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International Brain Initiative: An Innovative Framework for Coordinated Global Brain Research Efforts

International Brain Initiative*
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The International Brain Initiative (IBI) has been established to coordinate efforts across existing and emerging national and regional brain initiatives. This NeuroView describes how to be involved and the new opportunities for global collaboration that are emerging between scientists, scientific societies, funders, industry, government, and society.

Vision of the International Brain Initiative

> *Catalyzing and advancing neuroscience research through international collaboration and knowledge sharing, uniting diverse ambitions to expand scientific possibility, and disseminating discoveries for the benefit of humanity.*

The intent to form an International Brain Initiative (IBI) was declared in December 2017. Since then, the IBI has established a shared vision and aspirational goals, a governance structure, topical working groups, and a 5-year strategic plan. The initiatives and organizations involved in the IBI aim to provide a robust forum for global information sharing and resources for collaborations.

The International Brain Initiative

Understanding the human brain is one of the most significant scientific challenges of our time. Despite significant advances in understanding how individual cells and molecules function to regulate activity of the brain and nervous system, neuroscientists still lack an integrative, comprehensive understanding of basic brain functions. The IBI (https://www.internationalbraininitiative.org/) aims to catalyze and advance neuroscience research by leveraging the large-scale, nationally sponsored brain initiatives emerging across the world. Research from these initiatives will underpin new treatments needed to tackle the staggering global burden of disability from neurological and psychiatric disorders. Moreover, the IBI seeks to promote understanding the human brain and its massive computational and information storage capacities with the goal of unlocking the mechanisms underlying cognition, emotion, and creativity.

Several countries have recognized the urgent need to invest in brain research as a priority for economic development and improved health of their citizens. Over the past several years, many countries and the European Union launched large-scale projects, nearing billion-dollar investments.

The ambitious goal of understanding the brain is being approached by distinct initiatives; therefore, a synergistic international effort could provide greater overall impact and better utilization of precious research funding (Huang and Luo, 2015; Grillner et al., 2016; Mainen et al., 2016; International Brain Laboratory, 2017). In response, international delegates from the brain initiatives joined together, pledging a commitment to capitalize on the investment in brain research and maximize global impact.

The intent to form an IBI was declared in December 2017 by a number of major brain initiatives around the globe (see press release at http://www.internationalbraininitiative.org/brain-initiatives-move-forward-together). Since then, the IBI has developed a shared vision and aspirational goals for the organization and an internal governance structure, topical working groups, and funder and stakeholder collectives. The stated goals (https://www.internationalbraininitiative.org/about-us) intend to serve the scientific community, provide a forum for information sharing, and build resources for global brain research collaborations. The IBI will further ally individual brain initiatives for greater global impact by leveraging independent large-scale investments in neuroscience.

In addition, the IBI provides a platform for exploring new models of international collaboration between scientists, private and public funding bodies, industry partners, and government-related agencies, especially in the area of the social, economic, and ethical impacts of neuroscientific discoveries and their translation. Here, we describe the evolution of the IBI and seek to catalyze dialog and engagement with the wider community.

History and Overview

Beginning in 2013, large-scale brain research initiatives began to form in different countries (Huang and Luo, 2015; Grillner et al., 2016, Yuste and Bargmann, 2017). In 2016, the neuroscience community articulated the need for greater coordination among the initiatives (Grillner et al., 2016; Brose, 2016). A series of workshops and conferences were held in response (see Figure S1 and https://www.internationalbraininitiative.org/files/ibitimelineoct2019smallpng for the timeline), among which was the large "Coordinating Global Brain Projects" meeting in September 2016 held at Rockefeller University (Yuste and Bargmann, 2017). This meeting was complemented by a dialog among international representatives at the United Nations General

Assembly on the importance of brain research to the future of humanity, thus reiterating the benefit of better international coordination of efforts among each brain initiative. Representatives of seven established and emerging brain initiatives continued to meet throughout 2017, and, in December, the group made a declaration to work together to form the IBI (Figure S1). This declaration enabled the group to move to establish an initial organizational structure and several working groups. The IBI was officially launched on November 3, 2018, at the Society for Neuroscience meeting in San Diego.

Vision and Aspirational Goals

The IBI is a new organization designed to facilitate interactions among the global brain initiatives and to add value through collective interaction. The IBI is a coordinating organization, driven by scientists for scientists, enabling broad leveraging of resources across the participating initiatives and encouraging collaboration and information sharing. An adaptive IBI structure allows the organization to be shaped by the scientific community over time and to fulfill the changing needs for global coordination of brain science. IBI participants define brain science broadly, with an emphasis on interdisciplinary neuroscience and encompassing discipline areas such as biology, medicine, mathematics, physics, chemistry, engineering, and computer science. Common themes among the brain initiatives are to understand the neurobiological basis of cognition and behavior and to develop neurotechnologies in a responsible and ethical manner.

The 2016 National Academies of Science, Engineering and Medicine publication on "Understanding, Protecting and Developing Global Brain Resources" (G-Science Academies, 2016) was integral to the formulation of the specific aspirational goals of the IBI (see Box 1). These are to (1) promote coordination and leadership, (2) transcend borders, (3) share and disseminate knowledge, and (4) shape the future. These goals provided a foundation for the development of the strategic 5-year plan and defined the most important current issues the IBI aims to address.

In establishing the IBI, members have carefully identified the unique niche that can be filled across the participating initiatives, with flexibility to develop over time. The IBI is not a funding body; each brain initiative is associated with a funding stream or is in the process of obtaining such funding from regional governments. It is distinct from a professional society in that it plays a coordinating role for funded and emerging large-scale brain initiatives. It is an action-oriented entity whose body of work is implemented by its working groups.

Current Organizational Structure

The IBI organizational structure is outlined in Figure 1 and has five major operational components: (1) Strategy Committee, (2) Working Groups, (3) Funders Collective, (4) Stakeholders Collective, and (5) Facilitation Team. IBI's organization will be reviewed annually and updated as required.

Strategy Committee (SC)

The SC is composed of leaders from the seven current and emerging brain initiatives, with at least one representative each, and comprise the founding members of the SC. The representatives on this committee serve as liaisons between the IBI, their own organizations, funding agencies, and other relevant stakeholders to provide updates and gather feedback. The SC provides leadership to the IBI through the internal IBI governance policies and procedures, communication of the collective strategy and sustainability (with the Funders Collective), and encouragement of dialog between the Stakeholder Collective and each brain initiative. The SC further identifies the critical priority areas of work under the IBI vision, establishes and manages the workflow of the working groups tasked with related undertakings, and identifies and enables in-kind resources for the work. The SC is also responsible for nominating chairs for the IBI Working Groups. The SC is selected from the SC membership by a majority vote. The inaugural co-chairs are Professor Jan Bjaalie (Human Brain Project, Europe) and Professor Shigeo Okabe (Japan Brain/MINDS).

Working Groups

The IBI working groups lead and facilitate group-specific efforts in defined priority areas of work. The initial working groups have been devoted to tasks critical to the establishment of the IBI. Members of these groups are led by a working group chair initially selected by the SC and elected democratically in subsequent years. Working groups are established by the SC through submission of a scoping document and consideration of the in-kind resources available to support the working group activities.

Current and proposed working groups are (1) Global Neuroethics (Rommelfanger et al., 2019) (https://www.globalneuroethicssummit.com/), (2) Global Inventory of Brain Initiatives, (3) Education and Training, (4) Data Standards and Sharing, (5) Tools and Technology, and (6) Communication and Outreach. IBI working groups are responsible for identifying the goals, aims, and challenges within their respective targeted area.

Funders Collective (FC)

The FC is composed of individuals from funding organizations with a shared interest and alignment with the goals of the IBI and a desire to work in a collaborative manner. The goal of the Funders Collective, who met for the first time in Shanghai, China, in March 2019, is to promote interaction, coordination, and collaboration among funding organizations. Not all potential FC members may have designated funds to support specific activities related to the IBI, but they may contribute by sharing best practices and other resources. The FC works with the SC and Stakeholders Collective to harmonize goals and resolve challenges.

Stakeholders Collective (STC)

The STC is composed of representatives from organizations that are stakeholders of the IBI, specifically within five categories: (1) leaders from major national and international brain projects, especially any initiative not in the founding group; (2) neuroscience societies and organizations; (3) neuroscience initiatives not nationally sponsored; (4) industry partners; and (5) affiliates. Thus, STC representatives could be scientists, patient advocates, policy makers, engineers, and industry leaders representing their organizations. As defined at its first meeting in Shanghai, China, in March 2019, the STC provides expert viewpoints from the larger global landscape of neuroscience, feedback

Box 1. Aspirational Goals of the International Brain Initiative

1. PROMOTE COORDINATION AND LEADERSHIP

- *Among scientists.* Leverage resources and expertise available in different countries to provide the best value for investment, minimize duplication of effort, maximize reproducibility of results, and standardize data collection and sharing.
- *In large-scale research programs.* Identify areas of greatest potential global impact and coordinate large-scale and interdisciplinary research program. As new capabilities arise, articulate and help resource large-scale equipment and facilities to be utilized by groups around the world.
- *In innovative funding solutions.* Promote strategic investment in global initiatives and leverage private foundation projects and their interaction with public sectors to maximize global efforts.

2. TRANSCEND BORDERS

- *Between countries.* Support an interface between countries to promote involvement in the International Brain Initiative and enable synergistic interactions.
- *Between research fields.* Promote interdisciplinary approaches to neuroscience and training across different fields to drive neuroscience discovery and innovation.
- *Between global research efforts.* Provide a platform for collaboration between existing global research efforts and international neuroscience-relevant societies to establish means of interacting with brain researchers.

3. SHARE AND DISSEMINATE KNOWLEDGE

- *To global citizens.* Engage in a meaningful dialogue with citizens, patients, and all stakeholder communities around the world to understand their interests and communicate transparently about the opportunities and challenges arising from the latest research in neuroscience and brain-inspired artificial intelligence.
- *To accelerate discovery.* Implement mechanisms for the rapid dissemination of information and global data sharing to accelerate discovery.
- *To drive research translation and application.* Promote the acquisition of standardized data so that commercial risk is reduced for translation and provide a platform for engagement with industry to drive translation of discoveries.

4. SHAPING THE FUTURE

- *To empower future generations of neuroscientists.* Provide innovative transdisciplinary training that embraces a global research perspective and the benefits of neuroscience for all.
- *Of international collaboration.* Develop innovative and dynamic models for international research collaboration, including public and private stakeholders.
- *To promote brain health.* Practice a culture of sharing data related to brain diseases to enable integrated application and translation to improve brain health on a global scale.
- *Of ethical neuroscience practice.* Advance neuroscience with neuroethics as an integral part of the global neuroscientific enterprise.

to the FC and SC, and consultation on working group projects and connects their existing networks to the broader network of the science and supporter communities.

Facilitation Team (FT)

The FT facilitates collaboration, coordination, and flexible financial and in-kind contributions. Members of the FT support and ensure consistency within the IBI, engage with stakeholders, and maintain the IBI as an effort that transcends any single institution. Support and coordination of financial and staff resources help to build and maintain a sustainable, responsive, and independent entity and a strong community that meets the goals of the initiative. The FT is currently comprised of secretariat support from initial SC brain initiatives and The Kavli Foundation.

Engaging with the IBI

Increased engagement with the IBI leads to mutual benefit for the IBI and neuroscience organizations. Opportunities exist for an increased scale of impact, leveraging of aligned missions and investment, increased network and partnership building, and increased awareness and support of neuroscience research at large. Formal mechanisms for engaging with the IBI can occur through the participating brain initiatives, the STC (representing organizational affiliations), or the FC as follows.

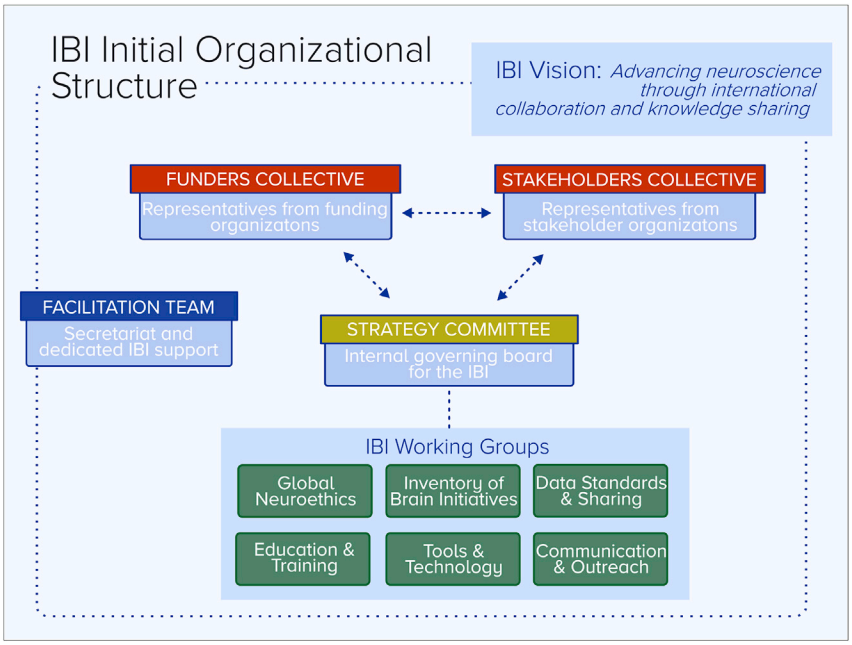

Figure 1. Organizational Structure of the International Brain Initiative

- Foundations and funding organizations (private and government) can contact the Facilitation Team to join the FC.
- Societies, industry groups, and other interested stakeholder groups with significant representation can join the STC by contacting the Facilitation Team.
- Individual scientists and supporters may become involved by subscribing to the IBI newsletter (https://www.internationalbraininitiative.org) for general updates, working group activities, and other relevant announcements from the participating initiatives. They can be identified for engagement in the working groups through participating brain initiatives or the STC based on skill and need.

Those interested in being involved should contact the Facilitation Team (https://www.internationalbraininitiative.org/contact).

Conclusions and Next Steps

With a solid infrastructure now in place and enthusiasm amassed, an immediate focus for the IBI is to establish and develop the core working groups that are making progress toward short-term deliverables. The IBI's 5-year strategic plan will also lead to more defined operational procedures. The execution of the strategic plan requires a comprehensive understanding of the specific aims, approaches, scientific research, and technology development that will form the basis of collaboration and priority setting. Furthermore, the process will involve extensive consultation with the global neuroscience research community to identify and support long-term directions of research to the benefit of society.

The structural and organizational framework enables the IBI to transcend borders, which required considerable negotiation and thought to come to fruition. While the IBI intends to leverage the fellowship and resources of the participating brain initiatives, the IBI also hopes to have impact well beyond the participating organizations. Such interactions have the potential to shape the directions of brain research in the longer term and provide a lasting legacy from these efforts to the benefit of society.

SUPPLEMENTAL INFORMATION

Supplemental Information can be found online at https://doi.org/10.1016/j.neuron.2020.01.002.

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Update

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Correction

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In the original publication of this NeuroView, Pingping Li was omitted from the member list for the International Brain Initiative. This has now been corrected online. *Neuron* apologizes for the error.