Three from MIT win NIH grants

Boyden, Ting and Tye receive grants for innovative medical research.

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Three MIT faculty members have been awarded National Institutes of Health (NIH) grants designed to promote innovative biomedical research.

The Institute's recipients of these NIH grants are Edward Boyden, an associate professor of biological engineering and brain and cognitive sciences; Alice Ting, the Ellen Swallow Richards Associate Professor of Chemistry; and Kay Tye, an assistant professor of brain and cognitive sciences and member of MIT's Picower Institute for Learning and Memory.

The NIH is awarding approximately $123 million to 78 researchers across the country through its High Risk High Reward program, supported by the NIH Common Fund, which funds innovative and risk-taking research programs. The awards are divided into three categories: the NIH Director's Pioneer, New Innovator and Transformative Research awards.

Tye, who is receiving a New Innovator Award, plans to study the obesity epidemic from the source of the problem: the compulsive consumption of unhealthy foods, such as those high in sugar. To develop a potential therapy to prevent craving from leading to compulsive behavior, she plans to use calcium imaging and electrophysiological recording data to identify the neural signature of craving. Once this neural signature of a craving state is identified, she plans to prevent the switch from craving to compulsion by transiently inhibiting the critical circuit elements using optogenetic manipulations. This research could lead to the identification of novel targets and new paradigms for obesity treatment that involve noninvasive strategies for neural manipulation such as focal ultrasound or transcranial magnetic stimulation.

Ting, who is receiving a Transformative Research Award, plans to develop technology that reveals complete "protein maps" of the interior of living cells. Cells are composed of many different parts that each carry out their own critical processes, determined by the proteins present in each one. However, the proteins within each individual part of living cells are still mostly unknown. The new maps, which will have high spatial and temporal resolution, will illuminate the inner workings of cellular regions that are currently poorly understood. This analysis could shed light on the molecular mechanisms of both disease and drug action, using only a small fraction of the cellular material required for current proteomic studies. Ting previously received an NIH Pioneer Award in 2008.

Boyden, who is also a member of MIT's Media Lab and the McGovern Institute for Brain Research, is receiving a Pioneer Award as well as a Transformative Research Award.

With the Pioneer Award, Boyden plans to design new nanotechnology-based electrical and optical neural recording devices capable of measuring neural dynamics across the mammalian brain. This would enable the creation of brain activity maps that could reveal how information is integrated from sensation towards emotion, cognition, and behavior. Such maps could also help reveal the changes in brain computations that occur in brain disorders that affect over a billion people around the world.

With the Transformative Research Award — a collaboration with George Church of Harvard University and Konrad Kording of Northwestern University — Boyden plans to develop a new synthetic biology approach to the problem of recording: a nanoscale device

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that writes neural activities onto DNA, like a nanoscale ticker-tape machine. The device will consist of a molecular construct that can be cheaply synthesized and easily delivered to neurons, where it will write the temporal dynamics of activity onto DNA molecules, which can later be analyzed via increasingly cheap genome sequencing technologies.

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