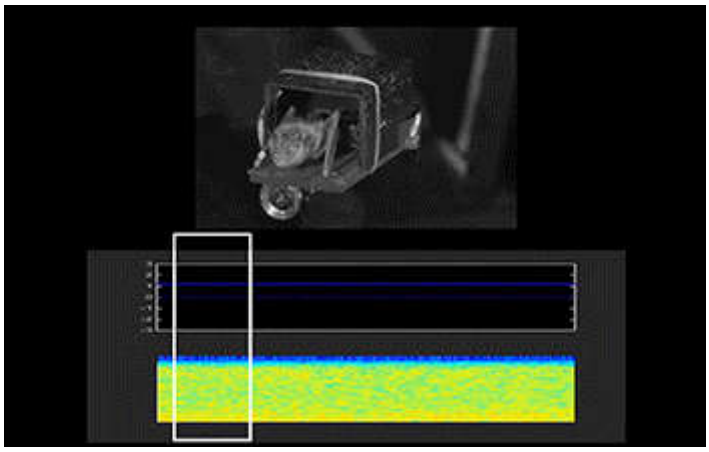
National Science Foundation
WHERE DISCOVERIES BEGIN

News Release 17-075

NSF funds new multidisciplinary approaches to study the brain

$16 million for cross-cutting research into neural and cognitive systems



How does the brain listen and adapt in noisy scenarios?

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August 8, 2017

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The National Science Foundation (NSF) made 19 awards to cross-disciplinary teams from across the United States to conduct innovative research focused on neural and cognitive systems. Each award provides a research team with up to $1 million over two to four years.

The awards will contribute to NSF's investments in support of Understanding the Brain <https://www.nsf.gov/news/special_reports/brain/> and the BRAIN Initiative, a coordinated research effort that seeks to accelerate the development of new neurotechnologies.

The awards will advance frontiers in cognitive science and neuroscience with an emphasis on four themes:

- Neuroengineering and brain-inspired concepts and designs.
- Individuality and variation.
- Cognitive and neural processes in realistic, complex environments.
- Data-intensive neuroscience and cognitive science.

The projects will leverage advanced research within these themes to investigate how neural and cognitive systems interact with education, engineering and computer science, thanks to the support of the NSF Integrative Strategies for Understanding Neural and Cognitive Systems (NCS) program <https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf17519> . The NCS program supports innovative, boundary-crossing efforts to push the frontiers of brain science.

"It takes insight and courage to tackle these problems," said Ken Whang, NSF program director in the Computer and Information Science and Engineering Directorate (CISE). "These teams are combining their expertise to try to forge new paths forward on some of the most complex and important challenges of understanding the brain. They are posing problems in new ways, taking intellectual and technical risks that have huge potential payoff."

The new projects are supported by four NSF directorates, allowing the program to identify interdisciplinary areas of research: CISE; Education and Human Resources; Engineering; and Social, Behavioral and Economic Sciences. The NSF Office of International Science and Engineering's Mathematical Sciences Innovation Incubator program also provided additional support this year. In addition to conducting neuroscience research, NCS-supported projects will use insights from neuroscience to advance the fields of engineering, social and behavioral sciences and education.

The award titles, principal investigators and sponsor institutions are listed below.

- Ground-truth analysis and modeling of entire individual *C. elegans* nervous systems <https://nsf.gov/awardsearch/showAward?AWD_ID=1734870> : Edward Boyden of Massachusetts Institute of Technology and Albert-Laszlo Barabasi of Northeastern University
- Decoding and reconstructing the neural basis of real world social perception <https://nsf.gov/awardsearch/showAward?AWD_ID=1734907> : Avniel Ghuman of University of Pittsburgh and Max G'Sell of Carnegie Mellon University
- Relationship of cortical field anatomy to network vulnerability and behavior <https://nsf.gov/awardsearch/showAward?AWD_ID=1734430> : Thomas Grabowski of University of Washington and Wanpracha Chaovalitwongse of University of Arkansas
- Understanding the neural basis for sensorimotor control loops using whisker-based robotic hardware platforms <https://nsf.gov/awardsearch/showAward?AWD_ID=1734981> : Mitra Hartmann of Northwestern University and Sarah Bergbreiter of University of Maryland, College Park
- A neurally inspired, event-based computer vision pipeline <https://nsf.gov/awardsearch/showAward?AWD_ID=1734980> : Garrett Kenyon of the New Mexico Consortium and Michael Flynn of University of Michigan Ann Arbor
- Neurobehavioral integration of visual and semantic number knowledge and its role for individual variation in the math ability of children and adults <https://nsf.gov/awardsearch/showAward?AWD_ID=1734735> : Melissa Libertus of University of Pittsburgh
- A computational theory to model the neurobiological basis of a visuo-cognitive neuroprosthetic <https://nsf.gov/awardsearch/showAward?AWD_ID=1734887> : Stephen Macknik of SUNY Health Science Center at Brooklyn

- Active listening and attention in 3-D natural scenes <https://nsf.gov/awardsearch/showAward?AWD_ID=1734744> : Cynthia Moss of Johns Hopkins University
- Seizure control through state-specific manipulation of cell assemblies <https://nsf.gov/awardsearch/showAward?AWD_ID=1734795> : Sarah Muldoon of SUNY at Buffalo and Ethan Goldberg of The Children's Hospital of Philadelphia
- Super resolution mapping of multi-scale neuronal circuits using flexible transparent arrays <https://nsf.gov/awardsearch/showAward?AWD_ID=1734940> : Piya Pal of University of California, San Diego
- Connecting spikes to cognitive algorithms <https://nsf.gov/awardsearch/showAward?AWD_ID=1734910> : Il Memming Park of SUNY at Stony Brook and Alexander Huk of University of Texas at Austin
- Connectome mapping algorithms with application to community services for big data neuroscience <https://nsf.gov/awardsearch/showAward?AWD_ID=1734853> : Franco Pestilli of Indiana University
- Integrative foundations for interactions of complex neural and neuro-inspired systems with realistic environments <https://nsf.gov/awardsearch/showAward?AWD_ID=1735004> : Terrence Sejnowski of The Salk Institute for Biological Studies and John Doyle of California Institute of Technology
- Data-driven modeling of visual cortex <https://nsf.gov/awardsearch/showAward?AWD_ID=1734854> : Robert Shapley of New York University
- Extracting functional cortical network dynamics at high spatiotemporal resolution <https://nsf.gov/awardsearch/showAward?AWD_ID=1734892> : Jonathan Simon of University of Maryland, College Park
- Neuroimaging to advance computer vision, NLP and A.I <https://nsf.gov/awardsearch/showAward?AWD_ID=1734938> .: Jeffrey Siskind of Purdue University
- Fully passive and wireless multi-channel neural recording for chronic in-vivo studies in animals <https://nsf.gov/awardsearch/showAward?AWD_ID=1734851> : John Volakis of Ohio State University and Junseok Chae of Arizona State University
- The impact of real world stressors on problem-solving <https://nsf.gov/awardsearch/showAward?AWD_ID=1734883> : Ying Choon Wu of University of California, San Diego
- Volitional modulation of neural activity in the visual cortex <https://nsf.gov/awardsearch/showAward?AWD_ID=1734916> : Byron Yu of Carnegie Mellon University and Matthew Smith of University of Pittsburgh

The program also awarded supplemental funds of up to $200,000 each to four projects to maximize the impact of basic research in computing, engineering and education on new challenges in neuroscience and cognitive science. This is the third round of brain research funding for this program.

- Probing neural connectivity at multiple temporal scales <https://nsf.gov/awardsearch/showAward?AWD_ID=1736390> : Laleh Najafizadeh of Rutgers University-New Brunswick
- Scalable neuromorphic learning machines: <https://nsf.gov/awardsearch/showAward?AWD_ID=1748095> Emre Neftci of University of California, Irvine
- Development of integrated memristive crossbar circuits for pattern classification applications: <https://nsf.gov/awardsearch/showAward?AWD_ID=1748194> Dmitri Strukov of University of California, Santa Barbara
- Moving objects databases for exploration of virtual and real environments <https://nsf.gov/awardsearch/showAward?AWD_ID=1213013> : Ouri Wolfson of University of Illinois at Chicago

To learn more about NSF investments in fundamental brain research, visit NSF.gov/brain <https://www.nsf.gov/news/special_reports/brain/> .

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The awards will contribute to NSF's investments in support of understanding the brain.
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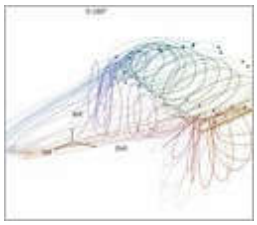

One challenge is to understand the dynamics that drive neural computation.
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Researchers study rat whiskers to learn how the brain combines information about movement and touch.
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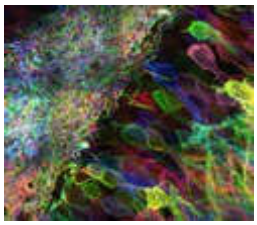

Projects will advance the fields of engineering, social and behavioral sciences and education.
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New research will explore the integration of visual and semantic number knowledge.
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