

U.S. ADHERENCE REVIEW
OF INTERNATIONAL SCIENTIFIC ORGANIZATIONS
AFFILIATED WITH THE
INTERNATIONAL SCIENCE COUNCIL

Board on International Scientific Organizations
National Academies of Sciences, Engineering and Medicine

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Context

On behalf of the United States, the National Academy of Sciences (NAS) adheres to the International Science Council (ISC) and a number of its international scientific Unions, Commissions, and Committees.¹ The Board on International Scientific Organizations (BISO) has responsibility within the NAS for ensuring robust U.S. participation in ISC and most of the affiliated organizations to which the NAS adheres. Funding for this involvement is provided by the National Science Foundation (NSF).

The international scientific unions fulfill essential roles in the global science community and help advance science worldwide. While specifics vary, many are responsible for their discipline's internationally recognized nomenclature, required for common understanding and the foundation on which science is based. Similarly, many unions are responsible for setting international constants in their discipline. These are needed to determine quality in science and technology, and allow evidence-based science and decision-making. The unions also organize scientific research programs, publish respected journals, maintain databases and/or monitor databases of importance to their field, help identify new and emerging issues, confer the major international awards in their disciplines, and promote diversity and the careers of young scientists. Each organization has its own unique strengths, and no single role determines the value of a union. Each union also supports a separate powerful, international network, including relationships with UN bodies.

In 2017-2018, BISO underwent three reviews. The first, in 2017, was an internal review that focused on BISO's "fit" within the NAS mission, as well as its future challenges and opportunities. The second, an external review conducted by Joe Taylor at BSCS in Colorado Springs, CO, examined BISO's role, collaborations, contributions, and effectiveness. The third review was a Committee of Visitors (COV) organized by NSF to review past proposals from and awards to BISO. The question of how we determine whether to adhere, or continue to adhere, to each union came up in the external and COV reviews. The same issues had been brought up by BISO staff numerous times in recent years.

The last major change of BISO's portfolio occurred in 2010 when the NAS ceased participation in all five unions in the biological sciences. This was due to a number of organizational and programmatic concerns, and the cessation of funding support from NSF's Biological Sciences Directorate.

Several factors have arisen in the last two years making a reexamination timely. These factors include:

- The merger of the International Council for Science (ICSU) with the International Social Science Council (ISSC) in July 2018 to form the new International Science Council (ISC). The ISC now involves unions and organizations from both the former ICSU and ISSC.

¹ "Unions" in this document should be understood to include all the reviewed ISC-related international scientific unions, scientific associates, commissions, and scientific committees.

- In 2017, NSF's Chemistry Division decided it was no longer interested in supporting U.S. involvement in the International Union for Crystallography (IUCr).
- The Director of Board on Research Data and Information (BRDI) has asked whether BISO could resume responsibility for CODATA, which was previously in the BISO portfolio.
- The U.S. National Committee for the International Commission on Illumination (CIE) has asked to be represented by the NAS and BISO. It currently exists as an independent body outside the NAS. CIE is a member of the ISC, and is closely associated with the International Union for Pure and Applied Physics (IUPAP) and the International Commission on Optics (ICO), both of which are represented in BISO.
- The International Union of Biological Sciences (IUBS), one of the unions that dropped in 2011, has asked the NAS to consider rejoining on behalf of the United States. IUBS took the U.S. criticisms and those of the six other countries that left contemporaneously very seriously and has made major changes in governance and programs in response.
- The International Union of Pure and Applied Biophysics (IUPAB) also has asked if the NAS would consider rejoining.

NSF's COV report² specifically raised the following questions:

- Given the merger between the former International Council for Science and the International Social Science Council and the creation of the new ISC, are there other ISC-related unions or organizations for which national support should be considered?
- Given that BISO's portfolio has remained constant since 2010, are the unions and organizations in it still strong and effective? Should any be dropped or added?

These questions, as well as an understanding that funds for international memberships and the necessary programmatic and administrative support are not limitless, have led BISO to conduct a review of the ISC-related unions and programs currently in its portfolio and those that might potentially be included. This review consists of two parts: 1) a review of ISC members, and 2) a union review.

Part I: Review of ISC Members³

Questions Addressed:

1. The ISC has both national members (i.e. National Academies of Sciences) and organizational members (i.e. unions, commissions, and scientific committees). Who are the current organizational members of ISC?
2. What is the membership base of each organization? National bodies, professional societies, individuals, or a combination?
3. Is the disciplinary area of the union of interest to the National Academies of Sciences, Engineering, and Medicine (NASEM)?
4. Is the disciplinary area covered by the union of interest to the NSF?

² COV Report on BISO Funding, https://www.nsf.gov/od/oise/OISECOV-Doc/BISOCOV/OISE_BISO_2018_COV_Report.pdf

³ See Appendix 1 for a list of all the ISC-related organizations.

5. Who currently represents the United States in the ISC-related union?

Findings:

1. The former memberships of ICSU and ISSC partially overlapped, with some organizations belonging to both. The new ISC includes all the organizations that were previously members of either ICSU or ISSC.
2. The current union (non-national) members of the ISC consist of a variety of organizations: large and small, general and specific.
3. The current union (non-national) members of the ISC reflect a variety of membership models: national representation, society representation, individual memberships, or a mix of these.
4. The national membership model is generally used by the larger, more established, broader, and/or interdisciplinary unions.
5. Generally, a national membership is held by a country's National Academy of Sciences.
6. The NAS is an appropriate body for national membership organizations.
7. Many, but not all, of the organizations with national membership models are in disciplines that fall within the jurisdiction of the National Science Foundation.
8. When current ISC organizations are reviewed against four criteria (i.e. national membership model, area of interest to the NASEM, area within the jurisdiction of the NSF, and currently without U.S. representation), all but two are already represented by the NAS and funded by the NSF. The two that are not are the International Union of Biological Sciences (IUBS) and the International Commission on Illumination (CIE), both of which have approached the NAS for representation.

Part II: Union Review

BISO manages the U.S. memberships in most, but not all, of the ISC-related organizations to which the NAS adheres on behalf of the United States. Our review covered only those unions and programs either currently within the BISO portfolio or those that have asked to become affiliated with BISO. These include:

ISC-related Unions:

- [International Astronomical Union](#) (IAU)
- [International Mathematical Union](#) (IMU) and its [International Commission on Mathematical Instruction \(ICMI\)](#)
- [International Union for Quaternary Research](#) (INQUA)
- [International Union of Crystallography](#) (IUCr)
- [International Union of Geodesy and Geophysics](#) (IUGG)
- [International Union of Geological Sciences](#) (IUGS)
- [International Union of Pure and Applied Chemistry](#) (IUPAC)
- [International Union of Pure and Applied Physics](#) (IUPAP)
- [International Union of Psychological Science](#) (IUPsyS)
- [International Union of Soil Sciences](#) (IUSS)

- [International Union of Theoretical and Applied Mechanics](#) (IUTAM)
- [Union Radio Scientifique Internationale](#) (URSI)

ISC Commissions and Committees:

- [Scientific Committee on Solar Terrestrial Physics](#) (SCOSTEP)
- [International Commission for Optics](#) (ICO), also a commission of IUPAP
- [Pacific Science Association](#) (PSA)

Other ISC-Related Organizations:

- [CODATA](#), currently housed in the Board on Research Data and Information (BRDI in PGA)
- [International Council on Illumination](#) (CIE), currently outside of the NAS
- [International Union of Biological Sciences](#) (IUBS), no current U.S. representation
- [International Union for Pure and Applied Biophysics](#) (IUPAB), currently represented by the Biophysics Society

Due to historic reasons, five other ISC-related programs are found in other parts of the NASEM. These are not included in this review. They are:

- [International Arctic Science Committee](#) (IASC), managed by the Polar Research Board (PRB) in the Division of Earth and Life Sciences (DELS);
- [Scientific Committee on Antarctic Research](#) (SCAR), managed by the PRB in DELS;
- [Scientific Committee on Ocean Research](#) (SCOR), managed by the Ocean Studies Board (OSB) in DELS;
- [International Geographic Union](#) (IGU), managed by the Geographical Sciences Committee in DELS; and
- [Committee on Space Research](#) (COSPAR), managed by the Space Studies Board (SSB) in the Division on Engineering and Physical Sciences (DEPS).

Questions Addressed in Part II of the Review:

1. For each organization, what is the total income, and what is the U.S. contribution?
2. What are the current roles, programs, and activities of each union?
3. What are the special roles performed by the U.S. National Committees (USNCs) in the United States because of or through the international unions and programs?
4. Using U.S. professional society membership as a proxy, how large is the associated U.S. science community? To what extent are they involved with the USNC or the union/commission/committee?
5. Using participation in leadership as a proxy, to what extent are U.S. scientists involved with the union and the USNC?
6. Based on the overall data, what changes in adherence are recommended?

Methodology:

For each union in which BISO currently or potentially participates, the following information was collected:

1. Finances
 - a. U.S. dues (currently paid through grant from NSF to the NASEM)
 - b. Organization's annual income
2. Roles and Responsibilities of ISC-related Unions, Commissions, and Scientific Committees
 - a. Major scientific roles, including nomenclature and standards responsibilities
 - b. Strategic Plan
 - c. Number of scientific meetings held in the last three years (per year)
 - d. Number of scientific meetings held in the United States the last three years (per year)
 - e. Databases owned or managed by the organization
 - f. Major prizes awarded
 - g. Scientific journals
 - h. Other publications
 - i. Major meetings organized (aside from governance meetings)
 - j. Early Career and/or student programs
 - k. Other significant roles of the organization
 - l. Social media outreach
3. USNC-U.S. Professional Society Interactions
 - a. U.S. societies associated with the related USNC
 - b. Total society membership (per society)
 - c. Percent of society membership U.S. and foreign (per society)
 - d. Role(s) of society on the USNC or in the union
 - e. USNC roles with the U.S. societies
4. Other significant roles of the USNC
5. Individuals involved with the union and USNC
 - a. Key NASEM members involved with the USNC over the last 6 years
 - b. U.S. based union officers over the last 6 years

Findings

1. Finances
 - a. Union annual incomes range from \$55,000 to \$1.4 million. Most unions have incomes in the \$100,000-500,000 range. Two are over \$1 million, and one is over \$3 million due to its journals.
 - b. Twelve unions, including all the wealthiest unions, produce one or more journals. Many of these journals are among the most important and highly regarded in their field. For these unions, changes in the publishing environment due to open science considerations may well affect that income stream.
 - c. U.S. dues range from \$6,000 to \$146,000 per year. Most are in the \$15,000-50,000 range. Two are over \$100,000.
 - d. No direct relationship exists between U.S. dues and either how active the union or organization is or how large the U.S. community is.

- e. In three cases, very low union budgets limit the roles and activities of the organization.
- f. U.S. dues are not as great a proportion of the total income as often assumed. Of the total reviewed, U.S. dues to four were less than 5% of the union's income; seven were 5-10%, two were 10-15%, and four were over 15%. In an additional two cases, the U.S. does not currently adhere so does not pay dues. In a third case involving a commission, U.S. dues are included in the payment made to the parent union.
- g. Because of other countries' contributions, the U.S. contributions are strongly leveraged.⁴
- h. U.S. dues and contributions provide access and allow U.S. scientists to engage with important international organizations at leadership (governance) and/or scientific levels.⁵

2. Roles and Responsibilities of Unions

- a. About half the unions have strategic plans or similar strategy documents.
- b. Similar goals and types of activities are seen across all unions.
 - i. While specifics vary, almost all organizations advance science, support workforce development, and promote global capacity building.
 - ii. No single criterion determines the strength of a union or organization.
 - iii. Each organization has unique strengths and capabilities.
- c. The international scientific organizations fulfill essential roles in the global science community and help advance science worldwide.
 - i. Many unions organize scientific research programs.
 - ii. Many unions publish respected journals in their fields.
 - iii. Unions maintain databases and/or monitor databases of importance to their field.
 - iv. Many unions are responsible for their discipline's internationally recognized nomenclature. Nomenclature is required for common understanding, and is the foundation on which science is based.

⁴ This point also was noted in NSF's COV report, which states, "[N]ational membership fees are the financial resources that allow ISC subsidiary bodies to undertake activities that are more clearly aligned with [NSF's] two merit review criteria, and that U.S. participation is leveraged many-fold by other nation's contributions to common efforts undertaken by the organizations." COV Review of BISO, https://www.nsf.gov/od/oise/OISECOV-Doc/BISOCOV/OISE_BISO_2018_COV_Report.pdf, p. 8.

⁵ William Phillips (NAS), NIST, Nobel Laureate, IUPAP Commission 2 Chair and USNC/IUPAP member, sent the following statement to BISO while this review was underway: "My participation in Commission C2 of IUPAP (with responsibility for units, fundamental constants, and related topics) has been essential in the global relations aspects of metrology and of the upcoming reform of the International System of Units (the SI). The creation of an international program to resolve the long-standing problem of the Newtonian gravity constant, and my representation to international bodies of the U.S. perspectives on the new SI were possible only because of U.S. participation in IUPAP."

- v. Similarly, many unions are responsible for setting international constants in their discipline. These are needed to determine quality in science and technology, and allow evidence-based science and decision-making.
- vi. Some unions provide indispensable services on which technologies are based.
- vii. Unions offer a forum in which to recognize international achievement in science or mathematics. This includes the major international awards in a discipline, such as the Fields Medal in mathematics.
- viii. Union science programs help identify new and emerging issues.
- d. Unions have a global focus. They provide cooperative and collaborative forums for their field, and allow all countries to have a voice in scientific decisions.
- e. Each union supports a separate powerful, international network.
 - i. Unions are involved with other important international bodies, including those associated with the United Nations.
 - ii. Unions engage in important synergistic activities. Recent ISC grants have allowed unions to pursue joint projects.
- f. Many unions and their associated USNCs actively support workforce development.
 - i. Unions and USNCs promote opportunities for workforce development, independent of career stage or individual's location.
 - ii. Many unions and USNCs support programs to help early career scientists engage in the global community and build personal networks.
- g. Union communications are either very strong or very limited.
 - i. Unions with larger income and permanent staff generally have good communications and are active and visible on social media.
 - ii. Smaller unions and those without permanent staff have limited communications and rely primarily on websites. Most of these have little presence on social media.
 - iii. Lack of communications, particularly lack of presence on social media, hinders the visibility of the organization in the United States and abroad.

3. USNC-U.S. Professional Society Interactions

- a. The USNC-U.S. society relationship is important to both.
 - i. Given the overall membership in U.S. societies, these organizations offer an important communications route into the U.S. scientific community. Interactions between U.S. societies and USNCs are important for visibility and outreach.
 - ii. USNCs and societies leverage each other's activities and names.
 - iii. Almost all U.S. societies involved with the USNCs include some proportion of foreign members, although this varies by society.
 - iv. Interestingly, although some societies are involved in more than one USNC, their participation in those USNCs can be very inconsistent.
- b. USNC and U.S. societies reflect a variety of interactions.

- i. While variation can be seen among the USNCs, 19 types of recurring interactions⁶ can be identified.
- ii. Some USNCs and professional societies have written, long-standing agreements regarding support and engagement.
- iii. Societies can be separated into two categories: a large one that has sustained, regular, and deep interactions with the USNC and/or union, and a much smaller one that has more superficial connections but continues to want their name connected to the USNC.
- iv. A society's activity level is not dependent on its size. Some small societies make out-sized contributions.

4. Other significant roles of the USNC

- a. USNCs often fulfill roles for the U.S. scientific community that are independent of the related union.
- b. USNCs organize conferences, workshops, and scientific symposia focused primarily on and held in the United States. (Note: Funding for these activities is often provided by non-NSF sources.)
- c. USNCs organize bilateral and multilateral workshops on scientific topics and workforce development.

⁶ Recurring interactions between USNCs and U.S. professional societies include the following:

Role of Society in USNC

- 1 - Agreement with NAS re committee membership
- 2 - Society appoints members to serve on USNC according to written agreements
- 3 - Society recommends members to serve on the USNC
- 4 - Society director serves on USNC (ex officio)
- 5 - Society director or elected leaders served in major union committee or leadership role
- 6 - Society or sponsoring agency served as union secretariat
- 7 - Society provides funding or financial support for USNC activity
- 8 - Society organizes or provides logistics for major union meeting in the United States
- 9- Society provides substantial in-kind support
- 10 – Society and USNC work together on bids, resolutions, nominees, and programs for union General Assemblies

USNC Work with Societies

- 1 - USNC members and/or BISO staff organize sessions related to the USNC or the union at society meetings
- 2 - USNC members and/or BISO staff make presentations about the union and/or the USNC to the society Executive Board or International Committee
- 3 - USNC members and/or BISO staff prepare and submit articles for society publications
- 4 - USNC members and/or BISO staff include society tags on social media items about union or USNC activities
- 5 - USNC members and/or BISO staff organize joint webinars or events with societies
- 6 - USNC cosponsors society programs and activities
- 7 - USNC and society representatives organize joint events or presentations at society or union meetings
- 8 – USNC and society partner on early career programs
- 9 – USNC and society partner on projects in developing countries

5. Individuals involved with the union and USNC
 - a. U.S. scientists demonstrate their interest and commitment through volunteering their time to the USNCs and unions.
 - b. The importance of the unions and the USNCs to the U.S. scientific community is reflected in the caliber of individuals that become involved, and are willing to run for and serve in important union and USNC leadership positions.
 - i. A number of NAS and NAE members have served on the USNCs. (Note: NAS Sections are consulted for USNC and union nominations.)
 - ii. Many U.S. scientists, including NAS and NAE members, have served in important union leadership positions.

Recommendations

1. The NAS should continue to adhere to all the existing reviewed organizations, including the IUCr, and responsibility for CODATA should be transferred back to BISO, as per the BRDI Board Director's request. These organizations fulfill important roles for the U.S. and global scientific communities and show solid plans and results.
2. For four organizations (PSA, ICO, CIE and IUBS), a provisional period of five years is recommended, at which time U.S. funding and adherence should be reexamined.

International Science Council
Member Unions, Committees, and Affiliated Organizations
 October 2018

Those highlighted in yellow are currently, or recommended to be, in the BISO portfolio. IIASA, highlighted in blue, is housed in BISO, but is not part of these considerations.

ISC Member Organization	U.S. Member
<i>Unions</i>	
International Association of Legal Science (IALS)	None
International Arctic Social Sciences Association (IASSA)	Individual members only
International Astronomical Union (IAU)	National and individual memberships. National member is the National Academy of Sciences
International Cartographic Association (ICA)	Cartography and Geographic Information Society (CaGIS)
International Economic Association (IEA)	American Economic Association
International Federation of Societies for Microscopy (IFSM)	Microscopy Society of America (MSA)
International Geographical Union (IGU)	National Academy of Sciences (not BISO)
International Mathematical Union (IMU)	National Academy of Sciences
International Union for Quaternary Research (INQUA)	National Academy of Sciences
International Peace Research Association (IPRA)	Individual members only
International Political Science Association (IPSA)	Individual memberships. No national memberships.
International Sociological Association (ISA)	Individual and organization memberships. No national membership.
International Society for Ecological Economics (ISEE)	Individual members only
International Society for Photogrammetry and Remote Sensing (ISPRS)	American Society for Photogrammetry and Remote Sensing (ASPRS)
International Union of Anthropological and Ethnological Sciences (IUAES)	American Anthropological Association (AAA) Society for Applied Anthropology (SfAA)
International Union of Biological Sciences (IUBS)	None. Formerly National Academy of Sciences
International Union of Crystallography (IUCr)	National Academy of Sciences
International Union of Food Science and Technology (IUFoST)	Institute of Food Technologists (IFT)
International Union of Forest Research Organizations (IUFRO)	Many, including various colleges, the U.S. Forest Service , and the National Park Service
International Union of Geodesy and Geophysics (IUGG)	National Academy of Sciences
International Union of Geological Sciences (IUGS)	National Academy of Sciences

International Union for History and Philosophy of Science and Technology (IUHPST)	None. Formerly National Academy of Sciences
International Union of Immunological Societies (IUIS)	American Association of Immunologists (AAM)
International Union of Materials Research Societies (IUMRS)	Argonne National Laboratory (ANL) National Institute of Standards and Technology (NIST) Oak Ridge National Laboratory (ORNL) Sandia National Laboratory (SNL) United States Automotive Materials Partnership (USAMP)
International Union of Microbiological Societies (IUMS)	Society members. American Phytopathological Society (APS) American Society for Microbiology (ASM) American Society for Virology (ASV) Mycological Society of America (MSA) Society for Industrial Microbiology and Biotechnology (SIMB) U.S. Culture Collections Network (USCCN) National Academy of Sciences (inactive)
International Union of Nutritional Sciences (IUNS)	American Society for Nutrition (ASN)
International Union for Pure and Applied Biophysics (IUPAB)	Biophysical Society National Academy of Sciences (inactive)
International Union of Pure and Applied Chemistry (IUPAC)	National Academy of Sciences
International Union of Pure and Applied Physics (IUPAP)	National Academy of Sciences
International Union for Physical and Engineering Sciences in Medicine (IUPESM)	American Association of Physicists in Medicine (AAPM)
International Union of Basic and Clinical Pharmacology (IUPHAR)	American Society for Clinical Pharmacology and Therapeutics (ASCPT) American Society for Pharmacology and Experimental Therapeutics (ASPET)
International Union of Physiological Sciences (IUPS)	American Physiological Society (APS) Formerly National Academy of Sciences
International Union of Psychological Science (IUPsYS)	National Academy of Sciences
International Union of Soil Sciences (IUSS)	National Academy of Sciences
International Union for the Scientific Study of Population (IUSSP)	Population Association of America (PAA)
International Union of Theoretical and Applied Mechanics (IUTAM)	National Academy of Sciences
International Union of Toxicology (IUTOX)	Society of Toxicology (SOT)
Union Radio Scientifique Internationale (URSI)	National Academy of Sciences
World Association for Public Opinion Research (WAPOR)	Individual members
ISC Scientific Committees:	
CODATA	National Academy of Sciences (not BISO)

Committee on Space Research (COSPAR)	National Academy of Sciences (not BISO)
Scientific Committee on Solar Terrestrial Physics (SCOSTEP)	National Academy of Sciences
ISC Affiliated Members (formerly ICSU Scientific Associates):	
Society for Social Studies of Science (4S)	Individual members
International Council on Illumination (CIE)	USNC for the CIE
International Federation of Geometry (FIG)	National Society for Professional Surveyors (NSPS)
International Association of Applied Psychology (IAAP)	Individual members
International Association for Hydro-Environment Engineering and Research (IAHR)	Individual and institute members
International Arctic Social Sciences Association (IASSA)	Individual members
International Commission for Acoustics (ICA)	Acoustical Society of America (ASA) Institute of Noise Control Engineering of the USA (INCE/USA)
International Council for Industrial and Applied Mathematics (ICIAM)	Society members. American Mathematical Society (AMS)
International Council for Laboratory Animal Science (ICLAS)	American Association for Laboratory Animal Science (AALAS)
International Commission for Optics (ICO), also a commission of IUPAP	National Academy of Sciences
International Council for Scientific and Technical Information (ICSTI)	Library of Congress U.S. Office of Science and Technical Information
International Federation of Data Organizations for Social Science (IFDO)	6 university-based centers (Harvard, Wisconsin, UNC Chapel Hill, UCLA, Chicago, Connecticut)
International Federation for Information Processing (IFIP)	None
International Federation of Library Associations and Institutions (IFLA)	Membership list not available
International Foundation for Science (IFS)	Not a membership organization
International Institute for Applied Systems Analysis (IIASA) (a research institution)	National Academy of Sciences
International Studies Association (ISA)	Individual and institutional members
International Society for Digital Earth (ISDE)	National memberships available to national digital earth societies. None from the U.S. listed. Organizational and individual memberships also available.
International Union for Vacuum Science, Technique, and Applications (IUVSTA)	AVS Science & Technology Society
International Water Association (IWA)	Individual, corporate and university memberships
Pacific Science Association (PSA)	National Academy of Sciences
Science Council of Asia (SCA)	None
Social Science Research Council (SSRC)	Based in the US
Transnational Institute (ITNI)	Support primarily from private foundations
The World Academy of Sciences (TWAS)	None, but NAS frequently partners with them
Union Internationale de Speleologie (UIS)	National Speleological Society (Cavers) National Caves Association