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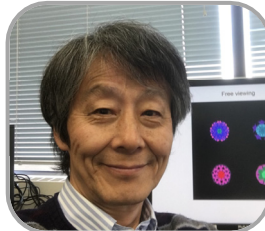
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**Neuroscientists Ann M. Graybiel, Okihide Hikosaka, and  
Wolfram Schultz Share \$500,000 Gruber Neuroscience Prize for  
Their Pioneering Work on the Structure, Organization and  
Functions of the Basal Ganglia**



Ann M. Graybiel



Okihide Hikosaka



Wolfram Schultz

**May 10, 2018, New Haven, CT** – The 2018 Gruber Neuroscience Prize is being awarded to neuroscientists Ann M. Graybiel, of the Massachusetts Institute of Technology, Okihide Hikosaka, of the National Institutes of Health’s National Eye Institute, and Wolfram Schultz, of the University of Cambridge. These renowned scientists are receiving the prestigious prize for their pioneering and inspiring work on the structure, organization and functions of the basal ganglia, a group of nuclei (clusters of neurons) deep within the forebrain. Their work has fundamentally transformed the study of the basal ganglia and has led to influential new ideas about how the brain learns and retains new habits and skills, manages movements and processes rewards for learning and decision-making. It has also deepened our understanding of a wide range of neurodegenerative and neuropsychiatric disorders in which the basal ganglia and behavioral control is compromised.

The prize, which includes a \$500,000 award, will be presented to Graybiel, Hikosaka, and Schultz on November 4 in San Diego, California, at the annual meeting of the Society for Neuroscience.

“When these three extraordinary scientists began their careers, few people were paying much attention to the basal ganglia,” says Dr. Robert Wurtz, NIH Distinguished Investigator and chair of the Selection Advisory Board to the Prize. “Today, thanks to their pioneering research, we now recognize the central role that this area of the brain plays in normal brain function and behavior. The significance of their work cannot be understated, as it has also transformed our understanding of the neurobiology behind

some of our most devastating brain disorders, including Parkinson’s disease, Huntington’s disease, and drug addiction.”

Graybiel discovered that the striatum, the largest nucleus within the basal ganglia, has a complex, modular structure. She then followed this transformative discovery with studies describing the functionality of that architecture, including the finding that changes in striatal neural activity during the learning process lead to the formation of pathological habits, such as those that characterize obsessive compulsive disorder. In his landmark research, Hikosaka identified the basal ganglia circuitry involved in saccadic (voluntary) eye movements and then went on to make further discoveries that described the importance of this circuitry in memory, motor behavior and reward — findings that opened up exciting new avenues of research into the study of motivation. Schultz’ work has revolutionized the concept of how reward information is processed in the brain. He demonstrated that dopamine neuronal signals within the basal ganglia are directly related to reward prediction errors, which are thought to be the key signal needed to drive reward-related learning.

“So much of what we know about basal ganglia and its impact on behavior stems directly from the remarkable work of these three scientists,” says Frances Jensen, Professor of Neurology and Chair of Neurology at the Perelman School of Medicine, University of Pennsylvania, and member of the Selection Advisory Board to the Prize. “Each of their contributions to neuroscience has been profound, and it’s a great honor to be awarding them this year’s Gruber Neuroscience Prize.”

### **Additional Information**

In addition to the cash award, each recipient will receive a gold laureate pin and a citation that reads:

*The Gruber Foundation proudly presents the 2018 Neuroscience Prize to Ann M. Graybiel, Okihide Hikosaka, and Wolfram Schultz for their pioneering discoveries on the organization and function of the basal ganglia.*

*Ann M. Graybiel discovered the striosome-matrix organization of the striatum and demonstrated that striosomes form key nodes in corticostriatal circuits affecting repetitive behaviors, cost-benefit evaluation and responses to stress.*

*Okihide Hikosaka elucidated the basal ganglia circuitry involved in saccadic eye movements, interactions between reward and punishment, and unique pathways involved in goal-directed actions and skilled responses.*

*Wolfram Schultz’ work revolutionized our conception of how reward information is processed by demonstrating that dopaminergic signaling is directly related to reward prediction error, critically underlying reward related learning.*

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#### Laureates of the Gruber Neuroscience Prize:

- **2017: Joshua Sanes**, for groundbreaking discoveries about synapses, transforming our understanding of how the human brain functions
- **2016: Mu-Ming Poo**, for his pioneering and inspiring work on synaptic plasticity
- **2015: Carla Shatz and Michael Greenberg**, for their elucidation of the molecular mechanisms through which neural activity controls wiring and plasticity of the brain
- **2014: Thomas Jessell**, for his pioneering work on the differentiation of spinal cord neurons and their wiring into networks
- **2013: Eve Marder**, for her contributions to understanding how circuit dynamics and behavior arise from the properties of component neurons and their synaptic connections
- **2012: Lily and Yuh Nung Jan**, for their fundamental contributions to molecular neurobiology
- **2011: Huda Y. Zoghbi**, for her pioneering work on revealing the genetic underpinnings of neurological disorders
- **2010: Robert H. Wurtz**, for pioneering work concerning the neural bases of visual processing in primates
- **2009: Jeffrey C. Hall, Michael Rosbash, and Michael Young**, for revealing the gene-driven mechanism that controls rhythm in the nervous system
- **2008: John O'Keefe**, for discovering place cells, which led to important findings in cognitive neuroscience
- **2007: Shigetada Nakanishi**, for pioneering research into communication between nerve cells in the brain
- **2006: Masao Ito and Roger Nicoll**, for work on the molecular and cellular bases of memory and learning
- **2005: Masakazu Konishi and Eric Knudsen**, for work on the neural basis of sound localization
- **2004: Seymour Benzer**, for applying the tools of molecular biology and genetics to the fruit fly, *Drosophila*, and linking individual genes to their behavioral phenotypes

The Prize recipients are chosen by the Neuroscience Selection Advisory Board. Its members are:

**Susan Amara**, NIH/NIMH; **Tobias Bonhoeffer**, Max Planck Institute for Neurobiology; **Frances Jensen**, University of Pennsylvania; **Tirin Moore**, Stanford University; **Angela Roberts**, University of Cambridge; **Carla Shatz**, Stanford University; and **Robert Wurtz**, National Institutes of Health (Chair).

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By agreement made in the spring of 2011 The Gruber Foundation has now been established at Yale University.

The Gruber International Prize Program honors individuals in the fields of Cosmology, Genetics and Neuroscience, whose groundbreaking work provides new models that

inspire and enable fundamental shifts in knowledge and culture. The Selection Advisory Boards choose individuals whose contributions in their respective fields advance our knowledge and potentially have a profound impact on our lives.

The Neuroscience Prize honors scientists for major discoveries that have advanced the understanding of the nervous system.

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For more information on the Gruber Prizes, visit [www.gruber.yale.edu](http://www.gruber.yale.edu), e-mail [info@gruber.yale.edu](mailto:info@gruber.yale.edu) or contact A. Sarah Hreha at +1 (203) 432-6231. By mail: The Gruber Foundation, Yale University, Office of Development, PO Box 2038, New Haven, CT 06521.

Media materials and additional background information on the Gruber Prizes can be found at our online newsroom: <https://gruber.yale.edu/news-media>

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