This presentation does not contain any proprietary, confidential, or otherwise restricted information

Agile BioFoundry

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

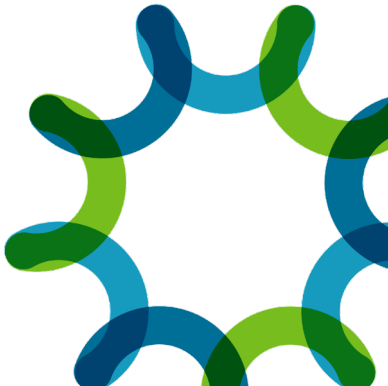
BIOENERGY TECHNOLOGIES OFFICE

DOE Bioenergy Technologies Office (BETO)
2023 Project Peer Review

Industry Engagement & Outreach

April 3, 2023
Conversion Technologies

Philip Laible, Christopher Johnson, and Emily Nelson
DOE Agile BioFoundry



Project Overview

Industry Engagement and Outreach (IEO) Goals and BETO relevance

- **IEO goal:** Identify and help remove barriers to industry adoption of biomanufacturing technologies, communicate how the Agile BioFoundry (ABF) can address industry needs, maintain metrics for determining impact of ABF technologies, and increase the visibility of the ABF

- **Relevance to BETO's goals:** IEO will enable the ABF to serve the needs of, and be responsive to, the industrial biotech industry

- **Specific research question:** How can engaging with biomanufacturing stakeholders enable the ABF to develop impactful, industry-relevant tools and technologies?

Project Overview

History: Task initiated at the inception of the Agile BioFoundry

- Efforts delocalized in early years of the Foundry
- Activities refocused and expanded with increased budget in rescoping exercise

Context: To fulfill Foundry's mission, painpoints of industry need to be known and Foundry efforts need to be visible

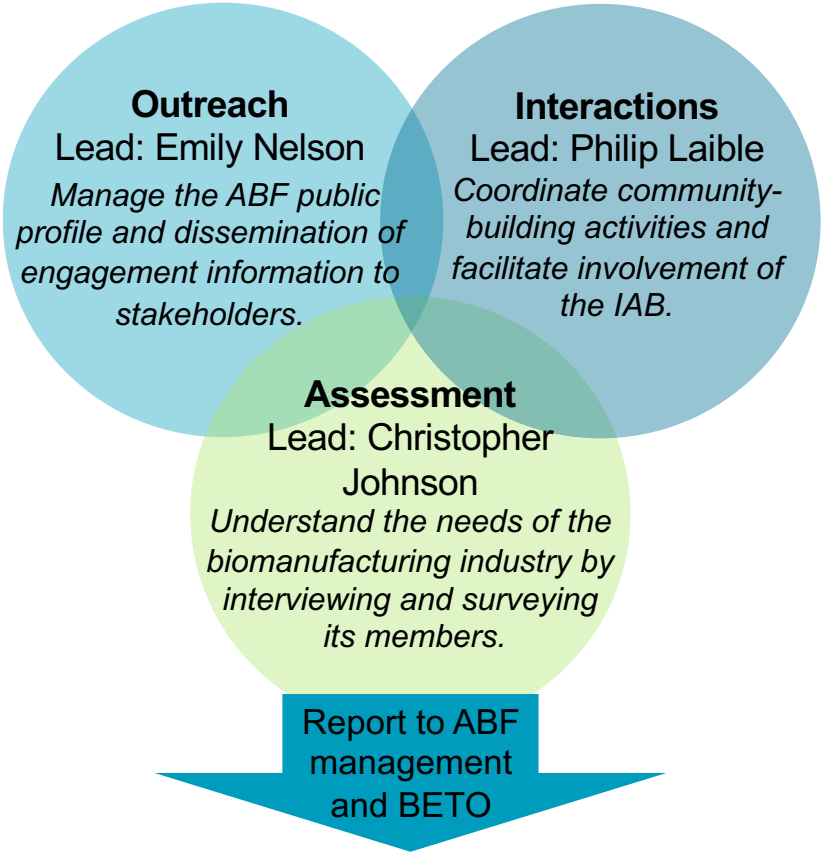
- Tremendous opportunity to learn how to increase success rate of relatively infant biomanufacturing industry
- Foundry succeeds only as industry is engaged and adopts resulting technologies

Objectives: Contribute significantly to the synthetic biology revolution

- Generate reports on industry needs (via interviews and surveys)
- Provide feedback from industry stakeholders to inform ABF R&D
- Organize yearly ABF Industry Days
- Facilitate transfer of ABF tools and technology to industry
- Advertise and educate potential partners about ABF

1. Approach

Approach: Task Management



Team coordination and ABF integration

- Biweekly internal calls
- Monthly calls with ABF management and BETO
- Involvement of Task leads in Industry Days & Industry Advisory Board (IAB) interactions
- Submission of annual interview reports to ABF and BETO

Approach: Technical

Outreach
- Website: Main source of visibility to industry
- Newsletter
- Marketing materials
- Social media: LinkedIn, Twitter, YouTube

Interactions
- IAB Meetings: Quarterly
- Conference attendance
- Annual Industry Day
- Webinar series

Assessment
- Energy I-Corps Approach
- ~25 Interviews annually
- Surveys

SIMB | Society for Industrial Microbiology and Biotechnology

Bio IMPACT Ag & Environment Conference

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy
BIOENERGY TECHNOLOGIES OFFICE

Agile BioFoundry

Top Potential Challenges

- **Dependent upon biotech industry participation**
  - In order to learn about industry needs and develop and promote adoption of tools and technologies to address then, industrial stakeholders must engage with the ABF
- **Industry needs to be aware of and understand the ABF value proposition**
  - The biomanufacturing industry must be aware of ABF capabilities, tools, and technologies in order to promote their migration to industry
- **Relative lack of experience in business development and marketing**
  - While members of the ABF IEO team have worked in industry and participated in Energy I-Corps, they are not formally trained in business development or marketing, which could result in opportunity costs

Risks and Mitigations

Risk	Severity	Description	Mitigation Plan
May not receive enough engagement from biotech industry	Low	Biomanufacturing stakeholders must share their pain points with the ABF and understand how the ABF can help to address them	Over-request input or interactions (e.g., for 20 useful interviews, request 100; interview the 25 that respond), ensure communications are clear and engaging
Industry needs to be aware of and understand the ABF value proposition	Medium	For the ABF to have impact, the biotech industry must first be aware of what the ABF is and how we can help them meet their goals	Clear and consistent marketing of ABF capabilities and opportunities for collaboration
Relative lack of experience in business development and marketing	Medium	Without formal training in business development and marketing, the IEO may miss opportunities or not be as effective as someone with training might	Currently hiring a business development lead to help enable these activities

Go/No-Go Decision Point

- **Date:** March 31, 2021
- **Description:** 5 target molecules or tools transferred between host organisms that are able to at least achieve 1 g/L or higher in the first host. Successful target molecule transfers will have product titers greater than 1 g/L. For 3 of 5 of these, 2X biological engineering cycle efficiency gains demonstrated over attempts made in prior host organisms
- **Result:** Go

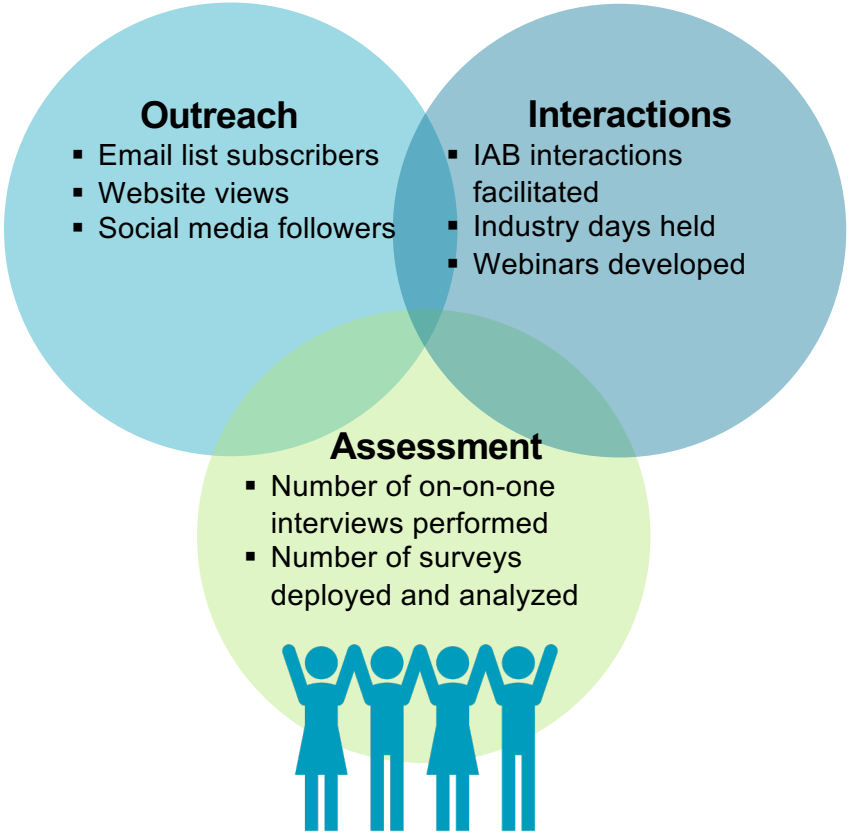
Transfers of target molecule pathways between hosts and realized efficiency gains

Target molecule	First host (titer g/L)	New host (titer g/L)	Wall time	Clock time	Resources	Overall
3HP		*A. niger* (>1)	4X	6X	2X	
3HP						

Transfers of tools between hosts and realized efficiency gains

Tool	First host	New host	Wall time	Clock time	Resources	Overall
Muconate biosensor		*C. glutamicum*	1.5X	3X	2X	
Microfluidics screening		*C. glutamicum*				2X
Microfluidics screening		*Rhodobacter*	2X		1X	2X
Genomic integration		*C. necator*	>10X	>10X	1X	10X
Fungal transporters						

Economic and Technical Metrics



Related BETO projects and IAB

- **Other BETO consortia**
  - Continue to integrate TEA/LCA support across consortia
  - ChemCatBio: catalytically convert ABF molecules into value-added compounds
  - SepCon: secreted hydrophobic, acid, and intracellular products recovery
  - FCIC: understanding the effect of feedstock variability on strain robustness
  - Performance-Advantaged BioProducts: ABF molecules could be used
  - CCPC (BPMS): Bayesian inference of metabolic kinetics collaborations

- **BETO State Of Technology (SOT)**
  - Improve genetic tools for SOT organisms to accelerate & increase DBTL cycle efficiency

- **Industry Advisory Board**
  - Contributes to the ABF maintaining industrial relevance and understanding industry pain points and innovations
  - Acts as a sounding board for feedback on ABF progress and plans

2. Progress and Outcomes

Progress and Outcomes

Assessment: One-on-One Interviews

- **Interviews are conducted each year (skipped in 2022 due to conference cancelation)**
  - Numbers of interviews each year vary by need and approach
  - Energy I-Corps approach utilized, responses not shared outside ABF
  - Diverse industrial biotechnology stakeholders – scientists, executives, investors, etc. – sampled
  - Diversity with respect to size, geography, product(s), and business model is targeted
  - More than 90 interviews conducted to date
- **Key Learnings from one-on-one interviews**
  - The mission and goals of the ABF are viewed favorably
  - Growing interest in learning how companies can work with the ABF
  - Providing cost share, even in-kind support, is a frequent concern, especially for smaller, less established companies
  - Industry supports a balanced approach for host onboarding breadth vs. depth
  - Could benefit from making it easier to engage and work with industry
    - Distinguish the ABF from other consortia, research centers, and user groups
    - Clearly communicate capabilities
    - Facilitate streamlined partnership agreements

Progress and Outcomes

Interactions: Industrial Advisory Board

Assembled diverse IAB

- Area of specialization
- Age/size of company
- Location of operation
- Gender

IAB Meetings

- > 20 meetings to date

Established charter

- Expresses expectations and governs operations
- Operate without NDAs with IAB members or firms

Collected/reported feedback

- Approach
- Operations
- Dashboard metrics
- Milestone achievements
- Target/host selection process
- Outreach activities
- Overall impact

Companies represented in FY22 roster

amyris
Trelys
CALYSTA
Agilent Technologies
GINKGO BIOWORKS™ THE ORGANISM COMPANY
BioMADE™
BASF We create chemistry
novonutrients food and feed from CO_2™
teselagen BIOTECHNOLOGY
SYNTHETIC EVOLUTION™
AUTODESK. RESEARCH
ThermoFisher SCIENTIFIC

Progress and Outcomes

Interactions: Videos and Live Webinars

6 Topics To Date
ABF Overview
Pathway Development and Evaluation
Techno-Economic and Life Cycle Assessment
Scaling Capabilities
How to work with the ABF
Machine Learning, Deep Learning, Testing and Modeling Techniques

ABF's Christopher Johnson describes our metabolic engineering strategies to enable production targets associated with various beachhead molecules.

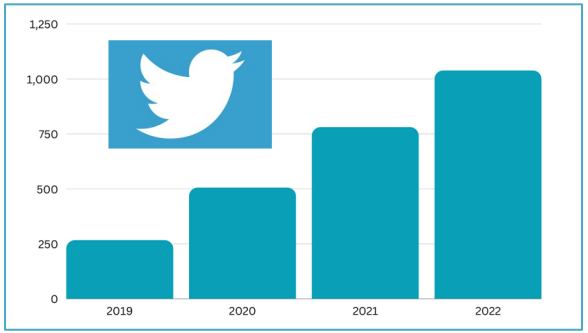
Deepti Tanjore, co-lead of ABF's Process Integration and Scaling Task, outlines ABF's fermentation capabilities.

Progress and Outcomes

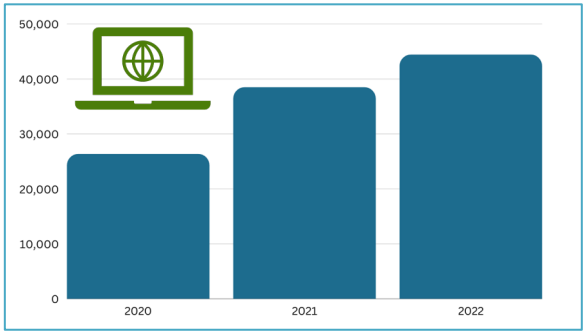
Outreach: Communication and Social Media Activities

- Generate success stories on ABF collaborations and research
- Share ABF news, events, and job opportunities
- Amplify relevant announcements (funding opportunities, press releases, etc.) from BETO, DOE, or ABF member labs
- Market the ABF to potential collaborators/partners in industry and academia
- Participate in online synthetic biology community on Twitter and LinkedIn

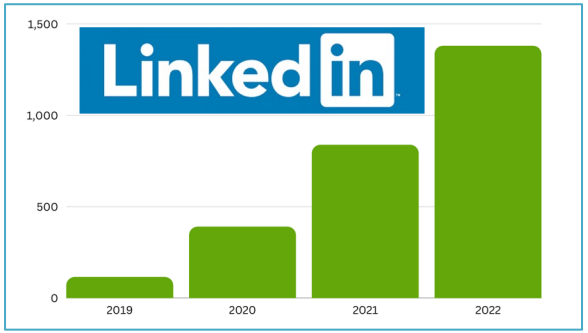
Twitter followers



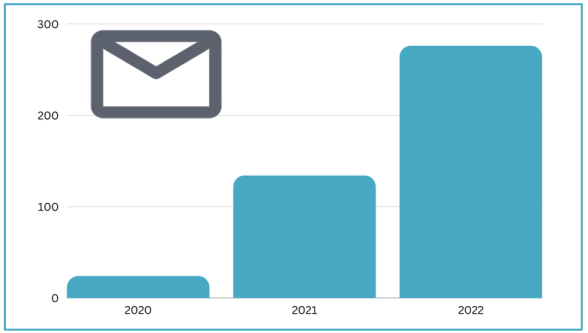
Website pageviews



LinkedIn followers



Mailing list subscribers

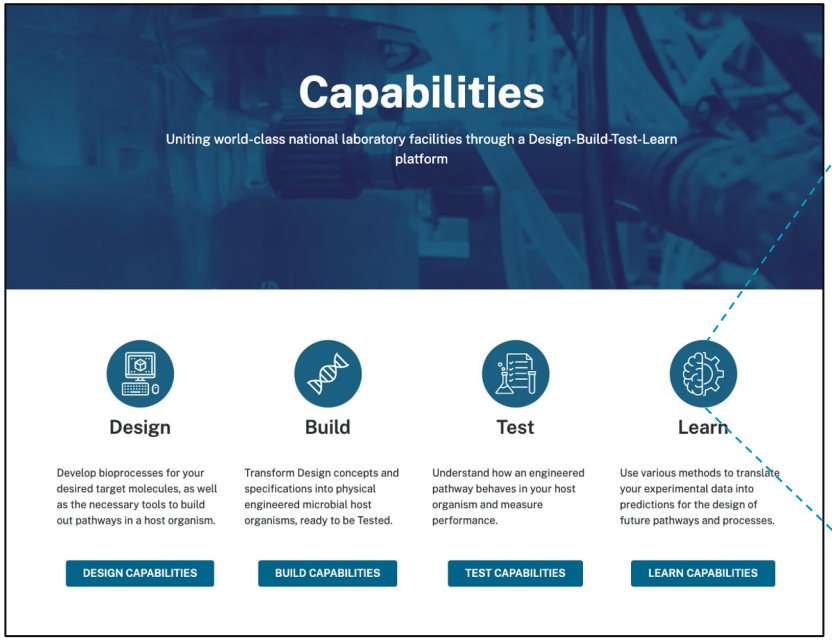


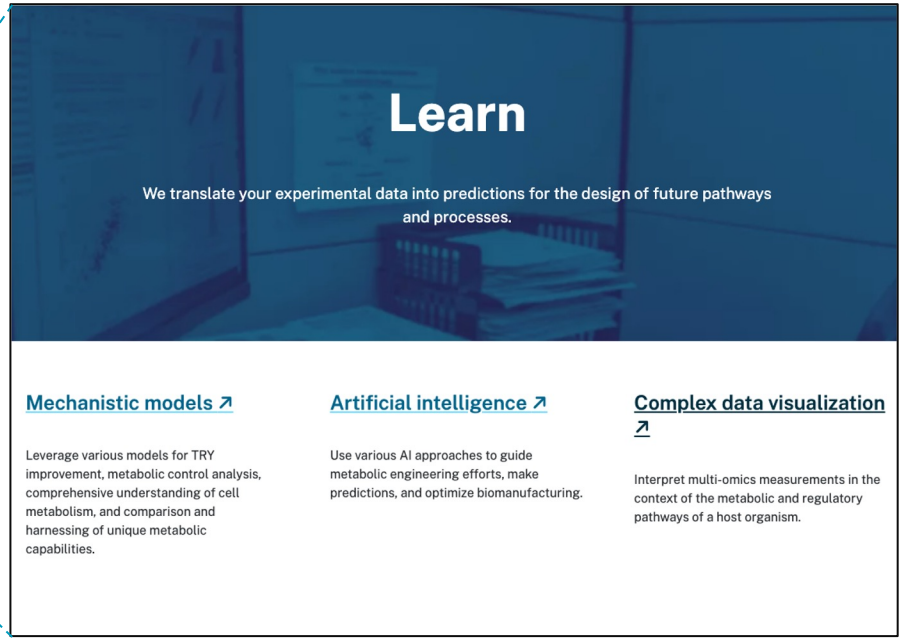
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy
BIOENERGY TECHNOLOGIES OFFICE

Agile BioFoundry

Progress and Outcomes
Outreach: Renewed Capabilities Webpages

https://agilebiofoundry.org/capabilities





Progress and Outcomes
Diversity, Equity, and Inclusion (DEI)

- In FY22, The Industry Engagement and Outreach (IEO) team drafted a DEI plan
- **ABF DEI Vision Statement:** The Agile BioFoundry is dedicated to building a diverse workforce, promoting equal access to biomanufacturing careers, developing accessible tools to democratize synthetic biology, and creating an inclusive and welcoming environment for our staff and partners.
- ABF DEI activities will primarily address two of the key emphasis areas from BETO, workforce development and diversity in STEM. These activities could include:
  - Collecting data to assess DEI within the ABF
  - Hosting interns from underrepresented groups
  - Develop presentation on synthetic biology for audiences at high schools and undergraduate institutions – especially those in underrepresented communities – to encourage diversity in STEM
  - Post-doc flash talks at future ABF all-hands meetings to promote inclusion and career development
  - Engage with Minority Serving Institution STEM Research and Development Consortia (MSRDCs) to establish new outreach activities

IEO Milestones FY21-22

Type	Milestone description	Due date
QPM Regular (joint w/ management)	FY21Q1_IEO_R1. ABF website and project materials update complete.	12/31/2020
QPM Regular (joint w/ management)	FY21Q2_IEO_R2. Facilitate external partnerships by developing a public ABF biomanufacturing coverage map (using information from FY20Q2_DBTL_R3) that is accessible through the ABF website that specifies the specific industrially relevant biosynthetic pathways and beachhead molecules the ABF offers and provides a format for suggestions and feedback.	03/31/2021
QPM Regular	FY22Q2_IEO_R1: Incorporate sessions/speakers on DEI in Annual Meetings and Face-to-Face interactions (in person or virtual). Reevaluate IAB membership and strongly consider all areas of diversity as membership is revised.	03/31/2022
QPM Regular	FY22Q2_DEI_R1: Plan and establish an approach for DEI across the ABF. Specify SMART outcomes to be achieved for at least 2 of BETO's 4 key emphasis areas.	03/31/2022
QPM (joint w/ management)	FY22Q3_IEO_R2 - Public report released documenting technical advances of the consortium, with emphasis on process economics. The report will also summarize feedback received on the consortium's progress and impact.	03/31/2022

How disseminating results

- **Assessment**
  - Results of on-on-one interviews and reported to ABF management team and BETO technology manager

- **Interactions**
  - Communications with IAB
  - Facilitating Industry days to inform the biomanufacturing community
  - Engaging industry members at conferences

- **Outreach**
  - Newsletters
  - Website updates
  - Social media posts

Impact if successful

- Increase visibility of ABF
  - Promote collaboration and partnership
  - Advance biomanufacturing in the US
  - Contribute to decarbonization of industry
  - Contribute to BETO's goals for SAFs and bio-based chemical production
- Ensure ABF is responsive to industry needs
  - Dynamic based on industry trends and scientific advances
  - Promote transfer of ABF tools and resources to private sector

Summary

IEO facilitates transfer of ABF tools and technologies to industry

Approach

– 3 Focus Areas: Assessment, Interactions, and Outreach
– Continually conduct interviews and surveys, provide feedback from industry stakeholders to inform ABF R&D, and participate in active online community

Technical accomplishments

– Submitted yearly reports on findings from interviews and surveys
– Conducted regular meetings with IAB
– Grew mailing list and social media following
– Organized Industry Days and advertised the ABF on website and fact sheet

Relevance

– Provide feedback supporting project-planning and decision-making activities to ensure industry responsiveness

Future work

– Continue interviews and surveys
– Grow outreach and DEI programs
– Plan panels and sessions at national meetings

Quad Chart Overview

Timeline

- Project start: *October 1, 2019*
- Project end: *September 30, 2022*

	FY22 Costed	Total Award
DOE Funding	*(10/01/2021 – 9/30/2022)*	*$15M*
Project Cost Share		

TRL Range: 2-4

Project Goal

Enable biorefineries to achieve 50% reductions in time to bioprocess scale-up as compared to the current average of around 10 years

End of Project Milestone

- One representative target at a TRY within 20% of the fossil feedstock incumbent MSP demonstrated, from DMR-EH hydrolysate or mock hydrolysate
- At least 10 of the ABF beachheads across onboarded hosts achieve titer metrics
- Adapt baseline metabolic models for at least 3 ABF hosts to calculate theoretical yield. Calculate the minimum selling price of chemicals to benchmark realistic target chemical markets.
- Bring a total of at least 15 microbial hosts to at least Tier 1 capability, provide corresponding information, resources, and tools via publicly-accessible ABF HObT website

Funding Mechanism

AOP

Project Partners

LBNL (23%), SNL (20%), NREL (18%), PNNL (17%), LANL (8%), ORNL (8%), ANL (6%)

Agile BioFoundry

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

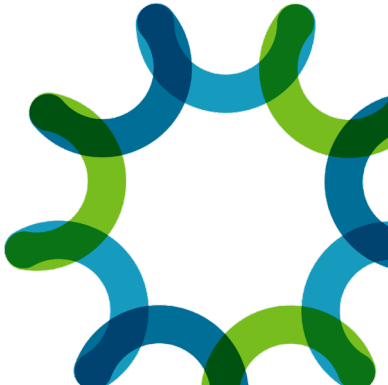
BIOENERGY TECHNOLOGIES OFFICE

DOE Bioenergy Technologies Office (BETO)
2023 Project Peer Review

Management

April 3, 2023
Conversion Technologies

James Gardner, Alastair Robinson and Angela Tarver
DOE Agile BioFoundry

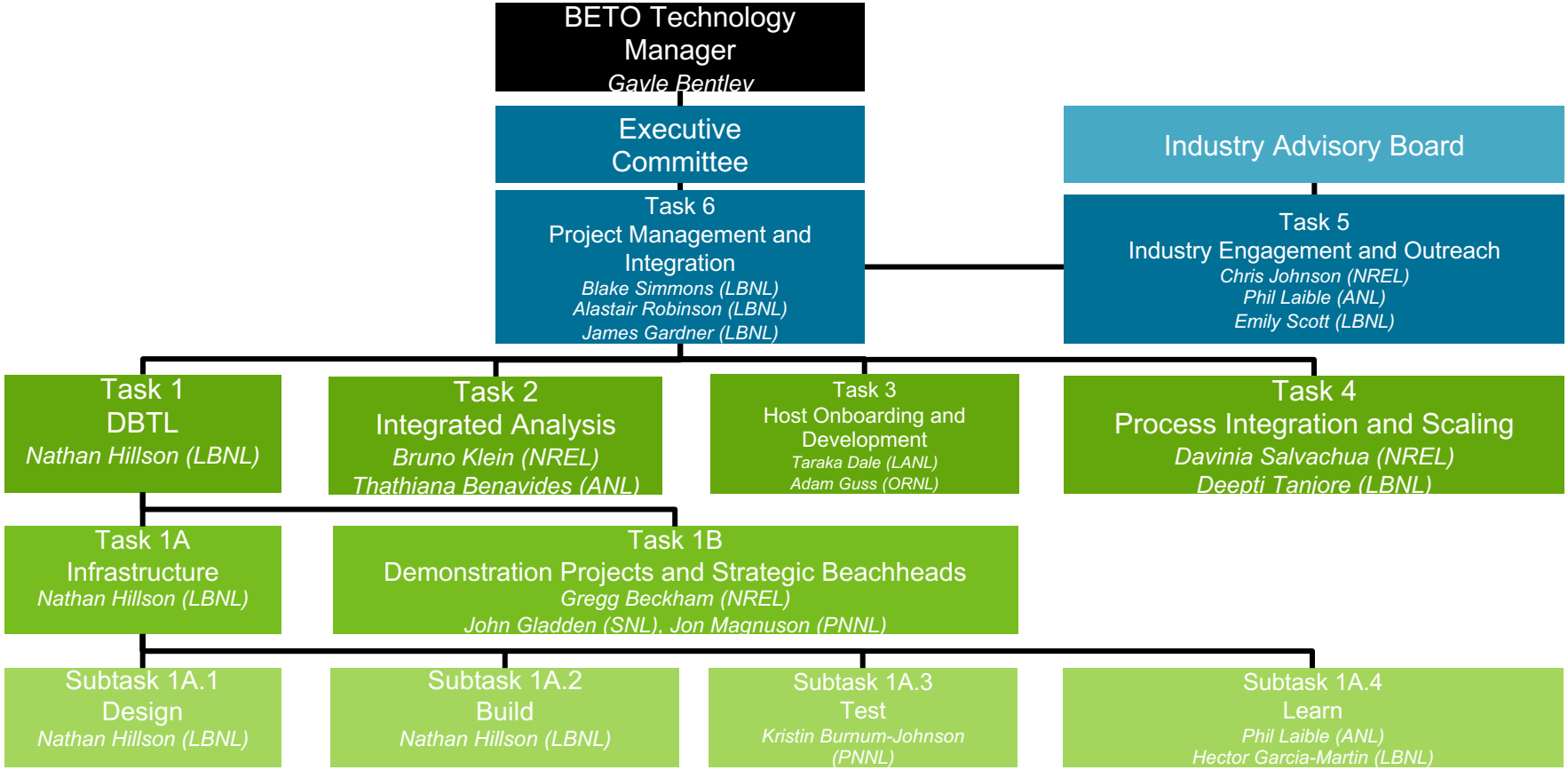


Project Overview

Project Structure

- **Funding**
  - FY17-19: $45M + $5M ABF-Directed Funding Opportunity (DFO), $4.5M FOAs
  - FY20-22: $45M + $15M DFO, $15M + $5M DFO each FY
- **Coordination** with FY18-19 ABF FOAs
- **Seven National Lab consortium**
- **Industry Advisory Board** actively engaged
- **Six tasks** for overall project
  - 4 research tasks, 2 management tasks
- **Multiple milestones** per quarter
  - Multiple annual SMART milestones and a 18-month Go/No-Go decision point
- **Monthly and quarterly progress reporting** to BETO

Org Chart



Roles and Responsibilities

- **Executive Committee**
  - Includes: PI, Task Leads, Program Managers, BETO Technology Manager, others as needed
  - Strategic direction and oversight
  - Support collaboration between institutions
  - ABF policy guidance
  - Conflict resolution and performance management
  - Progress tracking
  - Demonstration Project / Strategic Beachhead, and Host selection
  - Technical challenge identification/resolution

- **Program Manager:** Alastair Robinson – 50% effort
  - Manage core project including team meetings and Annual All Hands Meeting
  - Collaboration & progress/metrics tracking tools
  - Manage communication across labs for integration of consortium
  - Primary core project communications & operations point-of-contact
  - BETO reporting for core project

- **Program Manager:** James Gardner – 50% effort
  - Manage DFO projects and coordination with ABF-related FOAs
  - Manage annual DFO preparations and review/selection process
  - Primary DFO communications and operations point-of-contact
  - BETO reporting for DFO projects

1 – Approach

1– Approach: Management

Annual Operating Plan

- Organizes and operates project management of the 6 ABF major tasks
- Provides internal coordination and communications
- Supports capital expenditure
- Provides deliverables to BETO

External collaborations

- Maintain working relationships with joint funding opportunity partners (e.g., NSF)
- Manage funding opportunity application and selection processes
- Coordinate meetings between ABF labs and partners
- Collect, organize and report performance metrics and project outcomes to BETO

1– Approach: Risks to Management*

Risk	Sev.	Risk	Mitigation Plan
Inefficiencies associated with a distributed model	Low	Important to consider the effects a distributed model have on the overall goals	Mitigate inefficiencies with monitoring of activities to minimize delays. Communication is key.
Untimely execution of processes resulting from consensus-style management	Med	Group decision-making slows execution to the point of impacting project success	Set deadlines & expectations for team input on key decisions. Assume more active decision-making role for ABF management.

**The* Partnering Mechanisms *peer review discussion captures additional risks specific to collaboration*.

2 – Progress and Outcomes

2 – Progress and Outcomes: AOP

Organize and Operating Project Management

- 90%+ successful on completion of milestones, exceptions approved for change control approved by BETO, required due to science-related to challenges/obstacles

Internal communications and coordination

- Regular management, technical and task-specific meetings to support team integration across tasks and deliverables

Updates and deliverables to BETO

- Regular monthly reports to BETO Technology Manager, supported by regular tag-up to address issues arising, in addition to quarterly reporting requirements

Support capital expenditure

- High value equipment and instrumentation, such as LC-MS, automated liquid handlers, and bioreactor equipment

2 – Progress and Outcomes: Collaborations

Maintain working relationships with joint funding partners (e.g., NSF)

- Coordinate solicitation contents, communications, and timelines
- Ensure funding opportunity selection criteria align with BETO/ABF goals & objectives
- Further grow and diversify through additional funding partner development

Manage funding opportunity processes

- Champion process improvements by evaluating options and sharing with stakeholders
- Oversee planning of application timelines, applicant meetings, and external reviewer discussions

Report performance metrics and project outcomes to BETO

- Collect cost share and task status reports
- Augment internal data-sharing of ABF IP and licensing opportunities
- Collect partner impact statements and data related to their ABF collaboration

3 – Impact

3 – Impact

Standardized approaches for Design, Build, Test and Learn activities

- Standard operating procedures developed for manual and automated unit operations in support of measuring DBTL cycle efficiency for demonstration projects

Effective integration of technical expertise across major research tasks

- Management and coordination of work on technical objectives via regular meetings and team communications

ABF has assumed a leadership role in the global synbio community

- Convened partnering panel discussions at Global Biofoundry Alliance
- Strategic partner via MOU with Korea Research Institute of Bioscience and Biotechnology (KRIBB), recently acknowledged by US Department of State leadership

Recent dramatic expansion and diversification of partner opportunities

- BETO and ABF management successfully leveraged relationships to increase ABF's reach (i.e., NSF & MSRDC), supporting BETO/ABF goals & objectives
- Pursuing a relationship with BioMADE for possible 2024 joint opportunities

Summary: AOP

GOAL: Coordinate team efforts and communicate effectively with consortium Labs to implement project plan, adapting where appropriate

Accomplishments

- Integration of expertise and experience of consortium National Labs to deliver against technical goals and objectives
- Ensure completion of deliverables according to goals and objectives, managing scope change where appropriate
- Providing timely updates and reporting to BETO
- Adapting approach to reflect appropriate industry feedback

Future Work

- Reorientation of team around new task descriptions and priorities and mapping of activities to support integration

Summary: Collaborations

GOAL: Provide oversight needed to expand the ABF partnership portfolio to further BETO's mission.

Accomplishments

- Expanded project management staff
- Procured grant management software for future growth
- Oversaw a doubling of annual projects
- Leveraged funding partner investment
- Acted on DOE DEI objectives with MSI community partners

Future Work

- Onboard business development lead and actively develop funds-in and BETO-funded projects that result in technology transfer to industry
- Fully implement grant management software

Quad Chart Overview

Timeline

- Project start: *October 1, 2019*
- Project end: *September 30, 2022*

	FY22 Costed	Total Award
DOE Funding	*(10/01/2021 – 9/30/2022)*	*$15M*
Project Cost Share		

TRL Range: 2-4

Project Goal

Enable biorefineries to achieve 50% reductions in time to bioprocess scale-up as compared to the current average of around 10 years

End of Project Milestone

- One representative target at a TRY within 20% of the fossil feedstock incumbent MSP demonstrated, from DMR-EH hydrolysate or mock hydrolysate
- At least 10 of the ABF beachheads across onboarded hosts achieve titer metrics
- Adapt baseline metabolic models for at least 3 ABF hosts to calculate theoretical yield. Calculate the minimum selling price of chemicals to benchmark realistic target chemical markets.
- Bring a total of at least 15 microbial hosts to at least Tier 1 capability, provide corresponding information, resources, and tools via publicly-accessible ABF HObT website

Funding Mechanism

AOP

Project Partners

LBNL (23%), SNL (20%), NREL (18%), PNNL (17%), LANL (8%), ORNL (8%), ANL (6%)

Additional Slides

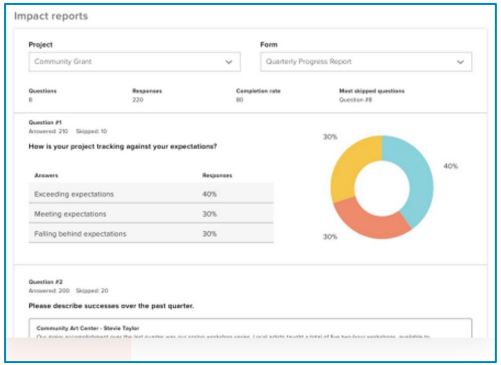
2 – Progress and Outcomes: Milestones

Milestone description	Due date
FY22Q2_M_R1 - Gap analysis conducted to determine key priorities and challenges for industry around commercialization. Assess ABF industrial partnerships with respect to the time required for contract agreement, milestone accomplishment, and overall outcomes as expressed by partner management in direct interviews and synthesize these findings in a report to guide directions and foci of future partnerships.	03/31/2022
FY21Q3_M_R2: Statistics gathered and industry partner decision making processes analyzed for choice between traditional (exclusive license, shorter option period) and alternative (non-exclusive, longer option period) CRADA IP model that retains incentives for industry yet enables ABF to learn and leverage past experience. Utilize data to determine preferred model(s) for future industry collaboration, reflecting funding sources and mechanisms	03/31/2022
Management - Activity Reports submitted to BETO on a quarterly/monthly basis. Quarterly and Milestone Completion Reports, and final AOP documentation following agreement with all ABF Labs and BETO, submitted in a timely fashion. ABF website regularly updated to reflect the latest news, events and scientific efforts of the ABF. ABF Annual Meeting coordinated.	Annual

2 –Outcomes/Next Steps: Collaborations

- **Standardizing & Improving Scalability of ABF's Partnerships**

  - Grant management software
  - Increase project tracking efficiency
  - Centralize application-related information
  - Improve reliability and ease of use for managers, applicants, reviewers and other stakeholders
  - Forms, workflows, visualization tools
  - Advanced reporting, impact reports, data driven decisions, identify insights and trends



U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy
BIOENERGY TECHNOLOGIES OFFICE

Agile BioFoundry

Additional Slides

Responses to FY21 Peer Review Comments

"…it might be worth exploring how to communicate better outwards in addition to having an actively engaging website."

- In the past two years, our social media presence on Twitter and LinkedIn has continued to grow and increase awareness of the ABF's mission, capabilities and achievements. We also maintain and are continually building a mailing list that we use to announce important updates and opportunities.

"IEO should solicit explicit feedback from industry on specific capabilities in order to guide the prioritization of ABF technology development, based on interest."

- The IEO has used interviews, surveys, and polls to solicit specific feedback on topics such as beachhead molecule selection and breadth vs. depth for host onboarding

"IEO needs specific goals and metrics to define success, without which it is difficult to judge its approach, impact and progress. "

- The IEO team appreciates the need to evaluate the impact and success of IEO efforts, which is inherently challenging given that the outcomes are not easily quantified. To this end, in our quarterly interactions with the IAB, we have begun to utilize a Dashboard that highlights expanded metrics of publications, publication impact, tools developed, intellectual property, Cooperative Research and Development Agreements (CRADAs), Strategic Partnership Projects (SPPs), Work for Others (WFOs), and alumni involvement in biomanufacturing.

Publications, Patents, Presentations, Awards, and Commercialization

70 publications, 189 presentations to date

- 54 publications and 115 presentations since FY2019
- The following slides list these publications and presentations

16 patents, 10 records of invention, 9 software disclosures, & 6 licenses

- The following slides list these intellectual property assets

Publications

- Garima Goyal, Zak Costello, Jorge Alonso Guitierrez, Aram Kang, Taek Soon Lee, Hector Garcia Martin, and Nathan J Hillson. (2018) "Parallel Integration and Chromosomal Expansion of Metabolic Pathways" ACS Synthetic Biology DOI: 10.1021/acssynbio.8b00243
- Jha RK, Narayanan N, Pandey N, Bingen JM, Kern TL, Johnson CW, Strauss CEM, Beckham GT, Hennelly SP, Dale T. Sensor-enabled alleviation of product inhibition in chorismate pyruvate-lyase. ACS Synthetic Biology (2019), 10.1021/acssynbio.8b00465.
- Oyetunde, T., Liu, D., Martin, H. G., & Tang, Y. J. "Machine learning framework for assessment of microbial factory performance." PloS one 14.1: e0210558 (2019).
- Ando, D., and Garcia Martin, H. "Genome-Scale 13 C Fluxomics Modeling for Metabolic Engineering of Saccharomyces cerevisiae" Microbial Metabolomics. Humana Press, New York, NY: 317-345 (2019).
- Costello, Zak, and Hector Garcia Martin. "How to Hallucinate Functional Proteins." arXiv preprint arXiv:1903.00458 (2019).
- Chen Y, Vu J, Thompson MG, Sharpless WA, Chan LJG, et al. (2019) A rapid methods development workflow for high-throughput quantitative proteomic applications. PLOS ONE 14(2): e0211582. https://doi.org/10.1371/journal.pone.0211582

Publications

- Paul Opgenorth, Zak Costello, Takuya Okada, Garima Goyal, Yan Chen, Jennifer Gin, Veronica T. Benites, Markus de Raad, Trent R. Northen, Kai Deng, Samuel Deutsch, Edward E.K. Baidoo, Christopher J. Petzold, Nathan J Hillson, Hector Garcia Martin, and Harry R Beller. (2019) "Lessons from two Design-Build-Test-Learn cycles of dodecanol production in Escherichia coli aided by machine learning". ACS Synth. Biol., DOI: 10.1021/acssynbio.9b00020 https://pubs.acs.org/doi/10.1021/acssynbio.9b00020
- Nathan Hillson, Mark Caddick, Yizhi Cai, Jose A. Carrasco, Matthew Wook Chang, Natalie C. Curach, David J. Bell, Rosalind Le Feuvre, Douglas C. Friedman, Xiongfei Fu, Nicholas D. Gold, Markus J. Herrgård, Maciej B. Holowko, James R. Johnson, Richard A. Johnson, Jay D. Keasling, Richard I. Kitney, Akihiko Kondo, Chenli Liu, Vincent J. J. Martin, Filippo Menolascina, Chiaki Ogino, Nicola J. Patron, Marilene Pavan, Chueh Loo Poh, Isak S. Pretorius, Susan J. Rosser, Nigel S. Scrutton, Marko Storch, Hille Tekotte, Evelyn Travnik, Claudia E. Vickers, Wen Shan Yew, Yingjin Yuan, Huimin Zhao & Paul S. Freemont. (2019) "Building a global alliance of biofoundries". Nature Communications, 10:2040 https://doi.org/10.1038/s41467-019-10079-2

Publications

- Jesus F. Barajas, Ryan P. McAndrew, Mitchell G. Thompson, Tyler W. H. Backman, Bo Pang, Tristan de Rond, Jose H. Pereira, Veronica T. Benites, Héctor García Martín, Edward E. K. Baidoo, Nathan J. Hillson, Paul D. Adams, and Jay D. Keasling. (2019) "Structural insights into dehydratase substrate selection for the borrelidin and fluvirucin polyketide synthases" J Ind Microbiol Biotechnol https://doi.org/10.1007/s10295-019-02189-z
- Jesus F. Barajas, Maren Wehrs, Milton To, Lauchlin Cruickshanks, Rochelle Urban, Adrienne McKee, John Gladden, Ed-Been-Goh, Margaret E. Brown, Diane Pierotti, James M. Carothers, Aindrila Mukhopadhyay, Jay D. Keasling, Jeffrey L. Fortman, Steven W. Singer, Constance B. Bailey. (2019) "Isolation and characterization of bacterial cellulase producers for biomass deconstruction: A microbiology laboratory course" J Microbiology and Biology Education. Just accepted. https://doi.org/10.1128/jmbe.v20i2.1723
- Mitchel G. Thompson, Jacquelyn Blake-Hedges, Pablo Cruz-Morales, Jesus F. Barajas, Samuel C. Curran, Christopher B. Eiben, Nicholas C. Harris, Veronica T. Benites, Jennifer W. Gin, William A. Sharpless, Jose H. Pereira, Edward E.K. Baidoo, Christopher C. Petzold, Paul D. Adams, Adam P. Arkin, Adam M. Deutschbauer, Jay D. Keasling (2019) "Massively parallel fitness profiling reveals multiple novel enzymes in pseudomonas putida lysine metabolism" MBio. https://doi.org/10.1128/mBio.02577-18

Publications

- Chen, Yan; Guenther, Joel; Gin, Jennifer; Chan, Leanne Jade; Costello, Zak; Ogorzalek, Tadeusz; Tran, Huu; Blake-Hedges, Jacquelyn; Keasling, Jay D; Adams, Paul; Garcia Martin, Hector; Hillson, Nathan; Petzold, Christopher. (2019) "An automated 'cells-to-peptides' sample preparation workflow for high-throughput, quantitative proteomic assays of microbes" Journal of Proteome Research Manuscript ID: pr-2019-00455n Submitted July 8, 2019 Accepted 8/22/2019 https://doi.org/10.1021/acs.jproteome.9b00455
- Carbonell, P., Radivojevic, T. and Garcia Martin, H., 2019. Opportunities at the Intersection of Synthetic Biology, Machine Learning, and Automation. ACS Synthetic Biology 1474-1477 (2019)
- Roell, G.W., Carr, R.R., Campbell, T., Shang, Z., Henson, W.R., Czajka, J.J., Martín, H.G., Zhang, F., Foston, M., Dantas, G. and Moon, T.S. A concerted systems biology analysis of phenol metabolism in Rhodococcus opacus PD630. Metabolic engineering (2019).
- Tijana Radivojevic, Elena Akhmatskaya, "Modified Hamiltonian Monte Carlo for Bayesian inference", Statistics and Computing, https://doi.org/10.1007/s11222-019-09885-x
- Pablo Carbonell, Tijana Radivojevic, Héctor García Martín "Opportunities at the Intersection of Synthetic Biology, Machine Learning, and Automation", ACS Synth. Biol. 2019, 8, 1474?1477

Publications

- Gayle J. Bentley, Niju Narayanan, Ramesh K. Jha, Davinia Salvachúa, Joshua R. Elmore, George L. Peabody, Brenna A. Black, Kelsey Ramirez, Annette De Capite, William E. Michener, Allison Z. Werner, Dawn M. Klingeman, Heidi S. Schindel, Robert Nelson Lindsey Foust, Adam M. Guss, Taraka Dale, Christopher W. Johnson, Gregg T. Beckham, "Engineering glucose metabolism for enhanced muconic acid production in Pseudomonas putida KT2440", in press at Metabolic Eng.
- Peabody GL, Elmore JR, Martinez-Baird J, and Guss AM. Engineered Pseudomonas putida KT2440 co-utilizes galactose and glucose. Biotechnol Biofuels 12, 295 (2019) doi:10.1186/s13068-019-1627-0
- Christopher B. Eiben, Tristan de Rond, Clayton Bloszies, Jennifer Gin, Jennifer Chiniquy, Edward E. K. Baidoo, Christopher J. Petzold, Nathan J. Hillson, Oliver Fiehn, Jay D. Keasling. (2019) "Mevalonate Pathway Promiscuity Enables Noncanonical Terpene Production", ACS Synth. Biol. https://doi.org/10.1021/acssynbio.9b00230
- Yan Chen, Deepwanita Banerjee, Aindrila Mukhopadhyay, Christopher J. Petzold. (2020) "Systems and synthetic biology tools for advanced bioproduction hosts", Curr. Op. Biotechnol. https://doi.org/10.1016/j.copbio.2019.12.007

Publications

- Jacquelyn M. Blake-Hedges,Jose Henrique Pereira, Pablo Cruz-Morales, Mitchell G. Thompson, Jesus F. Barajas, Jeffrey Chen, Rohith N. Krishna, Leanne Jade G. Chan, Danika Nimlos, Catalina Alonso-Martinez, Edward E. K. Baidoo, Yan Chen, Jennifer W. Gin, Leonard Katz, Christopher J. Petzold, Paul D. Adams, Jay D. Keasling. (2019) "Structural Mechanism of Regioselectivity in an Unusual Bacterial Acyl-CoA Dehydrogenase", J. Am. Chem. Soc. https://doi.org/10.1021/jacs.9b09187
- Thompson, Mitchell G., Allison N. Pearson, Jesus F. Barajas, Pablo Cruz-Morales, Nima Sedaghatian, Zak Costello, Megan E. Garber et al. "Identification, characterization, and application of a highly sensitive lactam biosensor from Pseudomonas putida." ACS Synthetic Biology (2019).
- Production of ent-kaurene from lignocellulosic hydrolysate in Rhodosporidium toruloides. Geiselman GM, Zhuang X, Kirby J, Tran-Gyamfi MB, Prahl JP, Sundstrom ER, Gao Y, Munoz Munoz N, Nicora CD, Clay DM, Papa G, Burnum-Johnson KE, Magnuson JK, Tanjore D, Skerker JM, Gladden JM. Microb Cell Fact. 2020 Feb 5;19(1):24.

Publications

- Chen, Yan; Guenther, Joel; Gin, Jennifer; Chan, Leanne Jade; Costello, Zak; Ogorzalek, Tadeusz; Tran, Huu; Blake-Hedges, Jacquelyn; Keasling, Jay D; Adams, Paul; Garcia Martin, Hector; Hillson, Nathan; Petzold, Christopher. (2019) "An automated 'cells-to-peptides' sample preparation workflow for high-throughput, quantitative proteomic assays of microbes" Journal of Proteome Research Manuscript ID: pr-2019-00455n Submitted July 8, 2019 Accepted 8/22/2019 https://doi.org/10.1021/acs.jproteome.9b00455
- Carbonell, P., Radivojevic, T. and Garci?a Marti?n, H., 2019. Opportunities at the Intersection of Synthetic Biology, Machine Learning, and Automation. ACS Synthetic Biology 1474-1477 (2019)
- Roell, G.W., Carr, R.R., Campbell, T., Shang, Z., Henson, W.R., Czajka, J.J., Martín, H.G., Zhang, F., Foston, M., Dantas, G. and Moon, T.S. A concerted systems biology analysis of phenol metabolism in Rhodococcus opacus PD630. Metabolic engineering (2019).
- Pablo Carbonell, Tijana Radivojevic, Héctor García Martín "Opportunities at the Intersection of Synthetic Biology, Machine Learning, and Automation", ACS Synth. Biol. 2019, 8, 1474?1477

Publications

- Gayle J. Bentley, Niju Narayanan, Ramesh K. Jha, Davinia Salvachu?a, Joshua R. Elmore, George L. Peabody, Brenna A. Black, Kelsey Ramirez, Annette De Capite, William E. Michener, Allison Z. Werner, Dawn M. Klingeman, Heidi S. Schindel, Robert Nelson, Lindsey Foust, Adam M. Guss, Taraka Dale, Christopher W. Johnson, Gregg T. Beckham. Engineering glucose metabolism for enhanced muconic acid production in Pseudomonas putida KT2440. Metabolic Engineering (2020), 59, 64-75
- Peabody GL, Elmore JR, Martinez-Baird J, and Guss AM. Engineered Pseudomonas putida KT2440 co-utilizes galactose and glucose. Biotechnol Biofuels 12, 295 (2019) doi:10.1186/s13068-019-1627-0
- Radivojevic, T., Costello, Z., Workman, K., & Martin, H. G. (2020). A machine learning Automated Recommendation Tool for synthetic biology. Nature Communications, 11(1), 1-14.
- Zhang, Jie, Søren D. Petersen, Tijana Radivojevic, Andrés Ramirez, Andrés Pérez-Manríquez, Eduardo Abeliuk, Benjamín J. Sánchez et al. "Combining mechanistic and machine learning models for predictive engineering and optimization of tryptophan metabolism." Nature Communications 11, no. 1 (2020): 1-13.

Publications

- Ernst Oberortner, Robert Evans, Xianwei Meng, Sangeeta Nath, Hector Plahar, Lisa Simirenko, Angela Tarver, Samuel Deutsch, Nathan J. Hillson, and Jan-Fang Cheng. (2020) "An Integrated Computer-Aided Design and Manufacturing Workflow for Synthetic Biology". In: Chandran S., George K. (eds) DNA Cloning and Assembly. Methods in Molecular Biology, vol 2205. Humana, New York, NY. https://doi.org/10.1007/978-1-0716-0908-8_1
- Gledon Doçi, Lukas Fuchs, Yash Kharbanda, Paul Schickling, Valentin Zulkower, Nathan Hillson, Ernst Oberortner, Neil Swainston, Johannes Kabisch. (2020) "DNA Scanner: a web application for comparing DNA synthesis feasibility, price, and turnaround time across vendors". OUP Synthetic Biology, ysaa011, https://doi.org/10.1093/synbio/ysaa011
- Deng, S., Z. Dai, M. Swita, K.R. Pomraning, B.A. Hofstad, E.A. Panisko, S. Baker and J.K. Magnuson 2020. Deletion analysis of the itaconic acid biosynthesis gene cluster components in Aspergillus pseudoterreus ATCC32359. Appl Microbiol Biotechnol 104, 3981-3992.

Publications

- Yuqian Gao, Thomas L. Fillmore, Nathalie Munoz Munoz, Gayle J. Bentley, Christopher W. Johnson, Jamie Meadows, Meagan C. Burnet, Anna K. Lipton, Aivett Bilbao Pena, Daniel J. Orton, Young-Mo Kim, Jeremy D. Zucker, Joonhoon Kim, Ronald J. Moore, Errol W. Robinson, Scott E. Baker, Bobbie-Jo M. Webb-Robertson, John M. Gladden, Gregg T. Beckham, Jon K. Magnuson, Kristin E. Burnum-Johnson*, High-throughput targeted proteomics assays for quantifying large-scale pathway proteins in Pseudomonas putida KT2440, in press at Frontiers Bioeng. Biotechnol.
- Isabel Pardo‡, Ramesh Jha‡, Molly Gaddis, Ryan Bermel, Felicia Bratti, Molly Gaddis, Emily McIntyre, William E. Michener, Ellen L. Neidle, Taraka Dale, Gregg T. Beckham*, Christopher W. Johnson*, Gene amplification, laboratory evolution, and biosensor screening reveal MucK as a terephthalic acid transporter in Acinetobacter baylyi ADP1, Metabolic Eng. (2020), 62, 260-274.
- Joshua R. Elmore, Gara N. Dexter, Davinia Salvachúa, Marykate O'Brien, Dawn M. Klingeman, Kent Gorday, Joshua K. Michener, Darren J. Peterson, Gregg T. Beckham, Adam M. Guss*, Engineering Pseudomonas putida simultaneously catabolizes five major components of lignocellulosic biomass: Glucose, xylose, arabinose, p-coumaric acid, and acetic acid, Metabolic Eng. (2020), 62, 62-71.

Publications

- Chris Lawson, Jose Manuel Martí, Tijana Radivojevic, Sai Vamshi R. Jonnalagadda, Reinhard Gentz, Nathan J. Hillson, Sean Peisert, Joonhoon Kim, Blake A. Simmons, Christopher J. Petzold, Steven W. Singer, Aindrila Mukhopadhyay, Deepti Tanjore, Josh Dunn, and Hector Garcia Martin. (2020) "Machine learning for metabolic engineering: A review" Metabolic Engineering https://doi.org/10.1016/j.ymben.2020.10.005
- Riley LA and Guss AM*. Approaches to genetic tool development for rapid domestication of non-model microorganisms. Biotechnol (2021) 14:30. doi: 10.1186/s13068-020-01872-z.
- Somtirtha Roy, Tijana Radivojevic, Mark Forrer, Jose Manuel Marti, Vamshi Jonnalagadda, Tyler Backman, William Morrell, Hector Plahar, Joonhoon Kim, Nathan Hillson, and Hector Garcia Martin. (2021) "Multiomics Data Collection, Visualization, and Utilization for Guiding Metabolic Engineering". Frontiers in Bioengineering and Biotechnology 9, 45. DOI=10.3389/fbioe.2020.01009

Publications

- Pomraning, K., Dai, Z., Munoz, N., Kim, Y., Gao, Y., Deng, S., Kim, J., Hofstad, B., Swita, M., Lemmon, T., Collett, J., Panisko, E., Webb-Robertson, B., Zucker, J., Nicora, C., De Paoli, H., Baker, S., Burnum-Johnson, K., Hillson, N., and Magnuson, J. (2021) Integration of Proteomics and Metabolomics Into the Design, Build, Test, Learn Cycle to Improve 3-Hydroxypropionic Acid Production in Aspergillus pseudoterreus. Frontiers in Bioengineering and Biotechnology.
- Hector A. Plahar, Thomas N. Rich, Stephen D. Lane, William C. Morrell, Leanne Springthorpe, Oge Nnadi, Elena Aravina, Tiffany Dai, Michael J. Fero, Nathan J. Hillson, and Christopher J. Petzold. (2021) BioParts-A Biological Parts Search Portal and Updates to the ICE Parts Registry Software Platform"" ACS Synthetic Biology DOI: 10.1021/acssynbio.1c00263"
- Chen Ling, George L. Peabody, Davinia Salvachúa, Young-Mo Kim, Colin M. Kneucker, Michela A. Monninger, Nathalie Munoz, Brenton C. Poirier, Kelsey J. Ramirez, Peter C. St. John, Sean P. Woodworth, Jon K. Magnuson, Kristin E. Burnum-Johnson, Gregg T. Beckham*, Adam M. Guss,* Christopher W. Johnson,* Muconic acid production from glucose and xylose in Pseudomonas putida KT2440 via evolution and metabolic engineering, in review at Nature Comm.

Publications

- Nicholas A. Rorrer,‡ Sandra F. Notonier,‡ Brandon C. Knott,‡ Brenna A. Black,‡, Avantika Singh,‡ Scott R. Nicholson,‡ Christopher P. Kinchin, Graham P. Schmidt, Alberta C. Carpenter, Kelsey J. Ramirez, Christopher W. Johnson, Davinia Salvachúa, Michael F. Crowley, Gregg T. Beckham*, Production of B-ketoadipic acid from glucose in Pseudomonas putida KT2440 for use in performance-advantaged nylons, in review at Cell Reports Phys. Sci.
- Precise genomic riboregulator control of metabolic flux in microbial systems. Naresh Pandey, Steffi A. Davison, Malathy Krishnamurthy, Daniel Trettel, Chien-Chi Lo, Shawn Starkenburg, Katherine L. Wozniak, Theresa Kern, Sean D. Reardon, Clifford J. Unkefer, Scott P. Hennelly and Taraka Dale. Submitted to ACS Synthetic Biology December 2021.
- Chen Y, Kaplan Lease N, Gin JW, Ogorzalek TL, Adams PD, Hillson NJ, et al. (2022) Modular automated bottom-up proteomic sample preparation for high-throughput applications. PLoS ONE 17(2): e0264467. https://doi.org/10.1371/journal.pone.0264467

Publications

- Making Security Viral: Shifting Engineering Biology Culture and Publishing Rebecca Mackelprang, Katarzyna P. Adamala, Emily R. Aurand, James C. Diggans, Andrew D. Ellington, Samuel Weiss Evans, J. L. Clem Fortman, Nathan J. Hillson, Albert W. Hinman, Farren J. Isaacs, June I. Medford, Shadi Mamaghani, Tae Seok Moon, Megan J. Palmer, Jean Peccoud, Elizabeth A. Vitalis, India Hook-Barnard, and Douglas C. Friedman ACS Synthetic Biology 2022 11 (2), 522-527 DOI: 10.1021/acssynbio.1c00324
- Hyun Gyu Lim, Kevin Rychel, Anand V. Sastry, Gayle J. Bentley, Joshua Mueller, Heidi S. Schindel, Peter E. Larsen, Philip D. Laible, Adam M. Guss, Wei Niu, Christopher W. Johnson, Gregg T. Beckham, Adam M. Feist, Bernhard Palsson, Machine-learning from Pseudomonas putida KT2440 transcriptomes reveals its transcriptional regulatory network, Metabolic Eng. (2022) 72, 297-310.
- Lim HG, Rychel K, Sastry AV, Bentley GJ, Mueller J, Schindel HS, Larsen PE, Laible PD, Guss AM, Niu W, Johnson CW, Beckham GT, Feist AM, Palsson BO. Machine-learning from Pseudomonas putida KT2440 transcriptomes reveals its transcriptional regulatory network. Metab Eng. 2022 Jul;72:297-310. doi: 10.1016/j.ymben.2022.04.004. Epub 2022 Apr 27.

Publications

- Chen Ling, George L. Peabody, Davinia Salvachúa, Young-Mo Kim, Colin M. Kneucker, Michela A. Monninger, Nathalie Munoz, Brenton C. Poirier, Kelsey J. Ramirez, Peter C. St. John, Sean P. Woodworth, Jon K. Magnuson, Kristin E. Burnum-Johnson, Adam M. Guss,* Christopher W. Johnson,* Gregg T. Beckham*, Muconic acid production from glucose and xylose in Pseudomonas putida KT2440 via evolution and metabolic engineering, Nature Comm. (2022) 13, 4925
- Hector Garcia Martin*, Tijana Radivojevic, Jeremy Zucker, Kristofer Bouchard, Jess Sustarich, Sean Peisert, Dan Arnold, Nathan Hillson, Gyorgy Babnigg, Jose Manuel Marti, Christopher J. Mungall, Gregg T. Beckham, Lucas Waldburger, James Carothers, ShivShankar Sundaram, Deb Agarwal, Blake A. Simmons, Tyler Backman, Deepanwita Banerjee, Deepti Tanjore, Lavanya Ramakrishnan, Anup Singh, Perspectives for self-driving labs in synthetic biology, submitted to Curr. Opin. Biotech
- N. Pandey, S.A. Davison, M. Krishnamurthy, D.S. Trettel, C. Lo, S. Starkenburg, K.L. Wozniak, T.L. Kern, S.D. Reardon, C.J. Unkefer, S.P. Hennelly and T. Dale. 2022. Precise genomic riboregulator control of metabolic flux in microbial systems. ACS Syn. Biol https://doi.org/10.1021/acssynbio.1c00638

Publications

- Pomraning K.R., Z. Dai, N. Munoz Munoz, Y. Kim, Y. Gao, S. Deng, and T.L. Lemmon, et al. 2022. "Itaconic acid production is regulated by laeA in Aspergillus pseudoterreus." Metabolic Engineering Communications
- Kyle R. Pomraning; Shuang Deng; Joonhoon Kim; Kristen B. Campbell; Ana L. Robles; Beth Hofstad; Nathalie Munoz; Yuqian Gao; Teresa Lemmon; Marie S. Swita; Jeremy D. Zucker; Young-Mo Kim; Kristin E. Burnum-Johnson; Jon K. Magnuson; Ziyu Dai. 2022 “Metabolic engineering to improve production of 3-hydroxypropionic acid from corn-stover hydrolysate in Aspergillus species.” Metabolic Engineering
- Kevin J. McNaught, Eugene Kuatsjah, Michael Zahn, Érica T. Prates, Huiling Shao, Gayle J. Bentley, Andrew R. Pickford, Josephine N. Gruber, Kelley V. Hestmark, Daniel A. Jacobson, Brenton C. Poirier, Chen Ling, Myrsini San Marchi, William E. Michener, Carrie D. Nicora, Jacob N. Sanders, Caralyn J. Szostkiewicz, Dušan Veličković, Mowei Zhou, Nathalie Munoz, Young-Mo Kim, Jon K. Magnuson, Kristin E. Burnum-Johnson, K.N. Houk, John E. McGeehan, Christopher W. Johnson, Gregg T. Beckham, "Initiation of fatty acid biosynthesis in Pseudomonas putida KT2440", Metabolic Engineering, Volume 76, 2023, Pages 193-203, https://doi.org/10.1016/j.ymben.2023.02.006

Presentations

- Gregg Beckham, Hybrid biological and catalytic processes to manufacture and recycle plastics, Princeton University, November 28th, 2018
- Nathan J. Hillson. “DOE Agile BioFoundry Overview”. Invited Talk, SynBioBeta 2018 visit to ESE, Emeryville, CA, October 1, 2018
- Nathan J. Hillson. “Recent developments at the U.S Department of Energy Agile BioFoundry”. Invited Talk, 2nd Darmstadt RoboWorkshop, Darmstadt, Germany, November 7, 2018
- Nathan J. Hillson. “DIVA (DNA Design, Implementation, Validation Automation) Platform”. Invited Talk, 2nd Darmstadt RoboWorkshop, Darmstadt, Germany, November 8, 2018
- Garcia Martin, H. “Towards a predictive synthetic biology enabled by machine learning and automation". Ginkgo Bioworks, Boston, MA, November 12, 2018; AIChE annual meeting, Pittsburgh, PA, October 31 2018; Thermo Fisher, San Jose, CA, October 19, 2018; DTRA Tech Watch, Ft. Belvoir, VA, October 10, 2018.
- Garcia Martin, H. “A New Approach to Flux Analysis". ABF Annual Meeting, Berkeley CA, September 7, 2018.
- Nathan J. Hillson. “BioDesign Department Overview”. Invited Talk, BSE Annual Meeting, Berkeley, CA, January 24, 2019

Presentations

- Nathan J. Hillson. “Agile BioFoundry Overview”. Invited Talk, BETO Peer Review, Denver, CO, March 7, 2019
- Nathan J. Hillson. “Agile BioFoundry DBTL Infrastructure”. Invited Talk, BETO Peer Review, Denver, CO, March 7, 2019
- Nathan J. Hillson. “DNA Synthesis Science at the U.S. DOE Joint Genome Institute: Biosecurity Sequence Screening and Broader Aspects Review”. Invited Talk, EBRC Spring Retreat 2019, Boston, MA, March 23, 2019
- Nathan J. Hillson. “ABF: plans for the next 3-year cycle”. Invited Talk, BETO Quarterly FY19Q2, Washington DC, March 27, 2019
- Jennifer Chiniquy. “Emery Station East DIVA DNA Sequencing”. Invited Talk, BSE Annual Meeting, Berkeley, CA, January 24, 2019
- Garcia Martin, H. " Towards a predictive synthetic biology enabled by machine learning and automation". EmeryStation Campus, Emeryville, CA, February 7th, 2019.
- Garcia Martin, H. "Metabolic modeling, drug synthesis, and their interaction". LBNL Biosciences Experts Advisory Committee, Berkeley, CA, February 8th, 2019.
- Garcia Martin, H. " Towards a predictive synthetic biology enabled by machine learning and automation". Google X, Mountain View, CA, February 14th, 2019.

Presentations

- Garima Goyal, Z. Costello, J.A. Gutierrez, A. Kang, T.S. Lee, H.G. Martin, and N.J. Hillson. “PIACE: Parallel Integration and Chromosomal Expansion of metabolic Pathways”. Invited Talk, ACS Conference, Orlando, Florida, April 4, 2019
- Nathan J. Hillson. “DNA synthesis use and biosecurity screening at U.S. DOE projects including the Joint Genome Institute, Joint BioEnergy Institute, and Agile BioFoundry”. Invited Talk, Gene Synthesis Governance Meeting, Johns Hopkins Center for Health Security, St. Regis Hotel, Washington, DC, April 9, 2019
- Nathan J. Hillson. “DOE Agile BioFoundry: Overview and Recent Highlights”. Invited Talk, SBFC 2019 Session ST-2: Global Research Consortia, Seattle, WA, May 1, 2019
- Nathan J. Hillson. “2019 BETO Merit Review Process”. Invited Talk, ABF IAB FY19Q3, Zoom Videoconference, May 17, 2019
- Nathan J. Hillson. “Machine Learning-assisted MiSeq library loading”. Invited Talk, ABF IAB FY19Q3, Zoom Videoconference, May 17, 2019
- Nathan J. Hillson. “Global Biofoundries Alliance: 2019 Annual Meeting Report Out”. Invited Talk, ABF IAB FY19Q3, Zoom Videoconference, May 17, 2019
- Nathan J. Hillson. “2019 BETO Peer Review Report Out”. Invited Talk, ABF IAB FY19Q3, Zoom Videoconference, May 17, 2019

Presentations

- Nathan J. Hillson. “ICE/DIVA, EDD, and ART”. Invited Talk, Software for Synthetic Biology Workflows Workshop, SEED 2019, New York, NY, June 27, 2019
- Nathan J. Hillson. “DOE Agile BioFoundry: Overview and Recent Highlights”. Invited Talk, JBEI Annual Meeting 2019, Monterrey, CA, May 30, 2019
- Henrique C. De Paoli. “Overview of Synthetic Biology principles”. Invited Talk, Xu’s Research Group, UC Dept. of Materials Science and Engineering, Berkeley, CA, May 13, 2019.
- Nathan J. Hillson "ABF: CRADA updates and FY20-22". Invited Talk, BETO Conversion Call, July 1, 2019
- Wei Xiong and Nathan Hillson, "Synthetic C1 Condensation Cycle for Formate-Mediated ElectroSynthesis". Invited Talk, BETO Conversion Call, July 8, 2019
- Ernst Oberortner, Nathan J. Hillson, and Jan-Fang Cheng. "The Operon Refactoring and Construction Assistant (ORCA): Streamlined gene cluster refactoring". Invited Talk, 11th International Workshop on Bio-Design Automation, University of Cambridge, UK July 9, 2019
- Nathan J. Hillson "ABF Overview, FY19 Update, and FY20-22 Plans". Invited Talk, ABF Annual Meeting, Richland, WA, July 30, 2019
- Nathan J. Hillson "FY22Q4_DBTL_AS1: 5x efficiency improvements". Invited Talk, ABF Annual Meeting, Richland, WA, July 31, 2019

Presentations

- Nathan J. Hillson "DOE Agile BioFoundry: Overview and Recent Highlights". Invited Talk, VIP Visit - Wendy Pulling | Director of ESG Integration University of California Office of the Chief Investment Officer, Emeryville, CA, Aug 6, 2019
- Nathan J. Hillson "DOE Agile BioFoundry: Overview and Recent Highlights". Invited Talk, Tiangong Forum Distinguished Lecture, Tianjin Institutes of Industrial Biotechnology (TIB), Chinese Academy of Sciences (CAS), Tianjin, China, August 16, 2019
- Nathan J. Hillson "DOE Agile BioFoundry: DBTL Infrastructure". Invited Talk, SynBioYSF 2019, Tianjin Institutes of Industrial Biotechnology (TIB), Chinese Academy of Sciences (CAS), Tianjin, China, August 17, 2019
- Nathan J. Hillson "U.S. DOE Agile BioFoundry: Overview and Recent Highlights", Invited Talk, Genscript Double Helix Symposium 2019, San Francisco, CA September 30, 2019
- Jennifer Chiniquy "DIVA DNA Sequencing". Invited Talk, 2019 ABF All Hands Meeting, Pacific Northwest National Laboratory, Richland, WA, July 30, 2019.
- Tijana Radivojevic, "Automatic Recommendation Tool", Invited Talk, ABF Annual Meeting 2019, Richland, WA, July 30, 2019
- Nurgul Kaplan."Automated DNA Construction: "from j5 protocol design to Laboratory Robotics" Invited Talk, ABF Annual Meeting 2019, Pasco, WA, July 30, 2019

Presentations

- Nathan J. Hillson “U.S. DOE Agile BioFoundry: Organization and Capabilities”, Invited Talk, ABF Industry Day 2019, Emeryville, CA October 4, 2019
- Garcia Martin, H. “Machine Learning, Synthetic Biology and Automation: Engineering Life for the Benefit of Society”. NERSC data seminar, Berkeley CA, November 1st, 2019.
- Garcia Martin, H. “ART: a machine learning Automated Recommendation Tool for guiding synthetic biology”. AI4Synbio Symposium, Arlington VA, November 8th, 2019.
- Garcia Martin, H. “Opportunities in the intersection of:Artificial Intelligence & Synthetic Biology & Automation”. Army Science Planning and Strategy Meeting, Burlington MA, November 13th, 2019.
- Nathan J. Hillson “ABF: CRADA updates and FY20-22”. Invited Talk, BETO Conversion Call, July 1, 2019
- Wei Xiong and Nathan Hillson, “Synthetic C1 Condensation Cycle for Formate-Mediated ElectroSynthesis”. Invited Talk, BETO Conversion Call, July 8, 2019
- Ernst Oberortner, Nathan J. Hillson, and Jan-Fang Cheng. “The Operon Refactoring and Construction Assistant (ORCA): Streamlined gene cluster refactoring”. Invited Talk, 11th International Workshop on Bio-Design Automation, University of Cambridge, UK July 9, 2019

Presentations

- Nathan J. Hillson “ABF Overview, FY19 Update, and FY20-22 Plans”. Invited Talk, ABF Annual Meeting, Richland, WA, July 30, 2019
- Nathan J. Hillson “FY22Q4_DBTL_AS1: 5x efficiency improvements”. Invited Talk, ABF Annual Meeting, Richland, WA, July 31, 2019
- Nathan J. Hillson “DOE Agile BioFoundry: Overview and Recent Highlights”. Invited Talk, VIP Visit - Wendy Pulling | Director of ESG Integration University of California Office of the Chief Investment Officer, Emeryville, CA, Aug 6, 2019
- Nathan J. Hillson “DOE Agile BioFoundry: Overview and Recent Highlights”. Invited Talk, Tiangong Forum Distinguished Lecture, Tianjin Institutes of Industrial Biotechnology (TIB), Chinese Academy of Sciences (CAS), Tianjin, China, August 16, 2019
- Nathan J. Hillson “DOE Agile BioFoundry: DBTL Infrastructure”. Invited Talk, SynBioYSF 2019, Tianjin Institutes of Industrial Biotechnology (TIB), Chinese Academy of Sciences (CAS), Tianjin, China, August 17, 2019
- Nathan J. Hillson “U.S. DOE Agile BioFoundry: Overview and Recent Highlights”, Invited Talk, Genscript Double Helix Symposium 2019, San Francisco, CA September 30, 2019
- Jennifer Chiniquy “DIVA DNA Sequencing”. Invited Talk, 2019 ABF All Hands Meeting, Pacific Northwest National Laboratory, Richland, WA, July 30, 2019.

Presentations

- Tijana Radivojevic, “Automatic Recommendation Tool”, Invited Talk, ABF Annual Meeting 2019, Richland, WA, July 30, 2019
- Nurgul Kaplan.”Automated DNA Construction: “from j5 protocol design to Laboratory Robotics” Invited Talk, ABF Annual Meeting 2019, Pasco, WA, July 30, 2019
- ART: A machine learning Automatic Recommendation Tool for guiding synthetic biology”, Invited Talk, Computational Bio-Science Meeting, Berkeley, CA, April 23, 2020
- Garcia Martin, H. “Opportunities in the intersection of machine learning, synthetic biology, and automation”. ABLC 2020, Virtual meeting, July 10th, 2020.
- Garcia Martin, H. “Leveraging machine learning and automation to make synthetic biology predictable”. SPIE Optics + Photonics 2020, Virtual meeting, August 24th, 2020.
- Nathan J. Hillson, "FY20 ABF CRADA Call: Process, Applications, and Selections", Conversion R&D Standing Lab Update Call, via WebEx, July 27, 2020
- Nathan J. Hillson, "Perspectives from the U.S. DOE Agile BioFoundry”, OECD BNCT Virtual Workshop, Session 1: Biofoundries and COVID-19, via Zoom, July 29, 2020
- Nathan J. Hillson, "DIVA, EDD, and ART: Software spanning the Design/Build/Test/Learn cycle", invited talk, COMBINE 2020, via Zoom, October 5, 2020

Presentations

- Nathan J. Hillson, "DIVA, EDD, and ART: Software spanning the Design/Build/Test/Learn cycle", invited talk, SPARC Workshop (IIT Kharagpur) 2020, via Zoom, October 19, 2020
- Invited talk: Guss AM. “Domestication of non-model microbes for the production of renewable fuels and chemicals” (2021) The Metabolic Engineering Virtual Seminar Series at the University of Texas-Austin. Virtual.
- Garcia Martin, H. “Leveraging machine learning and automation to make bioengineering predictive”. The Metabolic Engineering Virtual Seminar, UT Austin, February 12th, 2021.
- Garcia Martin, H. “Machine Learning for Bioengineering”. JBEI Board of Directors, March 12th, 2021.
- Nathan J. Hillson, "ABF Overview", invited talk, BETO Peer Review 2021, via Zoom, March 9, 2021
- Nathan J. Hillson, "ABF DBTL Infrastructure", invited talk, BETO Peer Review 2021, via Zoom, March 9, 2021
- Nathan J. Hillson, "ABF Overview", invited talk, BSA ExComm, via Zoom, March 12, 2021
- Guss AM. “Synthetic biology and metabolic engineering of non-model microbes for the production of renewable fuels and chemicals” Seminar at Purdue University Northwest. April 16, 2021.

Presentations

- Radivojevic, T., “Automated Recommendation Tool (ART): Design of Experiments via Probabilistic Predictive Modeling", Autonomous Discovery in Science and Engineering Workshop, April 21, 2021(Invited Tutorial)
- Radivojevic, T., “Guiding synthetic biology via machine learning", Symposium on Biomaterials, Fuels and Chemicals (SBF): Speeding up synthetic biology, April 27, 2021
- Radivojevic, T., “Guiding synthetic biology via Automated Recommendation Tool (ART)", Synthetic Biology: Engineering, Evolution & Design (SEED) 2021, Computation, Artificial Intelligence, and Machine Learning for Biological Design Session, June 17, 2021 (Invited Speaker)
- Guss AM. “Domestication of non-model microbes for the production of renewable fuels and chemicals” Student-invited seminar at North Carolina State University. September 27, 2021.
- Radivojevic, T. “Guiding synthetic biology via machine learning and multi-omics technologies”, IWBDA 2021, 13th International Workshop on Bio-Design Automation, September 20, 2021 (virtual)
- Hillson, Nathan J. “Session Introduction”, Metabolic Engineering 14, Block 8: Session – Biofoundries, (Virtual via Remo), July 15, 2021

Presentations

- Hillson, Nathan J. “Updates on DOE assets including Agile BioFoundry, Joint BioEnergy Institute, and Joint Genome Institute”, Digital Biology Engineering Meeting (Air Force) via zoom, September 23, 2021
- Garcia Martin, H. “Machine Learning Tools Can Make Synthetic Biology Predictable”. SIMB, August 9th, 2021.
- Garcia Martin, H. “Leveraging machine learning and automation to make bioengineering predictable”. Indo-US Workshop on Application of Data Science in Biological Systems, September 7th, 2021.
- Garcia Martin, H. “Leveraging machine learning and automation to make bioengineering predictable”. Air Force Research Laboratory MIrACLE Forum, September 10th, 2021.
- Garcia Martin, H. “Challenges and opportunities in high-throughput data synthesis”. NSF Challenges and Opportunities in Synthesizing Massively Parallel Assays and High-Throughput Datasets Workshop, September 17th, 2021.
- Garcia Martin, H. “Guiding metabolic engineering via kinetic deep learning and multi-omics”. Quantitative Modelling of Cell Metabolism Conference, September 21th, 2021.
- Davison, S. Reprogramming Microbes for Biomanufacturing, Science in 3 at Los Alamos National Laboratory, September 2021

Presentations

- Wozniak, K. Engineering a Sustainable Future: Fine-tuning Gene Expression for Biomanufacturing, Science in 3 at Los Alamos National Laboratory, September 2021
- Davison, S. Fine-tuning gene expression in bioproduction pathways in diverse bacterial hosts, SIMB Annual Meeting, August.
- Wozniak, K. Targeting global regulatory responses using precise and programmable cis-riboregulators SIMB Annual Meeting, August
- Adam Guss. “Genetic tools and microbial engineering for biological production of sustainable fuels and chemicals” Presented to Weekly Seminar for DOE CCI/SULI Students. October 27, 2021
- Adam Guss. “Domestication of diverse non-model microbes for plastics upcycling and sustainable fuel and chemical production” Biological Sciences Departmental Seminar, Michigan Technical University. Oct 28, 2021.
- Garcia Martin, H. “Guiding metabolic engineering via kinetic deep learning and multi-omics”. Quantitative Modelling of Cell Metabolism Conference, October 20th, 2021.
- Garcia Martin, H. “Machine learning for industrial biotechnology ”. Delft Advanced Course Integrated Multi-Omics approaches for Improvement of Industrial Microbes, November 5th, 2021.

Presentations

- Hillson, Nathan J. “Opportunities for CABBI collaboration with JBEI (and other DOE assets) in laboratory operations and data management infrastructure”, CABBI seminar, via zoom, October 19, 2021
- Hillson, Nathan J. “Automation in Biotechnology: Challenges and Opportunities”, Panelist at SENAI CETIQT (Brazil), via zoom, October 29, 2021
- Hillson, Nathan J. “ABF Overview and Capabilities”, ABF Industry Day (via zoom), November 19, 2021
- Hector A Plahar, Stephen D. Lane, William C Morrell, Nathan J. Hillson and Christopher J. Petzold. “A Biological Parts Search Portal and Updates to the ICE Parts Registry Platform”, JBEI Annual DOE Review, Dec 6-8, 2021
- Tijana Radivojevic, “Creating a Machine Learning Chassis to Maximize the Efficiency of the DBTL Cycle in Synthetic Biology”, Synthetic Biology-Based Therapeutics Summit, December 9, 2021 (virtual)
- Hillson, Nathan J. “Overview and capabilities of the ABF and opportunities for collaboration with CSU”, Colorado State Seminar Series (via zoom), February 3, 2022
- Hillson, Nathan J. “ABF prospective collaboration with other BETO consortia and projects”, BETO Conversion Call (via MS Teams), March 7, 2022

Presentations

- Bilbao, A. "Investigating deep learning approaches to advance data processing in Liquid Chromatography, Ion Mobility and Data-Independent Acquisition Mass Spectrometry Omics". 70th ASMS Conference on Mass Spectrometry and Allied Topics, Minneapolis, Minnesota, June 9th, 2022.
- Dai Z., K.R. Pomraning, S. Deng, J. Kim, K.B. Campbell, A.L. Robles, and B.A. Hofstad, et al. 05/02/2022. "Assessment and Optimization of 3-hydroxypropionic acid production in industrial filamentous fungus-Aspergillus species." Presented by Z. Dai at 44th Symposium on Biotechnology for Fuels and Chemicals (SBFC 2022), New Orleans, Louisiana
- Adam Guss. "High efficiency DNA integration in diverse non-model microbes for rapid tool and pathway prototyping" SIMB SBFC. New Orleans, LA, May 3, 2022
- Magnuson, J.K.; Beckham, G.T.; Gladden, J.M.; Dale, T.; Guss, A.M.; Laible, P.; Hillson, N.J. 05/03/2022. "The Agile BioFoundry" Presented by Jon Magnuson at the 44th Symposium on Biotechnology for Fuels and Chemicals (SBFC 2022), New Orleans, Louisiana.
- Poirier, B.C. et al. "Mechanical cell disruption enhances the extraction of metabolites from bacterial and fungal species commonly used in metabolic engineering". 70th ASMS Conference on Mass Spectrometry and Allied Topics, Minneapolis, Minnesota, June 5-9, 2022.

Presentations

- Poirier B.C. et al. “Behavior of lactam molecules during aqueous sample preparation and mass spectrometry analysis”. 70th ASMS Conference on Mass Spectrometry and Allied Topics, Minneapolis, Minnesota, June 5-9, 2022.
- Hillson, Nathan J. "Overview and Capabilities of the DOE Agile BioFoundry", ABF Webinar (via zoom) April 29, 2022
- Hillson, Nathan J. "Overview and Capabilities of the DOE Agile BioFoundry", Lessafre visit to ESE (via zoom) May 6, 2022
- Hillson, Nathan J. "Overview and Capabilities of the DOE Agile BioFoundry" (Keynote Presentation) Bioindustry 4.0 – Synthetic Biology & Biofoundry, CHEY Institute – Scientific Innovation Series (via zoom) 12 May 17 (PDT) 18 (KST), 2022
- Hillson, Nathan J. "Overview and Capabilities of the DOE Agile BioFoundry", Wageningen University visit to ESE (via zoom) May 31, 2022
- Hillson, Nathan J. “ABF overview and DBTL Infrastructure”, BETO Conversion Call (via MS Teams), June 13, 2022
- Nathan Hillson. “ABF Decarbonization Efforts”, Invited Talk, LBL Carbon Negative Initiative – Biological Applications – Lightning Talk Session (via zoom) 6/27/2022

Presentations

- Radivojevic,Tijana. “Guiding synthetic biology via machine learning”, Boston University, April 14, 2022, Guest lecture
- Deng S., J. Kim, K.R. Pomraning, Z. Dai, Y. Gao, N. Munoz Munoz, and Y. Kim, et al. 08/07/2022. "Identification of a specific exporter that enables high production of aconitic acid in A. pseudoterreus ATCC32359." Presented by S. Deng at SIMB annual meeting, San Francisco, California.
- Pomraning K.R., Z. Dai, S. Deng, N. Munoz Munoz, Y. Kim, B.A. Hofstad, and Y. Gao, et al. 08/10/2022. "Bioconversion of lignocellulosic feedstocks to 3-hydroxypropionic acid using acidophilic fungi." Presented by K.R. Pomraning at Society for Industrial Microbiology and Biotechnology, San Francisco, California.
- Jha RK. High throughput test tools for industrially relevant microbial chassis, SIMB 2022, San Francisco, August 2022 (invited talk).
- Adam Guss. “Using synthetic biology to solve challenges in plastic waste and renewable chemical production”. Biological Sciences Departmental Seminar, Missouri S&T, Rolla, MO. September 27, 2022.
- Nathan Hillson. “Agile BioFoundry Connections with NSF, MSRDC, and Beyond”, Invited Talk, LBL Biosciences Expert Advisory Committee: connections beyond Biosciences July 8, 2022

Presentations

- Nathan Hillson. “Biosecurity concern anecdote”, Screening Tools for Genome Engineering and Genome Editing (Inscripta-funded; Sarah Carter organized), via MS Teams, 9/9/2022
- Nathan Hillson. “Webinar Agenda and ABF Overview”, ABF Webinar: Cutting-Edge Technologies for Accelerating Bioproduct Development at the Agile BioFoundry, 9/22/20222
- Garcia Martin, H. “Machine Learning and Automation for Predictive Synthetic Biology”. Basque Center for Applied Mathematics, Bilbao, Spain, July 15th, 2022.

License partners and patent applications

License partners

- University of Georgia
- Kiverdi, Inc.
- LanzaTech, Inc.
- Visolis, Inc.
- Danimer Scientific
- University of Washington

Patent Applications

- Terephthalate biosensor and applications thereof
- Mutant transporters for bacterial uptake of terephthalic acid
- Alleviating the bottleneck in enzyme evolution and pathway optimization using novel biosensors (Disclosure Title) Modified Biosensors and Biocatalysts and Methods of Use (Application Title)
- Mutant transporters for bacterial uptake of terephthalic acid
- ART: A machine learning Automated Recommendation Tool for guiding synthetic biology

Patent applications

Patent Applications (cont.)

- A Generative Model for Protein Sequences for the Purpose of Protein Design or Phenotypic Inference
- Predicting Metabolic Pathway Dynamics from Time Series Multiomics Data Using Machine Learning Techniques
- Use of Statistical Learn Approaches to Predict Next Generation Sequencing Subsequence Depth of Coverage
- Mutant transporters for bacterial update of terepthalic acid
- Method and strain for sugar conversion
- Engineered Microorganisms for the Production of Intermediates and Final Products (1st)
- Engineered Microorganisms for the Production of Intermediates and Final Products (2nd)
- Production of organic acids from *Aspergillus pseduoterreus* cadA deletion strain (1st)
- Production of organic acids from *Aspergillus pseduoterreus* cadA deletion strain (2nd)
- Genetically engineering an industrial filamentous fungus *Aspergillus niger* for 3-hydroxypropionic acid production
- A specific exporter responsible for aconitic acid high production in *Aspergillus pseduoterreus*

Records of invention

Records of Invention

- Bioproduction of limonene from syngas
- Mutant transporters for bacterial update of terepthalic acid
- Method to produce branched chain polyhydroxyalkanoates and branched chain 3-hydroxyacids
- A genetic circuit to reduce cell-to-cell production heterogeneity
- High yield conversion of D-xylose to D-arabitol in R. toruloides
- Manipulation of tRNA thiolation gene ncs2 for enhanced production of fatty-acyl-CoA derived chemicals in R. toruloides
- Efficient production of cis, cis-muconic acid from mixed substrates of glucose, D-xylose and L-arabinose
- Whole cell biosensors for industrially relevant polymers precursors
- Engineered Microorganisms for the Production of Intermediates and Final Products
- Method and strain for sugar conversion

Software disclosures

Software Disclosures

- Automated Recommendation Tool (ART) v2.0
- Kinetic Learning v0.1
- Automated Recommendation Tool (ART): v1.0
- PIACE: Parallel Integration and Chromosomal Expansion of Metabolic Pathways
- OMG, Omics Mock Generator Library: v0.1.1
- Fermentation Data Processing
- Fermentation Data Manipulation and Analysis Once imported
- DIVA/Device Editor 3.1
- DIVA/Device Editor (DIVA) v6.0.0

