

ABPDU

ADVANCED BIOPROCESS
DEVELOPMENT UNIT

Science of Scale-Up

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Program Manager

Oct-22-2026

A central nexus for connecting groups, assessing & developing tech, and advancing Science of Scale-Up

Mission: R&D to de-risk US product commercialization, lowering energy costs via use of domestic raw materials

Support technology developers to make domestic manufacturing and supply chains more feasible.

Expand US production of innovative processes and products.

96

Industry Partners Supported

20

Products Launched in Market

15k

Sq. Ft. State-of-the-Art Facility

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96 Corporate Collaborators

Biofuels, Biomass, & Waste Conversion



Materials & Chemicals



Food, Health, & Ag



Testing Infrastructure Across Deconstruction, Fermentation, and DSP

Comprehensive pilot-scale infrastructure across four specialized laboratories: Deconstruction, Fermentation, Recovery (DSP), and Analytics.

Deconstruction and Chemical upgrading

- IKA 2 L reactors
- IKA 50 L reactor
- HTX 24 well blocks
- 10 L Parr reactors
- 210 L Andritz reactor
- HMI controllers

Fermentation

- 96 and 48 well HT
- Sartorius AMBR 250
- 2x300L bioreactors.
- Real-time monitoring
- Gas fermentation 0.5 L and 20 L
- Flexible gas mix control.
- RT mass spec for head gas monitoring

Downstream (DSP)

- Disc stack centrifuge
- Filtration units
- Homogenizer
- Akta Avant FPLC

Analytics

- HPLC/RI/DAD/F/MS
- GC-FID/MS
- Calorimetry
- X-ray Fluorescence
- Advanced sample prep
- Automated liquid handling
- Protocols and expertise

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ADVANCED BIOPROCESS DEVELOPMENT UNIT

About Us | Collaborations | What We Offer | Capabilities | Research | Newsroom



The Advanced BioProcess Development Unit (ABPDU), part of Lawrence Berkeley National Laboratory, was established by the United States Department of Energy to help ramp up the bioeconomy.

We enable early stage advanced biofuels, biomaterials, and biochemicals product and process technologies to successfully scale from the lab to commercial relevance.

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What have you done for me *lately*…?







RioTinto





Schmidt Sciences









BioCircular Valley





Bioprocess development

Upskilling across T-BRSC

Rare earth elements recovery

Discrete expression switching

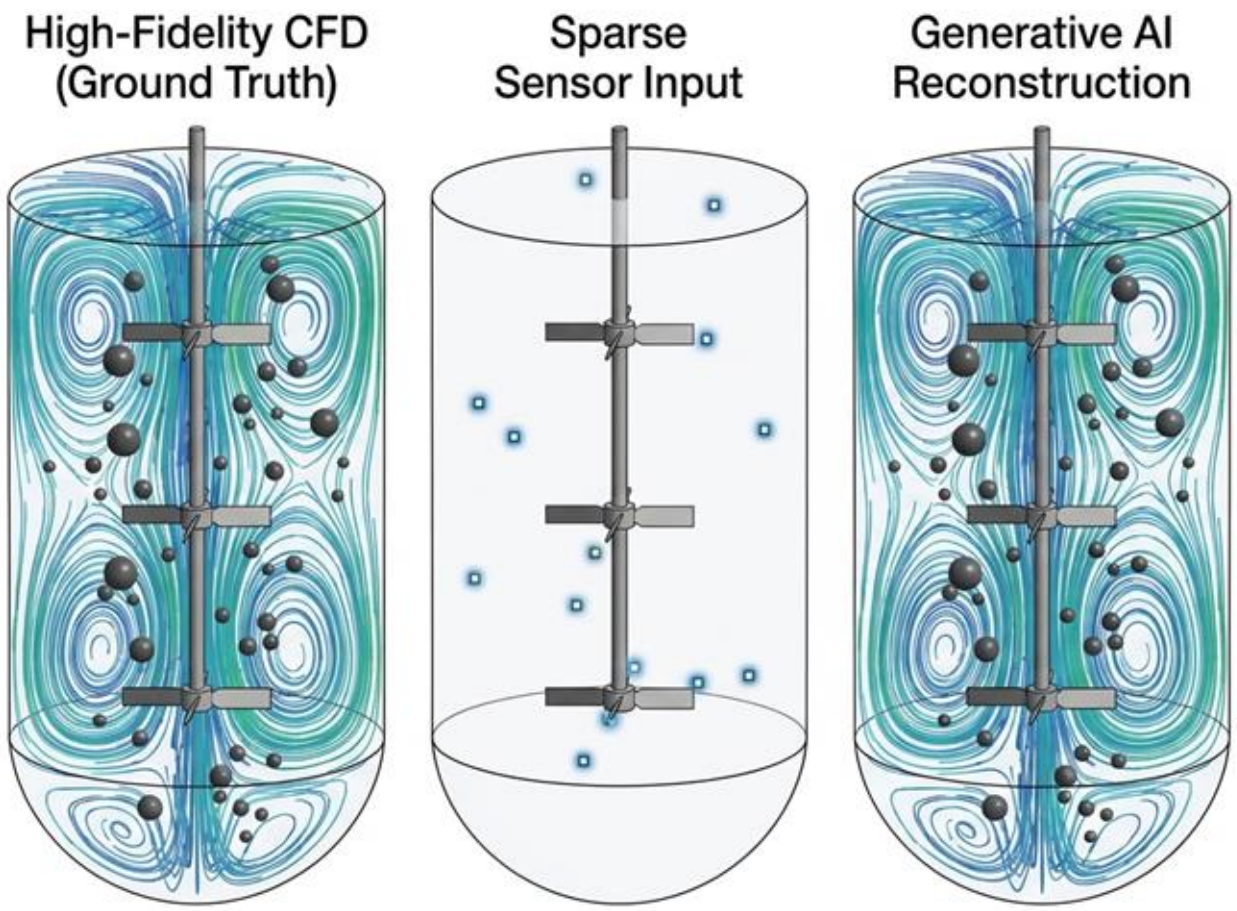
Regional bioeconomy R&D

Multi-Lab AI/ML industrial microbiology
Tacit knowledge FAIRification

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Generative AI Reconstruction of Fluid Dynamics

Couple realtime CFD with metabolic models to deliver a bioreactor digital twin.



40x **COMPUTATIONAL ACCELERATION**
Generative AI reduces traditional CFD simulation time: **4 hours → 6 minutes**

Predictive Flow Modeling

- Trained on high-fidelity CFD and experimental data.
- Predicts complex multiphase flow fields with reliable error bounds.

Sparse Sensor Conditioning

- Conditioned on sparse, RT experimental sensor data.
- Generates physically accurate multiphase flow fields.

Autonomous Control

- Enables self-driving autonomous bioreactor operations and active, closed-loop process control.

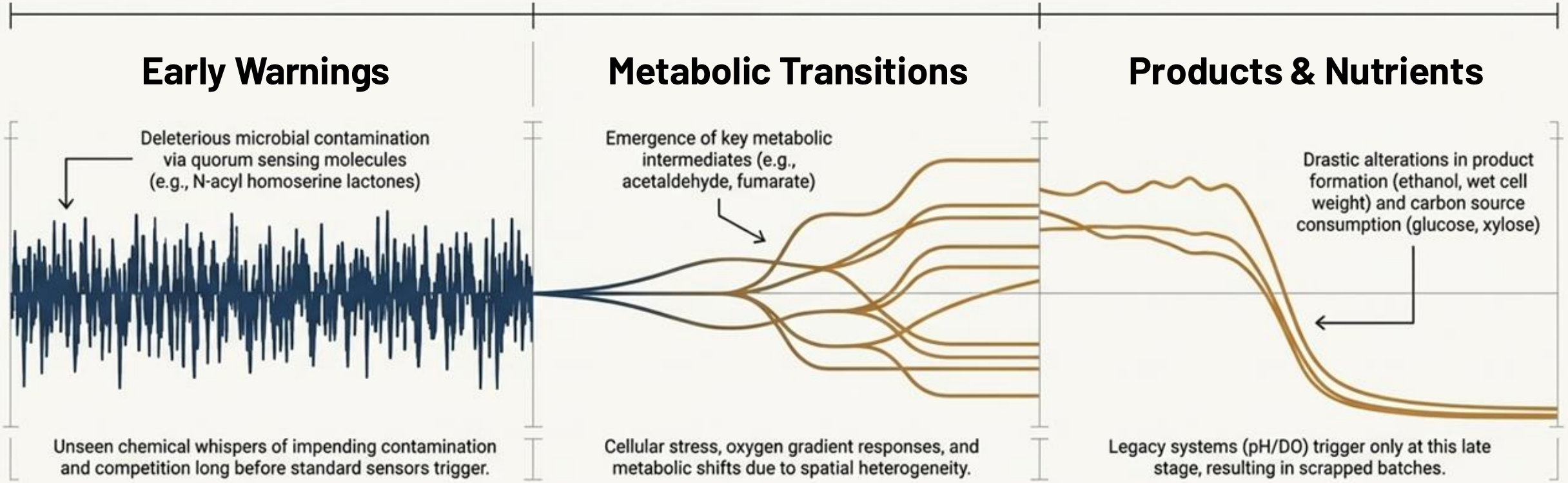
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***BIG GOAL** Enable CFD for routine use* **in silico** *and for realtime control.*

Early Detection: Contamination & Cellular Stress

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Alternative Fuels and Feedstocks Office

Measure quorum sensing molecules and extracellular metabolites for AI/ML and toward RT Metabolomics.



Far below the sensitivity and detection capabilities of most probes	A data-rich extracellular metabolome speeds intervention	Products, intermediates, and media dynamics inform rapid DBTLs

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***BIG GOAL** Offer early interventions by tracking fermentation performance alongside liquid & gas phase metabolites in scaled-down industrial models.*

ProKnoDE: ABPDU's AI-Ready Batch Management Software

Contextualize tribal knowledge and rescue stranded information for truly actionable data.



Complete Run Context

Organizes conditions, media, equipment, and results seamlessly.



Lessons From Every Run

Tracks objectives, problems,, corrective actions, and tacit knowledge.



AI-Ready Datasets

Enables scale-up models and risk checks.

BIG GOAL

Feed all knowledge from pilot-scale runs into realtime intervention networks.

What data do you need?

Take our survey!

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Alternative Fuels and Feedstocks Office

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