THE TRANSATLANTIC BIG SCIENCE CONFERENCE

Executive Summary

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Deutsches Elektronen-Synchrotron DESY
A Research Centre
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Executive Summary

As we look around us, it's clear that the scientific challenges facing us are increasing with alarming swiftness, while the world seems to become smaller and more complicated every day. The pandemic and climate change have underscored our interconnectedness and the profound impact of our decisions. Emerging health threats, from novel pathogens to antimicrobial resistance, add to this urgency, particularly in the context of global conflicts and inequities. To address these challenges, we must expand our collaborative efforts across disciplines and borders.

Building on its 2022 inaugural event, the Transatlantic Big Science Conference reconvened in Berlin on June 27-28, 2024, bringing together over 150 influential international leaders, researchers, and policymakers. Participants discussed ways to enhance transatlantic research collaborations and pave the way toward a sustainable future. The conference yielded numerous practical proposals aimed at strengthening scientific cooperation across the Atlantic.

Key Themes and Recommendations

Several key themes emerged from the discussions. Participants emphasized the need to **establish international norms and standards for safe data sharing**, drawing inspiration from secure practices in the finance sector. They also advocated for the **creation of scientific 'free trade zones' among aligned nations** to facilitate the exchange of algorithms, expertise, and components. Additionally, the importance of **involving early-career researchers in multi-year planning for emerging technologies** was stressed, including integrating researchers from the Global South into future big science infrastructure development.

Transatlantic Big Science Conference Co-Chairs Eric Isaacs, President, Carnegie Science and Helmut Dosch, Chairman, DESY Board of Directors

Session 1: Basic Science

Co-Chairs: Harriet Kung (US Department of Energy) Otmar Wiestler (Helmholtz Association)

Moderator: Serena DeBeer (Max Planck Society)

Panellists: Nicolas Arnaud (CNRS), Christian Doeller (Max Planck Society), Young-Kee Kim (U Chicago)

The importance of Transatlantic partnership in scientific discovery will increase as geopolitical tensions worsen and become more stratified. To benefit the new generation of transatlantic researchers, we should seize this moment of relative calm to create plans for researcher mobility, talent management, and avenues for cooperation on the world's grand challenges.

However, achieving transatlantic research security is just one side of the coin; freedom of inquiry also requires safeguards to protect sensitive data and intellectual property. With these considerations in mind, several key recommendations emerged:

- Recognize and nurture a new researcher type: Scientists specialized in one area and its corresponding AI analytical aspect should be encouraged. Establish research schools based on this paradigm, using data from major infrastructures to increase its appeal.
- Develop joint training and outreach programs: Initiate transatlantic programs for younger generations to blend different disciplines and foster personal links among peers.
- Establish collaborative planning frameworks: Create structured planning processes that actively involve scientists at all career stages, fostering a coordinated, inclusive approach with shared responsibility.
- Create interdisciplinary research teams: Form transatlantic teams with two Principal Investigators (PIs) bringing complementary expertise, such as one experimental and one analytical.
- Address visa and regulatory hurdles: Lobby for a more lenient framework to ease data and personnel mobility while considering associated risks.

Session 1 co-chaired by Harriet Kung and Otmar Wiestler

- Improve science communication: Establish initiatives to better communicate the societal benefits and responsible resource use of transatlantic scientific cooperation, making a clear case to the public for its continued support.

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Session 2: Bio-Preparedness and Health

Chair: Matthias Tschöp (Helmholtz Munich)

Panellists: Edith Heard (EMBL), John Hill (BNL), Chikwe Ihekweazu (WHO), Joseph Simmonds-Issler (CEPI)

The pandemic demonstrated a rapid collaborative learning curve – initial panic gave way to unprecedented data sharing, with unnecessary bureaucracy falling away. However, global solidarity has since regressed, highlighting the need to rebuild consensus on priorities.

The session also addressed the political failure to secure equitable access to vaccines and the risk of the 'never again' sentiment fading over time. In light of these challenges, several key recommendations emerged:

Session 2 chaired by Matthias Tschöp

- Reduce bureaucracy for data access: While health data requires protection, balance efficient data exchange with bureaucratic oversight. Define norms and standards across countries.
- Address export controls and IP laws: Balance open science principles with the need to protect certain innovations. Recommend clearer guidelines for lawmakers.
- Ensure inclusivity in big data resources: Avoid building silos within the transatlantic community; incorporate data from beyond this region to maximize research potential.
- Leverage volunteer tech communities and private sector cooperation: Adjust the approach to working with the private sector, clearly defining financial and commercial rights and responsibilities.

Session 3: Energy, Earth Systems, Oceans, and Climate Change

Chair: Susanne Buiter (GFZ)

Panellists: Corrine Almeida (UTA Cape Verde), Katherine Jungjohann (NREL), Paweł Rowiński (Polish Academy of Sciences)

Session 3 chaired by Susanne Buiter

There is a need to shift the narrative from disaster to opportunity, stressing the importance of communicating positive developments to maintain public and policymaker engagement in finding and implementing climate solutions. Existing technologies can help measure and address climate change, but the focus should now be on making these tools last longer and easier to recycle. Addressing climate challenges will require technological solutions, interaction with society and political engagement to foster effective policy coordination among governments.

Regional disparities in climate action were also addressed, noting that the primary obstacle in the global south is not a lack of interest, but rather a shortage of infrastructure and resources. To address these challenges, several recommendations were put forward:

- Create job opportunities for researchers in the Global South: Develop postdoctoral programs to enhance mobility for postdocs and provide a clearer understanding of regional climate impacts.
- Utilize real-world data and machine learning: Improve the longevity of clean technologies such as batteries and photovoltaic systems, helping to achieve higher longevity goals and building broader support for clean tech.
- Leverage AI and support transatlantic data sharing: Enhance data standards and sharing to accelerate progress in climate research and technology development.

Session 4: Joint Perspectives for Fusion

Chair: Kim Budil (LLNL)

Panellists: Michael Campbell (Rochester), Thomas Feurer (European XFEL), Leonida Gizzi (CNR), Constantin Häfner (Fraunhofer Society), Ingo Hofmann (TU Darmstadt)

A key point of discussion was leveraging results from the National Ignition Facility (NIF) globally, considering both political and commercial challenges. While Europe has a long history of investing in fusion, participants suggested expanding investment into inertial and laser-based fusion, despite both approaches being far from their goals. The importance of building an ecosystem with viable public-private partnerships was emphasized.

The transatlantic fusion community was encouraged to identify common technologies and supply chains and manage political and social expectations effectively. Several key recommendations emerged from the session:

- Sustain political support through short-term milestones: More precise project timing and funding can better demonstrate realistic goals and set appropriate expectations.
- Improve public communication: Enhance understanding of fusion's future benefits, such as a local, consistent supply of high-intensity energy. Highlight potential future jobs, meeting energy demands of data centres/AI, and energy sovereignty to engage politicians.

Session 4 chaired by Kim Budil

- Address supply chain challenges: Recognize that the public sector alone cannot fund or create the market, necessitating market preparation for fusion through current technologies.
- Plan for a new laser-based fusion facility: Draw on magnetic fusion's experience in international collaboration.
- Capitalize on political momentum: Foster collaboration within the fusion community and promote fusion research, potentially drawing parallels with the 'space race' to generate public interest and support.

Session 5: AI and Digitalization

Chair: Beate Heinemann (DESY)

Panellists: Joseph Broz (IBM), Oliver Kraft (KIT), Thomas Mason (LANL), Alberto Di Meglio (CERN)

Transatlantic science stands to benefit enormously from the advancing power of quantum computing, artificial intelligence, and digitalization. As these technologies move into an era of practical utility, they bring both opportunities and challenges to "big science."

This includes the need to address issues such as handling discarded data in AI analysis, creating coherence in heterogeneous instructions and metadata, managing AI hallucinations, and balancing global data access with governmental security concerns. Several key recommendations emerged:

- Start developing standards for curated, high-quality data: Focus on each research area, with fundamental science typically having more freedom from commercial concerns.
- Advocate for a free trade zone: Promote collaboration among like-minded nations for algorithms, people, and components to counteract protectionism and address national security concerns.
- Develop measures and controls for AI in research: Collaborate with social scientists and lawmakers to develop standards addressing AI biases in different layers of society.

Session 5 chaired by Beate Heinemann

Session 6: Novel Materials and Key Quantum Technologies

Chair: Jürgen Mlynek (WE Heraeus Foundation)

Panellists: Oliver Benson (HU Berlin), Cornelia Denz (PTB), Eleni Diamanti (CNRS), John Sarrao (SLAC)

To envision large-scale quantum computing, it's essential to consider building large-scale quantum computing fabrication facilities internationally. Striking the right balance between openness and protecting strategic interests during this critical period in quantum computing development is crucial.

Session 6 chaired by Jürgen Mlynek

Several key recommendations emerged:

- Accelerate development of reliable standards: Strengthen international collaboration through reliable quantum technology standards.
- Focus on clear, exciting goals for researchers: Highlight promising areas like satellite quantum communications, which require relatively little monetary investment and offer opportunities for international cooperation in components and experiments.
- Increase the number of professorships in the field: Continue promoting mixed research groups to remove barriers between disciplines and enhance transatlantic exchanges.

Session 7: Science, Society, and International Collaborations

Chair: Michael Moloney (AIP)

Panellists: Rolf-Dieter Heuer (SESAME), Chris Fall (MITRE), Lise Korsten (African Academy of Sciences), Julie Maxton (Royal Society), Lia Merminga (FNAL)

In some areas in Europe and North America, there is a decreasing perception of science. Scientists are aware of the importance of this, as the pandemic acted as a wakeup call to make a more vivid impact on society.

International collaborations must be clear in terms of engagement; it should be with countries with shared scientific values, even if cultural values may be different.

Session 7 chaired by Michael Moloney

Several key recommendations emerged:

- Targeted public engagement: Recognize that the 'public' is too broad a category. For example, more effort should be made to engage with the financial community, providing them with the best information possible for policy decisions.
- Unified scientific voice: National academies should collaborate on big topics such as biodiversity, presenting a critical mass of scientific viewpoints to the public.
- Support science in the Global South: Private philanthropy has the potential to foster big science in the Global South. Address basic infrastructure needs, such as water and energy for labs in Africa, to remove significant obstacles for researchers. Holistic investment in infrastructure is recommended to allow science to make a rapid difference.

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June 27 Roundtable Discussions Summary

During the conference, a series of Thematic Tables hosted by partnered organizations and foundations brought participants together for informed discussions on specific issues.

Capacity Building in Science in the Global South

Co-Hosts: Sekazi Mtingwa, African Light Source / Rolf-Dieter Heuer, SESAME

The table discussed how to best coordinate both human and infrastructure capacity building.

- Establish regional and transatlantic partnerships to construct and support large infrastructures (e.g., the African Light Source, Greater Caribbean Light Source, SESAME) and small lab size infrastructures in the near term.
- Ensure projects are at 'eye level' (i.e., no teaching from one side) and bottom-up, ensuring ownership and partnership.
- Urgently need funding and partnerships (such as LEAPS) for these initiatives.

Confidence in Communicating About Science - A European U.S. Perspective

Co-Hosts: Matthias Mayer, Körber Foundation / Laura Hassink, Elsevier

The table discussed how to involve specific actors in research and enable their participation.

- Make these discussions ongoing, with the next edition of the conference being a good opportunity to gather wider viewpoints.
- Collect best practice examples on identifying stakeholders early to enable participation and on capacity building for grassroots initiatives.

Quantum Computing - Quantum Sensing - Quantum Materials

Co-Hosts: Kerstin Borras, DESY & RWTH Aachen / Bianca Giaccone, FNAL

The table discussed funding, potential benefits of quantum technologies, and how quantum and research can work together.

- Develop an internationally agreed roadmap for setting priorities and guiding funding lines on national and international levels.

Thematic table on Quantum Computing

Enabling US-German Scientific Cooperation whilst Safeguarding Science in National Labs and Helmholtz Centers

Co-Hosts: Otmar D. Wiestler, Helmholtz Association / Harriet Kung, U.S. Department of Energy

The table discussed how to ensure the vitality and longevity of transatlantic scientific cooperation in light of current geopolitical tensions.

- Establish a small working group across both side of the Atlantic to collaborate on implementation approaches.
- Exchange and jointly pursue research security policies.

Governing the Dual-Use Impact of AI

Host: Antje Dahlman, IFSH

The table discussed how to govern the dual-use impact of AI, establishing international norms on the use of AI while simultaneously respecting national technological, corporate, and security interest.

- De-stigmatize discussions on dual-use possibilities in basic research. This ensures careful consideration of the applications of research and the specific risks and requirements they entail.
- Identify areas for potential transatlantic cooperation, including research on ensuring the sufficient quality of raw data, and developing a scientific framework for common benchmarks on quality and capabilities of AI systems.

High Power Lasers for Fusion and Advanced Accelerators

Host: Tom Cowan, HZDR

The table discussed the impact of laser fusion energy on basic science and technological applications.

- Exploit fusion-advanced accelerator synergies to advance both communities, establish an implosion capability in the EU coupled to light sources, and develop laser-driven probes for existing and future implosion facilities.
- Strengthen relations between EuXFEL and LCLS. Prioritize adding intermediate-scale laser drivers at XFELs to address key scientific challenges and build inertial fusion energy expertise.
- Establish transatlantic training programs for workforce development, with long-term commitments including multi-year grants and PhD funding.

Microelectronics - Safe and Secure Supply Chains

Host: Patrick Bressler, Fraunhofer Group for Microelectronics

The table discussed R&D opportunities and societal challenges in microelectronics.

- Develop a joint approach for PFAS and research for new materials.
- Increase reciprocal (transatlantic) access to facilities and researcher exchanges.
- Exploit complementary capabilities among "like-minded states."
- Create joint working groups on cataloging existing industrial collaborations (e.g., CRO activities) and developing standards for chiplets, heterogeneous integration, characterization & testing, Edge AI, and Data Management.

Open Science

Co-Hosts: Karin Zach, DPG / Young-Kee Kim, APS

The table discussed the principles and policies for international scientific collaboration.

- Gain trust from policymakers by demonstrating awareness of the problems and challenges alongside our responsibilities.
- Secure better funding possibilities to bring early-career scientists from around the world together, especially from countries with fewer resources.

Thematic table on Open Science

Renewable Energy Materials

Co-Hosts: Rutger Schlatmann, HZB / Katherine Jungjohann, NREL

The table discussed the transatlantic science of sustainability technologies.

- Enable a circular strategy from the beginning, especially focusing on recycling at the End of Life.
- Ensure maintaining mutually beneficial relationships between transatlantic scientists is part of any standard DOE/European national research project.

Science Diplomacy

Co-Hosts: Anke Reiffenstuel, German Federal Foreign Office / Andreas Kosmider, Falling Walls Foundation

The table discussed the need to find a new balance and somewhat redefine the field of science diplomacy.

- Provide researchers with guidance on the "big picture" and (geopolitical) risks; provide politics with guidance on emerging topics and new opportunities.
- Strengthen forums for exchange of perspectives between science and politics (e.g., the Carnegie meeting of research ministers).
- Move away from case-by-case analysis towards a general strategic approach and well-designed analysis schemes shared between organizations.

Supporting the Science System in Ukraine

Co-Hosts: Anatoly Zagorodny, National Academy of Sciences of Ukraine (NASU) / Martin Sandhop, DESY

The table discussed the activities of Ukrainian researchers during the current full-scale Russian military aggression in the country.

- Support scientific institutions and researchers working in Ukraine, and start international long-term science support programs in Ukraine.
- Integrate Ukraine into the European Research Area, with active cooperation with international partners and EU countries through transatlantic scientific projects, multinational consortia, and international scientific cooperation.
- Recognize that restoring science in Ukraine will be a difficult task requiring solidarity and mobilization of all participants. This will strengthen cooperation aimed at the future renewal and modernization of the Ukrainian scientific sector.

The Life Science Alliance (LSA) as a Model to Promote Transatlantic Collaboration in Biomedical Sciences

Co-Hosts: Matthias Wilmanns, EMBL / Keith Hodgson, Stanford University

The table discussed how to Identify more sustainable opportunities with long-term support from funding organizations such as the DFG, NIH/NSF, DOE, HHMI.

- Creating opportunities for project-oriented fellowships (example: Walter Benjamin / DFG), as opposed to lab-oriented fellowships, could open new opportunities.
- Encouraging institutional partnerships to facilitate transatlantic cooperation. Do not give up on "thinking big" in terms of future funding opportunities despite political uncertainties.

Transatlantic Partnerships for Innovation and Transfer

Co-Hosts: Robert Okabe, DPI / Dorothea Ringe, DESY

The table discussed creating a transatlantic innovation culture and mindset.

- More investment in entrepreneurship education starting earlier in the career of scientists
- Share best practices in the area of IP-transfer from research organization to startup
- Consider the i-Corps and SBIR programs as a best practice for supporting and funding R&D in collaboration between small businesses and research organizations

Internationalization and Research Security

Host: Zahar Barth Manzoori, DAAD & DWIH San Francisco

The table discussed raising awareness and establishing support structures for transatlantic research.

- Recognize research security as an increasingly important aspect of international academic collaboration.
- Address current debates in Europe and North America on similar aspects: raising awareness, and establishing support structures.

Thematic table on Research Security

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Future Transatlantic Big Science Conference initiatives

The success of the 2024 conference emphasizes the necessity of ongoing international scientific cooperation. The scientific community is committed to fostering enhanced collaboration, shared knowledge, and groundbreaking discoveries that benefit humanity. Participants expressed a strong desire to continue these vital discussions, aiming to include more diverse voices, particularly from the Global South and early-career researchers.

The TTBSC Steering Committee is planning to organize the third conference in the United States in 2026. The committee invites interested parties to contribute to shaping the future of this initiative, which seeks to strengthen transatlantic scientific collaboration and address the most pressing global challenges.

APPENDIX

2024 CONFERENCE SURVEY RESULTS

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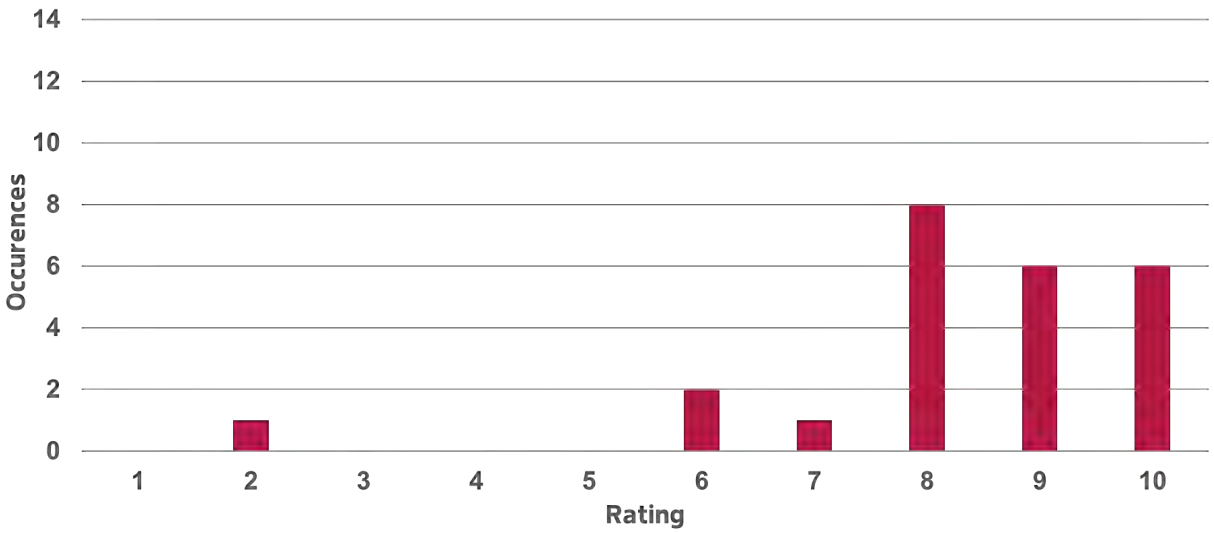
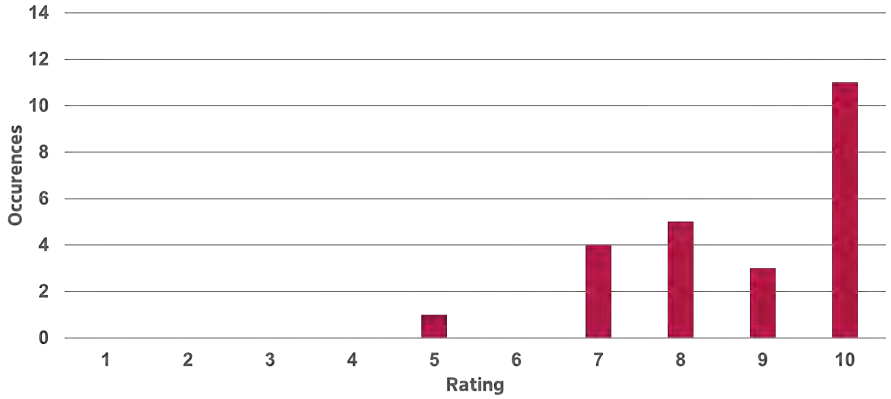
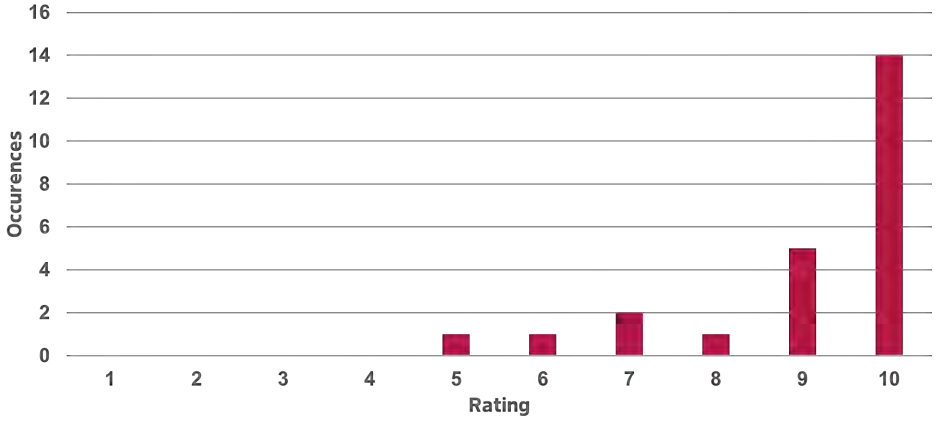
How satisfied were you with the Transatlantic Big Science Conference?



How satisfied were you with the networking opportunities provided?



How satisfied were you with the organization and logistics of the event?



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What topics would you like to see more of at our next event?

Selected Quotes:

- *"More on **crises to come** (water stress, climate change, migrations)"*
- *"**Communication with governments** (political and funding agencies). Perhaps a session devoted to this issue with invited panelists from the government side at the policy making level to discuss how to strengthen ties and what we can do to help"*
- *"I would love to see a **"practical session", maybe with examples how facilitate cooperations but also taking into account administrative hurdles**. What administrative obstacles do we have and how to overcome?"*
- *"Scientific: life sciences, medicine but **a stronger focus on the administrative and legal sides of transatlantic cooperations as well as methods and ideas to foster these cooperations** would be my wish for the next conference."*
- *"Scientists and **projects from Latin America, Africa and Far East**, including Japan. Discussion on possible motivations for international (Transatlantic) cooperation. Discussion of global perspective of science and where Transatlantic fits in this perspective. Discussion of existing win-win collaborations across the Atlantic/Pacific."*

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What was for you the most important take-home message?

Selected Quotes:

- *"**Necessity to involve younger generation** to transatlantic collaborations. We need to search for ways to take concrete actions within most important societal challenges, among them the war in Ukraine."*
- *"That **we have common interests and challenges** and we (Europe and US) should work harder on **joint efforts at the strategic level**, not the individual PI level"*
- *"International collaboration is more important than ever"*
- *"The most important message for me is, that **we need strategies to come in concrete action**. Maybe it would be good to have something more concrete in the end. I also find it difficulty that often the statement was, to **include more early career scientists**. It is problematic to attract them in involving in politics and spent time on this instead of actual science, because PhDs/Postdocs which mostly have limited contracts. I thinks if this is wanted, there need to be a clear obvious benefit to get involved."*
- *"People are active in shaping a mutually beneficial cooperation landscape between Europe and USA (and Canada) and trying to formulate key points that still have to be improved to optimize the (initiation) processes of transnational cooperations. **Understanding transatlantic** also as a term that **involves African and South and Central American** countries is under development."*

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