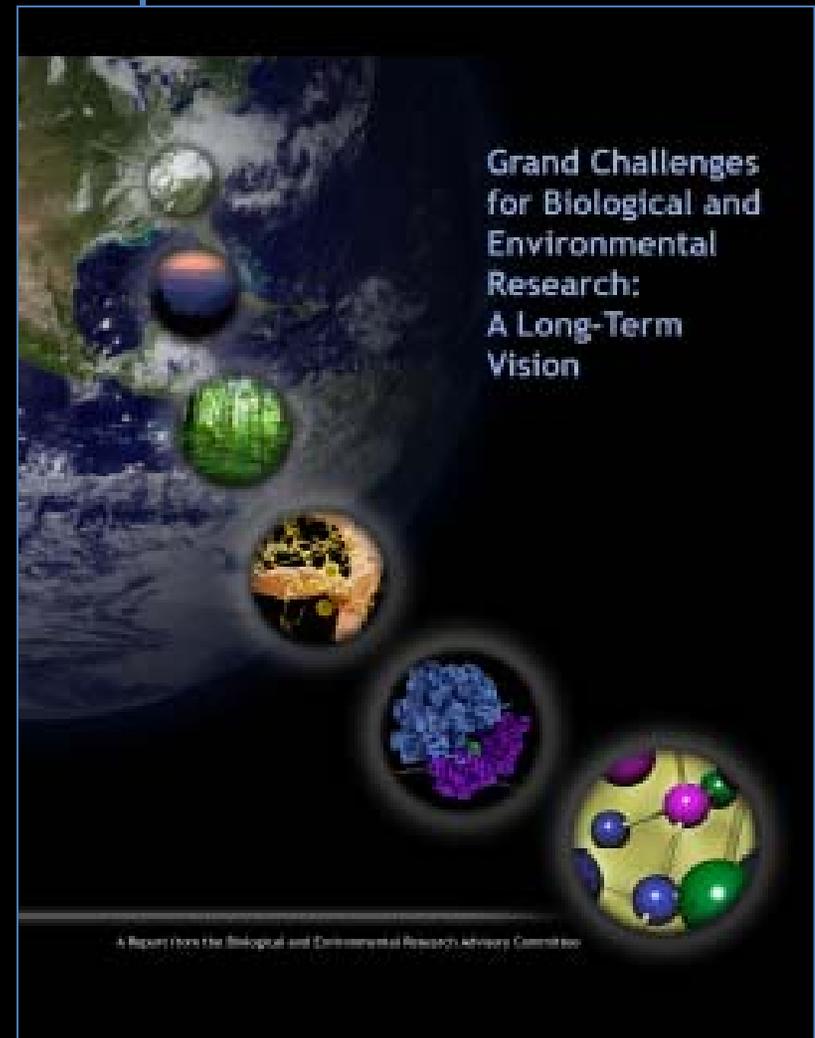


Grand Challenges for Biological and Environmental Research: A Long- Term Vision

Overview of the Report from the
March 2010 Workshop



Workshop Development and Planning



2010 Workshop Development and Planning

Charge letter from William Brinkman, DOE Office of Science Director, dated September 29, 2009

- Look beyond near- to mid-term time horizons to coming decades
- Key workshop goals:
 - Identify greatest scientific challenges in biology, climate, and environment that DOE will be facing
 - Describe how BER should be positioned to address these challenges
 - Determine new and innovative tools needed to advance BER science
 - Suggest how to train the future workforce in integrative system science
- Series of conference calls with BERAC planning committee
- 4 white papers:
 - Grand Challenges for Systems Biology
 - Systems Integration Framework of Informational and Synthetic Biology
 - Twenty Year Vision for Climate Change
 - Systems Sustainability for Energy Options



Four subcommittees were formulated, each chaired by a BERAC member who also served on the overall planning committee. These subcommittees had other non-BERAC members to insure broad, expert coverage of the four topical areas. These subcommittees developed the white papers that were used as the foundation for the subsequent workshop.

Climate/Carbon (Dave Randall, chair)

Systems Biology (G. Stacey, chair)

**Information and Synthetic
Biology Systems Integration
Framework – (Gary Sayler,
Chair)**

**Research Framework for
Energy Sustainability. –
(Margaret Riley, Chair)**

Workshop Development and Planning

Workshop held March 3-4, 2010

- Four disciplinary breakout discussion groups
 - Systems Biology
 - Information and Synthetic Biology Systems Integration Framework
 - Climate Change
 - Research Framework for Energy Sustainability
- Four interdisciplinary breakout discussion groups
 - Understanding Systems Across Temporal and Spatial Scales
 - Meeting Workforce and Education Needs
 - Data Integration and Knowledgebase Development
 - Novel Tools, Techniques, and Probes



BERAC Workshop: “Grand Research Challenges to Set BER’s Long-Term Scientific Vision”

Meeting Agenda:

March 2: arrivals

March 3: 30 min plenary presentations:

Chris Field, Climate and Life
Richard Murray, Synthetic Biology
Virginia Dale, Sustainability
David Hill, Systems Biology

Lunch

Break-out groups:

Climate Change - Chaired by David Randall

Systems Biology - Chaired by Gary Stacey.

Information and Synthetic Biology Systems Integration framework - Chaired by Gary Saylor

Research Framework for Energy Sustainability.- Chaired by Peg Riley

March 4: Remarks by Undersecretary Steve Koonin

30 min plenary presentations:

Leroy Hood, The Future of Systems Biology

Isaac Held, Climate Dynamics

Doug Landis, Sustainability

Break-out groups:

Understanding Systems Across Temporal (milliseconds to millennia) and Spatial Scales (microns to ecosystems) - Chaired by Greg Pestko

Meeting the Workforce and Education Needs to Address the Grand Challenges – Chaired by Jo Handelsman

Data Integration and Knowledgebase Development - Chaired by Bob Cottingham

Novel Tools, Techniques, and Probes - Chaired by Joe Ecker

March 4-5: Writing committee prepares draft report

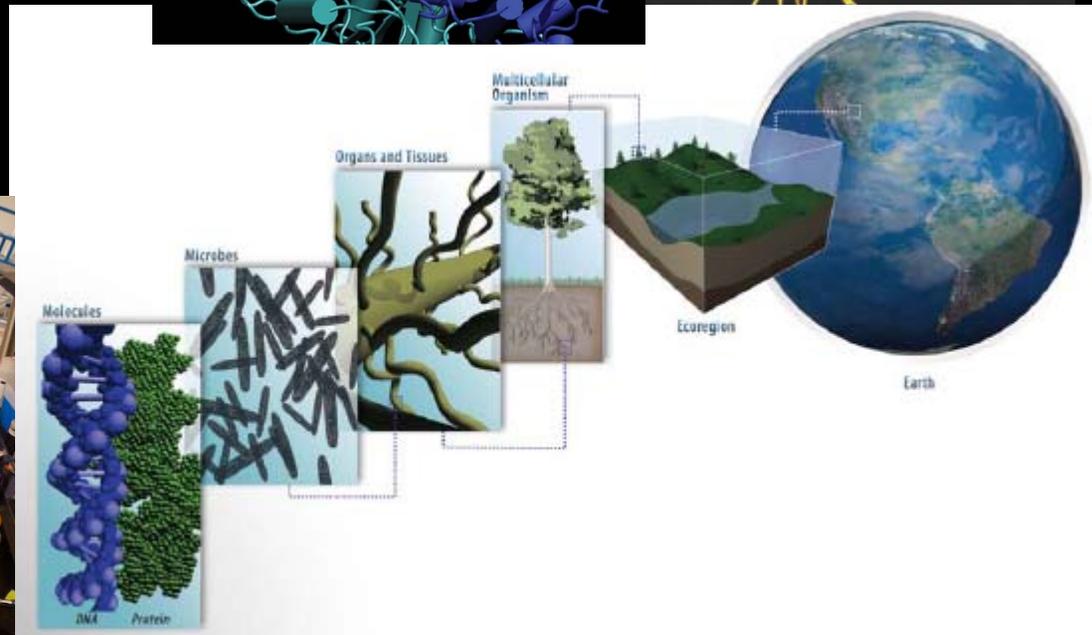
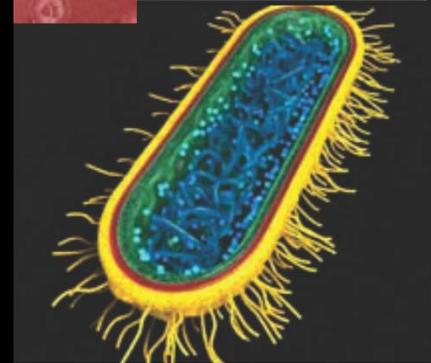
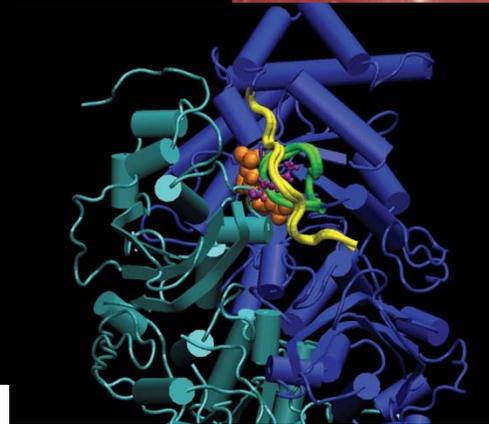
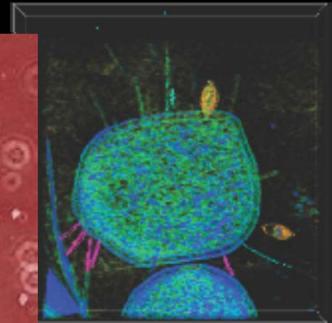
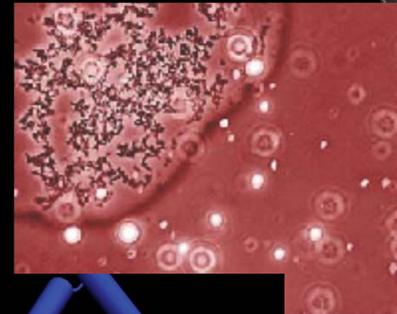
Workshop Results



Workshop Results

Cross-Cutting Themes

- Complexity
- Scales
- Multidisciplinary research
- Computing and mathematics
- Education
- Human impacts



Workshop Results

Grand Challenges



- **Biological Systems**

- Systems biology provides the approaches needed to address biological complexity, while synthetic biology tests this understanding through application.

- **Computational Bioscience**

- Biology is becoming a data-intensive, informational science that requires new paradigms to deal with data management and complexity.

- **Climate Research**

- Issues of climate change and sustainability require that we develop a better understanding of earth system processes.

- **Energy Sustainability**

- An essential component of energy sustainability is fundamental knowledge of relevant natural and physical processes, their interactions and human influences.

- **Education and Workforce Training**

- The imperative need is to educate our future workforce to think about properties of whole systems, which rarely can be explained as an accumulation of parts.

New Bioimaging Technologies for Plant and Microbial Systems

U.S. DEPARTMENT OF **ENERGY** Office of Science
Office of Biological and Environmental Research

WORKING GROUP ON VIRTUAL DATA INTEGRATION

A REPORT FROM THE AUGUST 13-14, 2015, WORKSHOP | BETHESDA, MD

U.S. DEPARTMENT OF **ENERGY** Office of Science
Office of Biological and Environmental Research

BER Molecular Science Challenges

Workshop Report

Atmosphere Oceans Continents

Aquatic Basins Regions

Aquatic Biomes Terrestrial Biomes

Ecosystem Ecology, Watersheds, and Field Plots

Communities, Organisms, and Cells

Biobased Factories

Pathways and Networks

Proteins and Protein Machines

U.S. DEPARTMENT OF **ENERGY** Office of Science
Office of Biological and Environmental Research

Building Virtual Ecosystems: Computational Challenges for Mechanistic Modeling of Terrestrial Environments

Workshop Report

U.S. DEPARTMENT OF **ENERGY** Office of Science
Office of Biological and Environmental Research

Data-Model Needs for Belowground Ecology

Carbon & Nutrients

Water

Energy

A Summary Report from the Terrestrial Ecosystem Science (TES) Mini-Workshop
May 8, 2014

U.S. DEPARTMENT OF **ENERGY** Office of Science
Office of Biological and Environmental Research

Research for Sustainable Bioenergy: Linking Genomic and Ecosystem Sciences

Workshop Report

U.S. DEPARTMENT OF **ENERGY** Office of Science
Office of Biological and Environmental Research

Climate and Environmental Sciences Division

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

ATMOSPHERIC RADIATION MEASUREMENT CLIMATE RESEARCH FACILITY - ATMOSPHERIC SYSTEM RESEARCH HIGH-RESOLUTION MODELING WORKSHOP

U.S. DEPARTMENT OF **ENERGY** Office of Science

Research Priorities for Tropical Ecosystems Under Climate Change

Workshop Report

U.S. DEPARTMENT OF **ENERGY** Office of Science
Office of Biological and Environmental Research

2016-17 BERAC Long-Term Vision Project

Charge letter from DOE Office of Science Director, Dr. C.A. Murray, dated March 3, 2016. Specifically charges BERAC to address the following questions....

- To what extent has DOE BER successfully met, or positioned itself to meet, challenges outlined in the 2010 report that are within mission objectives of the Office of Science?
- To the extent that such predictions can be made, what are the greatest scientific challenges that DOE will be facing in the long term (20 year horizon) and for which of these should BER take primary responsibility?
- How should we position BER to address those challenges? For example, what continued or new disciplines of BER-relevant science are needed to achieve its future mission challenges?
- What new tools should be developed to integrate and analyze data from different disciplines, including the advancement of system science?
- What unique opportunities exist to partner with, or leverage assets from other programs within the Office of Science, or with other federal programs?
- What scientific and technical advances are needed to train the workforce of the future in integrative science, including complex system science?



Way forward.....

If we following the 2010 model, then....

1. Establish a workshop planning subcommittee that represents the breadth of BER science and BERAC expertise.
2. Identify key scientific drivers relevant to the charge.
3. Establish subcommittees to address these scientific drivers and to deliver concise white papers laying out the opportunities, challenges and approaches. These subcommittees will be chaired by BERAC members but will include other members drawn from the pertinent scientific communities.
4. Invite members to attend a workshop to discuss the specific questions within the charge using the white papers as an initial basis for discussion.
5. Establish a writing committee that will take the results of the subcommittee and workshop discussions and convert this into a readable, informative "Grand Challenges Report"
6. Deliver this report to BERAC for final approval and submission to Dr. Murray's office **on or before Fall, 2017**.
7. Win another award!!!





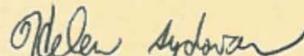
The STCWDC-MB Chapter Presents

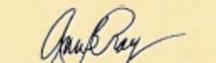
Gary Stacey
University of Missouri
with an

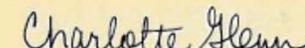
Award for Distinguished Technical Communication

in the 2011-2012 Summit Competition
for Technical Communication for the entry:

*Grand Challenges for Biological and Environmental Research:
A Long-Term Vision*


Judging Manager


Competition Manager


President

Kudos to Betty Mansfield and her fine team at ORNL.....