Mississippi EPSCoR

2008 Education/Outreach

Giselle Thibaudeau
Mississippi State University

MS EPSCoR Education/Outreach Team

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Grow the pipeline in science, technology, engineering and mathematics (STEM)

- **Provide pathways for students in the computational sciences (K – graduate school)**
- **Expand existing and develop new program components that include University partnerships**
- **Recruit and retain promising students in computational majors**

Research as key to address challenges

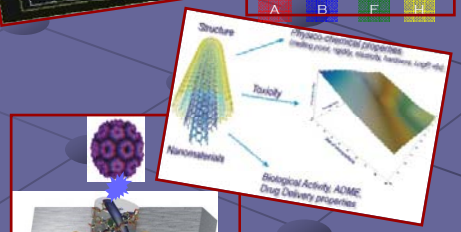
Computational Biology

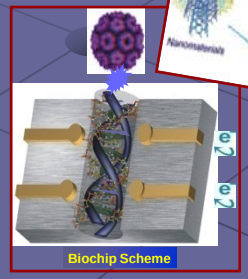
Data integration

Gene ontology @ http://www.agbase.msstate.edu/

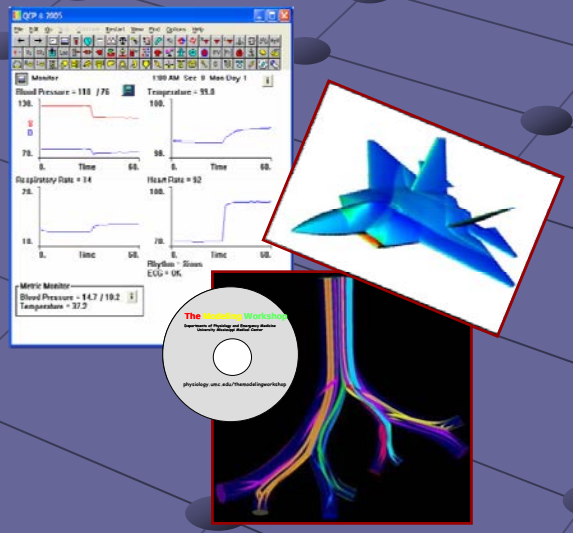
Functionally annotated genome

Computational Chemistry





Computational Modeling



Approach

- Content Knowledge Survey
- Summer Teacher Enhancement Workshops
- Curricular Materials (High School and College)
- Identify Educatiuon and Career Pathways
- Undergraduate Research

Computational Science Content Knowledge Survey

- → **Discussed by Education and Evaluation Teams**
  - →→ **researcher input was requested**
- → **Designed by Evaluation Team Spring 2008**
- → **Implemented Fall 2007 & 2008**
  - → **Analysis Presented in Evaluation Report 2008**
  - → **Request to Continue Data Collection post EPSCoR funding**

Bioinformatics for High School and College Instructors
June 2008

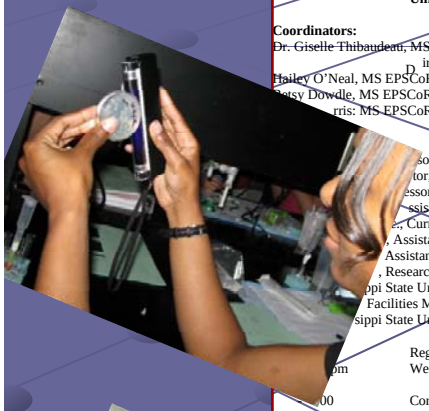
Where: Mississippi State University

Duration: 4 days (residential)

Contributors: JSU, MSU, UM, USM, BioRad

Participants included:

- 1 middle school teacher
- 22 high school teachers
- 3 community college instructors
- 3 university faculty members
- 1 graduate student



Bioinformatics for College and High School Instructors 2008
National Science Foundation EPSCoR 05-589
Jackson State University, University of Southern Mississippi,
University of Mississippi, Mississippi State University

Coordinators:
Dr. Giselle Thibaudeau, MS EPSCoR Education/Outreach Coordinator;
irector, Electron Microscope Center, Mississippi State University
Hailey O'Neal, MS EPSCoR Education/Outreach Planning Team, Mississippi State University
Patsy Dowdle, MS EPSCoR Education/Outreach Planning Team, Mississippi State University
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ssistant Professor of Biology, Jackson State University
, Curriculum and Training Specialist, Bio-Rad Laboratories
, Assistant Professor, CVM Basic Science Department, Mississippi State University
Assistant Research Professor, Mississippi State University
, Research Associate, Life Sciences and Biotechnology Institute,
ppi State University
Facilities Manager, Life Sciences and Biotechnology Institute,
sippi State University

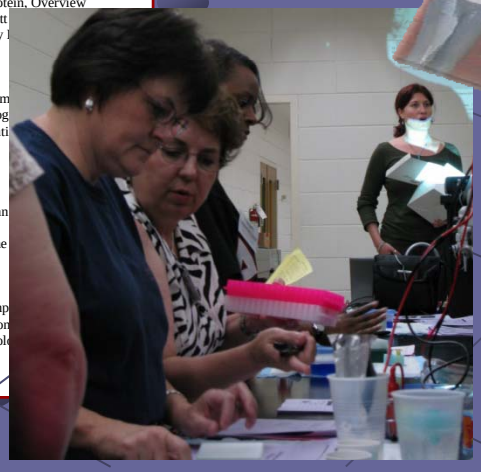
Monday
Registration @ Hunter Henry
pm Welcome Dinner/Orientation: **Drs. Giselle Thibaudeau & Susan Bridges**

Tuesday, June 3, 2008
00 Computer Lab (105): **Dr. Susan Bridges**: DNA → Protein, Overview
10:00-10:45 Lab (245): Intro to lab, protocol, safety; Genes in a Bott
11:00-12:30 Lecture (107): **Ms. Juliet Tang**: How Scientists Study
12:30-1:30 Lunch
1:30-4:30 Lab (245): pGLO Transformation Kit

Wednesday, June 4
Computer Lab (105): **Dr. Raphael Isokpehi**: Bioinform
Analysis Software. Sequence Formats/Conversion Prog
omputer Lab (105): **Dr. Sherry Herron**: Bioinformati
nome Project Module
unch
Lab (245): pGLO results; GFP Purification

Thursday, June 5
Lecture (107): **Dr. Robert Hester**: Modeling of Human
Tour LSBI
Joint Lecture (107): **Ms. Juliet Tang**: Analysis of Gene
Lunch
Lab (245): PCR and Crime Scene Investigation

Friday, June 6
Computer Lab (105): **Dr. Fiona McCarthy**: Blast samp
Lab (245): View results from Crime Scene Investigation
Computer Lab (105): **Dr. Bindu Nanduri**: Mining Biol
0 Lunch
Tour Vet School and HPC2
15 Post-Test and Evaluation (107)



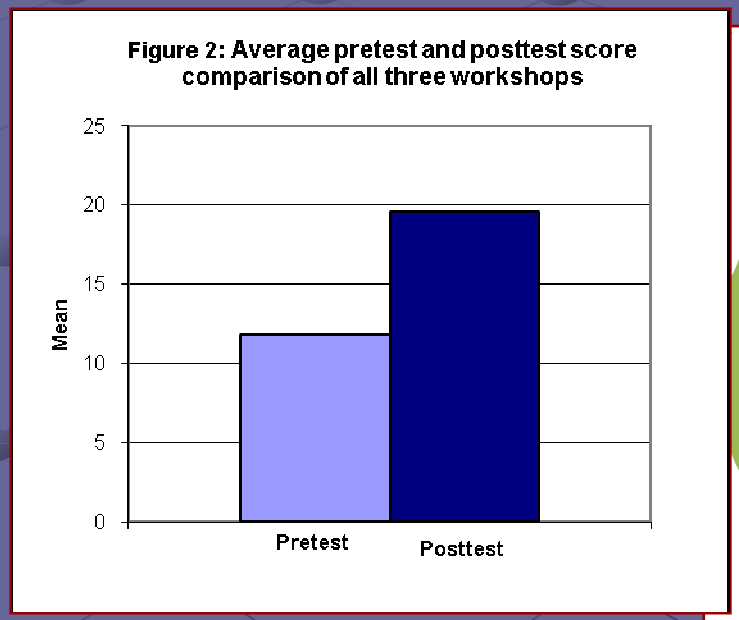
(25) Under-represented

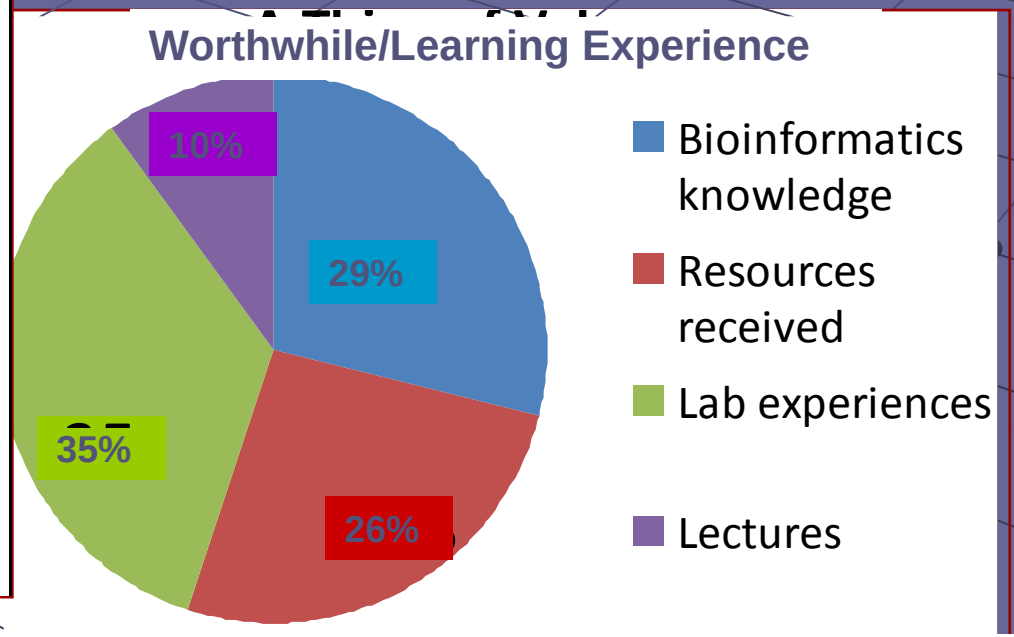
CEUs & Graduate Credit

Bioinformatics for High School and College Instructors

June 2008 Results

- 25/30 from underrepresented groups
- CEUs or Graduate Credit received
- Staff Development Seminars to Colleagues
- Posttest scores → Increase content test
- Bioinformatics Workshop Manual (Guide) for Teachers
- Development and Presentation of Promotion of Bioinformatics Workshop (by teachers)
- Presentations at Mississippi Science Teachers Association (by teachers





Bioinformatics for High School and College Instructors June 2009

Where: Mississippi State University

Duration: 4 days (residential)

Contributors: JSU, MSU, UM, USM, BioRad

Bioinformatics for College and High School Instructors 2009
National Science Foundation EPSCoR 05-589
JSU, MSU, UM, USM

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Director, Electron Microscope Center, Mississippi State University
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Contributors:
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Dr. Sherry Herron, Director, Center for Science & Mathematics,
University of Southern Mississippi
Dr. Robert Hester, Professor of Physiology, University of Mississippi Medical Center
Dr. Raphael Isokpehi, Assistant Professor of Biology, Jackson State University
Ms. Essy Levy, M. Sc., Curriculum and Training Specialist, Bio-Rad Laboratories
Dr. Fiona McCarthy, Assistant Professor, CVM Basic Science Department,
Mississippi State University
Dr. Bindu Nanduri, Assistant Research Professor, Mississippi State University
Dr. Andy Perkins, Assistant Professor, Mississippi State University

Monday, June 15, 2009

6:30-8:00 pm	Welcome Dinner/Orientation: Drs. Giselle Thibaudeau & Susan Bridges

Tuesday, June 16, 2009

8:30-9:00	Dr. Sherry Herron: Lesson Plan Overview/ Refresher with Follow-Up workshop participants
9:00-10:30	Computer Lab : Dr. Susan Bridges: DNA → Protein, Overview of Bioinformatics/ Computational Science
10:30-11:15	Lab : Essy Levy: Intro to lab, protocol, safety Genes in a Bottle
11:30-12:30	Lecture: Dr. Andy Perkins: Phylogenetics Analysis
12:30-1:30	Lunch
1:30-4:15	Lab: Essy Levy: PV 92
4:15-5:00	Daily Reflection and Small Group time

Wednesday, June 17

8:00-9:30	Computer Lab: Dr. Raphael Isokpehi: Bioinformatic Language: Sequence Analysis Software. Sequence Formats and Conversion Programs
9:45-11:45	Computer Lab: Dr. Sherry Herron: Bioinformatics and the Human Genome Project Module
11:45-1:00	Lunch
1:00-4:15	Lab : PV92 Results PGlo Transformation Kit
4:15-5:00	Daily Reflection and Small Group Time

Thursday, June 18

8:00-9:30	Lecture: Dr. Robert Hester: Mathematical Modeling of Human Physiology
11:00-12:30	Ken Pendarvis: Analysis of Gene Expression.
12:30-1:30	Lunch
1:30-4:15	Lab: PGlo Extension, Column Chromotography, and Protein Gel
4:15-5:00	Daily Reflection and Small Group time

Friday, June 19

8:00-9:30	Computer Lab: Dr. Fiona McCarthy: Blast sample gene/protein lists 9:30-10:00 Computer Lab: Dr. Sherry Herron: Bioserve
10:15-11:45	Computer Lab: Dr. Bindu Nanduri: Mining Biological Information
11:45-3:00	Lunch , Lesson Plan Presentations, Closing

Applicants include:

middle school teachers
high school teachers
community college instructors
university faculty members
graduate students

from across the state

Bioinformatics for High School Teachers and College Instructors
Follow-up Workshop June 2009

Where: Mississippi State University

Duration: 1.5 days (residential)

Materials: Follow-up Lecture/Lab/Lesson Plan Development

Participants include:

16 Participants from 2008

Products Resulting from Effort

manual/guide for teachers
bioinformatics tool kit
plan and materials for loaner lab

Computational Science Demos (Modules)

- ***Implementation of demo continues***

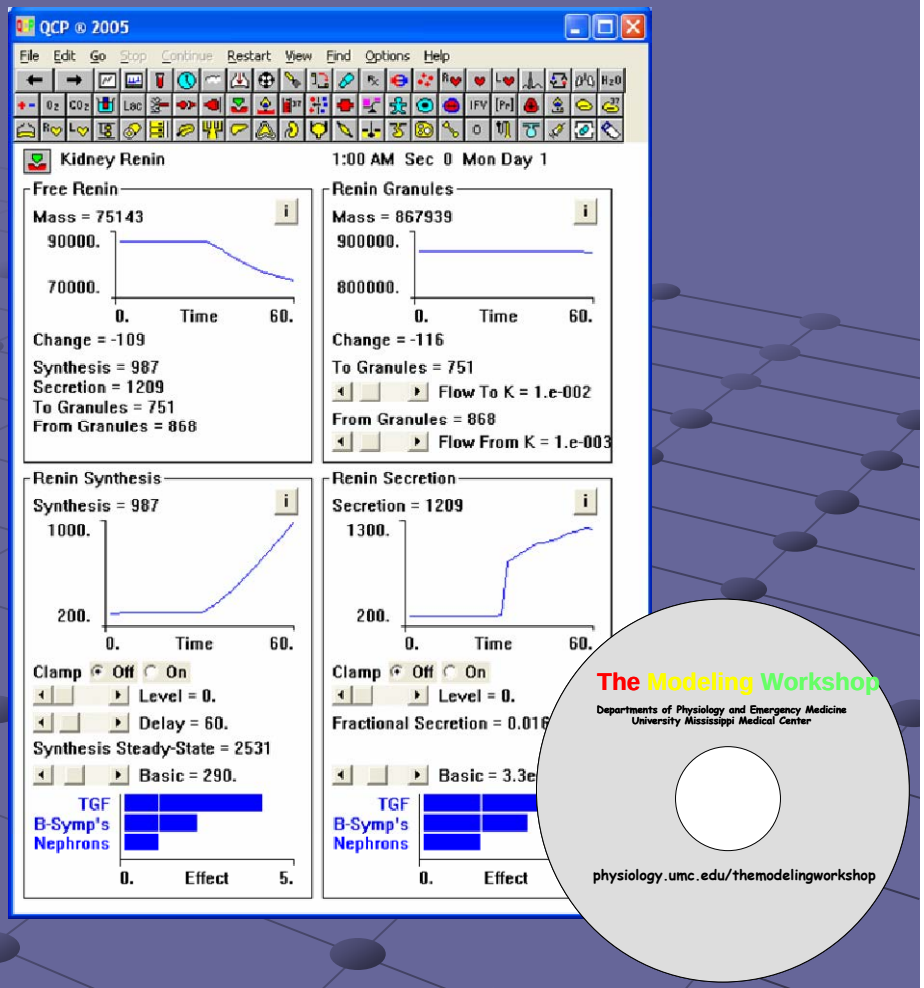
  → **Computational Modeling**

- ***Development of demos (07/08)***

  → **Computational Chemistry**

http://comp.chem.olemiss.edu/webmo

  → **Computational Biology**



A MULTILEVEL, INTEGRATIVE MODEL OF HUMAN PHYSIOLOGY
developed by
T Coleman, R Summers, R Hester (UMMC)

Curricular Pathway

- Courses at each MRC institution that could be used toward a Computational Science degree or certificate were identified *(completed 2007)*

- Courses that could be shared at each (all) other MRC institutions were identified
(discuss implemetation 2007)

- Computational Science curricular map was created *(complete; see detailed maps; new courses developed; bring to MRC/IHL)*

- New Courses in Computational Science have been developed

New Courses that Support Computational Science Efforts Across MRC Institutions

MSU

Computational Biology
Essentials of Molecular Genetics
Bio-computing
Modeling Functional Genomics Datasets

USM

Essential Bioinformatics
Perl Programming for Bioinformatics
Statistical Analysis of Microarray Data

JSU

Molecular Quantum Mechanics.
College Teaching in Chemistry.

UM

Medicinal Chemistry of Therapeutic Agents I
Advanced Medicinal Chemistry I
Drug Action and Design I
Drug Action and Design II
Medicinal Chemistry Research Methodology

EPSCoR-funded Undergraduate Researchers
Summer 2008 & Academic year 2008/2009

EPSCoR Ed-funded summer undergraduate researchers

MSU – MSU EPSCoR Ed funded (7)
UM – UM EPSCoR Ed funded (4 + 1 faculty from HBCU)

EPSCoR Ed-funded undergraduate researcher scholarship recipients

MSU – MSU EPSCoR Ed funded (10)
UM – UM EPSCoR Ed funded (8)

>50% from under-represented groups
All present work at University, regional, and/or national meeting
Many continue research throughout academic year and beyond

EPSCoR Ed-Funded Undergraduate Research
Examples from 2008

- ***Computational Biology***
  - Comparative analyses of gene expression/sequence similarity datasets
  - Spatial models of Cactoblastis cactorum spread in North America
  - Genomic analysis of Listeria testing the distributed-genome hypothesis
  - Inferring patterns of microsatellite evolution from distribution and implied stability
  - DataMiner: annotation of microarrays to enable systems biology modeling.
- ***Computational Modeling* of Human Physiology**
  - Development of numerical algorithms for multi-phase bio-fluid flows
  - Physio-chemical properties of lung tissue: integration within simulations
  - Transport modeling of particle deposition and drug delivery in the lung
  - Coupling simulation with system-level physiological model
- ***Computational Chemistry***
  - Simulations of the interactions of polyamides with DNA
  - An ab initio investigation of a stereospecific aldol reaction
  - Design of a catalyst for an aldol reaction using computational chemistry

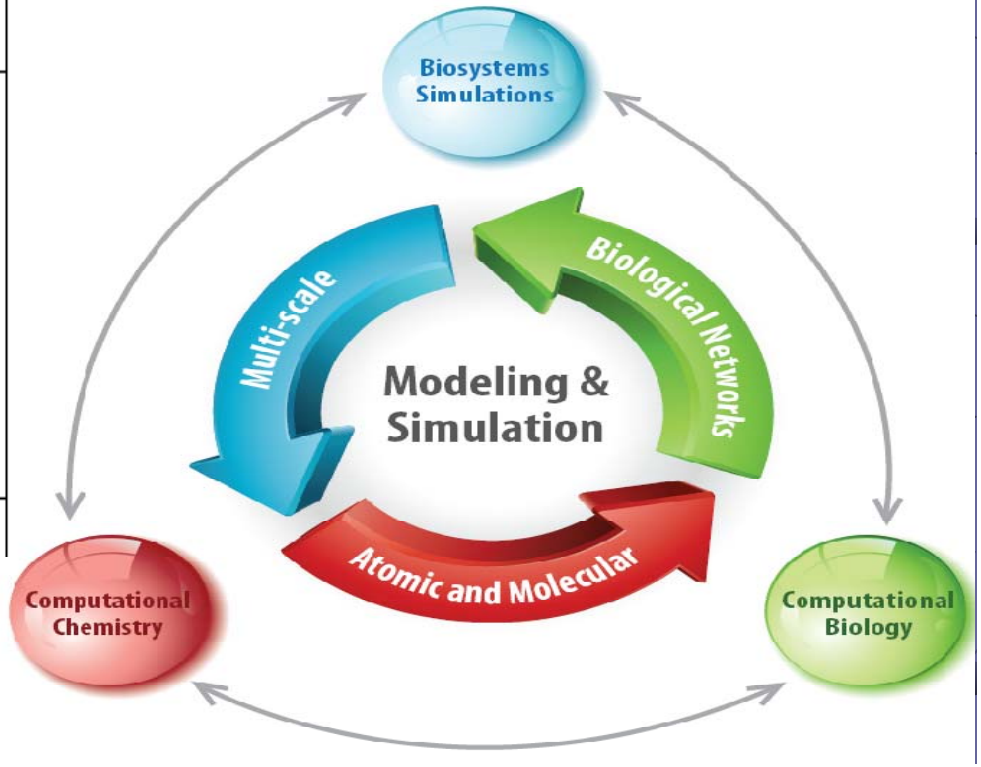
Summary (Ed/outreach)

- **Provide computational science pathways for K-12 students through increased teacher awareness**
- **Provide computational science pathways for undergraduate students**
- **Recruit and retain promising students in computational majors (undergraduate to graduate degrees)**
- **Expand existing and develop new program components that include University partnerships (Research, Education, and Outreach efforts all led to tangible collaboration and products)**
- **Products of effort include manual/guide for bioinformatics workshop, undergraduate curriculum enhancements, bioinformatics/biotechnology loaner lab for K-16**

MS EPSCoR

Innovation in Computational Sciences

Peer Reviewed Articles	152
Books	20
Presentations	127
Theses/Dissertations	20
Copyrights/Patent Applications	5 Copyrights/5 Patent apps
Faculty CAREER Awards	1 awarded/1 pending
Faculty Recruited	7
Faculty Promoted	8
K-12 Teachers Trained	70
K-12 Students Impacted	3,000
Professional Development Workshops (K-16)	8
Graduate Students Supported	93
Undergraduate Students Supported	58
Proposals	129
Awarded	$25,446,488
Pending	$17,419,955



MS EPSCoR

Innovation in Computational Sciences

- from nowhere (not quite nothing)
- to growing strength of individuals & teams
- to growing strength in clusters
- to true Statewide network of collaborations & innovation

Growth from research strengths and collaboration

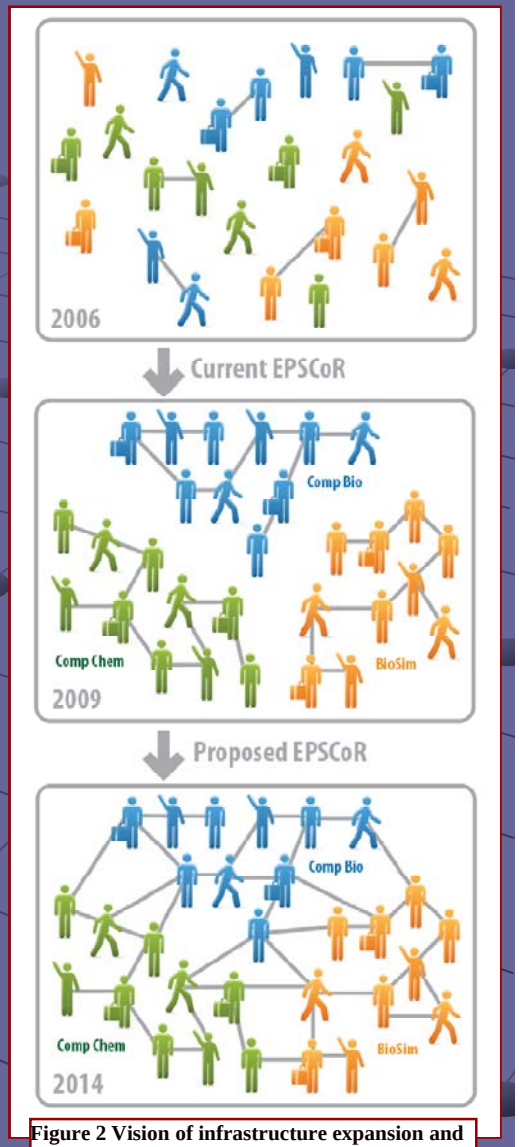


Figure 2 Vision of infrastructure expansion and integration.

Questions and Discussion

Outreach from JSU

- 12 Workshops (482 STEM Teachers)
- School Visits (500 6th Grade Students)
- STEM Research Tour (200 6th Grade Students)
- Careers in STEM Workshop (15 Students)
- NASA/ERC Education Booth at Regional Science Fair (1500 Students)