



GMOD powering LanzaTech

Asela W. S. Dassanayake
Bioinformatics Research Scientist
Model Systems Group

2016 GMOD Meeting
Indiana University, Bloomington, Indiana, United States
June 30 – July 1, 2016

2015 LanzaTech. All rights reserved.

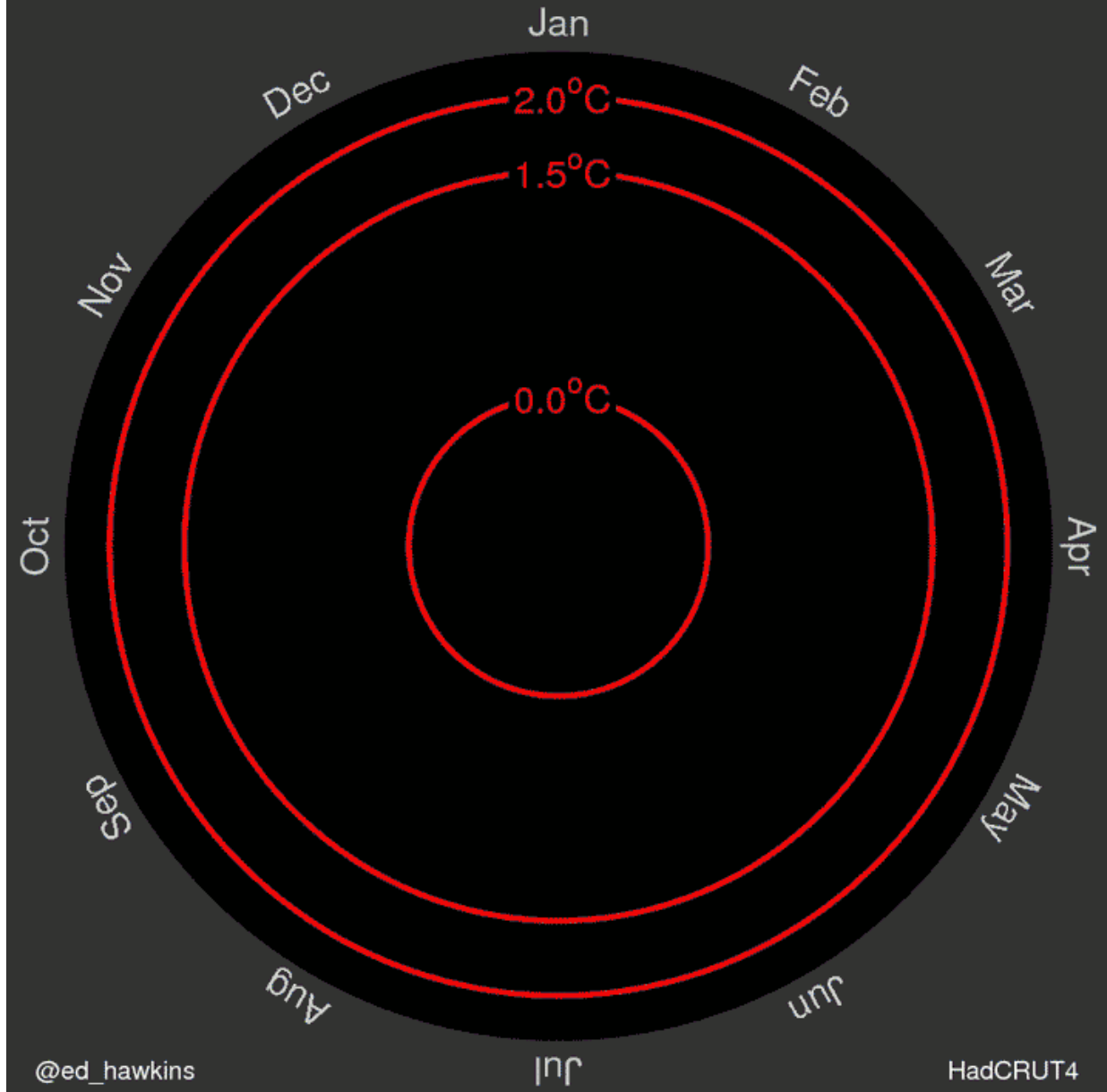


asela.dassanayake@lanzatech.com

The outline

- LanzaTech - Who we are and what we do
- How GMOD is powering the information flow at LanzaTech
- Proposing a Synthetic Biology platform?

Global temperature change (1850–2016)

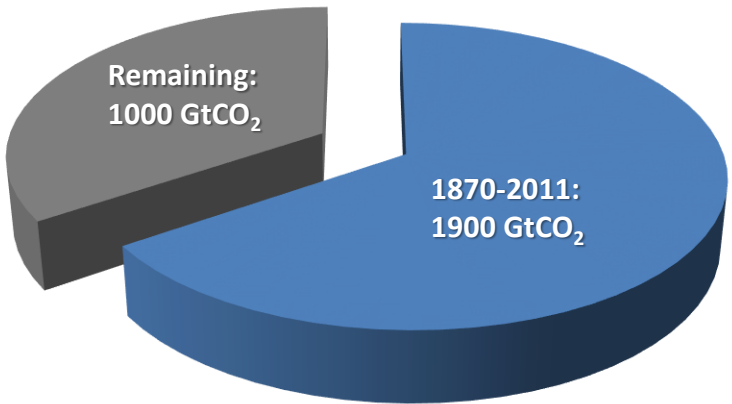


@ed_hawkins

HadCRUT4

Ed Hawkins,
Climate scientist,
National Centre for
Atmospheric Science,
University of Reading.
@ed_hawkins

Carbon smart world



65% of 2° carbon budget: USED

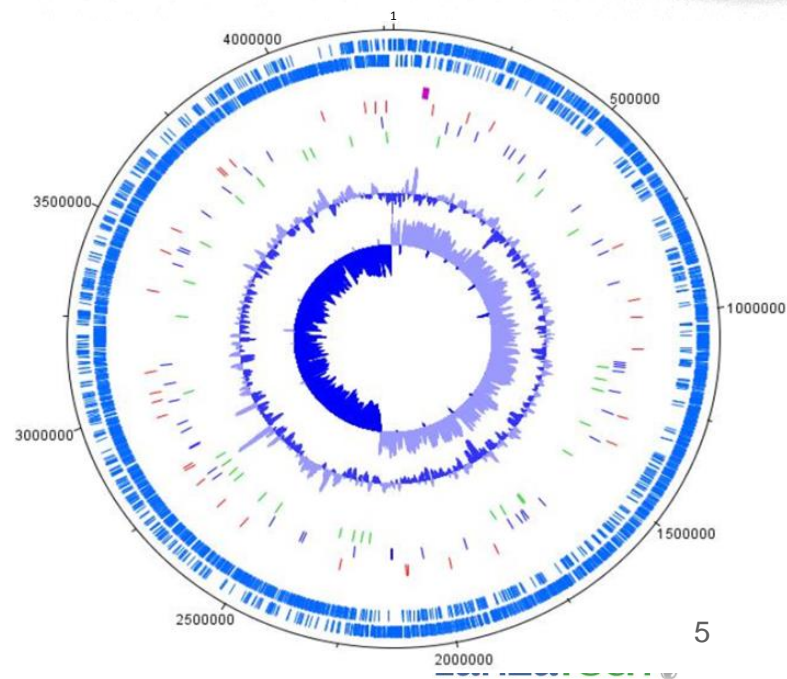
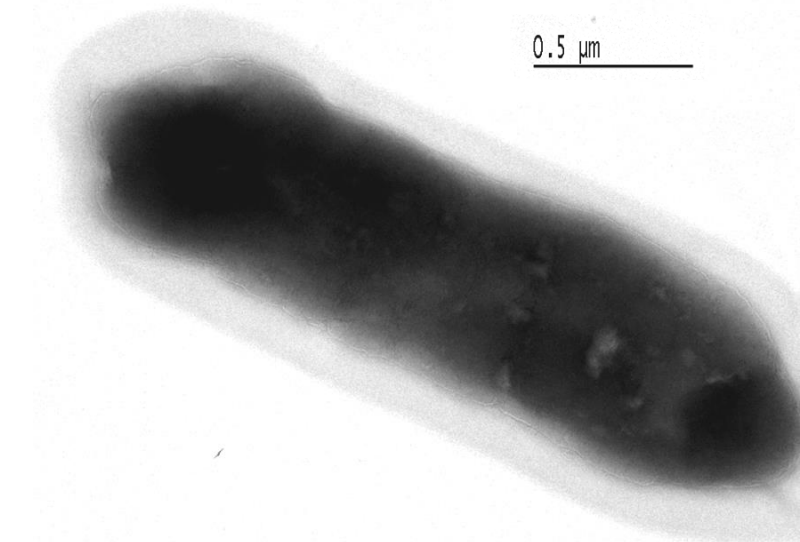
 52% of natural gas reserves	 35% of oil reserves	 88% of coal reserves
--	---	--

Must stay in the ground

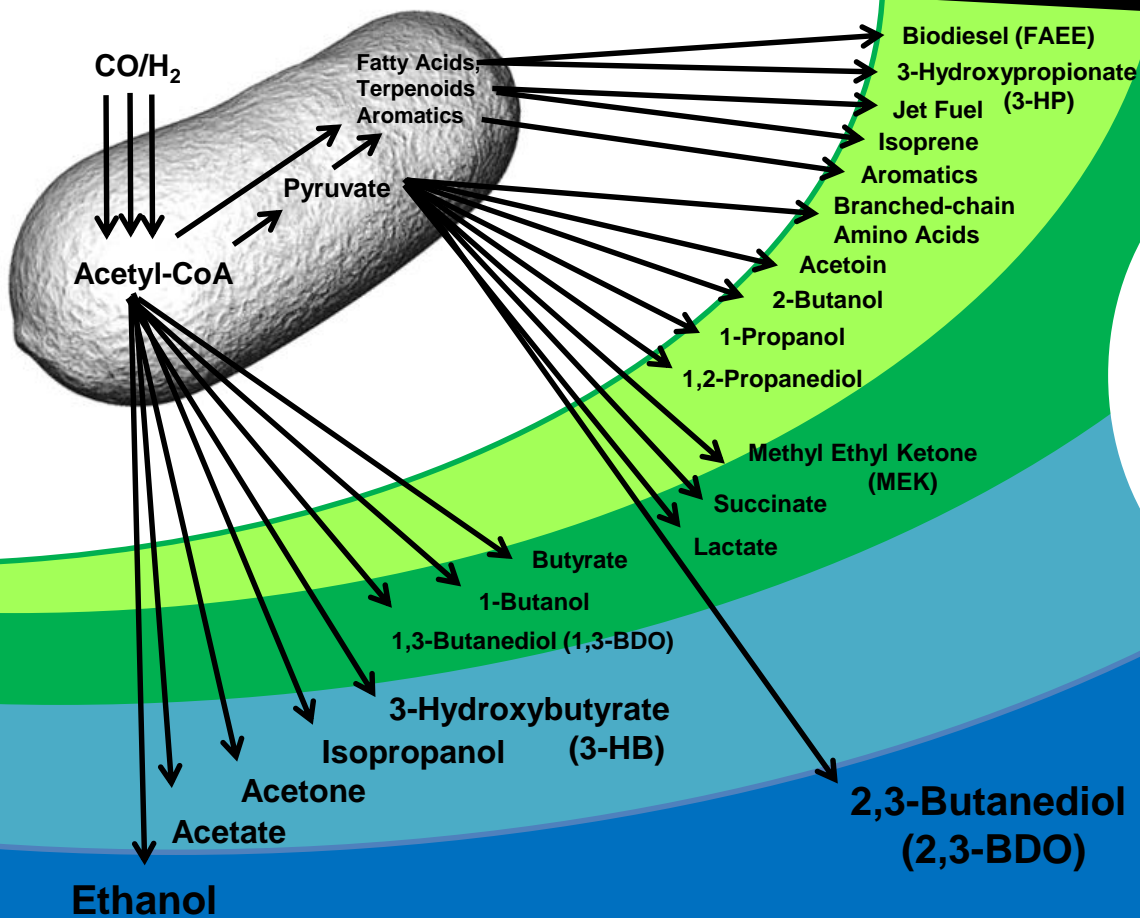


Proprietary Acetogenic Biocatalyst

- **Worlds' first autotrophs**
- **Acetogenic bacterium with ability to utilize sole energy and carbon source**
 - CO
 - CO+H₂ or CO+CO₂+H₂
 - CO₂+H₂
- **LanzaTech has developed a proprietary strain of *Clostridium autoethanogenum***
- **Obtained by extensive selection program, having improved characteristics**
 - High gas uptake and ethanol production rates
 - Fast growth on defined minimal media
 - Non-sporulating and non-motile



1 Organism, over 25 Products...



Discovery **Continuous lab-scale fermentation** **Piloting >50% selectivity at lab scale** **Scaled Up**

Partnerships

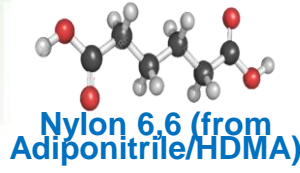
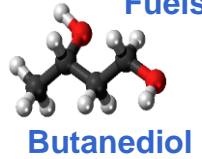
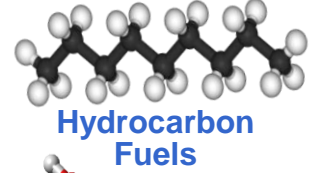
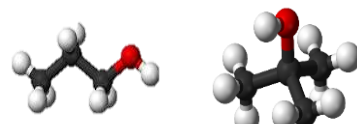
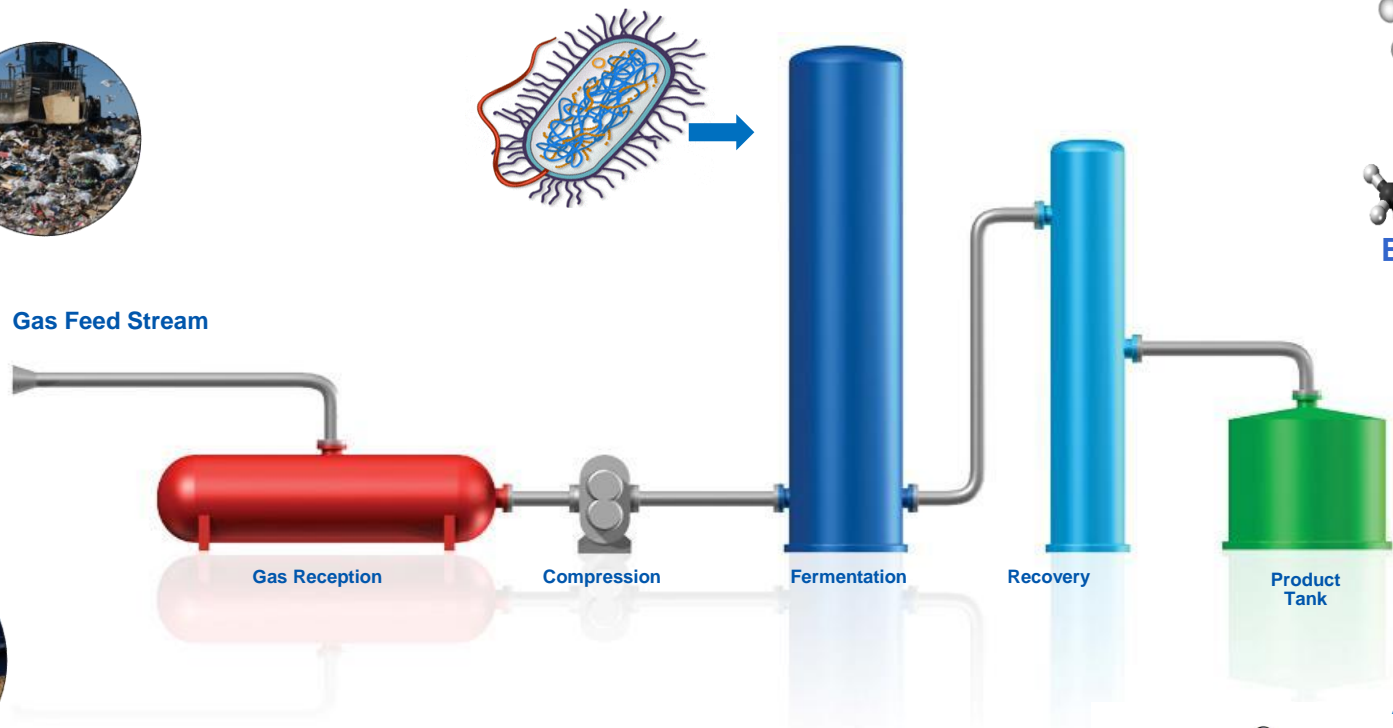
- 1,3-Butadiene
 - INVISTA
- Biopolymers
 - EVONIK INDUSTRIES
- Butylene
 - GLOBAL BIOENERGIES



The LanzaTech Process



Gas Feed Stream

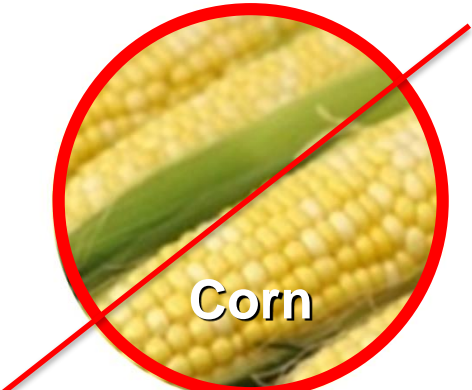


A sensible path

We use:



We do not use:



3 Commercial projects underway



Strong Pipeline and Committed Partners

Commercial Production 2017

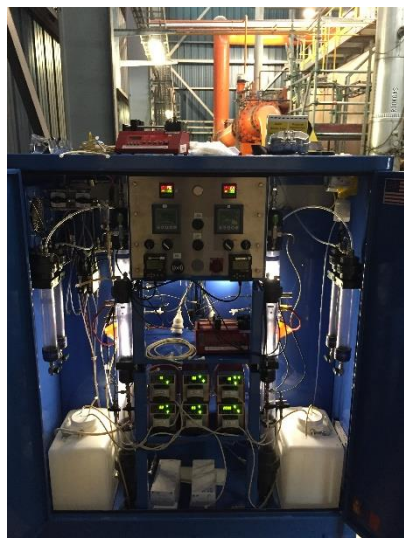


ArcelorMittal, Gent



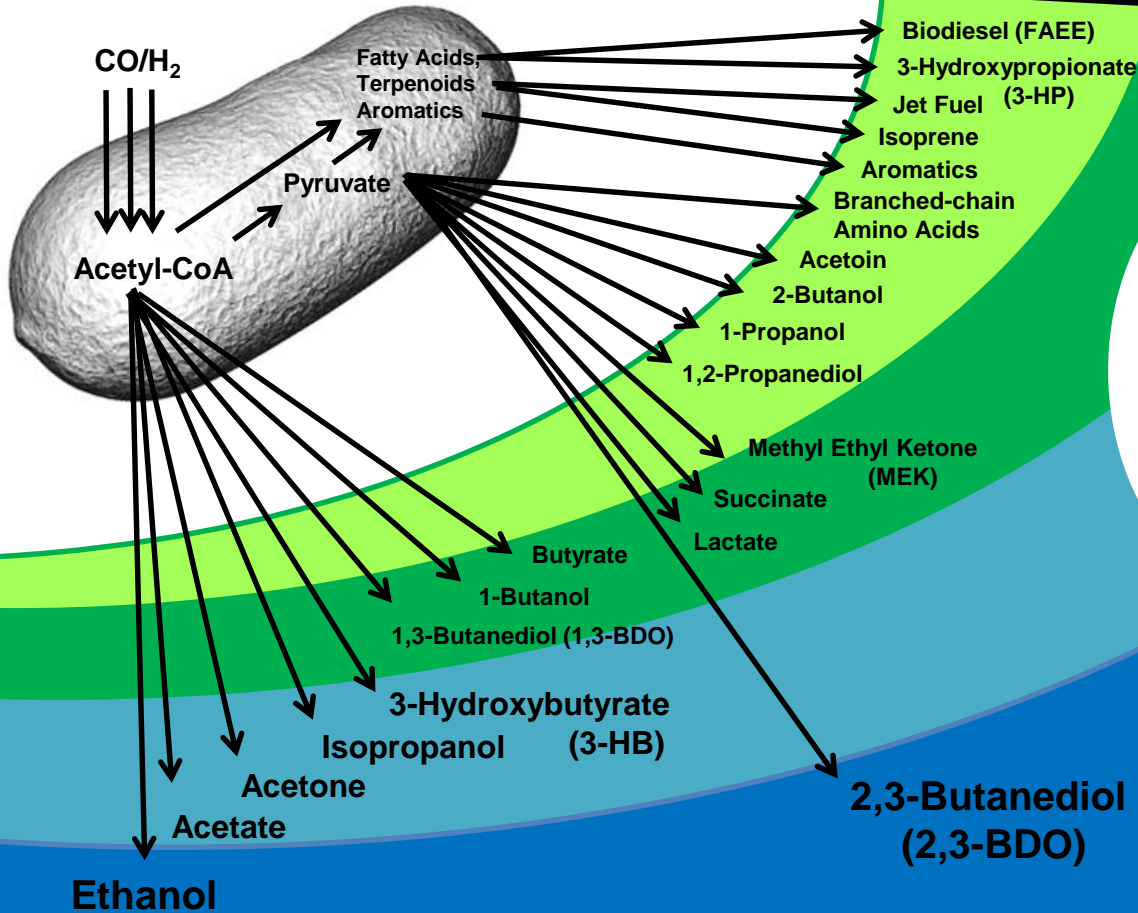
Ground Works Started
October 2015

Gas Testing Station
Produces Ethanol
January 2016



Connection to Steel
Mill Gas Lines
March 2016

1 Organism, over 25 Products...



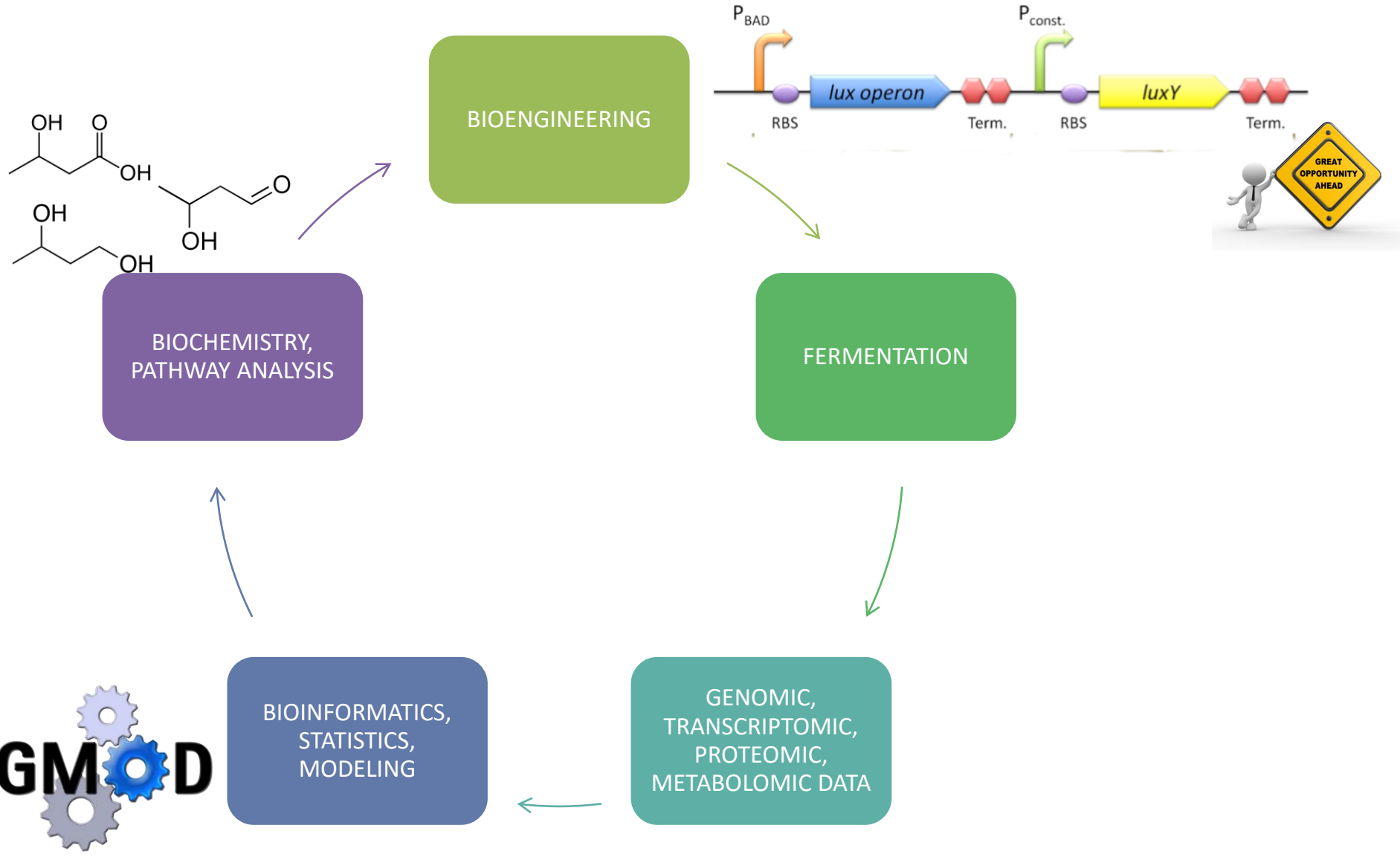
Discovery **Continuous lab-scale fermentation** **Piloting >50% selectivity at lab scale** **Scaled Up**

Partnerships

- 1,3-Butadiene
 - INVISTA
- Biopolymers
 - EVONIK INDUSTRIES
- Butylene
 - GLOBAL BIOENERGIES



Information flow at LanzaTech



GMOD at LanzaTech



External Collaborators

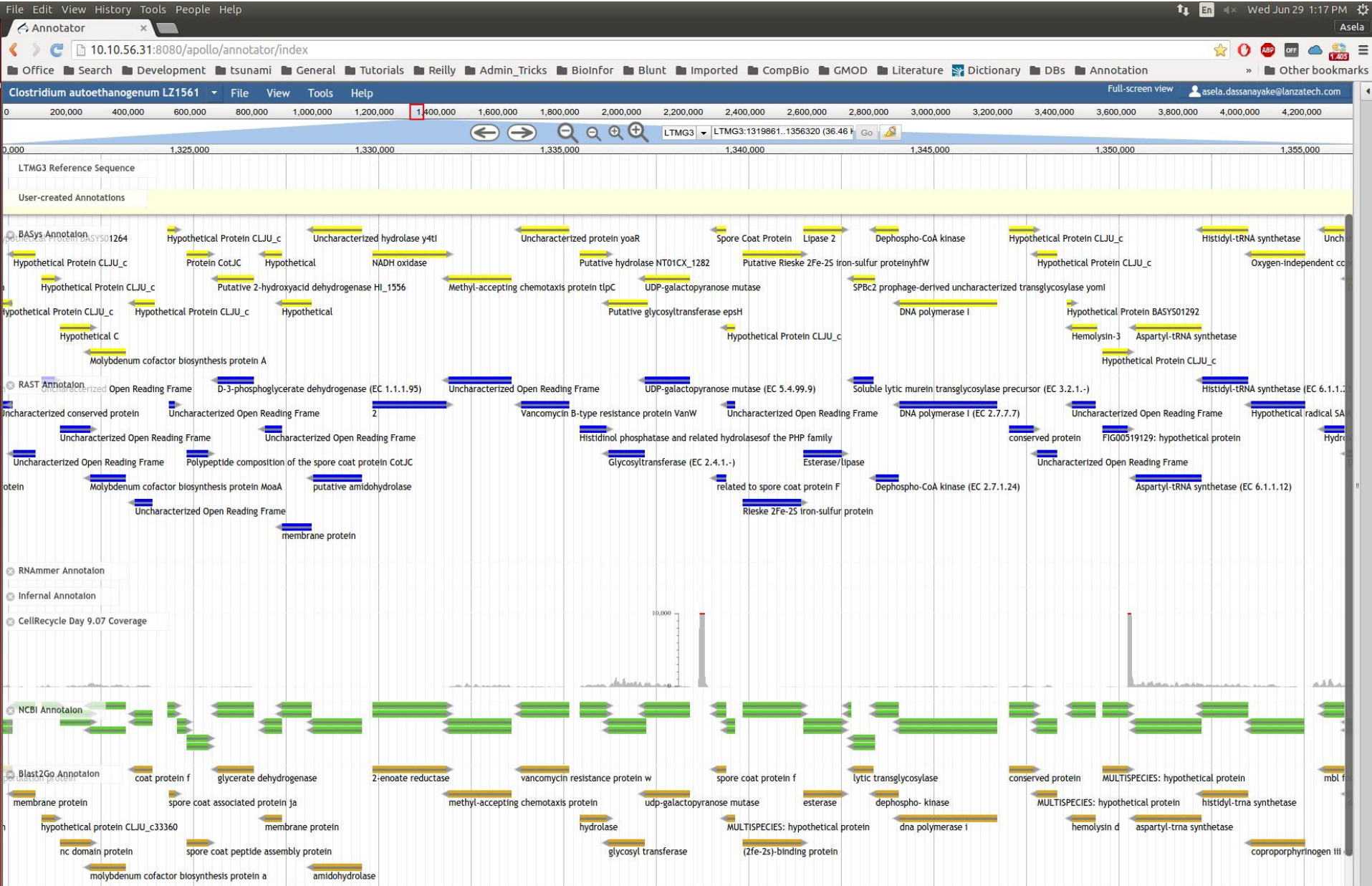


CHADO

Chado: Biological database schema

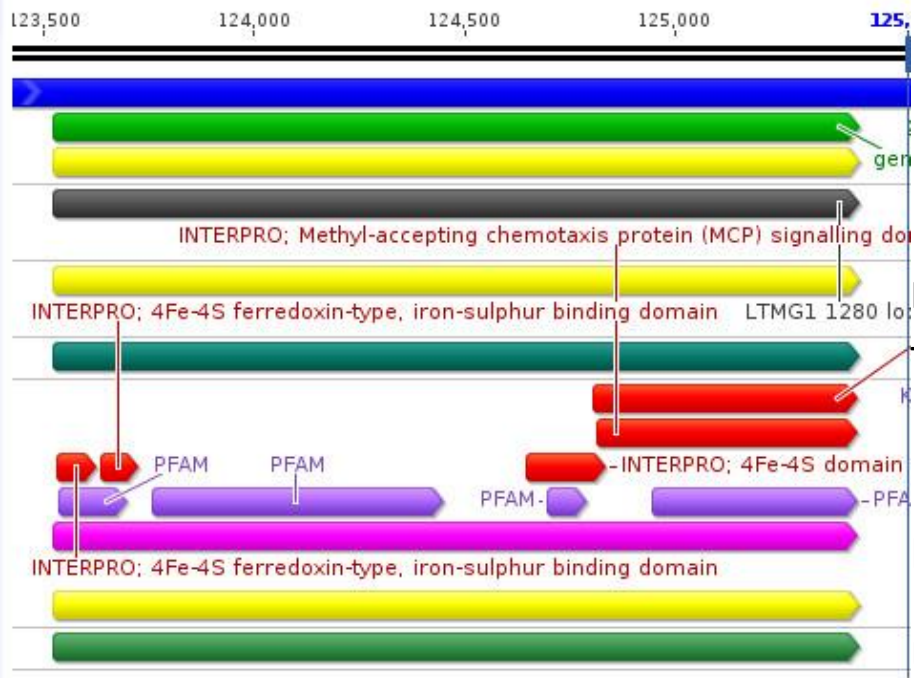


Apollo at LanzaTech - Internal



Roshomon

- LTMG1
- ▼ NCBI PGAP
- ▼ LanzaTech
- ▼ BASys
- ▼ BLAST2GO
- ▼ JGI IMG
- ▼ RAST



Transcriptional Regulator

Methyl accepting chemotaxis protein

Transcriptional Regulator

Iron-Sulphur binding cluster

Uncharacterised ORF

RNASeq Experiment Portal version 0.01



View omics data, beautifully.

Provide list of 1-10 Locus IDs to view expression profiles.

Experiment

Gene

Gene

Gene

Gene

Submit

Generate a list of genes based on Fold Change

Experiment

Select list of genes with Fold Change

More than

Less Than

Submit

View co expressed genes for a gene of interest

Experiment

Gene of interest

Number of co expressed genes

Submit

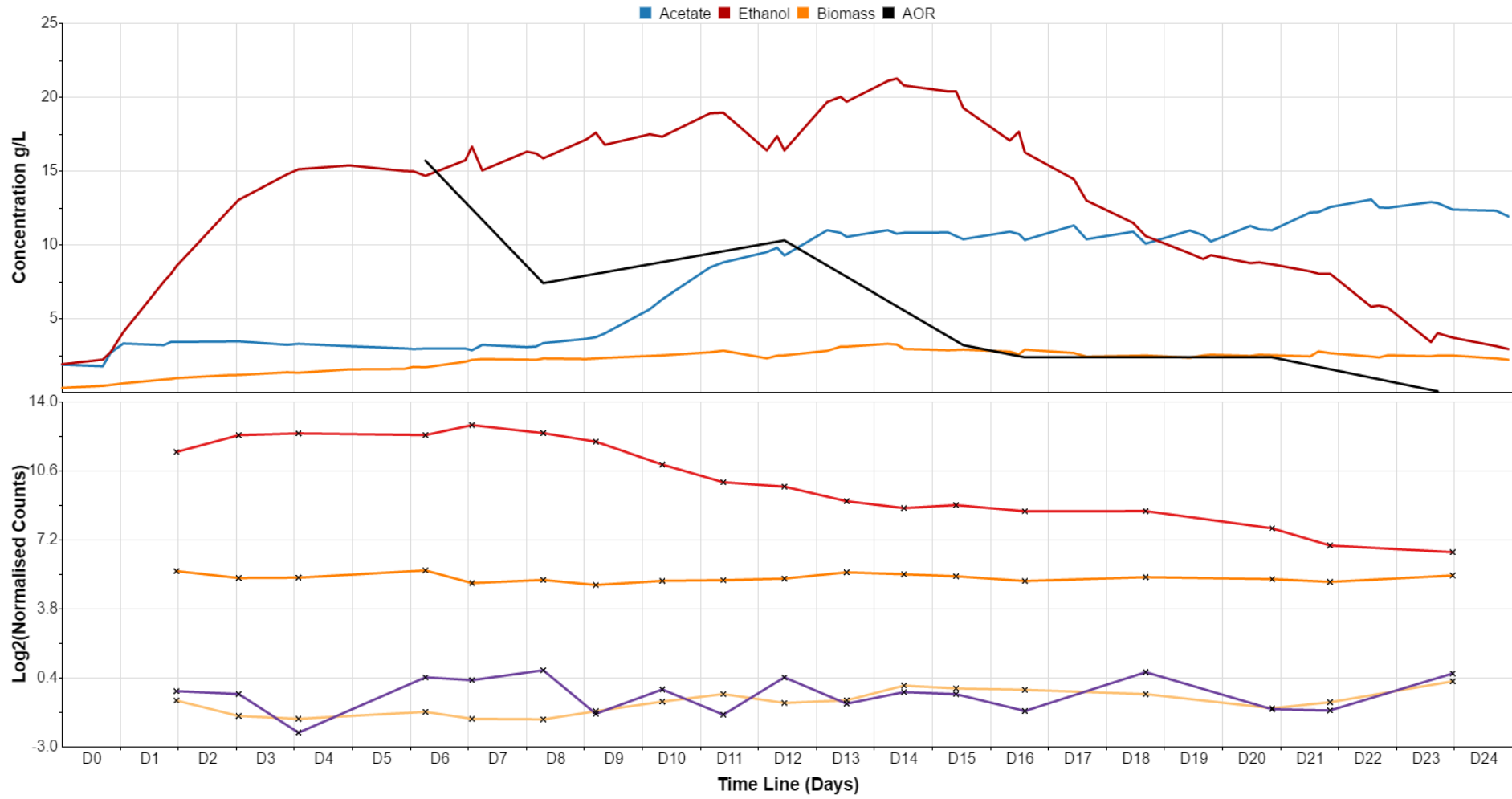
Compare a gene profile between experiments

Experiment1

Experiment2

Gene of interest





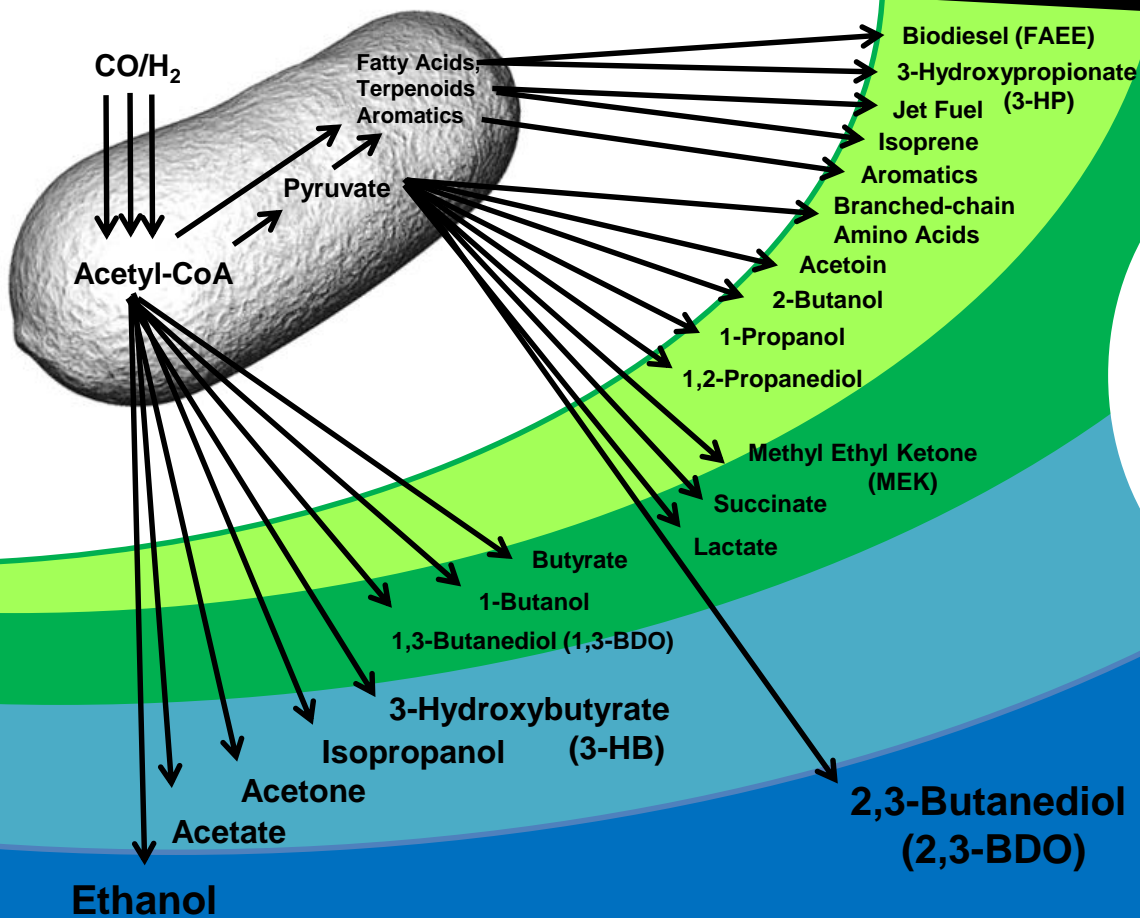
Gene Key

- aldehyde:ferredoxin oxidoreductase (LTMG3_1070)
- nitrogenase (LTMG3_4520)
- MerR family transcriptional regulator (LTMG3_7540)
- histidine kinase (LTMG3_9540)

[Back to Form](#)



1 Organism, over 25 Products...



Discovery **Continuous lab-scale fermentation** **Piloting >50% selectivity at lab scale** **Scaled Up**

Partnerships

- 1,3-Butadiene
 - INVISTA
- Biopolymers
 - EVONIK INDUSTRIES
- Butylene
 - GLOBAL BIOENERGIES



Proposing an Integrated Synthetic Biology platform

- User data organization and management
- BLAST Interface
- Database Searching



- Literature searches and bibliography



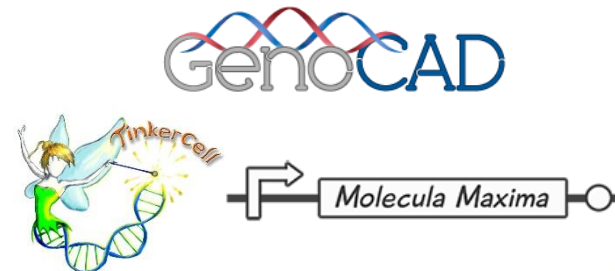
- Genome browser



- Data Visualization



- Synthetic Biology CAD with SBML/SBOL



Integrated Synthetic Biology platform

Tools and Controls

- blastn
- blastp
- blastx
- tblastn
- Primer-BALST
- SmartBLAST
- Global Align
- CD-search
- IgBLAST
- MA
- CDART

User Data

Project

- BRP_crt
- Ethanol_test
- DGM_tye
- MRT_uyp

Enter Query Sequence BLASTN programs search

Enter accession number(s), gl(s), or FASTA sequence(s) [Clear](#) **Query subrange**

From To

Or, upload file No file chosen

Job Title
Enter a descriptive title for your BLAST search

Align two or more sequences

Choose Search Set

Database Human genomic + transcript Mouse genomic + transcript Others (nr etc.):

Organism Optional Exclude
Enter organism common name, binomial, or tax id. Only 20 top taxa will be shown

Exclude Optional Models (XM/XP) Uncultured/environmental sample sequences

Limit to Optional Sequences from type material

Entrez Query Optional [YouTube](#) [Create custom database](#)
Enter an Entrez query to limit search

Program Selection

Optimize for Highly similar sequences (megablast) More dissimilar sequences (discontiguous megablast) Somewhat similar sequences (blastn)
Choose a BLAST algorithm

Search database **Nucleotide collection (nr/nt)** using **Megablast (Optimize for highly similar sequences)**

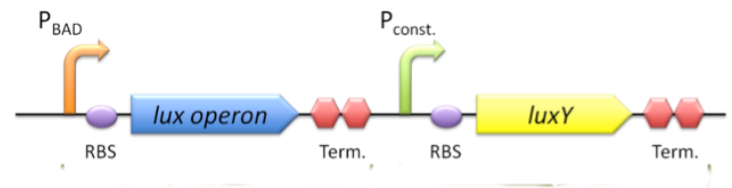
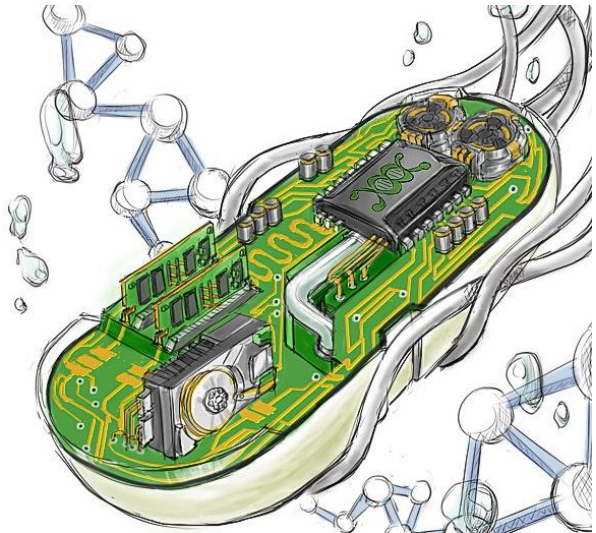
Show results in a new window

[+ Algorithm parameters](#)



More Users? Funding?

↗ promoter	↘ primer binding site
▭ cds	restriction site
⤴ ribosome entry site	blunt restriction site
⊥ terminator	└ 5' sticky restriction site
□ operator	┌ 3' sticky restriction site
◻ insulator	≡ 5' overhang
✂ ribonuclease site	≡ 3' overhang
♀ rna stability element	≡ assembly scar
✂ protease site	▭ signature
♀ protein stability element	▭ user defined
○ origin of replication	



redhat