



# Bioinformatics and Computational Biology NIGMS/NIH

Karin A. Remington, Ph.D.

Coalition for Academic Scientific Computing, Winter Meeting

March 17, 2011 – Arlington, VA





The prevailing view of NIH...





# NIH is 27 separately funded Institutes and Centers...

Bethesda, MD:

NIH Campus

Rockville, Poolesville, MD

NCI, NINDS, NIBIB, NIMH, NCRR

Baltimore, MD

Bayview Campus: NIDA, NIA

Frederick, MD

Frederick Cancer Research Center

Research Triangle Park, NC

NIEHS

Hamilton, MT

Rocky Mountain Laboratory



# The National Institutes of Health: 27 Individual Institutes and Centers



OD

NIA

NIAAA

NIAID

NIAMS

NIBIB

NICHD

NIDCD

NIDCR

NIDDK

NIDA

NIEHS

NIGMS

NIMH

NINDS

NINR

NCI

NEI

NCCAM

NCMHD

NCRR

NHGRI

NHLBI

NLM

FIC

CC

CSR

CIT





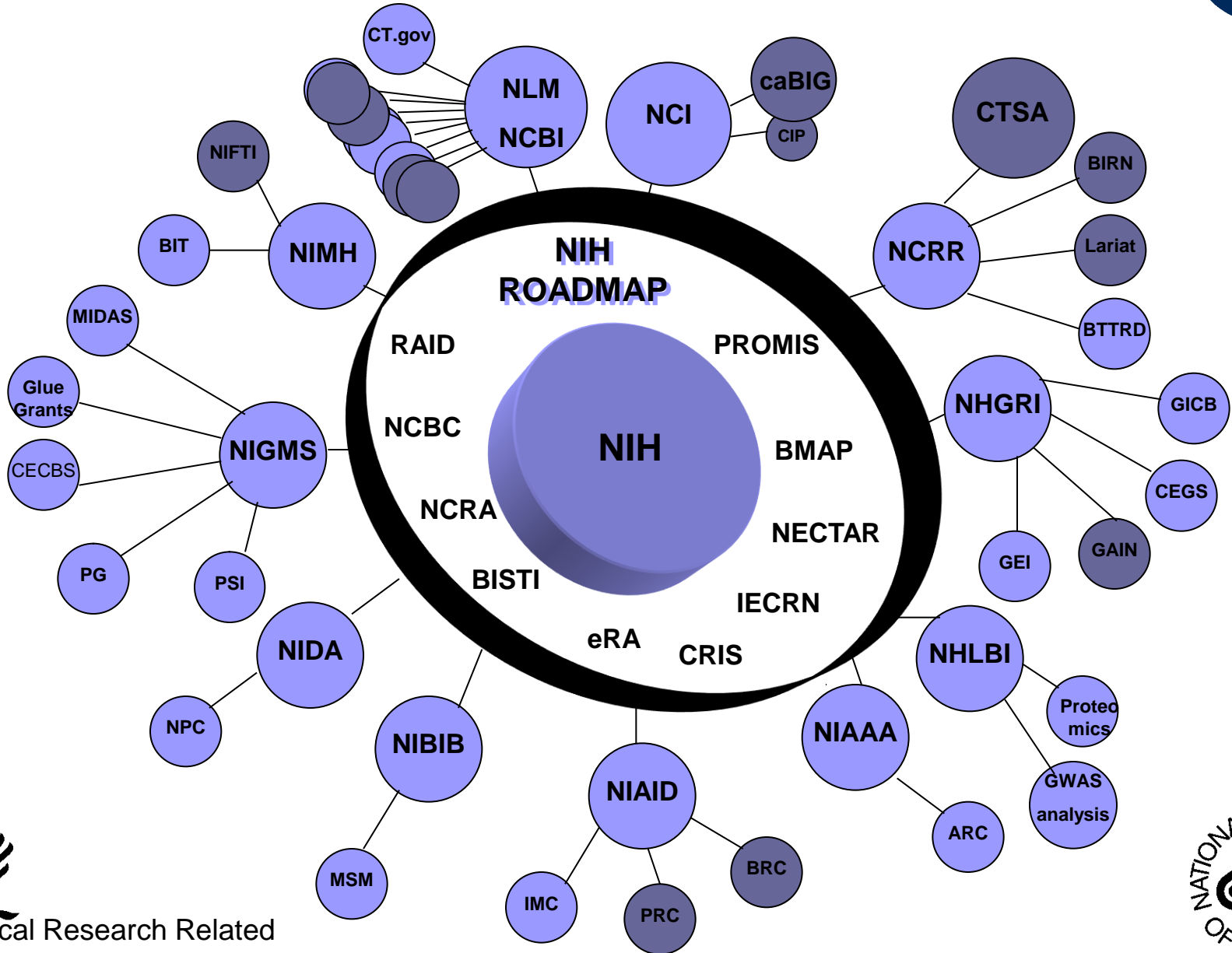
**“BISTI”**

***The Biomedical Information Science and  
Technology Initiative***





# BISTI related NIH activities...





**...WITHIN NIGMS**





## ***National Institute of General Medical Sciences mission:***

“...conduct and support of research, training, and as appropriate, health information dissemination, and other programs with respect to ***general or basic medical sciences*** and related natural or behavioral sciences which have ***significance for two or more national research institutes*** or are outside the general area of responsibility of any other national research institute.”

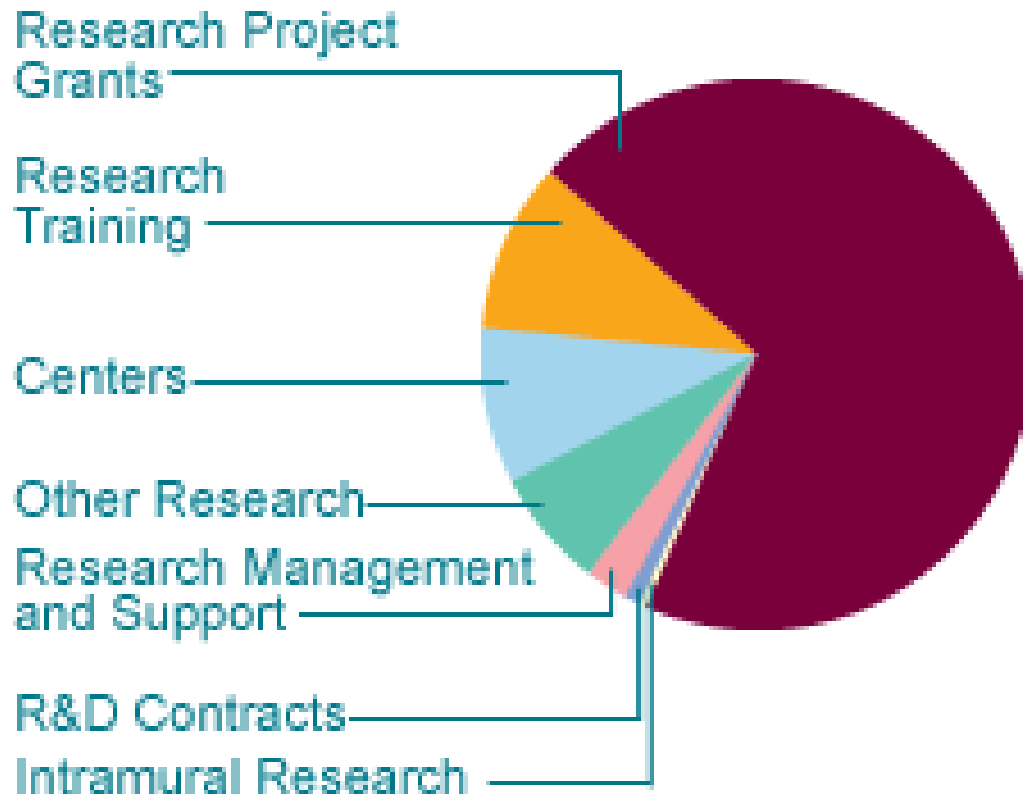


Established in 1962





# NIGMS Budget Overview



Annual budget of approximately \$2 Billion





# NIGMS

## Center for Bioinformatics and Computational Biology (CBCB)

### ■ NIGMS:

- R01 portfolio in bioinformatics (interpreted very broadly), modeling, software development and maintenance...
- Joint NSF DMS-NIGMS Program in Mathematical Biology
- Systems Biology Centers
- MIDAS (Models of Infectious Disease Agent Study)
- Training grants in Bioinformatics, and Biostatistics

### ■ Trans-NIH:

- Common Fund: National Centers for Biomedical Computing
- BISTI: Biomedical Informatics Science and Technology Initiative

### ■ Inter-agency Coordination





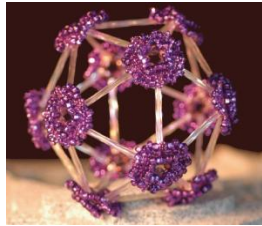
## CBCB sponsored Research Program Grants (R01s):

Some current and emerging interests:

- Structural and functional prediction of proteins
- Biostatistics – modeling, study design, data analysis
- Numerical linear algebra and optimization algorithms
- Network analysis/graph theory
- Systems biology approaches
- Innovative genomic analysis techniques
- Interdisciplinary training emphasizing collaborative science between Math/CS and Biology
- Biomedical data infrastructures supporting aggregation, interoperability and preservation

***Fully integrating mathematics and computer science  
in the context of biological studies***





# Joint NSF/NIH Mathematical Biology Program

## Workshop Announcement

### Frontiers in Mathematical Biology: NSF-NIH PIs Meeting 2010

April 26-27, 2010

The Marriott Inn & Conference Center, University of Maryland University College  
Hyattsville, Maryland

#### Keynote Speakers:

David Botstein, Princeton University  
Philip Maini, Oxford University  
Bin Yu, University of California, Berkeley

#### Objectives:

The purpose of the meeting is to promote collaborations between the biology and mathematics communities, facilitating the advance of biological and biomedical research. Specific aims are:

- Provide a forum for PIs to share experiences, exchange ideas, and explore new collaborations

#### Organizer:





## Models of Infectious Disease Agent Study

Computational and mathematical investigations of:

- Dynamics of emergence and spread of pathogens and their products
- Identification and surveillance of infectious diseases
- Effectiveness and consequences of intervention strategies
- Host/pathogen interactions
- Ecological, climatic, and evolutionary dimensions of infectious diseases outbreaks.





**...TRANS-NIH**





Some (of many) application challenges requiring major developments in biomedical computing:

- Assessment of the metabolic and regulatory potential of 1000s of microbes
- Quantitative imaging of macromolecules in single cells – through space and time
- Reverse engineering the brain
- Modeling the spread of infectious disease throughout the population
- Clinical data exchange across research centers – seamless, secure, coordinated





## What biologists want from their computational resources...

- Can I evaluate an experimental design?
- Can I store the results?
- Can I visualize the results?
- Can I reproduce the results?
- Can I make inquiries?
- Can I share and build upon the data, tools, and results?

From the 2006 CRA-NIH Computing Research Challenges Workshop in Biomedicine  
(Gwen Jacobs & Ed Lazowska)





What NIH has invested in ...

Examples:

- National Centers for Biomedical Computing (NCBCs)
- NCRRT's programs for equipment, Institutional Development awards (IDeA), CTSAs, etc.
- Training programs related to computational biology (NLM, NIGMS, e.g.)
- BISTI consortium opportunities





## The National Centers for Biomedical Computing program:

- BISTI Report (Botstein, Smarr, et al., 1999)
  - Recommended 5-20 National Programs of Excellence in Biomedical Computing
- P20 Planning Grants for National Program in Biocomputing
- NIH Roadmap process (2002-2003)
  - Internal competition among potentially transformative, trans-NIH concepts
  - Bioinformatics and Computational Biology one of nine areas selected





## Building a Biomedical Cyberinfrastructure :

### NCBC Goals

- **Development** of cutting edge computer science
- **Translation** of this computer science into biomedical computation, i.e., effective algorithms and environments for solving real biological problems
  - Enable the analysis, modeling, understanding, and prediction of dynamic and complex biomedical systems across time and distance scales
  - Allow the integration of biomedical and behavioral data and knowledge at all levels of organization





## Building a Biomedical Cyberinfrastructure :

### NCBCs Software and Data Integration Working Group

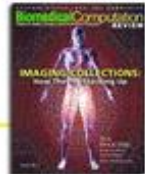
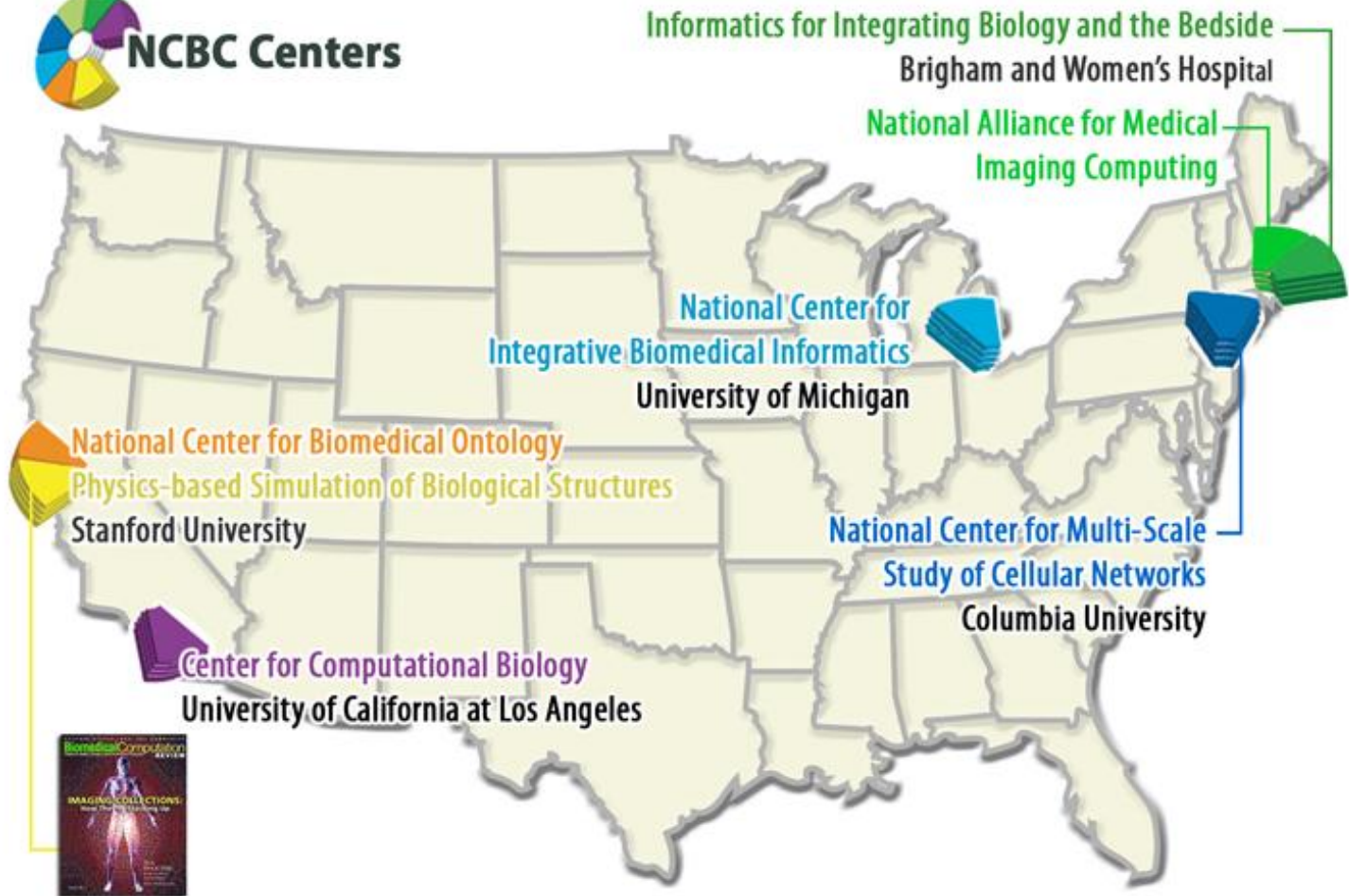
#### **Mission Statement:**

- To advance the domain sciences, and promote software interoperability and data exchange.
- To capture the collective knowledge of software engineering and practices among the Centers and publish this knowledge widely.





# NCBC Centers



[www.ncbcs.org](http://www.ncbcs.org)





# Shared and High-end Instrumentation Grants from NCRR

[NCRR Home](#) > [Biomedical Technology](#) > [Shared Instrumentation](#)

## Shared Instrumentation

 [WEB SHORTCUT: NCRR.NIH.GOV/SIG](http://NCRR.NIH.GOV/SIG)

**ON THIS PAGE:** [Awards](#) • [Purpose](#) • [Eligibility Requirements](#) • [How to Apply](#) • [Forms for Grantees](#) • [Contact Information](#)

**SEE ALSO:** [High-End Instrumentation](#) • [SIG Fact Sheet](#) • [SIG Program Announcement](#)

NCRR's **Shared Instrumentation Grant (SIG)** program supports the purchase of research equipment in the \$100,000 to \$600,000 price range. Examples of instrumentation supported by SIG funding include nuclear magnetic resonance systems, electron and confocal microscopes, mass spectrometers, protein and DNA sequencers, biosensors, X-ray diffractometers and cell sorters.

- [View the FY 2012 SIG Program Announcement](#) (Deadline: March 23, 2011)

From FY 2000 to FY 2010, the SIG program provided 1,503 awards to biomedical research institutions in 45 states and the District of Columbia, totaling \$507,711,280.

[NCRR Home](#) > [Biomedical Technology](#) > [High-End Instrumentation](#)

## High-End Instrumentation

**ON THIS PAGE:** [Awards](#) • [Purpose](#) • [Eligibility Requirements](#) • [How to Apply](#) • [Forms for Grantees](#) • [Contact Information](#)

**SEE ALSO:** [Shared Instrumentation](#) • [American Recovery and Reinvestment Act \(ARRA\) Instrumentation Awards](#) • [HEI Fact Sheet](#) • [HEI Program Announcement](#)

NCRR's **High-End Instrumentation (HEI)** grant program supports the purchase of a single major piece of research equipment that costs more than \$750,000. Instruments in this price range include structural and functional imaging systems, macromolecular NMR spectrometers, high-resolution mass spectrometers, electron microscopes, and supercomputers.

Since its inception in 2002, the HEI Program has provided 140 awards to biomedical research institutions in 27 states, totaling \$224,088,003.





**“BISTI”**

***The Biomedical Information Science and  
Technology Initiative***





BISTI Website: <http://www.bisti.nih.gov>

Biomedical Information Science and Technology Initiative (BISTI) - Windows Internet Explorer

http://www.bisti.nih.gov/

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Biomedical Information Science and Technology Initiative

Your source for biomedical informatics at NIH

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The **Biomedical Information Science and Technology Initiative** is a consortium of representatives from each of the NIH institutes and centers. BISTI was established in May 2000 to serve as the focus of biomedical computing issues at the NIH.

The mission of BISTI is to make optimal use of computer science and technology to address problems in biology and medicine by fostering new basic understandings, collaborations, and transdisciplinary initiatives between the computational and biomedical sciences.

In support of this mission, the BISTI coordinates research grants, training opportunities, and scientific symposia associated with biomedical computing. Regular monthly meetings are conducted to discuss program status, future needs and directions, and topics of interest to the bioinformatics community.

[NIH Working Definition of Bioinformatics and Computational Biology](#), July 2000

[http://www.bisti.nih.gov/index.asp](#)

**Funding**

Funding for biomedical informatics is spread broadly across NIH Institutes and Centers. The NIH Guide is available for customized searches of current announcements. BISTI coordinates several cross-cutting opportunities. [Read more about funding »](#)

**Library**

BISTI-related reports, white papers, and other documents are posted in our online library for reference. [Read more in the BISTI library »](#)

**Related Initiatives**

Links to an alphabet soup of programs related to BISTI are consolidated here in

**Intramural Research**

NIH is home to a rich intramural research community. [Read more about](#)

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BISTI Website: <http://www.bisti.nih.gov>

**BISTI** Biomedical Information Science and Technology Initiative  
*Your source for biomedical informatics at NIH*

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### BISTI R01 Contact List

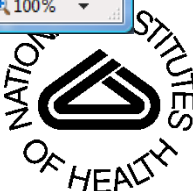
IC	Contact	Email	Phone No.
National Institute of Allergy and Infectious Diseases (NIAID)	Dr. Cheryl Kraft	<a href="mailto:CKraft@niaid.nih.gov">CKraft@niaid.nih.gov</a>	301-496-7551
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National Institutes of Diabetes and Digestive and Kidney Diseases (NIDDK)	Dr. Arthur Castle	<a href="mailto:CastleA@mail.nih.gov">CastleA@mail.nih.gov</a>	301-541-7719
National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)	Dr. Gayle Lester	<a href="mailto:gl83g@nih.gov">gl83g@nih.gov</a>	301-594-5055

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# BISTI Program Announcements: Innovations in Biomedical Computational Science and Technology (R21/R01)

**Purpose.** The NIH is interested in promoting research and developments in biomedical informatics and computational biology

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Intentionally broad in scope, including:

- database design
- graphical interfaces
- querying approaches
- data retrieval
- data visualization and manipulation
- development of integrated analytical tools
- tools for electronic collaboration

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**...ACROSS AGENCIES**





## Many Related Inter-Agency Activities:

- Joint NSF DMS/NIH NIGMS Initiative to Support Research in the Areas of Mathematical Biology - NSF Solicitation 10-579 (next due date: October 3<sup>rd</sup>. 2011)
- Collaborative Research in Computational Neurosciences (CRCNS) - NSF Solicitation [11-505](#) (next due date February 7, 2011)
- Interagency coordination (no specific programs): Networking and Information Technology Research and Development (NITRD)
- Interagency Modeling and Analysis Group (IMAG): Multiscale Modelling Consortium (MSM): Solicitation funded 24 projects, and has hosted several PI meetings and active working groups.



# Interagency Modeling and Analysis Group

## IMAG Multiscale Modeling (MSM) Consortium Working Groups

- Filament Dynamics and Simulation (FDS)
- Cardiac and Skeletal Muscle Physiology
- Macro-To-Micro Scale Transport in Human Systems
- Cell Level Modeling
- High Performance Computing, Computational Issues and Algorithms
- Tissue Mechanics
- Multiscale Imaging
- Theoretical Methods
- Nano-modeling
- Model Sharing



Contact: Grace Peng, NIBIB, email: [penggr@mail.nih.gov](mailto:penggr@mail.nih.gov)



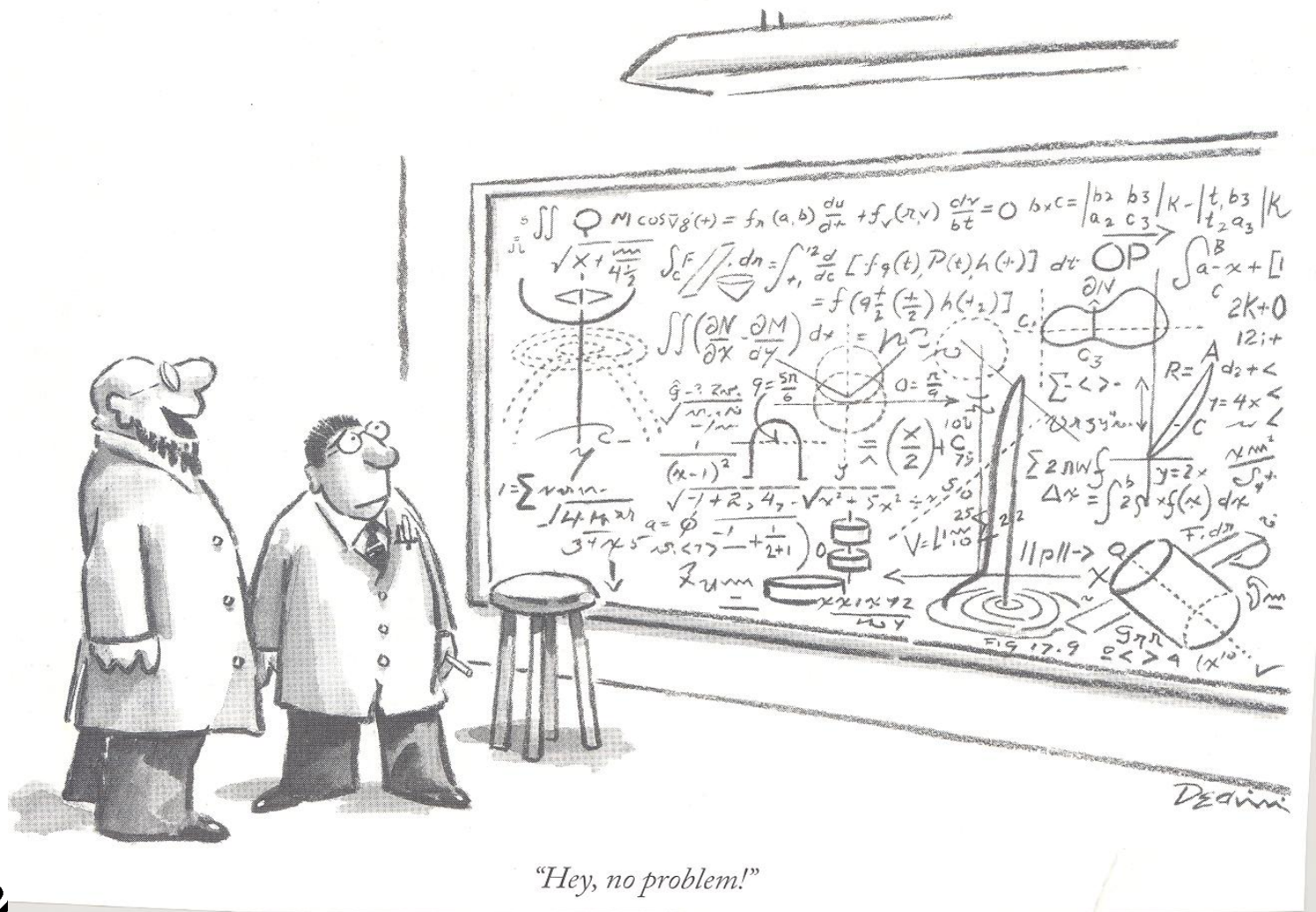


The CHALLENGE of interdisciplinary funding at the NIH,  
including projects with substantial mathematics  
components:





# Language barriers:



"Hey, no problem!"



Support of NIH Study Sections, when it comes to proposals featuring software and data sustainability:





To encourage fair review of the desired collaborations:

- Special Emphasis Panels for targeted FOAs
- Multiple PI applications
- Encouragement of “New” Investigators

IC-level policies to boost likelihood of funding



Support of NIH Institutes and Centers, when it comes programs requiring pooled resources and commitment:





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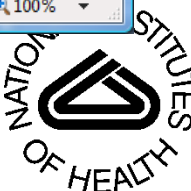
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National Institute of Allergy and Infectious Diseases (NIAID)	Dr. Cheryl Kraft	<a href="mailto:CKraft@niaid.nih.gov">CKraft@niaid.nih.gov</a>	301-496-7551
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# NIH/NIGMS Center for Bioinformatics and Computational Biology

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