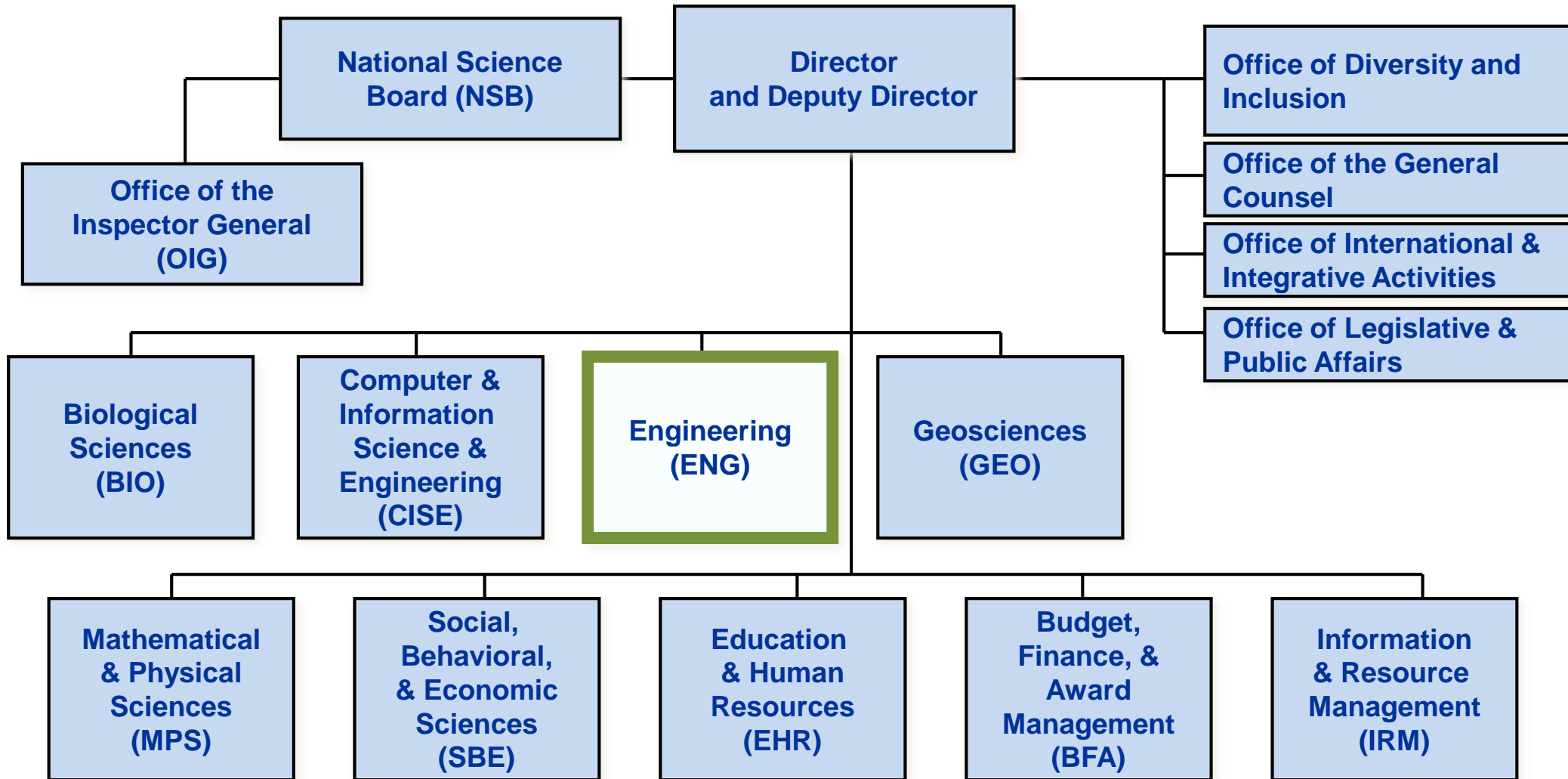




Research to Support Multiscale Modeling of Biomedical Systems

Michele J. Grimm, PhD
Program Director
EMBS and DARE Programs

National Science Foundation





COMMON MYTH

- “NSF does not support research related to human health”

This is FALSE!

- The Engineering Directorate has 12 programs that specifically support research related to improving human health and medicine
 - Many will support modeling-based proposals
- The Biological Sciences Directorate does avoid biology related to human medicine



FUNDING MECHANISMS

- Proposals are submitted to a specific program or solicitation
- “Unsolicited” Proposals
 - Standard funding mechanism for all levels of investigators
 - One or two submission windows each year
 - General funding levels of \$100k/year for 3 years (including ICR)
- CAREER Awards
 - Funding mechanism for junior faculty (untenured but in tenure track)
 - Due each year in July
 - General funding level of \$100k/year for 5 years (including ICR)
 - Must include an INTEGRATED Educational component
- Special Solicitations
 - Often multi-disciplinary or cutting edge
 - Specified submission deadlines and budget guidelines
 - Released electronically at least 90 days before deadlines

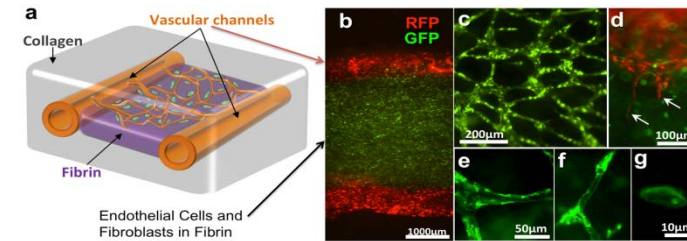


Program Objectives:

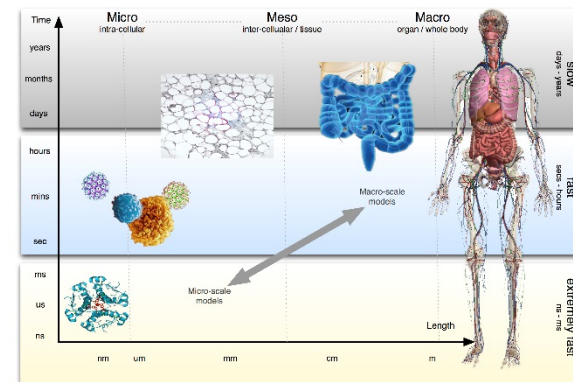
- Develop novel ideas into transformative solutions for biomedical problems
- Advance engineering and biomedical sciences, integrating the two disciplines

Key Components Related to MSM:

- Development of validated models of normal and pathological tissues and organ systems
 - In vitro or in silico
 - For understanding basic principals
 - To investigate diagnostic or treatment interventions



In vitro vascularization



Modeling of Physiological Processes from Molecule to Organism



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BIOMECHANICS & MECHANOBIOLOGY

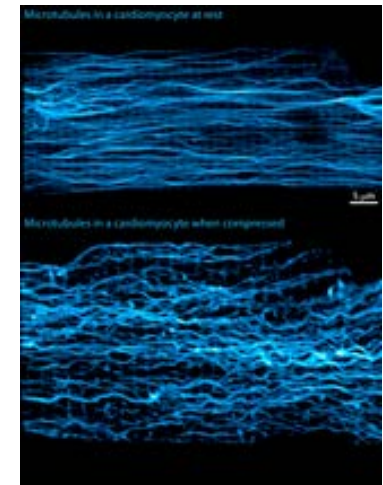
CMMI
Dec 30 – Jan 13
September 1 - 15

Program Objectives:

- Fundamental research
- Theoretical, computational, and experimental approaches supported

Key Components Related to MSM:

- Multiscale mechanics approaches - integration across molecular, cell, tissue and organ domains
- Fundamental study of cellular biomechanics important for building 3D organs



Microtubules in a cardiomyocyte at rest (top) and when compressed.



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CELLULAR & BIOCHEMICAL ENGINEERING

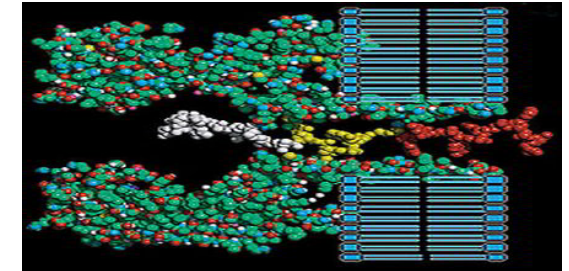
CBET
October 1 – 20

Program Objectives:

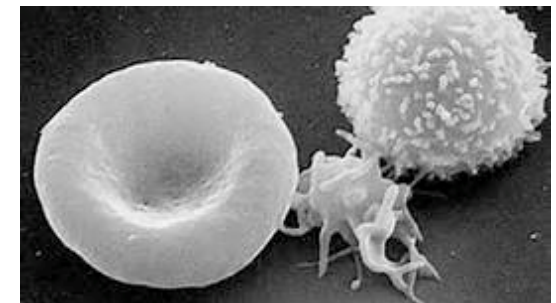
- Fundamental engineering research that advances understanding of cellular and biomolecular processes in engineering biology
- Eventually leads to development of enabling technology for advanced manufacturing of the therapeutic cells, biochemical, biopharmaceutical, and biotechnology industries

Key Components Related to MSM

- Quantitative systems biotechnology
- Single cell dynamics and modeling in the context of biomanufacturing



**Modeling of Molecular
Systems**



**Scaled up Advanced
Biomanufacturing of
Therapeutic Cells**



NSF REVIEW CRITERIA

- Intellectual Merit:
 - Does the proposed work advance and contribute knowledge in its own field or across different disciplines?
 - Does the proposal involve creative and original concepts?
 - Is the proposal well-conceived and organized?
 - Is the PI (or team) qualified to conduct the proposed work?
 - Does the team have sufficient access to resources to conduct the work?
- Broader Impact
 - Does the research and related activities contribute to the achievement of societally relevant outcomes?
 - May include activities that:
 - Broaden participation in STEM
 - Improve STEM education
 - Increase public scientific literacy



KEYS TO SUCCESS

- Identify the right Program and tailor your project to that Program
- Contact the Program Director you hope to submit to in order to discuss your ideas and confirm the fit of the project with the program
 - Start with an email (include your project objectives) and follow up with phone call or visit for more extensive discussion

DO NOT WAIT UNTIL THE LAST MINUTE!

- Know the difference between an NSF and an NIH project
- Spend time on the Broader Impacts – don't rely on the future benefit to human health
- Include enough preliminary data to prove that the work is doable
- Tell a good story explaining why your work is important, innovative, and (if successful) transformative
- Volunteer to serve as a panelist to better understand process and review