

Biological and Environmental Research (BER)

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Associate Director of Science
Biological and Environmental Research

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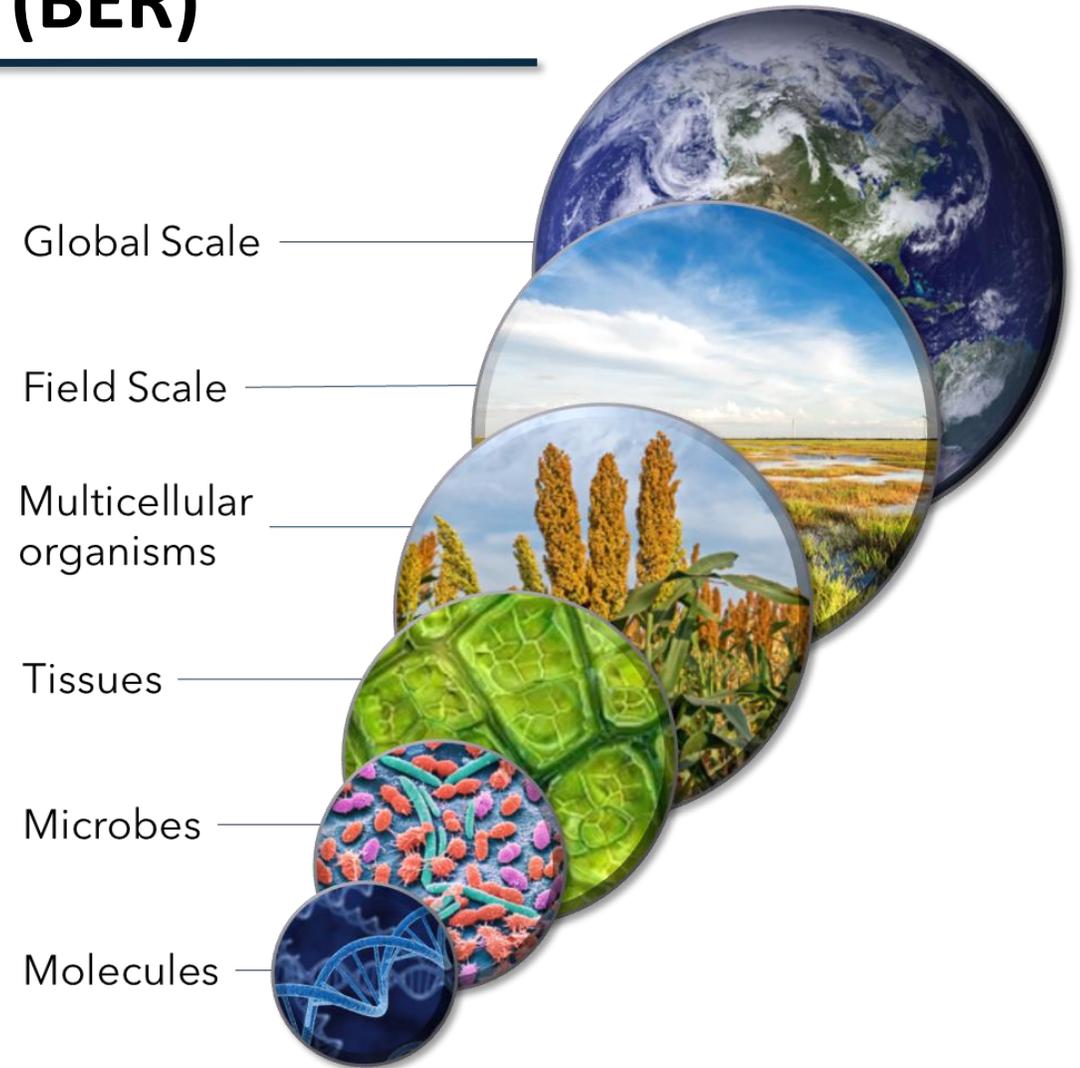
U.S. DEPARTMENT
of **ENERGY**

Office of
Science

<https://www.energy.gov/science/ber/>

Biological and Environmental Research (BER)

- Achieve predictive insights:
 - Discover the mechanisms by which plants and microbes respond to and modify their environments.
 - Re-design molecules, microbes, microbiomes, and plants for energy and economic potentials.
 - Anticipate near-term interactions among complex biological-earth-energy systems.



Discovering biosystems designs of increasing complexity from molecules to ecosystems. Integrating environment, biology, and energy.



DOE Office of Science
Harriet Kung, Acting Director

Advanced Scientific Computing Research

Basic Energy Sciences

Fusion Energy

Biological and Environmental Research
Dorothy Koch, Associate Director

High Energy Physics

Nuclear Physics

Current Structure

Biological Systems Science Division

- Genomic Science, Bioenergy Research Centers
- Biomolecular Characterization & Imaging Science
- Joint Genome Institute (JGI)

Earth & Environmental Systems Science Division

- Atmospheric System Research
- Environmental System Science
- Earth and Environmental Systems Modeling
- Environmental Molecular Sciences Laboratory (EMSL)
- Atmospheric Radiation Measurement (ARM)

New Structure, June 2026

Research Division

- Biodesign
- Earth-Biology-Energy

Facilities and Enabling Technologies Division (FET)

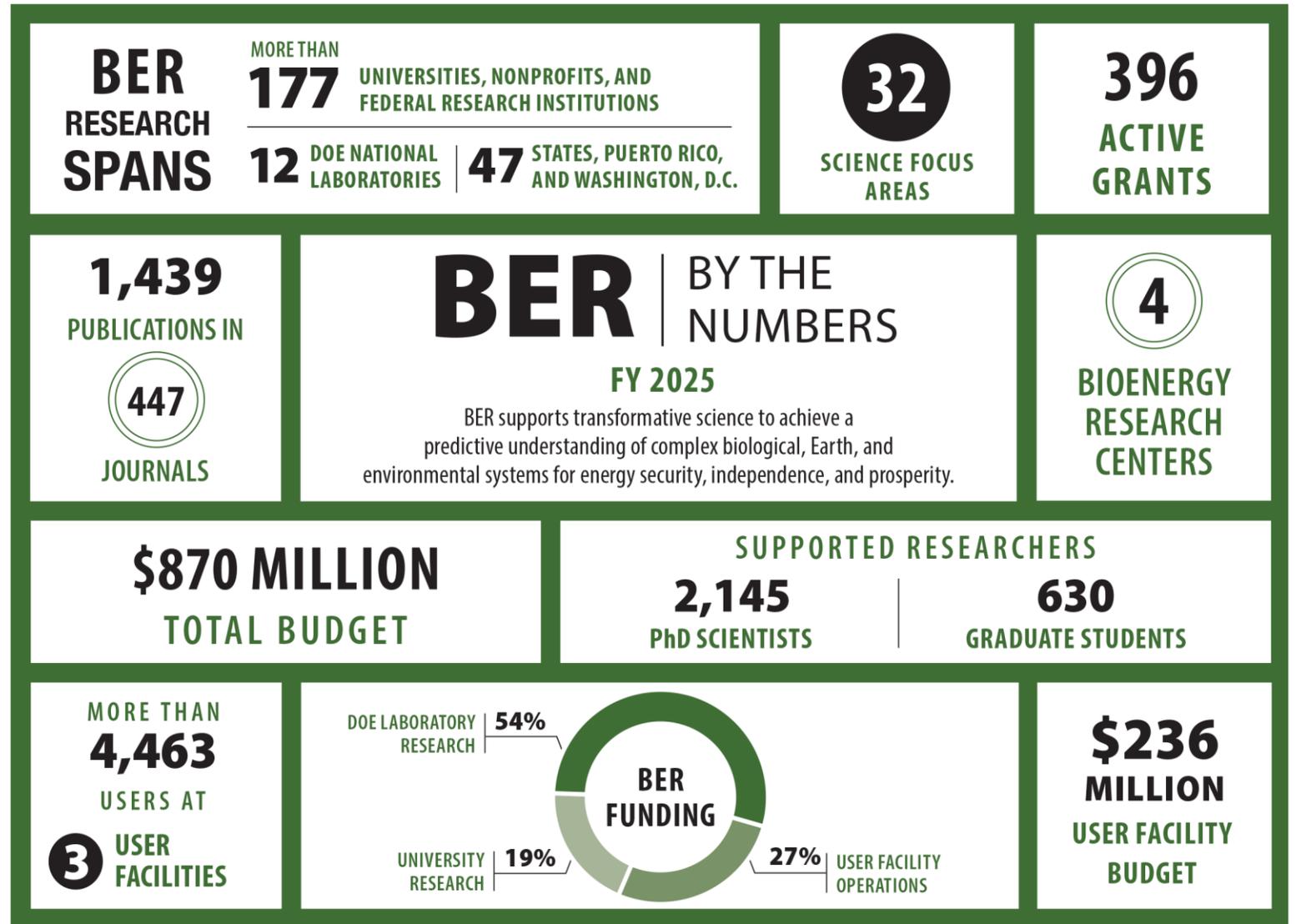
- Facilities
- Enabling Technologies: Data, Computation



BER By The Numbers

BER Funding History

FY24	FY25	FY26
\$900M	\$870M	\$854M



BER's Science Legacy



Sequencing Revolution



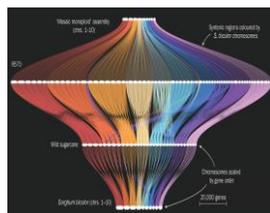
Human Genome Project



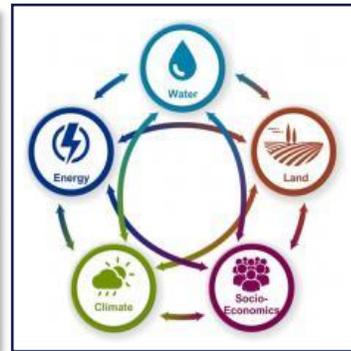
Atmospheric, terrestrial field research



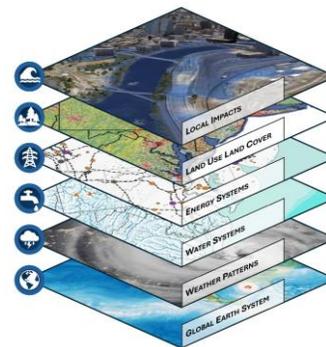
Plant and microbial sequencing



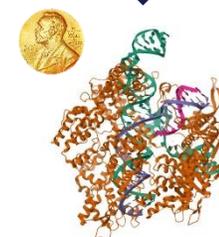
Molecular, microbial and biogeochemical dynamics



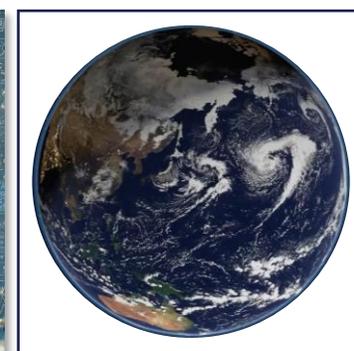
Multi-sector dynamics, energy and related sectors



Synthetic Biology



CRISPR-CAS Genome Engineering

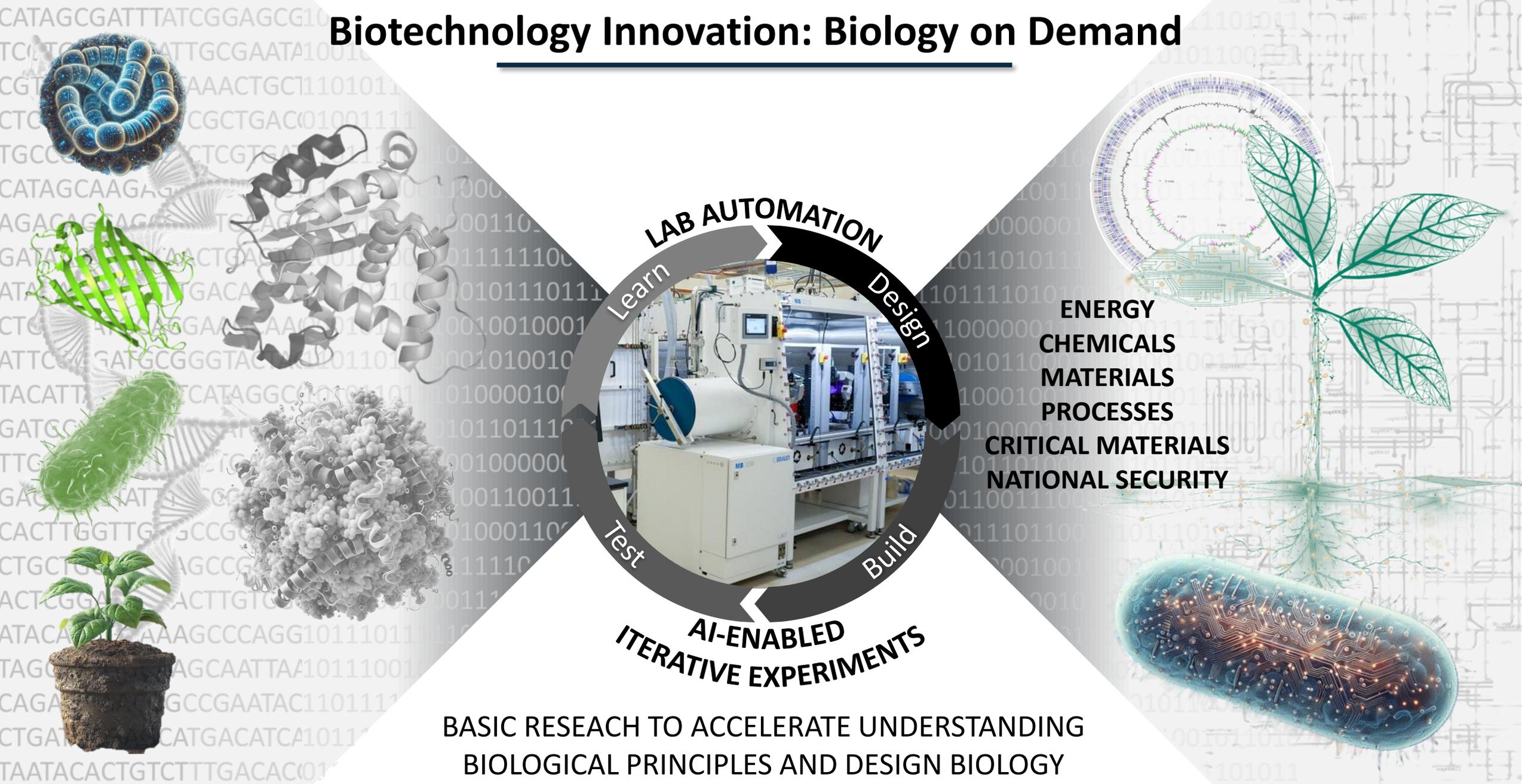


Exascale Earth System Model, Computation

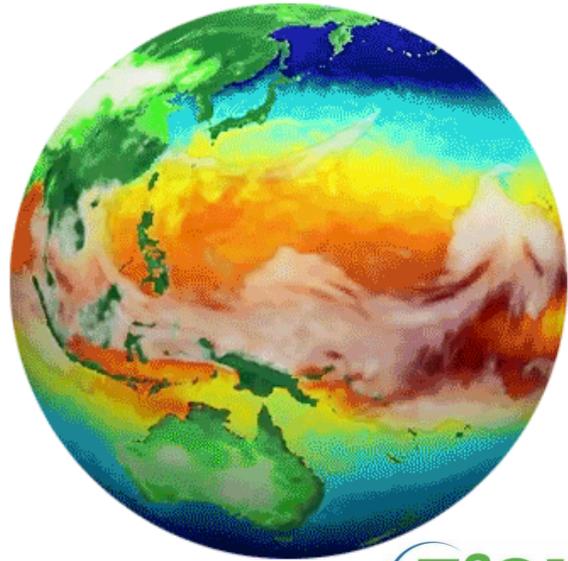


SCREAM Atmosphere, Gordan Bell Prize

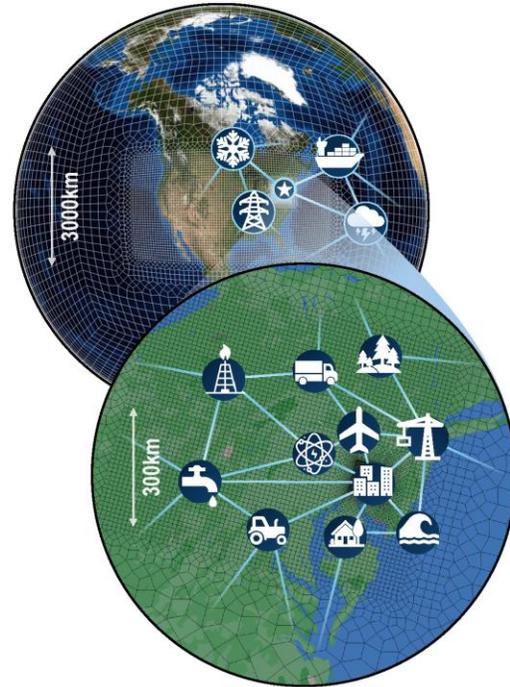
Biotechnology Innovation: Biology on Demand



Integrated Earth – Biology – Energy Science



E³SM
Energy Exascale
Earth System Model



AI-driven integrated modeling and field research to achieve breakthrough predictive skill for water availability (for fossil, nuclear, hydropower), extreme temperatures, storms (for grid and infrastructure), and biomass for future weeks to years.



Genesis Mission Engagement

BER's Major S&T Challenges (FY 2026)



Scaling the Biotechnology Revolution; Autonomous Laboratories



Predicting U.S. Water for Energy



Securing America's Critical Minerals Supply



Unleashing Subsurface Strategic Energy Asset



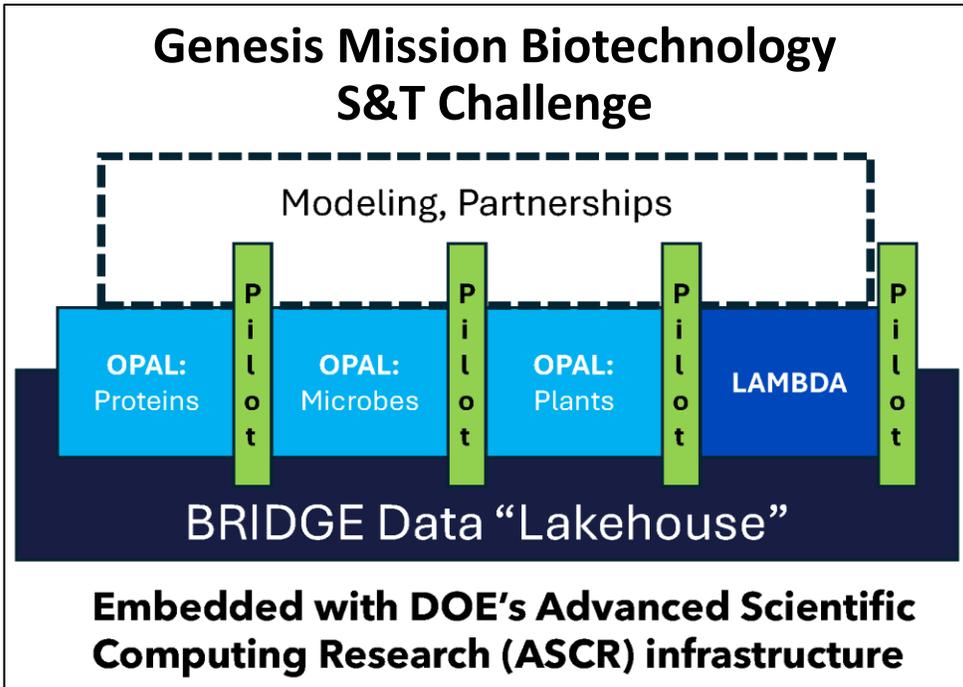
Scaling the Grid to Power the American Economy



AI in Fluid Flow for Energy Components and Technologies

- Genesis Mission is vital to advance BER research!
 - New AI-driven investments in FY2025 and FY2026 (planned)
 - Incorporating AI-focus in existing Laboratory projects
- Active cross-government engagement

Building the Biotechnology Genesis Mission S&T Challenge



- **Data Coordination:**
 - **BRIDGE** - Data Lakehouse: Biological and EnviRonmental Infrastructure for Data ManaGement and Exploration
 - **LAMBDA**: Lakehouse-enabled AI-ready Multi-modal Bioimaging Data Architecture
- **Laboratory Infrastructure Coordination:**
 - **OPAL**: Orchestrated Platform for Autonomous Laboratories to Accelerate AI-Driven BioDesign
- **AI Pilot Science Projects**



Current BER Scientific User Facilities

Joint Genome Institute (JGI): state-of-the-art genomic sequencing, functional genomics, DNA synthesis and metabolomics, computational analytics.



Environmental Molecular Sciences Laboratory (EMSL): molecular instruments, data analytics, and modeling for biological and environmental processes.



Atmospheric Radiation Measurement (ARM): globally distributed high-resolution observatories for atmospheric research, to study clouds, aerosols, and precipitation processes for Earth System Models.



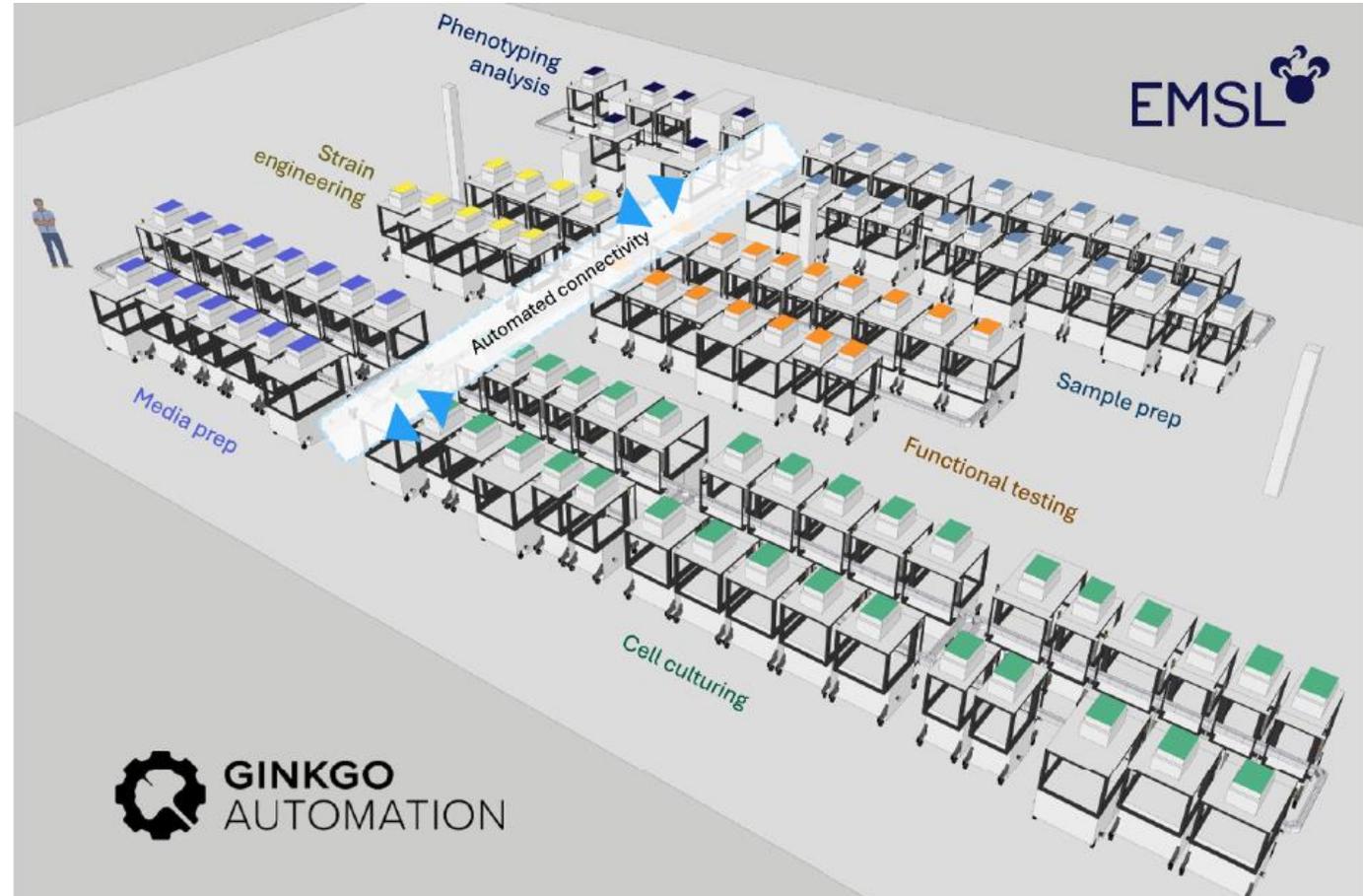
Project 1: Microbial Molecular Phenotyping Capability (M2PC)

Dynamic AI-based, automated platforms to map microbial gene expression patterns with growth profiles in real-time at high throughput.



➔ **Unlock Genotype to Phenotype mapping**

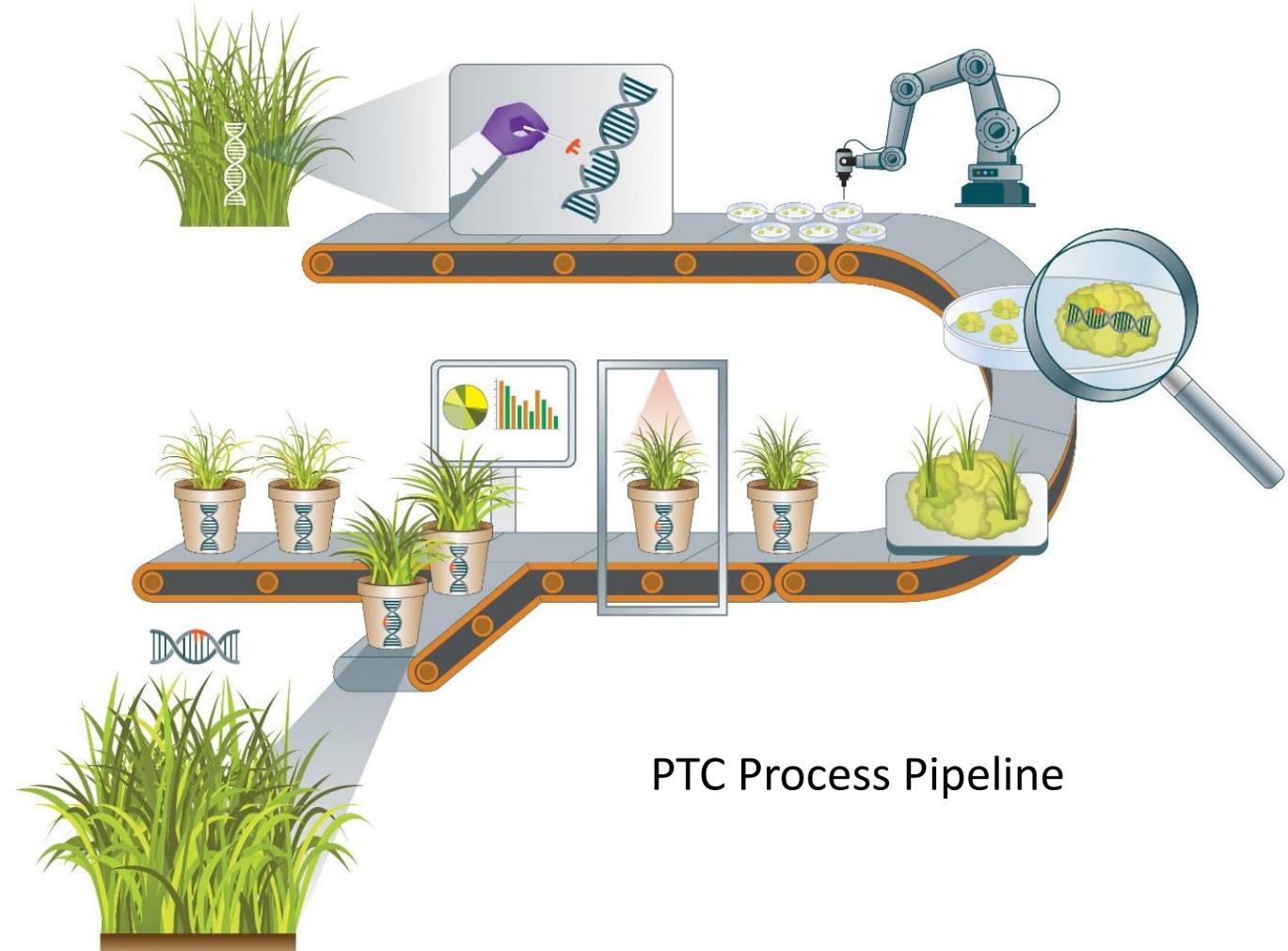
CD-2/3 2025



Project 2: Plant Transformation Capability (PTC)

Revolutionary next-generation AI-driven automated capability to create precise and efficient methods to reprogram plant genomes.

➔ **Address a critical gap in industrial and agricultural plant biotechnology**



CD-0 2024



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Project 3: Drizzle, Aerosol, and Cloud Observation Chamber (DRACO)

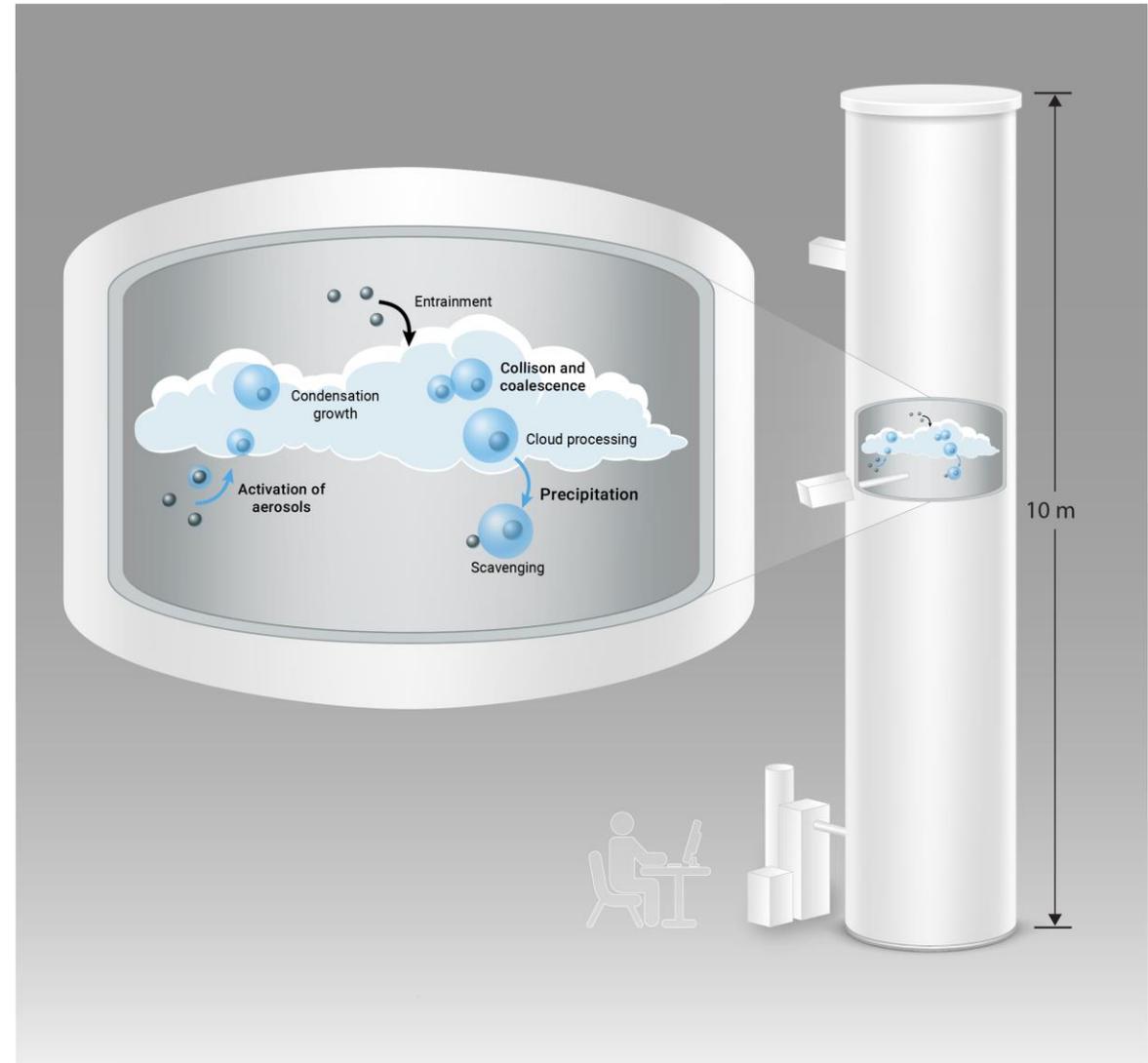
World-class laboratory experimental system for precision research on complex multi-phase cloud-aerosol dynamics.

- Specialized advanced sensors and models for controlled laboratory cloud research.
- Key validation for Genesis Mission Water-Energy cloud research and simulation.

➔ ***Resolve long-standing cloud and precipitation uncertainties***

CD-0 2023

ARM

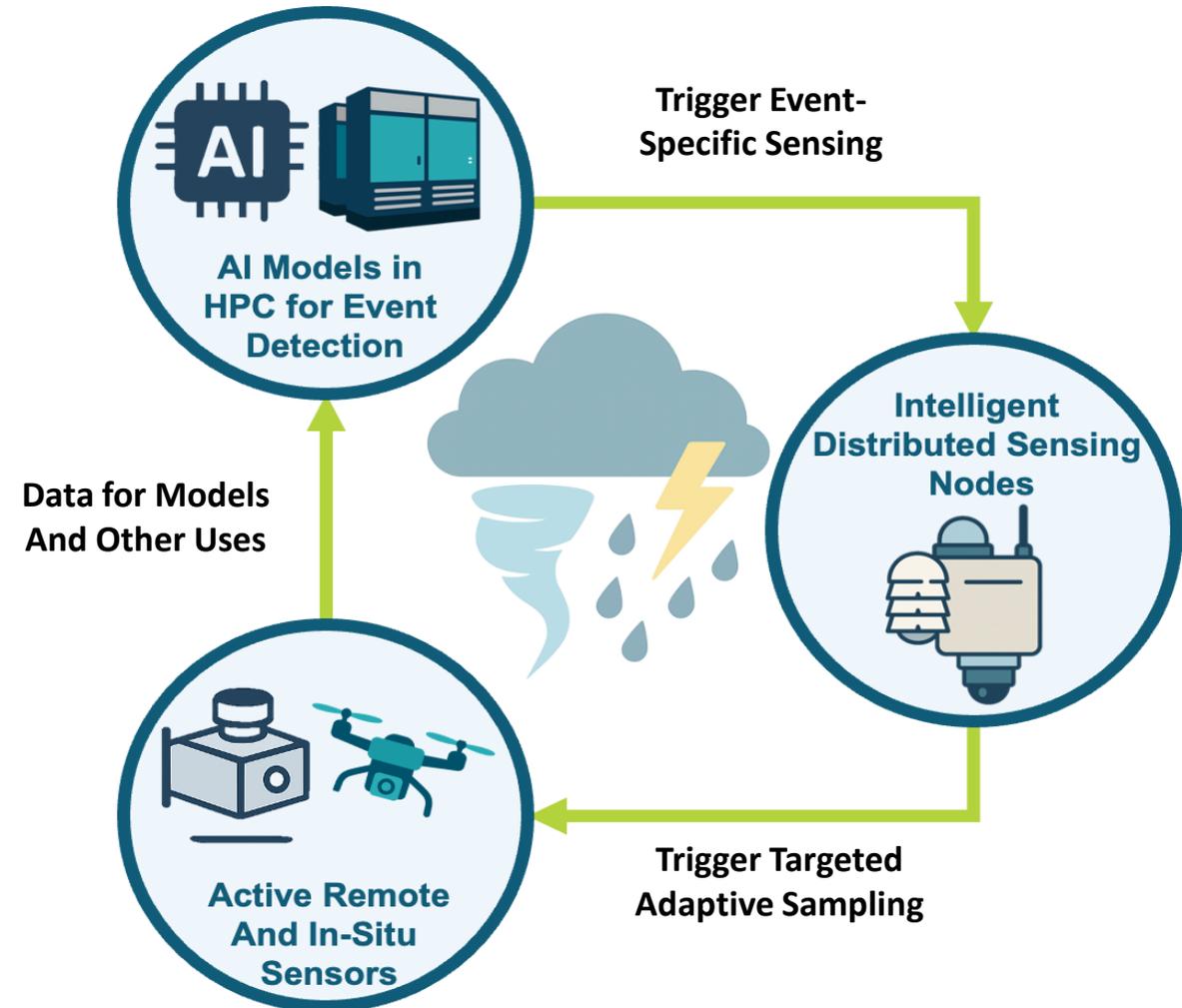


Project 5: Integrated Mobile Field Facility

Unique AI-based field-based capability to capture dynamic data, couple to experiments and models and evolve field discovery in real-time

- Plant, soil, atmosphere and energy system dynamics.
- Leverage DOE's existing mobile field platforms and sampling networks.

➔ New Concepts in AI-controlled Sensor Designs and Deployment



Thank you

