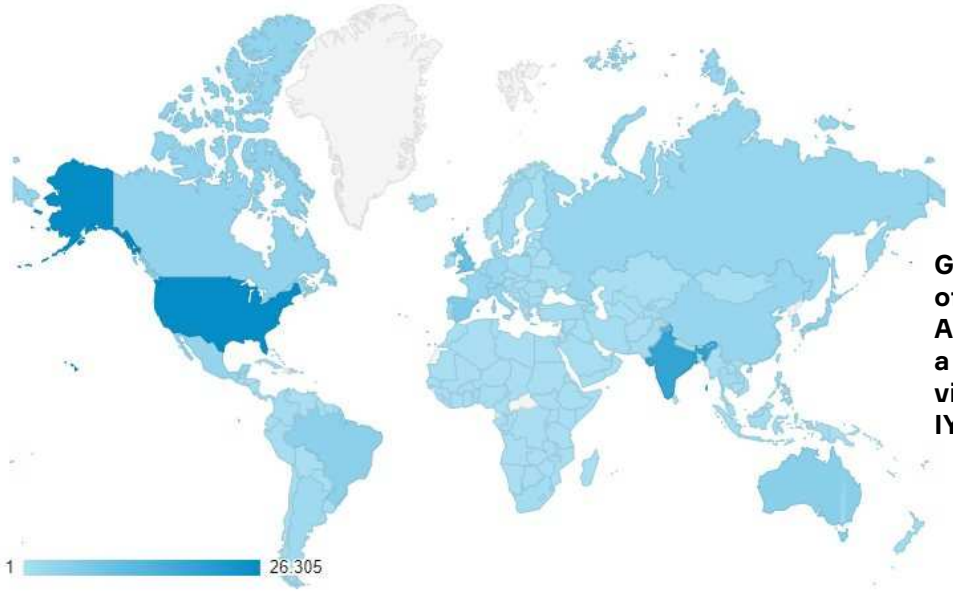
WEBSITE

The IYPT2019 website (www.iypt2019.org) was the main source of information about the various IYPT2019 themes and activities around the world. The website was designed to be simple in use, to be compatible with the fact that many people would access it on mobile devices, and yet complete enough that it could provide all the key information about the different themes of the IYPT2019.

The website should also be providing ways to learn about the origin of IYPT2019 and about the involved sponsors. Furthermore, it provided a platform of interesting links and videos and a display of several variations of the Periodic Table. Besides that, a news archive could be found on the page. A further important feature of the website were the two forms: one form allowed all visitors to publish their events, ongoing activities and merchandise on the website and the other form allowed the visitors to contact the IYPT2019 secretariat for any questions.

Over 172,000 people visited the website throughout the year 2019 from close to 200 countries. Around half of the visitors (43,4%) were made from organic search, meaning that a visitor landed on the site from a search engine. Other visitors came via referrals from other websites (26,6%), direct access using the websites URL (23,8%) and social media (6%).

www.iypt2019.org



Global distribution of IYPT2019 website visitors. A darker shade of blue indicates a higher number of unique visitors to the official IYPT2019 website.

SOCIAL MEDIA

Social media accounts for IYPT2019 were founded during May 2018. It was decided to use multiple platforms in order to reach as broad of an audience as possible.

Facebook

The official IYPT2019 Facebook page reached a total amount of 2,828 followers. 58 messages were published by the organizers. Thereby, single messages could reach as many as 17,500 viewers with up to 749 clicks and 614 shares/likes/comments for a single message.

Facebook was mainly used as a community building page. People were encouraged to share their celebrations with the rest of the world. Over 10,000 messages from the community were posted on Facebook sharing their celebrations with others.

Twitter

The official IYPT2019 Twitter page reached a total amount of 3,263 followers. Several messages were published by the organizers. These posted messages reached about 700,000 impressions distributed around the world.

However, Twitter was mainly used as a community building page. People were encouraged to share their celebrations with the rest of the world: over 160,000 messages were posted by the community related to IYPT2019, sharing their celebrations with the world and thereby reaching over 90 million people around the globe.

Other platforms

There were also messages via other media, such as Instagram, blogs, Reddit and YouTube. These added slightly to the total reach (not counted in detail).

WORLDWIDE MEDIA COVERAGE

IYPT2019 engaged the services of the media monitor company Meltwater (www.meltwater.com) to carry out comprehensive analysis of worldwide media mention of the International Year of the Periodic Table of Chemical Elements. By searching the world's media for mentions of various phrases and keywords in 25 different languages, we were able to obtain a clear picture of the international media impact. In particular, this analysis yielded there were a total of 3,000 distinct media mentions (newspaper, online, TV) with a potential reach of 5,8 billion people from countries all over the world. The potential audience (Comscore) of these media mentions is 67, with an equivalent value in terms of paid advertising of USD 49 million.

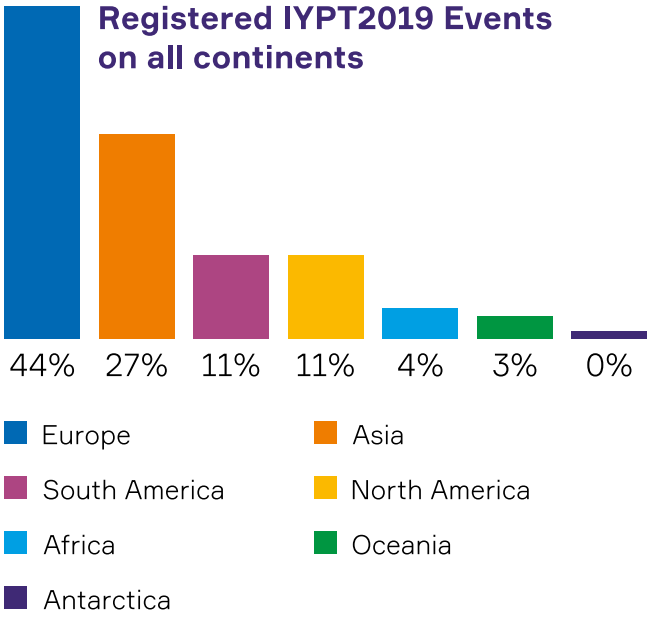
Overview of IYPT2019 Activities

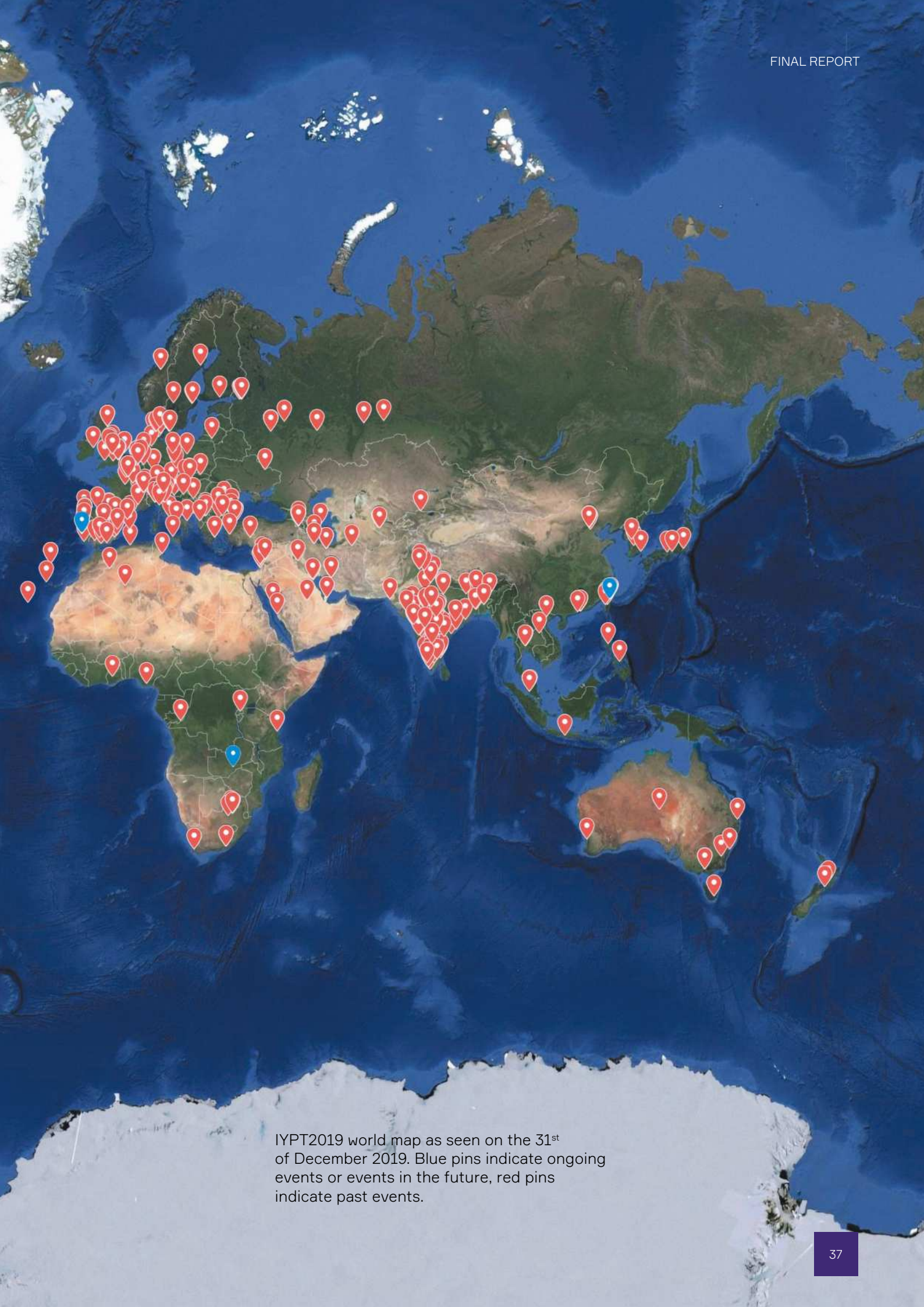
WORLD MAP

Throughout the year everybody could submit their IYPT2019-related activities and events on the IYPT2019-website (www.iypt2019.org). This lead to a total of 560 registered events on the World Map, varying from international conferences of multiple days to high school projects of a single afternoon.

Although the Management Committee has tried to its best efforts to motivate and encourage everyone to share their events with the world, we are very well aware that not all activities and events have been submitted via the official website. Therefore, the actual amount and impact of IYPT2019-related activities is most likely much higher than the ones represented in this report. Despite these missing events, the registered celebrations of IYPT2019 reached all continents of the world, including even Antarctica.

Despite the fact not all activities were registered, the 560 registered events that were registered took place in all seven continents of the world, including one event in Antarctica. Most registered events took place in Europe (245) and Asia (152). South America (64) and North America (62) were also well presented. Africa (23) and Oceania (16) were less active in the IYPT2019 celebrations.





IYPT2019 world map as seen on the 31st of December 2019. Blue pins indicate ongoing events or events in the future, red pins indicate past events.

SELECTED MAJOR ACTIVITIES

With so many activities to choose from, making a selection of highlights is extremely difficult without leaving out some truly excellent activities. In chapter 3 an overview of the main events per country can be found. Before describing these selected activities, however, we first summarize the two high-level events that bracketed the official UNESCO program of the year, i.e. the formal opening and the formal closing ceremonies. This will be followed by reports submitted by our main sponsors and organizations.

Opening Ceremony

The International Year of the Periodic Table organized an official kickoff meeting on the 29th of January 2019 in the iconic UNESCO Headquarters Fontenoy Building in Paris, France.

During this Opening Ceremony close to 1,300 participants (scientists and educators, musicians and diplomates, students and journalists) gathered to officially launch the International Year of the Periodic Table of Chemical Elements (IYPT2019).

The International Year of the Periodic Table in Paris began with an impressive performance dedicated to an outstanding scientific discovery. The idea of the show with awesome display of projection mapping and live music scenes highlighted the history of the discovery of the Periodic Law - the basis of a new, truly scientific era in chemistry and other related sciences. The public felt the importance of the new system, which had allowed to learn, to anticipate, to turn chaos into a harmonious system, an elegant scientific instrument, where everything was in its place.

The event was prepared in cooperation with UNESCO team. The all-Russian Science Festival NAUKA 0+ was the official operator of the opening ceremony of the International Year of the Periodic Table of Chemical Elements in Paris, who also arranged all side events in Paris and exhibitions dedicated to the IYPT during the year around the world .

The programme of the opening ceremony of the International Year in Paris included lectures by legendary scientists, Nobel Prize laureates, presentations of rising stars of science, interactive scientific shows, musical performances and etc. Among the lecturers there were the world-famous scientists: Ben Feringa (laureate of the 2016 Nobel Prize in Chemistry), Sir Martyn Poliakoff (Vice-President of the Royal Society, author of the “The Periodic Table of Videos”), professor Yuri Oganessian (element 118 was named after him – “oganesson”) and other representatives of the international scientific community. A special session “STANDUP

The periodic table is an illustration of our universal quest for knowledge, a quest spanning from antiquity to the present day, from the handful of elements identified by the ancients to the 118 classified by scientists today...

When he published his periodic table in 1869, Dimitri Mendeleev deliberately left certain boxes empty. He knew that it would be up to future generations of researchers to complete the work he had begun.

Audrey Azouley
UNESCO Director General

4 PERIODIC TABLE" was dedicated to the representations of outstanding young scientists around the world which was moderated by Dr. Michel Spiro, President Designate of the IUPAP. The speakers were nominated according to the decision of the ISC meeting on 10 October 2018, where ISC Regional Offices agreed to select the young scholar to represent their regions.

Ms. Audrey Azoulay, Director-General of UNESCO, welcomed everyone and thereby officially opened the International Year of the Periodic Table of Chemical Elements (IYPT2019).

The year-long celebration of the periodic table coincides with the 150th anniversary of Dmitri Mendeleev's first arrangement of the known elements into an orderly system according to their properties. Many of the talks at the Opening Ceremony looked back at Mendeleev and his table. Following the opening, several presidents of International Unions entered the stage. Also several highly valued international scientist gave a presentations , such as Nobel Laureate Ben Feringa and Yuri Oganessian, Scientific Director Flerov Laboratory in Dubna, During his keynote speech Feringa called Mendeleev, "a real hero of chemistry." Feringa continued on the importance of international collaboration. "Chemists have a universal language using the elements and molecules; we have no borders." Yuri Oganessian also gave a presentation about the newcomers in the periodic table, of which element number 118 was named Oganesson to honor Yuri Oganessian. Furthermore he was honored with a stamp in his home country Armenia.

At the opening also Sir Martyn Poliakoff presented a talk, addressing his periodic videos, see: https://www.youtube.com/watch?v=sK7i1c0QGsU.

In addition to the several talks the Opening Ceremony featured round table discussions and musical performances. Mira Yevtich performed an excellent piano performance playing pieces from Brahms Rhapsody and Chopin's Nocturne.

Outside the main auditorium, delegates took part in hands-on chemistry demonstrations and admired a display of many periodic tables, including the Periodic Table of Scarcity from EuChemS, a macramé Periodic Table by Jane Stewart, a chemical bar and a display of the oldest Periodic Table.

IYPT2019 was aimed at enhancing global awareness of and education in the sciences with a special focus on the countries of the developing world. The Opening Ceremony was merely the beginning of a year full of events, activities and competitions. The full program booklet can be found here: IYPT2019 Opening Ceremony program booklet . The video of the opening ceremony will remain visible at the following website till end of 2021: http://webcast.unesco.org/live/vod/2019/sc/20192901_sc_room-01/en/

UNESCO offcial photos depository https://www.flickr.com/photos/131897504@N08/31974571947/in/album-72157678184881078/

Science for All:
Interactive Chemistry Exhibition –

An exciting journey into the world of «living» Chemistry – the opportunity to feel like a real scientist, to carry out a series of chemical experiments, discover the history, immerse yourself into virtual reality and explore outer space.

The interactive chemical exhibition was presented with the zone of virtual reality with advanced educational technologies, the zone of scientific experiments, the IT-zone where visitors had an opportunity to create their own Periodic Table, the “green chemistry” zone as well as the zone of scientific arts where artworks devoted to chemistry were presented. The historical cluster of the exhibition depicted a chemical laboratory of the 19th century, the first drafts of the Periodic Table as well as a selfie zone with the author of the Periodic Table D.I. Mendeleev. The audience learned about the birth of chemical elements in the Universe, about the production of synthesized elements as well as visited the stand of the Joint Institute for Nuclear Research in the cluster of space and new elements of the Table. Moreover, visitors of the exhibition could attend a Chemical molecular bar and test chemical robots. Launched as part of the Opening Ceremony of the International Year of the Periodic Table of Chemical Elements (IYPT2019) on January 29th, this exhibition traveled around the world during the year 2019.

HISTORICAL AREA OF THE EXHIBITION DEDICATED TO THE DISCOVERY OF DMITRY MENDELEEV

BULLETTIME

CHEMISTRY BAR

Closing Ceremony
Dec 5, 2019, Tokyo, Japan

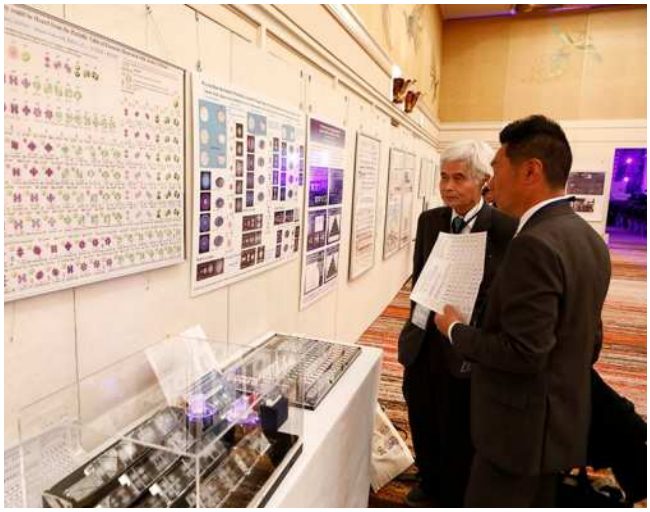
The Closing Ceremony of IYP2019 in Tokyo was held on December 5, 2019 at Tokyo Prince Hotel located at Shiba-Koen. The venue used nearly a half of its allocated space for the exhibitions by various domestic and oversea contributors, such as the Mendeleev Russian Chemical Society, Science Festival, Chemical Society located in Taipei, and those involved in the Special Exhibition that travelled across Japan. The exhibition site was developed by the relevant people till very late at night on the day before the Ceremony and some people completed and left only at 3-4 am. The ceremony started with the musical performance by three professional young ladies, where two ladies (Hitomi Kawai, left; Naoko Sasaki, right) sang a traditional Japanese song "Sakura" in a duet style while the third one (Megumi Nakanomori) played the piano. One of the singers was the daughter of Prof. Kawai (President, CSJ). In the afternoon ceremony, they further sang a beautiful medley on several well-known traditional Japanese songs.

The opening welcome addresses were made by Prof. Kawai, Prof. Tamao (Chairman, the Executive Committee of IYPT2019 in Japan), Prof. Tarasova (Past President, IUPAC; Co-Chair, Inter-Union IYPT2019 Management Committee), Mr. Philippe Pypaert (UNESCO office Beijing, replacing the Director General of UNESCO), Prof. Grigory Trubnikov (Russian Federation), and Prof. Hiroshi Matsumoto (President, RIKEN). The opening congratulatory addresses were given by Dr. Miyoko Watanabe (Vice President, SCJ), Prof. Aslan Tsivadze (President, Mendeleev Russian Chemical Society), Prof. David Cole-Hamilton (Past President, EuChemS), Dr. Bonnie Charpentier (President, American Chemical Society), Prof. Zhigang Shuai (Vice President, Chinese Chemical Society), and Prof. Hyun-Joon Ha (President, Korean Chemical Society). The morning session continued by accepting some presentations reporting the activities in IYPT2019 in various countries. This included the speeches from Dr. Lynn M. Soby (Executive Director, IUPAC), Prof. Alexey Khokhlov (Russian Academy of Sciences), Prof. Mei-Hung Chiu (Executive Committee Member, IUPAC; National Taiwan Normal University), and Mr. Yoji Hisamatsu (Ehime Prefectural Science Museum, Special Exhibition in Japan).

After the lunch break, presentations focused on the IYPT events in the world were given by Prof. Reedijk (Co-Chair, Inter-Union IYPT2019 Management Committee) and Mr. Frank Sekeris (IYPT2019 Management Assistant, Netherlands), Dr. Bipul Behari Saha (India; IUPAC Bureau), Prof. Christopher Brett (Vice President, IUPAC), and Dr. Brigitte Van Tiggelen (Science History Institute). These were followed by the sessions focused on the "Discoveries of chemical elements" (Chaired by Prof. Yoshiteru Maeno of Kyoto University) and the "Creation of superheavy elements" (Chaired by Dr. En'yo). The latter involved some presentations by the superheavy element researchers with many of the scientists related to elements 104-118 appearing on the stage (see picture on the next page).

The afternoon session also involved piano performance by a high school girl (Honoka Motai), who had composed a song of "Nihonium". She also presented her invention on a "Periodic Flags of Elements" in a 5-m long cord. Further, a junior high school boy Riku Kakuhata introduced the "3-Dimensional Periodic Table of Rotatable Elements" which he invented when he was a 6 years-old kid. Lichit Nagamori (10 years-old boy) finally gave an attractive presentation on a story entitled: "Kingdom of the Chemical Elements" written by himself.

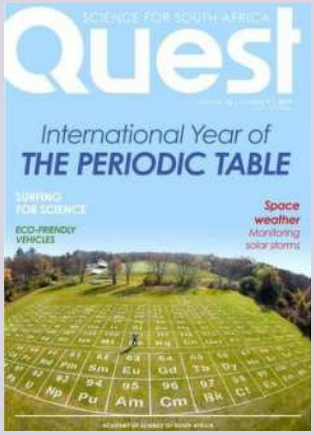
In addition to the presentations by these younger generations, some senior scientists also gave presentations, such as the talk by Prof. Makoto Kobayashi (2008 Nobel Laureate in Physics) and the video message from Dr. Akira Yoshino (Asahi Kasei) who had just been awarded the 2019 Nobel Prize in Chemistry with his technological breakthrough on the "Lithium-Ion Batteries" and was thus on the way to the award ceremony in Sweden.

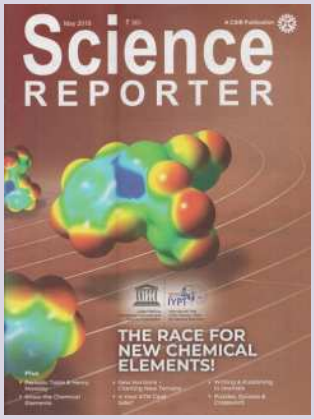


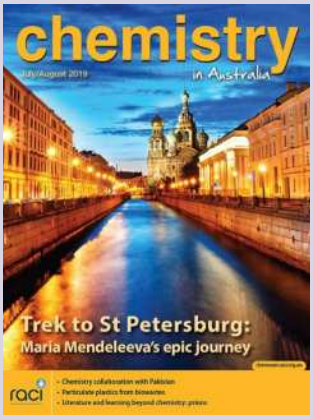
Finally, the closing remarks were presented by Prof. Qi-Feng Zhou (President, IUPAC), Prof. Bruce McKellar (Past President, IUPAP), and Prof. Junichi Watanabe (Vice President, International Astronomical Union) followed by a musical performance by the "Orchestra Chimica" consisting of the members of CSJ. With the fruitful banquet held after all these events, the Closing Ceremony for the IYPT2019 ended with success.

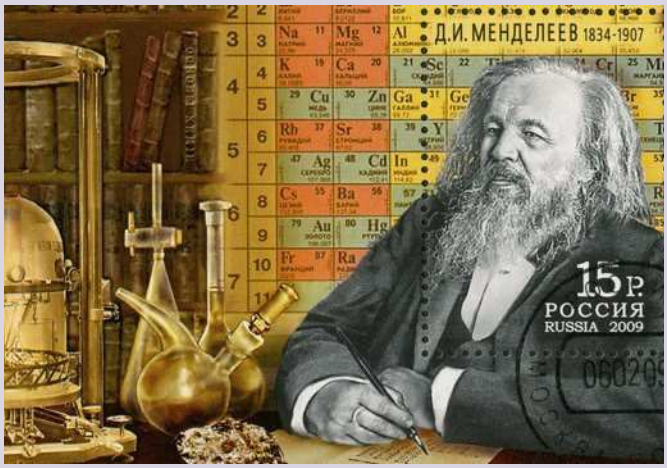
All the Japanese hosts were convinced and happy that most of the events planned went without any troubles and hoped all the participants could enjoy the time together at the prestigious ceremony in Tokyo. A weblink to the whole ceremony is visible at: https://iypt.jp/en and the video at: https://iypt.jp/en/videos.html.

PUBLICATIONS DEDICATED TO THE INTERNATIONAL YEAR OF THE PERIODIC TABLE OF CHEMICAL ELEMENTS







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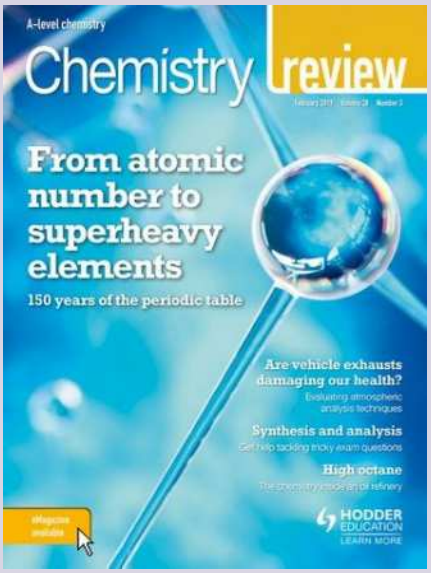
A UNIVERSE OF ELEMENTS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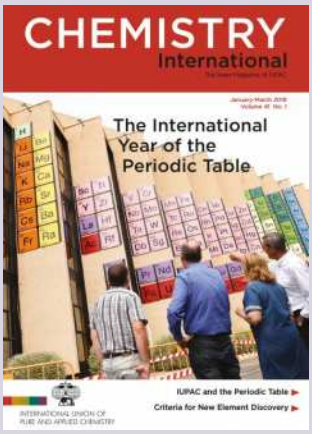
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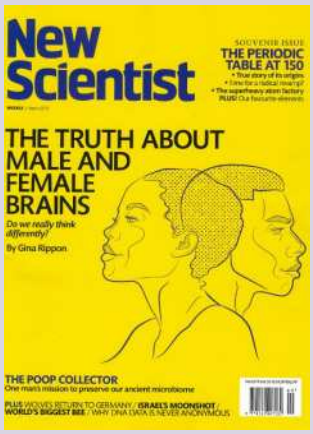
The International Year of the Periodic Table
IUPAC and the Periodic Table
Criteria for New Element Discovery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Do we really think differently?
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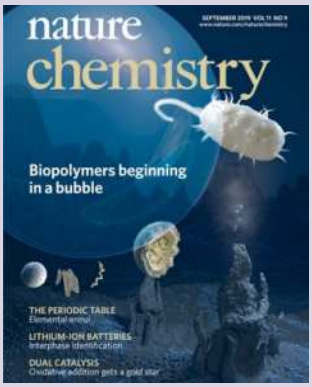
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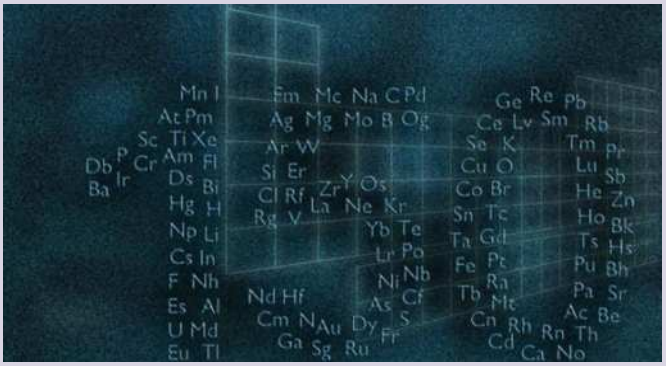
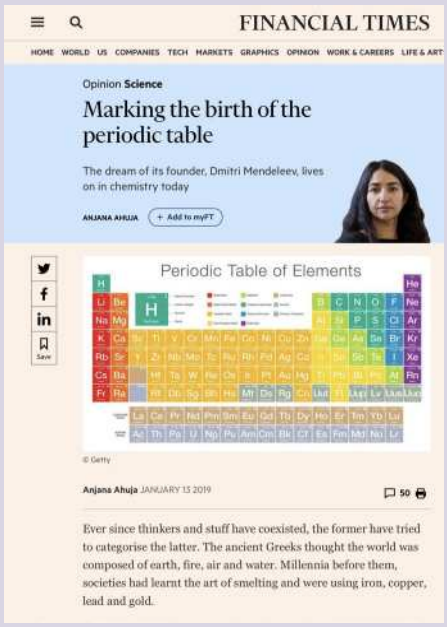
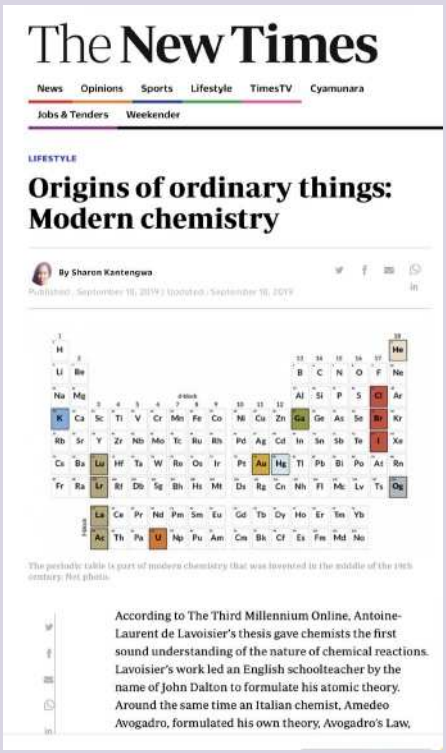
ДМИТРИЙ МЕНДЕЛЕЕВ




FINANCIAL TIMES
Opinion Science
Marking the birth of the periodic table
The dream of its founder, Dmitri Mendeleev, lives on in chemistry today
ANJANA AHUJA
Periodic Table of Elements
Anjana Ahuja JANUARY 13 2019
Ever since thinkers and stuff have coexisted, the former have tried to categorise the latter. The ancient Greeks thought the world was composed of earth, fire, air and water. Millennia before them, societies had learnt the art of smelting and were using iron, copper, lead and gold.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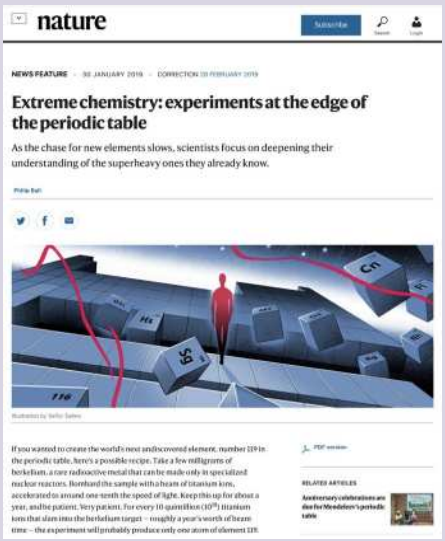
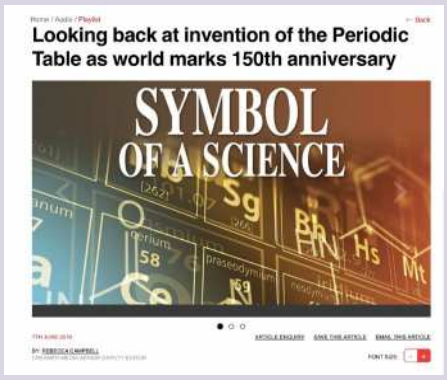
LIFESTYLE
Origins of ordinary things: Modern chemistry
By Sharon Kantengwa
According to The Third Millennium Online, Antoine-Laurent de Lavoisier's thesis gave chemists the first sound understanding of the nature of chemical reactions. Lavoisier's work led an English schoolteacher by the name of John Dalton to formulate his atomic theory. Around the same time an Italian chemist, Amedeo Avogadro, formulated his own theory, Avogadro's Law,


nature
NEWS FEATURE
Extreme chemistry: experiments at the edge of the periodic table
As the chase for new elements slows, scientists focus on deepening their understanding of the superheavy ones they already know.


Looking back at invention of the Periodic Table as world marks 150th anniversary
SYMBOL OF A SCIENCE


Observations
Happy Sesquicentennial, Periodic Table!
The organizing scheme that revolutionized our understanding of the chemical elements turns 150 in 2019
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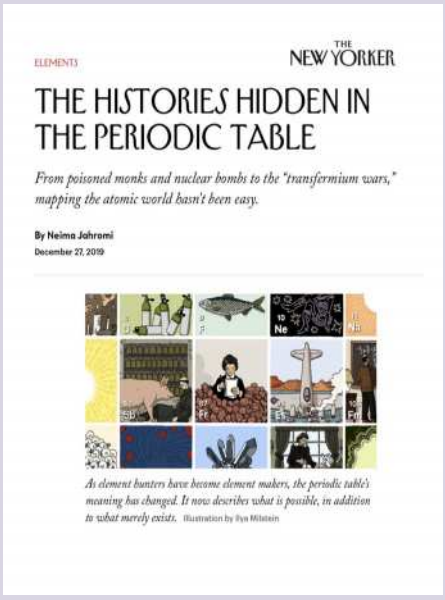
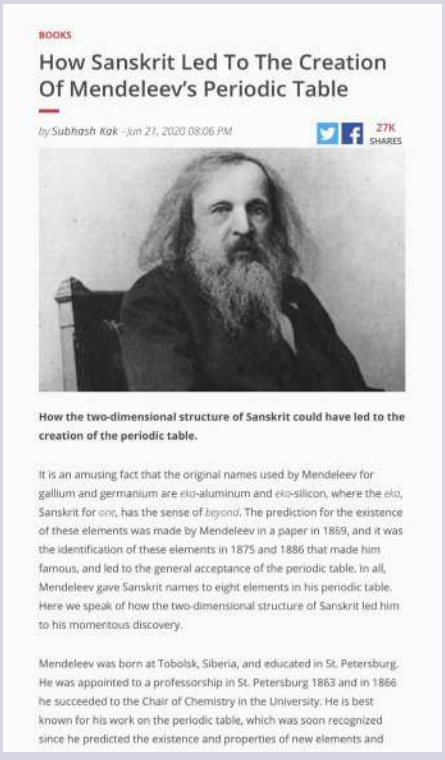

ELEMENTS
THE NEW YORKER
THE HISTORIES HIDDEN IN THE PERIODIC TABLE
From poisoned monks and nuclear bombs to the "transfermium wars," mapping the atomic world hasn't been easy.
By Neima Jahromi
December 27, 2019
As element hunters have become element makers, the periodic table's meaning has changed. It now describes what is possible, in addition to what merely exists. Illustration by Ilya Milstein


Penn Today
SCIENCE & TECHNOLOGY
Celebrating 150 years of the periodic table
Students and faculty continue to rely on the periodic table as a resource for understanding the fundamentals of chemistry.


BOOKS
How Sanskrit Led To The Creation Of Mendeleev's Periodic Table
by Subhash Kak - Jun 21, 2020 08:06 PM
27K SHARES
How the two-dimensional structure of Sanskrit could have led to the creation of the periodic table.
It is an amusing fact that the original names used by Mendeleev for gallium and germanium are eka-aluminum and eka-silicon, where the eka, Sanskrit for one, has the sense of beyond. The prediction for the existence of these elements was made by Mendeleev in a paper in 1869, and it was the identification of these elements in 1875 and 1886 that made him famous, and led to the general acceptance of the periodic table. In all, Mendeleev gave Sanskrit names to eight elements in his periodic table. Here we speak of how the two-dimensional structure of Sanskrit led him to his momentous discovery.
Mendeleev was born at Tobolsk, Siberia, and educated in St. Petersburg. He was appointed to a professorship in St. Petersburg 1863 and in 1866 he succeeded to the Chair of Chemistry in the University. He is best known for his work on the periodic table, which was soon recognized since he predicted the existence and properties of new elements and


ROYAL SOCIETY OF CHEMISTRY
News & events
Ceramic periodic table
By Kate Smith, Teacher with responsibility for chemistry, The Weald School
Tell us your story
Press office


PUNCH
Ibadan varsity joins others to celebrate Periodic Table's 150th anniversary

THE HINDU

KOZHIKODE

Science centre brings alive periodic table on pookkalam

STAFF REPORTER

Creative alchemy: The pookkalam prepared at Regional Science Centre, Kozhikode, using different salts and other chemicals. | Photo Credit: RP

It is the latest entrant in IUPAC's Nobelium contest

In the International Year of the Periodic Table of Chemical Elements (IYPT 2019), the Regional Science Centre in Kozhikode gave a scientific touch to the traditional pookkalam, which has become the latest entrant in the Nobelium contest of the International Union of Pure and Applied Chemistry (IUPAC).

The pookkalam prepared at the centre on Wednesday, on the occasion of

The New York Times

Is It Time to Upend the Periodic Table?

The iconic chart of elements has served chemistry well for 150 years. But it's not the only option out there, and scientists are pushing its limits.

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DOUG BONDERUD

Jun 10th 2019

It's Elementary: A Brief History of the Periodic Table

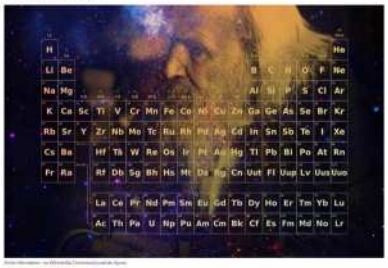
Northrop Grumman | notable scientists | scientific discoveries

As visual representations of scientific concepts go, the periodic table is hard to beat. It's easily recognizable, relatively simple to understand and for the last 150 years has acted as a reliable roadmap to help chemists uncover new elements and expand the sum of human knowledge. The American Chemical Society (ACS) described it as "perhaps as foundational to chemistry as the discovery of DNA has been to biology."

DAILY

How Far Does the Periodic Table Go?

Efforts to fill the periodic table raise questions of special relativity that "strike at the very heart of chemistry as a discipline."



LIFESTYLE

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Periodic law: the discovery of a masterpiece

The enduring significance of the periodic table of chemical elements 150 years after it was first published

The periodic table, as significant today as it was when first published 150 years ago. Getty Images

Katy Gillett

March 2, 2019

It was on March 6, 1869, that Russian scientist Dmitri Mendeleev published the first periodic table. It was an ad hoc chart, titled "draft of system of elements: based on their atomic masses and chemical characteristics".

It was controversial, because it validated the belief that atoms existed and it identified a fundamental scientific truth that other scientists had not previously been able to express: the periodic law. A law that demonstrated there are connections between chemical elements.

ScienceNews

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CHEMISTRY

How the periodic table went from a sketch to an enduring masterpiece

150 years ago, Mendeleev perceived the relationships of the chemical elements.

THE HINDU

SCIENCE

An ode to Mendeleev and his periodic table of elements

D. Balasubramanian

The periodic table symbolises the logical cogency, principled rationality of all science

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UNITED NATIONS

2019 Is the International Year of the Periodic Table

By Jessica Liken and Senior Lead Educator for Physical Science at the Perot Museum of Nature and Science • Published February 1, 2019 • Updated on February 1, 2019 at 2:21 pm

The United Nations has proclaimed 2019 as the International Year of the Periodic Table. The periodic table is more than just a list of known elements, it is a powerful tool that helps scientists predict and understand the properties of matter throughout the universe.

So why 2019? For starters, this year marks the 100th anniversary of the International Union of Pure and Applied Chemistry (IUPAC). The group was founded in 1919 to establish international standards for chemistry and address global chemistry issues. Some of IUPAC's responsibilities include setting the rules for naming new chemical elements on the periodic table and standardizing methods to measure their atomic weight.

The Statesman

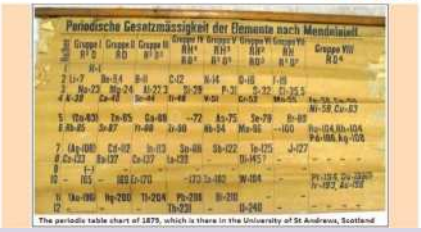
Sunday, 21 June, 2020

Home / Supplements / Science / Invention of the periodic table

Invention of the periodic table

Russian chemist Dmitri Mendeleev published what is regarded as the first clear classification of the elements based on a measure of the mass of the atoms, in 1869

S Ananthanarayanan | New Delhi | January 25, 2019 13:48



The periodic table chart of 1879, which is there in the University of St Andrews, Scotland

INDEPENDENT

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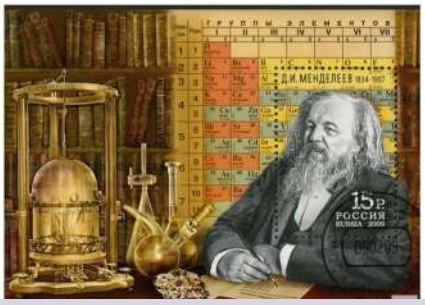
News > Long Reads > Science and Technology

After 150 years, is it time to flip the periodic table on its head?

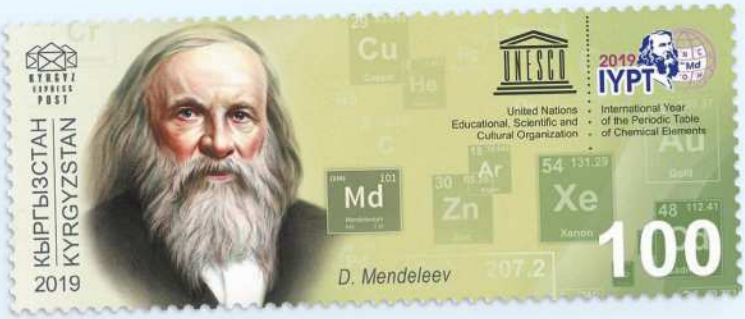
The chart would bring solidity to a field of inquiry that had long been squishy. But does it hold up, asks Siobhan Roberts

Wednesday 28 August 2019 23:00



Selection of other worldwide activities not connected to a particular country or society
Worldwide Philatelic Activities

Despite the fact that stamps are used less and less on postage, stamps are still produced for special occasion. So the philatelic program in nine countries celebrated IYPT2019 commemorative in launching a special stamp, i.e. Algeria, Bulgaria, Hungary, Kyrgyzstan, Moldavia, North Macedonia, Portugal, Russia and Spain. They are depicted below.



The Periodic Table of Videos

Sir Martyn Poliakoff, one of the instigators of IYPT2019, is a professor of chemistry at the University of Nottingham in the UK and the lead presenter on the award winning YouTube channel, the Periodic Table of Videos (PTOV), www.periodicvideos.com. PTOV is a collaboration between the talented video-maker Brady Haran and a group of enthusiastic Nottingham chemists. Its aim is to familiarize students and the general public with one video about each of the 118 elements in the periodic table. Started in 2008, it now has 664 videos with over 1.4 million YouTube subscribers and more that 227 million views. Brady and Martyn have played a role in publicizing many recent developments in the periodic table, for example the naming of the four latest elements, www.youtube.com/watch?v=Nkz5ZAL3jSc.

The PTOV team in Nottingham with Brady Haran centre

Academician Yuri Oganessian in Sir Martyn's office holding the vial containing Martyn's hair with the world's smallest periodic table on it. Yuri was in Nottingham in March 2019 to give the Sir Jesse Boot Lecture as part of Nottingham's IYPT2019 celebrations.

Sir Martyn Poliakoff, academician Yuri Oganessian and Professor Natalia Tarasova at the ceremony in the Joint Institute for Nuclear Research (Dubna, Russia), May 2019.

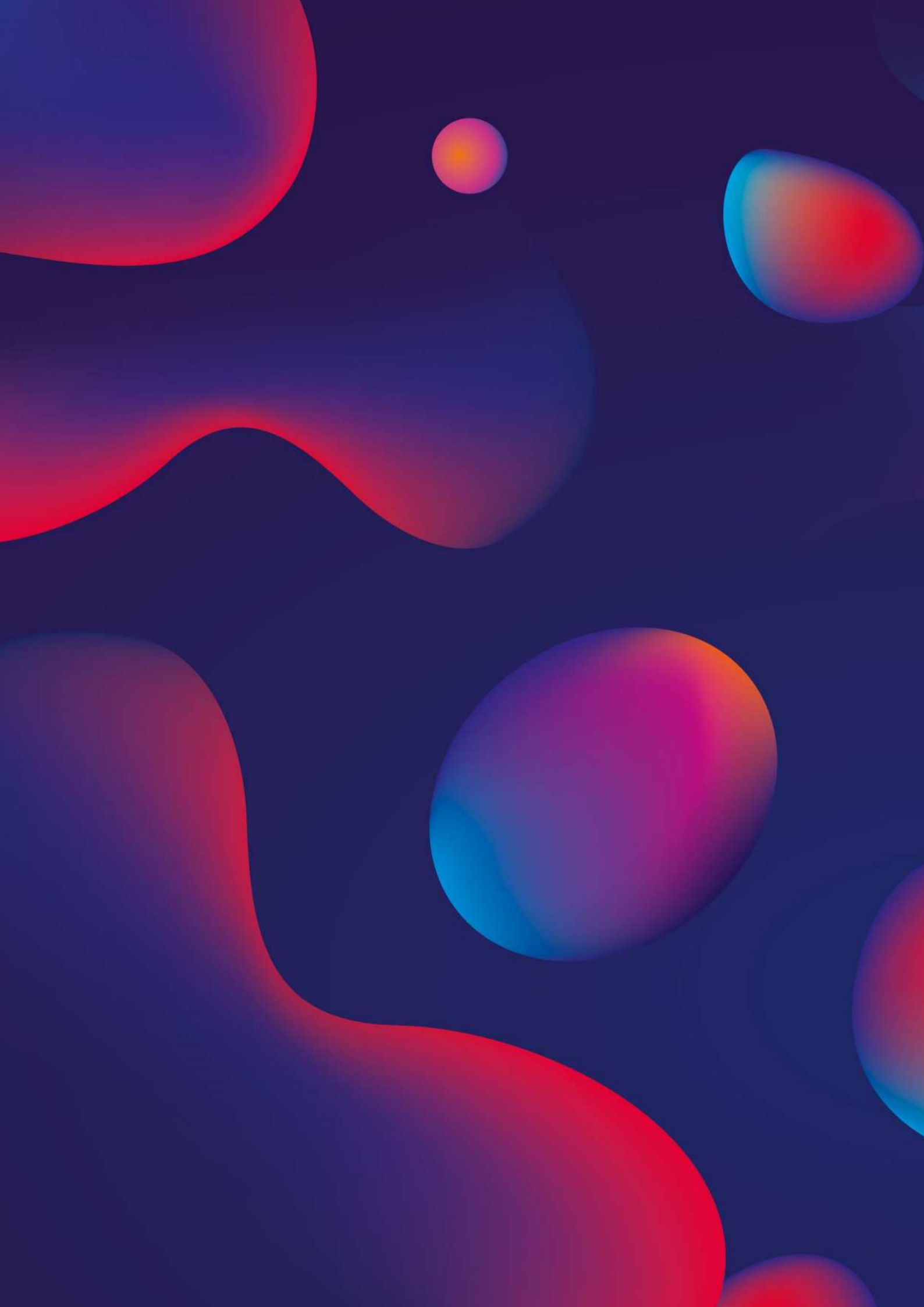
So it is perhaps not surprising that PTOV became an integral part of many IYPT2019 celebrations and activities worldwide. Sir Martyn was invited to speak on Mendeleev's Gift to Education at the Paris Launch of IYPT2019. He devised a highly original lecture based on some of the many periodic tables and items on display in his office in Nottingham, including a copy of one of the oldest periodic tables www.youtube.com/watch?v=FfC4OGbbHLc and the world's smallest, engraved on one Sir Martyn's hairs https://www.youtube.com/watch?v=cQU2IAsQak8.

The lecture ended with a showing of We ♡ The Periodic Table, a compilation of highlights from the PTOV videos, specially made by Brady for IYPT2019, see: https://www.youtube.com/watch?v=Zgge1O9wdPY. The video was released on YouTube immediately after Sir Martyn's lecture and, by the end of the ceremony, it had already been watched over 20000 times. In the course of IYPT2019, Martyn developed the lecture delivering it across the world at the Moscow opening (in Russian), in Portugal and other places. At the same time Brady was making more videos, for example featuring the wonderful collection of early books that featured in the Royal Society of Chemistry's IYPT2019 exhibition https://www.youtube.com/watch?v=83RSwczyyRY.

In May 2019, Natalia Tarasova and Sir Martyn were joint winners of the G.N. Flerov Prize on the Joint Institute for Nuclear Research in recognition of their roles in publicizing the Periodic Table and superheavy elements. The Prizes were presented by Academician Yuri Ts. Oganessian, creator of many of the superheavy elements. www.youtube.com/watch?v=1VaY9N7Alq0, and one of the heroes of IYPT2019.

The International Chemistry Olympiad

The International Chemistry Olympiad (IChO) is an annual competition for the world's most talented chemistry students at the high school level. During IYPT, its 51st edition took place in Paris from 21 – 30 July 2019, after the celebrations of IUPAC100 and IYPT2019.



PART 3:
WORLDWIDE CELEBRATIONS

FOUNDING PARTNER ACTIVITIES

MENDELEEV
RUSSIAN
CHEMICAL
SOSIETY

RUSSIAN FEDERATION

Over **800 events** were held in Russia, including scientific conferences, exhibitions, festivals, forums, quests, fashion shows and more. Most events had a focus on both IYPT2019 and 150 years of Mendeleev Periodic Table. A selection of these events is provided below:

FEBRUARY 6, 2019, MOSCOW, OPENING CEREMONY FOR THE INTERNATIONAL YEAR OF THE PERIODIC TABLE OF CHEMICAL ELEMENTS IN RUSSIA, MOSCOW, RUSSIAN ACADEMY OF SCIENCES PREMISES

The opening ceremony was attended by over 2,000 people from different regions of Russia and other countries. In the halls of the building of the Presidium of the Russian Academy of Sciences there was an international interactive exhibition dedicated to chemistry and its modern achievements.

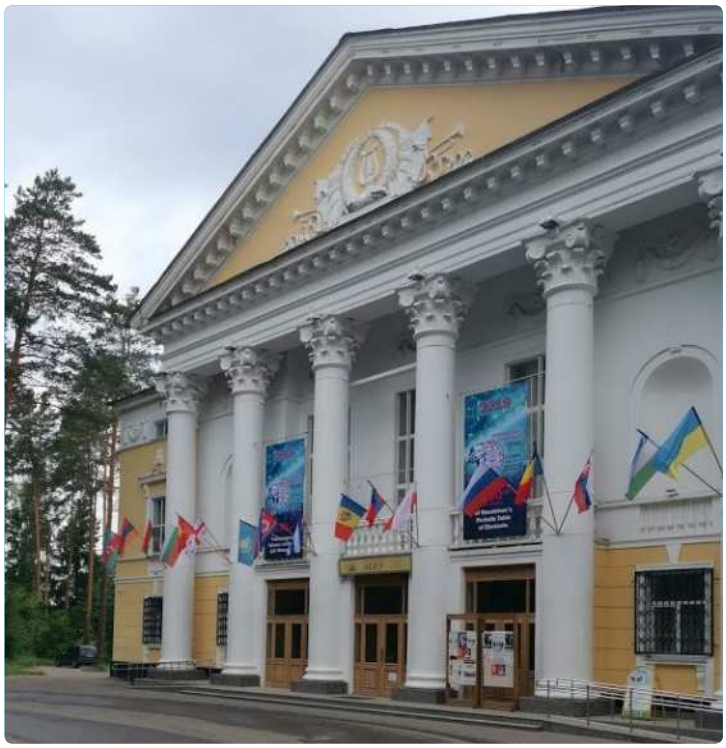
The IYPT Opening ceremony in Russia on Russian Science Day and Dmitry Mendeleev's birthday, Moscow, Russian Academy of Sciences Presidium. Welcoming speech by Chair of the Organizing Committee of the International Year in Russia, Prime Minister Dmitry Medvedev.

FEBRUARY 7, 2019, 80 REGIONS OF RUSSIA, OPEN LESSON IN CHEMISTRY «MENDELEEV? ELEMENTARY!»

In schools in 80 regions of Russia an open lesson was organized by the Ministry of Education of Russia, and the portal «ProeKTOria» about Mendeleev and the elements.

APRIL 21-27, 2019, MENDELEEV INTERNATIONAL CHEMISTRY OLYMPIAD, ST. PETERBURG, RUSSIA

MAY 30-31, 2019, “THE PRESENT AND THE FUTURE OF THE PERIODIC TABLE OF CHEMICAL ELEMENTS” JOINT INSTITUTE OF NUCLEAR RESEARCH (JINR) DUBNA RUSSIA



Shamila Nair-Bedouelle
Assistant Director-General for Natural Sciences at the International symposium “The present and the future of the Periodic Table of Chemical Elements”

(30 - 31 May JINR Dubna, Russia)

«By proclaiming the International Year of the Periodic Table of Chemical Elements, the United Nations invited UNESCO not only to celebrate the genesis and development of the Periodic Table over last 150 years but also to pay tribute to the person who developed it and raise global awareness about its role in sustainable development and for the benefit of humankind in the spirit of multilateral scientific cooperation. The International commemoration of the IYPT globally give us opportunity to work out new ways to communicate science – to spark interest of every student, to explain the power of science. I am certain that these activities will only strengthen the importance of research in basic sciences in the minds of our children for today and tomorrow and for our future.»

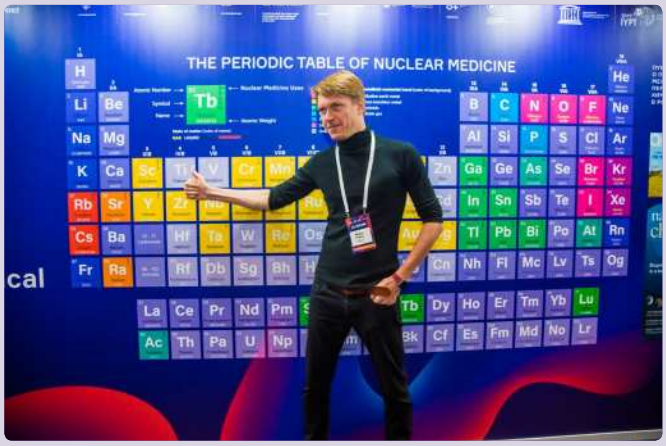
http://www.jinr.ru/posts/foto-i-video-150-letie-tablitsy-mendeleeva-v-oiyai/

SEPTEMBER 9-13, 2019, XXI MENDELEEV CONGRESS ON GENERAL AND APPLIED CHEMISTRY, SAINT PETERSBURG, RUSSIA

XXI Mendeleev Congress was held under the auspices of the International Union of Pure and Applied Chemistry (IUPAC) and UNESCO. The XXI Mendeleev Congress was one of the main events of the International Year of the Periodic Table of chemical elements. The XXI Mendeleev Congress on General and Applied Chemistry in St. Petersburg was attended by more than 4,000 people from 60 countries.


150 YEARS
2019
IYPT


ИСКУССТВО
НАУКА И СПОРТ
IYPT
019


THE PERIODIC TABLE OF NUCLEAR MEDICINE


2019
IYPT
THE INTERNATIONAL YEAR
OF THE PERIODIC TABLE
OF CHEMICAL ELEMENTS


2019
IYPT


CONGRESS

https://english.spbu.ru/news/3189-leading-chemists-discussed-ways-to-solve-global-challenges-at-the-mendeleev-congress

The XXI Mendeleev Congress on General and Applied Chemistry was launched on 9 September 2019 in St. Petersburg. The Congress was a key event of the IYPT and was held under the auspices of UNESCO and IUPAC. Its participants included more than 3,000 scientists, with Nobel Prize winners and presidents of chemical societies among them. More than half of the participants were young scientists. The scientific programme of the congress consisted of ten sections, five English-language symposia and four roundtable discussions, youth conference 'Mendeleev-2019', which included the 'New Chemist' roundtable. Additionally, during the Mendeleev Congress, the University hosted the grand opening of the historic site of the European Physical Society. The key topics discussed at the 21st Mendeleev Congress were: the development of new pharmaceuticals and diagnostic methods; alternative energy sources; modern metallurgy and petroleum chemistry; the use of radioactive elements in medicine; and the chemistry of the universe.

World-leading scientists delivered their lectures, including Academician Yu. Ts. Oganessian, Scientific Leader of the Laboratory of Nuclear Reactions JINR. In his speech at the opening of the Congress, Yuri Oganessian, an outstanding Soviet and Russian scientist, traced the history of the study of atomic "bricks" and the synthesis of new elements. These discoveries were made for the last 150 years, since the creation of the Periodic Table of Chemical Elements, and allowed to add new elements to the Table. On the same day, Nobel Prize holders Jean-Pierre Sauvage and William Moerner, as well as British chemist, science populariser Martyn Poliakoff delivered their reports.

Nobel Laureate Professor William Moerner

«I am happy and pleased to be able to participate in the celebration of the 150th anniversary of Mendeleev Periodic Table, of his great contribution to science. Thanks to him, we speak a common language, a language now used in different areas of science. It really is a monumental contribution to science.»

Nobel Laureate Professor Jean-Pierre Sauvage

«...the classification introduced by the Periodic Table of Chemical Elements is one of the most important milestones in the development of science and humanity. This table was the result of a combination of intuition, on one hand, and rationality, on the other. This table helped us realize that everything on this planet, both inorganic and organic matter, is a combination of various elements linked together. This table can also help explain the power of science to the general public, which, in my opinion, is very important – especially to people who are not focused on science. We can tell them that the smallest particles and the largest elements in our world have the same structure. They consist of the same building blocks. All of them consist of elements included in the periodic table. I think this should make people think about science and its power.»

IUPAC President Professor Zhou Qi-Feng

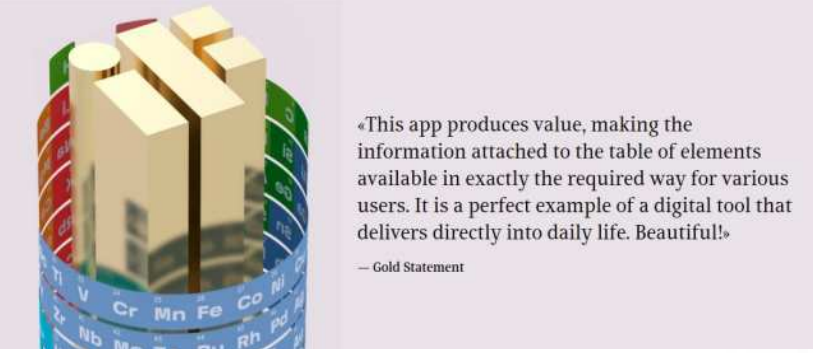
«The history of the periodic table is, on the one hand, an excellent example of the amazing ability of the human spirit to explore new theories and to push the boundaries of the unknown. On the other hand, it is also an amazing model of combining individual genius and international research efforts. The periodic table demonstrates the periodicity and cyclical properties of the elements, and of course, it is of great importance for other sciences, such as biology, astronomy and medicine. That is why the International Year of the Periodic Table of Chemical Elements received the tremendous support of researchers from various disciplines from all over the globe. IUPAC is an international union. I would like to say that we are very grateful to the organising committee of this International Year for their efforts. In addition, we organised a competition on the periodic table and a high profile youth event that brought together young people from around the world. We hope that this will serve as a source of inspiration for young people, and that young people will bring their energy to promoting science in the future.»

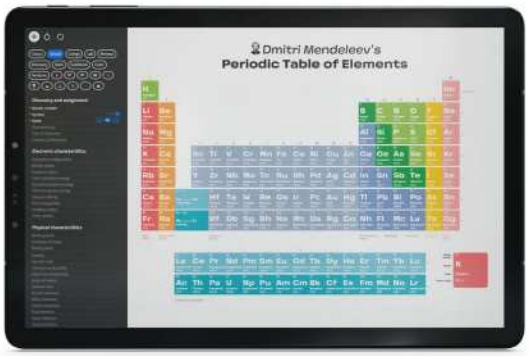
OCTOBER 23-24, 2019, RUSSIA-AFRICA SUMMIT, SOCHI, RUSSIA

Exhibition dedicated to the 150th anniversary of the Periodic Table of Chemical Elements

THE MOST ADAPTABLE PERIODIC TABLE OUT THERE

6th of June 2019 - Moscow-based design company Art. Lebedev Studio has released a new Periodic Table which can be adapted for any task. The periodic table of elements created at the studio was awarded a Gold iF Product Design Award.





CONTRIBUTION TO THE LEGACY OF THE IYPT 2019

Also following the International Year program outcomes, the Plan of Events («road map») for the preparation and holding of the celebration of the 190th anniversary of D.I. Mendeleev in 2024 will be presented to the Government of the Russian Federation. Within its framework it is envisaged to establish The Day of the Periodic Law, the annual D.I. Mendeleev Prize for achievements in the field of popularization of chemistry, and hold events at UNESCO headquarters to summarize the results of the International Year of the Periodic Table of Chemical Elements and prepare for the celebration of the 190th anniversary of D.I.Mendeleev in 2024, as well as the organization of annual Chemistry Festivals for schoolchildren in all interested countries.

In the framework of follow up to the International Year of the Periodic Table of Chemical Elements (IYPT2019), the Government of the Russian Federation proposed to establish and fund the joint **UNESCO/Russian Federation International Prize in the name of the Russian chemist Dmitry Mendeleev for the Basic Sciences.**

Collective sewing **Mendeleev's Table, made in the style of patchwork**, in a single canvas. The table **of 3 x 5 meters**. It was created by about **100 masters** from different regions of Russia, from Vladivostok to Kaliningrad, Belarus and Kazakhstan. The age of the project participants is from 12 to 65 years. For all of them, patchwork is a hobby, though the «elements» themselves are made masterfully.

Each element in the People's Table, and all 118 of them, as it should be, is a small masterpiece. In a square of 25 by 25 cm patchwork, collage, embroidery, graphic special markers for the fabric and, most importantly, the fantasy of the author were combined. Each element, made by a craftswoman, is unique. And the whole table is an exceptional art object.

ELEMENTARY!

A series of posters on elements, chemistry and life

Texts:
Lyubov Strelnikova, Editor-in-Chief, Chemistry and Life magazine.
Heinrich Ehrlich, Doctor of Chemical Sciences, Lomonosov Moscow State University.
Roald Hoffman, Nobel Prize Laureate in Chemistry, Cornell University.

A series of educational posters « ELEMENTARY!» is dedicated to the 150th anniversary of the Periodic Table of Chemical Elements. The style of the posters of the series is reminiscent of the famous, in Russia in 1919-1921 «Windows of ROSTA», and it is no accident – it was inspired by the poems of Vladimir Mayakovsky, who participated in creating this peculiar form of public campaigning art. Moreover, each poster is also a replica of the famous work of fine art of the late XIX - early XX century. It seems that Dmitry Mendeleev would have liked this approach. After all, he loved, understood and had an excellent knowledge of painting, was a friend to many artists and supported them. As a professor teaching chemistry, he would have appreciated this informative, visual and imaginative material, which can be used for teaching at school classes.

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY (IUPAC)

IUPAC was heavily involved in the celebrations of IYPT2019. Furthermore, the year coincided with their 100th year anniversary (IUPAC100), which was celebrated with projects such as the Periodic Table Challenge, the Periodic Table of Younger Chemists and the Global Womens Breakfast as all mentioned above in section 1 of this report.

Chemistry International (CI), the magazine of International Union of Pure and Applied Chemistry (IUPAC), embraced the opportunities to celebrate the International Year of the Periodic Table during 2019. First of all, Natalia Tarasova, wrote about a history of the proclamation of the International Year of the Periodic Table of Chemical Elements, in Chem. Int. 2018, 40 (2), p.1. In addition, two special issues, one published in January and the second in October, approached the theme of the Periodic Table is two very distinct ways. The first issue echoes how the work of IUPAC and the evolution of the PT crisscrossed; and thus the issue includes features illustrating how IUPAC contributes to the curation of the information presented in the Periodic Table. The second issue tagged with the title Elements of X, is a collection of essays that emphasizes the pluridisciplinarity and iconic character of the Table. The articles are mentioned below.

IUPAC and the PT – Jan 2019 CI

- Introduction to the International Year of the Periodic Table 2019, Jan Reedijk and Natalia Tarasova, Chem. Int. 2019, 41(1), p. 2
- IUPAC and the Periodic Table, G.J. Leigh, Chem. Int. 2019, 41(1), p. 6
- Criteria for New Element Discovery: Providing Assurance in a Field of Allure and Romance by Sigurd Hofmann, Chem. Int. 2019, 41(1), p. 10
- Looking Backwards and Forwards at the Development of the Periodic Table, Eric Scerri, Chem. Int. 2019, 41(1), p. 16
- Isotopic Abundances and Atomic Weights: History of IUPAC Commission II.1 in the Service of Chemistry, John R. De Laeter, Chem. Int. 2019, 41(1), p. 21
- Isotopic Abundances and Atomic Weights: IUPAC Commission II.1 Today, Juris Meija, Chem. Int. 2019, 41(1), p. 24
- Isotopes Matter by Norman E. Holden, Tyler B. Coplen, and Peter Mahaffy, Chem. Int. 2019, 41(1), p. 27

Following an introduction by Jan Reedijk and Natalia Tarasova, co-chairs of the Management Committee coordinating IYPT, the issue starts with a feature by G. Jeffery Leigh that focuses on the role of IUPAC in the development of the periodic table during the last century, and of the preceding Atomic Weights Commission which oversaw the Periodic Table before 1919. In the next article, Sigurd Hofmann reviews the history of the criteria for new element discoveries and their acceptances. To illustrate that the discussions on the format of the table is an on-going debate, Eric Scerri discusses the issues around group 3 elements—including lanthanoids and actinoids—and their placement in the Periodic Table. Next, a brief history of the IUPAC Commission on Isotopic Abundances and Atomic Weights is presented. A short update about the state of the Commission today is echoed by the current chair, Juris Meija. And last, Peter Mahaffy, Norman Holden, and Ty Coplen review why "Isotopes Matter," a feature supported by a detailed technical report published in Dec 2018 in Pure and Applied Chemistry.

The issue includes a back cover tear-off page with, on one side, a reprint of the most recently released IUPAC Periodic Table of the Elements (version 1 Dec 2018) and on the other side, the Periodic Table of the Elements and Isotopes.

Printed copies of the Jan-Mar issue of Chem Int were included in the bags presented to all attendees at the IYPT Opening Ceremony held at UNESCO on 29 January 2019.

A review of that special issue was published in CITAC News in April 2019. (Chemistry International 2019 at the Intersection of IYPT & IUPAC100, F. Meyers, CITAC News, April 2019, pp. 55-59)

Elements of X – Oct 2019 CI

- Element of IYPT2019 - Foreword by Jan Reedijk, Chem. Int. 2019, 41(4), ifc
- Elements of X, Lars Öhrström, Chem. Int. 2019, 41(4), p. 2
- Elements of Education, Peter Atkins, Chem. Int. 2019, 41(4), p. 4
- Elements of Stars, Maria Lugaro and Ewine van Dishoeck, Chem. Int. 2019, 41(4), p. 8
- Elements of the Future, Kit Chapman, Chem. Int. 2019, 41(4), p. 12
- Elements of Life at the Oxo Wall, Harry B. Gray, Chem. Int. 2019, 41(4), p. 16
- Elements of Technology, Michael Droescher, Chem. Int. 2019, 41(4), p. 20
- Elements of Scarcity, David J. Cole-Hamilton, Chem. Int. 2019, 41(4), p. 23
- Elements of Flair and Fashion, Marielle Agbahoungbata, Chem. Int. 2019, 41(4), p. 29
- Elements of Heroism, Suze Kundu, Chem. Int. 2019, 41(4), p. 34
- and ultimately published in the following Jan 2020 issue:
- Elements of Sports: From IYPT2019 to Tokyo2020, Miki Hasegawa, et al, Chem. Int. 2020, 42(1), p. 5

This special issue was envisioned by Lars Öhrström who with just a few keywords, challenged a small group of authors to bring views from some different vantage points: "Elements of ..." was the broad approach.

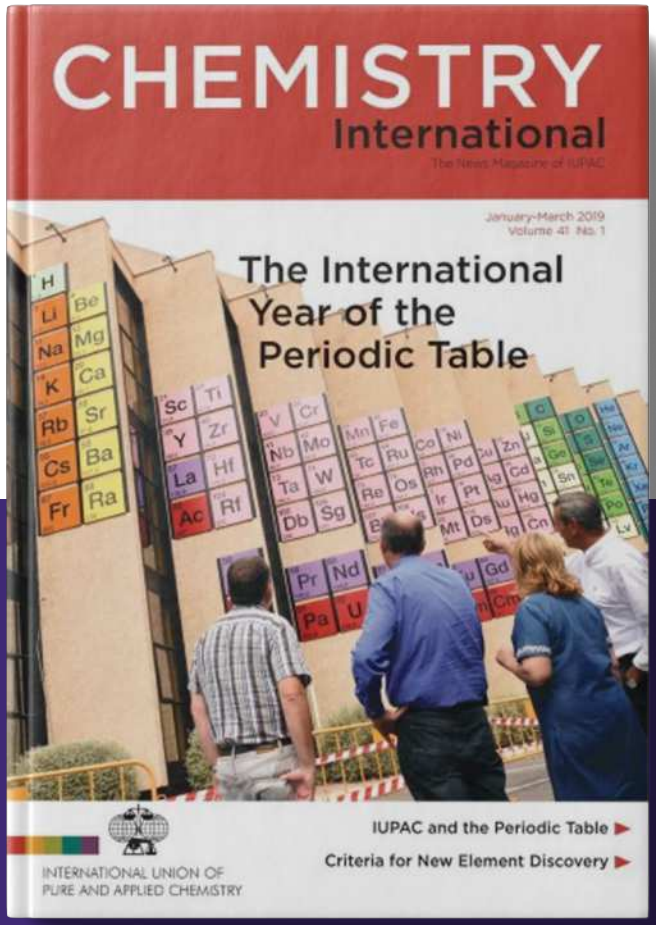
The CI issue Elements of X starts with Peter Atkins discussing the table in the broad context of chemical education, but then quickly move into specifics. How did it all start? The chemical consequences of the Big Bang is explained by Ewine van Dishoeck. The Future is touched upon by Kit Chapman who follows the element hunt to some unexpected places. A very personal treatise on (di)oxygen, some of the metallic elements of enzymes and their relevance to life and death, is offered by the doyen of bioinorganic chemistry, Caltech professor emeritus Harry Gray. But more than life depends on elements, our technology is using a larger and larger part of the periodic table. Finite resources as we all know, and just how finite is outlined by David Cole-Hamilton. But scarcity may also be the mother of invention, and Michael Droescher takes us on an entrepreneurship tour of the elements. Not everything is utility and function, flair and fashions has a place also in a chemist's heart, and Marielle Agbahoungbata guides the reader all the way from ancient Egypt to the Lagos Fashion Week in Nigeria. Expect gold, color and gemstones! Heroes there are plenty, and another side of bravery in an essay by Suze Kundu. Crime fighters, comic book heroes and daring sabotage actions are part of that more adventurous, and sometimes dark, side of chemistry. Sports also captures our attention occasionally, and Miki Hasegawa tell us about inventions and devices that will lead us up to the 2020 Olympic Games in Tokyo (feature ultimately published in Jan 2020).

Not only does the issue covers some diverse geographical terrain, Öhrström points out in his introduction that the essays also emphasizes that the IYPT2019 did not come to be because of IUPAC only; physics, astronomy, biology, philosophy: they all come together in the Periodic Table. And so, the issue also acknowledges our fellow international unions: International Union of Pure and Applied Physics (IUPAP), European Chemical Society (EuChemS), the International Science Council (ISC, previously ICSU), International Astronomical Union (IAU), and the International Union of History and Philosophy of Science and Technology (IUHPS).

The last elements to notice in that issue are the Elements of Credits recognizing the creative illustrations used throughout the issue and also on the cover: the chemical elements tiles are part of the IYPT Timeline of Elements project organized by Chem 13 News and the University of Waterloo in Ontario, Canada. More details on all artwork is online: https://uwaterloo.ca/chemistry/timeline-elements-image-gallery.

A regular section of CI is Stamp International. In "IYPT and The Mother of All Tables" Daniel Rabinovich shows us six stamps, all especially released for IYPT2019. The outside back cover of the issue is a reprint of the special IYPT Periodic Table released by EuChemS, depicting The 90 natural elements that make up everything. How much is there? Is that enough?

Printed copies of the October-Dec issue of Chem Int were included in the bags presented to all attendees at the IYPT Closing Ceremony held in Tokyo on December 5, 2019.



References:

Chemistry International Volume 41, No. 1., January-March 2019
Chemistry International Volume 41, No. 4., October-December 2019

IUPAC

INTERNATIONAL UNION OF
PURE AND APPLIED CHEMISTRY

INTERNATIONAL UNION OF PURE AND APPLIED PHYSICS (IUPAP)

When the International Union of Pure and Applied Physics (IUPAP) let its support to the proposal made to UNESCO for the International Year of the Periodic Table (IYPT), it wrote to UNESCO saying "Because of the central role that the periodic table of the elements plays in physics, and because of the possibilities that would open up for increasing the understanding of the public of this critical part of physics, the International Union of Pure and Applied Physics is pleased to support the application sponsored by the IUPAC that 2019 be designated as the International Year of the Periodic Table."

All of the elements are made in nuclear reactions. For most of the elements that were discovered by the 1939 these reactions occurred in stars and in galaxies billions of years ago, and those that were discovered since 1940 staging the nuclear reaction is a part of the discovery process. Celebrating these recently discovered elements the cooperation of physicists and chemists in the discoveries played a key part in the way that the IUPAP contributed to the IYPT.

One of the contributions was organizational. IUPAP and IUPAC established a Joint Working Group on the Procedures for Validating Claims for the Discovery of New Elements and Naming those Elements whose recommended procedures have been published during the IYPT, Pure Appl. Chem. 2018; 90(11): 1773–1832; https://doi.org/10.1515/pac-2018-0918 After a period during which comments on the procedures could be addressed to the Presidents of the Unions they were confirmed by the Unions.

As examples of the contributions of physicists to the IYPT we can look at outreach activities in Sweden publicizing the science of the Periodic Table to the general public. The "Berzelius Day" was organized in Stockholm, by the chemists including physicist as invited speakers. In Lund the "Cultural Night of Lund" was celebrated in September. There are many activities all over the city, open to the public. At the Department of Physics there was an open house which concentrated on periodic table activities. Book shops at various places, and various times during the year, were encouraged to display books related to the periodic table. The Chair of the IUPAP Commission on Nuclear Physics (C12), Claes Fahlander, personally gave many lectures on the Periodic Table.

Similarly in Brazil, the previous Chair of C12, Alinka Lépine-Szily, was involved in a number of interviews and podcasts on the IYPT, with the University of Sao Paulo Journal, https://jornal.usp.br/universidade/tabela-periodica-resume-todo-conhecimento-do-mundo/ on the web page of the State of São Paulo Research Foundation, https://revistapesquisa.fapesp.br/2019/03/14/a-encruzilhada-da-tabela-periodica/ https://revistapesquisa.fapesp.br/2019/04/05/entrevista-alinka-lepine-szily/ and in the Jornal Hoje (News Today) of the popular open TV Channel GLOBO https://globoplay.globo.com/v/8078049/

In March there was a special issue on the Periodic Table in the journal Nuclear Physics News, Vol 29, No 1 (2019), http://www.nupecc.org/npn/npn291.pdf, containing articles on the Super Heavy Elements:

- Discovery of Superheavy Elements, by Claes Fahlander
- Super Heavy Elements: On the 150th Anniversary of the Discovery of the Periodic Table of Elements, by Yuri Oganessian
- The Periodic Table of Elements: Superheavy in Chemistry, by Robert Eichler
- Electronic Structure at the Edge of the Periodic Table by Ephraim Eliav, Anastasia Borschevsky, and Uzi Kaldor
- Laser Spectroscopy of the Heaviest Elements: One Atom at a Time by Mustapha Laatiaoui and Sebastian Raeder

The major international conference on Superheavy Elements, the 6th International Conference on the Chemistry and Physics of the Transactinide Elements, TAN19, happily occurred in the IYPT in Wilhemshafen in Germany at the end of August 2019. During the conference there was focus on the periodic table, a public lecture by Professor Gisela Boeck from the University of Rostock on the history of the Periodic Table, and there were of course talks by living discoverers on the discoveries of elements 112, 113, 114, 115, 116, 117, 118. The conference was endorsed by both IUPAC and IUPAP and their Presidents gave welcome addresses.

The International Conference on Nuclear Physics, ICNP2019 also occurred during the IYPT, and Jim Al-Khalili, nuclear physicist, science communicator, celebrated TV star, gave a very popular public lecture Nuclear Physics and the Making of the Modern Periodic Table.

Science is a co-operative process, and a competitive process. Progress often needs co-operation, and the personal, industrial and social rewards are competed for. It is no surprise that physicists and chemists co-operate and compete about the elements. The co-operation has been enhanced by the International Year of the Periodic Table, and the IUPAP and IUPAC have agreed to a memorandum of understanding which build on that experience to continue the cooperation.

INTERNATIONAL ASTRONOMICAL UNION (IAU)

The periodic table of the elements is regarded as a significant achievement for all domains of science. Chemical elements are central to the existence of ourselves and our surroundings, and their origin has therefore been a basic question for various different disciplines. For astronomers this question has been an important topic of study. The universe's most abundant elements, hydrogen and helium, were formed during the Big Bang and all subsequent elements that make up our everyday lives were all forged deep in the core of stars and on the violent stellar explosions that spread them across the universe.

The search for different molecules in astronomical environments has been very successful and surprises us with ever more complex systems as the search continues. Recent detections of gravitational waves have confirmed that heavier elements can be created by merging neutron stars. The collision of these compact stellar remnants creates gold, platinum, uranium and other heavy elements which are then released into space.

Within the framework of the International Astronomical Union 100 year celebrations (IAU100) celebrated in 2019, the IAU developed, together with the design studio Science Now, the open-source exhibition IAU Above and Beyond (http://100exhibit.iau.org), which takes the visitor on a chronological journey through the past century, highlighting the main astronomical discoveries in each decade together with the main technological and cultural developments in that period. One of the key elements of the exhibition is the discovery of the cosmic origin of the chemical elements in the 1950s illustrated with a very visual display. Since its opening in August 2018 at the IAU General Assembly in Vienna (Austria), the traveling exhibition has been present in Austria, Slovakia, Czech Republic, Belgium, Ireland and Italy. In addition, the IAU100 Secretariat also released a reduced version consisting of 12 A0 posters that have been used in schools, museums, science festivals in over 75 countries.

Another important activity of the IAU during IYPT2019 was the participation of IAU President Ewine van Dishoeck on the IYPT2019 Opening Ceremony at UNESCO headquarters in Paris (France) and the Mendeleev 150: 4th International Conference on the Periodic Table in St. Petersburg (Russia) where she addressed the topic of the "Origin of the Elements in Outer Space' and co-organized the symposium on 'The Periodic Table through Space and Time'.

Furthermore, as part of the IAU100 celebration, the IAU encouraged professional and amateur astronomers worldwide to participate in IYPT2019 by organising events that explore the origin and value of the elements in the universe.

Event highlights included the XI. Astronomical Obstacle-race in Nagyszénás (Hungary), organized on the topic of the 100th anniversary of the IAU, the 50th anniversary of the first moon landing and the International Year of the Periodic Table 2019. On the obstacle-race, teams of the nearby primary schools participated solving different types of tasks such as modelling the Solar System, specifying the acronyms of astronomical organisations, drawing the first

Opening of the Dutch version of the IAU Above and Beyond exhibition at the Leiden Observatory in Leiden (the Netherlands). Credit: M. Shaw / Leiden University.

moon landing, solving a puzzle of the periodic table or just writing an essay about the IAU.

In Argentina, The Periodic Table rockolla project developed a periodic table devoted to light and music and the The Chemical elements come from the stars project organized using exhibitions, conferences and workshops to involve the communities around Argentina in this important topic.

Finally, many public talks about the cosmic origins of the chemical elements were organized by many astronomers around the world. An article 'Elements of Stars' was written for a special issue of Chemistry International Oct-Dec 2019 by Maria Lugaro and Ewine van Dishoeck.

INTERNATIONAL UNION OF HISTORY AND PILOSOPHY OF SCIENCE AND TECHNOLOGY (IUHPST)

This Union acted during three major events, and reported on these in Paris, Maastricht and St. Petersburg.

IUPAC CONGRESS 2019: Symposium 6 - IUPAC and Chemistry: A Century of Intertwined History, a Common Heritage for the Future (1919-2019) in the frame of the 47th IUPAC World Chemistry Congress, in Paris, 7-12 July 2019 **(NB: there has never been before historical sessions at an IUPAC congress!)**

The three historical sessions celebrated the 100th anniversary of the birth of IUPAC, and also the 150th anniversary of Mendeleev's successful attempt to arrange the chemical elements according to their atomic weights. The sessions brought together historians of chemistry, and chemists, to tackle the interwoven evolution of IUPAC and chemistry, with a special session devoted to the specific role of IUPAC in respect of the filling of the PT. These sessions featured invited speakers as well as contributed papers.

Organizers: Danielle FAUQUE (Université Paris Sud/ Paris Saclay, FR) and Brigitte Van TIGGELEN (UCL, Louvain-la-Neuve, BE; Science History Institute, Philadelphia, USA)

Session 6.1: IUPAC's Legacy to Chemistry
This Symposium addressed the manifold aspects of the great plasticity of chemistry as a discipline, and the resilience and adaptability of IUPAC to crystallize or promote these mutations.

Session 6.2: IUPAC and the heritage of Chemistry
As Chemistry and IUPAC both develop, they leave a rich heritage behind that is at risk of disappearing. This Symposium welcomed papers that showcased examples of preservation of the heritage of chemistry, be it industrial or academic, with a special emphasis on IUPAC's legacy and role.

Session 6.3: The Periodic Table at 150
This Symposium welcomed papers that dealt with the historical development and use of the PT, with an emphasis on the role of IUPAC.

The International Conferences on the History of Chemistry (ICHC) are organized by the EuChemS **Working Party on the History of Chemistry** (WPHC) every year. In 2019, the 12ICHC was hosted by Maastricht University, 29 July – 2 August, 2019, with Ernst Homburg as chair of the Local Organizing Committee.

The organizers, selected speakers and participants gather around Lavoisier in the garden of the Maison de la Chimie

Two sessions of the 12ICHC celebrated the 150th anniversary of the periodic system and the 100th anniversary of the International Union of Pure and Applied Chemistry (IUPAC): the panel 150 years of the Periodic System organized by Gisela Boeck, Annette Lykknes, Isabel Malaquias and Luis Moreno-Martínez and the panel "IUPAC and the other international scientific organizations: competition or synergy?" organized by Brigitte Van Tiggelen and Danielle Fauque.

The conference was furthermore the opportunity to unveil the new volume **"Women in Their Element: Selected Women's Contributions to the Periodic System"** edited by Annette Lykknes and Brigitte Van Tiggelen, in presence of both editors and several contributors.

"Celebrating D.I. Mendeleev's Periodic System. A Historical Perspective"

The symposium "Celebrating D.I. Mendeleev's Periodic System. A Historical Perspective" was organized as a satellite meeting in the frame of the XXI Mendeleev Congress at the Saint Petersburg State University (Russia), on 10-13 September 2019.

This was a memorable event and a high point for historians of science too. This international symposium gathered scholars to tackle questions pertaining to the historical emergence, development and use of the Periodic System (PS), and its most powerful scientific icon, the Periodic Table (PT). While there are still many debates and ongoing discussion about the nature of the PS, the best

arrangement of the elements, and the underlying laws that govern such a classification, this symposium specifically held a historical perspective. Beyond the story of discovery, and its context, it was the opportunity also to examine the response and the appropriation processes that explain the longevity of this classification across time, space and culture. In particular, this symposium aimed at providing space for less discussed topics such as the use of PT in textbooks and the pedagogical context, the presence of the PT in popular culture, and the role of women scientists in the development of the PS and the PT. The symposium was bilingual, with translation to English provided when papers were given in Russian, which provided a unique opportunity to meet with the Russian community of historians of science. The full program is to be found at the symposium website: https://hystsymposium.wordpress.com/

The cultural and social program was the most dense and rich, and provided the participants with the opportunity to visit the main sites of Mendeleev's life and work (St Petersburg University and the Metrological Institute) as well as scientific and cultural heritage such as the Kunstkamera and the Lomonosov Museum. Among the high points was a visit to a little-known periodic wall chart devised by Mendeleev himself for his teaching in 1876, and still to be seen in the lecture hall where it was in 1894.

The fruitful exchange on the periodic system and the discovery of the amazing heritage related to D.I. Mendeleev and the history of chemistry still to be seen, prompted the participants to issue a recommendation at the end of this meeting. This recommendation plead for IUPAC and the chemical societies celebrating the IYPT across the world to foster attention to the heritage of D.I. Mendeleev, to encourage support for archives, museums and other historical and scientific exhibitions concerning his work, and related fields, and to help implement international historical and chemical projects (educational, research and publishing projects) in order to further study the legacy of D.I. Mendeleev, and make it available to the wider community. The participants also recommend applying to UNESCO for a recognition of Mendeleev's Museum and Archive as a World Heritage Site, with the support of the Mendeleev Russian Chemical Society and other national and international chemical and scientific organizations.

The setting up of the symposium also involved several members of the EuChemS WPHC: Gisela Boeck, Isabel Malaquias and Elena Zaitseva.

The 1876 PT wallchart, flanked with busts of Alexander Mikhaïlovitch Butlerov, on the left hand side, and D.I. Mendeleev, on the right hand side (picture by B. Van Tiggelen)

EuChemS
European Chemical Society

EUROPEAN CHEMICAL SOCIETY (EuChemS)

National Partners:
41 Member Societies, 19 Professional Networks

Estimated number of IYPT activities organized:
Centrally 50, 100s by Member Societies

Number of people reached:
70,000 directly, Millions through media coverage

Women in Science

Because we lose so many outstanding women to the chemistry profession, women featured heavily in the EuChemS Celebrations of IYPT. The outstanding book, Women in Their Element Selected Women's Contributions to the Periodic System, Edited By: Annette Lykknes and Brigitte Van Tiggelen, respectively Chair-elect and Chair of the EuChemS Working Party on the History of Chemistry (WPCH) outlines the work of the many women who made major contributions to the development of the Periodic Table as we know it, many of whom had been almost forgotten.

This theme was further developed at the International Conference in Murcia, Setting their Table: Women and the Periodic Table of Elements organized in conjunction with IUPAC, the Royal Spanish Chemical Society and hosted by Pedro Lozano. Details and pictures are in Section 1.

The WPHC also organized a special symposium during the Mendeleev Congress on Pure and Applied Chemistry in St Petersburg entitled Celebrating D.I. Mendeleev's Periodic System. A Historical Perspective and were heavily involved in the first ever EuChemS Chemistry Landmark, which was awarded to the Ytterby mine in Sweden, where 8 (mainly lanthanoid) elements were discovered.

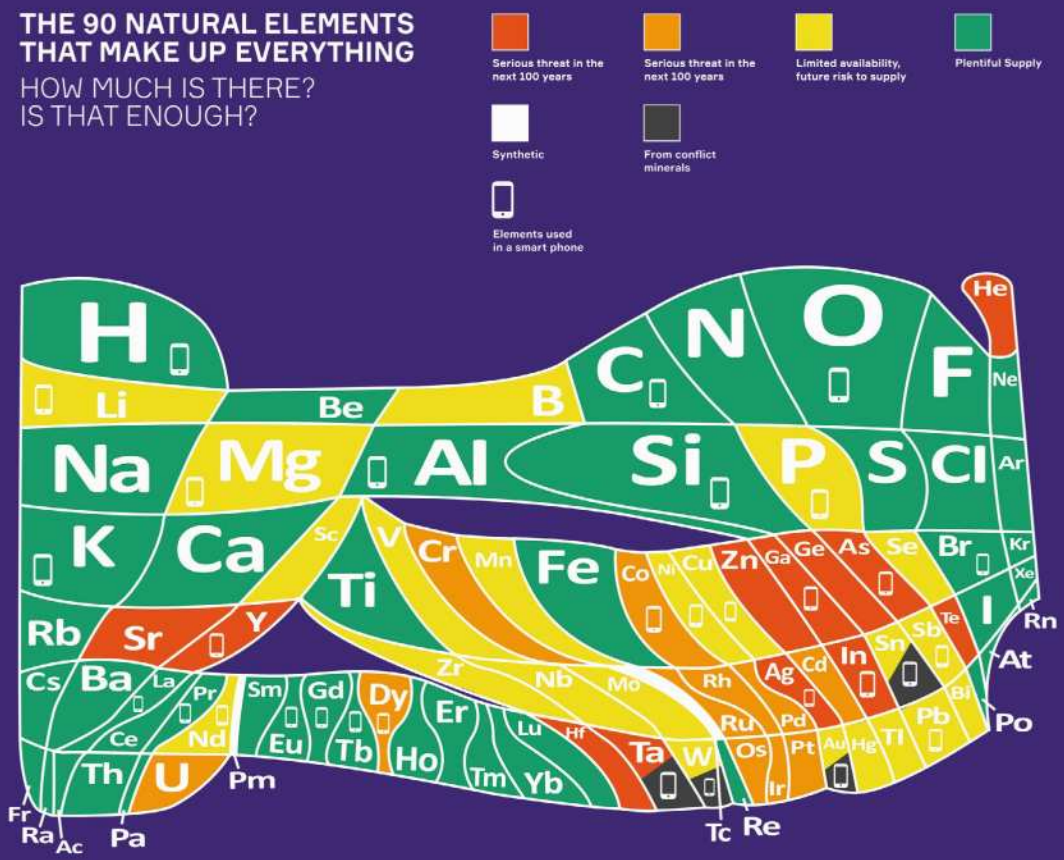
The EuChemS Division of Inorganic Chemistry held its biennial conference in Moscow as a celebration of the Periodic Table.

Focus on Youth

Young people were very strongly engaged by the European Young Chemists Network (EYCN) In a hugely successful video competition (In their element) and through the Pint of Science. These are described in detail in a separate EYCN entry. Young people also engaged enthusiastically with the video game commissioned by EuChemS, Elemental Escapades! A Periodic Table Adventure. This game follows the adventures of Jan, who has been sucked into a parallel universe and must complete some complex puzzles and tasks in order to collect up all the elements in groups so that (s)he can return to the usual laboratory environment. It is great fun, teaches some chemistry and had a huge impact when it was launched in the European Parliament by Catherine Stihler MEP. It has been downloaded >3000 times and continues averaging 5 downloads per day. It is available in 12 different languages thanks to translations by EYCN members.

Periodic Table of Scarcity

A new Periodic Table has been developed with the idea of placing it in all age appropriate schools in Europe. Placing in schools has been particularly successful in Italy, Israel, the Netherlands, Portugal and Turkey. Available in 31 different languages or scripts, this new Periodic Table highlights that there are only 90 naturally occurring elements and that they are all we have to build our diverse and beautiful world. The area occupied by each element represents its abundance in the earth's crust and the atmosphere whilst all the elements are color coded to show how quickly they are being dispersed by human usage. Elements that can come from conflict minerals are highlighted as are those in most smart phones.



After being launched in the European Parliament by Catherine Stihler MEP along with the oldest printed PT wallchart (recently found in St Andrews, see Scotland entry and the video game), news reports about it appeared in six continents. It was featured on Italian, US, Russian and German television, Canadian and South American on-line news channels, many radio programs on the BBC, UK local radio, Italian national and local stations, Swiss national radio and in almost all UK and Italian newspapers as well as magazines. It has been printed on mugs (Germany, EuChemS) and T-shirts for teachers and children (Israel, Portugal, Greece). It was sent to 50,000 RSC members and has been the subject of at least 50 lectures to schools and the public especially in Italy (Roadshow by Nicola Armaroli reaching >3000 teachers and learners) and the UK. In addition to the European Parliament, it has been exhibited and or talked about often with the old PT wallchart and sometimes with an unusual macramé Periodic Table at the Opening and Closing Ceremonies of IYPT (It was printed on the delegates bags at the Closing Ceremony), at the Scottish Parliament, at the Presidents' Summer Parties in the Royal Society of Chemistry and the Royal Society of Edinburgh, at the Portuguese Science Summit, the Italian Cultural Centre (London), the Greek closing Ceremony for IYPT, the Edinburgh Festival, The RSC IYPT Exhibition in London, the Royal Institution (London) during the filming of the Christmas lectures, the European Young Chemists meeting in Bremen, Germany, the EuChemS Green and Sustainable Chemistry Conference in Tarragona, on a travelling tour to 16 different cities in Japan, in a major science festival in Taipei and many other places. Other talks about it have been given in Belgium, Spain, Italy, Portugal, Greece, Germany, the USA and the Netherlands as well as many venues in the UK (England, Scotland and Wales).

Several articles have been written about this Periodic Table and it continues to be discussed. It is a living document which will be updated as and when new information becomes available. Its legacy must be that people will change their behavior. To increase the time between upgrades of electronic goods, to repair them when something goes wrong, to give them to others to use after the have finished with them and finally to hand them in for ethical recycling. It is simply not acceptable to keep these valuable resources in a drawer. In short, we must develop the circular economy for electronic goods. We need more and larger facilities for ethical recycling and we need to stop used electronic goods being exported to the third world to be mined for some elements often by children under appalling conditions. Not only is the massive overuse of electronic goods a potential disaster for some elemental resources but it creates a huge waste problem, which we have hardly begun to tackle. Other elements such as helium, which is used to cool the magnets of MRI scanners, must also be nurtured because if it is released into the atmosphere it will escape into outer space forever. Supplies are very limited so we must try to protect them. Particularly problematic are helium party balloons, which currently use 10 % of all helium, which all escapes into the atmosphere and is lost forever.

EUROPEAN YOUNG CHEMISTS' NETWORK (EYCN)

Number of IYPT Activities organized: 8
Estimated Number of People Reached by IYPT Activities: ~ 25,000

Chemistry Rediscovered

EYCN took the opportunity to organize the second edition of their Chemistry Rediscovered video contest with the theme 'In Your Element'. The contest turned out to be a tremendous success and >250 videos were submitted from 17 different countries across Europe. The submissions showed a remarkable variety of chosen topics and approaches, and delightfully most of the chemical elements were used as inspiration to make interesting and educational videos. After the jury's deliberation, the two winning teams were unveiled, and the winners had the opportunity to attend a special event at the Maison de la Chimie organized by young chemists during the 47th IUPAC World Chemistry Congress in July 2019 in Paris. Funding was provided by the Wilkinson Charitable Foundation for the top prize in the under 18 category, as well as by the American Chemical Society (ACS).

Pint of Chemistry

EYCN also coordinated and hosted the Pint of Chemistry night as a single-night outreach event across Europe. This event, which started as a collaboration between the EYCN and Pint of Science, in celebration of the IYPT2019 was supposed to bring chemistry (and in this case chemistry of various chemical elements) to the general public. The event was sponsored by the Royal Society of Chemistry (RSC) and supported by IUPAC, EuChemS and by the early-career teams of the national member societies.

The event took place in the second week of November 2019 in seven European cities: Liverpool (UK), Huddersfield (UK), Cambridge (UK), Ciudad Real (Spain), Paris (France), Bologna (Italy), and Munich (Germany). The organizing teams were composed of EYCN delegates and local Pint of Science volunteers. Overall, Pint of Chemistry reached outstanding results, such as collecting more than 100 people in multiple of the locations and therefore already leading to the start of planning next year's edition of the event.

PUBLIC ENGAGEMENT PARTNER ACTIVITIES

1001 INVENTIONS

Journeys from Alchemy to Chemistry

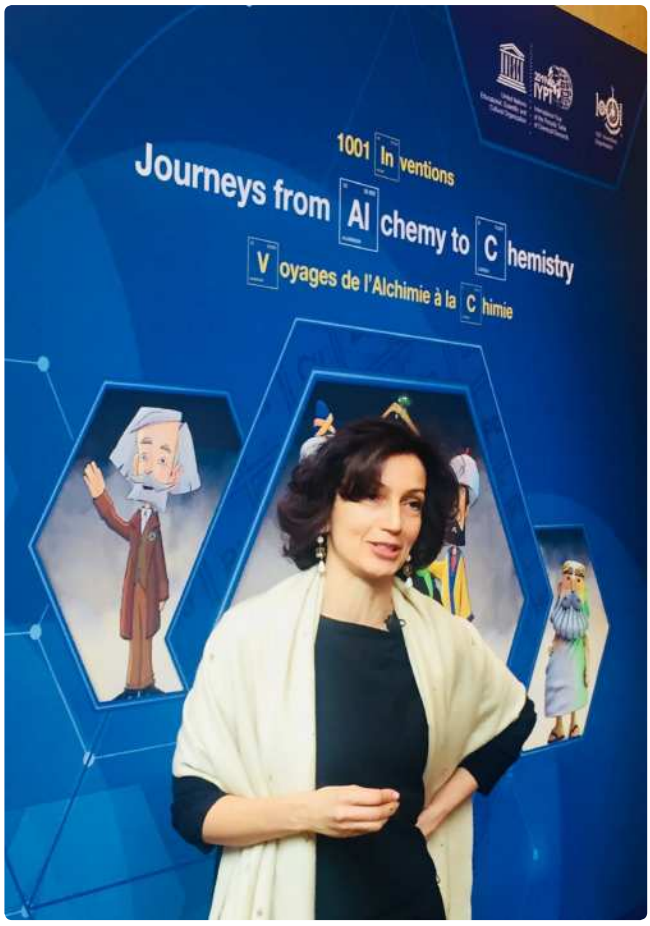
1001 Inventions, a British not-for-profit science and culture heritage organization, is the Public Engagement Partner of the International Year of the Periodic Table of Chemical Elements (IYPT2019). 1001 Inventions creates international educational initiatives to spark young people's interest in science while promoting diversity and inclusion. Since its creation in 2016, 1001 Inventions has engaged over 450 million people across the globe.

1001 Inventions launched the "Journeys from Alchemy to Chemistry" global educational initiative, in partnership with UNESCO and IYPT2019, to inspire a new generation to learn more about basic sciences and its importance for sustainable development. Also, to recognize humanity's shared scientific heritage leading to the rise of the science of chemistry. Through exciting learning experiences, the initiative focuses on contributions to the foundations of modern chemistry by lesser-known pioneers from ancient cultures and civilizations, in particular, the remarkable work of the pioneering polymath Jabir ibn Hayyan, in the 8th century. Jabir ibn Hayyan, better known as Geber in the West, vastly increased the possibilities of chemistry by devising and perfecting a number of chemical processes, discovering vital substances, and building precision instruments still used today. His contributions helped lay the foundation for modern-day chemistry.

Elements of the "1001 Inventions: Journey from Alchemy to Chemistry" initiative includes a short animated film narrated by renowned scientist, author and broadcaster Jim Al-Khalil that has been translated into six languages. Also, an interactive and immersive theatrical live show brings to life the characters and weaves in chemistry demonstrations related to their discoveries. The film and live show are coupled by hands-on workshops led by international and locally trained science explainers. Such experiential activities help illustrate important principles of chemistry and its applications relevant to our daily lives.

The success of IYPT2019 must be attributed to the collective efforts by the community that organized thousands of events in 2019 all over the world. 1001 Inventions is delighted to contribute to such success through the "Journeys from Alchemy to Chemistry" initiative that has engaged millions of people globally. In addition to direct engagement through attendance of events, over 15 million people have been reached through themed 1001 Inventions online and social media campaigns, viewers of freely available online film and users of the educational resources.

"1001 Inventions: Journeys from Alchemy to Chemistry" was launched during the IYPT2019 Opening Ceremony at UNESCO HQ in Paris. The initiative then rolled out in different cities around the world. **Select events organized by 1001 Inventions to celebrate IYPT2019 included the following:**



UNESCO Headquarters, PARIS

1001 Inventions launched its IYPT2019 activities at UNESCO headquarters in Paris in January 2019. Over 3,000 students joined the events organized for primary schools. Through the short animated, immersive on-stage experiments weaved in a theatrical performance and exciting hands-on workshops children were creatively introduced to the Periodic Table and the fascinating journey from alchemy to chemistry, across the ages, by remarkable pioneers from different backgrounds and cultures.

In attendance at the launch were Audrey Azoulay, UNESCO Director-General, and Professor Yuri Oganessian, one of the world's leading scientists, after whom the element Oganesson was named. The UNESCO Director-General said: "This is a fantastic occasion to talk to children and the public about the benefits of science, the journey of science and the contributions of the world to that journey. I want to thank 1001 Inventions for this partnership with UNESCO that helps explain how science has been a collaborative experience with one civilisation transmitting to another its progress and creating common good."

China Science Festival, Beijing

1001 Inventions took "Journeys from Alchemy to Chemistry" to the 6th China Science Festival in Beijing in August 2019. As one of the anchor exhibitors, 1001 Inventions led children and families through exciting learning experiences that focused on the foundations of modern chemistry by ancient cultures and civilizations.

After a Mandarin version of the short animated film, the audience enjoyed fun and educational on-stage experiments and hands-one workshops delivered by a team of both local and international science explainers. Thousands of children with their families also had the opportunity to get their pictures taken with 1001 Inventions' Jabir ibn Hayyan mascot.

Open Science Day, Montenegro

In October 2019, 1001 Inventions took part in the Open Science Days organized in Montenegro. 1001 Inventions partnered with the Bureau of Metrology, which screened the Journeys from Alchemy to Chemistry short animated video to all visitors, alongside hands-on activities and science demonstrations organized by the Bureau of Metrology, to spark children's interest in chemistry and physics, particularly those related to measurements.

All-Russian Science Festival, Moscow

1001 Inventions took part in the All-Russian Science Festival (NAUKA 0+) held on October 12-13, 2019. The Festival was organized by the Ministry of Science and Higher Education of the Russian Federation in collaboration with the Ministry of Education, the Moscow Government and the Lomonosov Moscow State University. This edition of the festival celebrated IYPT2019 by marking the 150th anniversary of its creation by the Russian scientist Dmitry Mendeleev.

This iteration of 1001 Inventions: Journeys from Alchemy to Chemistry was launched at the official opening ceremony at Pioneers Palace in Moscow, where festival activities dedicated to children were organized. The opening ceremony included a screening of the Journeys from Alchemy to Chemistry short animated film in Russian, which was also a feature of the programming children and families took part in over two days of the Festival together with on-stage experiments and hands-on workshops.

Berlin Science Week

1001 Inventions partnered with Berlin Science Week to produce a version of Journeys from Alchemy to Chemistry to primary schools. Over four days the 1001 Inventions team visited select primary schools and engaged with over 750 children, thanks in part to a contribution by the Ernest Solvay Fund.

To organize a fully immersive program for students, the 1001 Inventions team transformed classrooms into an inspiring space for the children to enjoy an exciting educational experience. The children left the workshops after being introduced to basic concepts of chemistry and learning that science exists not only inside labs but makes up an important part of their everyday lives. Towards the end of their experience students met the Jabir ibn Hayyan mascot who shared further information about the program and how students could access online the 'Educational Workshops' guide with a variety of themed activities.

Royal Society of Chemistry, London

In partnership with the Royal Society of Chemistry (RSC), 1001 Inventions organized in December four days of exciting activities to celebrate IYPT2019. Over 1200 primary school students and home-schooled children attended events held at the RSC's historic building at Burlington House in London helping draw them closer to the exciting world of chemistry.

After a screening of the Journeys from Alchemy to Chemistry short animated video, children enjoyed the live show which included references to British famous chemists, such as Nobel Prize winner Dorothy Hodgkin. Following the participation at engaging hands-on workshops led by local post-graduate students from different backgrounds and cultures, participants left with a set of resources supplied by the RSC.

Gemma Woods, Manager, Special Projects at the RSC said: "The International Year of the Periodic Table is a wonderful opportunity for us to celebrate this vital tool, our profession and our communities. We are delighted to be working with 1001 Inventions to bring to life the Periodic Table and inspire the next generation of potential chemists."

Maker Faire Cairo

In February 2020 Journeys from Alchemy to Chemistry made it to Egypt where thousands of children and young people joined the anchor event at Maker Faire Cairo. At this popular family-friendly showcase of invention and creativity, visitors flocked to watch the Arabic version of the animated film and were then dazzled with a bit of mystery as they enjoyed exciting on-stage demonstrations introducing many chemical processes and reactions in a fun way.

UK Alchemy to Chemistry School Fair Program

In the UK, 1001 Invention together with the Royal Society of Chemistry launched the Journeys from Alchemy to Chemistry School Fair Program. Through this Program schools receive educational resources and a grant to produce their own Journeys from Alchemy to Chemistry themed School Fair, furthering the reach of IYPT2019 to communities throughout the UK.

IYPT2019 – Enduring Legacy

In addition to events organized around the world, a themed Educational Resources Guide has been created to allow audiences to continue their journeys and to carry the inquisitiveness and curiosity sparked at Journeys from Alchemy to Chemistry events into their schools and communities. This Guide, together with the animated video are available online for free downloading to help extend the learning to youth, teachers and families around the world ensuring an enduring legacy for IYPT2019.

The spirit of IYPT2019 lives on as 1001 Inventions continues to present Journeys from Alchemy to Chemistry related programming around the world in 2020 and beyond. More details about this global educational initiative on: https://www.1001inventions.com/chemistry

ALL-RUSSIAN SCIENCE FESTIVAL NAUKA 0+

NAUKA O+ Science for All: Interactive Chemistry Exhibition

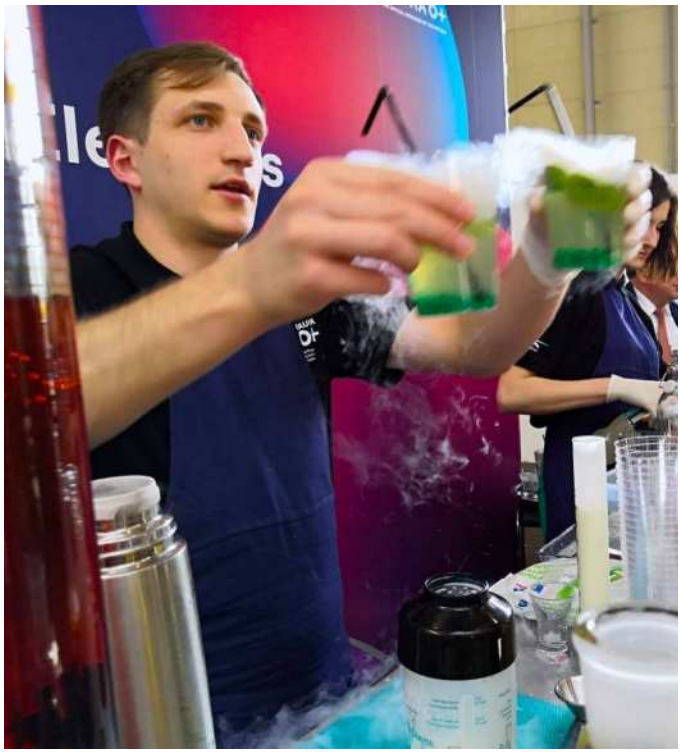
The All-Russian Science Festival NAUKA 0+ was the official operator of the Opening ceremony of the International Year of the Periodic Table of Chemical Elements in Paris and Moscow. Its mission is to promote science and encourage young people to study and dedicate their lives to academic research. In 2019, the Festival of Science was dedicated to the International Year of the Periodic Table of Chemical Elements. More than 5 million people attended the lecture and exhibition programs. The Mobile Chemical Education Exhibition of the Science Festival NAUKA 0+ under the auspices of UNESCO.

Outstanding scientists, including Nobel Prize winners, shared their knowledge and presented science in all its different aspects on the Festival sites through the exhibition of innovative achievements of universities and other scientific organizations, talks on the latest discoveries and developments, public educational show programs.

An exhibition dedicated to the 150th anniversary of the Periodic Table of Chemical Elements was held during the year:

RUSSIAN INVESTMENT FORUM, SOCHI
FEBRUARY 14-15, 2019

HANNOVER MESSE - 2019, HANNOVER, GERMANY
01-05 APRIL 2019



INTERNATIONAL ARCTIC FORUM «THE ARCTIC – THE TERRITORY OF DIALOGUE», ST. PETERSBURG
09-10 APRIL 2019

MOSCOW INTERNATIONAL EDUCATION SALON
10-13 APRIL 2019

DAY OF CHEMISTRY AT LOMONOSOV MOSCOW STATE UNIVERSITY, MOSCOW
MAY 23, 2019

INTERNATIONAL ECONOMIC FORUM, ST. PETERSBURG
06-08 JUNE 2019

INTERNATIONAL ECONOMIC FORUM VLADIVOSTOK
04-06 SEPTEMBER 2019

MENDELEEV CONGRESS ON GENERAL AND APPLIED CHEMISTRY, ST. PETERSBURG
09-13 SEPTEMBER 2019

RUSSIA-AFRICA SUMMIT, SOCHI
23-24 OCTOBER 2019

INTERNATIONAL SCIENCE FESTIVAL BEIJING, CHINA
02-05 NOVEMBER 2019

INTERNATIONAL YEAR OF THE PERIODIC TABLE OF CHEMICAL ELEMENTS CLOSING CEREMONY TOKYO, JAPAN

DECEMBER 05, 2009

SCIENCE FESTIVAL NAUKA 0+ AT THE MOSCOW STATE UNIVERSITY OPENING CELEBRATIONS

The biggest Periodic Table Wall in Moscow The colorful representation of the Mendeleev Table was over 67 meters long and 9 meters high. Can you imagine a 20-storeyed skyscraper?

Reports from other sponsor and society activities

PHOSAGRO®

The main sponsor of the IYPT2019 was PhosAgro. Due to their focus on the sustainable development goals and their great relations with both UNESCO and the UN, PhosAgro was chosen to be an official partner. They were involved in several main events and a few of them are displayed below.

Opening Ceremony of the International Year of the Periodic Table of Chemical Elements

Prior to the Opening Ceremony in the UNESCO Headquarters in Paris, France on the 29th of January 2019 PhosAgro joined the IYPT2019 as a sponsor. Thereby, they became an official partner of the celebrations throughout the year about the Periodic Table as well as a sponsor for the Opening Ceremony itself.

During the Opening Ceremony a delegation of PhosAgro was present, among which Andrey Guryev, member of the Commission of the Russian Federation for UNESCO and CEO of PhosAgro, one of the world's leading producers of phosphate-based fertilizers. In his speech, Andrey Guryev noted:

> We are proud and grateful for the fact that the UN chose PhosAgro to be a partner of the International Year of the Periodic Table. For me and my colleagues at PhosAgro, this is a great honor and recognition of our solid long-term partnership with UNESCO in the field of science and education.

> Eight years ago, during the International Year of Chemistry, it was in this very room that the historic decision was taken to launch the Green Chemistry for Life global program, which has been life-changing for dozens of young scientists from all around the world. This project was the first joint step on the path of long-term cooperation between PhosAgro and UNESCO, a path that now includes not only science but also our concern for the environment and the fight against hunger, two integral parts of the UN's sustainable development goals. At the foundation of this system are discoveries made by Dmitri Mendeleev 150 years ago.

> As one of the leading companies in the global fertilizer industry, PhosAgro is delighted to be involved in the continuation and development of the tremendous scientific heritage of this great Russian scientist in an effort to solve global problems, primarily to ensure food security in Russia and in the world. PhosAgro's efficient and pure fertilizers are in high demand in 100 countries throughout the world.

Our work doesn't end once our fertilizers have been sold; we share our knowledge and experience with consumers to ensure that our fertilizers are used in the most efficient way possible. We are responsible for the quality, safety and environmental friendliness of our products, which is why we devote significant resources to innovation and scientific developments.

PhosAgro is also home to one of the world's leading specialised research institutes for fertilizers and agrochemicals and the only institution of its kind in Russia, which de facto created the mineral fertilizer industry in our country and is now developing innovations that are enabling Russian fertilizer producers to successfully compete in every corner of the world. In addition, we also cooperate with the Russian Academy of Sciences and leading scientific institutions, and we invest at least 5% of our revenue into research and development.

We are also confident that the events that will take place to mark Mendeleev's discovery during the International Year of the Periodic Table will be extremely beneficial for the further development of technologies in the fields of green chemistry, sustainable development and food security. And, of course, we expect this year to introduce us to many new names and discoveries that will benefit humanity.

Other attendants of the Opening Ceremony were UNESCO Director-General Audrey Azoulay, Russia's Minister of Science and Higher Education Mikhail Kotjukov, President of France's Académie des Sciences, Pierre Corvol and 2016 Nobel Laureate Ben Feringa.

XXI Mendeleev Congress on General and Applied Chemistry, 9-13 September 2019, Saint-Petersburg

From the 9th till the 13th of September 2019 the 21st Mendeleev Congress on General and Applied Chemistry took place at the St. Petersburg Mining University. This conference, organized under the auspices of the International Union of Pure and Applied Chemistry (IUPAC), was one of the main events in the International Year of the Periodic Table of Chemical Elements. PhosAgro was the general sponsor of the Mendeleev Congress.

Over 2,500 congress participants were addressed by Russian Prime Minister Dmitry Medvedev, Russian Minister of Science and Higher Education Mikhail Kotyukov, IUPAC President Zhou Qifeng, President of the Russian Academy of Sciences Alexander Sergeev, St Petersburg Governor Alexander Beglov, St. Petersburg Mining University Rector Vladimir Litvinenko, PhosAgro CEO Andrey Guryev and the Deputy Director of the Art, Science and Sport Foundation, Fatima Mukhomejan.

To open the congress, Alexander Sergeev of the Russian Academy of Sciences read out welcoming remarks on behalf of Russian President Vladimir Putin. President Putin noted that the discovery of the Periodic Law of Chemical Elements "had a truly revolutionary impact on the development of all natural sciences, and it enabled humanity to take a confident step forward on the path to understanding the universe.

> It is gratifying that, in honor of the anniversary of this momentous discovery for the entire scientific world, 2019 was declared the International Year of the Periodic Table of Chemical Elements. I am certain that this prestigious congress, which brings together well-known scientists, representatives of leading research schools and major international scientific organizations, will be the Year's key event."

In his opening remarks, Russian Prime Minister Dmitry Medvedev quoted Mendeleev: "it is impossible to foresee the limits of scientific knowledge". Based on this principle, Russia has made support for promising research and talented scientists a state priority.

> We are trying to do everything we can to continue the great traditions of the past, the traditions of great scientists. What is most important is that new talents emerge who are capable of changing our world for the better.

PhosAgro CEO Andrey Guryev noted that it was a great honor for his company to have an opportunity to be involved in developing the incredible scientific legacy of the great Russian scientist Dmitry Mendeleev, who is also the founder of agricultural chemistry in Russia.

> It is obvious for us at PhosAgro that, without an effective partnership between science and business, it is impossible to ensure sustainable development and to solve the global challenges facing humanity", he said in addressing the congress participants.

PhosAgro's CEO spoke about the Company's close cooperation with Russian and international scientific organisations, through which PhosAgro is responding to global issues such as hunger and soil degradation, while also helping ensure global food security and caring for the environment, and improving production efficiency at the same time. Mr Guryev promised that PhosAgro would make every effort to ensure that this year sees further integration of Russian basic science, real-world business and global international institutions in the area of sustainable development.

The first day of the 21st Mendeleev Congress ended with a gala reception hosted by PhosAgro for participants and distinguished guests. The theme of the event was "Chemistry joins us together".

The 6th Award-Giving Ceremony of the PhosAgro/UNESCO/IUPAC international grant program Green Chemistry for Life

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has awarded grants for research in the field of green chemistry to leading young scientists from around the world in conjunction with PhosAgro Group and the International Union of Pure and Applied Chemistry (IUPAC).

The ceremony was held at UNESCO headquarters in Paris and was timed to coincide with World Science Day for Peace and Development on the 10th of November 2019. In attendance were UNESCO Assistant Director-General Shamila Nair-Bedouelle and Deputy Director-General Xing Qu; Peggy Oti-Boateng, Director of UNESCO's Division of Science Policy; Natalia Tarasova, Director of the Institute of Chemistry and Problems of Sustainable Development at Dmitry Mendeleev University of Chemical Technology of Russia and a Past-President of IUPAC; Professor Pietro Tundo of Ca' Foscari University of Venice, UNESCO Chair on Green Chemistry and Chair of the IUPAC Interdivisional Committee on Green Chemistry and Sustainable Development; John Corish, Chair of the International Scientific Jury for the Green Chemistry for Life project and a professor at the School of Chemistry at Trinity College, University of Dublin; Nicole Moreau, Chair of the Scientific Board of UNESCO's International Basic Sciences Program; and Andrey A. Guryev, PhosAgro CEO and a member of the Commission of the Russian Federation for UNESCO.

Since the program's launch in 2014, the authoritative international scientific jury consisting of 13 scientists from 11 countries has reviewed more than 700 applications from 120 countries submitted by young scientists conducting advanced research in the field of green chemistry. The diverse origins of the winners demonstrates the program's global reach, with 41 young scientists from 29 countries in Asia, Africa, the Middle East, Europe and Latin America having already received grants.

In 2019, the international scientific jury selected seven winners: Jesús Campos Manzano (Spain), María Antonieta Fernández-Herrera (Mexico), Abu Ashfaqur Sajib (Bangladesh), Wilbert Mtangi (Zimbabwe), Sara Abdel Hamid Abdel Gaber (Egypt), Hamdy Hefny (Egypt) and Galina Kalashnikova (Russia).

The work of all these young chemists is aimed at creating breakthrough technologies focused on environmental protection, healthcare, food, energy efficiency and the management of natural resources.

AMERICAN CHEMICAL SOCIETY (ACS)

The American Chemical Society (ACS) was an active and enthusiastic participant in the 2019 International Year of the Periodic Table of Chemical Elements (IYPT 2019). In addition to participating in official IYPT activities through UNESCO, ACS members and affiliated groups held dozens of events across the world and engaged thousands of people. ACS promoted IYPT2019 at events, through publications, and with a dedicated webpage to share information, materials, and have ACS member-organized events. Below is a short list of some of the highlights from the ACS IYPT activities.

ACS Activities and Events

Collaborative Events with Non-ACS Organizations

- IYPT Opening Ceremony, Bonnie Charpentier, IUPAC, Paris, January 29
  - > 450 web views through ACS webcast. International launch ceremony at UNESCO HQ in Paris, live-streamed remarks given by ACS President Dr. Bonnie Charpentier. 1,000 ACS bags distributed.
- Events at the U.S. Congress
  - > IYPT Congressional Reception, February 28
    - *Over 250 attendees. Congressional IYPT-themed reception for congressional and agency staff. Remarks given by ACS Past-President Dr. Peter Dorhout. Partnered with BASF, ACC, ASBMB, SACNAS, NOBCChE, AACT, Chemical Education Foundation; all had display tables.*
  - > ACS & Battelle Element Slam: November 19: 50 attendees, including seven Members of Congress. Early career scientists from six U.S. Department of Energy National Labs presented in a poetry slam style competition at the U.S. Capitol. Each participant gave a 5-minute «lightning talk» about their favorite element in celebration of IYPT. The winning element was Titanium as presented by Dr. Teresa Palazzo from PNNL.
- Landmark Ceremony to honor the "Discovery of Transuranium Elements at Berkeley Lab", Lawrence Hall of Science, Berkeley, California, August 11.
  - > Approximately 150 attendees. Rededicated landmark and moved plaque to an area that was publicly accessible.
- ACS & NSF: IYPT Colloquium "Perspectives in Chemistry: 150 Years of the Periodic Table", November 20.
  - > ACS, in partnership with the National Science Foundation, highlighted chemistry breakthroughs enabled by our understanding of the periodic table during a full-day colloquium and reception at the National Academies in Washington, D.C.

National and Regional Meetings

- ACS Orlando National Meeting – March 30-April 2
  - > IYPT Presidential Outreach Event: Over 340 participants and 48 volunteers. ACS President Dr. Bonnie Charpentier presented the Orlando Science Center with a Salute to Excellence Award.
  - > C&EN and ACS on Campus IYPT Pub Trivia Night. Over 100 competitors.

  - > Celebratory Reception with the ACS International Activities Committee (IAC): Over 400 registrants. IYPT photo booth & periodic table posters from ACS Hungary Chapter.

Wayne State University Periodic Table 17000 m^2

> Outreach Workshop: IYPT and Chemists Celebrate Earth Week - Roughly 40 students attended. The ACS Committee on Community Activities (CCA) updated their annual spring workshop for undergraduate students to include suggestions on how to celebrate IYPT.

> ACS Theater Presentation: 1,900 views on Facebook Live. Presentation gave information on IYPT and shared how to get involved. IUPAC announced group of Periodic Table of Younger Chemists winners.

- ACS San Diego National Meeting, August 25-29

> ChemLuminary "Elements of our Success", IYPT Themed Awards

> Returning Events:

- *#IYPT2019 Social Media Wall*
- *Periodic Table giveaways at the ACS Booth*
- *CCA Presidential Outreach Event*
- *IAC Reception*

> IYPT Related Symposia:

- *C&EN and EAC symposium honor of Sir Martyn Poliakoff capped with a live Q&A (recorded) and potential magazine signing.*
- *HIST: 150 Years of the Periodic Table*
- *CHED: UN Sustainable Development Goals: Unique Opportunities for the Chemical Enterprise*

ACS Member-Initiated Events

- NEACT Conference, «The Periodic Table", Concord, MA, July 29-31.
- ACS Chemists with Disabilities Committee, 3D printed periodic table highlighting disabilities to be presented at CERM, National Meeting in San Diego, August 25-29.
- IYPT Speaker: Periodic Table Author Theodore Gray, Olympia, Tacoma, and Leavenworth, WA, October 2-5.
- Puget Sound Local Section sponsoring IYPT themed speakers Dr. Daniel Burgard and author Theodore Gray at WCCTA 27th Annual Conference, October 4.
- World's Largest Periodic Table, Allendale, MI, October 19
- IYPT & Mole Day Celebration, Collin College-McKinney Campus, October 23.

Outreach

- Government Outreach
  - > U.S. Congress Resolution: S.Res.283 - A resolution expressing support for the designation of 2019 as the «International Year of the Periodic Table of Chemical Elements.» Passed unanimously.
  - > Resolutions passed in U.S. State Legislatures: Puerto Rico, South Carolina, Massachusetts, California, Texas, Vermont, Washington

- Communications, News & Publications
  - > Chemical & Engineering News (C&EN)
    - *C&EN IYPT Landing Page - "Celebrating the Periodic Table": 5,976 page views in 2019. Launched January 7, new material released monthly.*
    - *Total page views for IYPT related articles: 97,842 page views*

- Online Engagement
  - > #IYPT2019: ACS social media accounts used the hashtag throughout the year to discuss ACS IYPT-related activities and digitally participate in the global IYPT community.
    - *Twitter: 196 posts with 1.3M impressions; Facebook: 118 posts with 1.66M impressions; LinkedIn: 55 posts with 217,120 impressions*
  - > #PeriodicPlayoffs: ACS ran a March Madness style tournament for the elements of the periodic table where people voted on Social Media for their top 64 elements, then we matched them head to head each week leading up to the National Meeting in Orlando where Silver was declared the winner.
    - *Impact: Nearly 500,000 social impressions, 8,900 votes from 7,800 unique visitors, over 14,000 page visits, over 1,000 downloads of the printable playoff bracket.*
  - > ACS Program in a Box: The Evolving Periodic Table and its Incredible Elements, February 26
    - *Activity: Interactive Broadcast targeted towards student university chapters and local sections held twice annually. Theme corresponded with IYPT. Distributed IYPT giveaways.*
    - *Impact: 10,104 attendees with 402 groups registered/participated live.*
  - > Which Periodic Table Element Are You?
    - *Activity: Buzzfeed quiz, released May 20: Impact: 8,000+ views, about 3,700 clicks came via the bit.ly link used in ACS social media posts.*
  - > Webinar: The Next Element: How Chemists are Expanding the Periodic Table- May 29
    - *Impact: 744 registrants and 316 Live Attendees, 1,281 YouTube views to date*

Grand Valley State University

ACS IYPT2019 webpage transformed into evergreen periodic table website: www.acs.org/IYPT

ROYAL SOCIETY OF CHEMISTRY UK (RSC)

It's been our great privilege to lead the UK's contributions to the International Year of the Periodic Table (IYPT). IYPT has allowed us to celebrate our profession, our members and our communities through the celebration of our most recognizable tool. From public lectures and outreach events to teacher resources and grants for member networks, themed journals and books, the RSC worked to inspire people of all ages, experience and backgrounds to engage with the Periodic Table of Elements. The flagship activities delivered by the RSC to celebrate IYPT includes:

Story of the Periodic Table exhibition

The Story of the Periodic Table Exhibition was a free to attend, public exhibition open in the RSC's London Office for two weeks in August 2019. Exhibits were on loan from St Catharine's College, University of Cambridge and alongside what is thought to be one of the earliest examples of a classroom Periodic Table (on loan from University of St Andrews) and a copy of the more recent EuChemS Periodic Table, told the story of the periodic table from its conception through to its modern day versions. The exhibition received over 1,600 visitors during the 15 days that it was open. The audience was diverse including scientists, non-scientists, international visitors and families. The response to the exhibition was overwhelmingly positive with visitors enjoying the contrast of old and modern exhibits.

Artefacts from The Story of the Periodic Table exhibition at Burlington House in London: © Royal Society of Chemistry

IYPT Public Lectures

20 free to attend public lectures focusing on the history, science and value of the periodic table were delivered by high profile speakers across the UK and Ireland in association with Science Centres, Universities and other scientific societies. The lectures attracted 1,800 members of the public and were tailored to attract high science capital audiences to some events whilst appealing to the general public for others. The RSC also held joint lectures with the Geological Society (to celebrate IYPT and the Geological Society's year of Carbon), the Royal Institution and other sister institutions and societies throughout 2019.

Peter Sadler, Professor of Chemistry at the University of Warwick, lectures in celebration of the IYPT: © Drew Forsyth/Science Museum Group

Grants and Funding Opportunities

The RSC awarded a total of over £83,000 in individual and member network grants in support of 97 global projects designed to engage diverse audiences and promote IYPT to the wider public. Grants were awarded in India, Italy, Belgium, South Africa, New Zealand, Finland, Nigeria, Tunisia and the UK and Ireland.

Projections

In celebration of IYPT, the RSC projected the Periodic Table on to 11 university buildings around the UK and Ireland. The animation not only marked the 150th anniversary of the Mendeleev periodic but also highlighted the importance of saving our precious elements. Through these events we were able to engage with over 2,000 members of the general public and start the discussion around the sustainability of elements used in mobile phones and other electronic devices (see below). The projection was also live streamed to events at the Scottish Parliament and to events held in the Royal Institution (RI).

An Open House visitor to the RSC's Burlington House in London inspects a bespoke scientific periodic table installation: © Royal Society of Chemistry/Ash Knotek

1001 Inventions is making chemistry interactive: © Royal Society of Chemistry/Rhys Thwaites-Jones

Elements in danger

Many elements are critical to our daily lives, but they are in limited supply. Many of the elements used in consumer tech exist in the earth in tiny proportions, and the process needed to mine and refine them comes at a considerable environmental cost. Not only that but these elements are also used in everything from sustainable technology to medical treatments.

During IYPT, we commissioned a survey from IPSOS Mori on people's technology habits. We found that there could be as many as 40 million old devices sitting unused in people's homes in the UK alone.

In August 2019, we launched our 'Elements in danger' campaign – a global campaign to raise awareness of the rare and special elements in our technology, and the need to reduce our consumption before it's too late. The story made headlines around the world.

Since the campaign launched:

- Numerous individuals and organizations have got in touch to ask questions, offer support, or suggest collaborations.
- Members of parliament in England, Scotland and Wales tabled motions calling on government to work towards sustainability goals for rare elements.
- We have given further interviews to TV stations, print journalists and podcasts.
- We are finalizing plans for a follow-up campaign in 2020, looking at the problem on a global scale.

1001 Inventions Interactive Schools Workshop

In partnership with the RSC, 1001 Inventions held a four day interactive workshop and exhibition in our London offices for primary aged school children called Journeys from Alchemy to Chemistry. The overarching objective was to employ experiential learning to spark children's interest in science and a passion for creativity and learning while promoting diversity and intercultural appreciation.

Pupils were treated to a live stage performance by actors depicting a modern day scientist, Jabir ibn Hayyan (also known as Geber), and pioneering experimentalist Al-Kindi. Following the theatre show, pupils rotated to different workshop stations where they engaged in demonstrations led by chemistry postgraduate students from several London universities. Follow up support material was made available online to parents and teachers.

Over 1,200 primary and home-schooled pupils in the London area, from diverse and 'hard-to-reach' audiences joined us across the four day exhibition.

The RSC's scarce elements campaign projected onto the University of Nottingham: © Royal Society of Chemistry

Professor Saiful Islam at the Royal Institution Picture: © Royal Society of Chemistry

Collaboration with the Royal Institution (RI)

The RSC provided sponsorship for three joint IYPT events with the RI:

- Family fun day (attracting families with high scientific capital to engage with activities such as exploring elements in food, the chemistry of smells, Element Play Your Cards Right and the creation of a giant, hand-crafted periodic table).
- For Your Inspiration: The Elements of Success (a careers aimed at inspiring the next generation of chemists by demonstrating the diversity and wealth of chemistry careers to this age-group). Professor Saiful Islam gave an engaging lecture followed by a Q&A session. The lecture was supported by exhibition stands, experiments and explanations from a dozen university and industry groups and companies.
- Royal Society of Chemistry, Chemistry Week 2019: Saving precious Elements (a panel event hosted by the RSC and the RI. Prof Andrea Sella (UCL), Prof. Margaret Bates (University of Northampton), Dr. Tim Gabriel (Manchester Metropolitan University, Janet Gunter (The Restart Project) and Victoria Gill (BBC Science Correspondent) spoke at the event to raise awareness of our campaign around precious elements found in electronic devices and how they must be designed, developed and disposed of in a more sustainable manner. 200 delegates attended.

Other activity

In addition to our flagship activities, the RSC also tailored much of its regular content and activities around IYPT. Highlights from across the organization include:

- The production of five additional teaching resource packs to support the promotion of IYPT in secondary schools across the UK
- Compound of Interest Elements campaign - Infographics now available to download free of charge and translated into multiple languages from the RSC IYPT website.
- Dedicated and specially commissioned content across the RSC journal and book portfolios.
- Distribution of almost 140,000 IYPT promotional items and merchandise including notepads, bags, pens, pencils, lanyards and t-shirts.
- The Members magazine, Chemistry World, published a variety of articles about different aspects of the Periodic Table in every monthly issue in 2019. It sent a poster with the RSC periodic Table on one side and the EuChemS Element Scarcity table on the other to all 50,000 RSC members with the January, 2019 issue

CHINESE CHEMICAL SOCIETY (CCS)

The activities held by the Chinese Chemical Society (CCS) and the China Science and Technology Museum (CSTM) to celebrate IYPT 2019

Date	Event	Organizer	Location
24th March 2019	IYPT 2019 launching ceremony	CCS, CSTM	Beijing, China
5th May 2019	A Song of the Periodic Table of the elements in Chinese	SIOC	Shanghai, China
19th-26th May 2019	Periodic Table Exhibition at Beijing Sanlitun	CCS	Beijing, China
21st May 2019	Building a Periodic Table in Beijing	ICCAS	Beijing, China
24th May 2019	IYPT 2019 Excellent Popular Science Book Recommendation	CCS	China
30th May 2019	Periodic Table of Young Chinese Chemists	CCS	China
20th June - 31st December 2019	Periodic Table Challenge	IUPAC, CCS, CSTM	China
10th July - 23rd August 2019	The Periodic Law – A Theme Exhibition about Periodic Table of Chemical Elements	CCS, CSTM	Beijing, China

IYPT 2019 launching ceremony

On 24th May 2019, the IYPT 2019 launching ceremony was held by CCS and CSTM in China Science and Technology Museum. Yin Hao, Director of the CSTM, Han Buxing, the member of CCS Standing Board, Fan Qinghua, the Secretary General of CCS, Zheng Suping, the Deputy Secretary General of CCS, and Jiang Shangda, Assistant Professor at Peking University attended this ceremony. After this ceremony, Jiang Shangda gave a lecture about the Periodic Table of Elements as a prelude to series popular science lectures co-organized by CCS and CSTM. (https://www.chinesechemsoc.org/do/10.5555/b163aa3a-b523-49bd-81ac-47347247fb7f/abs/)

Periodic Table Exhibition at Sanlitun, a chic area in Beijing

On 18th May, CCS held a periodic table theme light box exhibition at Sanlitun, known as a Beijing crowded and fashionable district surrounded by Embassies. This 'cross-border' science exhibition was last for one week on 19-26 May.

To celebrate the 150th anniversary of the Periodic Table of the Elements, CCS selected the fashionable commercial district for the exhibition venue in order to expose to tourists with science, and in particular chemistry. CCS selected 118 young chemists in China to serve as "Chinese Young Chemist Element Spokesmen/Spokeswomen" for the exhibition. Displayed on 8 themed light boxes, the 118 elements contained QR codes that, when scanned, introduced the 118 young chemists and their research, as well as some of their thoughts on the 118 elements. (https://www.chinesechemsoc.org/do/10.5555/d399267c-be7b-4ac7-acf4-913c3155829f/abs/)

A Periodic Table Song for chemical elements in Chinese

A song is composed with adaptation from a popular song in China, «The Chinese Uncommon Words». Thus this song is named as «The Chemistry Uncommon Words», referring to the elements. It's a special commemoration of the 150th anniversary of the PT of elements. The actors are composed of Chinese scientists and scholars.

Please find this video at: https://m.weibo.cn/status/4368695084610647?sourceType=weixin&wm=5091_90006&featurecode=newtitle&from=timeline&isappinstalled=0&display=0&retcode=6102 From 1 minute 08 seconds, it enters into a section of singing each element in Chinese words.

Building a Periodic Table Wall in Beijing

On 18th May, the Institute of Chemistry, Chinese Academy of Sciences (ICCAS) held an Open House for the public with the theme of "Chemistry Creates a Better Life – a Memorial to the Mendeleev Periodic Table of 150 years". ICCAS decorated a 10-storey building wall with a periodic table, probably the biggest one in the world.

Zhang Deqing, Director of the ICCAS, said in an interview that scientific research may seem boring, however, it contains infinite mysteries. He gave the periodic table of the elements as a perfect example and commented that its discovery was a major breakthrough in understanding the laws of the objective world. «When you look carefully at this table, you will certainly feel the wonder of the material world,» he said. (https://www.chinesechemsoc.org/do/10.5555/ffdc344c-192b-4cb3-bae6-a4e3211f66b3/abs/)

IYPT 2019 Excellent Popular Science Book Recommendation

To popularize and spread the "element" knowledge and to encourage young people to understand the interests of chemistry, the CCS held an "Excellent Popular Science Book" recommendation activity. After selection, according to the multi-dimensional indicators such as relevance, science, interest, diversity, innovation, finally 12 excellent books stood out. (http://www.chemsoc.org.cn/IYPT2019/a3219.html)

Periodic Table of Young Chinese Chemists

To celebrate the IYPT 2019, to spread the knowledge of elements and chemistry, and to show the contemporary young Chinese chemists, CCS selected 118 young chemists in China to serve as "Chinese Young Chemist Element Spokesmen/Spokeswomen". (http://www.chemsoc.org.cn/a3225.html)

Periodic Table Challenge

To celebrate the 100th anniversary of the International Union of Pure and Applied Chemistry (IUPAC) and the International Year of the Periodic Table of the Chemical Elements (IYPT 2019), in January 2019, IUPAC released the IUPAC Periodic Table Challenge and this activity will continue throughout the year. On June 20, authorized by the IUPAC, the CCS translated the Challenge questions/answers generated by the IUPAC Periodic Table Challenge project team, and released the Chinese version of the Challenge together with the China Science and Technology Museum.

Till 17th November 2019, there were 143947 views
35337 people who tried to answer the PT questions
23479 people who completed the PT questions

(https://www.chinesechemsoc.org/do/10.5555/a480e545-6847-4ada-8c1e-7c5ad3d3afb7/abs/)

The Periodic Law – A Theme Exhibition about Periodic Table of Chemical Elements

Exhibition date: July 10 - August 23
Location: China Science and Technology Museum, Beijing, China
Organizers: Chinese Chemical Society & China Science and Technology Museum

This exhibition has a total area of 1,500 square meters with 4 major parts:

1. Key people and techniques in the field of chemical element research from the time of the ancient period to the time when Mendeleev proposed the periodic table of elements in 1869
2. After Mendeleev, the scientists further refined the periodic table of elements, and the property of the elements closely related to human beings and the human understanding to the periodic law
3. The application of the elemental cycle law in the aspects of chemistry learning, production and scientific research
4. On the basis of the above, the last part shows the extension of chemical laws to other laws on which humans understand and change the world

(http://www.chemsoc.org.cn/a3299.html)

CHEMICAL SOCIETY LOCATED IN TAIPEI (CSLT)

The Chemical Society Located in Taipei (CSLT) organized a lot of activities in collaboration with the National Taiwan Normal University (NTNU), supervised by Ministry of Science and Technology (MOST), Ministry of Education (MOE), Toxic and Chemical Substances Bureau, EPA, Executive Yuan (TCSB) and Department of Education of the Taipei City Government (DOE). A selection of these events can be found below.

Light shows in November and December 2019

101 Light Shows

Taipei 101 is a skyscraper located in Taipei. The 101-story building is 508 meters high. It was the world's tallest building from December 31, 2004 to January 4, 2010. Taipei 101 is one of the most iconic landmarks in Taipei. At night, the outer wall could be marked with light shows.

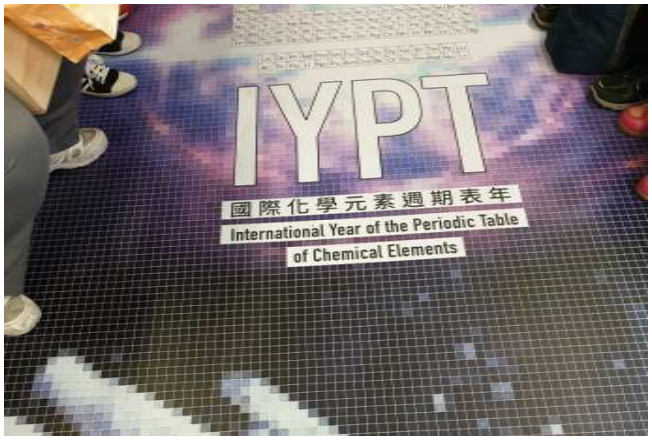
To commemorate the scientist behind the periodic table Dmitri Mendeleev, the team and Taipei 101 collaborated on bringing a celebratory IYPT Periodic Light Show to reality. Coincidentally, the chemical element Md, which was named after Mendeleev, was number 101 on the periodic table. The coincidence only made the light show at Taipei 101 even more attractive.

The light show had two stages. The first stage of the light show was text lighting. On November 14 and 15, 2019, two promotional messages were displayed: «Hydrogen is 1 and Lithium is 3», «What element 101 is?», «Md 101» (See Figures below), «In memory of Mendeleev", "International Year of the Periodic Table", and "IYPT in TW". The second stage of the light show was animated lighting. On December 13-14, 2019, IYPT commemorative animations displayed on the entire wall to convey "chemical elements are ubiquitous", "commemorate Mendeleev and IYPT", and "cherish the resources". The lightshow received positive feedback from both the general public and the academia. Related documentary videos could be viewed from the following links: https://www.youtube.com/watch?v=AMhKjycYqww & https://www.youtube.com/watch?v=97OAVcRuloE

Decorated MRT trains

To reach an even wider audience, the team designed two IYPT themed trains in Taipei MRT We adopted mosaic visual communication techniques to design two carriage paintings. The images of objects were divided into small tiles and each tile was embedded with chemical elements that constituted the individual object, see Figures below. Starting with hydrogen, the train was decorated with the birth of the planets, natural landscapes, living objects and human technological civilization to convey the message that everything was made from chemical elements. There were also short passages on the window introducing relevant knowledge with QR codes that take users to introductory videos on chemical elements. In this way, the activity not only used colorful images to decorate the carriage but also had educational implications.

The two decorated trains ran from December 11, 2019, to February 27, 2020, on the Bannam Line (Blue Line), and from December 23, 2019, to February 21, 2020, on the Tamsui Xinyi Line (Red Line). For related videos, please see: https://www.youtube.com/watch?v=cdUPrCuOyLU and https://www.youtube.com/watch?v=Yfh0K2TEfk4



IYPT Special Exhibition at the Science Center in Taipei

The celebration started with the special exhibition of «International Year of Periodic Table of Chemical Elements (IYPT)» co-sponsored by NTNU, CSLT, and the National Taipei Science Education Center (NTSEC) from June to August, 2019. The exhibition showcased a projection mapping work titled «118 Magic Cubes». The work presented the periodic table of chemical elements in a manner that infused the local culture, and introduced the unique features of 12 elements (the video could be viewed on the website: https://youtu.be/qoPJsjApuJg). Moreover, there were many other exhibits, such as a display of 118 element cubes that provided chemical information on all 6 faces of the cubes; a discovery timeline of the elements; a Periodic Table of Chemical Elements for persons with visual impairments; and Periodic Table made from middle school students' drawings.

Other worldwide activities

Below you can find a selection of IYPT2019 related activities around the world. The information provided below is on basis of the registered country information of the official IYPT2019-website (www.IYPT2019.org), material submitted by countries and a selection by the Management Committee co-chairs. Several sponsors and countries also made a contribution and their detailed activities are previously mentioned on the pages above.

ALBANIA

150 anniversary of the periodic table

On the 21st of October 2019 an event took place with 1) Information about the periodic table, 2) a biography of Mendeleev and 3) posters with the periodic table in Elbasan.

ALGERIA

Chemical Bonding

On the 28th of February 2019 an event was organized that provided a brief history of the evolution of the periodic table and all the properties. In order to show how the Periodic Table helps us in observing, we took electro negativity as an example and showed how it affects chemical bonds and chemical reactions.

Mendeleev and Periodic Table and Materials Science

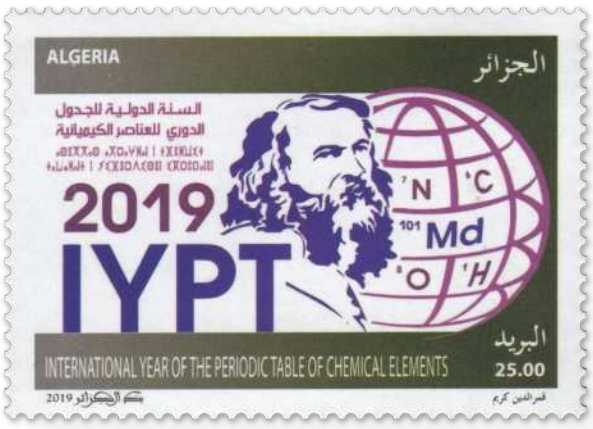
A special quiz competition on 'Mendeleev and Periodic Table' was organized throughout schools, universities and research centers on the 4th of November 2019 in Algeria.

Days on The Periodic Table of the Elements

On the 25th and 26th of November 2019 the Phytochemistry & Organic Synthesis Laboratory (POSL) organized the Days on the Periodic Table of Elements.

IYPT2019 stamp

In 2019 an official IYPT2019 stamp was released to celebrate the Periodic Table.



ARGENTINA

IYPT-Talks for a general audience and teachers

In the International Year of the Periodic Table, a series of talks were organized free of charge. They were intended for a general audience, and some of them for teachers. These talks were conducted between March and October 2019.

- Gestation of the periodic table of the elements over centuries
- Crystal structure of the elements and their link with the periodic table.
- How to make models in the classroom.
- Spectators from space.
- "Third dimension of the periodic table": electronegativity and its definition.
- A ride from the periodic table of the element to its "relatives": the nuclides
- What are the living organisms made of?: the biological Periodic Table
- Radioisotopes in science.
- They are present in medicine, archaeology, geology... and in everyday life.

Comodoro Rivadavia

The Department of Chemistry-Faculty of Natural and Health Sciences at National University of Patagonia San Juan Bosco organizes a Symposium on the 6th of December 2019 to celebrate the International Year of the Periodic Table of Chemical Elements. During this event, talks related to the periodic table were given, department members and students presented posters about education and research in chemistry, and there was an exposition of periodic tables, among other activities.

Mural: «La Tabla Periodica de los elementos»

A mural was made by 6th year Chemistry and Constructions of EEST (N 8, Juan Bautista Alberdi, Tolosa La Plata) on the occasion of the 150th anniversary of the publication of the Periodic Table of Elements.

The Periodic Table rockolla project developed a periodic table devoted to light and music and the The Chemical elements come from the stars project organized using exhibitions, conferences and workshops to involve the communities around Argentina in this important topic.

ARMENIA

Periodic table in Armenian alphabet

The Armenian alphabet has its link with the periodic table of chemical elements published by Russian chemist Dmitri Mendeleev in 1869. That is, the sum of the alphabetical characters' indexes in the old Armenian name of an element is equal to the atomic number of that element, although this is applicable to 7 elements known at the time of the invention of the Armenian alphabet: gold, copper, silver, iron, tin, lead, mercury. On the 30th of April students presented their findings on the history of the Periodic Table and the connection to the Armenian alphabet.

Periodic Table Talks

YSMU 'Heraci; High School organized several talks in April about the Periodic Table related to its origination, its history and its importance.

AUSTRALIA

IYPT Expo

On the 11th of August 2019 the Royal Australian Chemical Institute organized the IYPT Expo. At this all ages free family friendly event, visitors could experience the Periodic Table come to life. There was a wide range of chemistry experiences from the chemistry of fireworks and chocolate, experiments and workshops on chemical elements that are fundamental to everyday life.

Be in your Element!

On the 23rd of October 2019 chemistry students had the opportunity to select a chemical element from the periodic table and create a poster to explain its scientific significance from the time of discovery to 2019.

Largest Periodic Table of Elements

On the 6th of December 2019 Edith Cowan University, Western Australis revealed the decoration of one wall of a new science building with what it believes is the world's largest periodic table of the elements with a size of 662 square meters. See photo:

AUSTRIA

The Good, the Bad, and the Chemical

On the 3rd of October 2019 TU Wien and UNESCO Club Vienna collaborated to celebrate the IYPT2019 with lectures by Prof. Dr. Peter Weinberger, Prof. Dr. Marchetti-Deschmann, Anastasia Yatsko, Prof. Dr. Karl Kirchner, Dr. Gerald Bauer, Dr. Luka Omladič. The program ended with food, drinks and music.

150 Jahre elementare Weltordnung

This event on the 22nd of May 2019 in Salzburg consisted of two parts: 1) a seminar for teachers and students with four presentations on the role of the Periodic Table of Elements in chemistry, physics, astronomy and biology, and 2) a summary talk in the evening for the general public about the importance of the Periodic Table of Elements in all natural sciences.

AZERBAIJAN

Conference 150th Anniversary of the Periodic Table of Mendeleev

On the 8th of February 2019 a conference was held dedicated to the 150th anniversary of the Periodic Table of Mendeleev, held with the joint support of the Institute of Petrochemical Processes of the National Academy of Sciences of Azerbaijan and the Russian Information and Cultural Center in Baku.

BANGLADESH

Babipo IYPT Talk (মহাবশ্বিরে সুর | পর্যায় সারণী)

On the 31st of December the history of the Periodic Table was explained in the event. Some experiments were done live and the mechanism was explained.

1st Bangladesh ChemCarnival & Celebration of IYPT2019

On the 27th of July 2019 the ACS International Student Chapter, University of Dhaka proudly organized the '1st Bangladesh ChemCarnival-2019' and 'International Year of Periodic Table (IYPT) Celebration in Bangladesh'. There were different competitions like a chemistry quiz, a project display, a wall magazine, a undergraduate poster competition and speeches and posters about my favorite element. There were many other attractions like lectures related to chemistry in everyday life, career in chemistry and periodic table and a 'Chem-Show' for the participants with some demonstrations of interactive chemical experiments.

BELGIUM

IITC-MAM Conference Workshop on Materials in the Semiconductor Industry

On the 3rd of June 2019 a workshop was given in Brussels in which leading scientists and innovators reviewed the materials evolution in the industry, looked at trends in the logic, memory, packaging, IoT and power areas. They also addressed the associated metrology and sustainability challenges when introducing these new materials.

Celebrating 150 Years Periodic Table

KVCV, VeLeWe and Universiteit Antwerpen celebrated IYPT2019 on the 15th of June 2019 with keynote lectures of Eric Scerri, a world authority on the history and philosophy of the periodic table, Sammy Verbruggen, Titanium in the Periodic Table of Younger Chemists, and Jan Tytgat, director Government Affairs EU at Umicore, one of the world's largest precious metals recycling companies.

150 ans du Tableau de Mendeliev - 12 recherches à UCLouvain

A dozen UCLouvain researchers (Belgium) presented their research activities on a particular element: H, Li, C, N, Si, Cr, Ni, Ru, Bi ... Put in context for a wide audience of students and others, the posters will aim to demystify some of the elements that are ultimately part of our daily lives: new fuels, greenhouse gases, soil amendments, tomorrow's batteries, etc.

Christmas Lecture Faculty of Science

On the 14th of December Dr. Pieter Thyssen delivered a Christmas Lecture titled «Mendelejevs nightmare» at the Leuven University in Dutch.

BRAZIL

Brazil of chemistry

On top of IYPT2019 Brazil also commemorated the 63rd anniversary of the Brazilian Mater Chem Act, signed on June 18, 1956, by then President Juscelino Kubitschek, which made it possible to create Chemistry and established the specific attributions of each of the professionals directly related to Chemistry. The purpose of this project was to stimulate interest in chemistry and to emphasize the importance of this sciences and its professionals in the development of society. These lectures were given throughout the country.

Huge Periodic table at Belo Horizonte

On the 3rd of September 2019 the windows of the main building of the Federal Center for Technological Education of Minas Gerais (CEFET) became a very large periodic table (14m by 7m). It was displayed in one of the main streets of Belo Horizonte and is clearly visible to thousands of people passing by every day. A big sign is also placed in the street, where the UNESCO/IYPT logo is visible, together with the hashtag #IYPT2019.

Coesi Science Fair

On the 16th of October 2019 the commemoration of the IYPT2019 and presentation of science research activities took place in Aracaju.

The Elements in Your Hands

An event was organized on the 13th of November 2019 in Sao Paolo with the title: «The Elements in Your Hands: 2019 International Year of the Periodic Table» and the inauguration of a periodic table with everyday objects that represented the chemical elements.

BULGARIA

Living periodic table

On the 10th of May 2019 students arranged a living Periodic Table by wearing colored T-shirts and cards representing the periodic elements.

IYPT2019 stamp

In 2019 a special IYPT2019 stamp was released in Bulgaria to celebrate the Periodic Table.

The Periodic Table: A Masterpiece in the Magical Field of Chemistry

The Maths School organized a celebration on the 14th of June 2019, called “The Periodic Table: A Masterpiece in the Magical Field of Chemistry”. As most of the students were involved, there were various events throughout the day, such as a chemical competition and a magic chemistry show.

The Periodic System and the Space

On the 30th of October 2019 an individual student competition for 13 to 18 year old students was organized. They are from the schools of the Dimitrovgrad municipality. The purpose of the competition is to stimulate interest of students in both sciences: astronomy and chemistry.

CANADA

Chemistry Magic Show for IYPT 2019

On the 19th of January 2019 the Carleton University organized a special edition of its annual Chemistry Magic Show. The event amazed the audience with impressive and interactive demonstrations.

World’s Largest Periodic Table

The department of chemistry at Université Laval attempted to create the world’s record for the largest periodic table. This project has brought together the scientific community of the eastern Canada and has been an opportunity to celebrate the periodic table in a creative and fun way.

Timeline of the Elements: exhibit unveiling

On the 26th of October 2019 the Department of Chemistry and the Faculty of Science organized a special occasion to celebrate IYPT2019. During this occasion a large artistic mural as well as three interactive displays were unveiled.

CHILE

Mendeleev, The New Periodic Table and the student science societies

Juan Pablo Cid Ugalde, a graduate of USACH, organized a presentation on the 25th of June 2019 about Mendeleev and the new Periodic Table.

CHINA

See above under section major sponsors

COLOMBIA

Living mural - «meet and greet» with the elements

Students have organized a living mural on the 17th of May 2019 where each one will represent an element of the periodic table. They made stencils to paint t-shirts that resemble the periodic table. All members of the school community have been invited to the «meet and greet» the elements space.

IYPT2019 Invited lectures

On the 19th of July 2019 scientists whose research is closely related to the periodic table (mathematical structures behind the periodic table, super heavy elements structure and properties) lectured about the chemical elements and the periodic table to commemorate the 150 anniversary of Mendeleev's periodic table.

The Periodic Table and Astronomy

Lectures series entitled: The periodic table and astronomy that includes five conferences every Saturday from October 5 to November 2 at the Planetarium of Bogotá.

CONGO-BRAZZAVILLE

O Tableau

On the 27th of June 2019 a class of Congolese officers celebrated the 30th anniversary of their organization. For this special year, honoring Mendeleev Table, a contest was organized on the general knowledge of the symbols of the elements, applied to other subjects. It's called «O TABLEAU». The contestants came from eight high schools, each one represented by four pupils. They demonstrated a strategy associated with their general knowledge.

COSTA RICA

Celebración del Año Internacional de la Tabla Periódica de los Elementos y su 150 aniversario

The National University in Costa Rica celebrated IYPT2019 on the 22nd of August 2019 through an activity with the participation of high school students. The purpose of the activity was to generate in the people a rapprochement to The Periodic Table, and to the scientific knowledge product of the study of the elements and science in general. We did have the participation of Dr. Plinio Sosa Fernandez, chemist of UNAM, Mexican National Award of Chemistry 2018.

CROATIA

U potrazi za Mendeljejevim!

Elementary school students celebrate the IYPT2019 by playing an escape room game Searching for Mendeleev.

Symposium PSE and IUPAC

Symposium on the occasion of the 150th anniversary of the Mendeleev´s Periodic System of the Elements and the 100th anniversary of the International Union of Pure and Applied Chemistry – IUPAC on the 5th of December 2019 in Zagreb.

CURACAO

First complete Periodic Table in Papiamentu

On April 29th 2019, JCI CLIC in partnership with SKAIH, the only secondary school in Curacao with their native language of Papiamentu as language of instruction, is holding a ceremonial press release to introduce the first complete Periodic Table in Papiamentu to the native speakers of Papiamentu and the world. New words in Papiamentu were developed in this process, making our native language richer. The main goal is to use this new periodic table in the educational system in Curacao and Aruba.

CZECH REPUBLIC

International Children's Exhibition of Fine Arts Lidice

To celebrate IYPT2019 15,526 works of art from 70 countries were sent to Lidice Memorial. An international jury selected about 1,100 best examples to be exhibited. The ceremonial opening was held on May 28, 2019 in Lidice Memorial and National Technical Museum in Prague.

DENMARK

Det periodiske system fra Ac til Zr

During this seminar Ulla Gro Nielson explained why the periodic table is the chemist's bible and explored the fascinating information hidden. Why are 8 and 18 magical and why does sodium react violently with water while elemental gold and platinum exist in Nature? In addition, there were examples of how researchers today use the periodic table to design materials for water remediation, catalysis and energy. The talks were given eight times on several locations and dates between the 25th of April and the 25th of November 2019.

Banners: '150 years – one common language'

Exposition of the IYPT2019 and the periodic table in general by two large banners (8 by 12 m) on a publicly very exposed facade at the University of Copenhagen between the 28th of November 2019 and January 2020.

NKPT Meeting: Discussions about the Periodic Table

Discussions took place on the 3rd of December with two Danish publishers of printed small and lecture-hall-sized periodic tables to encourage them to strive for consistency with IUPAC conventions adapted to Danish.

FINLAND

The evening of Mendeleev's Periodic Table

To celebrate the 150th anniversary of the periodic table of elements, the Finnish Chemical Society hosted a special panel conversation, informal, educational event free for the public.

FRANCE

En voir de toutes les couleurs avec de l'or nanométrique

What if gold wasn't always yellow? Without knowing it, glassmakers of the Renaissance included gold nanoparticles into stained glasses for their intense ruby red color. Through chemistry experiments, we will show that by changing the size and shape of gold particles, it is possible to make them take various hues through an effect called surface plasmon resonance. Beyond the pleasure of the eyes, this phenomenon has applications in medicine and photonics. Event organized by ESPCI-LPEM, member of Université PSL on the 28th of January 2019.

Mendeleev 2019 contest launch

The UdPPC organized the «Mendeleev 2019» contest in French secondary/high schools. It aims at rewarding pedagogic and scientific projects within the commemoration of the 150 years of the Periodic Table of Chemical Elements. The official launch and the opening registrations took place on the 6th of September 2018.

Construction of a periodic table of elements

Students from the Middle School Hubert Fillay discovered chemical elements with a giant periodic table on the 4th of February 2019. Each element is illustrated with an identity card, samples and QR codes (videos of experiences, examples of use, etc.) Each box of the Periodic Table can rotate.

Le tableau périodique : 150 ans d'évolution

On the 21st of March 2019 the history of the periodic system and how it evolved from the early 1850 up to now was discussed in front of an assembly of around 450 high school students. It was the occasion to discuss the appearance of new concepts such as periodicity, atomic mass, atomic number, isotopes and quantum chemistry. It was illustrated with experiments around the discovery of some elements and the separation of lanthanides.

Voyage musical à travers «Les Eléments»/A Musical journey through «The Elements»

On the 4th of April 2019 a HiFi concert – multimedia conference aimed at musical emotion through excellence in Rambouillet. The principles are to introduce and to contextualize hidden masterpieces over 2000 years and over 5 continents, in some words, pictures and videos ; then to listen to them in their best interpretation with the best possible sound reproduction (high-quality HiFi system installed by Le Studio HiFi, Versailles). Whatever your luggage, embark on a musical journey through traditional and chemical elements, from fire, air, earth, water, ... to carbon, oxygen, silicon, uranium, etc., over several centuries and over several cultures!

Elémentaire, ma chère chimie!

Muséum d'Auxerre designed a temporary exhibition on atoms, elements and Mendeleev's periodic table from the 12th of May 2019 till the 25th of August 2019. Browse the periodic table and learn about famous chemists, from Arabic alchemists to Dmitri Mendeleev and Maria Curie. Discover why we are all made of stardust. Uncover the stories behind some of the most famous elements: gold, fluorine, lead, uranium...

La Nuit Mendeleiev

The Visiatome organized a convivial evening to discover the matter and the atoms on the 18th of May 2019. On the program were a conference, workshops and games.

Chancourtois, the Telluric helix and the prodigious history of element names

Pierre Avenas discussed the Telluric Screw and its role in the history of chemistry, as well as the origin of several element names. This event was organized at Mines ParisTech, member of Université PSL on the 17th of June in Paris.

Les métaux, la vie et le chimiste

As part of the program for its annual Nuit Sciences et Lettres, the École normale supérieure, member of Université PSL, presented «Les métaux, la vie et le chimiste» a theatre play on metals on the 7th of June 2019 in Paris. Often accused of being toxic, metals are however crucial to life and responsible for paramount events in biology. And what about chemists? How can they use metals to make new molecules? This play proposes answers to those questions with the help of songs, texts and paintings. By Clotilde Policar (Professor, Ecole normale supérieure) and Judith Policar (stage director), with Coralie Emilion-Languille (actress and painter).

Chimie ParisTech

Several lectures related to the IYPT2019 took place at the Chemie ParisTech.
12th of October 2019: The Louvre's particle accelerator AGLAE and the periodic table
12-13 October 2019: Mille et une mesures
23rd of September 2019: The Louvre's particle accelerator AGLAE and the periodic table
4th of October 2019: PSL fête la Science : Les éléments [En]Jeux

Musée Curie

The Museum dedicated to the life of Madame Curie organized several lectures related to her life and her contribution to the periodic table.
21st of June 2019: Mam'zelle Radium
5th of October 2019: Mesurer la radioactivité : la Méthode Curie
12th of October 2019: Visite thématique - Radium, polonium et compagnie...

150th anniversary of the periodic table

ESPCI Paris organized a mini symposium on the 4th of November 2019 which occurred with the exceptional presence of Dr Lelaung (Merck Sigma) and of Sir M. Polyakoff (University of Nottingham), famous professor of the Periodic Videos Youtube Channel.

51st International Chemistry Olympiad (IChO)

The International Chemistry Olympiad (IChO) is an annual competition for the world's most talented chemistry students at the secondary school level. The 51st edition took place in Paris from 21 – 30 July 2019. Nations around the world send a team of four students who are tested on their chemistry knowledge and skills in a five-hour laboratory practical exam and a five-hour written theoretical examination

Deep-focus earthquakes reproduced in laboratory thanks to the Germanium

Down at several hundreds of kilometers in the Earth's mantle, very special earthquakes happen. Their origin has been recently demonstrated thanks to the help of Germanium. During the Fête de la Science 2019 (11 to 13 October 2019), geologists from the ENS Paris, member of PSL University, invite you to discover the experimental facilities that allowed this discovery.

Sorbonne University: Campus Pierre et Marie Curie

On the 19th of December illustrated boards were accompanied by emblematic objects in show-cases, with spectacular native elements, minerals, Haüy models.

The alphabet of Alchemy

Islamic alchemy is the origin of the periodic table which is the alphabet of the universe, so the facade of Paris Arabic Center displayed a gigantic version of it with the word «Abjad» (alphabet) on the 29th of November 2019.

GERMANY

Primary National Organizer

Gesellschaft Deutscher Chemiker e.V. (GDCh, German Chemical Society)
Other National Partners: GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt (GSI), Johannes Gutenberg University and Helmholtz Institute Mainz, German Wikipedia Chemistry Editorial Group.

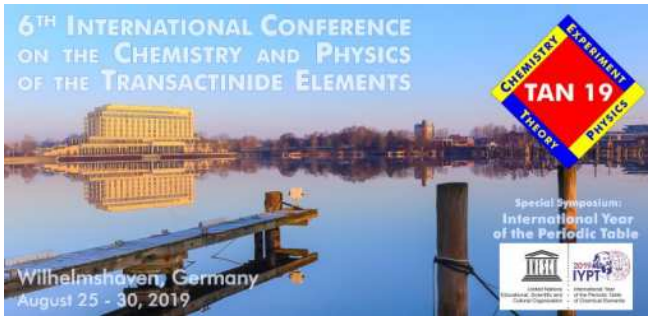
Highlights of IYPT 2019 Activities in Germany

The German Chemical Society supported, coordinated and organized a wide variety of events and activities, as highlights can be mentioned:

A GDCh delegation led by GDCh President Matthias Urmann attended the IYPT 2019 Opening Ceremony at UNESCO headquarters in Paris.

Hans-Georg Weinig, Matthias Urmann and Willis Muganda (from left) at the International Year of the Periodic Table of Chemical Elements exhibition in the UNESCO headquarters in Paris (Photo: GDCh)

As part of the IYPT 2019, the IUPAC endorsed Conference on the Chemistry and Physics of Heavy Elements (TAN) taking place in Wilhelmshaven, Germany from the 25th to the 30th of August, brought together the discoverers of new chemical elements in a unique historical gathering. Researchers from Germany, Russia and Japan, who have added new elements to the periodic table in recent years, met at the international congress. The GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt (GSI), the Johannes Gutenberg University and the Helmholtz Institute Mainz were the organizers of this year's TAN conference. Besides others, three IUPAC Poster Prizes have been awarded at occasion of TAN19.

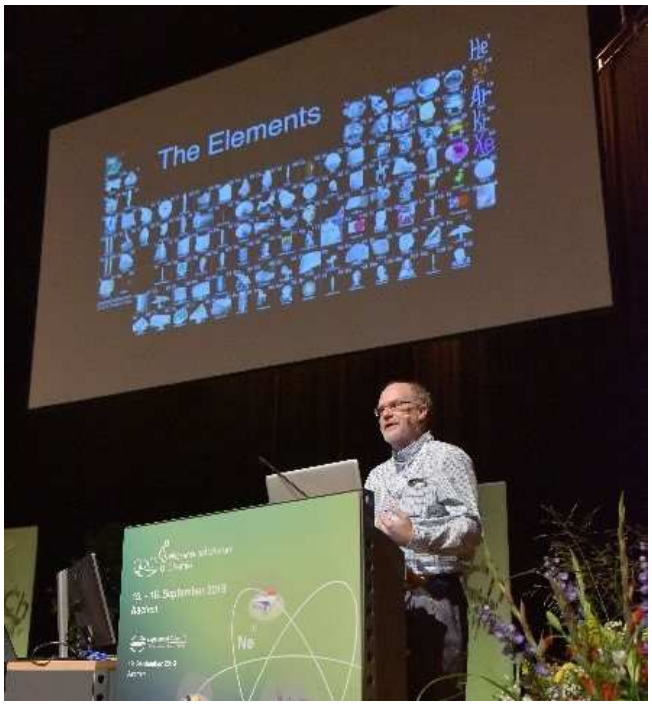


Source: https://www-win.gsi.de/tan19/

The four element discoverers — from left: Professor Peter Armbruster and Professor Gottfried Münzenberg, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt; Dr. Kouji Morimoto, RIKEN Nishina Center for Accelerator-Based Science, Wako, Japan; Professor Yuri Oganessian, Flerov Laboratory for Nuclear Reactions, Dubna, Russland (Photo: Björn Lübbe, Wilhelmshavener Zeitung)

Source: https://www-win.gsi.de/tan19/

GDCh's biennial conference "GDCh Science Forum Chemistry" (September 15-18, 2019, Aachen) referred to the IYPT 2019 with the plenary lecture "The Periodic Table: Completing a Work of Ages" given by Theodore Gray and a special symposium dedicated to the history and latest development of the periodic table.



Theodore Gray presenting at GDCh Science Forum Chemistry in Aachen (Photo: Christian Augustin)

In addition, the GDCh Division of Nuclear Chemistry held its annual conference from September 25-27, 2019, in Dresden.

The brochure "Elements – 150 Years Periodic Table", 70.000 printed copies was produced and published in co-operation with the German popular scientific journal "Spektrum der Wissenschaft". GDCh members' magazine "Nachrichten aus der Chemie" informed in detail about the historic development towards the periodic table and triggered an expert discussion about the correct positioning of the f-block elements. Nachrichten aus der Chemie also engaged chemists throughout the whole year to solve riddles about the chemical elements.

©GDCh/Spektrum-CP

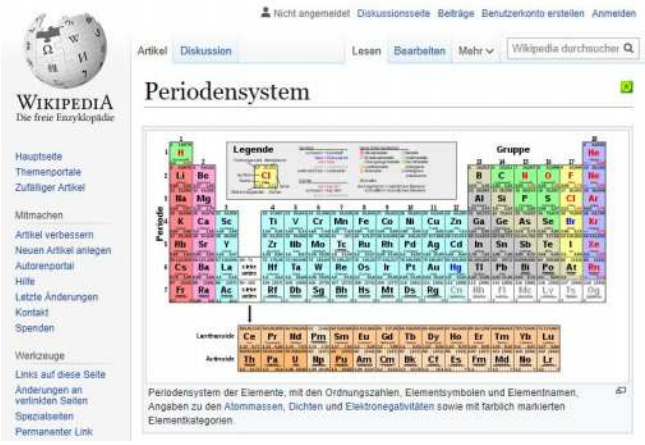
©GDCh/Nachrichten aus der Chemie

©GDCh/Nachrichten aus der Chemie (Chemical elements' riddles)

The GDCh website offered throughout the whole year various stories, links and information around the periodic table (www.gdch.de/periodensystem).

Also in 2019, as part of its 100th anniversary, the IUPAC Global Women's Breakfast took place. Events by and for female chemists took place in many places around the world on February 12, 2019. The GDCh office in Frankfurt also participated in the Global Breakfast and invited students, young and senior scientists from all areas of chemistry.

The German Wikipedia website "Periodic Table" was selected as "Excellent Article of the Day" on November 28th, 2019. The German Wikipedia chemistry editorial group received already in 2016 the GDCh Award for Journalists.



Source: https://de.wikipedia.org/wiki/Periodensystem

Die Ordnung der Stoffe - Geschichte und Geschichten rund om das Periodensystem der Elemente

A lecture by Ulf von Rauchhaupt, Frankfurter Allgemeine Sonntagszeitung, was given on the 23rd of January 2019 in Darmstadt as part of the public lecture series «Wissenschaft für Alle» by GSI and FAIR.

Celebrating the PSE in chemistry class

On the 23rd of May 2019 the M. Ed. Students of the Technical University of Darmstadt devoted themselves to the historical development of the Periodic Table of the Elements. They paid tribute to Mendeleev's achievements and discussed some interesting options for getting into the periodic table of elements in chemistry lessons. Among other things, they grasped the idea of a teacher trying the basic principle of systematization with sweets (DOI: 10.1002 / ckon.201010121). We used the IYPT2019 as an opportunity to study the fascinating chemistry of Rare Earth Elements (DOI: 10.12691 / wjce-7-2-8).

6th International Conference on the Chemistry and Physics of the Transactinide Elements (TAN 19)

The TAN 19 took place from 25 – 30 August 2019 in Wilhelmshaven and was the sixth in the series of international conferences dedicated to recent achievements and developments in experiments and theory of the chemistry and physics of transactinide elements. TAN 19 opened with Special Symposium on occasion of the "International Year of the Periodic Table". The extension of the Periodic Table by new chemical elements is at the heart of the TAN conferences. The symposium program included presentations by discoverers of elements 107 to 118 and by directors of the laboratories at which these elements were discovered. Further presentations looked back in time and illustrate the spreading of the concept of the periodic table, discussed the transformation of the concept of chemical elements, or addressed questions associated with the placing of new elements in the periodic table in historical times.

GDCh Science Forum Chemistry

The German Chemical Society (GDCh) held its next Science Forum Chemistry: WiFo (Wissenschaftsforum Chemie), the most important chemical scientific forum in the German-speaking world. Related to the IYPT2019, the chemical communities of Germany and the Benelux countries met in Aachen from 15 to 18 September 2019 at Eurogress with the motto 'Chemistry - The Essential Element'.

Annual Meeting of the GDCh Division of Nuclear Chemistry

On the 25th of September 2019 the Annual Meeting of the GDCh Division of Nuclear Chemistry took place in Dresden. The conference gave unique insight into the interdisciplinary research area of nuclear chemistry related to the periodic table.

GHANA

KNUST celebrates IYPT2019

The Department of Chemistry of the Kwame Kwame Nkrumah University of Science and Technology (KNUST), KUMASI, Ghana in collaboration with the Women in Science, Technology, Engineering and Mathematics (WiSTEM)-Ghana, commemorated the IYPT2019 with a colloquium at the Allotey Auditorium at the Aboagye Menyeh Complex of KNUST on the 12th of February 2019. Topics to be discussed include: '150 years of the Periodic Table: Contribution to the Advancement and Development of Science' by Prof. Evans Adei, 'The Contribution of Women to the Development of the Periodic Table' by Dr. Marian Asantewah Nkansah, 'The Impact of Ghanaian Female Scientists in the Public Space and their Contribution to the Economic Development in Ghana' by Prof. Frances Owusu Daaku among others. The program brought together University Management, faculty, university students, basic and high school students and the media.

GREECE

The Periodic Table in the Universe

An outreach event organized by the NuSTRAP Group at the University of Athens, Greece in collaboration with the high school teachers in 1st High School of Kaisariani. The event comprised lectures, demonstrations and hands-on experience on the properties of chemical elements included in the Periodic Table.

Closing of IUPAC100 and IYPT2019

On the 14th of December 2019, during the General Assembly of the Association of Greek Chemists, presentations were giving on IUPAC100 and IYPT2019, among others by Sir David Cole-Hamilton (former president of EuChemS).

HUNGARY

Hungary launched a special IYPT2019 stamp to celebrate the Periodic Table and create awareness.

A highlight has been the 11th Astronomical Obstacle-race in Nagyszénás), organized on the topic of the 100th anniversary of the IAU, the 50th anniversary of the first moon landing and the International Year of the Periodic Table 2019. On the obstacle-race, teams of the nearby primary schools participated solving different types of tasks such as modelling the Solar System, specifying the acronyms of astronomical organizations, drawing the first moon landing, solving a puzzle of the periodic table or just writing an essay about the IAU.

Several other events were planned throughout the year. An impression can be found here: http://www.rekord2019.mke.org.hu/index.php/fotogaleria

INDIA

The “International Year of the Periodic Table of Chemical Elements” – IYPT 2019 was celebrated in a big way in India involving school children, college and university students, academicians, industrial chemists and scientists from different disciplines.

A Quick Start

The kick-off meeting was held on August 2, 2018 at R&D Centre of NACL Industries in Hyderabad where detailed plan was worked out to celebrate IYPT in India throughout the year. The very first program of IYPT was held on January 2, 2019 in Hyderabad in which students and chemistry professionals participated. The topics of presentation were: “Contribution of Mendeleev – A True Genius”, “History of Periodic Table”, “Life and Achievements of Mendeleev”, “Modern Periodic Table”, “Periodic Trends and Patterns” and “Element 101 – Mendelevium”. A quiz competition on “Mendeleev and Periodic Table” was also held.

Continuous activities

The next program was held in New Delhi on January 9, 2019. “Federation of Indian Chambers of Commerce and Industry” invited Dr. B. Saha to make a presentation on “Life and Works of Mendeleev” and “IYPT” which was attended by industry stalwarts. On the very next day (January 10), at the invitation of industry association based in Mumbai, Dr. B. Saha spoke about “IYPT2019” and requested chemical industry of India to support the celebrations.

A major event involving school children was held on February 1, 2019 at the “Indian Institute of Chemical Technology”. More than 150 students participated in the event. The highlights of the program were a quiz contest on “Periodic Table and Elements” and a speech by Dr. B. Saha on “Mendeleev and Periodic Table”.

As a part of Platinum Jubilee celebration, Indian Institute of Chemical Technology, Hyderabad invited Professor Sason Shaik to deliver a speech on “The Periodic Table – An Universal Icon: Its Birth 150 years ago and its popularization through Literature, Art, and Music”.

On March 20, 2019, NACL Industries R&D Centre organized “Periodic Table Memory Contest” for school children and chemists, followed by “Chemical Magic Show” which was highly appreciated.

Vivekananda College, Secunderabad organized a program on July 23 to celebrate IYPT 2019 and invited Dr. B. Saha to make a presentation on "150th Anniversary of Mendeleev's Periodic Table".

In the southern part of India, students of Reeds World School, Coimbatore organized a two day program on August 13 and 14 on the theme "Celebrations of IYPT 2019 – Chemical Elements through our Lives". Students drew a big photo of Mendeleev on the floor of the school hall. There were programs on the "Periodic Table Song", "Dance to celebrate IYPT" and "Drama and Speeches on Life of Mendeleev".

The next big program was "Science Fair on Periodic Table", jointly organized by Royal Society of London (India Deccan Local Chapter), Indian Institute of Chemical Technology and White Board Ventures. About 200 delegates from 58 schools participated. They presented various types of models of periodic table and elements which included "Periodic Table for the Blind (Braille Periodic Table)" and "Periodic Table by Artificial Intelligence (A.I)". In this program, Dr. B. Saha was invited to make a presentation on "Life of Mendeleev – A True Genius" and "Fun with Elements".

The NGP School, Coimbatore organized "State Level IYPT Celebration" which included (a) a Quiz on the Periodic Table, (b) a recitation of all 118 elements from memory, (c) an innovative depiction of the Periodic Table and (d) significance of the Periodic Table on other Branches of Science" .

Media coverage

To reach a wider audience, an article entitled "150th Anniversary of Periodic Table and Mendeleev" written by Dr. B. Saha and Dr. N.J.C. Reddy was published in reputed magazines like "Chemical Weekly", "Chemical News", and "Chemical Industry Digest". The cover page of February issue of "Chemical News" carried photo of Mendeleev. All events in India were widely covered by these magazines which are distributed in India and many Asian countries.

Closing ceremony of IYPT 2019 in India was held on December 21, 2019 in Hyderabad where students made presentations on "Life and Woks of Mendeleev" and "Periodic Table". Dr. B. Saha reviewed the IYPT celebrations in India and thanked Indian students, academicians, chemists and industrialists for their overwhelming support.

INDONESIA

Seminar A Chemical Element On The Moon and Moon Observation

Students in the St. Mary Ganjuran orphanage compared the farming conditions of chemical elements on the earth and the moon. How does proven farming technology in sand iron in Yogyakarta function? And can we farm on the moon?

IRELAND

What Am I Made Of?

Carbon, Hydrogen, Oxygen and Nitrogen are known as the building blocks of life and make-up over 96% of your body mass. Calcium, Sulfur and Phosphorus are also present in significant amounts along with metals such as Potassium, Iron, Magnesium and Sodium, but what do all these elements do and where can they be found on the Periodic Table? This event was delivered by staff and students from the TCD School of Chemistry and focused on the chemical elements found in the Human Body, detailing their chemical behaviors and how they function: a fun, interactive and family-friendly event especially targeted for the non-specialist.

IRAN

IYPT Opening Ceremony in Iran

On the 16th of April 2019 INMOST organized a one-day scientific forum, «The official opening of 2019 as the International Year of the Periodic Table of Chemical Elements» in Iran National Museum. Dr. Saadaleh Nassiri Qidari, the former Secretary-General of the Iranian National Commission for UNESCO, presented his speech on the role of global events in realizing UNESCO's goals and programs. Furthermore, Dr. Mohammad Kouti, chairman of the Iranian Chemical Society pointed out to the importance of the Periodic Table in science and technology. Dr. Mansour Vesali, Shahid Rajaee University Professor, pointed out the role of science popularization in society and he mentioned that popularization is interdisciplinary and its elements are human and social science. Dr. Seifollah Jalili, INMOST chairman, as the host of this event, said that the purpose of this program is to form a group of scholars throughout the country to implement various activities for introducing the value and status of the periodic table of elements in 2019.

Make your own periodic table of elements

On the 1st of June students got creative with the periodic table of elements. There was no limitation for them. They could use everything to construct the creative periodic table. The tables were judged by referee teams and presented in a festival called «International year of periodic table of elements» at the university of Mohaghegh Ardabili, Iran.

Unveiling of the ZnU IYPT monument

On the 9th of December the ZnU IYPT monument is a periodic table of elements that is made from transparent colored plexiglass sheets was unveiled. It hangs like a curtain in front of a large window in the Chemistry Building.

IRAQ

Periodic Table of Chemical Elements for all

The University of Bagdad invited secondary schools to participate on the 18th of April 2019 in Ibn al-Haytham for a day of learning and fun! Schools could send a team of five students to represent their school at their regional Ibn Hytham - center. The aim of the Festival was to enable young students to explore the fun of chemistry and help plant the seed long term interest in chemistry and its applications in life also aims at sharing the values and often hidden potential of chemistry.

ISRAEL

Element 112, The Marinov Affair» documentary screening

There are some people whose curiosity and quest for knowledge does not let them linger about idly and becomes the journey of their lives. This is the story of the courage and determination of a handful of scientists who pursued their research for over forty years in the face of widely accepted norms. Their research was led by the Israeli physicist, Professor Amnon Marinov. The film tells a story that made waves in the scientific community and has not yet come to its conclusion. It was shown on the 10th of December 2018.

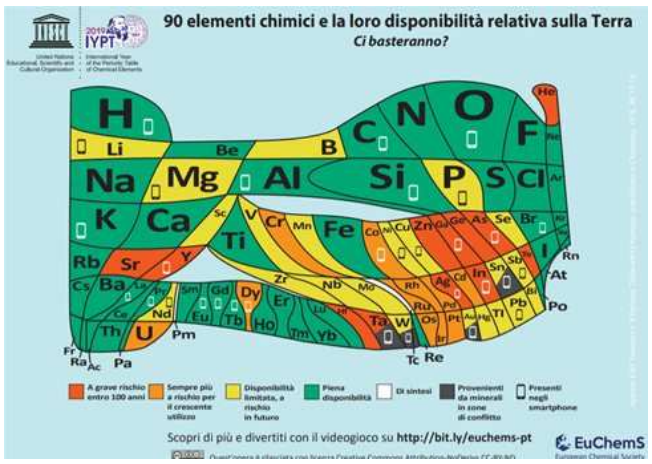
The Table does not lie – 150 Years of the Periodic Table of Chemical Elements by Mendeleev

The Israel Association of Chemical Engineers and Chemists celebrated the basics of Chemistry on the 5th of March 2019, Tuesday, Engineering House, Dizengoff 200, Tel Aviv. The Periodic Table is much more than arranging and organizing of chemical elements. It holds a great knowledge and allows us to predict the behavior of these elements and those that have not yet been discovered. In a one-time event with leading lecturers in the field, we talked about everything you have not known about the Periodic Table, the contribution to the development of sciences and society, selected elements and their expression in the industry and the introduction of the four new elements (113, 115, 117 and 118) added to the Periodic Table in 2016.

ITALY

High School text books

The EuChemS Periodic Table of Scarcity is included in a chapter of two text books for Italian high schools. Thereby causing tens of thousands of students to become familiar with this information.



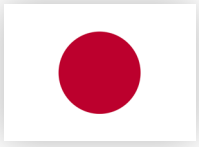
On October 18, a one day symposium was held in Rome, entitle: “The symphony of the elements”, in which also life and work of Primo Levi (born 100 years ago) was discussed.

Details are still at: https://www.chimicifisici.it/wp-content/uploads/2019/10/SINFONIA-ELEMENTI-programma-ENGLISH.pdf

JAMAICA

American Chemical Society (ACS) Chemistry Festival

On Wednesday November 27, 2019 the Chemistry department in Kingston, Jamaica welcomed preparatory & primary school students. Throughout the day students and accompanying teachers were engaged in hands on experiments related to the Periodic Table.



JAPAN

After the official IUPAC approval of the names for four new superheavy elements in November 2016, the Periodic Table of Chemical Elements had filled all the boxes available up to the seventh period until the 118th element, and subsequently a number of activities and events were initiated in Japan. The four most recently-added elements included Nihonium, discovered by the Superheavy Element Production Team led by Dr. Kosuke Morita at Riken's Nishina Center for Accelerator-Based Science. The Japanese society at large enthusiastically celebrated the approval of 'Nihonium' as the name for element 113. In 2017, a street named «Nihonium Dori», decorated with a series of plaques of chemical elements, was developed in Wako City where the Nishina Center is located in conjunction with the 50th anniversary of Wako City. So as soon as UN had proclaimed 2019 as the year to celebrate the 150th anniversary on the initiation of the Periodic Table under the "Periodic Law" proposed by the Russian chemist Dmitri Mendeleev in the end of 2017, very many activities in Japan started. A new subcommittee related to the IYPT2019 events within the Science Council of Japan (SCJ), consisting of the SCJ members from the Chemistry and Physics Committees, was established and chaired by prof. Ken Sakai. Their duties were to make announcements to all the relevant Japanese people and also to take the leadership to promote various domestic activities associated with this celebration year. In the next months the "Planning Subcommittee on the Domestic Activities of IYPT2019" was initiated.

During 2018, based on the suggestion by IUPAC President Prof. Qifeng Zhou to organize the UNESCO-endorsed version of the "Closing Ceremony of IYPT2019" in Japan, it was quickly decided to apply for this option. As a first step we expressed our willingness to have the closing ceremony in Tokyo to the Inter-Union IYPT2019 Management Committee (MC).

This was agreed by the MC, and also UNESCO staff gave a green light around the end of July 2018, i.e. just over a year prior to the time supposed to hold the Closing Ceremony in Tokyo. Thus, Japan had to make accelerated actions to set up all things including the fund raising within a limited period.

The action made immediately after agreeing to hold the IYPT2019 Closing in Japan was to set up a local organizing committee as a committee located within the Chemical Society of Japan (CSJ). Prof. Kohei Tamao, the Director of Toyota Physical and Chemical Research Institute, agreed to serve as a Chairman of the "Executive Committee for the IYPT2019 Events in Japan", which also was formally in charge of the organization of the IYPT2019 Closing Ceremony in Tokyo. As executive secretary for this local organizing committee Prof. Kaoru Yamanouchi was appointed.

To properly prepare the closing ceremony, a delegation from Japan joined the Opening Ceremony of IYPT2019 held at the Headquarters of UNESCO in Paris, where Prof. Tamao delivered introductory and welcoming remarks on the Closing Ceremony to be held in Japan. The picture on the next page (top left) shows a picture of the

Opening Ceremony in Paris, where Prof. Kawai (President, Chemical Society of Japan) gave a welcome speech in regard to the Ceremony in Tokyo (from left to right: Jan Reedijk, Maki Kawai, Kohei Tamao, Natalia Tarasova, and Ken Sakai).

The first formal event happened in Japan was a Celebration Ceremony held on February 23, 2019 as a kick-off meeting for all the planned IYPT2019 events in Japan. This ceremony was organized by the IYPT2019 Planning Subcommittee and was held at the Main Hall of SCJ in Nogizaka, Tokyo. As noted above, this subcommittee consisted of chemistry and physics people and therefore the distinguished speakers from both fields gave a speech by focusing on some specific topics on the chemical elements. Remarks at the opening session involved those given by the presidents of chemical and physical societies together with the introduction to the Paris Opening Ceremony by the author. Thereafter, Prof. Tamao talked on "various periodic tables", Prof. Hideo Hosono on the "innovative development of materials", Prof. Susumu Kitagawa on the "functional porous materials based on various metals", Prof. Yoshiteru Maeno on the "various periodic tables including the Elementouch invented by Maeno", Prof. Hiroko Tokoro on the "functional materials consisting of easily accessible elements", Prof. Kosuke Morita (see photo right) on the "first new element from Japan/Asia, Nihonium", and finally Prof. Kazuyuki Tatsumi (Past President, IUPAC) on the "determination of new element names and symbols within IUPAC". The ceremony was open for the public, being able to meet participants from a wide range of generations. The free discussion in the final stage resulted in fruitful discussions, due to many frank questions from the audience, especially from the school teachers attending, as well as elementary school kids. The photo below shows the guest speakers and organizers at the Celebration Ceremony at the SCJ hall.

Until December 2019 when the Closing Ceremony in Tokyo was held, several interesting IYPT2019-related gatherings were organized by those who are more or less associated with the above-mentioned committees. We mention a meeting under the title of “Nature and human life are all derived from chemical elements”, jointly organized by the Chemical Society of Japan (CSJ) and the Physical Society of Japan (JPS). This was held on March 17, 2019 during the time when both societies were running their annual meetings in different locations. The CSJ was running the meeting in Kobe at Konan University, while the JPS met in Fukuoka at Kyushu University. The two venues were connected via internet, where presentations and discussions were made in both directions. On September 21, another meeting open for the general public was held at Nagoya University in conjunction with the annual meeting of the Japan Society of Coordination Chemistry. This was organized by Prof. Miki Hasegawa and prof. Ken Sakai, under the title of “Elements, chemistry, and our future”. Various interesting talks from coordination chemists together with physics people were presented. The talks involved a speech from Prof. Kosuke Morita on “Nihonium” together with a more detailed speech by Prof. Tatsumi on the approval processes of new elements by the Inorganic Chemistry Division of IUPAC. Many questions were raised by the audience, leading to frank and fruitful discussion by all participants.

In order to make the final Closing Ceremony in Tokyo as attractive and gorgeous as possible, the IYPT2019 Executive Committee led by Prof. Tamao made great efforts in fund raising. The CSJ also gave a great contribution to it. One of the important approaches was to promote a rationally designed movement leading to involve contributions not only from the companies, but also from the academic institutions in Japan, including the universities. The executive secretary Prof. Yamanouchi was able to create a web-based platform displaying the activities of various organizations from a viewpoint of their progresses made in science and technology. Various domestic companies and academic institutions contributed to this event and exhibited the individual activities based on their specific chemical elements. For example, RIKEN contributed by expressing their special involvement to element 113, Nihonium. All these contributors were invited to attend the Closing Ceremony in Tokyo.

A summary and a selection of pictures at the Closing Ceremony on Dec 5, 2019, is available in a separate section of the IYPT2019 report.

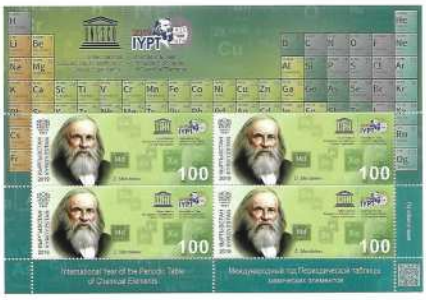
Of course, and in addition, the Japanese IYPT2019 Executive Committee also set up many domestic events specific to IYPT2019. One was to organize an “Essay Contest on a Specific Chemical Element” as a competition among the younger generations. Actually, junior high and high school levels of teams submitted their contributions on the individual chemical element. Some of the awardees were invited to the Closing Ceremony in Tokyo and presented their attractive essays at this ceremony. Another interesting approach was to organize an exhibition displaying a large variety of Periodic Tables and other the related materials, including real chemical substances at various venues in Japan. The exhibition was planned to make tours across Japan from Hokkaido down to Kyushu starting in August 2019 and planned until April 2020. The venues involved Sapporo, Yamagata, Funabashi, Tokyo, Nagoya, Tsuruga, Kyoto, Osaka, Okayama, Niihama, Oita, and Fukuoka (see right; the exhibition tour map made by Nagayasu Nawa, Kurume University Junior/Senior High School). This exhibition tour is still active and has further plans to visit more places in Japan.

In the end, on behalf of various organization bodies contributed to the above-mentioned domestic activities, the Japanese organizers would like to express their sincere thanks to all people who made their enthusiastic and time-consuming efforts towards the success of all IYPT2019 events in Japan.

KYRGYZSTAN

IYPT2019 stamp

On April 12, 2019 the State Committee of Information Technology and Communications of the Kyrgyz Republic put into circulation a Kyrgyz Express Post postage stamp “International Year of the Periodic Table of Chemical Elements”.



KOSOVO

Celebrating IYPT2019

On the 29th of January 2019 an event was organized in Gjilan to thank all those scientists who through their discoveries have enabled us to have a better life and well-being. Through this event, we encouraged the students to do good work and good education as a guarantee for the safe future of mankind.

KUWAIT

Chemistry department celebration of International Year of Periodic Table

The Chemistry Department of the Faculty of Science from the Kuwait University, celebrated the IYPT-2019 event. The celebration was sponsored by Kuwait Foundation for the Advancement of Sciences, KFAS. The Kuwait Chemical Society, KCS, and the Student Chemistry Club, also took part in this event. The program ran for two days (18-19/11/2019) and it consisted of talks, competitions, and social activates all of which related to the periodic table and Mendeleev.

LIBANON

ChemCarnival 2019

ChemCarnival is a unique outreach educational event in which students from the Organic Chemistry Club (OCC) at the American University of Beirut (AUB) conducted fun chemistry experiments. ChemCarnival promoted chemistry, particularly to the young minds, in a thrilling fun approach. The 2019 AUB ChemCarnival was organized on April 12, 2019 to celebrate the International Year of the Periodic Table (IYPT). Particular attention was given to experiments featuring elements in the Periodic Table.

LITHUANIA

Chemistry of the Universe

Vilnius University lecturer Carlos Viscasillas Vázquez visited Vilkaviškis Ąžuolo secondary school. During the visit Viscasillas met 3 and 4 grade students and gave a presentation explaining the origin of the chemical elements and their production in the stars. This theoretical activity was followed by practical periodical table construction.

MACRONESIA

MacaroNight

On the 27th of September 2019 the MacaroNight organized an Instagram contest called 'Chemistry in stuff!' in which the teenagers of the Macaronesia can make a photo of anything, upload it to Instagram with an explanation of the elements present in the photo and then everyone could vote for their favorite photo. The three photos with the most votes won a prize during the Researchers Night of the Macaronesia and their school got the chance to spend a day in the Chemical Labs of the Universities of their island.

MACARONIGHT
MACARONESIA'S RESEARCHERS' NIGHT
www.macaronight.eu

MALAYSIA

World Congress on Chemistry

Chemistry 2019 extends its heartfelt welcome to the «World Congress on Chemistry» held on August 19 and 20, 2019 in the alluring city of Kuala Lumpur, Malaysia with the theme «Delving into advances in Chemistry Research and Innovations". The "World Congress on Chemistry" aimed to bring together leading academic scientists, researchers, research scholars and entrepreneurs to exchange and share their experiences and research results on all aspects of Chemistry, with special attention for IYPT2019.

Pharmaceutical Chemistry Week 2019

The International Medical University (IMU), School of Pharmacy organized the Pharmaceutical Chemistry Week 2019 in conjunction with the International Year of the Periodic Table (IYPT2019) Celebration on the 27th until the 29th of August 2019. The staff and faculty constructed the largest 3D periodic table of chemical elements in Malaysia (The Malaysia Book of Records), and it's made from recycled materials!

MEXICO

Fiesta de la Tabla Periódica

Museo del Acero, A.C., presented a new demo "La Fiesta de la Tabla Periódica" on August 16th 2019. This demo was designed by the Educational Department in order to bring the visitors closer to the chemical elements in a fun and interactive way. The organization of the elements in the Periodic Table, their applications in daily life and their properties, as well as compounds and chemical reactions were explained. La Fiesta de la Tabla Periódica was daily presented for a whole year.

Exhibiton «The Table of the Elements»

From the 18th of September 2019 until the 21st of November 2019 an exhibition on the Periodic Table was displayed through a science and art project 'The Table of the Elements'. The exhibition displayed 118 pictorial and graphic pieces the 118 elements of the periodic table. It is important to note that the 121 participants of this collective work are renowned national and international plastic artists, musicians, photographers and scientists. The originality of the project is the result of three years of work on the design and structuring of a specific concept, together with the creators' relationships - María Luisa Passarge and Rogelio Cuéllar- with an enthusiastic response and immediate acceptance by each summoned artist.

118 reasons to love chemistry

The Universidad del Valle de Puebla, integrated itself in the IYPT2019 celebrations by organizing an event named "118 reasons to love chemistry" which was held on October 18th, 2019 in the Kukulcán auditorium. High school students shared with their class mates some chemical element importance and its application in worldwide scientific development.

Human interactive periodic table

On the 2nd of December 2019 a group of 204 students created an interactive board about the periodic table and presented it to the community in Cd Obregon, Mexico.

MOLDOVA

IYPT2019 stamp

In 2019 in Moldavia an official IYPT2019 stamp.was launched.

NETHERLANDS

ResourCity Oss

ResourCity is a game similar to Pokémon Go. However, in this game you collect the chemical elements and learn how they combine into molecules. Oss is the first city in the Netherlands where the game was launched. On the 15th of April 2019 a small ceremony for the opening was prepared with schoolchildren playing the game.

Avond van de Chemie 2019

Every year the Royal Netherlands Chemical Society (KNCV) puts chemistry in the spotlights in a theater in the Netherlands. On the 3rd of October 2019 this event took place with special attention for the Periodic Table, due to a few speakers: Marleen Kamperman was selected for the IUPAC100 Periodic Table of Younger Chemists and Ewine van Dishoeck gave a talk during the Opening Ceremony in Paris, France about the Origin of Elements.

KNCV Periodic Table Photo Competition

The Royal Netherlands Chemical Association (KNCV) yearly organizes the KNCV photo competition. All member of the Dutch chemical and life science community are encouraged to submit a photo. This year the theme is 'the Periodic Table'. The ten best pictures were displayed during CHAINS on the 10th and 11th of December 2019, the biggest chemistry event of the Netherlands, where the visitors decide the winner: 'Chrysopoeia - electrified golden tin clouds'.

NEW ZEALAND

Primary Science Week 2019 - Elements Matter

Primary Science Week in New Zealand (13-17 May 2019) celebrated the Periodic Table. For all primary schools there were two national activities to join in. A NZ Primary Schools Periodic table was produced where schools choose an appropriate element and link attributes of their school to those of the elements. Furthermore schools were asked to challenge their students to find pictures, or take photos, of items that are made of elements and display them on a Periodic Table. These were then shared on our website: nzapse.nzase.org.nz/primary-science-week-2019.

Elementary!

On the 2nd of July 2019 Elementary! looked at the development of the periodic table. We consider the history of the discovery of elements and previous attempts at introducing order on the elements known at the time.

NIGERIA

Public Lecture on the Periodic Table

On the 23rd of May 2019 a Public Lecture on the Periodic Table was given by Prof Ovi Julius Abayeh.

NORTHERN IRELAND

IYPT2019 PUBLIC LECTURE: BELFAST

In order to celebrate IYPT2019 in Belfast organized «A Lecture Celebrating the 150th Anniversary of Mendeleev's Periodic Table», given by Dr Peter Wothers, University of Cambridge, at W5 at the Odyssey. The lecture was held twice, at 11am and at 2pm on the 28th of August at W5.

NORTH MACEDONIA

IYPT2019 Postage stamp

The Macedonian Chemical Society held a competition to find the longest word made from the element symbols. On the 16th of October 2019 a postage stamp and First Day Cover dedicated to the International Year of the Periodic Table were published by the Post of Macedonia. See picture:

NORWAY

VitenLunsj – Unni Eikeseth: Bli kjent med grunnstoffene

Popular lecture on the chemical elements within the human body and the ones used in everyday life. Also discovery and origination were discussed.

PAKISTAN

Lahore Science Mela 2019

Lahore Science Mela (festival) is a grand science fest to engage citizens, of all ages and backgrounds, through stalls and exhibitions that celebrate science, engineering, medicine, technology, art, photography, creativity and innovation. This year's festival organized on the 12th of October 2019 especially celebrated the 150th anniversary of the periodic table of chemical elements, as recommended by UNESCO.

One Day Symposium on International Year of Periodic Table of Chemical Elements

On the 16th of December 2019 a One Day Symposium on the International Year of Periodic Table of Chemical Elements was organized in the Department of Chemistry, University of Sialkot, USKT, 1km from Daska road Sialkot, Punjab, Pakistan.

IYPT2019 Two Day Seminar

The Chemical Society, Lahore College for Women University, (LCWU) Lahore, Pakistan celebrated the IYPT2019 and organized a two days seminar on "International Year of the Periodic Table 2019".

POLAND

Periodic Element Table Day

On the 11th of March 2019 students celebrated the day by presenting the elements and their properties in English in Luboń.

PORTUGAL

Exhibitions about the Periodic Table

The University of Aveiro presented the Exhibition "What if Mendeleev were here?".

It was open to the public in Aveiro from 20 September to 20 October 20 and in Lissabon until January 12, 2020.

The International Year of the Periodic Table was highlighted on the 2nd of February 2019 on Lagos Ciência Viva Science Centre 10th anniversary. Several laboratory activities were carried out by families who visited the Centre where the chemical elements involved in the reactions were the main protagonists.

On the 1st of March an exhibition, named "Homo numericus - The Chemistry in us", was set up consisting of an infographic roll up that translates in numbers, curious aspects of the Chemistry of our body and some illustrative objects that represent the numbers addressed, providing an original experience in the contact with Science.

All sorts of Periodic Tables

On the 29th of January in Lissabon student, researchers, professors and administrative staff danced to music from a Portuguese well known music group, Mastiksoul and Los Manitos, with the choreography of Iza da Costa and Neuza Santiago. Everybody had a colored T-shirt with an element, 118 total and created a Periodic Table Flashmob.

On the same day Human Periodic Tables were formed all over Portugal, in the most emblematic places of Braga, Porto, Lisbon, Coimbra, Aveiro, Vila Real, Évora, Tomar, Funchal (Madeira), Covilhã, Faro and Castelo Branco. This activity aims to sensitize the youngsters of elementary and secondary schools and the general public to the importance of this icon of Chemistry, thus giving rise to the celebrations of the International Year of the Periodic Table!

On June 12, 2019 a Periodic Table was made using Flowers on the Terreiro da Sé, Porto, Portugal. The involvement of more than 250 students and many teachers, technicians and researchers was decisive for the success of the event.

9th grade students created a Periodic Table from tiles on the 14th of June 2019 in Vila Nova de Famalicão. . This activity did not only involve the Chemistry and Physics subject, the Arts department also cooperated and will help with the drawing, painting and the baking of the tile.

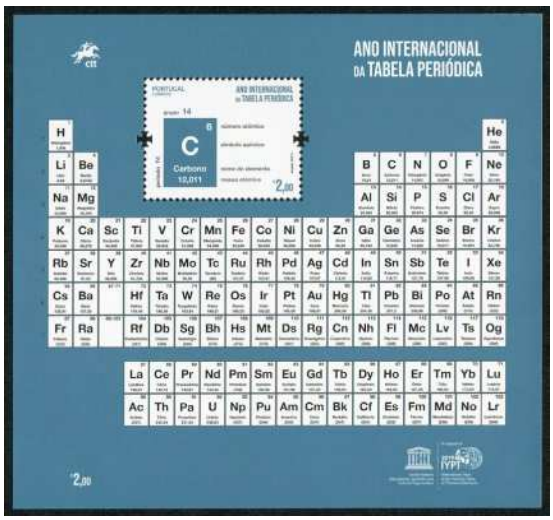
A giant Periodic Table was built on the 16th of June 2019 in Leiria from recycled card boxes, whilst playing and testing knowledge about the chemical elements.

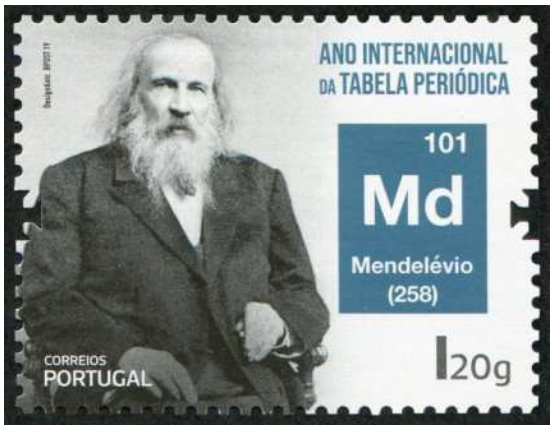
In Lisboa a decorated mat was displayed with the periodic table expressly made to celebrate the periodical table international year on the 21st of November 2019.

The Portuguese Science Summit, attended by the Prime Minister and the Ministers for Science and for the Environment featured a session on the Periodic Table.

IYPT2019 stamps

In 2019 several official IYPT2019 stamps were released to celebrate the Periodic Table.





QATAR

QU-IYPT

The department of Chemistry and Earth Sciences-College of Arts and Sciences at Qatar University organized a celebration of the IYPT2019 on Monday the 9th of September 2019. During this event, Dr. Scerri from the University of California at Los Angeles (UCLA) discussed the central role that the Periodic Table plays in education as well as research in science. During this event Faculty members from QU gave two talks related to aluminum as sustainable element and vanadium in catalysis. The students presented posters about chromium and carbon and their utilization in chemical processes.

IYPT2019 Celebration

On the 23rd of November 2019 several activities were organized in Qatar, such as forming large Periodic Tables by holding placards of elements, an Inter-Schools Competition, an Open Quiz, Students-Scientists Interactions and Science & Engineering Road Show.

RUSSIAN FEDERATION

See above under major sponsors and Mendeleev Chemical Society

ROMANIA

The unknown element - tell me who you are accompanying to tell you who you are

The event is dedicated to high school children in order to celebrate IYPT2019 by creative and original works of the kids about chemical elements in the form of essays, poetry, songs, drawings, paintings, original periodic tables etc. that were submitted and be presented at the University of Bucharest on 12th of April 2019.

RWANDA

Short Course on Cosmology

On the 3rd of April 2019 a three day short course on Cosmology was organized by ICTP-EAIFR devoted to the formation of light elements in the very early Universe. The course was meant for researchers and students in physics and mathematics. The goal of the course is to develop and instill skills, knowledge and understanding of the origin and evolution of the Universe, from the Big Bang to the formation of stars and galaxies, to its final fate in the distant future.

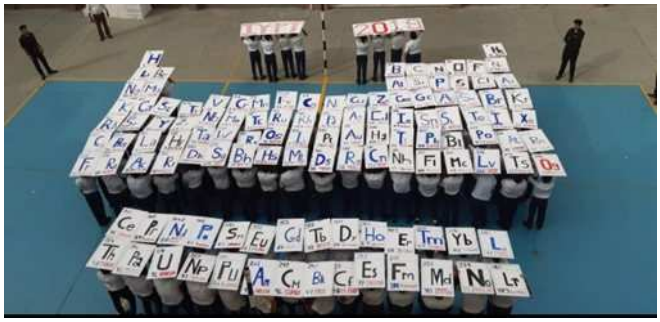
SAUDI ARABIA

International Year of the Periodic Table of Chemical Elements

On the 10th of January 2019 a seminar about the development of the Periodic Table was organized at the King Saud University in Saudi Arabia.

Human Periodic Table

On the 15th of December 2019 a Human Periodic Table was created with the help of 118 students from grade 9 and 10 in Djedda, Saudi Arabia. By holding the flash cards of size 70 cm x 50 cm students created a large Periodic Table.



SCOTLAND

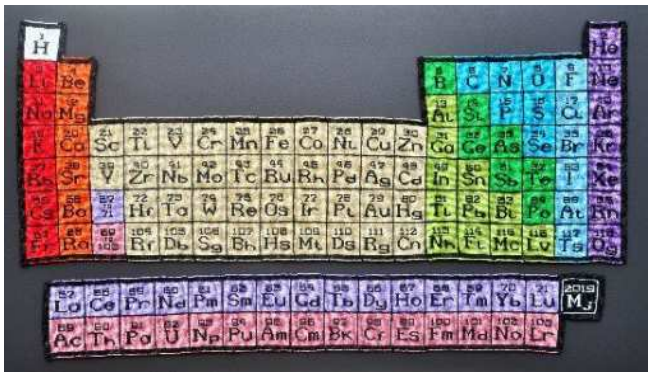
Estimated number of IYPT activities organized: 30

Number of people reached: 13,000 directly, Millions through media coverage

Four Periodic Tables

Much of the activity centered around four iconic Periodic Tables. A rolled-up wall chart found covered in dust by Dr Alan Aitken whilst clearing a storage area in St Andrews was shown by Dr. Pilar Gil to date from 1885 (arrived in St Andrews, 1888) and is the oldest known printed Periodic Table Wallchart (Guinness World Record). It was unveiled in the European Parliament along with the EuChemS Element Scarcity PT by Catherine Stihler MEP and Pilar Goya, President of EuChemS. The intense media coverage reached six continents. See Figure:

The original of the old table was exhibited in the Royal Society of Chemistry, Piccadilly, London throughout the summer alongside the EuChemS PT of endangered elements. They (Facsimile of the Old PT) were joined by the world's only macramé Periodic Table made by Jane Stewart from 200,000 knots for exhibitions in places as diverse as the Scottish Parliament, the Royal Society of Edinburgh, the Royal Society of Chemistry, the Royal Institution and the Inverness Science Festival. At the end of the year a PT knitted as a result of a community project in Glasgow was unveiled. See Photo.



A Periodic Tale: 150 years and still up to date

Talks about these Periodic Tables were given in Belgium, Spain, and across the UK (England, Scotland and Wales) of St Andrews. Other talks entitled 'A Periodic Tale: 150 years and still up to date' were given at nine different School and University venues throughout Scotland by Stephen Mansell.

Focus on youth

Edinburgh and St Andrews hosted the RSC outdoor video projection and Edinburgh is developing resources concerning the Periodic Table for primary schools. Primary schools also produced posters of individual elements that were stitched into a huge Periodic Table at two events entitled The Periodic Table – A fun fusion of science, art, music and history in Edinburgh and St Andrews. The old, macramé and EuChemS PTs were on display, there were lectures about them as well as Stephen Mansell's lecture, and two new pieces of classical music were commissioned through an international competition. The winners, Hydrogen, helium, etc (Robin Haigh) and Surface Bound (Nicole Murphy) were played 4 times live along with a Nocturne by Borodin, a chemist and colleague of Mendeleev. Individual school children sung versions of the Periodic Table to music by Sullivan (Tom Lehrer version) and the cancan (Offenbach). There were hands on activities for all ages including (in Edinburgh) a conjuror and an exhibition of stamps bearing images of famous scientists.

Graphic display

An outdoor exhibition of photographs from the University collection, which highlighted the role of elements in photography or told a story about certain elements ran on The Scores (a popular street overlooking the sea in St Andrews) during October.

SLOVAKIA

Slovak chemists in the IUPAC Periodic Table of Younger Chemists

On the 10th of September two Slovak awardees in the IUPAC PT of Younger Chemists were celebrated during the 71st Annual meeting of Slovak van Czech Chemists 2019.

XXVII. International Conference on Coordination and Bioinorganic Chemistry (ICCBiC)

The conference, commemorating also the IYPT, hosted in its traditional venue of Smolenice castle 68 scientists from 19 countries all over the world and 37 scientists from Slovakia from 2-7 June 2019.

Letter which form the world: Never ending story of chemical elements

Prominent members of the Slovak National Committee of IUPAC and Slovak Chemical Society have contributed by their knowledge, experience and thoughts to the content of this documentary film, which was shown on the 27th of May 2019.

SOUTH AFRICA

School concert

On the 24th of June 2019 a school concert, titled «Everything is Awesome» incorporated the Grade 7 year singing the Periodic Table of the elements song up until the end of the first chorus. They will be videoed and the video clip will be uploaded onto the school Facebook page.

Human Periodic Table

On the 15th of July 2019 all the students and staff of the Physical Sciences Department decorated T-shirts, each representing one of the elements on the Periodic Table. The group then gathered on the sports pavilion to take a group photo - forming a human periodic table!

The Periodic Table beyond the school curriculum

Learners in school identified some chemical elements, their importance, characteristics and use this information for performances such as: monologue, dialogue, poem, speeches, dance to an audience of students and staff on the 7th of August 2019 in Potchefstroom.

SOUTH KOREA

Elementary! Said Mendeleev

The National Science Museum of Korea launched «the special exhibition of Periodic Table - Elementary! Said Mendeleev». This exhibition launched on the 30th of July 2019 and remained open until the 27th of October 2019 in the National Science Museum in Daejeon, South Korea.

Mendeleev element

SciPort, the Busan National Science Museum organized an IYPT2019 exhibition, titled "Mendeleev element". The exhibition was open from the 29th of November 2019 until the 29th of March 2020 in order to celebrate the Periodic Table.

SPAIN

Open ceremony of IYPT in Catalonia

The Catalan Society of Chemistry (CSC), a subsidiary body of the Institute for Catalan Studies and member of EuChemS, organizes the Open Ceremony of IYPT2019 in Catalonia on the 5th of February 2019.

Women and the Periodic Table of Elements

An international symposium was organized on the 11nd and 12th of February 2019 in Murcia dedicated to the International Day of Women & Girls in Science.

Science in classrooms: past and present.

The López Piñero Institute for Science Studies (Spain) organized the event «150 years of the Periodic System: Science in classrooms. Past and present» (March 1 & 2, 2019) in Valencia. The sessions were a platform for discussing the history of the periodic table as a collective effort of many chemistry teachers, the didactic uses of the history of science in education and the history of the periodic table as an educational tool.

Presentation of IYPT-lottery ticket

The Spanish National Organisation for the Blind (ONCE) presented a lottery ticket dedicated to the Periodic Table of the Elements on the 20th of February 2019. ONCE issued 5.5 million copies of his lottery ticket with a face value of 1.50 euros. The draw was on the 27th of February 2019.

A Táboa Periódica e Galicia

On the 1st of March 2019 a high school poster contest was organized in Santiago de Compostella. Each participating team presented a poster about a chemical element of the periodic table, which includes the relevance of the selected element in daily life from the point of view of its relationship with the social, economic environment, environmental, health, or technical.

Aula Abierta sobre la Tabla Periódica

The CRAI Antonio de Ulloa of the University of Seville has organized a scientific dissemination activity with participation of Professor Adela Muñoz, Professor of Inorganic Chemistry of the University of Seville, which is entitled «Open Classroom on the Periodic Table» on the 21st of March 2019.

Future achievements and challenges of chemistry through cinema

Four films were projected by the Cultural Unit of the University of Jaén (Spain) on the 25th of March 2019, in order to raise awareness of chemistry among the general public and to attract young people into the field, as well as to highlight the role of chemistry in solving global problems.

Semana Cultural

Cultural week (8 – 14 April 2019) dedicated to the Periodic Table. With exhibitions, talks, activities, cultural outings, jobs, etc. The educational center was decorated and the week was devoted to the 2,000 students who know the periodic table and its history.

Sponsor an element

A contest was organized on the 15th of April 2019 for High school and Basic Vocational School students. The contest consisted of the realization of a multimedia project on any of the elements of the periodic table.

Nuestra tabla periódica

On Saturday, April 16 at the Principia Science Center in Malaga, 12 members gave a talk on the periodic table. The first part was dedicated to explaining its history and in the second part each member of the association told a story or conducted an experiment about their favorite element.

Periodic Table food boxes

The secondary school students of Saint George's School in Girona have carried out different entrepreneurial business projects to obtain food donations until they fill 800 boxes that were given to the "Banc dels Aliments", an organization which distributes food to the most needy. These boxes have been the central theme of the great Periodic Table activity, with the participation of all 200 students, the parents and teachers from Saint George's. At the school football field they built the largest periodic table ever in Spain (25x16m) where each of the 118 elements was represented by six boxes that were afterwards filled with food. See Photo.

Celebrating the Periodic Table in Luces

An exhibition of samples of elements was organized on the 17th of May 2019 in Asturias: from a «frying pan in glod» to a radioactive smoke detector – with important figures and discoverers, including Lise Meitner, Enrico Fermi, Niels Bohr, Eluyar´s brothers and, of course, Dimitri Mendeleiev.

Opening ceremony of IYPT2019

On 20th of May 2019 the presentation and opening of the activities was organized by the department of Chemistry of the University of the Balearic Islands, in commemoration of the IYPT2019.
The event was held in «Ca n'Oleo», a privileged setting located in the historic centre of the city of Palma. During the opening ceremony Dr. Bernardo Herradón gave a lecture entitled «Scientific, artistic and literary aspects around the Periodic Table of chemical elements».

School competition «our Periodic Table»

The Specialized Group of Didactics and History of Physics and Chemistry, common to the Royal Spanish Societies of Physics and Chemistry, organized this school competition on the 12th of June 2019 with the aim of promoting the relevance of the Periodic Table and its applications and contributions to society among non-university Spanish students.

The Chemical Societies in IUPAC100 and IYPT2019

The seventh edition of the Summer School on History of Chemistry organized at the University of La Rioja (Logroño, Spain) has as its main theme the history and present of IUPAC100 and in preparation of IYPT2019. It was organized from 11 till 13 July 2018.

Building the Periodic Table

From the 26th of September till the 20th of December 2019 an exhibition on the Periodic Table of the Elements was displayed at the Museum of Natural Sciences of the University of Zaragoza, Spain. It includes portraits of scientists (engravings and photographs), mineral specimens, samples of different elements, examples of use, etc. The objects are arranged according to the moment in which they began to be used: Elements of Prehistory, elements of the alchemists, the development of chemistry, the Periodic Table, rare earths, radioactivity and elements of the Cold War.

The Periodic Table in the UPM Books

From the 14th till the 29th of October 2019 a collection of books was exhibited in the UPM rector's building in Madrid. These books contain original editions (from the 16th to the 21st century) on the evolution of the concept of chemical element and on the history of the periodic table. Emphasis is placed on the Spanish contribution (co-discoveries of V, W and Pt during the Enlightenment, contribution to the development of atomic theory in the 1920s).

The Periodic Table: a Scientific, Social and Cultural Icon

The exhibition showed a series of books on scientific, communicative, artistic and literary content, together with other elements such as posters, games and different objects from the 15th of October till the 21st of November 2019 in Barcelona.

Conference series on the Periodic Table

A conference series on the Periodic Table given by experts on the history, education, research, and application of the chemical elements on the 22nd of October 2019 in Madrid.

Elemental: La Tabla Periódica de los Elementos Químicos

Started on the 5th of November, this exhibition in Madrid aims to expose the public to a large part of the elements with which we interact constantly and whose existence we are unaware of most of the time. These elements are present in the milk we drink, in our mobile phones, in the shell of a snail we come across, in the stone we stumble on, in the poison being used by the main character of the novel we are reading or in the painting we are admiring.

Expominer 2019

An exhibition about Minerals and Fossils: a source of culture and sustainability from the 8th till the 10th of November 2019 in Barcelona.

Periodic Balloon Table

The British School of Cordoba represented a huge periodic table with teachers and students holding symbol balloons on the 5th of December 2019.

Discovering IYPT to high school students

A group of Chemistry degree students from Universidad de La Rioja (La Rioja, Spain) gave talks about IYPT to high school students on the 14th of December 2018. The objectives were spreading IYPT, teaching some history of the Periodic Table and Chemistry, talking about the importance of women in science and providing students the opportunity of joining some activities related to Chemistry and IYPT.

Periodic Table in the school playground

Over 200 students aged between 12 and 17 were motivated to work together and form a complete Periodic Table in the school playground in Berja on the 17th of December 2019.

Collective Periodic Table

On the 20th of December 2019 students build a large (3.5m x 1.5m) bilingual periodic table in Mislata. Like the periodic table is the result of the collective work of chemists our periodic table is the result of the cooperation.

SWEDEN

A Common Language for Science

The publication by Mendeleev was published on 17 February, i.e. 3 March in the Gregorian calendar. On Thursday 28 February the IYPT2019 was launched in Sweden with a joint Swedish-Russian symposium devoted to the 150th anniversary of the Periodic Table of Chemical Elements.

The Ytterby Mine

The Ytterby mine is famous for being the site tied to the discovery of eight separate elements, an occasion all the more interesting as we celebrate IYPT2019. The unveiling of the first ever EuChemS Chemical Landmark Plaque took place on Saturday 27 April 2019 in Ytterby, Sweden.

Special Session celebrating IYPT2019

Oorgandagarna is a biennial conference organized by the division for inorganic chemistry within the Swedish Chemical Society. The conference opened on June 12 with a Special Session celebrating the IYPT2019 with three lectures by Eric Scerri (UCLA), Lars Öhrström (Chalmers) and Dirk Rudolph (Lund). In connection to this Special Session, a separate poster session (with poster prizes) covering elements discovered in Sweden was presented.

SWITZERLAND

Élémentaire!

All schools of Geneva (CH) were able to take part in this competition organized by the Chimiscope - UNIGE between February 4 and March 29, where students had to identify elements provided in a participation kit and create the illustration of an imaginary element. Over 2500 students participated.

Designed for Science- Complex Ideas in Clear Focus

In honor of IYPT2019, the Design Unit of UN Geneva hosted “Designed for Science: Complex Ideas in Clear Focus”, an event on the 11th of February 2019 in Geneva focusing on data visualization and design in science, with specific focus on the periodic table. What constitutes effective visual design, and how can it resonate with both expert and non-expert viewers? What is the evolving role of Artificial Intelligence in mass information translation? What design principles can we learn from the periodic table? These are a few of the many fascinating questions we will consider during this event as we examine one of the oldest and best examples of data visualization.

Experimental demonstrations on the chemistry of the elements

On the 10th of September 2019 in Lausanne a group of high school chemistry teachers presented simple demonstrations to be done in the classroom about the chemical properties of the elements, using only test tubes and beakers.

Periodic Table on the South Facade of our school

IYPT2019 was celebrated with an extra-large version of the periodic system on the facade of the school building in Appenzell, which was inaugurated on the 4th of October 2019.

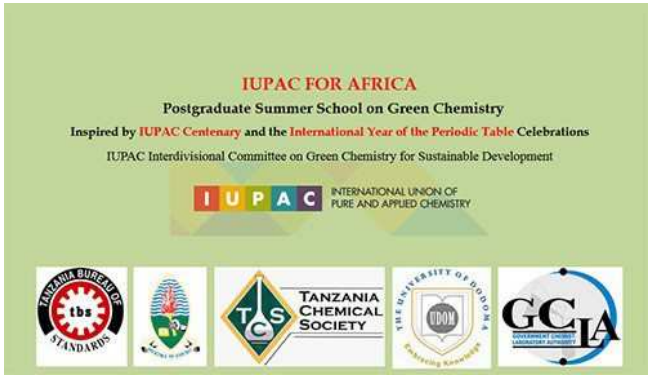
49e Bourse internationale aux minéraux

During the 49th mineralogical fair on the 12th of October 2019, the attention of the public was drawn to the periodic table of elements.. An actual table as well as related tables (by country of discovery, or made by very young kids in primary schools), and photos of famous world mines were commented upon by members.

TANZANIA

IUPAC for Africa - Postgraduate Summer School on Green Chemistry

Green chemistry, also known as sustainable chemistry, is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Green chemistry applies the cycle of a chemical product, including its design, manufacture, and use. Inspired by the IYPT2019 and the IUPAC centenary, the IUPAC hold a Postgraduate Summer School on Green Chemistry in Tanzania from the 12th until the 19th May 2019 in Dar es Salaam, Tanzania. This is the first time this event was held in Africa managed by the IUPAC Inter-divisional Committee on Green Chemistry for Sustainable Development (ICGCSD) in collaboration with the Tanzania Chemical Society (TCS). The event provided the participants with an understanding of the latest developments of the concepts and management of green/sustainable chemistry.



THAILAND

MA*HA*TAT

The Exhibition MA*HA*TAT- the Thai name meaning «The Great element» at the same time «MA*HA» is meaning «Going to learn...» – was organized on the 10th of January 2019. In this context MA*HA*TAT is learning all elements by periodic table. The exhibition is about the Periodic table related to every day life presented by Panel, Object, Model, Multimedia and Hands-on exhibits.

Elementary!

On the 23rd of May 2019 the event “Elementary!” looked at the development of the Periodic Table. The history of the discovery of elements and previous attempts at introducing order on the elements known at the time were considered. Looking at the specific breakthroughs that Mendeleev made and considering the development of the periodic table since Mendeleev including the synthesis of super-heavy elements. The talk rounded off with some other forms, and imaginings of the periodic table.

History of the Periodic Table of Chemical Elements

On the 18th of August 2019 at the Faculty of Science and Technology an event was organized to celebrate IYPT2019 with a lecture about the history of the Periodic Table.

TURKEY

IYPT2019 Opening Ceremony

The Turkish Chemical Society organized an opening ceremony for IYPT2019 on the 25th April 2019 in Istanbul.

The Key to Life: Periodic Table

This event was organized on the 14th and 15th October, 2019 in the Selçuk University, with the cooperation of the Turkish National Commission for UNESCO, on the occasion of the IYPT2019. Objectives of this event were; to raise awareness of target group members about the Periodic Table and UNESCO, to contribute to the development of the entrepreneurial and individual creativity of target group members, to inform target group members about the Nobel Prize, scholarships of Turkish Academy of Science, L'Oreal-UNESCO, and The Scientific and Technological Research Council of Turkey and to form an interdisciplinary point of view.

Periodic Table of the Visually Impaired

On the 28th of November 2019 in Manisa the The Tactile Periodic Table was revealed, which can be used by visually impaired and sighted students in chemistry education. Thereby making the Periodic Table accessible for the visually impaired.

Periodic Table in schools

The Turkish Chemical Society placed copies of the EuChemS Element Scarcity Periodic Table in many secondary schools.

UK AND ROYAL SOCIETY OF CHEMISTRY:

See above under major sponsors.

UKRAINE

Epic Chemistry

The team of cheerful and inventive students and teachers organized an event on the 13th of April 2019 in Charkov. The program consisted of interesting topics, such as color, health, metals and mineral fertilizers.

URUGUAY

Jornada Académico Recreativa

On the 1st of October 2019 in Montevideo "Jornada Académico Recreativa" was organized. It is an academic and recreational day in which the students of 3rd form of Secondary School received children of 5th year of Crandon Institute Primary and «Costa Rica» School. Secondary students provided information about the elements and played games made by themselves with the children of Primary. Then they shared muffins that form the periodic table.

USA AND ACS

See above under major sponsors.

VIETNAM

Year of the Periodic Table in Vietnam

In order to honor the IYPT2019, the Ministry of Science and Technology of Vietnam launched a competition on "Researching, designing the Periodic Table of the Elements" at STEM Festival 2019 on the 12th of June. Thanks to the university's reputation, as well as the ever growing socially-active alumni community, the organizers of the competition managed to promote the competition to an extension of participants such as the students, the high school, and the secondary school in Vietnam and abroad. We also set up three main topics as (i) "Designing a creative model of the Periodic Table", (ii) "Enhancing the public's awareness of the Periodic Table through technological advancements", and (iii) essay writing about the chemical elements. The award ceremony under the STEM festival atmosphere has inspired many students to more interest and finding the beauty of chemistry.

WALES

Periodic Table: Educating the public through Harry Potter sorting hat of elements and social dance

The celebrations consisted of three parts.

1. Prior to the STEMCon (22nd March 2019): Volunteers made element cards, two sides.

2. Friday March 22 at the STEMCon: At the dining hall - brought out a Harry Potter Style Sorting Hat. and sorted everyone out into s, p, d and f block or 'whilst everybody was at the dining hall, via an MC. This is an ideal Harry Potter Theme because we are in a big dining hall. Everyone cheered when each person ot chosen to be in their 'house'. They wore their elements and we all went to the social dance, where chemistry based mocktails were made and served. We educated the non-science students about the elements.

3. Saturday 23rd March at the STEMCon: At the end of the STEMCon, we stuck all of the elements onto a blank canvas to make the periodic table and displayed and took on tour in summer for outreach project with local schools.

ORGANIZATIONAL STRUCTURE

Steering Committee

The steering committee who coordinated the application to UNESCO, consisted of the following people

Professor Qi-Feng Zhou,
Vice -President (President-Elect) of the International Union of Pure and Applied Chemistry, China

Professor John Dudley,
University of Franche-Comté, France

Professor Hideyuki Sakai,
RIKEN Nishina Center, Japan

Professor Sergey N. Dmitriev,
Joint Institute of Nuclear Research, Russia

Professor James B. Roberto,
Oak Ridge National Laboratory, USA

Academician Yuri Ts. Oganessian (Element 118 – Oganesson),
Joint Institute of Nuclear Research, Russia

Sir Martyn Poliakoff,
lead presenter of the Periodic Table of Videos, the University of Nottingham, UK

Professor Tebello Nyokong,
Rhodes University, South Africa

Professor Bruce H.J. Mckellar,
President of the International Union of Pure and Applied Physics (IUPAP), Australia

Professor Natalia P. Tarasova,
President of the International Union of Pure and Applied Chemistry (IUPAC), Russia

Professor Silvia Torres-Peimbert,
President, International Astronomical Union (IAU), Mexico

Emeritus Professor David J. Cole-Hamilton,
Past President, European Association for Chemical and Molecular Sciences (EuCheMS), UK

Professor Efthymios Nicolaidis,
President, the International Union of History and Philosophy of Science and Technology (IUHPST), Greece

IYPT2019 Global Secretariat

A partnership with the Royal Netherlands Chemical Society (KNCV) was formed to host and facilitate the global secretariat. The secretariat coordinated the website, social media, mailbox and event support. Frank Sekeris – Program coordinator KNCV, management assistant IYPT2019 was acting secretary for the period May 1 2018 – April 30 2020.

The Inter-union International Management Committee for the International Year of the Periodic Table of Chemical Elements
Committee Composition as at the end of 2019

The IUPAC representatives are:

Natalia Tarasova (Past President IUPAC) – co-chair

Jan Reedijk (Past President Division II, IUPAC) – co-chair

Chris Brett (President Elect, IUPAC)

Chris Ober (Past President Division IV, IUPAC EC Member)

Lars Öhrström (President Division II, IUPAC)

Mei-Hung Chiu (Past President Committee Chemical Education, IUPAC EC Member)

Representatives of the other supporting organisations are:

Bruce McKellar – International Union of Pure and Applied Physics (IUPAP)

Alinka Lépine-Szily – International Union of Pure and Applied Physics (IUPAP)

Jorge Rivero-Gonzalez – International Astronomical Union (IAU)

David Cole Hamilton – European Chemical Society (EuChemS)

Brigitte van Tiggelen – International Union of History and Philosophy of Science and Technology (IUHPST)

Michele Zema – International Union of Crystallography (IUCr)

Nicole Moreau - IBSP (UNESCO)

Peggy Oti-Boateng – UNESCO

Anne Szymczak – French Ministry of Education

Jean Pierre Vairon – 2019 IUPAC World Chemistry Congress

Yulia Gorbunova – Mendeleev Russian Chemistry Society

Gemma Wood – UK Royal Society of Chemistry (RSC)

Hans-Georg Weinig – German Chemical Society (GDCh)

Zhigang Shuai – Chinese Chemical Society (CCS)

Lori Brown – American Chemical Society (ACS)

Berhanu Molla Abegaz – Chemistry Across Africa

David Winkler – Federation of Asian Chemical Societies (FACS)

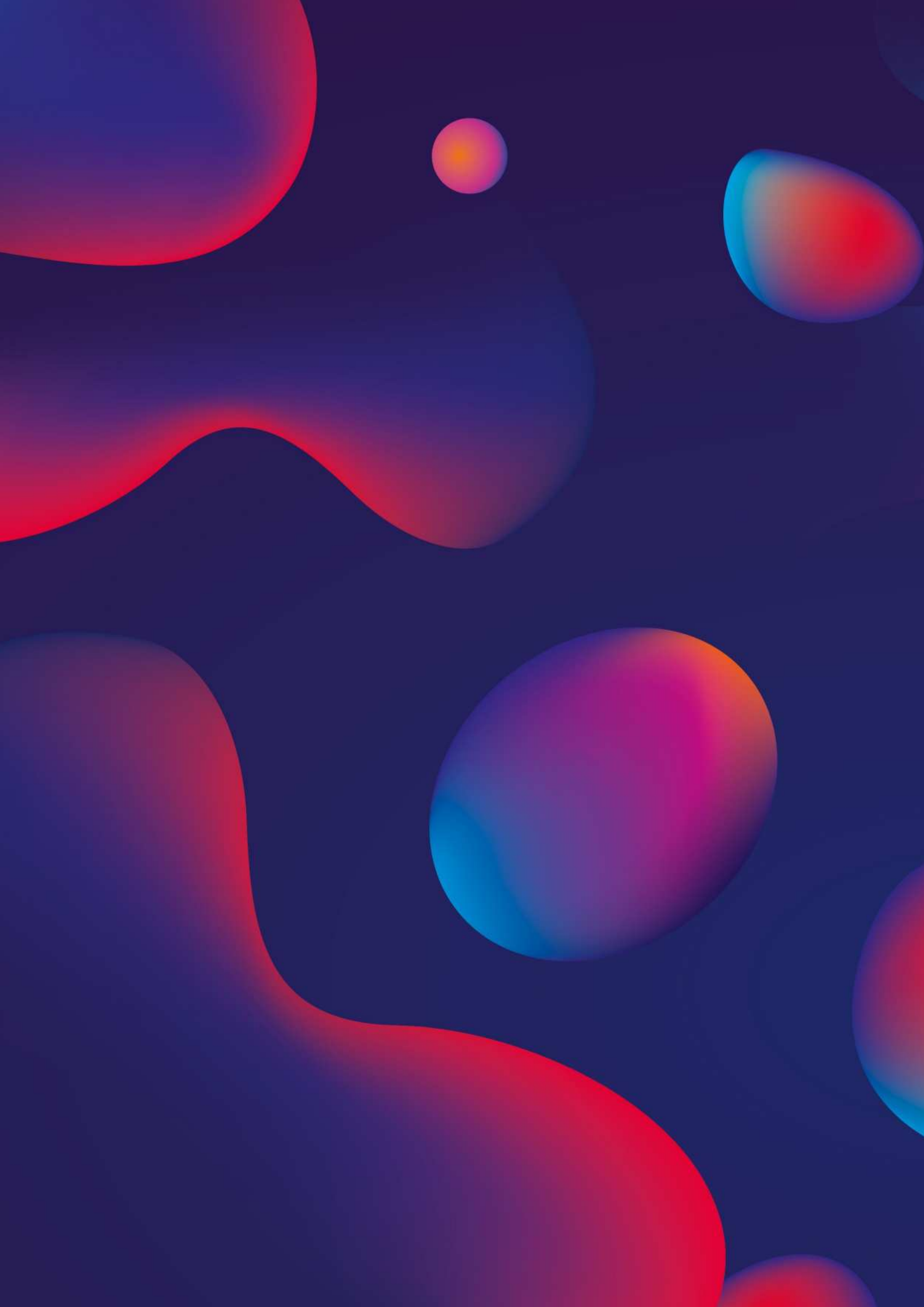
Ken Sakai – Japanese Science Council (JSC)

Chelsea Bock – US National Academy of Sciences

Veli-Jussi Haanpää – International Association of Physics Students (IAPS)

Alice Soldà – European Young Chemist' Network (EYCN)

Hanan Dowidar – 1001 Inventions



ANNEXES
UN RESOLUTIONS AND STATEMENTS

United Nations
Educational, Scientific and
Cultural Organization

Executive Board

Two hundred and second session

(Paris, 4 October – 18 October 2017)*

202 EX/Decisions

PARIS, 18 November 2017

DECISIONS ADOPTED
BY THE EXECUTIVE BOARD AT ITS 202nd SESSION

* Including the meetings of the subsidiary bodies before the plenary meetings.

Job: 201703308

3. Alarmed by the irremediable loss that shrinking glaciers represent for scientific knowledge,

4. Recalling the principles of the UNESCO Declaration on the Responsibilities of the Present Generations Towards Future Generations, adopted on 12 November 1997,

5. Convinced of the need for a rapid and coordinated reaction from the international community in order to conserve this memory and preserve ice cores in suitable ice core repositories;

6. Considering that the "Protecting Ice Memory" initiative is a relevant response to this issue,

7. Calls on Member States of UNESCO to support the "Protecting Ice Memory" initiative, in particular by mobilizing extrabudgetary contributions in order to further knowledge and scientific and technological research, and to contribute to the progress and wellbeing of humanity;

8. Recalls the special legal status of Antarctica established by the 1959 Antarctic Treaty and the other instruments of the Antarctic Treaty System, including the scientific bodies, such as the Scientific Committee on Antarctic Research (SCAR), and invites the Director-General to duly inform the Secretariat of the Antarctic Treaty of the "Protecting Ice Memory" initiative;

9. Also invites the Director-General to take into account the scientific, educational and cultural value of the "Protecting Ice Memory" initiative in the Organization's activities and programmes, and to inform it at its 205th session of the activities that could be established in collaboration with UNESCO in connection with the "Protecting Ice Memory" initiative, to be financed through extrabudgetary contributions.

(202 EX/SR.11)

43 Proposal for the proclamation by the United Nations of 2019 as International Year of the Periodic Table of Chemical Elements (202 EX/43; 202 EX/DG.INF; 202 EX/50)

The Executive Board,

1. Recalling 201 EX/Decision 38,

2. Recognizing the importance of chemistry and the advances in research and discoveries regarding the periodic table of chemical elements for sustainable development and for the benefit of humankind,

3. Stressing that the periodic table is widely used in vital spheres of scientific knowledge such as chemistry, physics and biology,

4. Taking note of the contribution of the international scientific community, including chemists, physicists, biologists as well as representatives of other allied professions, to addressing global challenges such as climate change, sustainable sources of clean water, food and energy and preservation of a wholesome environment,

5. Being aware that 2019 provides an opportunity to observe the outstanding scientific achievements that humankind has made since the discovery of the periodic system by Dmitry I. Mendeleev in 1869,

6. Also being aware that 2019 coincides with the anniversaries of a series of important milestones in the history of the periodic table, specifically: the isolation of arsenic and antimony by Jabir ibn Hayyan circa. 1,200 years ago; the discovery of phosphorus 350

years ago; the publication of a list of 33 chemical elements grouped into gases, metals, non-metals, and earths by Lavoisier in 1789; the discovery of the Law of Triads in 1829 by Döbereiner; the establishment of the periodic table by Mendeleev 150 years ago; and the discovery of francium by Marguerite Perey in 1939; recalling that lead smelting began at least 9,000 years ago in Africa, and the oldest known artefact made from lead is a statuette found at the temple of Osiris at the site of Abydos (Egypt) dated circa 3800 BC; and considering that the celebration of these discoveries in 2019 will provide an unparalleled opportunity to highlight the continuous nature of scientific discovery in different contexts, with particular emphasis on promoting science education among young people and women, especially in developing countries,

7. Welcoming international and interdisciplinary scientific cooperation that will be reinforced during the international year of the periodic table of chemical elements,

8. Seeking to enhance global awareness of, and to increase education in, the basic sciences, with special attention to the developing world, to improving the quality of everyday life and, *inter alia*, for future advances in research and development,

9. Having examined document 202 EX/43,

10. Welcomes the resolution of the International Union of Pure and Applied Chemistry (IUPAC) Council at its General Assembly in São Paulo, Brazil (July 2017) and the leadership of the International Basic Sciences Programme (IBSP), and the initiatives of the international scientific community through the large number of scientific societies, unions and institutions, to declare 2019 as international year of the periodic table of chemical elements;

11. Invites the Director-General to support all efforts leading the United Nations General Assembly to proclaim 2019 as international year of the periodic table of chemical elements;

12. Recommends that the General Conference adopt a resolution in this regard at its 39th session.

(202 EX/SR.11)

44 UNESCO's role in promoting literacy within the framework of the 2030 Agenda for Sustainable Development (202 EX/44 and Add. Rev.; 202 EX/DG.INF; 202 EX/50)

The Executive Board,

1. Having examined documents 202 EX/44 and Add. Rev.,

2. Recognizes the need to scale up efforts to address the literacy and learning needs of children, youth and adults, especially women and girls, to enhance the quality and relevance of learning;

3. Reiterates its conviction that the 2030 Agenda for Sustainable Development should strengthen the importance of literacy throughout life in an integrated and holistic vision of education, including the Global Alliance for Literacy (GAL);

4. Expresses its gratitude for the efforts of the Director-General to support literacy, and commends such efforts made by Member States, their development partners, the international donor community, the private sector, civil society and the specialized agencies and other organizations of the United Nations system, including the lead organization UNESCO;

United Nations
Educational, Scientific and
Cultural Organization

Organisation
des Nations Unies
pour l'éducation,
la science et la culture

Organización
de las Naciones Unidas
para la Educación,
la Ciencia y la Cultura

Организация
Объединенных Наций по
вопросам образования,
науки и культуры

منظمة الأمم المتحدة
للتربية والعلم والثقافة

联合国教育、
科学及文化组织

General Conference
39th Session, Paris, 2017

39 C

39 C/60
2 November 2017
Original: English

Item **4.19** of the agenda

PROCLAMATION OF 2019 AS THE UNITED NATIONS INTERNATIONAL YEAR OF THE PERIODIC TABLE OF CHEMICAL ELEMENTS

OUTLINE

Source: 202 EX/Decision 43.

Background: At the request of Member States, an item on the proclamation of 2019 as the International Year of the Periodic Table of Chemical Elements was included in the agenda of the 202nd session of the Executive Board (202 EX/43). By 202 EX/Decision 43, the Executive Board invited the Director-General to support all efforts leading the United Nations General Assembly to proclaim 2019 as the International Year of the Periodic Table of Chemical Elements, and recommended that the General Conference adopt, at its 39th session, a resolution concerning this subject.

Purpose: This document provides an explanatory note regarding the proposal to proclaim 2019 as the International Year of the Periodic Table of Chemical Elements. Detailed information including the rationale and objectives of the Year is provided in document 202 EX/43.

Decision required: Paragraph 5.

39 C/60

Explanatory Note

1. An International Year of the Periodic Table of Chemical Elements (IYPTCE) in 2019 will be a recognition of the important role of the basic sciences, and especially chemistry and physics, as fundamental in providing solutions to many of the development challenges that Member States face as they implement the United Nations 2030 Agenda for Sustainable Development. The Year also will be an occasion to pay tribute to the recent discovery and naming of four super-heavy elements of the Periodic Table of Chemical Elements with atomic numbers 113 (Nihonium), 115 (Moscovium), 117 (Tennessine) and 118 (Oganesson) resulting from close international scientific cooperation.

2. An International Year of the Periodic Table of Chemical Elements in 2019 will celebrate the 150th anniversary of the establishment of the Periodic Table of Chemical Elements by the Russian scientist Dmitri I. Mendeleev, who is regarded as one of the fathers of modern chemistry. The defining 1869 breakthrough of Mendeleev was the prediction of properties of five elements and their compounds. He also left space in the periodic table for elements to be discovered in the future.

3. An International Year of the Periodic Table of Chemical Elements in 2019 will offer to UNESCO's International Basic Sciences Programme an important opportunity to fulfil its mission of promoting international cooperation in the basic sciences for sustainable development, as well as in science education and capacity-building, namely through a Microscience Programme dedicated to the periodic table of chemical elements. This International Year will also trigger a wide range of cooperative undertakings within the context of the follow-up of the 2011 International Year of Chemistry and the 2014 International Year of Crystallography.

4. The participation of UNESCO in the celebration of the International Year of the Periodic Table of Chemical Elements in 2019 will be financed mainly from extrabudgetary funding.

5. In the light of the above, the General Conference may wish to adopt a decision along the following lines:

The General Conference,

Having examined document 39C/60,

Recognizing the importance of chemistry and the advances in research and discoveries on the periodic table of chemical elements for sustainable development and for the benefit of humankind,

Stressing that the periodic table is widely used in vital spheres of scientific knowledge such as chemistry, physics, and biology,

Considering that the celebration of the 150th anniversary of the Periodic Table of Chemical Elements in 2019 will provide an unparalleled opportunity to highlight the continuous nature of scientific discovery in different contexts, with particular emphasis on promoting science education at all levels among young women and men, especially in developing countries, including in Africa,

1. *Noting* that the year 2019 coincides with the anniversaries of a series of important milestones in the history of the periodic table, specifically with the isolation of arsenic and antimony by Jabir ibn Hayyan circa 1,200 years ago; the discovery of phosphorus 350 years ago; the publication of a list of 33 chemical elements grouped into gases, metals, non-metals, and earths by Lavoisier in 1789; the discovery of the Law of Triads in 1829 by Döbereiner; the establishment of the periodic table by Mendeleev 150 years ago; and the discovery of francium by Marguerite Perey in 1939;

2. *Being aware* that the year 2019 provides the opportunity to observe the outstanding scientific achievements that humankind has made since the discovery of the periodic system by Dmitry I. Mendeleev in 1869;

3. *Welcomes* 202 EX/Decision 43;

4. *Invites* the Director-General to support all efforts leading to the proclamation of 2019 as the International Year of the Periodic Table of Chemical Elements;

5. *Recommends* that the United Nations General Assembly, at its 72nd session, adopt a resolution declaring 2019 as the United Nations International Year of the Periodic Table of Chemical Elements.

United Nations A/RES/72/228

General Assembly

Distr.: General
18 January 2018

Seventy-second session
Agenda item 21 (b)

Resolution adopted by the General Assembly on 20 December 2017

[*on the report of the Second Committee (A/72/422/Add.2)*]

72/228. Science, technology and innovation for development

The General Assembly,

Recalling its resolutions 58/200 of 23 December 2003, 59/220 of 22 December 2004, 60/205 of 22 December 2005, 61/207 of 20 December 2006, 62/201 of 19 December 2007, 64/212 of 21 December 2009, 66/211 of 22 December 2011, 68/220 of 20 December 2013 and 70/213 of 22 December 2015,

Taking note of Economic and Social Council resolutions 2006/46 of 28 July 2006, 2009/8 of 24 July 2009, 2010/3 of 19 July 2010, 2011/17 of 26 July 2011, 2012/6 of 24 July 2012, 2013/10 of 22 July 2013, 2014/28 of 16 July 2014, 2015/27 of 22 July 2015, 2016/23 of 27 July 2016 and 2017/22 of 6 July 2017,

Recalling the 2005 World Summit Outcome,[1] as well as the outcomes of the World Summit on the Information Society[2] and the outcome document of the high-level meeting of the General Assembly on the overall review of the implementation of the outcomes of the World Summit on the Information Society,[3] as well as other relevant intergovernmental outcomes,

Recalling also the outcome document of the United Nations Conference on Sustainable Development, entitled "The future we want",[4]

Reaffirming its resolution 70/1 of 25 September 2015, entitled "Transforming our world: the 2030 Agenda for Sustainable Development", in which it adopted a comprehensive, far-reaching and people-centred set of universal and transformative Sustainable Development Goals and targets, its commitment to working tirelessly for the full implementation of the Agenda by 2030, its recognition that eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest

[1] Resolution 60/1.
[2] See A/C.2/59/3 and A/60/687.
[3] Resolution 70/125.
[4] Resolution 66/288, annex.

17-23303 (E) 230118

and update its mapping of science, technology and innovation activities in the United Nations system to:

(a) Guide further efforts at collaboration and capacity-building;

(b) Formulate coherent advice for Member States on aligning national science, technology and innovation frameworks with the 2030 Agenda;

28. *Encourages* the United Nations system to take an active role in forging a closer link with national science advisory bodies to optimally leverage science, technology and innovation for the Sustainable Development Goals;

29. *Calls upon* the United Nations funds and programmes and the specialized agencies, at the request of national Governments, to support, as appropriate, technical and scientific cooperation and North-South, South-South, triangular, regional and international cooperation on and access to science, technology, innovation and knowledge-sharing, on mutually agreed terms, including through improved coordination among existing mechanisms, including the Technology Facilitation Mechanism;

30. *Reiterates its call for* continued collaboration between United Nations entities and other international organizations, civil society and the private sector in implementing the outcomes of the World Summit on the Information Society, with a view to putting the potential of information and communications technologies at the service of development through policy research on the digital divide and on new challenges of the information society, as well as technical assistance activities, involving multi-stakeholder partnerships;

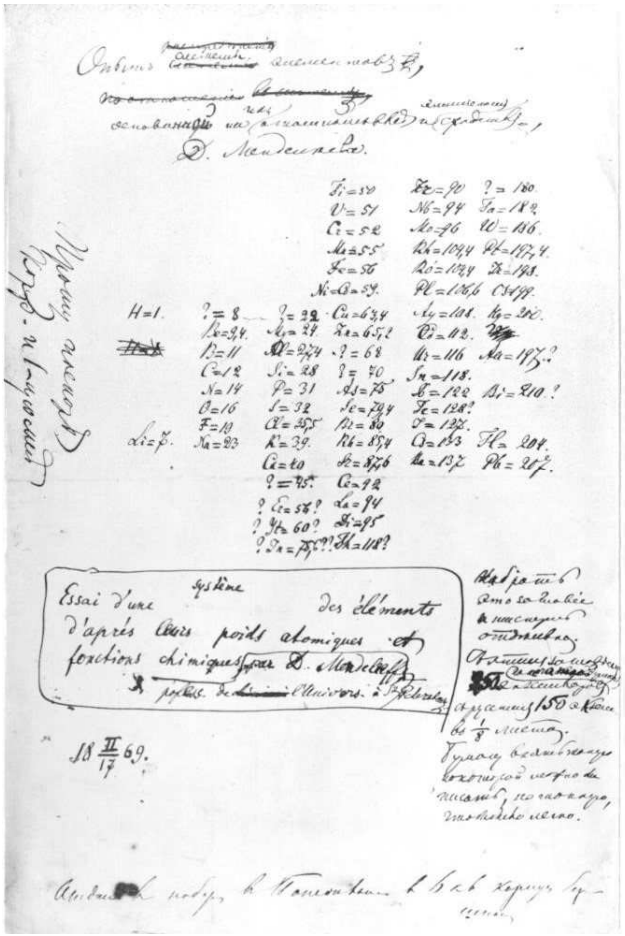
31. *Proclaims* the year beginning on 1 January 2019 the International Year of the Periodic Table of Chemical Elements to enhance global awareness of, and to increase education in, the basic sciences, with special attention to the countries of the developing world, to improving the quality of everyday life and, inter alia, for future advances in research and development, and invites the United Nations Educational, Scientific and Cultural Organization to serve as the lead agency for the International Year, in collaboration with other relevant agencies, within existing resources;

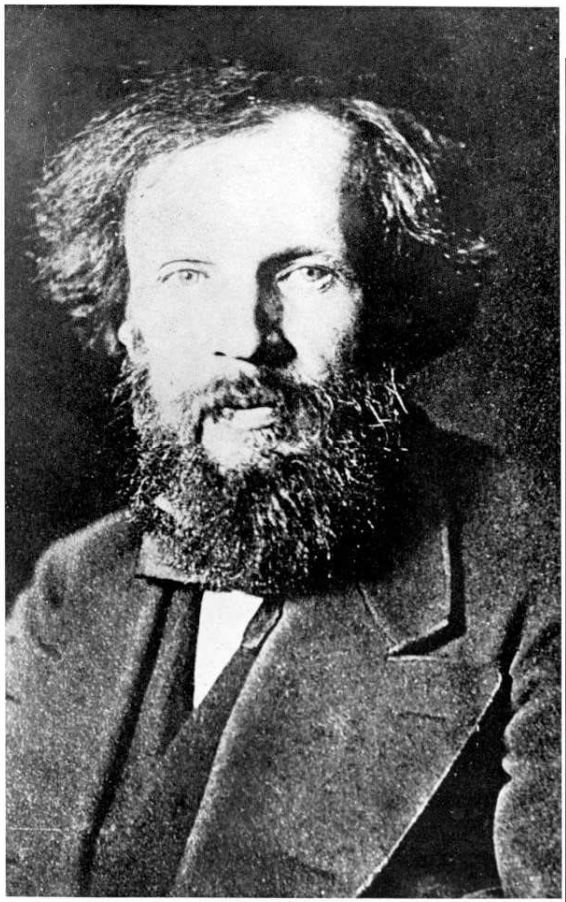
32. *Calls upon* the relevant organizations of the United Nations system, within their respective mandates and resources, to ensure that no one is left behind and no country is left behind in the implementation of the present resolution;

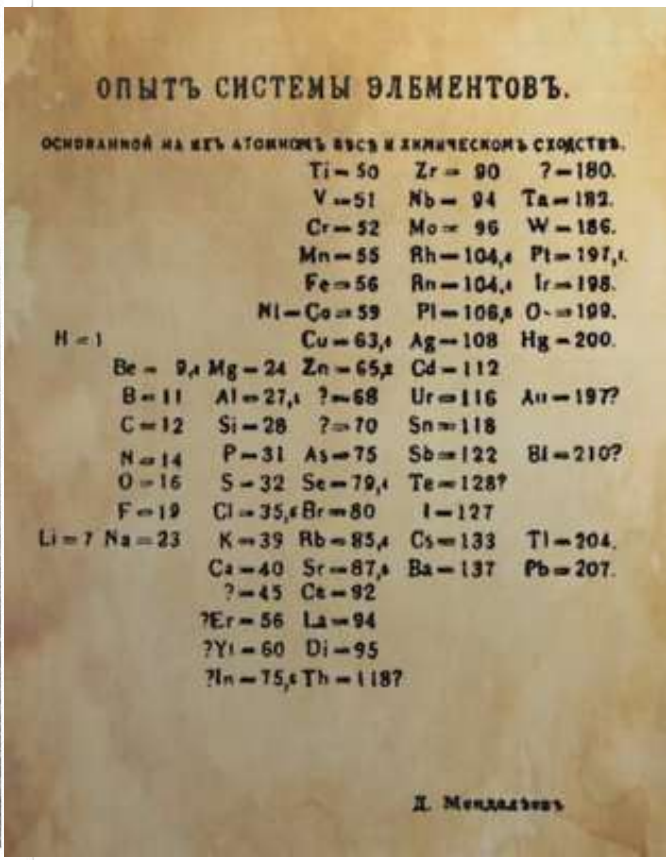
33. *Requests* the Secretary-General to submit to the General Assembly at its seventy-fourth session a report on the implementation of the present resolution and recommendations for future follow-up, including lessons learned in integrating science, technology and innovation policies into national development strategies as well as in supporting the implementation of the 2030 Agenda, and decides to include in the provisional agenda of its seventy-fourth session, under the item entitled "Globalization and interdependence", a sub-item entitled "Science, technology and innovation for sustainable development".

74th plenary meeting
20 December 2017

Periodic Table of Elements (1869)







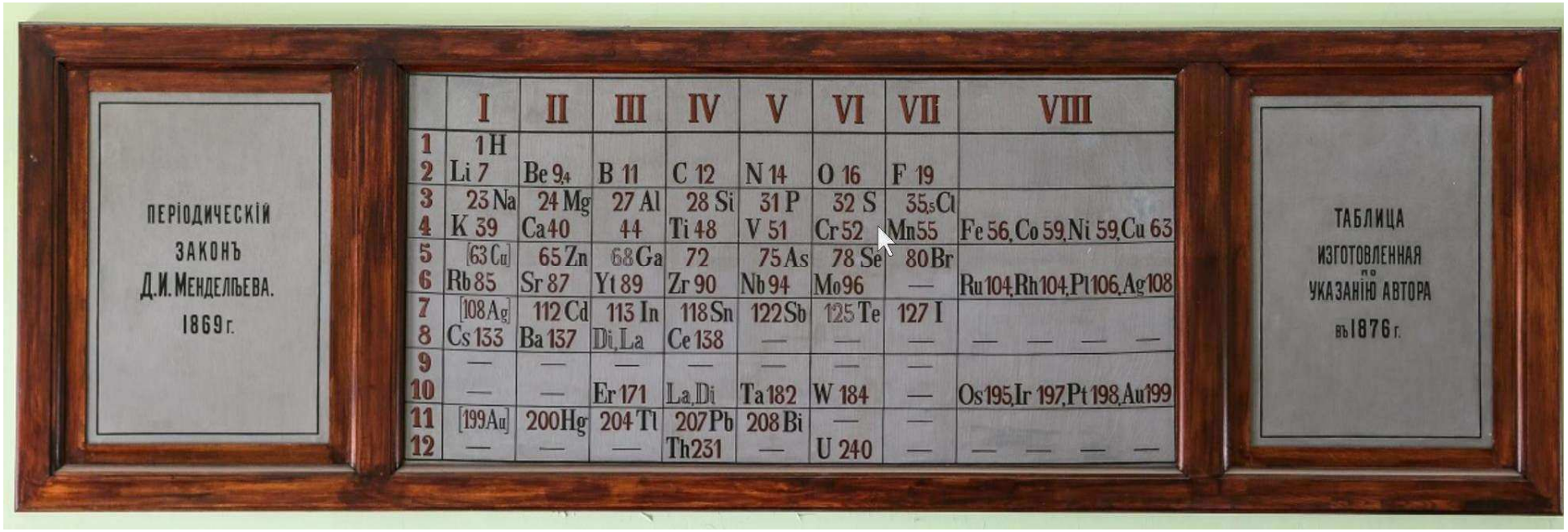
ОПЫТЪ СИСТЕМЫ ЭЛЕМЕНТОВЪ.

ОСНОВАННОЙ НА ИХЪ АТОМНОМЪ ВѢСѢ И ХИМИЧЕСКОМЪ СХОДСТВѢ.

			Ti = 50	Zr = 90	? = 180.
			V = 51	Nb = 94	Ta = 182.
			Cr = 52	Mo = 96	W = 186.
			Mn = 55	Rh = 104,4	Pt = 197,1.
			Fe = 56	Ru = 104,4	Ir = 198.
			Ni = Co = 59	Pl = 106,6	O = 199.
H = 1			Cu = 63,4	Ag = 108	Hg = 200.
	Be = 9,4	Mg = 24	Zn = 65,2	Cd = 112	
	B = 11	Al = 27,1	? = 68	Ur = 116	Au = 197?
	C = 12	Si = 28	? = 70	Sn = 118	
	N = 14	P = 31	As = 75	Sb = 122	Bi = 210?
	O = 16	S = 32	Se = 79,4	Te = 128?	
	F = 19	Cl = 35,5	Br = 80	I = 127	
Li = 7	Na = 23	K = 39	Rb = 85,4	Cs = 133	Tl = 204.
		Ca = 40	Sr = 87,6	Ba = 137	Pb = 207.
		? = 45	Ce = 92		
		?Er = 56	La = 94		
		?Yt = 60	Di = 95		
		?In = 75,6	Th = 118?		

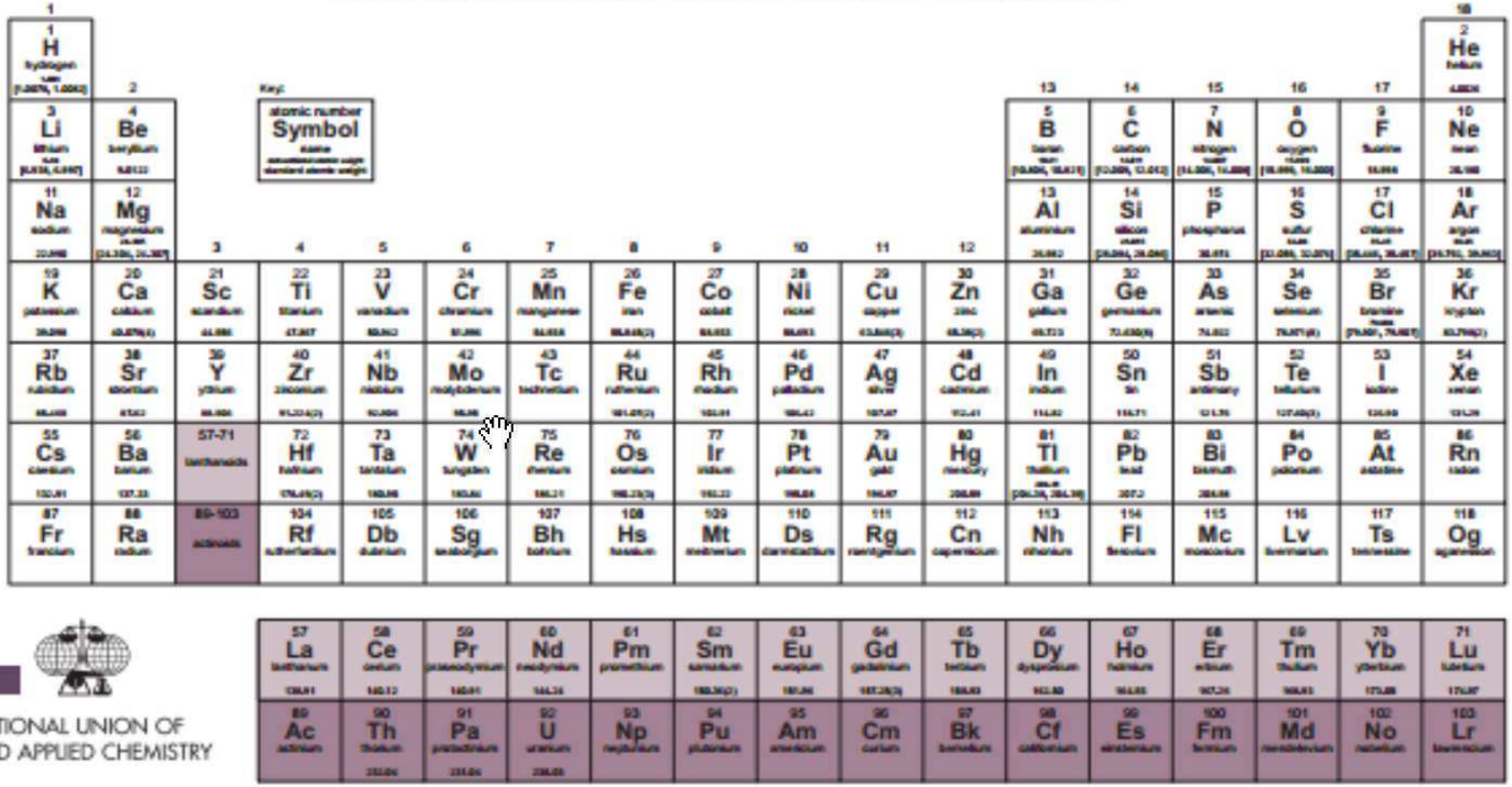
Д. Менделѣевъ

Oldest Periodic Table in any Lecture Theatre: *Mendeleev Lecture Theatre, Saint Petersburg State University* (1876); no Sc and Ge and Tc yet



	I	II	III	IV	V	VI	VII	VIII
1	1 H							
2	Li 7	Be 9,4	B 11	C 12	N 14	O 16	F 19	
3	23 Na	24 Mg	27 Al	28 Si	31 P	32 S	35,5 Cl	
4	K 39	Ca 40	44	Ti 48	V 51	Cr 52	Mn 55	Fe 56, Co 59, Ni 59, Cu 63
5	[63 Cu]	65 Zn	68 Ga	72	75 As	78 Se	80 Br	
6	Rb 85	Sr 87	Yt 89	Zr 90	Nb 94	Mo 96	—	Ru 104, Rh 104, Pt 106, Ag 108
7	[108 Ag]	112 Cd	113 In	118 Sn	122 Sb	125 Te	127 I	
8	Cs 133	Ba 137	Di, La	Ce 138	—	—	—	— — — —
9	—	—	—	—	—	—	—	
10	—	—	Er 171	La, Di	Ta 182	W 184	—	Os 195, Ir 197, Pt 198, Au 199
11	[199 Au]	200 Hg	204 Tl	207 Pb	208 Bi	—	—	
12	—	—	—	Th 231	—	U 240	—	— — — —

IUPAC Periodic Table of the Elements



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For notes and updates to this table, see www.iupac.org. This version is dated 1 December 2018.

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