

IUPAC
International Union of Pure and Applied Chemistry
Activities' Report – Year 2023
Lidia Armelao

1. Introduction

During 2023, IUPAC initiatives took place almost entirely in person, after the long interval of events organized in virtual mode due to the pandemic emergency. During the year, the intense activity of promoting and organizing cultural initiatives continued, such as the presentation of interdisciplinary scientific projects, the patronage and participation in national and international events, the coordination of special thematic issues in IUPAC journals, the publication of articles and notes in national and international journals. Furthermore, the role of the CNR and Italy in IUPAC is consolidated and recognized by the international scientific community, thanks to the constant and intense work carried out by the NAO CNR-Italy Commission. At the same time, the fruitful collaborative relationship with the Italian Chemical Society is also increasingly strengthened. This commitment has led to an ever-growing interest and active participation of many young researchers in IUPAC activities. The IUPAC General Assembly and the *Chains 2023* World Chemistry Congress held in The Hague, the Netherlands, represented the largest scientific international event of 2023. Finally, in 2023 the institutional mandate of the NAO CNR Italy Commission for the 2019 - 2022 term was completed and a new Commission was appointed starting from the first half of 2023.

2. Renewal of the Italian CNR Commission for participation in IUPAC

The Commission for the participation of the CNR in the IUPAC was reconstituted by the President of the CNR n. 61 (prot. AMMCNT no. 159681 of 25.5.2023) after the previous Commission, active in the four-year period 2019-2022, concluded its mandate. The Commission will remain in charge until 31 December 2026 and is composed by representatives of CNR, Italian Universities and the Industry sector. In particular, the appointed members are: Angela Agostiano (University of Bari), Lidia Armelao (DSCTM CNR - Rome), Silvia Borsacchi (ICCOM CNR - Pisa), Matteo Guidotti (SCITEC CNR - Milan), Mario Marchionna (SAIPEM - Milan), Giorgia Oliviero (University of Naples Federico II), Claudio Pettinari (University of Camerino), Maurizio Peruzzini (ICCOM CNR - Florence), Alessandra Sanson (ISSMC CNR - Faenza), Roberto Terzano (University of Bari). During the first meeting, held on 6 July 2023, the Commission elected Matteo Guidotti as President and Silvia Borsacchi as Scientific Secretary.

3. Main activities carried on by IUPAC during 2023 relevant for Italy and for CNR

IUPAC has granted endorsement to the following national and international conferences, organized by CNR and Italian universities, thus increasing their visibility and international participation.

- *Global Women Breakfast 2023@CNR Pisa. Breaking Barriers in Science*
Conference Chairs: Silvia Borsacchi (CNR-ICCOM), Elisa Carignani (CNR-ICCOM); CNR Research Area of Pisa, 14 February 2023. The IUPAC Global Women Breakfast was held in conjunction with the International Day of Women and Girls in Science. There were many events organized in Italy and reported on the IUPAC website (<https://iupac.org/gwb/>). The President of CNR, Prof. Maria Chiara Carrozza, attended the GWB organized by CNR and the University of Florence.
- *15th Postgraduate Summer School in Green Chemistry*
School Chairs: Fabio Aricó, Pietro Tundo (University of Venice, Ca' Foscari)
July 2 – 7 2023, Venice.
- *Global Conversation on Sustainability 2023 @CNR Pisa.*
Event promoted by Silvia Borsacchi (CNR-ICCOM) and Elisa Carignani (CNR-ICCOM) at the Pisa Research Area on 25 September 2023 in the framework of the global initiative organized by the

International Younger Chemists Network (IYCN) and IUPAC.

4. Activities carried on by Lidia Armelao within IUPAC during 2023 and impact on the Italian scientific community

1. 52^a IUPAC General Assembly

The Hague, Netherlands, 19–20 August 2023, World Forum Centre.

The IUPAC General Assembly consisted of a dense program of meetings of all IUPAC Divisions and Committees, aimed at discussing the activities carried out and planning future activities and cultural initiatives, also in collaboration between the various IUPAC bodies. The Italian representatives participated to the General Assembly as Presidents, elected members and Young Observers (YOs). In particular, the IUPAC Italian delegates at the General Assembly were:

- Pierangelo Metrangolo: Division I – Physical Chemistry and Biophysics. President (2022–2023), Past President (2024–2025).
- Lidia Armelao: Division II – Inorganic Chemistry. President (2022–2025).
- Roberto Terzano: Division VI – Chemistry and Environment. President (2022–2023), Past President (2024–2025).
- Matteo Guidotti: Division VI – Chemistry and Environment. Associate Member (2022–2023), Titular Member (2024–2025).
- Silvia Borsacchi: CHEMRAWN Committee. Associate Member (2022–2023), Secretary (2024–2025).

Among the YOs of the Italian delegation, Elisa Carignani participated to the activities of the CHEMRAWN Committee and of Division VI - Chemistry and Environment, and Fabiana Piscitelli attended the works of Division V - Analytical Chemistry.

2. 52^o IUPAC Council Meeting

The Hague, Netherlands, 23–24 August 2023, World Forum Centre.

The CNR delegation, as National Adhering Organization (NAO) at IUPAC, participated to all activities of the Council. During the assembly, the members of the Science Board and the Executive Board, two new governing bodies of IUPAC established in the renewed statute, were elected for the first time. Lidia Armelao was elected member of the Science Board, the central IUPAC body that will give the scientific guidelines to the Union for the next two years. During the Council Meeting, some Italian representatives received the following recognitions: Lidia Armelao received the 2023 *Distinguished Women in Chemistry and Chemical Engineering Award* for the commitment throughout her professional and scientific career. Roberto Terzano and Pierangelo Metrangolo received the *IUPAC Service Award*, for having served the Union in 2022–2023 as Presidents of Division VI - Chemistry and Environment, and of Division I - Physical Chemistry and Biophysics.

3. Top Ten Emerging Technologies 2023

On 16 October 2023, the results of the research on the Top Ten Emerging Technologies 2023 were published by IUPAC. The Italian CNR Commission for IUPAC, in collaboration with the Italian Chemical Society, contributed to disseminate the results of this selection of important enabling technologies that will have a fundamental role in the future to promote sustainable development processes while respecting the needs of humanity and safeguarding the environment.

4. Emergency Response Guidebook 2020 in Russian language

Nootdorp, The Netherlands, 27 November 2023, OPCW (Organisation for the Prohibition of Chemical Weapons) ChemTech Centre. The final text ERG 2020 – Emergency Response Guidebook was presented in the Netherlands to the international community and to the diplomatic representations of the nations where Russian is the official language. The text, which provides immediate practical information in the event of industrial accidents involving dangerous substances of a chemical, biological or radioactive nature, was officially presented to the delegates of Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan and Tajikistan, as well as to representatives of OPCW and IUPAC. The IUPAC NAO-CNR Commission is among the main European bodies promoting this international cooperation initiative with

the main countries of Eastern Europe and Central Asia.

5. *Publication activity in the IUPAC Chemistry International journal*

The second 2023 issue of Chemistry International (<https://iupac.org/etoc-chemistry-international-apr-june-2023/>), the IUPAC news magazine, contains three contributions of the Italian scientific community to international initiatives. Juliana Vidal and João Borges, chairs of the Global Conversation on Sustainability, present the video created by the Italian YOs on *Research for Sustainability* (<https://www.youtube.com/watch?v=sRclYbfhyKE>). A second contribution by S. Borsacchi, M. Guidotti, A. Sanson, A. Minguzzi, A. Pozzi, A. M. Paci, F. Kerton and M. Peruzzini is related to the event dedicated to Alessandro Volta and the key role of electrochemistry from the past to the future. The event, held in Como on 24 October 2022, organized by the NAO-CNR and supported by an IUPAC project, was included in the program of initiatives for the International Year of Basic Sciences for Sustainable Development. Finally, a contribution is presented by Silvia Borsacchi on the 1st Italian-French International Conference on Magnetic Resonance which was endorsed by IUPAC and held in Milan from 27 to 30 September 2022.

6. *Publication activity in the IUPAC Pure and Applied Chemistry (PAC) journal*

Two contributions presented at the event on Alessandro Volta were published on PAC (De Gruyter editore): C. Arbizzani, G. Lacarbonara "From Volta's pile to lithium-ion battery: 200 years of energy". *Pure and Applied Chemistry* **2023**, 95, 1131-1139 (<https://doi.org/10.1515/pac-2023-0502>); L. Fabbrizzi "The invention of Volta's Pile and its diffusion in Europe at war in the year 1800". *Pure and Applied Chemistry* **2023**, 95, 1141-1157 (<https://doi.org/10.1515/pac-2023-0504>). The preface was edited by M. Peruzzini and S. Borsacchi.

In 2023, the special issue dedicated to the memory of Mary Lowe Good was published in *Pure and Applied Chemistry* (<https://www.degruyter.com/journal/key/pac/95/6/html>). Mary L. Good, alongside a distinguished career in academic, government and industry, was the first woman to be elected President of an IUPAC Division (Division II, Inorganic Chemistry), as well as a member of the Bureau and Executive Committee (1985– 1993). The special issue, promoted by the Inorganic Chemistry Division, includes 9 original articles by national, European and international authors, and covers various research areas ranging from magnetochemistry, solid state, solution equilibria and gel systems, up to 2D films, chemistry of lanthanides, nanomaterials and their applications. One contribution concerns the discovery of new elements and Science as a tool for cooperation between countries. The preface is edited by the volume's guest editors: L. Armelao, L. Öhrström, D. Rabinovich, M. Hasegawa. L. Armelao contributed to the volume with a scientific paper.

In 2023, the special issue dedicated to the first Italian-French Magnetic Resonance Conference, held in Milan from 27 to 30 September 2022 and sponsored by IUPAC, was also published in *Pure and Applied Chemistry* (<https://www.degruyter.com/journal/key/pac/95/10/html>). The issue contains 6 original articles by the conference speakers, which illustrate, through different applications, the versatility and potential of the NMR technique.

During 2023, the special issue of *Pure and Applied Chemistry* dedicated to the V edition of the *Avogadro Colloquia*, sponsored by IUPAC and jointly organized by DSCTM CNR and the Italian Chemical Society, was prepared. The topic of the workshop, held in Rome at the headquarters of the National Research Council (Aula Marconi, 15 - 16 December 2022), was the role of hydrogen in a sustainable world. The event was one of the first initiatives for the celebrations for the CNR centenary. The preface is edited by L. Armelao, E. Giamello, G. Guerra.

7. *IUPAC projects.*

One of IUPAC's main scientific activities is the funding of projects, following a thorough peer-review process, that meet at least one of the following requirements: to be related to the needs of chemists around the world, not just in one country or region; to be connected to the role of chemistry in meeting humanity's needs; to be proposed by an international team.

Ongoing or recently completed IUPAC projects, coordinated by Italian experts:

Develop Solid State NMR Potential for Environment Protection and Sustainability

Chairs: Silvia Borsacchi, Elisa Carignani

<https://iupac.org/project/2023-017-2-600/>

Introducing the IUPAC Seal of Approval for a Wider Adoption of IUPAC Recommended Symbols, Terminology and Nomenclature: Stage 1 – Symbols

Chair: Alessandro Minguzzi

<https://iupac.org/project/2022-008-4-500>

Alessandro Volta's heritage: the past and future of electrochemistry

Chairs: Silvia Borsacchi, Maurizio Peruzzini

<https://iupac.org/project/2022-018-1-021/>

MLC-MS quantitative methods validation and performance: an exemplified guide

Chair: Fabiana Piscitelli

<https://iupac.org/project/2021-036-1-500>

Assessment of the contribution of IUPAC projects to the achievement of the United Nations Sustainable Development Goals

Chairs: Pietro Tundo, Jane Wissinger

<https://iupac.org/projects/2020-011-2-041>

Enhancing capabilities for the mitigation of chemical risk: the dissemination of the Emergency Response Guidebook in russian speaking countries

Chairs: Matteo Guidotti, Anton Martyniuk

<https://iupac.org/project/2020-020-2-600>

Metrics for green syntheses

Chairs: Fabio Aricò, Pietro Tundo

<https://iupac.org/project/2017-030-2-041>

Ongoing IUPAC projects in which Italian experts participate:

Effective teaching tools and methods to learn about e-waste.

Task Group Members: L. Armelao, S. Borsacchi, M. Peruzzini, A. Sanson

<https://iupac.org/project/2022-016-1-021/>

5. Evaluation of the participation in terms of benefits and membership cost

The evaluation of participation in IUPAC is very positive. Visibility, active presence in the Union and international relations of the Italian chemical scientific community, both of CNR and Universities, are a consolidated reality. In the two-year period 2022-2023, the presence of Italian representatives in the IUPAC divisions and commissions increased, both in responsibility positions and as members of the various divisional groups. A large group of young people (Young Observer, YOs) was formed who were interested and passionately dedicated to IUPAC activities, participating in most of the events and proposing numerous initiatives with colleagues from other countries. In this way, the initiatives and involvement of the Italian community - especially young people - in the international activities of IUPAC have been increased. Furthermore, the relevant number of active Italian-led scientific projects, supported by IUPAC, has allowed, and still allows to attract funding and cultural activities in Italy, not only at CNR Institutes, but also in academic institutions throughout Italy.

6. Evaluation of Italians' attendance and how to improve interest and involvement

Also, in relation to this aspect, the evaluation of participation in IUPAC is to be considered very good. The initiative and interest of the members of the Commission, and the synergy with the YOs have led to a significant increase in the country's role in IUPAC. To improve involvement, it would be important to increase communication towards the scientific network, further enhancing the important synergy with the Italian Chemical Society, and to present the main IUPAC activities at scientific events and conferences. In each dissemination activity, the presence of Italy in IUPAC and the role of CNR as the National Adhering Organization (NAO) were highlighted.

7. Italian experts with important roles within the Union or within related Commissions and Programs (if known)

1. Fabio Aricò – University of Venice, Ca' Foscari
Titular Member, Interdivisional Committee on Green Chemistry for Sustainable Development
2. Lidia Armelao – CNR DSCTM Rome e University of Padua
President, Inorganic Chemistry Division; Member of IUPAC Science Board; Member of IUPAC Evaluation Committee; Italian representative at IUPAC
3. Silvia Borsacchi – CNR ICCOM Pisa
Secretary, Committee on Chemical Research Applied to World Needs (CHEMRAWN)
4. Federica Camin – University of Trento
Associate Member, Commission on Isotopic Abundance and Atomic Weights (CIAAW)
5. Matteo Guidotti – CNR SCITEC Milano
Titular Member, Chemistry and the Environment Division
6. Gabriele Manca - CNR ICCOM Sesto Fiorentino (FI)
Associate Member, Chemical Nomenclature and Structure Representation Division
7. Pierangelo Metrangolo - Polytechnic of Milan
Past President, Physical and Biophysical Chemistry Division
8. Maurizio Peruzzini - CNR ICCOM Sesto Fiorentino (FI)
Associate Member, Committee on Chemical Research Applied to World Needs (CHEMRAWN)
9. Cristina Nativi - University of Florence
Secretary, Organic and Biomolecular Chemistry Division; Associate Member, Committee on Chemistry Education
10. Fabiana Piscitelli - CNR ICB Pozzuoli (NA)
Associate Member, Analytical Chemistry Division
11. Guido Raos - Polytechnic of Milan
Associate Member, Polymer Division
12. Antonella Rossi - University of Cagliari
Titular Member, Committee on Chemistry Education
13. Alessandra Sanson – CNR ISSMC Faenza (RA)
Associate Member, Inorganic Chemistry Division
14. Michele Saviano – CNR IC Bari
Titular Member, Chemistry and Human Health Division
15. Roberto Terzano - University of Bari “Aldo Moro”
Past President, Chemistry and the Environment Division

16. Luisa Torsi - University of Bari "Aldo Moro"
Secretary, Analytical Chemistry Division
17. Pietro Tundo - University of Venice, Ca' Foscari
Interdivisional Commission on Green Chemistry for Sustainable Development (ICGCSD)
(passed away on September 2023)

8. If Union with CNR Commission, short summary about the 2023 CNR Commission activities

- Commission meetings. The NAO-CNR met virtually 3 times during 2023 (06 July, 10 October, 12 December).
- Organization of events of national and international interest. The NAO-CNR organized an event of international importance "Global Women Breakfast (GWB) 2023".
- Communication activities. The NAO-CNR has kept the communication and publicization of its activities and those of IUPAC active and updated through continuous updating of the Commission website (www.iupac.cnr.it), completely renewed in 2019, with the active support of Mr. Francesco Verginelli (CNR DSCTM). Communication activity was strengthened and expanded with the opening of a Commission Twitter account.
- Publications
 1. S. Borsacchi, M. Guidotti, A. Sanson, A. Minguzzi, A. Pozzi, A.M. Paci, F. Kerton, M. Peruzzini "Alessandro Volta: still fully charged after 200 years" *Chemistry International* **2023**, 45, 17-21 (<https://doi.org/10.1515/ci-2023-0205>).
 2. S. Borsacchi, M. Guidotti, A. Sanson, A. Minguzzi, A. Pozzi, A.M. Paci, M. Peruzzini "Alessandro Volta e l'elettrochimica come volano per un futuro sostenibile: un evento IUPAC italiano per l'International Year of Basic Sciences for Sustainable Development", *La Chimica nella Scuola* **2023**, 1, 90-93.
 3. S. Carlotto, L. Babetto, M. Rancan, G. Bottaro, M. Casarin, L. Armelao "How to get deeper insights into the optical properties of lanthanide systems: a computational protocol from ligand to complexes". *Pure and Applied Chemistry* **2023**, 95, 671-682 (<https://doi.org/10.1515/pac-2023-0118>).
 4. L. Armelao, L. Öhrström, D. Rabinovich, M. Hasegawa "Editorial of the special issue in honor of Dr. Mary L. Good". *Pure and Applied Chemistry* **2023**, 95, 631-632 (<https://doi.org/10.1515/pac-2023-2006>).
 5. M. Burkitbaev, M. Guidotti, A. Martyniuk (Editors) "Emergency Response Guidebook ERG 2020, Руководство по реагированию на чрезвычайные ситуации ERG - выпуск 2020" in Russian language, Bishkek (Kirghizistan) **2023** (https://iupac.org/wp-content/uploads/2023/02/ERG2020-RUSSIAN_20230219.pdf).
 6. L. Armelao, E. Giamello, G. Guerra "Editoriale. Avogadro Colloquia 2022. Quale ruolo per l'idrogeno in un mondo sostenibile?" *La Chimica & l'Industria* **2023**, 5, 3-4.
- Italian IUPAC Young Observer Group. The NAO-CNR worked in close and continuous synergy with the group of 10 Young Observers selected in 2021, young researchers from the CNR and Italian universities. Elisa Carignani (CNR) participated on their behalf in all the NAO meetings. The activity of the Italian YO group has been recognized and appreciated several times in IUPAC and is listed below.

Projects led by Italian YOs:

- Task Group Chair: F. Piscitelli (CNR) “LC-MS quantitative method validation and performance: an exemplified guide” Analytical Chemistry Division, and Chemistry and the Environment Division, Chemistry and Human Health Division (<https://iupac.org/project/2021-036-1-500/>)
- Task Group Chair: A. Minguzzi (University of Milan), Task group member: Fabiana Piscitelli (CNR) “Introducing the IUPAC Seal of Approval for a wider adoption of IUPAC recommended symbols, terminology and nomenclature: Stage 1 - Symbols” Analytical Chemistry Division, and Committee on Publications and Cheminformatics Data Standards, Physical and Biophysical Chemistry Division (<https://iupac.org/project/2022-008-4-500/>)

Projects in which Italian YOs are members of the Task Group:

- “IUPAC SMILES+ Specification” Task group member: Elena Lenci (University of Florence) Committee on Publications and Cheminformatics Data Standards, Chemical Nomenclature and Structure Representation Division (<https://iupac.org/project/2019-002-2-024/>)
 - “Gold Book Update of Terms for Organic and Biomolecular Chemistry” Task group member: Gianluigi Albano (University of Bari) Organic and Biomolecular Chemistry Division, Joint Subcommittee on the IUPAC Gold Book (<https://iupac.org/project/2021-020-1-300/>)
 - "Minimizing environmental impacts of tyre and road wear particles" Task Group Member: Elisa Carignani (CNR) Chemistry and the Environment Division, Polymer Division, Analytical Chemistry Division (<https://iupac.org/project/2021-028-3-600/>)
 - “Harmonizing carbon sequestration measurement” Task group member: Nicola Sangiorgi (CNR) Chemistry and the Environment Division, Committee on Chemistry and Industry (<https://iupac.org/project/2022-010-2-600/>)
 - “Alessandro Volta's heritage: the past and the future of electrochemistry” Task group member: Alessandro Minguzzi (University of Milan) Committee on Chemical Research Applied to World Needs (<https://iupac.org/project/2022-018-1-021/>)
 - “Chemistry Entrepreneurship”, Task Group Member: Matteo Guidotti (CNR) Committee on Chemistry and Industry (<https://iupac.org/project/2023-012-2-022/>)
- The CNR Italian delegation as NAO at IUPAC participated in all the work of the 52nd GA and Council Meeting of IUPAC in August 2023 in The Hague, Netherlands. A member of the delegation was financially supported by the International Relations Unit of the CNR.

9. Conclusions

The ongoing activities of the Italian Representative at IUPAC and the members of the NAO CNR Commission have further strengthened and confirmed Italian participation in the Union, through the presence of young researchers, and maintaining a constant number of successful events and initiatives connected to IUPAC in Italy. It is important that CNR continues to support the work of the Commission and the participation of young researchers in the international and national events organized by IUPAC. To improve involvement, communication towards the scientific network will be increased and IUPAC activities will be presented, whenever possible, in meetings and conferences. The Commission aims at stimulating the presentation of interdisciplinary projects within IUPAC and to have an active, qualified and representative presence of the national scientific community in the divisions and permanent commissions of IUPAC.

Rome, May 1st 2024

Signature – Lidia Armelao