

# WURJ Journal



Massachusetts Institute of Technology Undergraduate Research Journal

## Introductory Letter

2 From MIT Professor Robert Langer

## MIT Science News In Review

3 Biomedical Research

## World Science News In Review

7 Biomedical Research

## Features

10 Winning by Folding: Protein Structure Formation Demystified  
*Adrian Slusarczyk*

14 Emerging Technologies for Influenza Vaccination  
*Aniket Schneider*

18 The Slope of Biology: An Interview with Eric Lander  
*Melis Anahtar and Paul Baranay*

22 Prion Diseases: A Review of a Potential Major Risk to Public Health  
*Mahesh Vidula*

## UROP Summaries

25 The Effect of p53 on the Spontaneous and Exogenously Induced Frequency of Homologous Recombination in Mice  
*Saja Fakhraldeen*

25 Protease Activated Electrostatic Ligand Coating for Targeted Gene Delivery  
*Peter Fung*

26 Structure and Function of MEG3  
*Wendy Chen*

27 Detection of Nanoparticle Assembly Using Suspended Microchannel  
*Steven Mo*

## Reports

28 Cellular Responses to UVA as a Source of Oxidative Stress  
*Kathy Xu*

30 Differences in Neuronal Responses Due to Aging  
*Wendy Chen*

35 Computational Modeling and Analysis of the Effects of Retinal Injury on the Formation of Response Feature Maps in the Primary Visual Cortex  
*Robert Chen*

42 Protein Printboard: Fibronectin Patterning to Control Cellular Organization  
*Asad Moten*



**Massachusetts  
Institute of  
Technology**

**UNDERGRADUATE  
RESEARCH JOURNAL  
Volume 16, Fall 2007**

**Editors-In-Chief**

Melis Anahtar  
Dawn Zhang

**Editors**

Paul Baranay  
Amy Chuong  
Gayle Denman  
Arkajit Dey  
Peter Fung  
Yasemin Gokce  
Ezgi Hacisuleyman  
James Colin Hill  
Ivana Lucero  
Asad Moten  
Ekavali Mishra  
Luvena Ong  
Basant Sagar  
Maresh Vidula  
Carolyn Wang  
Mimi Yen  
Hannah Zhou

**Contributors**

Paul Baranay  
Robert Chen  
Wendy Chen  
Saja Fakhraldeen  
Peter Fung  
Steven Mo  
Asad Moten  
Aniket Schneider  
Adrian Slusarczyk  
Maresh Vidula  
Kathy Xu

**Layout & Production**

Ivana Lucero  
Melis Anahtar  
Dawn Zhang  
Tom Pixton

Cover Photo: 'Light bulb,' by Jeff Lieberman, who also built the device. This is not a trick or a photoshop manipulation. The bulb and the casing contain hidden circuitry that uses electromagnetic feedback to levitate the bulb roughly 2.5" from the nearest object, and uses wireless power transfer to beam power from the housing into the bulb itself. Technical details can be found at <http://bea.st>.

**Massachusetts Institute of Technology  
77 Massachusetts Avenue  
Cambridge, MA 02139**

PSB 07-02-0097

2 **MURJ** Volume 16, Fall 2007

I am honored to introduce the current issue of the MIT Undergraduate Research Journal (MURJ). This issue focuses on Biomedical Research. This is a very important topic and one in which MIT has made, and will continue to make, enormous contributions.

With its outstanding programs in biology and bioengineering, and its superb Institutes such as the Whitehead, Broad, McGovern, and Picower; its world renowned Center for Cancer Research; and the Harvard-MIT Health Sciences and Technology (HST) program, MIT students are doing incred-

ible cutting edge research in new areas of biomedicine. This current issue of MURJ reflects the breadth and depth of this research. Such topics include prion diseases, new approaches for creating flu vaccines, micropatterning to control cellular organization, effects of neuronal responses due to aging, computational modeling to examine the effects of retinal injury, and developmental regulation during neurogenesis.

Not only have MIT students and faculty made major contributions to basic biomedical research, they have also done a wonderful job translating biomedical discoveries into practical products to help patients. In the past decade, at least 50 biomedical companies were started based on MIT inventions or discoveries. New potentially lifesaving products based on MIT inventions include new drugs based siRNA, nanotechnologies that enable precise targeted delivery to cancer cells, new intelligent medical devices and novel ways to diagnose disease. Biomedical research at MIT—fueled by its outstanding students—is transforming the nation and the world. This issue of MURJ is an exciting contribution to this very important area.



Institute Professor Robert Langer