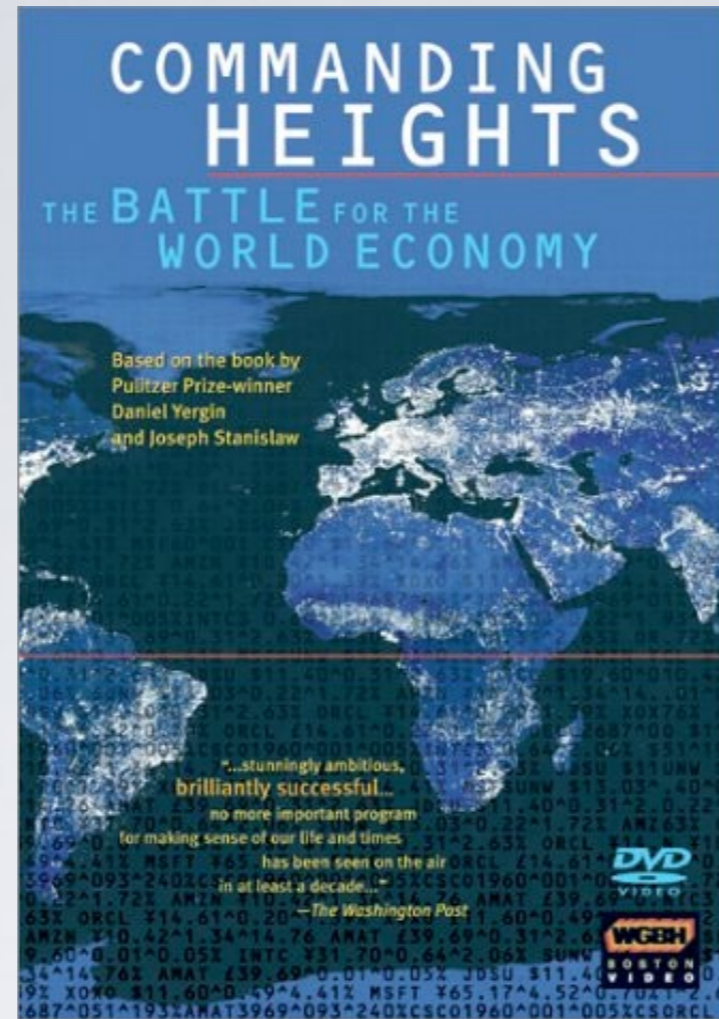
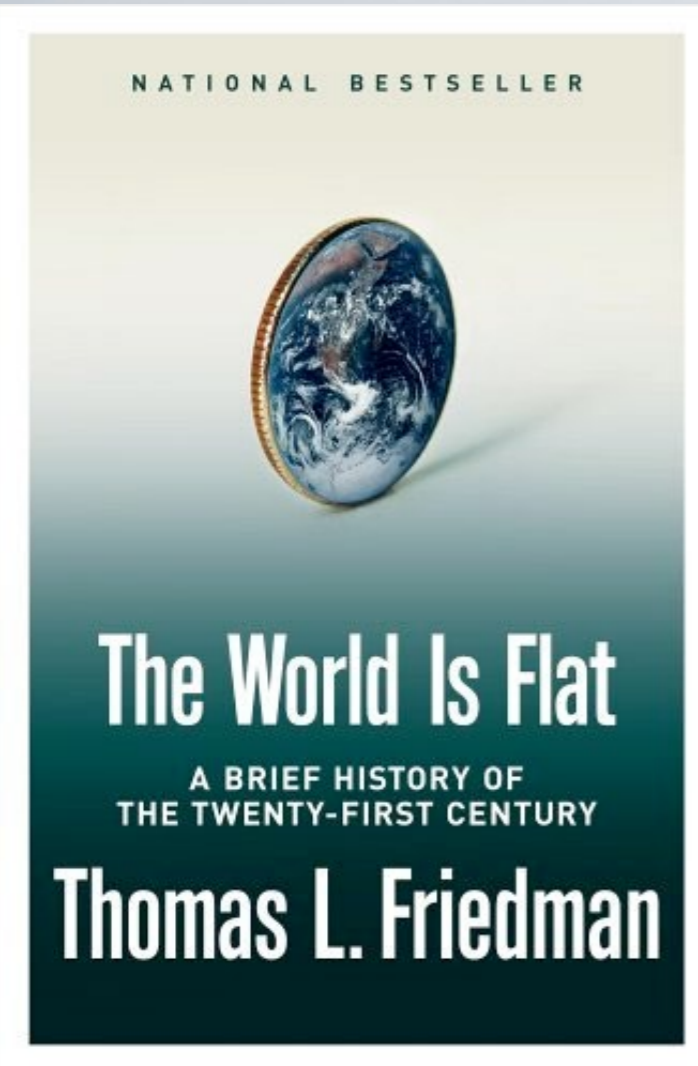


Interdisciplinary Mentoring Program

**IMPACT**

in Analysis, Computation, and Theory



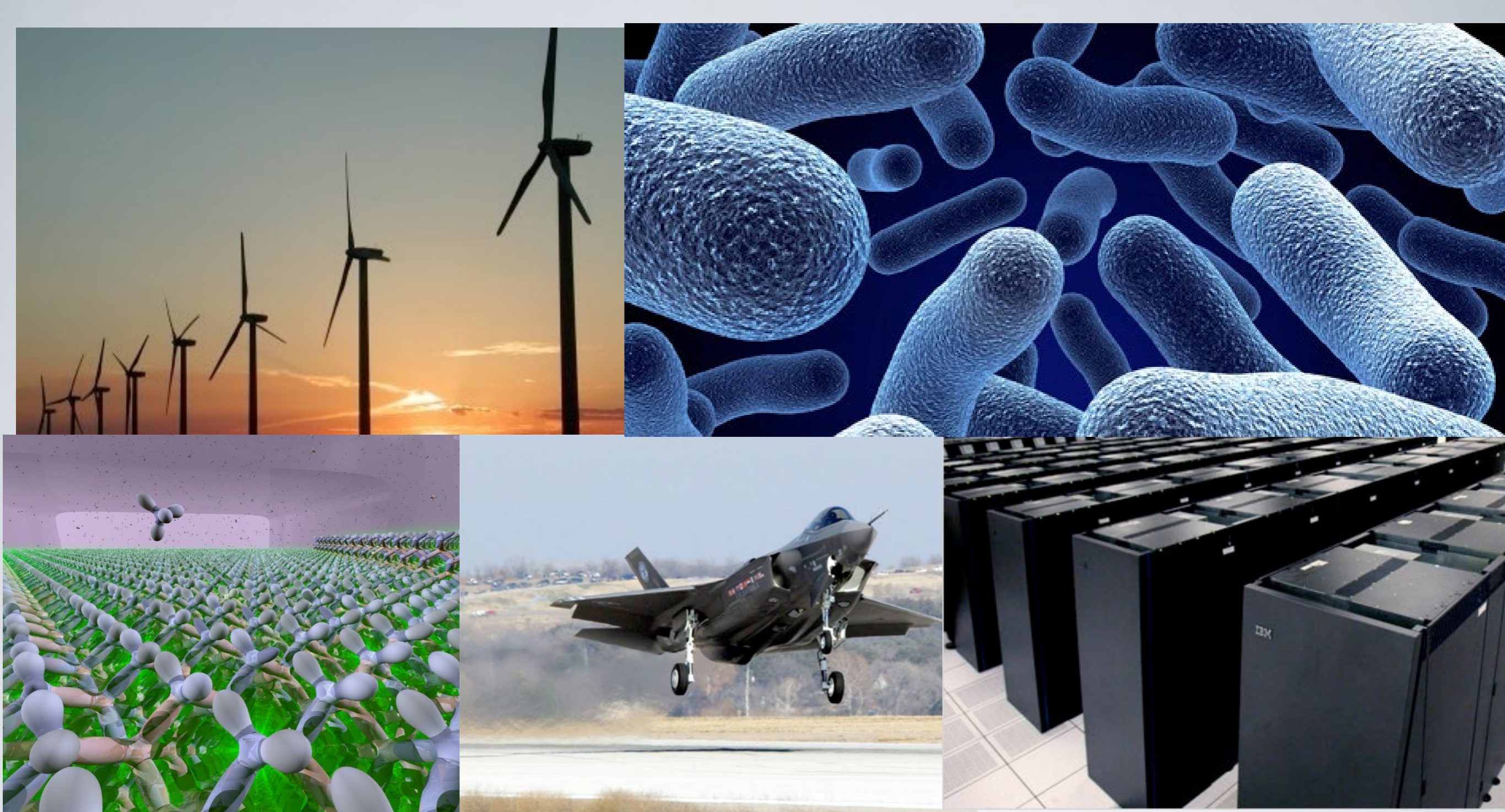
# Concerns About Globalization



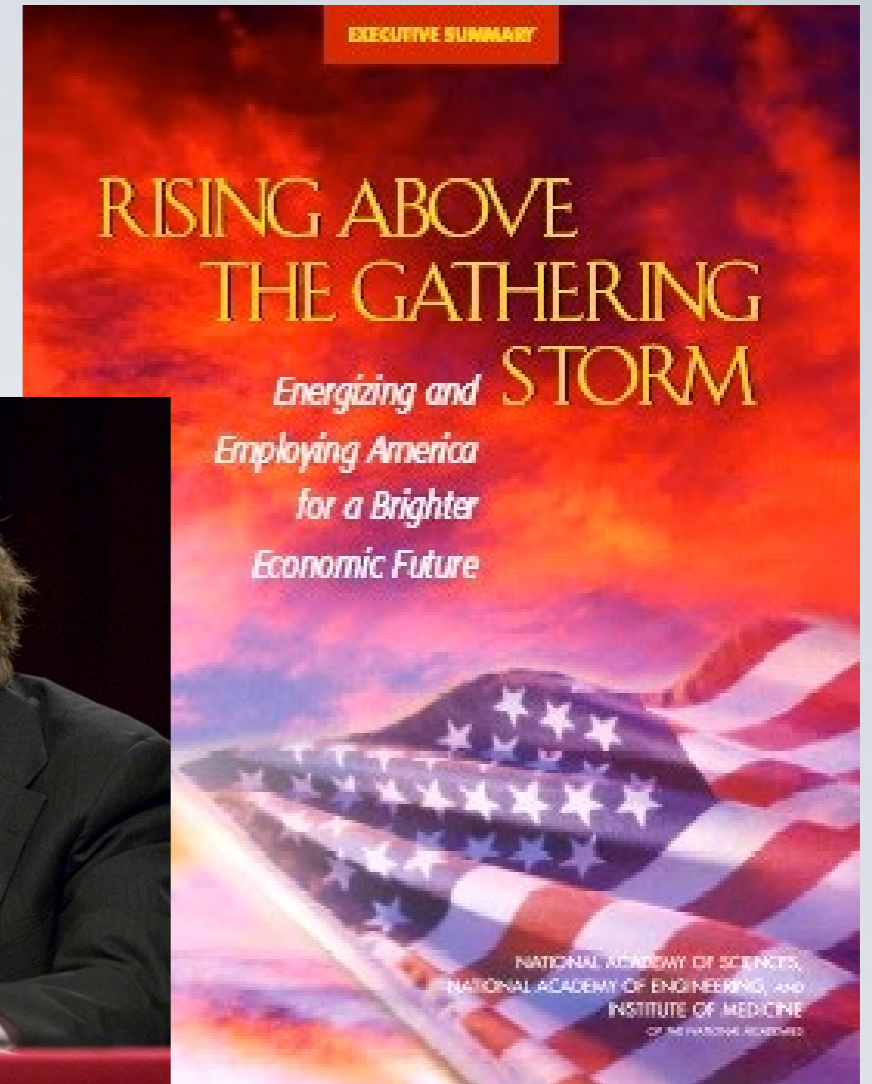
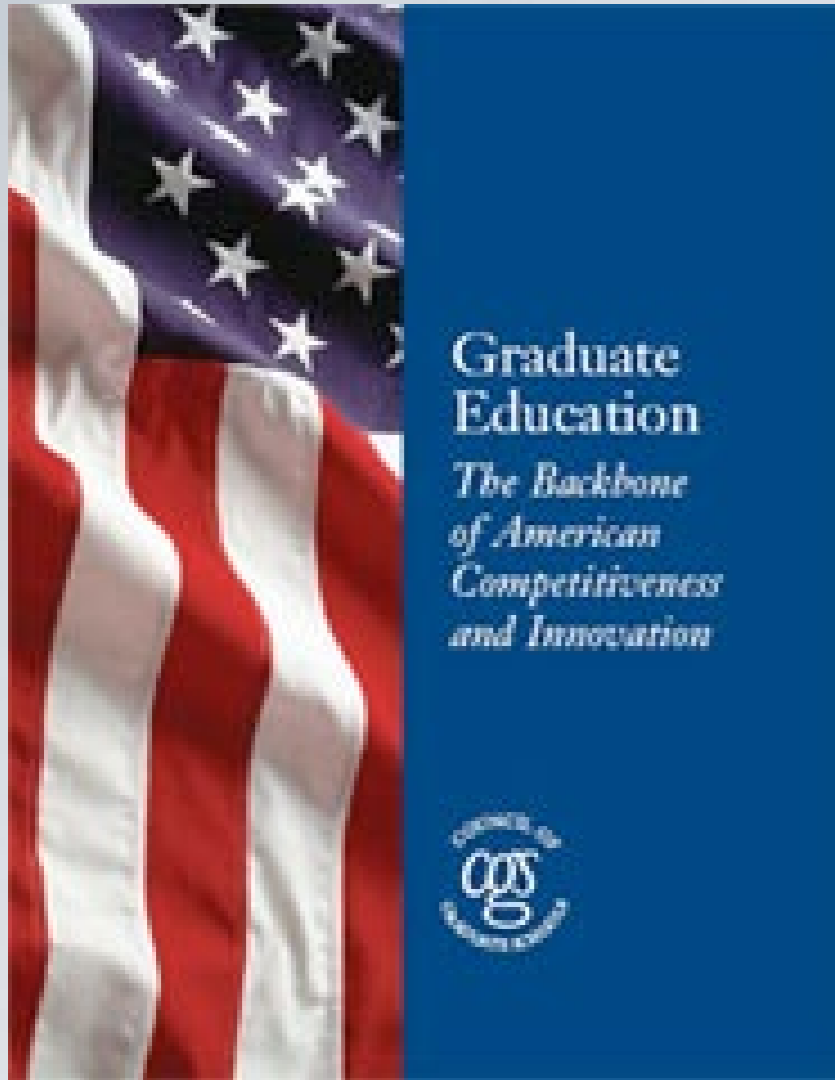
# Manufacturing & Technology



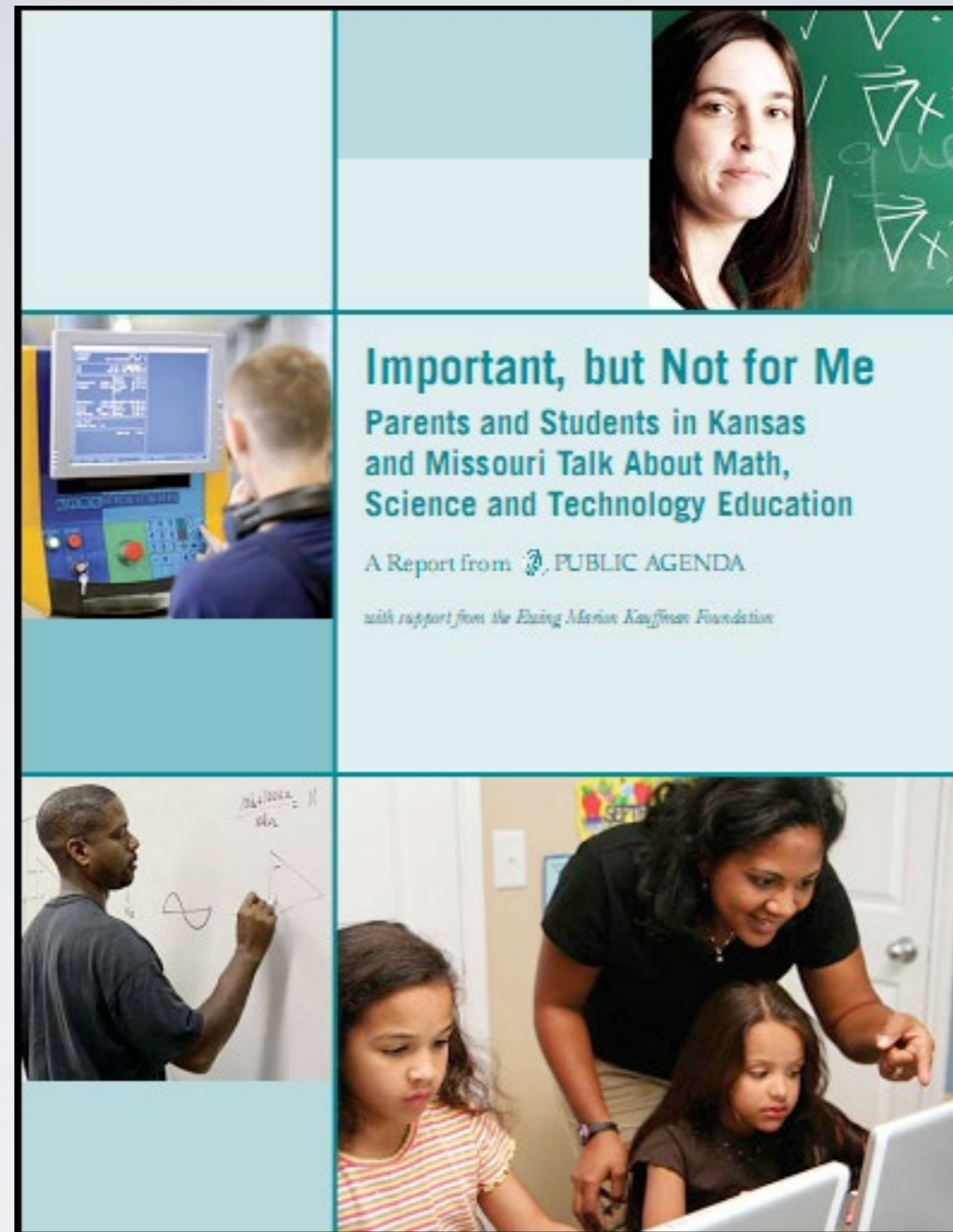
# Financial, Retail & Housing Markets



# Innovation Required For Economic Growth



Innovation Requires a Strong  
STEM Workforce



# Big Problem: Lack of Household Participation



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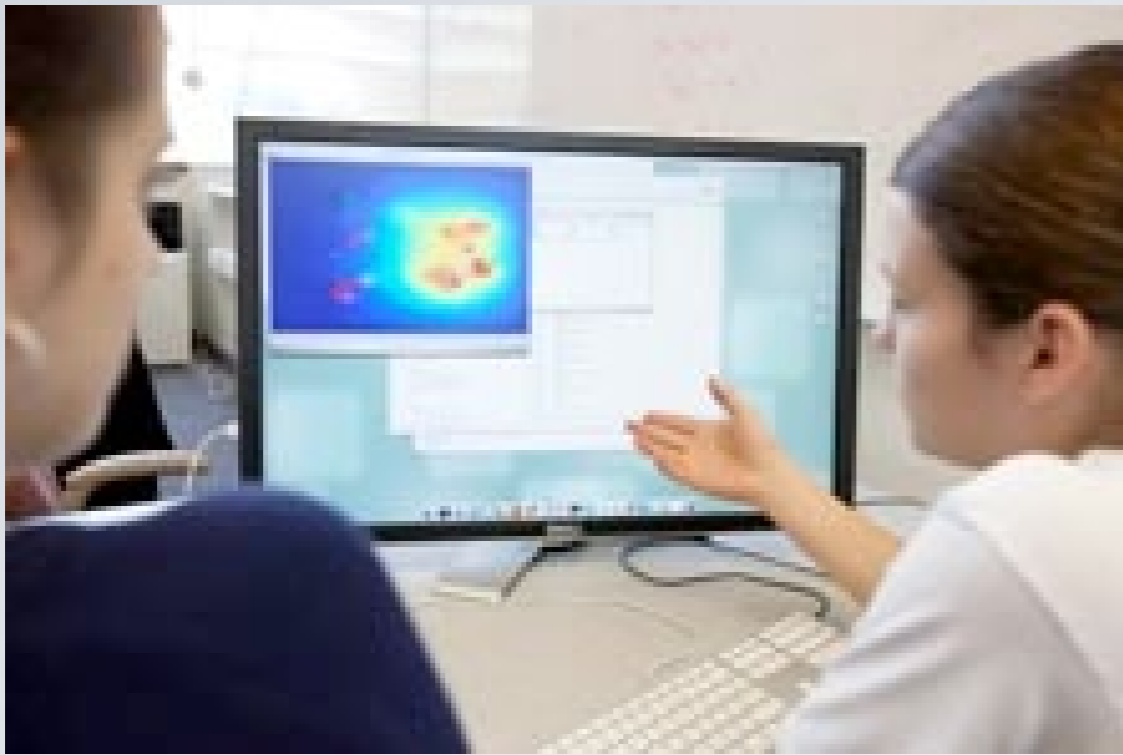
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## The National Science & Mathematics Access to Retain Talent Grant (National SMART Grant)

The National Science and Mathematics Access to Retain Talent Grant, also known as the National Smart Grant is available during the third and fourth years of undergraduate study (or fifth year of a five-year program) to at least

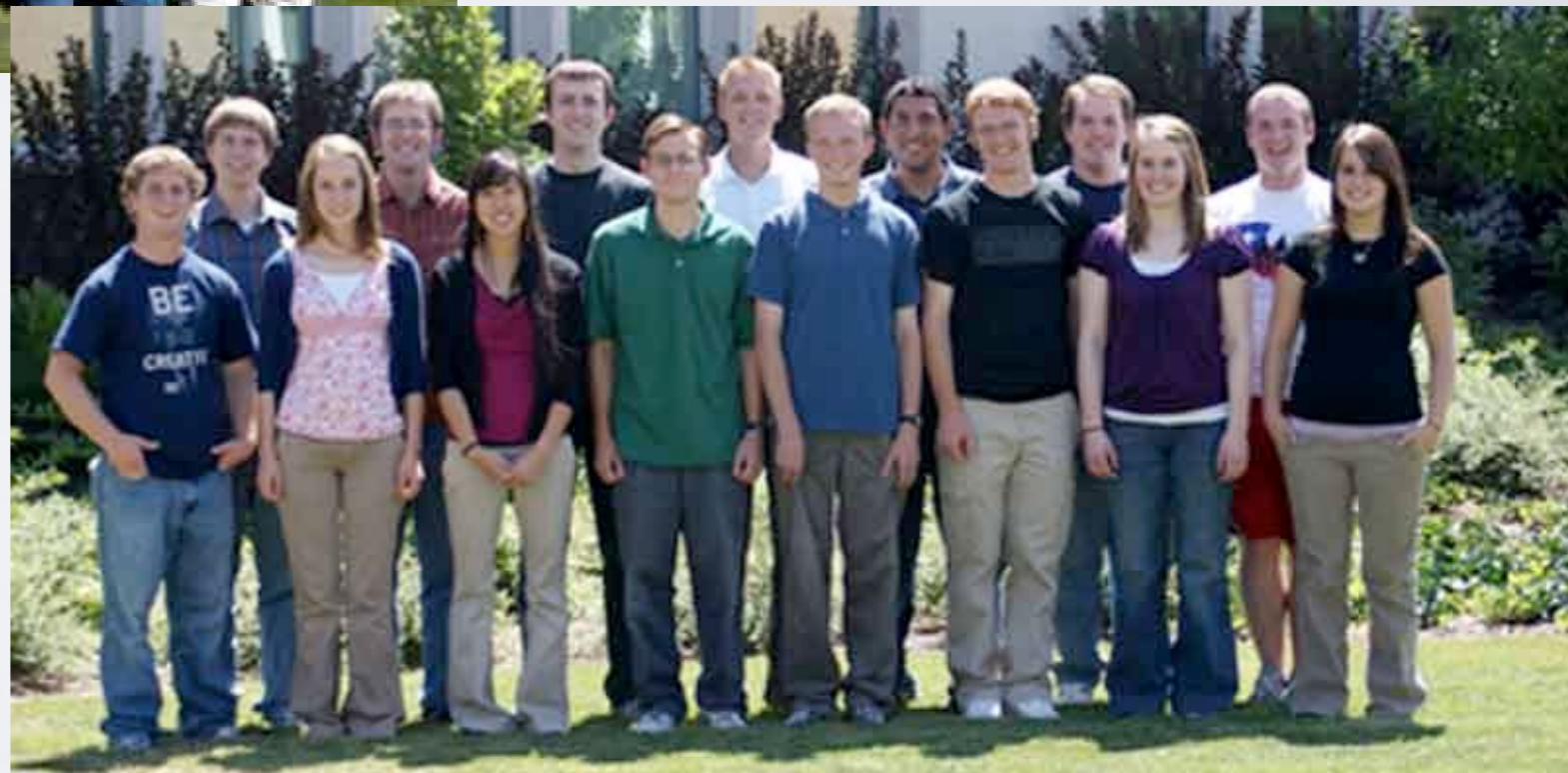
# Government Stimulating Growth in STEM Fields



# Need New Models for Research & Education

# IMPACT

Interdisciplinary Mentoring Program in Analysis, Computation,  
and Theory



# PERSONNEL

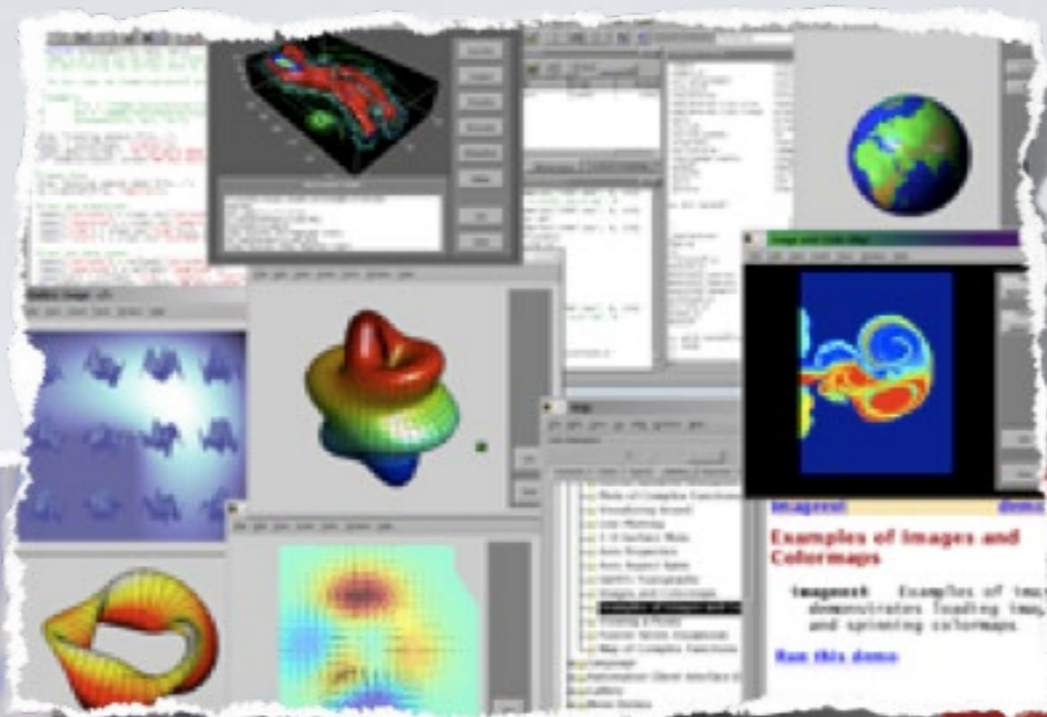
- 9 Faculty Mentors
- 7 Graduate Students
- 21 Undergraduates
- 11 Alumni (9 Ph.D students, 1 Medical School, 1 Workforce)
- 14 Members on Advisory Board



Computation

Analysis

Theory



Intellectual Core

Attract & Retain students into the mathematical sciences through:

- Interdisciplinary Research
- Modernized Curriculum
- Socialization and Team Building
- Industrial Cooperation



# Program Vision

- Summer Program (Bootcamp)
- Research During the School Year
- Spring Immersion



# CSUMS Program Schedule

## Linear Algebra Review

Inner Product Spaces

Spectral Theory

## Probability &

## Statistics

Introduction to Prob

Multivariate Stats

Bayesian Statistics

Regression

Time Series Analysis

HMM

## Optimization

Convex Analysis

Optimization

Adv. Least Squares

Unconstrained Opt.

Constrained Opt.

Optimal Control

## Signals and Systems

Signal Processing

Dynamical Systems

Control Theory

# Summer Topics



Linear Algebra  
Orthogonality, Fourier Coefficients  
Projections and Least Squares  
Singular-Value Decomposition (SVD)  
The Contraction Mapping Principle  
Newton's Method and Variants  
Inverse and Implicit Function Theorems  
Convex Analysis  
Jensen's Inequality  
Convex Optimization

Recurring Themes



- Principal Component Analysis
- Factor Analysis
- Latent Semantic Analysis
- Conjoint Analysis
- Hotelling Transforms
- Empirical Mode Decomposition
- Empirical Orthogonal Decomposition
- Proper Orthogonal Decomposition
- Karhunen-Loève Expansion
- Eigenfaces

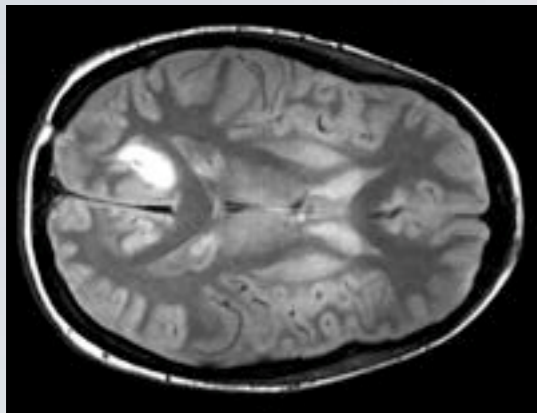


# SVD FAMILY

- Unconstrained Optimization
- Interior-Point methods
- Many Numerical Methods in Linear Algebra
- Many Numerical Methods in Differential Equations
- Proofs to Inverse and Implicit Function Theorems
- Existence and Uniqueness of ODEs
- Kalman filter; Recursive Least Squares
- Many/Most Results in Nonlinear Analysis

# Newton's Method and the Contraction Mapping Principle





- Actuarial, Investment, & Management Sciences
- Functional Data Analysis
- Mathematical Systems & Optimization
- Nonlinear Waves & Coherent Structures
- Computational Biology and Bioinformatics

# 2009-2010 Programs





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