

## Center Annual Report FY18

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Penn's hub for the integrative study of the mind, connecting researchers across our campus and with our community.

May 29, 2018

This is a report on the activities of the Mind Center for Outreach, Research, and Education (MindCORE). MindCORE was officially created in the fall of 2017 as one of the School's key endeavors under the "Mapping the Mind" initiative identified in the School's strategic plan, *Foundations and Frontiers*.

Sharon Thompson-Schill agreed to serve a two-year term as the first faculty director working in coordination with an Executive Committee (EC) that includes David Brainard, professor of psychology; Joseph Kable, associate professor of psychology; Nicole Rust, associate professor of psychology and Michael Weisberg, professor of philosophy, and staff director Heather Calvert after she joined the center in September. The EC is advised by a 19-member multi-school Faculty Advisory Board comprised of the following members:

Vijay Balasubramanian, Physics (2017-2020)  
Danielle Bassett, SEAS (2017-2020)  
Nancy Bonini, Biology (2017-2019)  
John Detre, PSOM (2017-2020)  
Angela Duckworth, Psychology (2017-2019)  
Emily Falk, Annenberg (2017-2020)  
Martha Farah, Psychology (2017-2020)  
Joshua Gold, PSOM (2017-2019)  
Konrad Kording, SEAS and PSOM (2017-2019)  
Caryn Lerman, PSOM (2017-2019)  
Barbara Mellers, Psychology and Wharton (2017-2019)  
Michael Platt, Psychology, PSOM and Wharton (2017-2019)  
Adrian Raine, Criminology and PSOM (2018-2020)  
Marc Schmidt, Biology (2017-2019)  
John Trueswell, Psychology (2017-2019)  
Lyle Ungar, SEAS (2017-2020)  
Charles Yang, Linguistics (2017-2020)  
TBD, SAS Advancement (ex-officio)  
Larry Gladney, SAS Associate Dean for the Natural Sciences (ex-officio)

## **Mission**

Penn MindCORE is an interdisciplinary effort to understand human intelligence and behavior. Research programs in MindCORE bring together faculty with diverse approaches to the study of the mind, from disciplines in the Arts & Sciences ranging from Psychology, Biology, Cognitive Science, Neuroscience, and Physics to Economics, Linguistics, Political Science, Sociology, and Philosophy; and they bridge to centers and departments in Medicine, Wharton, Engineering, and Annenberg. MindCORE is the home of several undergraduate and graduate programs that are educating the next generation of students of the mind. MindCORE promotes cutting-edge research, increases the broader societal impact of new knowledge about human behavior and decision making gained from current research, and influences public policy and education through coordinated outreach programs.

## **Most Significant Accomplishments**

During the first eight months, MindCORE has taken over or established several programs to unite the community at Penn working across mind and brain and accomplished the following:

### Created the Structure and Established Operations for a New SAS Center to Unite Penn's Work in Mind & Brain

- Hired staff including an executive director; promoted a former IRCS event planner to program manager, and identified a program coordinator who will start with MindCORE in FY19.
- Held 12 Executive Committee meetings to guide the structure of new programming and operations.
- Signed up 85 Penn and CHOP faculty working in areas related to mind and brain to be MindCORE affiliated faculty.
- Created a website that launched in January: <https://web.sas.upenn.edu/mindcore/>
- Set up a temporary center office in 112 Leidy that includes a small conference room to support interdisciplinary UG majors and minors.
- Created a Twitter presence with 1400+ Tweets and 303 followers (@MindCORE) focused on 1) building the community for mind and brain across the University and 2) promoting the work taking place within Penn to the greater academic and scientific community and the public.
- Launched a Facebook page focused primarily on outreach and sharing information on the science of mind and brain to a lay audience.
- Hosted two Faculty Advisory Board meetings, one in fall and one in spring.
- Surveyed MindCORE affiliates about their interest in programming for FY19. Received 39 responses with a third of those indicating support for regular networking events, a symposium, and a retreat. These suggestions will be used to shape programming for FY19.

### Organized and Supported Seminar Series, Professional Development Talks, and Special Events

- Continued the success of the Interdisciplinary Mind and Brain Seminar by hosting 22 speakers on campus at the invitation of the IMB Planning committee (Johannes Burge, Assistant Professor, Department of Psychology, SAS; Maria Neimark Geffen, Assistant

Professor, Department of Otorhinolaryngology, PSOM; Ted Satterthwaite, Assistant Professor, Department of Psychiatry, PSOM). The weekly seminars regularly attracted 60+ attendees.

- Organized 25 Computational Neuroscience Initiative talks including one standing-room only panel discussion on “What Does Functional Connectivity Measure?” with Jonathan Pillow of Princeton and Konrad Kording and Dani Bassett of Penn.
- Held the MindCORE Uncorked Launch Event on January 25 where 4 wines were discussed by one expert in olfaction (Jay Gottfried, PIK) and one expert in wine (Tim Kweder, sommelier).
- Hosted 7 professional development talks in coordination with two student groups on such topics as Negotiating Job Offers, Women in Science, 10 Simple Rules for Structuring Papers, Finding a Post-doctoral Position, How to Write a Successful Research Grant, Best Research Practices - Managing Multiple Projects and Collaborations, and Finding a Job In the Academy: Views from new Tenure-track Alumni. Speakers including Nazlı Bhatia (Wharton), Dani Bassett (Engineering), Martha Farah (Psychology), Hilary Gerstein (Center for Neuroscience Initiatives), Zab Johnson (Wharton Neuroscience Initiative), Allyson Mackey (Psychology), Nicole Rust (Psychology), Emily Falk (Annenberg), John Medaglia (Drexel University, Psychology), Michael Platt (Wharton Neuroscience Initiative), Sharon Thompson-Schill (Psychology), Konrad Kording (Neuroscience), Elizabeth Brannon (Psychology), Sudeep Bhatia (Psychology), and Ted Satterthwaite (PSOM Psychiatry).
- Organized the standing-room only 20th Annual Pinkel Lecture on April 6 in the Wu & Chen Auditorium of SEAS with Leslie Valiant, the T. Jefferson Coolidge Professor of Computer Science and Applied Mathematics, at Harvard University on “What Needs to be Added to Machine Learning?” See video of that lecture here: <https://www.youtube.com/watch?v=Kc-w3eCxb7M>)
- Co-sponsored a visit to campus by Nobel Laureate Eric Kandel with the Katz Center and other centers so he could deliver his talk “From Vienna to New York: Memory of a Life in Two Worlds” on April 17. See video of that lecture here: <https://www.youtube.com/watch?v=g-UaVAhU8Y>

#### Designed Interdisciplinary Grant Funding Programs & Awarded 2 Large and 5 Small Grants

- Established the application and award framework to support innovative interdisciplinary research in mind and brain within the University and agreed to fund 2 research proposals for up to a maximum of \$200,000 per year for 1-3 years, including:
  - Social and Decision Sciences (Coren Apicella): An understanding of the human mind, both its intelligent capacities and limitations or biases, is becoming increasingly important to explaining how human social, political and economic institutions work. Social and decision sciences use contemporary theories of behavioral decision-making, neuroeconomics, networks, and social evolution to understand how individuals and groups make decisions. It considers how to address a real-life problems in an array of fields, such as social and public policy, law, education, business, and medicine.
  - Language Science (John Trueswell): Human capacity for complex language is unique within the animal kingdom, and psychologists have long appreciated how the languages we learn can shape our patterns of thought in subtle ways. Language

science fosters collaboration between researchers in cognitive science, computer linguistics, psycholinguistics, and phonetics to drive research in language acquisition and use. This research aims to develop and improve language and speech technologies (e.g., automatic speech recognition, translation, and transcription). In addition, this research can develop computational tools to learn more about how the human brain works and how sciences understands social groups.

- Received 7 MindCORE Activity Fund Grant Applications and awarded 4 grants. (One was rejected; two are under review). Grants were awarded for such activities as a Sustainable Consumption SPSSI/SASP Small Group Meeting (May 18-20, 2018), a Penn Symposium on Cultural Evolution and Global Social Dynamics, and the Penn Child Development Labs Talk Series and Research Program Collaborations.
- Received 1 application for a Family Care Grant up to \$500 to support conference attendees who incur extra family care expenses while attending conferences important to career progression. Received two inquiries from other programs/institutions seeking to replicate this program. Program application available here: <https://web.sas.upenn.edu/mindcore/family-care-grants/>

#### Launched a New Fellowship and Selected Two Inaugural MindCORE Fellows

- Designed for individuals who have recently obtained a Ph.D. degree in psychology, linguistics, neuroscience, philosophy or other cognitive science discipline, the MindCORE Fellowship is intended as a springboard for young researchers to help them build and establish their own research. Fellows will pursue collaborative research with faculty working across disciplines at Penn. Fellows receive a competitive salary and health insurance plus a modest research budget. Fellows are invited to join regular working group meetings within their field plus career development workshops aimed at young researchers, and will be provided with a mentoring committee. Funding is provided in one year terms renewable for up to three years.
- 72 applications were received for the inaugural MindCORE Research Fellowship. These were reviewed by four faculty (Russell Epstein, Psychology; Josh Plotkin, Biology; Barb Mellers, Wharton/Psychology; and Charles Yang, Linguistics) on the postdoc review committee. Four candidates were invited to interview in April for two positions. The 2019 MindCORE Fellows are:
  - Colin Twomey (starting 7/1/18): Colin uses information theory to understand the social dynamics that cause natural languages to form efficient descriptions of sensory information. Prior to Penn, Colin studied computer science as a Goldwater Scholar at Colgate University, receiving his B.A. in 2008, and going on to study natural algorithms for optimization as a Fulbright Fellow at the Université libre de Bruxelles. In 2016, as a NSF Graduate Research Fellow, he earned his Ph.D. in Ecology and Evolutionary Biology from Princeton University for his investigation of the sensory rules underlying collective motion in animal groups. At Penn, Colin investigates the dynamics of collective behavior in both human and animal systems. Working from information-theoretic first principles, he builds mathematical models and develops the necessary computational tools to test theory with experiment. He has used this combination of theory, computation, and experiment to study the dynamics of ‘fright waves’ in schooling fish, both in the lab and from coral reef

communities in the field. Colin's work has been mentioned in the Economist and featured in Princeton's Art of Science annual public exhibition.

- Julia Leonard (starting 9/1/18): Julia is interested in understanding the various factors that impact children's decisions to persist in the face of challenges and applications of this research to real-world learning. Julia completed her PhD in 2018 in Brain and Cognitive Sciences at MIT exploring how the social environment shapes children's brain development, cognition, and motivation. She received her BA from Wesleyan University, where she studied Neuroscience and Behavior. Julia's research focuses on understanding how children decide to stick with a challenge. How does this depend on environmental factors, such as parents' and educators' actions and messages, home routines, and access to resources, as well as internal factors, like neural development, mood, and sensitivity to evidence? In addition to her goal of better understanding the neural and cognitive factors influencing persistence, Julia is interested in translating these findings into educational interventions. She approaches this topic using a variety of techniques including behavioral experiments, home recordings, neuroimaging, and computational modeling. In addition to research, Julia is passionate about outreach and teaching. During her undergraduate career, she co-founded an after-school science program for underserved elementary school children. During graduate school, she volunteered at community science events in Boston, Cambridge, and Philadelphia, teaching both children and parents about the developing brain and mind. Julia has also greatly enjoyed her time in the classroom, teaching developmental psychology and cognitive science, for which she received two Walle Nauta teaching awards. Her research has been funded by the NSF graduate student research fellowship.

#### Continued Key Education & Outreach Programs

- Undergraduate Summer Fellowship in Interdisciplinary Mind and Brain Studies. This program offers up to ten Penn undergraduates the opportunity to do research with Penn faculty. As part of this ten-week experience, participants receive a \$3,500 salary stipend for their research work with a faculty mentor, and a "boot camp" experience in MATLAB and R software.
- Undergraduate Summer Workshop. This program is open to undergraduate students at any college or university with a strong interest in social and decision sciences and/or language science. Participants receive free room and board, plus a travel stipend. (Additional information on these two program from summer 2017 and the planned programs for 2018 is included later in this report under "Education" and "Outreach".)

#### **Most Significant Challenges**

The launch this year has been relatively smooth with no significant set-backs to date. MindCORE was fortunate to have a map for launch in the SAS Strategic Plan and excellent faculty leadership.

The main concern/question headed into FY19 is regarding the agreement for MindCORE funding. It was understood that MindCORE could expect funding of \$750,000 for Year 1 (FY18),

\$1 Million for Year 2 (FY19) and \$1.25 Million for Year 3 (FY19). Right now the approved funding for FY18 and FY19 totals only \$1,315,703 (the amount committed in gifts to date), which is \$434,297 short of what was expected for the first two years. MindCORE programing was designed based on the greater budget number and the lower number means that currently MindCORE has no additional funding for program expenses such as outreach initiatives or new professional development programming and other key components of the FY19 budget.

MindCORE Research Initiative and Fellows programs are both based on 3-year funding awards and as such, MindCORE needs to have an understanding of what funding support can be expected in FY20 and beyond to continue to build and support these new initiatives.

### **Most Promising Areas of Research**

There are several areas of promising research for the affiliates identified above, including those associated with the research initiatives that were funded this year (Social and Decision Sciences Initiative and the Integrated Language Science and Technology Program) as well as the ongoing Computational Neuroscience Initiative (CNI).<sup>1</sup> Additionally, the MindCORE Fellows will work to explore information theory to understand the social dynamics that cause natural languages to form efficient descriptions of sensory information and understanding the various factors that impact children's decisions to persist in the face of challenges and applications of this research to real-world learning.

The Executive Committee is exploring a few themes for a research symposia in FY19 including those around the Minds in the World Theme explained as follows:

- To date, the greatest scientific progress in understanding mental life has come for experiments conducted in the least realistic settings. We know how the simplest kind of memory is encoded in neural cells, we understand how tradeoffs in the visual system give rise to visual illusions, and we know a lot about how undergraduates play simple games in laboratory settings. These are tremendous scientific achievements, but there remains a large gulf between what is known about the mind in laboratory settings, and the socially and perceptually rich environments that real people develop in, cope with, and change. While the application of well-controlled, traditional laboratory approaches has led to many important discoveries about how brain activity gives rise to perception and to behavior, we largely lack ways to quantify and describe more complex, ecologically-valid behaviors at the level of precision required to investigate their neural correlates. However, an emerging generation of young researchers have started to lay the foundational groundwork in developing the mathematical and experimental methods required to describe complex stimuli and behavior and to use these descriptions to investigate the underlying neural correlates. MindCORE is discussing the possibility of holding a series of workshops over the next several years within the general Minds in the World rubric, each focused on a separate content area. One idea discussed in this context is to use these workshops to establish

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<sup>1</sup> Although the CNI predates MindCORE and operates on its own budget line outside of the MindCORE budget, its activities have been closely coordinated with MindCORE to maximize integration and synergy.

connections with research in industry, where the need to develop intelligent applications and devices that interface well with humans puts "Minds in the World" front and center.

- Another idea for future research exploration might include Information Immune Systems— as humans have a greater number of machine and brain interfaces, we may need to look to the human immune system for models on how to protect ourselves from outside influence from machine viruses and intentional attacks. This idea is being discussed between Konrad Kording (SEAS & PSOM) and David Brainard (SAS) and other faculty.
- There has also been discussion with Martha Farah about the possibility of facilitating the inclusion of measures of socio-economic status and well-being into studies at Penn of the mind and brain, with the goal of increasing our understanding of how these factors impact the development and function of mind/brain.

**Fundraising**

MindCORE has been fortunate in that since it is a direct result of the SAS Strategic Plan, the SAS Advancement staff began raising donor funds from alumni and other donors during the silent phase of the Power of Penn campaign. To date, the following has been secured:

- \$1M from an anonymous donor has been pledged to endow support for Penn Undergraduate Summer Fellowships.
- \$1,315,703 additional dollars have been committed to date in support of MindCORE as part of the Power of Penn campaign as detailed below.

Gifts in Hand	FY19	FY20	FY21	FY22	FY23	Total Available over 6 Years
\$715,703	\$120,000	\$120,000	\$120,000	\$120,000	\$120,000	\$1,315,703

**Alignment with Strategic Plan**

MindCORE was born from the SAS Strategic Plan and as such, many of the initiatives launched this first year were specified there including:

- *“These contiguous facilities will now be used to promote intellectual synergies and serve as a dedicated home for shared instrumentation and collaborative laboratory facilities.”*
  - The two research initiatives approved for funding in FY18 both have shared instrumentation and laboratory facilities as a core component of their plan. Additionally, the cognitive development labs were supported this year with a MindCORE Activity Fund grant of \$2500.
- *“The School will establish a Neuroscience Council composed of faculty across the disciplines to propose additional targeted faculty hiring particularly where it will foster meaningful connections between the humanities, social sciences, cognitive science, and neuroscience. Recruitment strategies will include cluster hiring and the appointment of senior faculty who build bridges across schools, including through the Penn Integrates Knowledge program.”*
  - The Faculty Advisory Board serves as a council and a Minds in the World cluster hire proposal was provided to the Dean in April.

- *“SAS will also support post-doctoral “junior fellows” who will be recruited for their ability to work across disciplines and with multiple faculty mentors.”*
  - The MindCORE Fellows are specifically designed to work on their own research with multiple faculty across several disciplines.
- *“This initiative will also fund new opportunities for undergraduate research, especially in the summer.”*
  - Eleven Penn undergraduates will participate in the MindCORE Undergraduate Summer Fellows program in 2018 following the ten participants from the summer of 2017. A \$1M gift has been secured to endow this program for future years.

### **Education: Links to Undergraduate Education, Graduate Education & LPS**

MindCORE is currently the home of the Cognitive Sciences Major, and hosts two campus-based undergraduate summer programs, one for Penn students and one targeting underrepresented groups. The Center also supports professional development sessions for graduate students, and in the coming year will have talks that explore careers outside of academe. The Center will also look to create additional links to other interdisciplinary programs at Penn such as: Biological Basis of Behavior; Visual Studies; and Philosophy, Politics and Economics; and minors such as Computational Neuroscience, Consumer Behavior (with Wharton), Psychoanalytic Studies, and the proposed Neuroeconomics. The primary undergraduate education programs to date include:

- MindCORE provides all staff support to the Cognitive Sciences Program and as such supports 164 students in the major and 32 in the minor with declarations, enrolling students in courses, and providing year-round support for student registration issues. MindCORE staff also represent the COGS program at all recruitment events.
- MindCORE hosts the Undergraduate Summer Workshop (UGSW) on Interdisciplinary Mind and Brain, a two-week residential workshop for 27 undergraduate students enrolled at any university or college with an interest in Interdisciplinary Mind and Brain Studies. In the summer of 2017 the session ran from June 4-17, 2017. Lectures focused on Social and Decision Sciences (Week 1) and Computational Neuroscience (Week 2). Week 1 topics included cultural and evolutionary behavior, economic preferences and biases, social choices and decision-making, and reflective and intuitive thinking. Week 2 topics included both data and computational models pertaining to neural processing and behavior, in the domains of sensory encoding, perception, learning, memory, and decision-making.
  - One 2017 participant, Alicia Zeng, was a newly graduated senior with an interest in computational neuroscience who went on to become a visiting scholar at CNI in FY18, working with Vijay Balasubramanian.
  - For summer 2018 UGSW, 120 applications were received for 25 slots which will run from June 3-16, 2018. This year’s workshop lectures will have one week on Language Science and Technology and one on Social and Behavioral Science. Summer Workshop participants receive free room and board, plus a travel stipend.
- MindCORE offers an Undergraduate Summer Fellowship Program in Interdisciplinary Mind and Brain Studies for Penn students. The program is a full-time, 10-week Fellowship where admitted students are awarded a \$3500 stipend for research work with a faculty mentor. The program begins with an optional short training course in MATLAB or R, and weekly



journal club-style lunches that bring program participants together for research discussions throughout the summer.

- The summer 2017 program ran from June 12-August 18, 2017 and:
  - 51 applicants (14 URMS) 10 students were accepted into the program.
  - Distribution of applicant majors: BIO=3, PSYC=12, BBB=19, COGS=7, COGS/CIS double major=3, BE=2, PPE=2, COGS/PHIL double major=1, PHYS=1, BIO/CIS double major=1
  - Final research presentation titles:
    - Frank Aguilar, Betley Lab: The Effects of Hunger on the Innate Fear Response
    - Annie Sun, PLEEP Lab (Dr. Robert Kurzban): Do two wrongs make a right (or a slightly less wrong)?
    - Andreas Nolan, Brannon Lab: The Approximate Number System and Division Abilities in School-Aged Children
    - Kerneau Seok, Platt Lab: Modeling Loss Aversion: the Diffusion Model and Gambling Behavior
    - Donnisa Edmonds, Goodwin Lab: Environmental decision making
    - Zhao Zhong, Bhatia Lab: The Application of Drift Diffusion Model in Studying Contextual Effect
    - Sonia Pearson, Miracchi Lab: Promoting Diversity in Academia
    - Nitay Caspi, Brainard Lab: A Deep Learning Approach to Color Constancy
  - 7 of the 10 2017 undergraduate participants remained involved in research during the FY18 year.
- The summer 2018 program received 60 applications for the ten 10-week Undergraduate Summer Fellowship spots. The 2018 fellowships will begin next month.

### **Outreach: Enhancing Faculty and Student Diversity**

The Undergraduate Summer Workshop (mentioned above) has a particular focus on recruiting first generation and underrepresented minorities to the field. Recruitment and advertising is focused on HBCUs. In 2017 there were 166 applications, 34 of which were from URMs (20%) and of the accepted 26 students, 7 (27%) were from underrepresented groups. Applications were received from 22 states, Puerto Rico, DC, and Canada, plus two from HBCUs (Tuskegee University, Xavier University of Louisiana), and two from community colleges (Gateway Community College, CUNY).

Outreach is a core component of the MindCORE mission and in this year staff undertook a study of the current outreach landscape to include regular attendance at staff outreach meetings hosted by the SAS Science Outreach Initiative, meetings with the Netter Center, Franklin Institute, Mayor's Office for Community Schools, and other local stakeholders. Staff attended outreach training sessions and made connections to the PennNGG group and science advocacy groups and met with a Penn alumnus who is now an AAAS fellowship, working at the NIH on the BRAIN Initiative. MindCORE staff also attended events including the fantastic Kids Judge event

hosted by the Biological Basis of Behavior program and various events affiliated with the Philadelphia Science Festival.

MindCORE seeks to develop a formal outreach plan for their second year of operations and currently is examining a pop-up version of a living laboratory which would educate the public about research by immersing visitors in the process of scientific discovery. MindCORE is also exploring potential collaborations with local libraries and museums.

MindCORE will mark one full year of operations this September and is poised to continue the progress and success of the first year into 2019.

Respectfully submitted by,  
Heather Calvert, Executive Director