

THE TRANSATLANTIC BIG SCIENCE CONFERENCE

Oct. 31 – Nov. 1, 2022
Washington, D.C., USA

www.transatlanticscience.org

Executive Summary

For decades, scientists – and governments – on both sides of the Atlantic have shared ideas and collaborated on high-impact projects that have yielded great benefits for the global scientific enterprise and for humanity.

Unfortunately, many of those crucial transatlantic research connections have been diminished over the past few years by a combination of global pandemic and political conflict. Yet at the same time, we have seen the impacts of those powerful new collaborations, as when researchers in Germany and the United States worked together at fever pitch to develop safe, effective COVID-19 vaccines.

As we confront the urgent reality of climate change and its potential existential threat to the world, we have an opportunity and a duty to restore and expand these crucial scientific connections. This conference, organized by Carnegie Science and DESY, brought together more than 130 influential scientific leaders, researchers, and policymakers and offered an exceptional new forum for productive, thoughtful, and candid conversations about the future of transatlantic science.

Session 1 - Basic Science *Young-Kee Kim (Chair), Fabiola Gianotti, Robert Shelton, Michel Spiro, Daniel Zajfman*

Historically foundational scientific research has created exceptional opportunities for international collaborations, especially in particle physics and astrophysics. CERN presents a great example of the extraordinary discoveries that can be made when nations pool their financial and intellectual resources to build large-scale facilities staffed by large international team of great scientists.

As we seek new opportunities for transatlantic basic science, there are significant challenges to be addressed:

- Basic science is often big science, requiring major transnational investment; these projects must compete for public support and government funding
- The non-science public may not understand the timelines required for foundational scientific discovery (e.g. the “overnight” development of COVID-19 vaccines, based on decades of research)
- New strategies and methods are needed to recruit inclusive staffing, especially for postdocs and early career scientists at major projects; greater focus is needed on developing research capacity with partners from low- and middle- income countries, especially in the Global South

Session 2 - Challenges & Threats in Big Science *Francesco Sette (Chair), Antje Boetius, Michael Kaschke, Thomas Mason, Mary Woolley, Roger Falcone*

This session addressed urgent challenges – in climate change, energy transformation, sustainable development, and pandemics – and the need for international scientific research to meet those challenges while respecting technological sovereignty. Increasingly, frontier research requires “big science” – massive facilities and large teams of exceptional researchers working collaboratively. These huge investments of people and resources can yield benefits for decades, but the science community must learn how to communicate the importance of these projects and to advocate consistently and effectively for their continued public and governmental support.

- Project siting can pose political challenges, as government leaders may hesitate to commit to sending significant resources out of the country for decades to come
- U.S. CHIPS and Science Act provides significant new funding for research, but raises concerns about scientific “isolationism” that the science community must recognize and address
- Future partnerships may be constrained by government concerns about sharing classified materials and ultimate weaponization of new discoveries
- New strategies and networks are needed to speed the translation of basic science results into deployable technologies; industry partnerships are key

Session 3 - Challenges of Digital Transformation *John Kelly III (Chair), Tommaso Calarco, Beate Heinemann, Rick Stevens, Holger Hanselka*

Transatlantic research partnerships that linked the public and private sectors, played a crucial role in the past for the development of exascale computing, AI and quantum technologies. Even stronger transnational cooperation is needed to ensure adequate resources and a cohort of trained researchers as we move into quantum computing.

- Zettascale computing offers exciting opportunities, but may be constrained by the massive energy resources the equipment requires
- Cybersecurity remains a serious concern as cyberterrorism attacks become more frequent and more dangerous
- Building a transatlantic quantum computing user community will help to develop common standards and could lead to a breakthrough in integrated quantum communications
- A transatlantic program, similar to the U.S. Department of Energy's AI for Science initiative, could expand training for early career scientists to use AI tools to advance their research

Session 4 - Demystifying Science Through Public Participation *Marcia McNutt (Chair), Magdalena Skipper, Gerald Haug, Jürgen Mlynek, Sudip Parikh*

Most scientists struggle to communicate their work and its importance to the larger community. Too many scientists view communication as a secondary “soft skill” or even disparage effective communication as shallow or “glib”. Engaging the public in science will re-establish trust and support of our work.

- Enthusiasm for science-related entertainment and science-related content on social media platforms shows that the larger public is better educated and hungrier for our work than we may realize
- Instead of talking about “the public”, scientist community needs to learn how to better engage specific audiences with tailored messages (e.g. schoolchildren, marginalized communities, and professional groups)
- Younger scientists are often more skilled in sharing their work on digital platforms, but academic institutions have not yet developed means to reward early career researchers for effective public communication.

Session 5 - Science & Diplomacy *Ottoline Leyser (Chair), Rolf Heuer, Mohamed H.A. Hassan, Kimberly Montgomery, Mykola Shul'ga, Andrei Afanasev*

The international nature of science and the increasingly complex relationships between nations, underscore the need for new and expanded levels of science diplomacy. Scientists must recognize the need for discretion as they embark on and continue in international collaborations. Trained science diplomats are needed to advise national leaders and guide scientists in making responsible decisions about international partnerships.

- More universities should offer a science diplomacy curriculum, with an emphasis on participants representing low- and middle-income countries
- The war in Ukraine offers a painful example of the devastation that armed conflict wreaks on a nation's scientific infrastructure and established research capabilities
- Shifts in international geopolitics pose difficult questions for collaborations, as today's partner may be tomorrow's opponent; how can scientists best navigate these questions, and what should be done when an international member of an ongoing collaboration becomes threatening?

Session 6 – Moon and Mars Shots *Anthony Cheetham (Chair), Rick Stevens, Magdalena Skipper, Kimberly Montgomery, Young-Kee Kim, Francesco Sette*

It is hoped that this inaugural Transatlantic Big Science conference will be a first step toward exciting new research opportunities, with international science institutions working across disciplines to launch “Moon shot” and “Mars shot” projects. A steering committee is being set up to move proposals forward, with recommendations to be announced in 2023.

Thematic Tables

One of the highlights of the conferences was a series of Thematic Tables, hosted by organizations and foundations, that brought participants together around a lunch table for networking and informed discussion. Participants at each table were asked to consider a specific question or issue:

- How can big science contribute to capacity building in economically less developed countries?
Co-hosts: Rolf-Dieter Heuer, SESAME, and Sekazi K. Mtingwa, African Light Source
- Mobility of Scientists: Challenges and Perspectives
Host: Jörg Maxton-Küchenmeister, supported by the Joachim Herz Foundation
- Rebuilding Research Infrastructures in Ukraine: The NSC Kharkiv Institute of Physics and Technology as an Example
Co-hosts: Mykola Shul'ga, Director General of the National Science Center, KIPT, and Martin Sandhop, DESY
- Research Infrastructures and Sustainable Developments
Co-hosts: Lia Merminga, FNAL, and Frederick Bordry, CERN
- Safeguarding International Cooperation – Principles of Research Security
Co-hosts: Robert Feidenhans'l, European XFEL and Roger Falcone, UC Berkeley
- Science Diplomacy
Co-hosts: Jonathan Bagger, American Physical Society and Joachim Ullrich, German Physical Society
- Technology Transfer and Bridging Innovation Gaps
Co-hosts: Sebastian Wicklein, Fraunhofer USA and Arik Willner, DESY – supported by the Fraunhofer Association USA
- Transatlantic Science Cooperation in a New International Context
Host: Jürgen Mlynek, supported by the Wilhelm und Else Heraeus Foundation
- Funding Agencies Cooperation
Host: Lisbeth Olsson, Swedish Research Council and Luc Simard, National Research Council Canada

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