国際共同研究プログラムに基づく
日米連携による脳情報通信研究
[課題の概要]

2022年9月30日

国立研究開発法人情報通信研究機構

目次

1. 公募概要

募集期間：2022年9月7日（水）～2022年11月24日（木）日本時間正午
研究開発課題：国際共同研究プログラムに基づく日米連携による
脳情報通信研究（第6回）
Collaborative Research in Computational Neuroscience
（CRCNS） -Innovative Approaches to Science and
Engineering Research on Brain Function-

本募集においては、次の2区分のうちのいずれかを選択して
研究開発を行います。

【区分1】Research Proposals
【区分2】Data Sharing Proposals

採択予定：最大3件、
米国側予算とバランスを取り、1件当たり、総額10百万円/12か月
（税込）から総額25百万円/12か月（税込）
研究期間：36か月間

2. 研究概要図

課題 230　国際共同研究プログラムに基づく日米連携による脳情報通信研究（第６回）
（英語名: Collaborative Research in Computational Neuroscience）

計算論的神経科学の分野における日米での連携研究の促進、効率的な脳情報通信研究の推進を目指す。

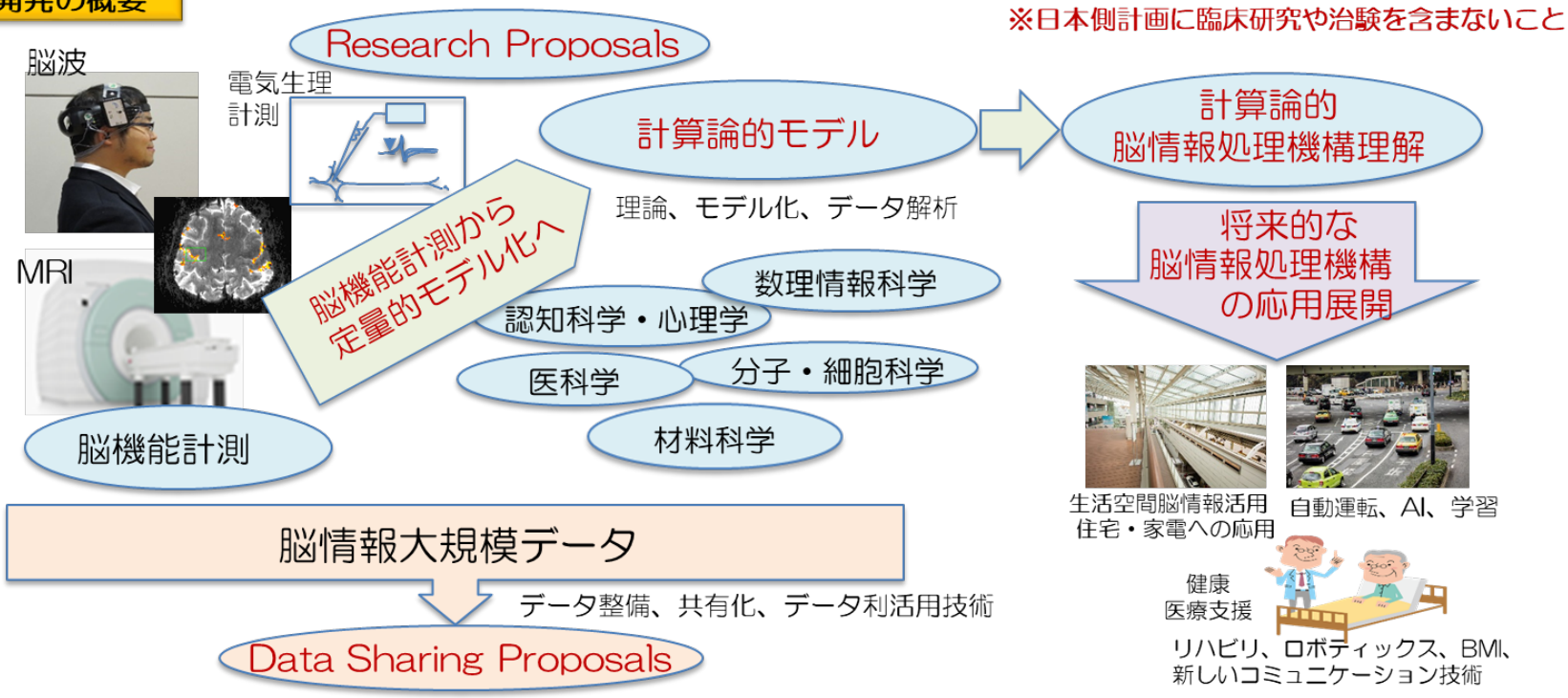
背景

計算論的神経科学は、脳情報通信研究において中心的領域であり、そこから生まれるデータの有効活用も求められている。

研究開発の目的

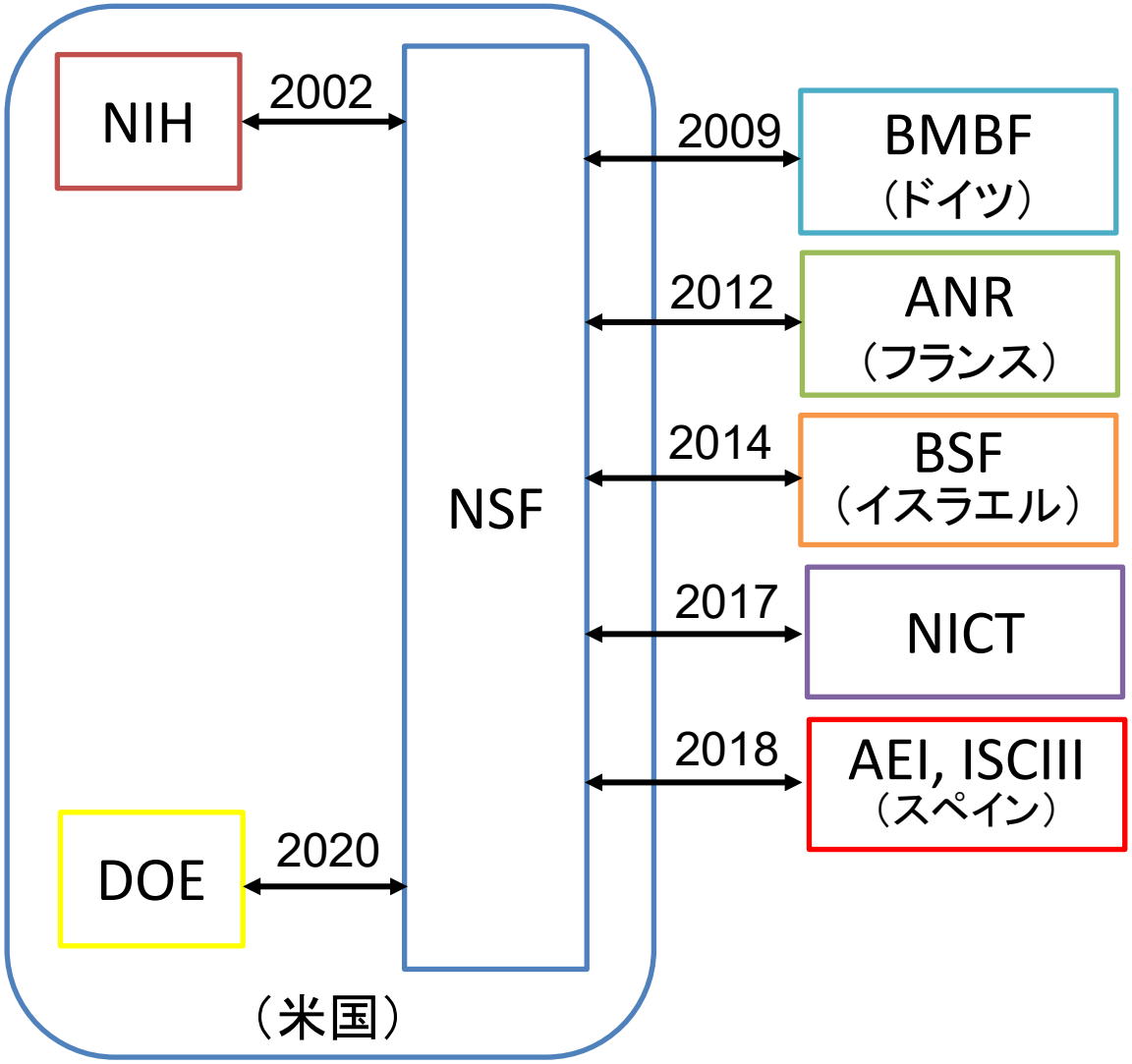
本プロジェクトは、異分野融合と国際協力により生まれる機構および受託者双方の成果を統合することにより、新しい脳情報通信技術の展開と社会貢献を目指す。

研究開発の概要



研究開発期間：2023年度委託研究開始日から36か月間
研究開発予算：1件12か月当たりの総額10百万円~25百万円（税込）、採択件数：最大3件

3. CRCNSについて（1：国際共同研究フレームワーク）



NSF:
National Science Foundation

NIH:
National Institutes of Health

BMBF:
Federal Ministry of Education and Research, Germany

ANR:
French National Research Agency

BSF:
United States-Israel Binational Science Foundation

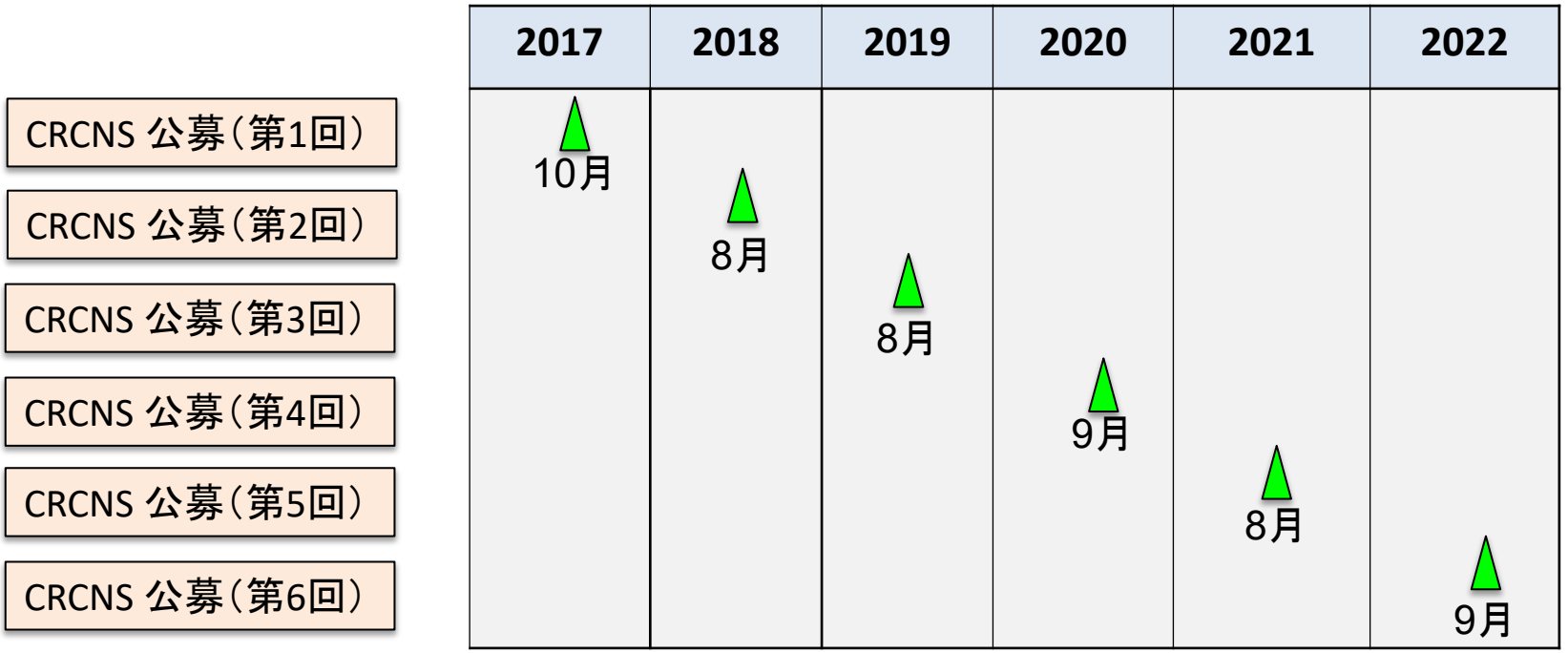
AEI:
State Research Agency, Spain

ISCIII:
National Institute of Health Carlos III, Spain

DOE:
Department of Energy

- 2002年に米国NSFとNIHの共同ファンディングとしてスタートし、ほぼ毎年公募を実施
- 2020年9月現在6ヶ国9ファンディング機関が参加、各機関はNSFとMOUを締結

3. CRCNSについて（2：NICTでの公募）



- 採択評価は、CRCNS参加各国からの評価者が参加するNSFのCRCNS Joint Panel Reviewのプロセスにより行います。
- 日本からは、NICTの評価委員会の委員が参加します。

4. 研究開発の目的

- **Synopsis of Program:**
  - Computational neuroscience provides a theoretical foundation and a rich set of technical approaches for understanding complex neurobiological systems, building on the theory, methods, and findings of computer science, neuroscience, and numerous other disciplines.
  - Through the CRCNS program, the U.S. National Science Foundation (NSF), National Institutes of Health (NIH), and Department of Energy (DOE); the German Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF); the French National Research Agency (Agence Nationale de la Recherche, ANR); the United States-Israel Binational Science Foundation (BSF); Japan's National Institute of Information and Communications Technology (NICT); and Spain's State Research Agency (Agencia Estatal de Investigación, AEI) and National Institute of Health Carlos III (Instituto de Salud Carlos III, ISCIII) support collaborative activities that will advance the understanding of nervous system structure and function, mechanisms underlying nervous system disorders, and computational strategies used by the nervous system.
  - Two classes of proposals will be considered in response to this solicitation:
    - **Research Proposals** describing collaborative research projects.
    - **Data Sharing Proposals** to enable sharing of data and other resources.

5. 研究開発の到達目標（1）

- **Program Description:**
  - Two classes of proposals will be considered in response to this solicitation: Research Proposals describing collaborative research projects, and Data Sharing Proposals to enable sharing of data and other resources. Domestic and international projects will be considered, as detailed in Sections V.A. and VIII of this solicitation.

  - In general, appropriate scientific areas of investigations may be related to the missions and strategic objectives of any of the participating funding organizations. Some specific examples are given at the end of this section. Questions concerning a particular project's focus, direction, and relevance to a participating funding organization should be addressed to the appropriate person in the list of agency contacts.

  - Each of the funding organizations participating in this program has a commitment to developing and supporting computational neuroscience research for the purpose of advancing the understanding of the neuroscience questions relevant to the missions of the organizations. Proposals selected for funding must be responsive to the mission of a participating funding organization.

5. 研究開発の到達目標(2)

- **Assurance of Innovative Collaborative Research Effort Across Scientific Disciplines:** The driving principle behind this program is the recognition that projects crossing traditional academic disciplinary boundaries often bring about increased productivity, creativity, and capacity to tackle major challenges. Collaborative efforts that bring together investigators with complementary experience and training, and deep understanding of multiple scholarly fields, are a requirement for this program and must be convincingly demonstrated in the proposal. A typical research collaboration might involve a computer scientist and a neurobiologist, for example, though note that this solicitation does not prescribe any particular mix of disciplinary backgrounds or scientific approaches. Proposals for research projects should describe collaborations that bring together the complementary expertise needed to achieve significant advances on challenging interdisciplinary problems. Proposals for data sharing should describe resources that respond to the needs of a broad community of investigators to enable wide-ranging research advances.
- This program emphasizes innovative research and resources, encouraging the application and development of state-of-the-art computational methods by theorists, computational scientists, engineers, mathematicians, and statisticians to tackle dynamic and complex neuroscience problems.
- Computational research supported under this program must relate to biological processes and should lead to hypotheses that are testable in biological studies. It is expected that: (1) research collaborations will build on complementary investigator expertise in computing, engineering, modeling, theory, and/or experimental neuroscience; (2) the collaborations should involve a dynamic and possibly protracted period of development and refinement of models, theories, and/or analytical techniques, and intense interactions among scientists and engineers from different disciplines; and (3) the development and testing of new models or theories should provide a framework for the design of experiments and the generation of new hypotheses that can help reveal mechanisms and processes of the nervous system.

5. 研究開発の到達目標(3)

- **Sharing of Data, Software, and Other Resources:** Sharing of data and software is highly recommended in all CRCNS projects, to facilitate the translation and dissemination of research results, to accelerate the development of generalizable approaches and tools that can be put to wide use by researchers, and to broaden the scope of collaboration in computational neuroscience and related communities.
- Data Sharing Proposals may relate to any of the scientific topics that would be appropriate for Research Proposals under this solicitation. Data sharing projects should be specifically aimed at the preparation and deployment of data, software, code bases, stimuli, models, or other resources in a manner that is responsive to the needs of an identified broad community of researchers, for example, by providing a coherent collection of data and other resources covering a set of topics, systems, or methods of interest. The major innovation and intellectual merit of a data sharing proposal could be in the breadth, depth, or importance of the resources being shared. Technical innovation (e.g., to facilitate usability, access, and integration), and thoughtful approaches to community development and continuous improvement, are encouraged as needed to make the proposed resources maximally effective. CRCNS support for data sharing focuses primarily on data and other resources, not more general infrastructure, or research to acquire the data. Proposers of data sharing projects are strongly encouraged to build on existing facilities and services where possible, rather than develop infrastructure from scratch. All CRCNS investigators are encouraged to coordinate with other data sharing projects and related activities, including national and international efforts to develop sustainable, extensible neuroscience resources.
- Innovative educational and training opportunities are highly encouraged, to develop research capacity in computational neuroscience, broaden participation in research and education, and increase the impact of computational neuroscience research. Activities at all levels of educational and career development are welcome under this solicitation. International research experiences for students and early-career researchers are highly encouraged in all projects involving international collaborations
- A broad range of topics and approaches is welcome under this solicitation. The list of examples below illustrates some areas of research that are appropriate under this solicitation.

5. 研究開発の到達目標(4)

The following list is not intended to be exhaustive or exclusive:

- Explanatory, predictive, and informative models and simulations of normal and abnormal structures and functions of the nervous system and related disorders;
- Mathematical, statistical, and other quantitative analyses of research related to genetic, epigenetic, molecular, sub-cellular, cellular, network, systems, behavioral, and/or cognitive neuroscience;
- Theoretical and computational approaches to delineate and understand the structures and functions of neural circuits and networks;
- High Performance Computing (HPC) enabled modeling and simulation approaches for extreme scale research and understanding;
- Theoretical and computational approaches that relate nervous system processes to learning algorithms and architectures, probabilistic representations, estimation, prediction, information theory, and inference;
- Data-driven and informatics-based approaches that exploit large-scale, high-throughput, heterogeneous, and/or complex data;
- Theory and algorithms for designing experiments and integrating and analyzing data related to imaging, electrophysiological, optogenetic, multi-omic, and other methods;
- Artificial intelligence and machine learning approaches adopting life-long learning, transfer learning, and other strategies for building, generalizing, or selecting models based on accumulating and diverse forms of evidence;

5. 研究開発の到達目標(5)

- Modeling approaches that efficiently assimilate new information, apply existing knowledge to new data, or optimize new data acquisition or closed-loop system performance;
- Machine learning algorithms combined with effective explanatory techniques mining neuro-behavioral data and linking multiple neuro-behavioral measures;
- Unbiased generation of neurobehavioral theories (discovering governing equations) using AI-generated dynamical and statistical models;
- Computational strategies for human neuroscience that reduce model bias towards underrepresented groups and improve data coverage, access, equity, and fairness;
- Methods for measuring and analyzing connectivity, dynamics, information, and causation in neural systems;
- Explanatory models of spatiotemporal brain dynamics across multiple scales;
- Approaches exploiting new methods and tools for simulating complex multi-physics, multi-scale systems;
- Approaches that integrate neural and cognitive models;
- Data-intensive approaches to modeling and analysis, and integrated theory- and data-driven models at different levels of abstraction;
- Efforts to compare large-scale experimental data to theoretical and computational models;
- Mathematical, statistical, and modeling approaches arising from areas such as communications, network science, the social, behavioral, and economic sciences, engineering, and other fields, applied to the nervous system;
- Multi-scale modeling spanning temporal and spatial scales, behavioral states, or normal and diseased states to understand and predict processes, behaviors, and diseases;
- Theoretical and computational methods that can be applied to: common pathways, circuits, and mechanisms underlying multiple diseases in the nervous system; translational research including therapeutic devices and drug development; and/or clinical research and clinical trials (e.g., predictive models of diseases, adaptive design of clinical trials, and simulation of clinical trials);

5. 研究開発の到達目標(6)

- Theoretical and computational methods that can be applied across multiple areas of basic, translational, and clinical neuroscience research;
- Development and dissemination of analytical, numerical, or conceptual predictive models;
- Theoretical, computational, and/or analytical approaches to integrating brain measures across levels of analysis (e.g., molecules, cells and circuits); and
- Approaches to neuroscience problems that advance computational and engineering principles.
- Examples of topics amenable to these approaches include but are not limited to the following:
- Neurodevelopment, neurodegeneration, neuroinflammation and repair;
- Pattern recognition and perception;
- Motor control mechanisms and sensorimotor integration;
- Learning, representation, and encoding;
- Cognitive and decision-making functions and dysfunction (including, e.g., impulse control and disinhibition);
- Neural origins of risk and time preference;
- Judgment, choice formation, and social-behavioral phenomena such as trust, competitiveness, and cooperation, including the role of emotion;
- Language and communication;
- Intellectual and developmental disabilities;
- Neural interface decoding and analysis, control, and modeling of processes affecting neural interfaces and neuroprostheses;
- Normal and abnormal sensory processing (vision, audition, olfaction, taste, balance, proprioception, and somatic sensation);
- Neurological, neuromuscular, and neurovascular disorders;
- Mental health, mental illness, and related disorders;
- Alcohol and substance use disorders, including their interaction with eating disorders and other psychiatric and neurological disorders;
- Emergent and state-space properties of dynamic neural networks and ensembles; and
- Modulation of central and/or peripheral neural processes by complementary and integrative health approaches (mind and body interventions, natural products), particularly in the context of pain processing and regulation.

6. 評価項目

CRCNS Joint Panel Reviewの評価項目

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and

- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
   a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
   b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?