ASEE ERC workshop
Bioengineering training and research support from NIH

March 5, 2012
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Associate Director for Science Programs
National Institute for Biomedical Imaging and Bioengineering
Topics for today

• NIH overview
• Training opportunities
• Research opportunities
• References and links
The Broad Reach of the NIH

NIH *is* an institution
(Intramural Research)

~ 6,000 scientists
~ 10% of NIH budget

NIH *supports* institutions & people
(Extramural Research)

> 4,000 institutions
> 300,000 scientists & research personnel
~ 85% of the NIH budget
NIH Grant Statistics

Fiscal Year 2010

• 88,000 applications received (all mechanisms)

• 240 Review Officers organized 1,600 meetings with 18,000 reviewers

• Over 62,000 research grants reviewed
NIH is organized into:

27 Institutes & Centers (IC) each with different:

- missions and priorities
- budgets
- ways of deciding which grants to fund
NIH FY10 Budget

NIH Divides most of its investment according to the interests of the component parts (i.e. Institutes or Centers), with <4% allocated to trans-NIH initiatives.

Total = $31.2 B
Research Project Grants (RPGs): The Mainstay of NIH Sponsored Research

Awards as percentage of all research grants.

Research Project Grants (RPGs) include R00, R01, R03, R15, R21, R22, R23, R29, R33, R34, R35, R36, R37, R55, R56, RL1, RL5, RL9, P01, P42, PN1, UC1, UC7, U01, U19, U34, DP1, DP2, RL1, RL2, RL5, RL9.

Research Project Grants (RPGs) Size

- Research Project Grants (RPGs) include R00, R01, R03, R15, R21, R22, R23, R29, R33, R34, R35, R36, R37, R55, R56, RL1, RL5, RL9, P01, P42, PN1, UC1, UC7, U01, U19, U34, DP1, DP2, RL1, RL2, RL5, RL9.

NIH Funding Supports Scientists at Every Career Stage

Approx. Stage of Research Training and Development

- GRADUATE/ MEDICAL STUDENT
  - Predoctoral Institutional Training Grant (T32)
  - Predoctoral Individual NRSA (F31)
  - Predoctoral Individual MD/PhD NRSA (F30)

- POST DOCTORAL
  - Postdoctoral Institutional Training Grant (T32)
  - Postdoctoral Individual NRSA (F32)

- EARLY
  - NIH Pathway to Independence (PI) Award (K99/R00)
  - Mentored Research Scientist Development Award (K01)
  - Mentored Clinical Scientist Development Award (K08)
  - Mentored Patient-Oriented RCDA (K23)
  - Mentored Quantitative RCDA (K25)

- MIDDLE
  - Independent Scientist Award (K02)
  - Midcareer Investigator Award in Patient-Oriented Research (K24)

- SENIOR
  - Senior Scientist Award (K05)

Funding Supports
Scientists at Every Career Stage
Team-Based Design Projects (R25)

- Capstone **design** courses at BME departments
  - **Open-ended** biomedical **design** projects
  - **Team-based** approach
- **Clinical immersion**
- Emphasize **translation** of biomedical devices, including industrial design, regulation and commercialization concepts
- New or existing programs
- $20k for parts and supplies, machining, didactic development, speaker expenses, patent searches, etc
- $20k for student stipends only for programs with a clinical immersion period in the summer

Design by Biomedical Undergraduate Teams (DEBUT) Challenge

- Open to undergraduate students

- Team-based design projects in three categories:
  - Diagnostic Devices/Methods
  - Therapeutic Devices/Methods
  - Technology to Aid Underserved Populations and Individuals with Disabilities.

- Winners in each category receive:
  - $10,000 prize
  - Up to $2,000 in travel costs to attend award ceremony at BMES Annual Meeting

- Entry deadline: May 26, 2012; Winners announced: July 31, 2012

http://debut.challenge.gov/
Institutional Training

- Disciplinary
- Multidisciplinary
- Interdisciplinary
Integrative Program in Complex Biological Systems (UCSF)

This HHMI-NIBIB Interfaces Program, using Boot Camps in computation and molecular biology and Team Challenges in biomedical imaging, molecular biology, and systems biology, trains students in the understanding and engineering of complex biological systems from the molecular to the organismal level.

Challenge 1 – Design and build a fluorescent microscope from component parts, using it to analyze an unknown spectrum.

Challenge 2 – Given a set of yeast samples, deduce what molecular perturbation occurred prior to their demise, constructing genomic microarrays and using bioinformatic tools.

Challenge 3 - Design a novel synthetic biological behavior using literature-derived genetic elements and specifying the system at the DNA level.
This HHMI-NIBIB Interfaces program, by integrating medical school and imaging coursework and dually mentoring students with basic and clinical mentors, produces translational scientists who understand the medical basis of disease and have the technological know-how to develop new imaging methods for detection, diagnosis, and treatment.
Research Education Programs for Residents and Fellows (R25)

Integrates education programs of Radiology and other clinical departments and supports residents and fellows in radiology and other NIBIB-relevant residency programs as clinician-scientists.

- Parent program based in radiology department.
- Program participants from radiology and other residency programs, including cardiology, neurology, oncology, orthopaedics, ophthalmology, and surgery.
- 12 or 24 month support
- >75% effort
- $70k/participant, $10k expenses, $1k travel
- 2 participants/yr
New and Early-Stage Investigators

**New Investigator** – Applicant has not previously been a PD/PI on a significant NIH independent research award.

**Early-Stage Investigator** - New Investigator within 10 yrs of completing their terminal degree or medical residency.

Peer reviewers will focus more on the approach of early-stage investigators than their track record and expect less preliminary data.

**NIBIB Edward C. Nagy New Investigator Policy**

- 5% payline relaxation for New Investigators
- Only for R01 applications
Career Development Programs

Mentored support for basic and clinical investigators who are transitioning to independence, changing their research focus, or need protected research time.

- K99/R00 – Pathway to Independence Award
- K01 – Research Scientist Development Award
- K25 – Quantitative Scientist Development Award
- K08 – Clinical Scientist Development Award
- K23 – Patient-Oriented Development Award

Receipt Dates: Feb/June/Oct 12 (Mar/July/Nov resubmissions)

K Kiosk: [http://grants1.nih.gov/training/careerdevelopmentawards.htm](http://grants1.nih.gov/training/careerdevelopmentawards.htm)
Pathway to Independence Program (K99/R00 - Kangaroo Award)

- US citizen/permanent residents or non-citizens on visas
- No more than 5 years of postdoctoral experience
- Must be in dependent position

**K99 Dependent Phase**
- 1-2 yrs mentored postdoctoral support
- $50K salary, $20K research costs + 8% F&A

**R00 Independent Phase**
- 3 yrs -- contingent upon securing an independent research/faculty position
- $249/yr total cost with full F&A
Pathway to Independence Program (K99/R00 - Kangaroo Award) – cont.

- NIBIB committed to 5 K99/R00 awards/yr
- 23 awards since 2007
- 9 successful transitions to R00 phase

Matthew J Allen, PhD
Assistant Professor
Department of Chemistry, Wayne State University

“Increasing the Utility of Contrast Agents for MRI”
NIH Director's Early Independence Award (DP5)

- Inspired by programs at Carnegie, UCSF, Whitehead, and other institutions.

- Helps exceptional MDs/PhDs **omit traditional postdoctoral training** and move directly into mentored research positions.

- Reduces the time it takes young scientists to launch independent research careers.

Receipt date: January 30, 2012
Mentored Quantitative Research Development Award (K25)

- Early-career investigators with quantitative backgrounds who are changing their focus to biomedical research.
- Quantitative (e.g., mathematics, statistics, economics, computer science) and engineering backgrounds

Brian S Caffo, PhD
Associate Professor
Department of Biostatistics, Johns Hopkins University
“Mentored Training Program in Quantitative Medical Imaging”
Research Scientist Development Award (K01)

- Early-career investigators with quantitative backgrounds who are transitioning to research independence
- Career path redirection or other institute-specific requirement may apply—check with Program Director before preparing application

Ann-Marie Broome, Ph.D.

Research Assistant Professor

Case Western Reserve University

“Imaging Complex Molecular Signatures in Cancer”
RESEARCH
DMR measurements

1. Sample collection

- Monodisperse (~38 nm)
- Clusters (~300 nm)

Binder
Enzyme

Magnetic nanoparticles

![Schematic of sample collection process](image)

2. On chip measurement

- Microcoil array
- Magnet

![Schematic of on chip measurement](image)

3. Flowchart of signal processing

- NMR signal (V)
- Time (ms)

World smallest NMR

NIBIB RO1 Weissleder: Molecular Analysis of Cells at the Point of Care

Smartphone powered & analysis: Ca, Protein biomarkers, DNA, bacteria, virus, drugs

Nat Med. 2008;14(8):869-74
Ham et al; IEEE 2009
Game changing technology

Ca Dx: DMR Accuracy 96% vs Biopsy Accuracy 84%

Science Transl Med. 2011;3(71):71
Bioengineering support at NIH

• FY 2010 - $3,166M
• Examples:
  - NIGMS ‘Implantable Sensor for Transplant Tissue Monitoring’
  - NHLBI ‘Pediatric Cardiac Monitor for Extracorporeal Life Support’
  - NINDS ‘Development and Early Clinical Evaluation of Noninvasive MRI Measurement of ICP’
R01 Percentiled Applications
Cumulative Count at Each Percentile
January Councils (2009-2012)
SBIR/STTR Program Reauthorization
Signed December 31, 2011

• Reauthorizes the SBIR/STTR programs for 6 years through FY 2017
• Most significant change to programs since their inception
1. Set aside requirements for Agencies will increase

<table>
<thead>
<tr>
<th>FY</th>
<th>Set-aside SBIR</th>
<th>Set-aside STTR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011 (current)</td>
<td>2.5%</td>
<td>0.30%</td>
</tr>
<tr>
<td>2012</td>
<td>2.6%</td>
<td>0.35%</td>
</tr>
<tr>
<td>2013</td>
<td>2.7%</td>
<td>0.35%</td>
</tr>
<tr>
<td>2014</td>
<td>2.8%</td>
<td>0.40%</td>
</tr>
<tr>
<td>2015</td>
<td>2.9%</td>
<td>0.40%</td>
</tr>
<tr>
<td>2016</td>
<td>3.0%</td>
<td>0.45%</td>
</tr>
<tr>
<td>2017</td>
<td>3.2%</td>
<td>0.45%</td>
</tr>
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# Key Reauthorization Provisions

## 2. Guidelines for Size of Awards

<table>
<thead>
<tr>
<th>Program</th>
<th>Phase I</th>
<th>Phase II</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBIR</td>
<td>$150,000</td>
<td>$1,000,000</td>
<td>150K/1M</td>
</tr>
<tr>
<td>STTR</td>
<td>$150,000</td>
<td>$1,000,000</td>
<td>100K/750K</td>
</tr>
</tbody>
</table>

## 3. Hard Limits* on award size to 50% over guidelines

<table>
<thead>
<tr>
<th>Program</th>
<th>Phase I</th>
<th>Phase II</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBIR</td>
<td>$225,000</td>
<td>$1,500,000</td>
<td>Flexible</td>
</tr>
<tr>
<td>STTR</td>
<td>$225,000</td>
<td>$1,500,000</td>
<td>Flexible</td>
</tr>
</tbody>
</table>

* Waiver possible for Specific Topics from Sm Buss Adm
4. Venture Capital Participation expanded up to 25% (other agencies 15%) of SBIR funds to SBCs majority owned by multiple VCs, hedge funds, or private equity firms

5. Technical Assistance programs
Both SBIR and STTR increased to $5,000 per Phase I and II award per year (previously limited to SBIR-only $4,000)
Who are you going to call?

- Web based information
- Scientific program staff at research institutes and centers
In addition to carrying out its scientific mission, NIH exemplifies and promotes the highest level of public accountability. To that end, the Research Portfolio Online Reporting Tools provides access to reports, data, and analyses of NIH research activities, including information on NIH expenditures and the results of NIH-supported research.
What Does NIH Already Support in My Interest Area?

NIH Searchable Databases Contain Abstracts of All Funded Projects

Search by
- MESH terms
- Key words
- Organizations
- States
- Investigators
- Mechanisms
- Solicitations
- Institutes
- Investigators
- ...
Funding Opportunities

NIBIB Research Education Programs for Residents and Clinical Fellows (R25)
PAR-12-085 • Posted: 01/27/2012 • Expires: 05/24/2014

Predictive Multiscale Models for Biomedical, Biological, Behavioral, Environmental and Clinical Research (Interagency U01)
PAR-11-203 • Posted: 04/15/2011 • Expires: 02/01/2014

Nanoscience and Nanotechnology in Biology and Medicine (R01)
PAR-11-148 • Posted: 03/14/2011 • Expires: 05/08/2014

Nanoscience and Nanotechnology in Biology and Medicine (R21)
PAR-11-149 • Posted: 03/14/2011 • Expires: 05/08/2014

Indo-US Collaborative Program on Low-Cost Medical Devices (R03)
PAR-11-044 • Posted: 11/23/2010 • Expires: 01/25/2013

Technologies for Healthy Independent Living (R01)
PAR-11-020 • Posted: 11/05/2010 • Expires: 09/20/2013

Design and Development of Novel Technologies for Healthy Independent Living (R21)
PAR-11-021 • Posted: 11/05/2010 • Expires: 09/20/2013

Bioengineering Research Partnerships (BRP) [R01]
PAR-10-234 • Posted: 07/21/2010 • Expires: 09/08/2013
Research

Scientific Program Areas (Extramural)

NIBIB is the newest of the NIH research Institutes and Centers. It was established to provide a research home for the development and application of new technologies and techniques for the delivery of health care in the 21st century. It brings together the research communities of biomedical imaging, bioengineering, the physical sciences and the life sciences to advance human health by improving quality of life and reducing the burden of disease.

Learn more about the mission and history of NIBIB.

Learn about the NIBIB research program areas, including descriptions, staff contacts, relevant programs and study sections:

- Biocatalysts
- Biomedical Informatics
- Drug and Gene Delivery Systems and Devices
- Image-Guided Interventions
- Image Processing, Visual Perception and Display
- Magnetic, Biomagnetic and Bioelectric Devices
- Magnetic Resonance Imaging and Spectroscopy
- Mathematical Modeling, Simulation and Analysis
- Interagency Modeling and Analysis Group (IMAG)
- Medical Devices and Implant Science
- Micro-Biomechanics
- Micro- and Nano-Systems; Platform Technologies
- Molecular Imaging
Alan McLaughlin, Ph.D.

Director
Division of Applied Science and Technology
Democracy Plaza II, Suite 200
Tel: 301-496-9321
Fax: 301-480-1614
E-mail: mclaughal@mail.nih.gov

Research Expertise

Dr. Alan McLaughlin is the Director of the Division of Applied Science and Technology at the NIBIB. With a background in physics, biophysics, and physiology, his portfolio includes magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS). He completed a post-doctoral fellowship in the Biochemistry Department at Oxford University, and subsequently held
NIH Grant Review Process YouTube Videos

NIH Peer Review Revealed

CSR has produced a series of videos to give you an inside look at how scientists from across the country review NIH grant applications for scientific and technical merit.

New and established applicants will find insights and understanding that can empower them to improve the applications and increase their chances for receiving a more positive review.

NIH Peer Review Revealed
Provides a front-row seat to a review peer review meeting.

NIH Tips for Applicants
Gives applicants practical advice and insights.

What Happens to Your NIH Grant Application shows our popular outreach talk.
You Tube

NIH Peer Review Revealed...

Peer Review and You

http://enhancing-peer-review.nih.gov/index.html
Summary

• Lots of help is available from web sites and also to program directors
• NIBIB is the tip of the bioengineering iceberg at NIH, consider us first but not exclusively
• Funding is available at all career stages and at many levels
• About 85% of NIH funds go out to the community