

# NIBIB: ENGINEERING THE FUTURE OF HEALTH<sup>SM</sup>

Bruce J. Tromberg, Ph.D.

Director

National Institute of Biomedical Imaging and Bioengineering



# American Institute for Medical and Biological Engineering (AIMBE) Leadership



**Joyce Wong, PhD**

AIMBE President



**Milan Yager**

Past AIMBE Executive  
Director



**Dawn Beraud, PhD**

AIMBE Executive Director

# Bioengineering at NIH

## NIBIB and BME Growth

### 2000: *Creation of NIBIB*

Public Law 106-580  
106th Congress

Dec. 29, 2000  
[H.R. 1795]

**National Institute of Biomedical Imaging and Bioengineering Establishment Act.**  
42 USC 201 note  
42 USC 285r note.

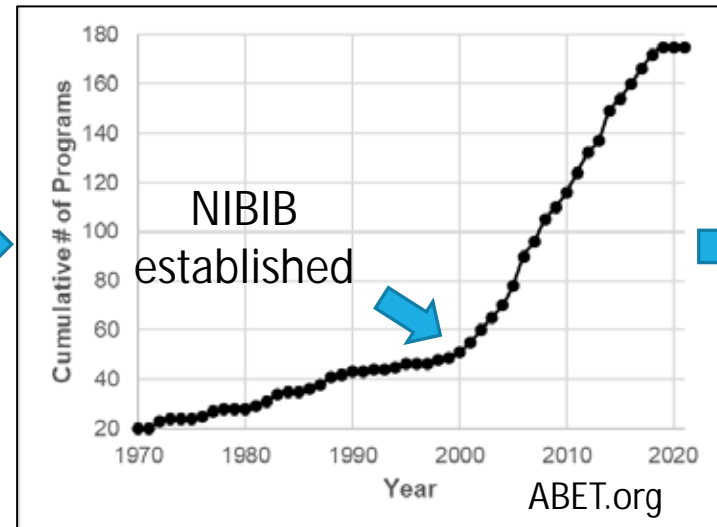
**An Act**  
To amend the Public Health Service Act to establish the National Institute of Biomedical Imaging and Bioengineering.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

**SECTION 1. SHORT TITLE.**  
This Act may be cited as the "National Institute of Biomedical Imaging and Bioengineering Establishment Act".

**SEC. 2. FINDINGS.**  
The Congress makes the following findings:  
(1) Basic research in imaging, bioengineering, computer science, informatics, and related fields is critical to improving health care but is fundamentally different from the research in molecular biology on which the current national research institutes at the National Institutes of Health ("NIH") are based. To ensure the development of new techniques and technologies for the 21st century, these disciplines therefore require an identity and research home at the NIH that is independent of the existing institute structure.

- 175+ accredited BME-related programs
- > 200 graduate programs

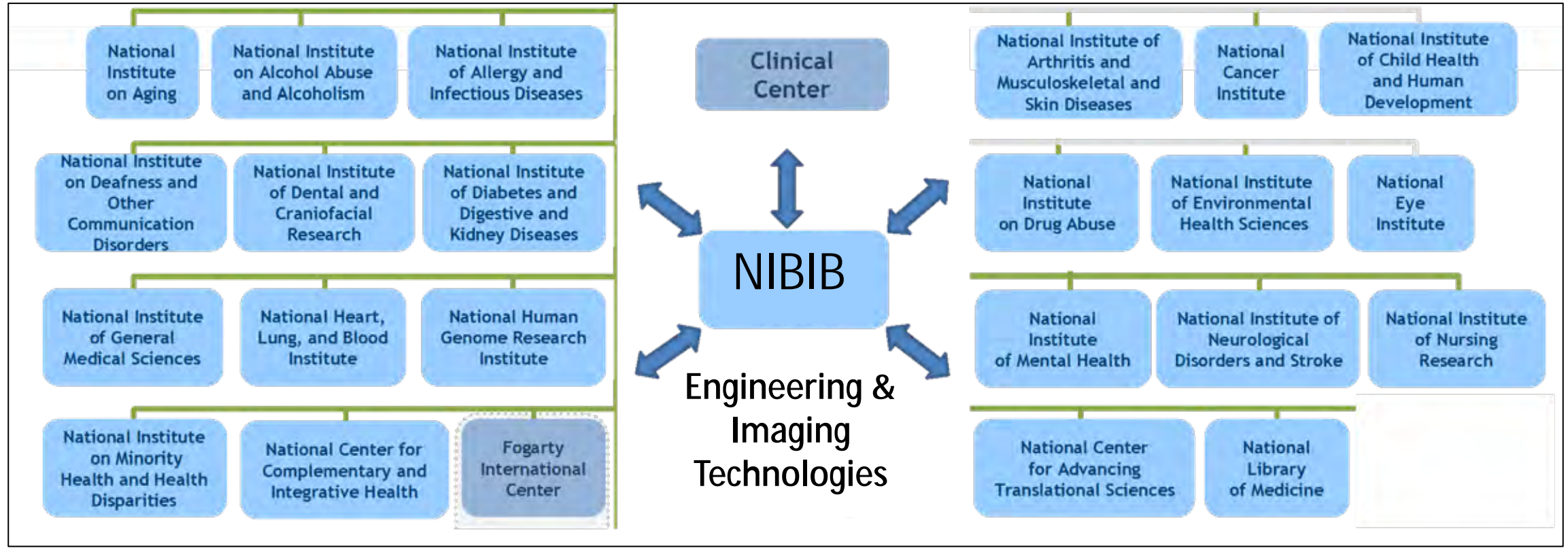


- **Human Health top priority of Engineering**
- **Medicine-Engineering partnerships: *Physicianeers***
  - University of Illinois Urbana-Champaign
  - Texas A&M University
  - BME Centers
- ***Drive Innovation, Entrepreneurship, Diversity***

<https://blog.collegevine.com/us-colleges-with-biomedical-engineering-major/>

**27 Institutes & Centers, ~\$47 Billion (FY23)**  
>300,000 researchers, >2500 institutions >50,000 grants

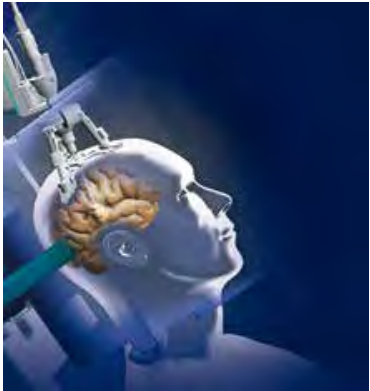
**NIBIB: ~1% NIH Budget** → *Partnerships and Collaboration*





# NIBIB Mission: *Technology & Innovation*

## Advanced Therapeutic Technologies



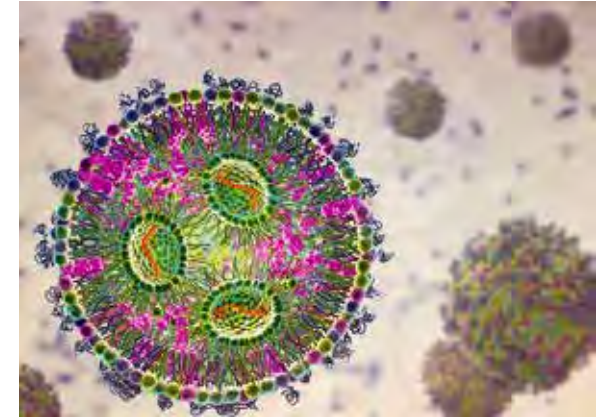
Monteris Medical, Inc.



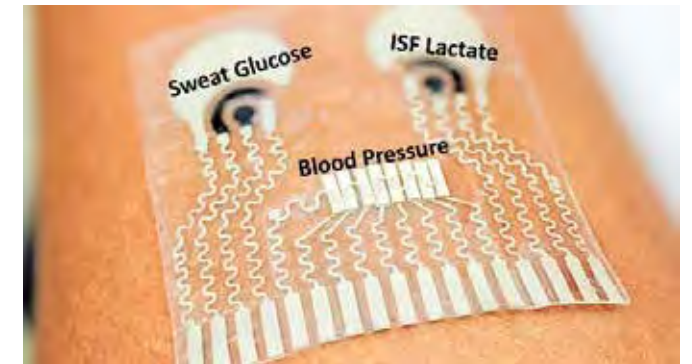
## Biomedical Imaging Technologies

M. Garwood, UMN

## Engineered Biological Systems



Whitehead, CMU  
(NICHD, NIAID support)



## Sensors and Point of Care Devices

S. Xu, UCSD

## Data Science, Modeling, and Computation



V. Venugopalan, J. Spanier, UCI

# 2020: NIBIB Pandemic Response

## NIBIB-Core Programs

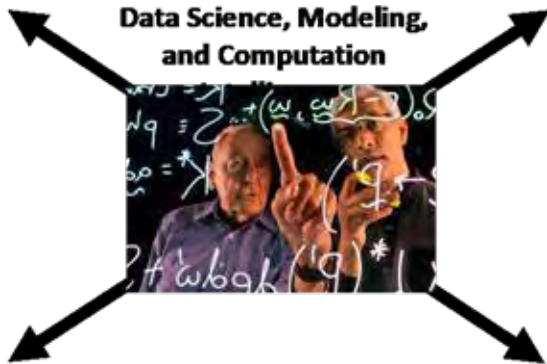
### Advanced Therapeutic Technologies



### Engineered Biological Systems



### Data Science, Modeling, and Computation



### Biomedical Imaging Technologies



### Sensors and Point of Care Devices



## NIBIB-Pandemic Response

PUBLIC LAW 116-139—APR. 24, 2020 \$1.5B to NIH

under this paragraph in this Act, not less than \$500,000,000 shall be transferred to the “National Institutes of Health—National Institute of Biomedical Imaging and Bioengineering” to accelerate research, development, and implementation of point of care and other rapid testing related to coronavirus: *Provided further*, That

- 1) *Imaging and AI (MIDRC.org)*
- 2) *In Vitro Diagnostics*
- 3) *Digital Health Platforms*

*Rapid Acceleration  
of Diagnostics  
(RADx Tech)*

# 2020: NIBIB Pandemic Response

## NIBIB Pandemic Response

- 1) *Imaging and AI*
- 2) *In Vitro Diagnostics*
- 3) *Digital Health Platforms*

Radiologists limited resource

Urgent need for equitable, accessible AI/ML

- Diagnose, assess extent disease
- Monitor therapy
- Detect complications
- Predict outcome
- Understand PASC (long COVID)

The screenshot shows the NIH website's News Releases section. The main headline is "NIH harnesses AI for COVID-19 diagnosis, treatment, and monitoring". The sub-headline reads: "Collaborative network to enlist medical imaging and clinical data sciences to reveal unique features of COVID-19." The article text describes the launch of the Medical Imaging and Data Resource Center (MIDRC) and the role of NIBIB. It includes quotes from Bruce J. Tromberg, NIBIB Director, and Guoying Liu, NIBIB scientific program lead. Two images are shown: a chest X-ray on the left and a CT scan of the chest on the right, both with red boxes highlighting areas of interest in the lungs.

NIH National Institutes of Health  
Turning Discovery Into Health

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## NEWS RELEASES

Wednesday, August 5, 2020

### NIH harnesses AI for COVID-19 diagnosis, treatment, and monitoring

*Collaborative network to enlist medical imaging and clinical data sciences to reveal unique features of COVID-19.*

[e](#) [m](#) [f](#) [t](#) [+](#)

The National Institutes of Health has launched the Medical Imaging and Data Resource Center (MIDRC), an ambitious effort that will harness the power of artificial intelligence and medical imaging to fight COVID-19. The multi-institutional collaboration, led by the National Institute of Biomedical Imaging and Bioengineering (NIBIB), part of NIH, will create new tools that physicians can use for early detection and personalized therapies for COVID-19 patients.

"This program is particularly exciting because it will give us new ways to rapidly turn scientific findings into practical imaging tools that benefit COVID-19 patients," said Bruce J. Tromberg, Ph.D., NIBIB Director. "It unites leaders in medical imaging and artificial intelligence from academia, professional societies, industry, and government to take on this important challenge."

The features of infected lungs and hearts seen on medical images can help assess disease severity, predict response to treatment, and improve patient outcomes. However, a major challenge is to rapidly and accurately identify these signatures and evaluate this information in combination with many other clinical symptoms and tests. The MIDRC goals are to lead the development and implementation of new diagnostics, including machine learning algorithms, that will allow rapid and accurate assessment of disease status and help physicians optimize patient treatment.

"This effort will gather a large repository of COVID-19 chest images," explained Guoying Liu, Ph.D., the NIBIB scientific program lead on this effort, "allowing researchers to evaluate both lung and cardiac tissue data, ask critical research questions, and develop predictive COVID-19 imaging signatures that can be delivered to healthcare providers."

Maryellen L. Giger, PhD, the A.N. Fritsker Professor of Radiology, Committee on Medical Physics at the University of Chicago, is leading the effort, which includes co-investigators Eta Pisano, MD, and Michael Tilkin, MS, from the American College of Radiology (ACR), Curtis Langlotz, MD, PhD, and Adam Flanders, MD, representing the Radiological Society of North America (RSNA), and Psui Kinahan, PhD, from the American Association of Physicists in Medicine (AAPM).

Institute/Center  
National Institute of Biomedical Imaging and Bioengineering (NIBIB)

Contact  
Ray MacDougall  
301-496-3500

Connect with Us



<https://www.midrc.org>

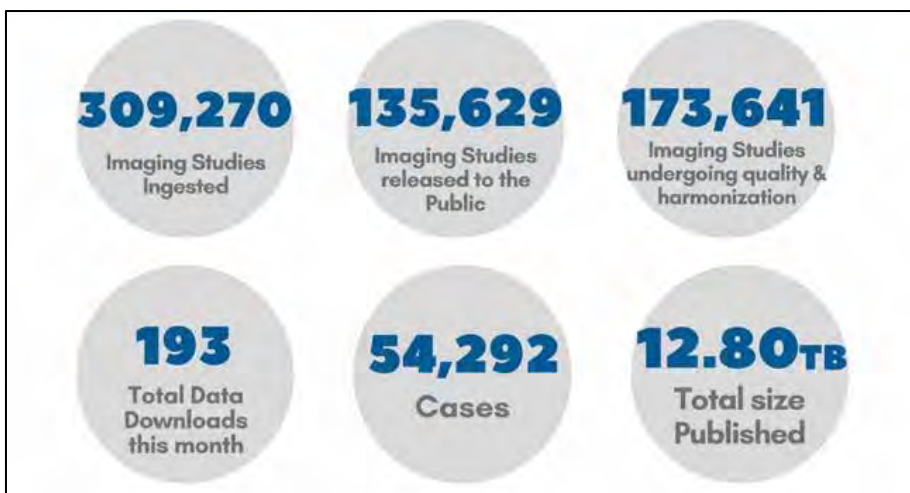


PI: Maryellen Giger, Ph.D.,  
UChicago



## Two scientific components of MIDRC:

1. Open Discovery Data Commons
2. Machine Intelligence Computational Capabilities



## Data Scholars



Brad Bower



Rui De Sá





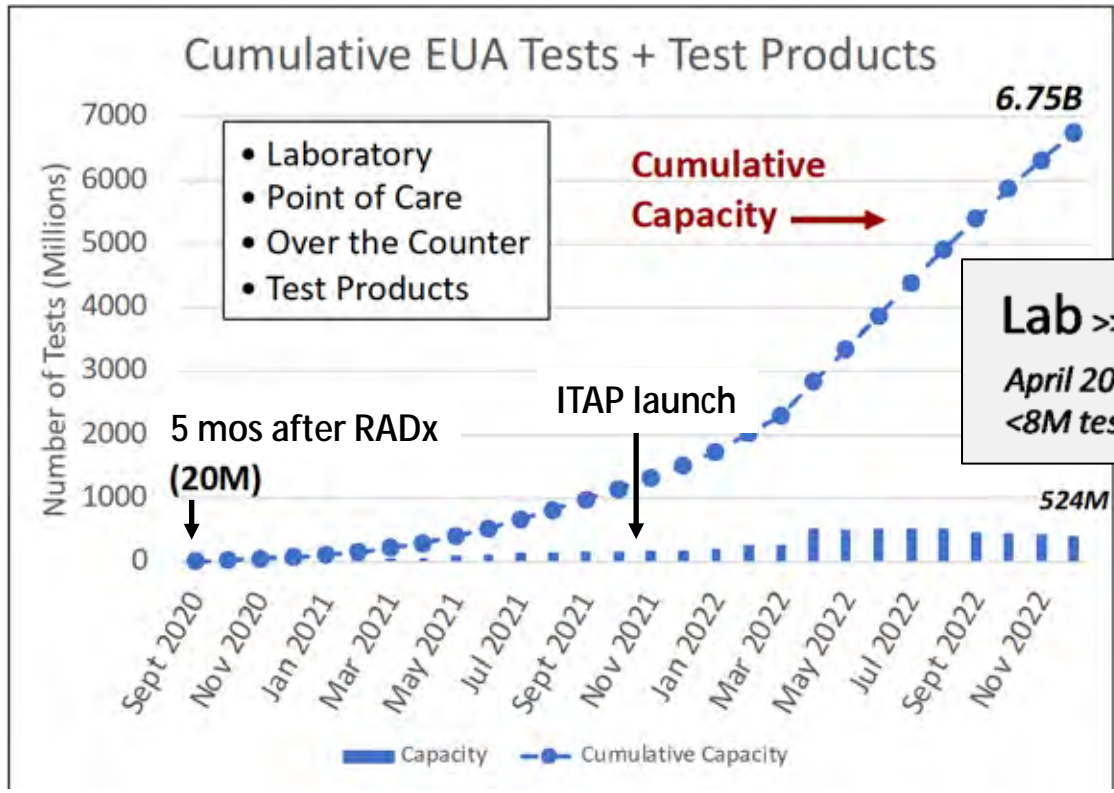
### Innovation Funnel (shark tank)

- 6.75 B tot capacity → Dec 20
- 56 EUAs: 19 OTC, 17 POC

# NIBIB Point of Care Tech Research Network (POCTRN)

Expanded April 29, 2020: >900 RADx experts & contributors: (USG, Academia, Industry, NFP)

- Emory-Gtech
- Johns Hopkins
- Mass Gen Hosp
- Northwestern
- UMass



*Dx Paradigm Shift*

**Lab >> POC** → **POC, OTC >> Lab (~12%)**  
 April 2020 <8M tests      Feb 2022 >1.1B tests w/~1B OTC

## FDA Independent Test Assessment (ITAP)

### ITAP Team Leads



Eric Lai Pam Miller

EUA ~8-12 weeks

# Demonstrations



Emory University and Georgia Institute of Technology,  
Atlanta, GA

At-home COVID-19 test evaluated by  
Rapid Acceleration of Diagnostics  
(RADx®) Tech Test Validation Core



Julie Sullivan, BS



Wilbur Lam, MD, PhD



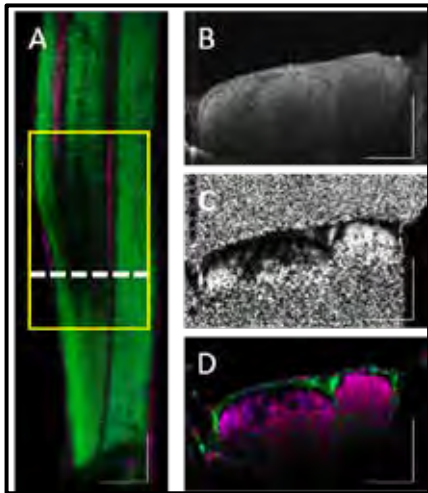
Erika Tyburski, BS



Smart-phone app for anemia  
detection

# Demonstrations

U.S. Food and Drug  
Administration Center for  
Devices and Radiological Health



Optical Coherence Tomography  
(OCT) for peripheral nerve imaging



Daniel X. Hammer, PhD



Sandhya Vasudevan, PhD



William Vogt, PhD



Anant Agrawal, PhD



# Demonstrations

Johns Hopkins University,  
Baltimore, MD



Surgical robot (Smart Tissue Autonomous Robot or STAR) performs laparoscopic anastomosis



Axel Krieger, PhD



Justin Opfermann, MS,  
PhD Student



Michael Kam, MS,  
PhD Student



Idris Sunmola, MS,  
PhD Student

# Demonstrations

North Carolina State University, Raleigh, NC  
& University of North Carolina,  
Chapel Hill, NC



A user testing a prosthetic device



He (Helen) Huang, PhD



Varun Nalam, PhD



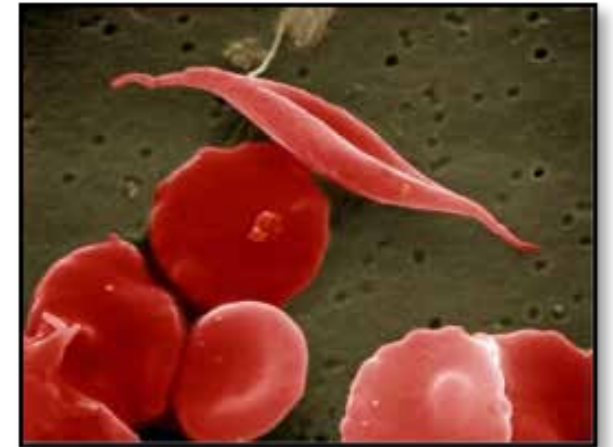
Brendan Driscoll,  
PhD Student

# Demonstrations

**Center for Biomedical  
Engineering Technology  
Acceleration (BETA  
Center), NIBIB, NIH**



**Mechanics And Tissue  
Remodeling Integrating  
Computational and Experimental  
Systems (MATRICES)**



**Manu Platt, PhD**

Irregular shape of blood cells resulting from abnormal hemoglobin which occurs in sickle cell anemia.