BER Advisory Committee (BERAC)
Fall 2024 Meeting

Biological and Environmental Research

October 24, 2024

Dorothy Koch

Associate Director, Office of Science

U.S. Department of **ENERGY** | **Office of Science**

Office of Science (SC) Statement of Commitment & Other Guidance

- **SC Statement of Commitment** – SC is fully and unconditionally committed to fostering safe, diverse, equitable, inclusive, and accessible work, research, and funding environments that value mutual respect and personal integrity.

  https://science.osti.gov/SW-DEI/SC-Statement-of-Commitment

- **Expectations for Professional Behaviors** – SC's expectations of all participants to positively contribute to a professional, inclusive meeting that fosters a safe and welcoming environment for conducting scientific business, as well as outlines behaviors that are unacceptable and potential ramifications for unprofessional behavior.

  https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies/Harassment

- **How to Address or Report Behaviors of Concern** – Process on how and who to report issues, including the distinction between reporting on unprofessional, disrespectful, or disruptive behaviors, and behaviors that constitute a violation of Federal civil rights statutes.

  https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies/How-to-Report-a-Complaint

- **Implicit Bias** – Be aware of implicit bias, understand its nature – everyone has them – and implicit bias if not mitigated can negatively impact the quality and inclusiveness of scientific discussions that contribute to a successful meeting.

  https://kirwaninstitute.osu.edu/article/understanding-implicit-bias
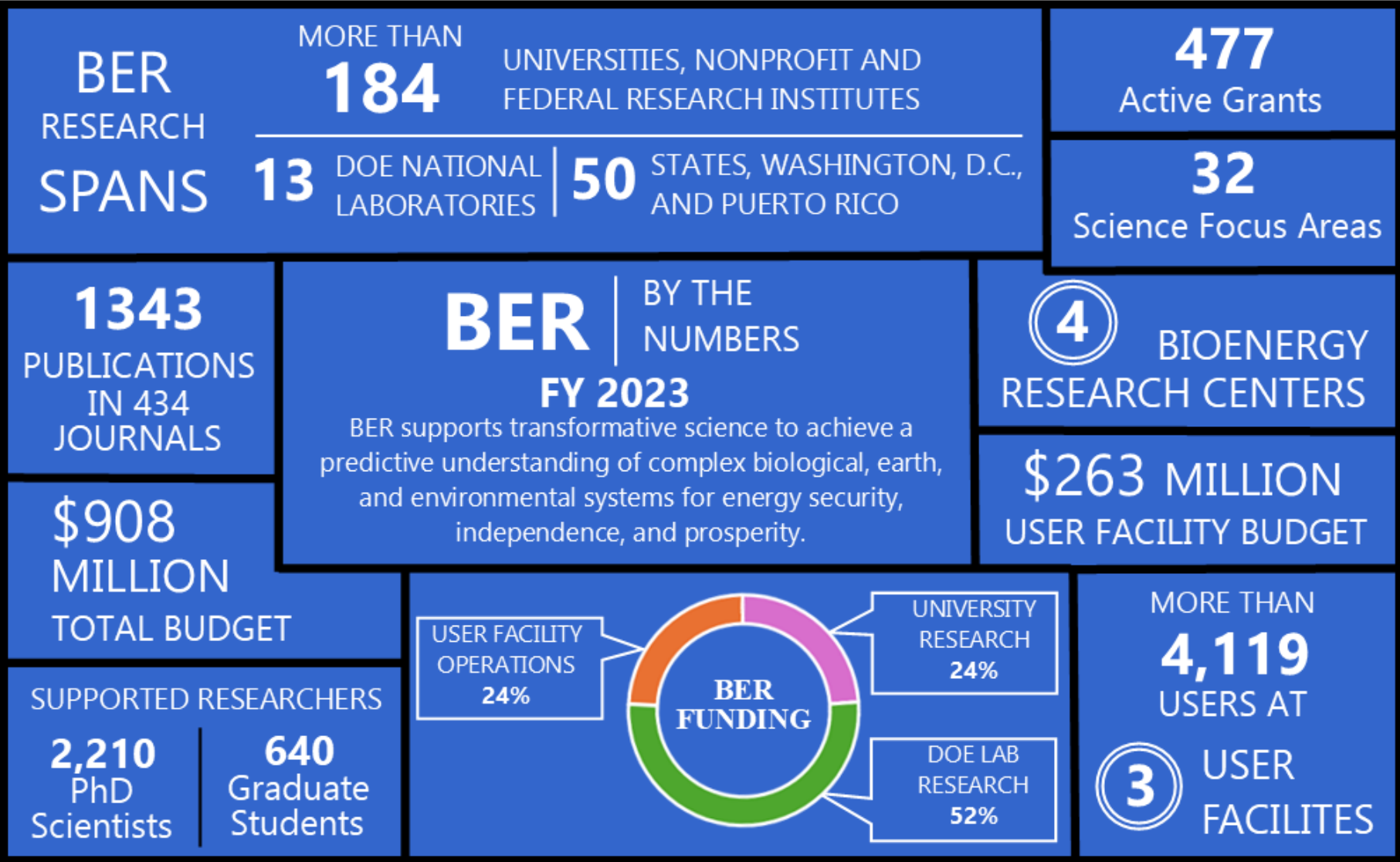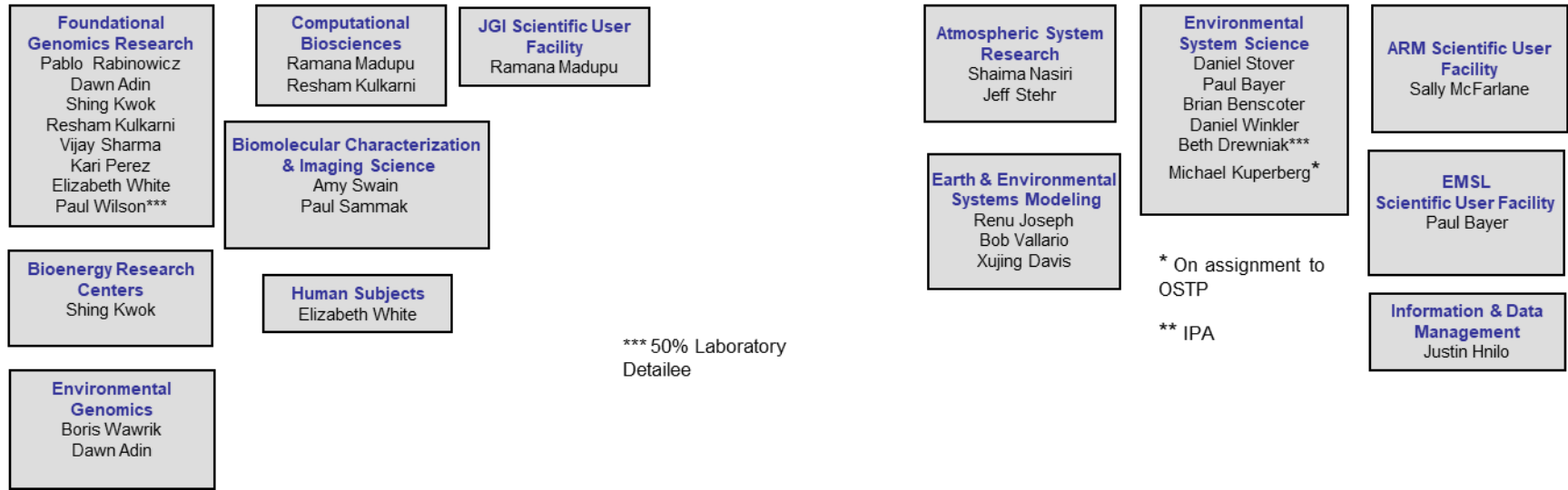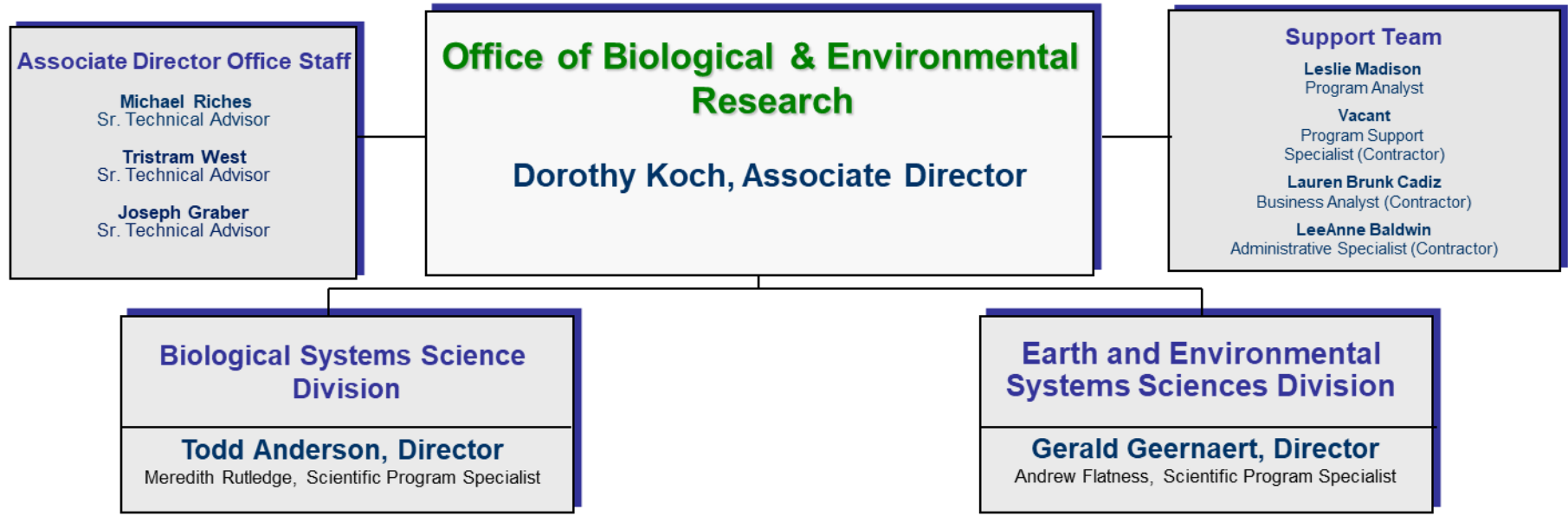
Biological and Environmental Research (BER)

Fundamental science for a predictive understanding of complex biological, Earth, and environmental systems to support clean energy and climate and biology innovation

BER – By The Numbers

BER RESEARCH SPANS

MORE THAN **184** UNIVERSITIES, NONPROFIT AND FEDERAL RESEARCH INSTITUTES

13 DOE NATIONAL LABORATORIES | **50** STATES, WASHINGTON, D.C., AND PUERTO RICO

477 Active Grants

32 Science Focus Areas

1343 PUBLICATIONS IN 434 JOURNALS

BER | BY THE NUMBERS

FY 2023

BER supports transformative science to achieve a predictive understanding of complex biological, earth, and environmental systems for energy security, independence, and prosperity.

4 BIOENERGY RESEARCH CENTERS

$263 MILLION USER FACILITY BUDGET

$908 MILLION TOTAL BUDGET

SUPPORTED RESEARCHERS

2,210 PhD Scientists | **640** Graduate Students

BER FUNDING

USER FACILITY OPERATIONS 24%

UNIVERSITY RESEARCH 24%

DOE LAB RESEARCH 52%

MORE THAN **4,119** USERS AT **3** USER FACILITES

Earth and Environmental Systems Sciences Research Drivers

➢ Design Earth system models that accurately reflect advanced scale-aware process representations of Earth system observations, incorporating physical, chemical, and biological modeling components?

➢ Understand cloud-aerosol-precipitation interactions, and their influence on the Earth's energy balance.

➢ Study terrestrial ecosystems, watersheds, urban and coastal systems and their resilience to climate-relevant changes and disturbance, with particular attention to disadvantaged communities?
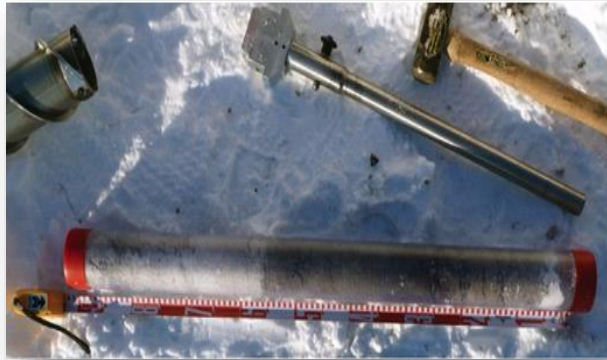
Biological Systems Sciences Research Drivers

➢ What information encoded in the genomes of plants and microorganisms describes their function?

➢ How do interactions among cells regulate the function of living systems?

➢ How do plants, microbes, and communities of organisms adapt and respond to changing environmental conditions?

➢ What organizing biological principles need to be understood to design and engineer new biological systems?
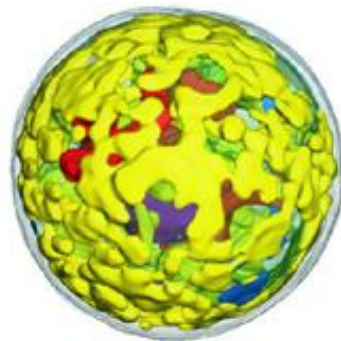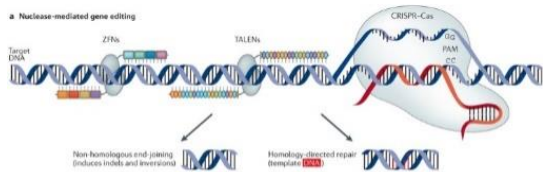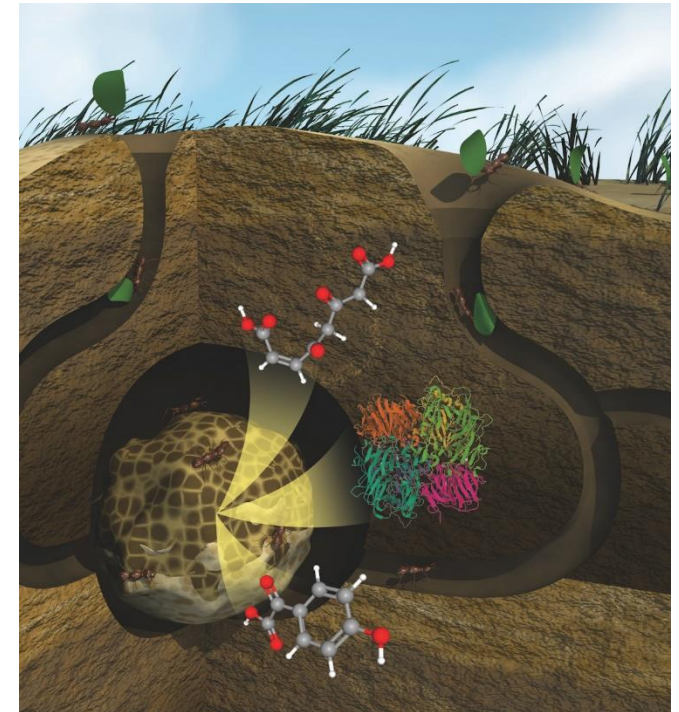
BER staff changes

Outgoing staff

Gil Bohrer
Program Manager
(OSU IPA)

Scott Collis
Program Manager
(ANL Detailee)

Kate Garmer
Business Analyst

Staff Transition

Lauren Brunk-Cadiz
Administrative Assistant to Business Analyst

Incoming staff

Daniel Winkler
Program Manager
Environmental System
Science

LeeAnne Baldwin
Administrative
Specialist

Paul Wilson
Program Manager
(PNNL Detailee)
Low Dose Radiation

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BERAC Researchers Recognized

Jorge Gonzalez-Cruz (University at Albany, SUNY)
American Meteorological Society, 2025 Helmut E. Landsberg Award
"for using modeling and observations to create societally significant contributions to our understanding of urban climate and land-use impacts in coastal California"

Rodrigo Vargas (University of Delaware)
2024 American Association for the Advancement of Science Fellow


Dev Niyogi (University of Texas at Austin)
2024 AGU Future Horizons in Climate Science – Turco Lectureship

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Dr. Warren Washington (1936 – 2024)

In memoriam

- Pioneer of climate modeling and sciences, including the use of parallelized codes, including DOE funded collaboration with DOE Labs on the Parallel Climate Model (PCI) project.

- NCAR Distinguished Scholar

- National Medal of Science (2009) "For his development and use of global climate models to understand climate and explain the role of human activities and natural processes in the climate system and for his work to support a diverse science and engineering workforce."

- BERAC member (1990's)

- DOE's NCAR Cooperative Agreement PI for many years

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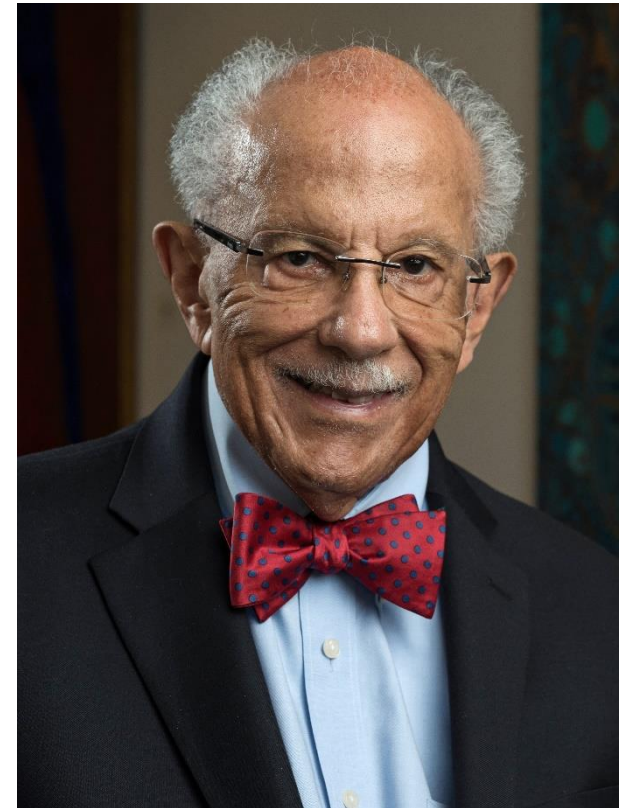
2024 Nobel Prize in Chemistry

The Nobel Prize in Chemistry 2024 was awarded with one half to David Baker "for computational protein design" and the other half jointly to Demis Hassabis and John M. Jumper "for protein structure prediction".

Demis Hassabis and John Jumper have successfully utilized artificial intelligence to predict the structure of almost all known proteins. David Baker has learned how to master life's building blocks and create entirely new proteins.

Professor David Baker
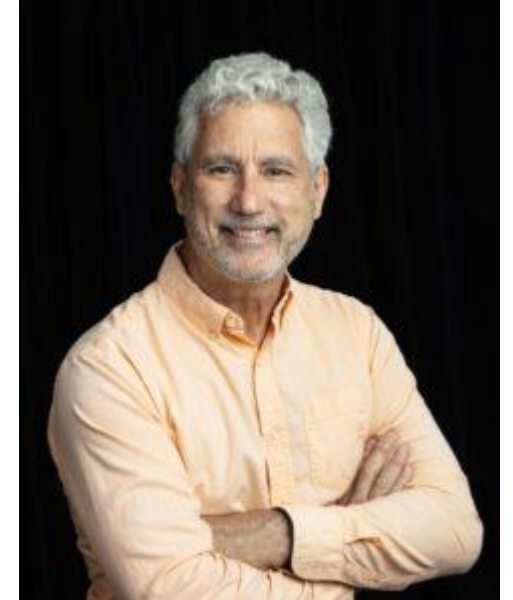
University of Washington

Use of DOE light sources (e.g. SIBYLS SAXS beamline), crystallography, BER's Integrated Data Analysis Technologies (IDAT), JGI and EMSL, high performance computing (NERSC and ALCF).

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BER Researchers Recognized

Gerald A. Tuskan Selected as 2024 Office of Science Distinguished Scientist Fellow for:

- foundational scientific advances in the development of resilient bioenergy feedstock crops;
- excellence in leading large, multi-institutional science teams toward a robust, sustainable bioeconomy; and
- supporting the next generation of diverse scientists.

Gerald A. Tuskan Lecture
Nov. 19, 2024, 1:30–3:00 PM ET

https://www.genomicscience.energy.gov/gerald-a-tuskan-selected-as-2024-office-of-science-distinguished-scientist-fellow/

BER Researchers Recognized

Fellows

American Association for the Advancement of Science

2023 AAAS Fellows

- Melinda Smith (Colorado State Univ.)
- Daniel Segrè (*Boston University), former BERAC member*
- Kirsten Hofmockel (PNNL)
- Trent Northen (LBNL)

American Geophysical Union

2024 AGU Fellows

- Deb Agarwal (LBNL)
- Michael Gooseff (University of Colorado)

Ecological Society of America

2024 ESA Fellows
- Jennifer Pett-Ridge (LLNL)
- Sasha Reed (USGS)
- Philip Robertson (Univ. of Michigan), former BERAC Member
- Steven Allison (University of California, Irvine)

2024 ESA Early Career Fellows
- Daniel Winkler (DOE BER)

National Academies of Science

2024 NAS Fellows
- Professor Qiang Fu (University of Washington)

BER Researchers Recognized

Institute of Electrical and Electronics Engineers

<u>2024 Elected Senior Member</u>

- Forrest Hoffman (ORNL)

American Geophysical Union (2024 Awards)

- Antonietta Capotondi (NOAA), Harald Sverdrup Lecture Award
- Shuyi Chen (University of Washington), Jacob Bjerknes Lecture Award
- William Collins (LBNL), Jule Gregory Charney Lecture Award
- Marjoria Friedrichs (Virginia Institute of Marine Science), Rachel Carson Lecture Award
- Justin S. Mankin (Dartmouth), Global Environmental Change Early Career Award
- Xubin Zeng (University of Arizona), Bert Bolin Global Environmental Change Award

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2024 Early Career Research Program (ECRP) BER Awards!
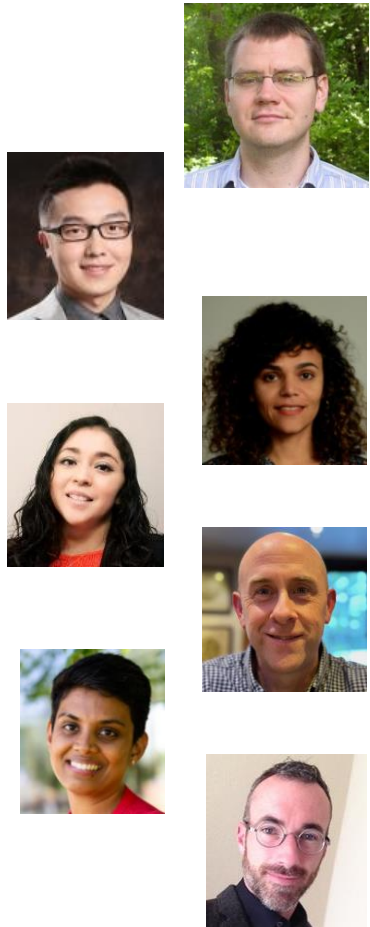
PI Name	Institution	Proposal Title	BER Division
Nathaniel Chaney	Duke University	Observing and understanding the role of surface thermal heterogeneity in mesoscale circulations over AMF3 BNF: Implications for land-atmosphere interactions	EESSD
Wei Qin	University of Oklahoma	Investigating the interactive impact of long-term warming and altered precipitation on grassland nitrifying communities	BSSD
Sara Shamekh	New York University	UNSHADE: Understanding and Modelling of Shallow to Deep Convection Transition	EESSD
Cristal Zuniga	San Diego State University	Genome-Scale Modeling of Microbial Members in the Rhizosphere under Fluctuating pH and Temperature	BSSD
Gavin Cornwell	PNNL	Disentangling the factors controlling the emission of bioparticles that act as ice nucleating particles	EESSD
Sneha Couvillion	PNNL	Microbial Metabolic Controls on Soil Carbon Dynamics through Root-Microbe-Soil Interactions: Connecting Molecular Processes to Ecosystem-level Impacts	BSSD
Steven Blazewicz	LLNL	Who Lives, Who Dies, Who Cares? Using Soil Microbial Demographics to Predict Carbon Transformation	BSSD

Early Career Research Program (ECRP)

Annual Awards per Division
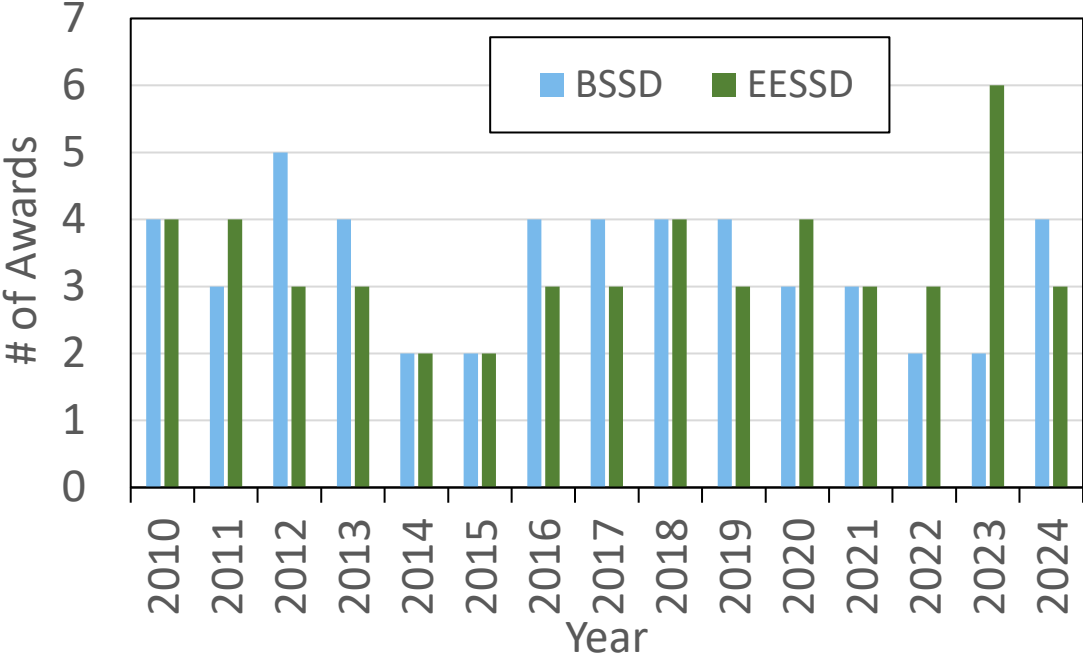
Annual Awards per Laboratory and University
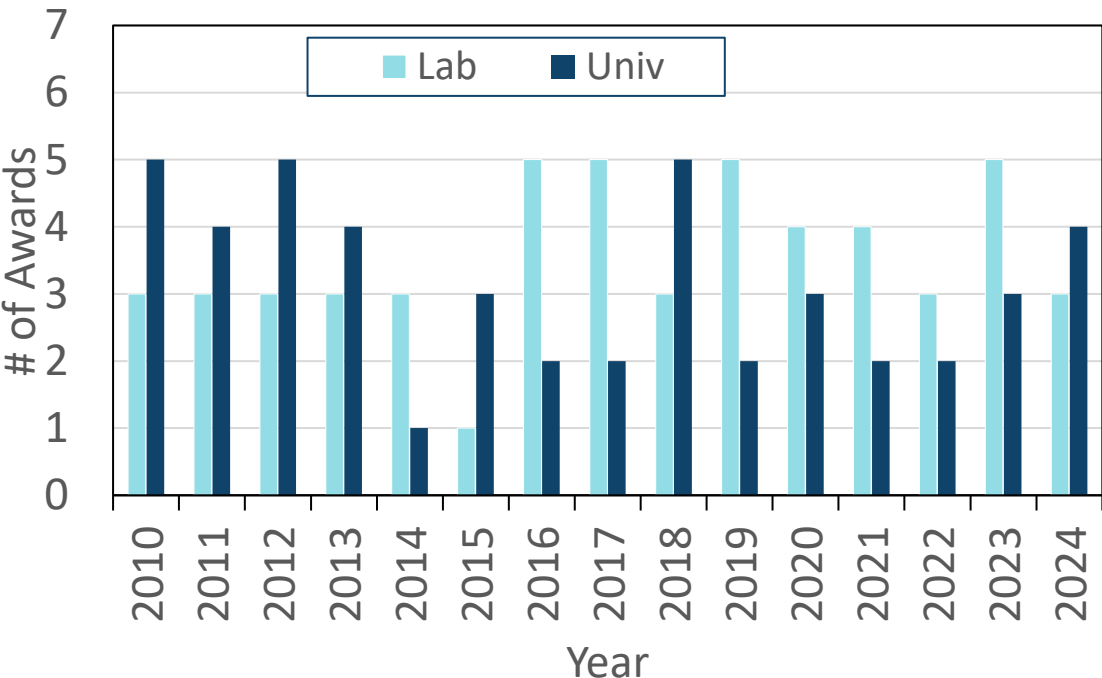
This year marks 100 Early Career Research Program awards by BER with 50 from each Division.

Grand Total for BER—
53 Awards to Labs; 47 to Universities

2024 Office of Science Graduate Student Research (SCGSR) Program

BER Awardees from Solicitation 1

Awardee	Institution	Host DOE Laboratory	Research Title
Ian Norwood	Michigan Technological University	LANL	Realistic Dust for Climate Models: Understanding Frictional Charging Effects on Coarse-Mode Dust Settling Times
Eleanor Fadely	University of California-Davis	SLAC	Developing a Multi-Modal Imaging Platform to Quantify Dynamic Biogeochemical Processes In Situ
Kevin Gu	University of California-Davis	LLNL	Novel sample delivery device for room temperature serial crystallography of membrane proteins with roles in energy conversion
Judson Van Wyk	Michigan State University	LANL	Assembling Biologically Relevant Bacterial Genomes from Fungal Metagenomes
Dana Johnson	University of Wisconsin-Madison	ORNL	Integrating field and laboratory data into a microbial-explicit soil carbon model to predict post-fire boreal forest soil carbon fluxes

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2024 Office of Science Graduate Student Research (SCGSR) Program

BER awardees for 2024 SCGSR Solicitation 2

> **The SCGSR program aims to prepare graduate students in areas critically important to the DOE Office of Science mission, by providing thesis research opportunities at DOE National Laboratories/Facilities**

- The SCGSR program provides **funding to graduate students** for spending **3 to 12 months** conducting part of their PhD thesis research **at a DOE National Lab** in **collaboration with a National Laboratory scientist**.

- This opportunity should advance the student's **PhD thesis** by providing access to the **expertise, resources, and capabilities** available at the DOE National Laboratories/Facilities.

Now accepting applications.
Applications are due November 6, 2024, 5:00PM ET.

https://science.osti.gov/wdts/scgsr

BER Strategy (2025-2035) Update

Purpose:

- Develop a consistent message that articulates significant scientific challenges, and BER's intention, strategy, role and capabilities to address these challenges.

- Provide an overarching framework, including areas of collaboration, for BER's Biology and Earth/Environmental science.

- Inspire and unify the BER community around these common objectives.

- Clarify within DOE and to domestic and international communities BER's unique role in addressing biological and environmental challenges.

Input to Strategy:

- Two BER staff retreats

- DOE Lab input

- BERAC reports

- Community workshop reports

Anticipated completion and release near the end of 2024 calendar year

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BERAC Low-Dose Report – BER Response

Assessment of BER Research in Low-Dose Radiation
Report from the BER Advisory Committee

- BERAC Low Dose Research (LDR) report recommendations:

  - Leverage DOE facilities and radiation research experience, systems biology and computation to advance radiation biology in low dose range

  - Link LDR physics and biology, spectrum of biological systems and an integrated approach to correlate LDR physics and biology

  - Coordinate international and multiagency efforts to link DOE findings with broader community questions

BER early response:

- FY24: BER relaunched the Low Dose Program, combining computational and experimental research to bridge gaps in understanding the effects of low dose radiation on cells, tissues and organs/organoids with human epidemiological observations.

- August 2024: Announced $19.5 million in funding over three years for 14 projects on low-dose radiation – studying the cellular and molecular responses to doses of radiation that are at or near lower exposure limits.

- CHIPS and Science Act assigns DOE the role to convene multiple agencies to address low dose research challenges. Todd Anderson convened the inaugural meeting on July 31, 2024.

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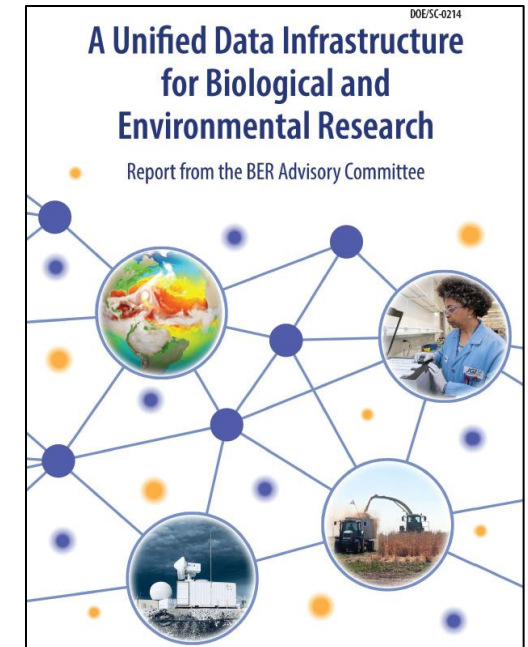
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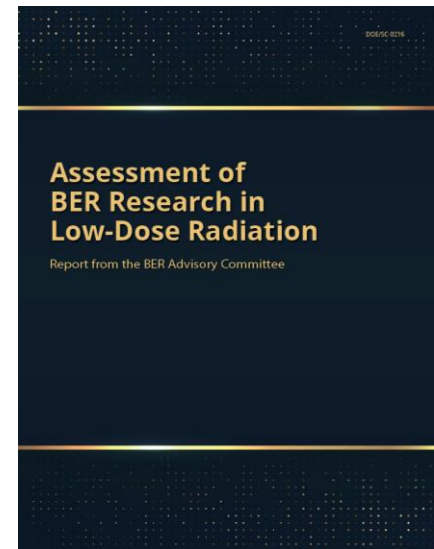
BERAC Unified Data Report – BER Response

BERAC Report recommendations:

- Project-driven collaboration strategy between infrastructure developers and researchers, with select Identify select high-impact science goals

- Include targeted outreach to reach diverse stakeholders into the initial design phase; establish BER marketplace for data

- Leverage existing BER facilities and data services. Integrate new technologies. Co-develop buildout with ASCR and other interagency, international data activities.

- Develop success metrics

BER response:

- Biology-Ecosystem data unification activity: JGI (genomic), EMSL (molecular), ESS-Dive (environmental), NMDC (microbiome) and K-base are developing system for data integration.

- Drivers: Integrated Research Infrastructure/High-Performance Data Facility (IRI/HPDF); AI and Frontiers in AI for Science, Security and Technology (FASST); BER Strategy 2025-2035.
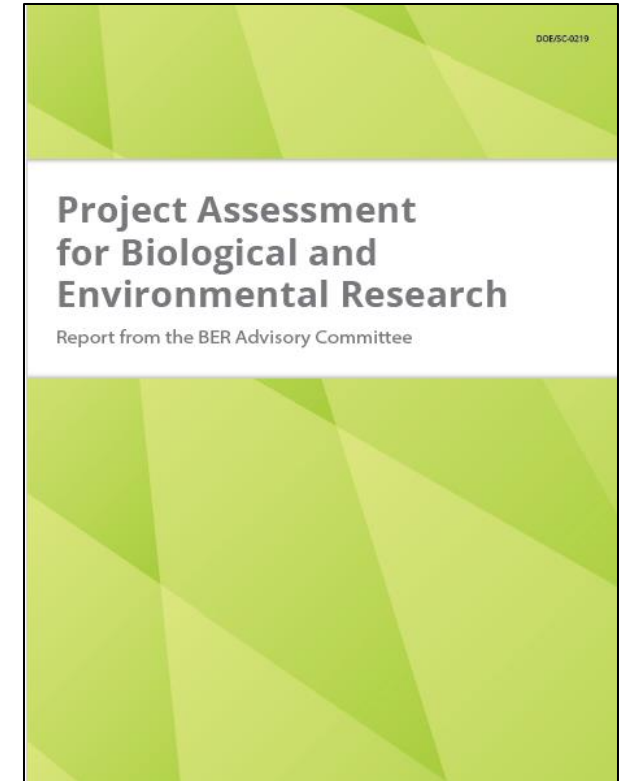

DOE/SC-0214

A Unified Data Infrastructure for Biological and Environmental Research

Report from the BER Advisory Committee

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BERAC Project Assessment Report – BER Response

BERAC Report recommendation

- 9 projects regarding facility capabilities were assessed for "potential to contribute to world-leading science" and "readiness for construction"

BER Response:

- BER (and SC) are adopting the top-ranked projects for budget prioritization considerations.

- BER adjusted and challenged the projects to address concerns raised in the report.

Project Assessment for Biological and Environmental Research
Report from the BER Advisory Committee

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Science Summit for Energy Earthshot Innovation

- Opportunity for multi-disciplinary teams funded in ASCR, BES, and BER to collaborate, engage, and discuss foundational research needed to support the DOE Energy Earthshot portfolio

- **September 4-5th, 2024** in Rockville, MD

- Over 200 attendees
  - **Energy Earthshot Research Centers (EERCs)**
  - **Bioenergy Research Centers (BRCs)**
  - **EMSL, JGI and ARM**
  - **E3SM**
  - Science Foundations for the Energy Earthshots (SFEEs)
  - Energy Frontier Research Centers (EFRCs)
  - ASCR Software Stewardship projects
  - User Facilities and other SC Resources
  - S4, SC Leadership & PMs, DOE Technology Offices

- Agenda included plenary talks, poster sessions, and discussion-based breakout sessions on DOE Energy Earthshot Research and Cross-cutting Foundational Science topics
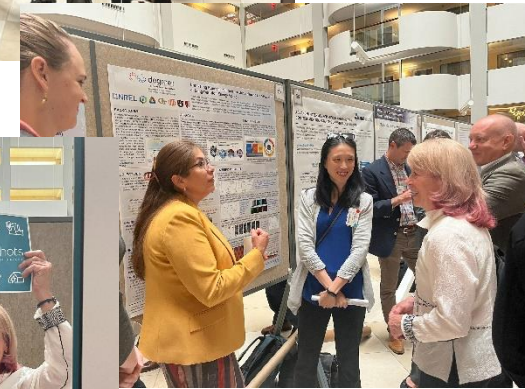
FY25 Budget

	FY 2024	FY 2025		
	Enacted	Request	House Mark	Senate Mark
Advanced Scientific Computing Research (ASCR)	1,016,000	1,152,682	1,105,000	1,152,000
Basic Energy Sciences (BES)	2,625,625	2,582,285	2,616,541	2,562,500
Biological and Environmental Research (BER)	900,000	945,225	850,000	930,000
Fusion Energy Sciences Research (FES)	790,000	844,496	825,000	825,000
High Energy Physics (HEP)	1,200,000	1,230,768	1,218,500	1,230,000
Nuclear Physics (NP)	804,000	833,091	830,000	850,000
Isotope R&D and Production (IRP)	130,193	183,900	169,808	165,400
Accelerator R&D and Production (ARDAP)	29,000	31,273	30,000	31,000
Workforce Development for Teachers and Scientists (WDTS)	40,000	43,100	32,000	43,000
Science Laboratories Infrastructure (SLI)	288,351	295,180	280,151	275,100
Safeguards and Security (S&S)	190,000	195,000	195,000	190,000
Program Direction (PD)	226,831	246,000	238,000	246,000
Artificial Inteligence and Machine Learning	...	...	...	100,000
Total, Office of Science	8,240,000	8,583,000	8,390,000	8,600,000

	FY 2024 Enacted	FY 2025 President's Request
EESSD	432,565	472,330
BSSD	457,435	453,895
BER	900,000	945,225

FY25 Budget

- Senate Mark highlights relevant to BER ($930M)
  - Specific minimum numbers on some programs, facilities
  - <mark>Continue FAIR, RENEW, EPSCoR</mark>
  - <mark>Energy Earthshots $15M for BER (FY23 was $20M; FY24 was $5M; FY25 PBR was $27.5M)</mark>
  - Low dose up to $20M, including AI/ML
  - <mark>Artificial Intelligence: $100M (for FASST) and $160M across SC</mark>
  - BER to work with White House OSTP to develop a roadmap for enabling the bioeconomy that makes use of key technology and research assets to have major impacts in health, climate and energy, food and agriculture, and supply chain resilience
  - Prioritize understanding science to advance understanding, risk assessments, and projections of potential tipping points in the Earth system, emphasizing the complex interactions between physical and social systems that could help identify thresholds and the onset of tipping points. $1,000,000 shall be used to produce an assessment [through USGCRP]
  - Prioritize operations of BER scientific user facilities

- House Mark highlights relevant to BER ($850M; (at least) $422M for BSSD, $409M for EESSD)
  - Specific minimum numbers on some programs, facilities
  - <mark>No funding for FAIR, RENEW; continues EPSCoR</mark>
  - <mark>Energy Earthshots $5M for BER (FY23 was $20M; FY24 was $5M; FY25 PBR was $27.5M)</mark>
  - Low Dose program $20M

FY 2025 BER Priority Directions

- Continue outreach efforts, including Climate Resilience Centers (CRC's), Urban Integrated Field Laboratories (Urban IFLs), possible launch of rural Integrated Field Laboratories ("Climate Science Initiative").

- Artificial Intelligence
  - Integrated climate modeling for energy
  - Biological scientific discovery
  - SC AI Roundtables, including biology-environment with BES

- Biology strategic planning
  - Bioeconomy workshops
  - Computational biology (BER-ASCR)

- Data integration
  - Bio-Eco data harmonization of data at JGI, EMSL, K-base, NMDC, ESS-Dive – launch point for further data integration
  - Develop data "Spoke" for IRI/HPDF "Hub"

- Cross-Division activities

- Explore Biology for Critical Minerals and Materials

- DOE Applied Offices partnerships: Earthshots, Integrated climate modeling, Bioenergy Research Centers

Questions?

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