Simons Center for the Social Brain

The mission of the Simons Center for the Social Brain (SCSB) at MIT, now in its seventh year, is to understand the neural mechanisms underlying social cognition and behavior and translate this knowledge into better diagnosis and treatment of autism spectrum disorders (ASDs). SCSB, founded in January 2012 with support from the Simons Foundation Autism Research Initiative, completed its first five-year phase of funding in December 2016. In January 2017, SCSB funding was renewed for a second phase.

SCSB studies the underlying mechanisms of ASDs in both humans and relevant model organisms and systems, as neural correlates of social cognition and behavior exist in diverse species. Its approaches take advantage of MIT's strengths in genetics and genomics, molecular and cell biology, analyses of neural circuits and systems, cognitive science, computation, and engineering.

During 2017–2018, in keeping with its renewal goals, SCSB supported postdoctoral fellows and its unique targeted projects that involve three to four researchers bridging multiple levels of analysis. In addition, we continued to host events that reach a wide audience, including a colloquium series and a lunchtime talk series.

Symposia and Events

To strengthen its community, SCSB runs a colloquium series that brings major autism researchers to MIT; the series has become the preeminent forum in the Boston area for research on autism and neurodevelopmental disorders. In addition, SCSB hosts a lunch talk series featuring postdoctoral fellows and faculty principal investigators presenting their latest ongoing research.

As in previous years, the colloquium was held roughly on alternate Wednesdays during the spring and fall terms. Lunch talks were held approximately once a month. During 2017–2018, SCSB hosted 12 external colloquium speakers and 12 internal lunch speakers. Additionally, SCSB co-hosted two special seminars that were relevant to autism and developmental brain disorders.

Research

Postdoctoral Fellowships

We continued our outreach efforts with respect to announcing, receiving, reviewing, and awarding postdoctoral fellowships. Announcements were widely advertised to various departments and centers at MIT as well as institutions throughout the Boston area. As in the past, the grant application and funding cycle occurred in two rounds (February and September).

From July 2017 to June 2018, SCSB awarded nine postdoctoral fellowships (including four renewals for a second year of funding). Applications were reviewed by peer committees that were set up for each round of applications and overseen by the SCSB steering committee, which met after each round of reviews.

Targeted Projects

SCSB supports collaborative, focused projects undertaken by multiple laboratories to explore in depth specific aspects or types of autism. These targeted projects are structured to require collaboration among researchers in order to quickly and flexibly address pressing questions in autism research. SCSB supported three targeted projects in 2017–2018. Two of these projects were continuations from previous years, while one was newly initiated.

The first project focuses on the nature of the pragmatic impairment in autism spectrum disorders. This project, which received its third and final year of funding in April 2017, involves three components:

- Characterizing the contributions of three neural systems—the core language system, the theory of mind system, and the cognitive control system—to pragmatic reasoning (Evelina Fedorenko and Rebecca Saxe)
- Investigating the nature of the pragmatic impairment among individuals with ASDs using a set of robust communicative paradigms (Edward Gibson)
- Conducting a computational and behavioral investigation of how developing and mature individuals with ASDs and neurotypical participants reason about others' utility functions (Laura Schulz and Josh Tenenbaum)

The second project addresses the role of the thalamic reticular nucleus (TRN) in thalamocortical coordination, cognitive processing, and sleep among those with ASDs. This project, which received its second year of funding in November 2017, involves four components:

- The role of TRN in spindle generation and hippocampal-neocortical coordination during wake/sleep (Matthew Wilson)
- Spindle activity and thalamocortical interactions (Dara Manoach)
- Molecular diversity and the role of ASD risk genes in the TRN (Guoping Feng)
- The role of the TRN in prefrontal representations underlying cognitive control and flexibility (Michael Halassa)

The third project focuses on circuit mechanisms associated with ASD-relevant behaviors in marmosets. This new project, initiated in April 2018, also incorporates four components:

- Neural circuits for social attention and social reward (Robert Desimone)
- Investigation of the striatal circuits in the marmoset brain underlying repetitive, perseverative behaviors (Ann Graybiel)
- Switching and prediction mechanisms in the marmoset cortex (Mriganka Sur)
- Molecular measurement and perturbation of marmoset brain networks (Alan Jasanoff)

Each of these projects involves teams of three to five investigators that meet regularly to discuss ongoing findings, provide feedback, and share results and ideas.

Major Research Publications

A wide range of publications resulted from SCSB funding. A sample is as follows:

- Maternal Gut Bacteria Promote Neurodevelopmental Abnormalities in Mouse Offspring (from the labs of Gloria Choi and Jun Huh, published in *Nature*)
- Domain-General Brain Regions Do Not Track Linguistic Input as Closely as Language-Selective Regions (from Ev Fedorenko's lab, published in the *Journal of Neuroscience*)
- Expansion Microscopy of Zebrafish for Neuroscience and Developmental Biology Studies (from Limor Freifeld and Ed Boyden, published in the *Proceedings of the National Academy of Sciences*)
- Cortical Responses to Dynamic Emotional Facial Expressions Generalize Across Stimuli, and Are Sensitive to Task-Relevance, in Adults with and without Autism (from Stefano Anzellotti and Rebecca Saxe, published in *Cortex*)
- Major Vault Protein, a Candidate Gene in 16p11.2 Microdeletion Syndrome, Is Required for the Homeostatic Regulation of Visual Cortical Plasticity (from Mriganka Sur's lab, published in the *Journal of Neuroscience*)

Impact

The impact of SCSB on the community is manifest in many ways. Over 75 investigators across 18 departments, labs, and centers at MIT and 11 Boston-area institutions are engaged as investigators or as postdoctoral mentors. SCSB has supported 36 postdoctoral researchers as Simons Fellows.

SCSB researchers have published more than 200 original research papers and obtained over $48 million in external funding. Simons Fellows continue to be very successful in obtaining faculty or independent research positions.

Administration and Governance

SCSB continues to be run by a small administrative core in which each individual performs a wide range of functions. In 2017–2018, the team included Mriganka Sur (director), Eleana Ricci (program administrator, facilities officer, and fiscal officer), and Alexandra Sokhina (administrative assistant and events coordinator). Leia Amarra supported fiscal management until November 2017.

SCSB has two levels of governance, and both were actively engaged in 2017–2018:

- Review committees made up of six to eight reviewers across MIT met during each round of funding to evaluate applications for seed grants and postdoctoral fellowships.
- The steering committee (Richard Hynes, Robert Desimone, Douglas Lauffenburger, Mriganka Sur, and Louis Reichardt) met following each review committee meeting to offer advice on funding decisions, targeted projects, and the overall direction of the center.

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