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]

2024年1月16日

国立研究開発法人情報通信研究機構

目次

１．公募概要

２．研究概要図

３．CRCNSについて

４．研究開発の目的

５．研究開発の到達目標

６．評価項目

1. 公募概要

募集期間：2023年12月26日（火）～2024年3月12日（火）日本時間正午
（NSF側締切日：2024年3月7日(木)）
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7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 235　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7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。

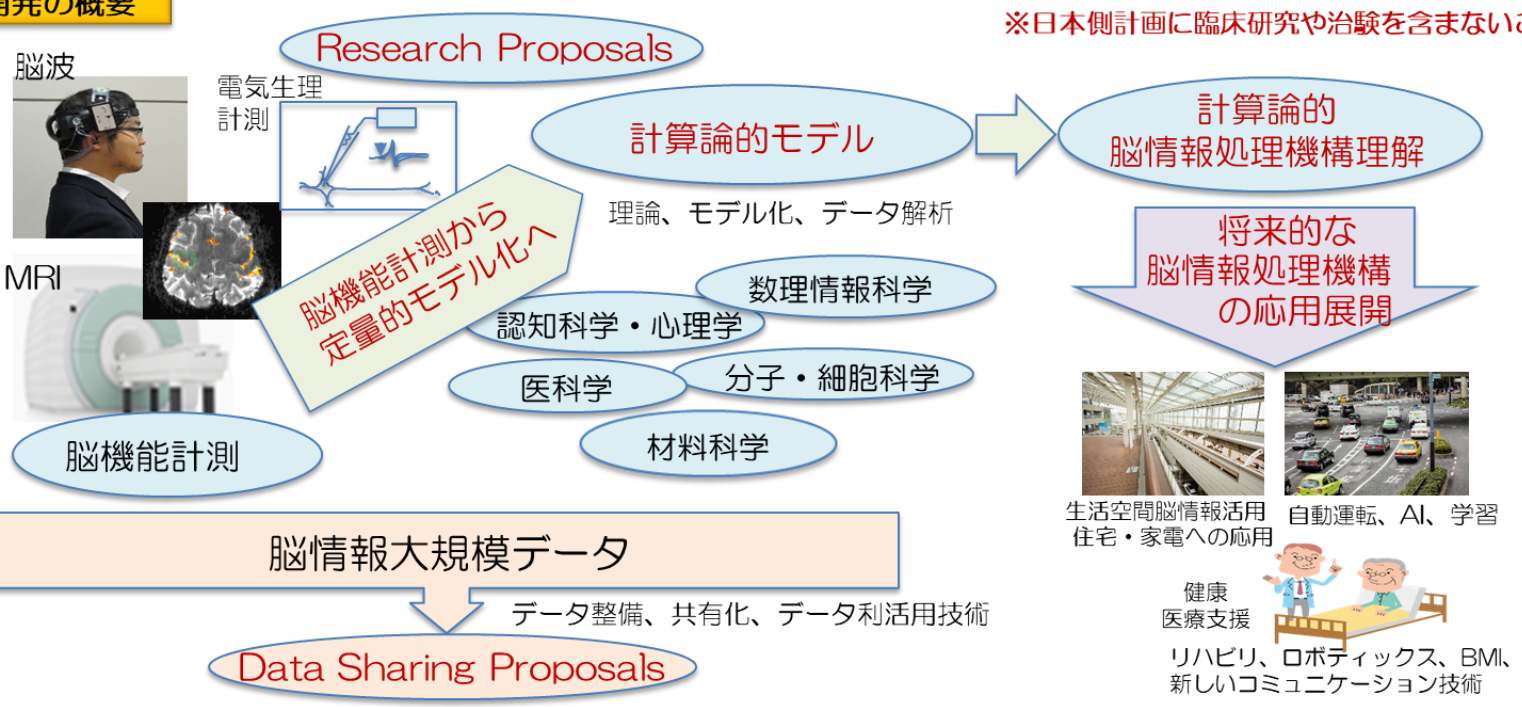
背景

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

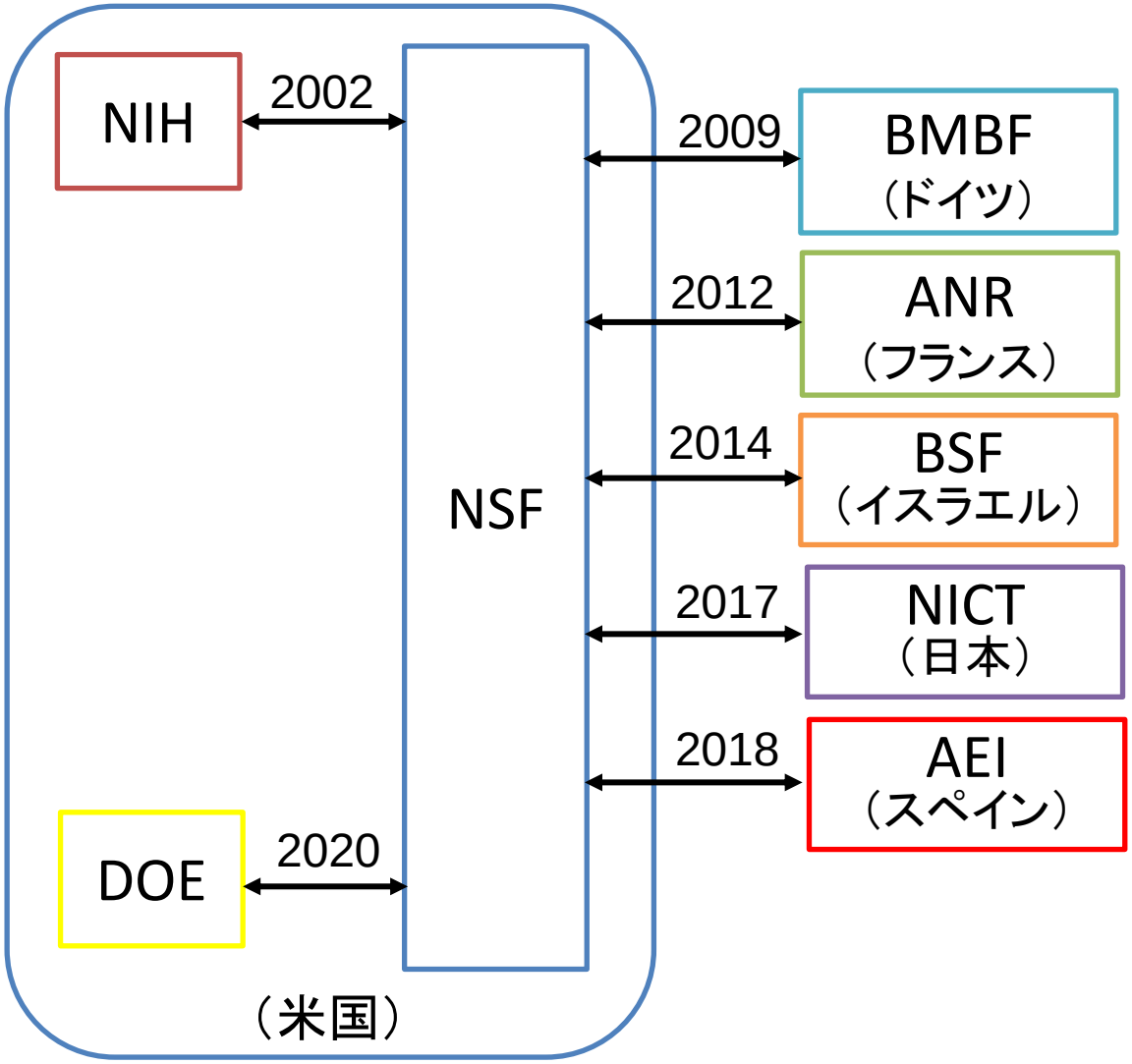
本プロジェクトは、異分野融合と国際協力により生まれる機構および受託者双方の成果を統合することにより、新しい脳情報通信技術の展開と社会貢献を目指す。

研究開発の概要



研究開発期間：2024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

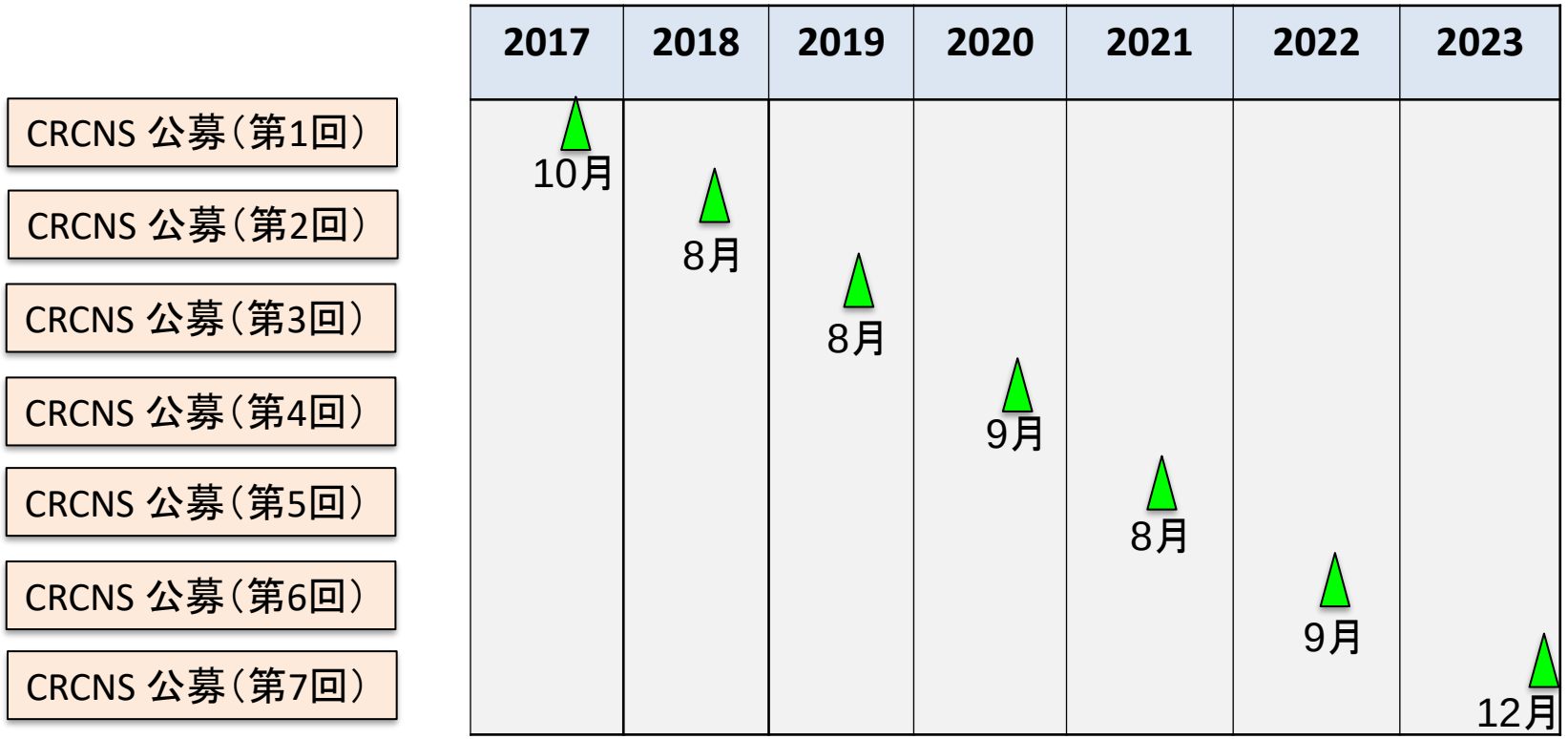
BSF:
United States-Israel Binational Science Foundation

AEI:
State Research Agency, Spain

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
- 2023年12月現在6ヶ国8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 the nervous system at all levels, building on the theory, methods, and findings of computer science, neuroscience, and numerous other disciplines to accelerate the understanding of nervous system structure and function, mechanisms underlying nervous system disorders, and computational strategies used by the nervous system.

Through the CRCNS program, the participating funding organizations support collaborative activities that span a broad spectrum of computational neuroscience
research, as appropriate to the missions and strategic objectives of each agency.

Two classes of proposals will be considered in response to this solicitation:

Research Proposals describing collaborative research projects, and
Data Sharing Proposals to support sharing of data and other resources.

5. 研究開発の到達目標(1)

Program Description:

Following from the above motivations, two classes of proposals will be considered in response to this solicitation: **Research Proposals** describing collaborative research projects, and **Data Sharing Proposals** to support sharing of data and other resources. Domestic and international projects will be considered, including proposals seeking parallel international funding as detailed in Sections V.A. and VIII of this solicitation.

Research Proposals should describe innovative, collaborative projects focused on challenging interdisciplinary problems in computational neuroscience. The scope of computational neuroscience is defined inclusively, encompassing structure, function, organization, and computation across all levels of the nervous system, and including theory, modeling, and analysis, disease and normal function, and implications for biological as well as engineered systems.

Collaborative efforts are required. No particular combination of disciplinary backgrounds or scientific approaches is prescribed. Proposers should determine and convincingly demonstrate the complementary expertise and close collaborations needed to make significant interdisciplinary advances

5. 研究開発の到達目標(2)

Examples of potential approaches and topics are given at the end of this section. Proposals selected for funding by this program must be responsive to the mission of a participating funding organization. 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 in Section VIII of this solicitation.

Data Sharing Proposals should focus on the preparation and deployment of data, software, code bases, stimuli, models, or other resources in a manner that will enable wide-ranging research advances in computational neuroscience. Data sharing projects are expected to respond to the needs of an identified broad community of researchers, representing any of the scientific areas that would be appropriate for Research Proposals under this solicitation. The major innovation of a data sharing project could relate to the breadth, depth, or importance of the resources being shared. Technical innovations and novel approaches to community development and continuous improvement are encouraged as needed to maximize the effectiveness and impact of shared resources.

5. 研究開発の到達目標(3)

Support for data sharing under this solicitation focuses primarily on data and other resources, not more general infrastructure development, or research to acquire the data. Proposers of data sharing projects are strongly encouraged to build on existing facilities and services where possible. A significant data sharing effort may also be proposed as a major component of a Research Proposal. 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 strongly encouraged in all CRCNS proposals 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, described in terms of explicit plans and goals, are strongly encouraged in all projects involving international collaborations.

5. 研究開発の到達目標(4)

A broad range of approaches and topics is welcome under this solicitation. The list of examples below illustrates some areas of research that are appropriate under this solicitation. **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 (AI/ML) approaches that provide new insights into neural data, neural systems, and behavior, and neuroscience that can inform AI/ML;
- Methods combining AI/ML, statistics, dynamical systems, and/or control theory;
- Modeling approaches that efficiently assimilate new information, apply existing knowledge to new data, or optimize new data acquisition or closed-loop system performance;
- Computational strategies for human neuroscience that reduce model bias towards underrepresented groups and improve data coverage, access, equity, and fairness;

5. 研究開発の到達目標(5)

- Computational models examining the mechanisms whereby social determinants of health interact with biological factors, including genetics, to influence risk or resilience for diseases in the nervous system;
- Methods for measuring and analyzing connectivity, dynamics, information, and causation in neural systems;
- Integration and modeling of data across levels of analysis, from molecular to circuit level mechanisms implicated with behavior;
- Explanatory models of spatiotemporal brain dynamics across multiple scales;
- 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;
- Theoretical and computational methods that can be applied to: common pathways, circuits, and mechanisms underlying multiple diseases in the nervous system; integrating brain measures across levels of analysis; and translational research; and
- Computational approaches in translational research aimed at addressing one or more phases (e.g., target identification) of drug discovery for nervous system disorders, including mechanistic neurobiological models of drug target engagement.

5. 研究開発の到達目標(6)

Examples of topics amenable to these approaches include but are not limited to the following:

- Neurodevelopment, neurodegeneration, neuroinflammation and repair;
- Pattern recognition and perception, learning, representation, and encoding;
- Motor control mechanisms and sensorimotor integration;
- Memory and attention;
- Cognitive and decision-making functions and dysfunction (including, e.g., impulse control and disinhibition, and addiction, broadly construed);
- 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;
- Application of knowledge of brain computation to devices;
- Normal and abnormal sensory processing (vision, audition, olfaction, taste, balance, proprioception, and somatic sensation);
- Neural mechanisms of adaptation to environmental constraints or disease;
- 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, and the effects of these conditions on cognitive processes;
- 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

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?

CRCNS 2024 公募説明会
審査の方法と審査会の様子

審査会について　審査体制や審査のポイント

2023年の公募の場合
全応募は199件(日本からは4件、うち1件採択)

1. 評価パネル(審査員)とNSF(National Science Foundation)、NIHのコーディネータで審査

2. 採択された提案課題の特徴

3.（NICT内部からの応募の場合）NICT側から求められているもの

採択後のPI総会(研究成果報告会) 2023年イスラエル・テルアビブの様子

採択後には研究費のサポートだけでなく、研究交流会も毎年開催されている

2023年開催のPI総会の様子@イスラエル

・開催期間 3日間 (2023年7月11日-13日)、参加費 150米ドル 22000円程度

・ディアスポラ博物館会議場 (およそCiNet Conference Roomの倍程度の大きさ)

・会場参加者 200-250名程度。ほか、外に設置されたモニタで聴講可能

YouTube配信 : https://www.youtube.com/playlist?list=PL4CUijpiEOAcBtb1IhdLIa3oXyek1E_O4

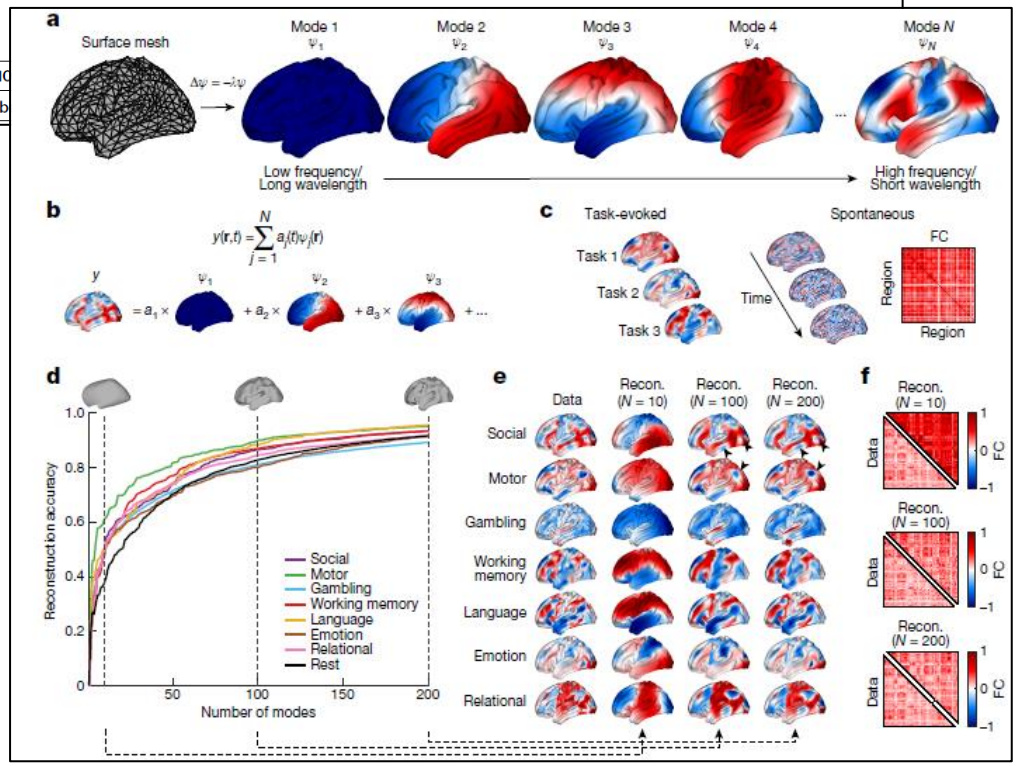
採択後のPI総会(研究成果報告会) 2023年イスラエル・テルアビブの様子

15:15 – 16:45	**Session 8: Connectomes** Chair: Yaniv Assaf, Tel Aviv University, Tel Aviv, Israel
15:15	KEYNOTE5: Computational approach to explore the connectome Andrew Zalesky, University of Melbourne, Melbourne, Australia
15:45	KEYNOTE6: Geometric constraints on human brain function Alex Fornito, Monash University, Melbourne, Australia
16:15	Mechanisms of cortical communication during goal-directed behavior Arseny Finkelstein, Tel Aviv University, Tel Aviv, Israel
16:30	Cross-species network theory measures of mesoscopic brain-wide functional integrity in aging Itamar Kahn, Columbia University, New York, USA
9:30 – 11:15	**Session 5: Brain architecture, connectivity and plasticity** Chair: Galit Yovel, Tel Aviv University, Tel Aviv, Israel
9:30	KEYNOTE2: Imaging and stimulating adaptive brain plasticity Heidi Johansen-Berg, Oxford University, Oxford, UK
10:00	Structural properties of the optic tract correlate with the size of V1 in the Human Connectome Project 7T Retinotopy Dataset Hiromasa Takemura, NICT, Suita-shi, Japan
10:15	Relating Activity and Connectivity in the Learning Brain Ido Tavor, Tel Aviv University, Tel Aviv, Israel
10:30	KEYNOTE3: Elucidating Brain Microstructure and Architectural Organization with MRI Peter Basser, National Institute of Health, Bethesda, Israel

Article

Geometric constraints on human brain function

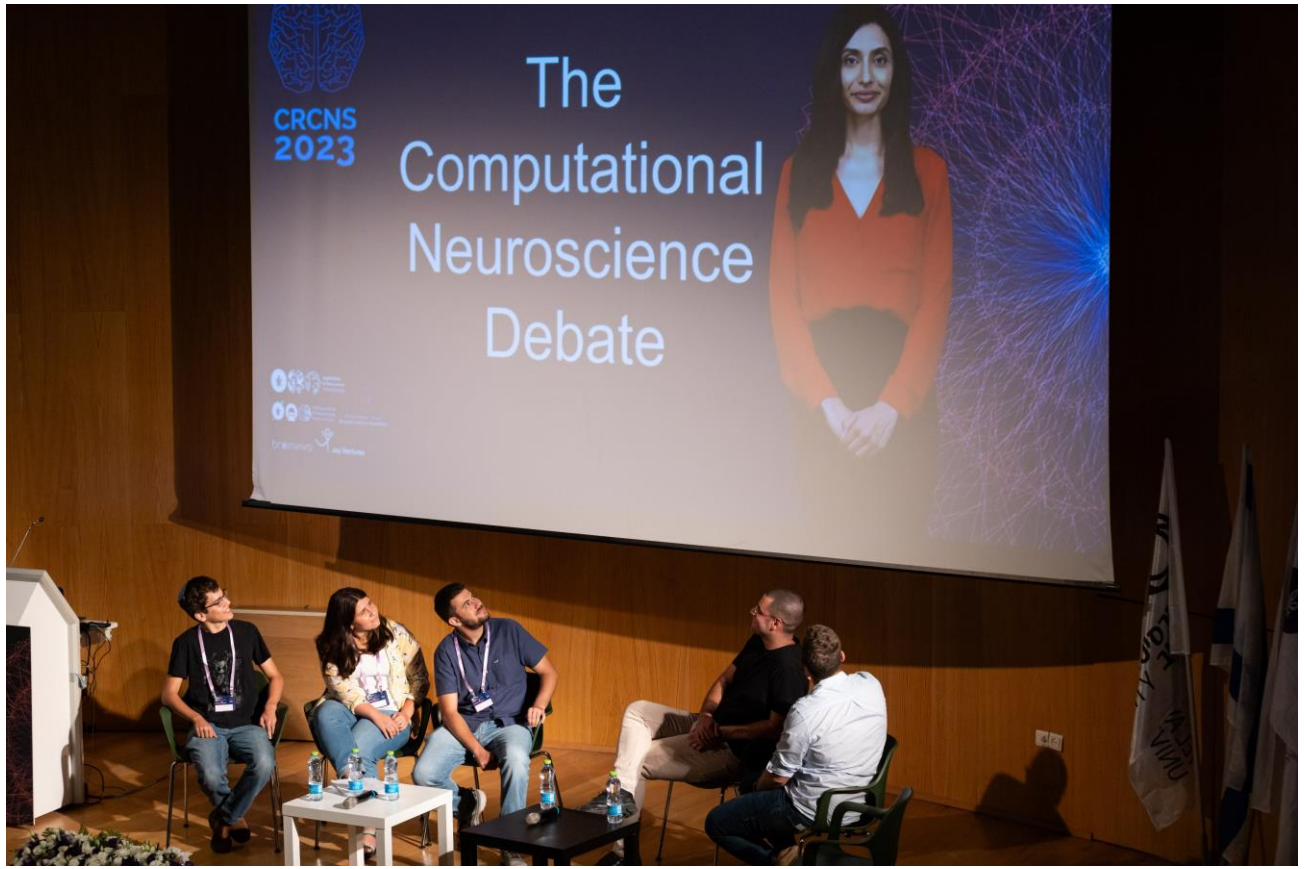
https://doi.org/10.1
Received: 14 Octob



・各セクションごとに著名研究者らの招待講演 (e.g. Alex Fornito, Heidi Johansen-Berg)
・その後、そのセクションの各採択研究の進捗状況報告(希望者のみ)。
・既に論文になっている研究(論文誌も様々)もあれば、まだこれから始める…という報告もあり。
・ポスター発表はテルアビブ大学やヘブライ大学の学生も参加

採択後のPI総会(研究成果報告会) 2023年イスラエル・テルアビブの様子

採択後には研究費のサポートだけでなく、研究交流会も毎年開催されている



計算神経科学のタイムリーな話題の
キャッチアップに有意義！！

・現地学生＋研究者らによるディスカッションセクションが数個あり
　e.g. 人工知能の発展によって退化するヒトの認知機能は何か、あるいは進化する機能は何か？
・ChatGPTが司会者となって話題を提供し、その質問に研究者が答えるセクションまであった