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Neuroscientist Huda Akil Receives $500,000 Gruber Neuroscience Prize For Pioneering Work In Understanding The Brain's Role In Mitigating Pain and Depression

Huda Akil

April 12, 2023, New Haven, CT — The 2023 Gruber Neuroscience Prize is being awarded to neuroscientist Huda Akil, Ph.D., of the Michigan Neuroscience Institute at the University of Michigan, for her pioneering contributions to understanding the molecular, anatomical, and behavioral mechanisms of pain, stress, depression and substance abuse. This includes the discovery that the brain has its own opioid system for blocking pain via endorphins and has a natural way of modulating depression and anxiety via a growth factor, FGF2.

These discoveries by Akil and her collaborators have helped elucidate the mechanism by which the brain can modulate the sensation of pain, revealed the mechanism of substance abuse and the risk for addiction, led to a new understanding of the interplay between stress and pain, and provided insights into new mechanisms and potential treatment targets for depression and other mood disorders. The Gruber Neuroscience Prize, which includes a $500,000 award, will be presented to Akil in Washington D.C. on Nov. 12 at the annual meeting of the Society for Neuroscience.

"Huda Akil's contributions to neuroscience have yielded ground-breaking insights into the neural circuitry and molecular mechanisms that underlie a wide range of neuropsychiatric conditions such as stress, pain, depression and drug addiction," says Pierre Magistretti, Distinguished Professor and Director of the KAUST Smart Health Institute and member of the Selection Advisory Board to the Prize. "These discoveries have changed what we know about the nature of these conditions, offering profound insights for their treatment."

The discovery of the role that the brain plays in blocking pain came while mapping the regions that were responsible for the ability to sense pain. Much to everyone's surprise, Akil and her colleagues discovered that electrical stimulation of specific brain regions produced an effect like morphine and blocked pain sensation. This effect, called stimulation-produced analgesia, was the first physiological evidence for

endorphins, which are molecules that bind to opiate receptors in the brain. Akil went on to show that deep brain stimulation in similar brain circuits is effective in blocking intractable pain in humans. In follow up studies, Akil demonstrated that the ability of the endorphins to block pain served an important survival function during acute stress. An extensive body of work in collaboration with her husband, Dr. Stanley Watson, and their trainees elucidated the neural circuitry of endorphins and opioid receptors and investigated their regulation and functions in addiction, stress, and emotions.

More recently, Akil and her collaborators in the Pritzker Consortium discovered that the fibroblast growth factor FGF2 is a natural antidepressant. This included the fact that FGF2 levels are decreased in the brain of humans with depression, with intermediate levels found in the brain of people being treated with antidepressants. Animal studies demonstrated a causal role of FGF2 in altering the development and online functioning of neural circuits that control emotions and decrease anxiety. Her laboratory is currently studying genetic, neurobiological, developmental, and environmental factors that shape temperament, which in turn affects the risk of developing mood disorders and addictive behaviors. She is especially interested in uncovering mechanisms of resilience to counter depression and addiction.

“In addition to being a world-class scientist, Huda Akil’s contributions to neuroscience have included her long legacy of mentoring future generations of scientists, and advocating for immigrants within the scientific community,” says Joanne Berger-Sweeney, President of Trinity College and member of the Selection Advisory Board to the Prize. “We are honored to recognize her contributions to the scientific community with the 2023 Gruber Neuroscience Prize.”

Additional Information

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

The Gruber Foundation proudly presents the 2023 Gruber Neuroscience Prize to Huda Akil for major contributions to the identification of the neural circuitry and molecular mechanisms that underlie a wide range of neuropsychiatric conditions such as stress, pain, depression, and drug addiction.

Akil was the first to provide experimental evidence supporting the existence of endogenous opioids and their roles, together with their receptors, in regulating pain and stress. She also initiated studies on the molecular underpinnings of mood disorders by identifying the involvement of fibroblast growth factor family members in depression. Her work on rodent models of mental disorders has been validated in translational studies defining genome-wide expression profiles in postmortem human brains.

In addition to scientific contributions that have transformed the field of the neurobiology of mental diseases, Akil has made many generous contributions to the neuroscience community, including mentoring future generations and illustrating the importance of socio-cultural transitions experienced by immigrants in the scientific community.

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

Laureates of the Gruber Neuroscience Prize:

- **2022: Larry Abbott, Emery Neal Brown, Terrence Sejnowski, and Haim Sompolinsky,** computational and theoretical neuroscience contributions
- **2021: Christine Petit and Christopher A. Walsh,** for elucidating the genetic and molecular mechanisms that underlie human neurodevelopmental hereditary disorders
- **2020: Friedrich Bonhoeffer, Corey Goodman and Marc Tessier-Lavigne,** for elucidating developmental mechanisms that guide axons to their targets
- **2019: Joseph S. Takahashi,** for pioneering work on the molecular and genetic basis of circadian rhythms in mammals
- **2018: Ann M. Graybiel, Okihide Hikosaka and Wolfram Schultz,** for pioneering work in the study of the structure, organization and functions of the basal ganglia
- **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 on 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 Society for Neuroscience partners with the Foundation on the Prize and nominates the members of the Selection Advisory Board that chooses the Prize recipients. Its members are:

Joanne Berger-Sweeney, Trinity College; **Frances Jensen,** University of Pennsylvania (Chair); **Pierre Magistretti**, King Abdullah University of Science and Technology; **Eve Marder,** Brandeis University; **Ikue Mori,** Nagoya University; **Eric Nestler**, Icahn School of Medicine at Mount Sinai; **Christine Petit,** Collège de France and the Institut Pasteur.

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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 Gruber Foundation was established in 1993 by the late Peter Gruber and his wife Patricia Gruber. The Foundation began its International Prize Program in 2000, with the inaugural Cosmology Prize.

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For more information on the Gruber Prizes, visit www.gruber.yale.edu, e-mail info@gruber.yale.edu or contact A. Sarah Hreha at +1 (203) 432-6231. By mail: The Gruber Foundation, Yale University, Office of International Affairs, PO Box 208320, New Haven, CT 06520.

Media materials and additional background information on the Gruber Prizes are in our online newsroom: www.gruber.yale.edu/news-media

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