



Fermentation Automation & Other Equipment and Research

James Gardner

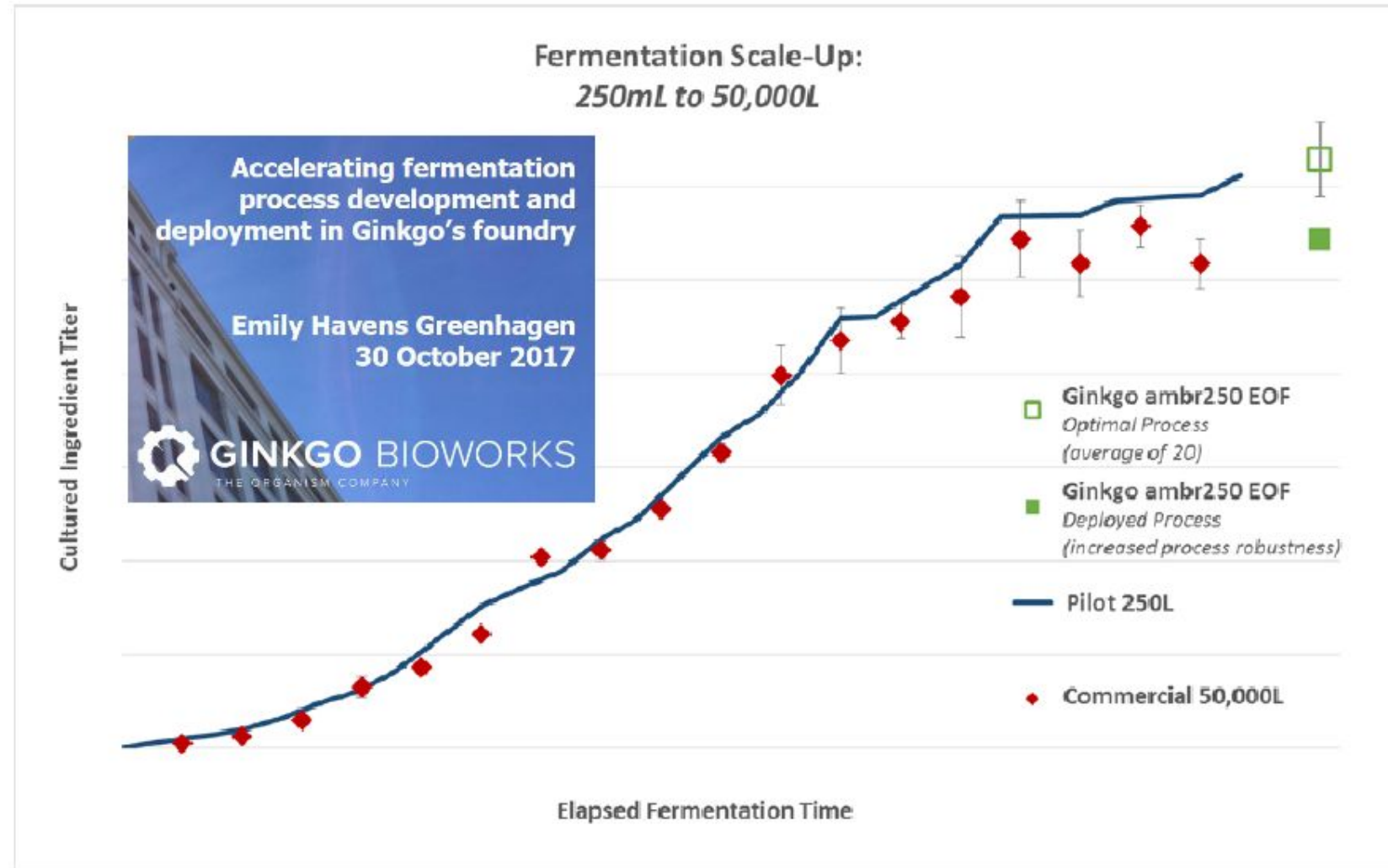
Fermentation at ABPDU



Volume:	≤1 mL	100 mL	250 mL	2L	300L
Reactors:	48	12	12	4	2

Reproducibility Across Scales

Successful scale-up exceeding commercial target



High Throughput (e.g. Testing Ag Residue Hydrolysates)

BioLector: Data-rich, controlled | \$\$, 1 plate



plate: \$270.00



Biolector:
pH, DO, Biomass

Shaker plate: Rapid, cheap, n plates | < control & data



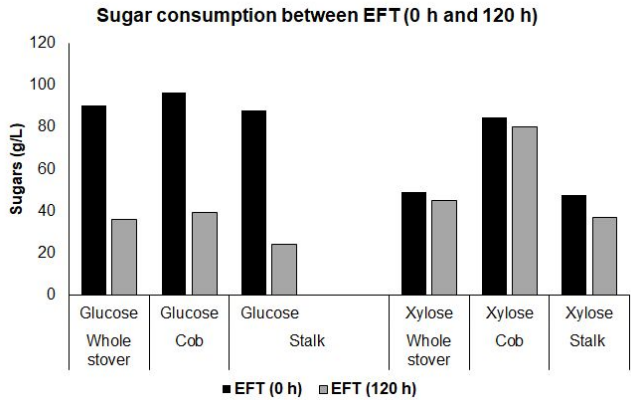
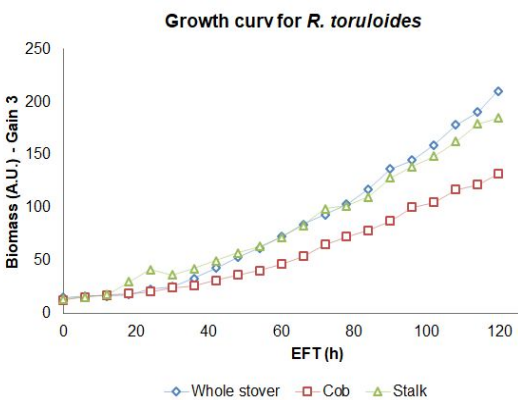
48-well plate: \$2.0



Shaker: controlled
temperature and humidity



microplate reader



Cross contamination testing with *R. toruloides*

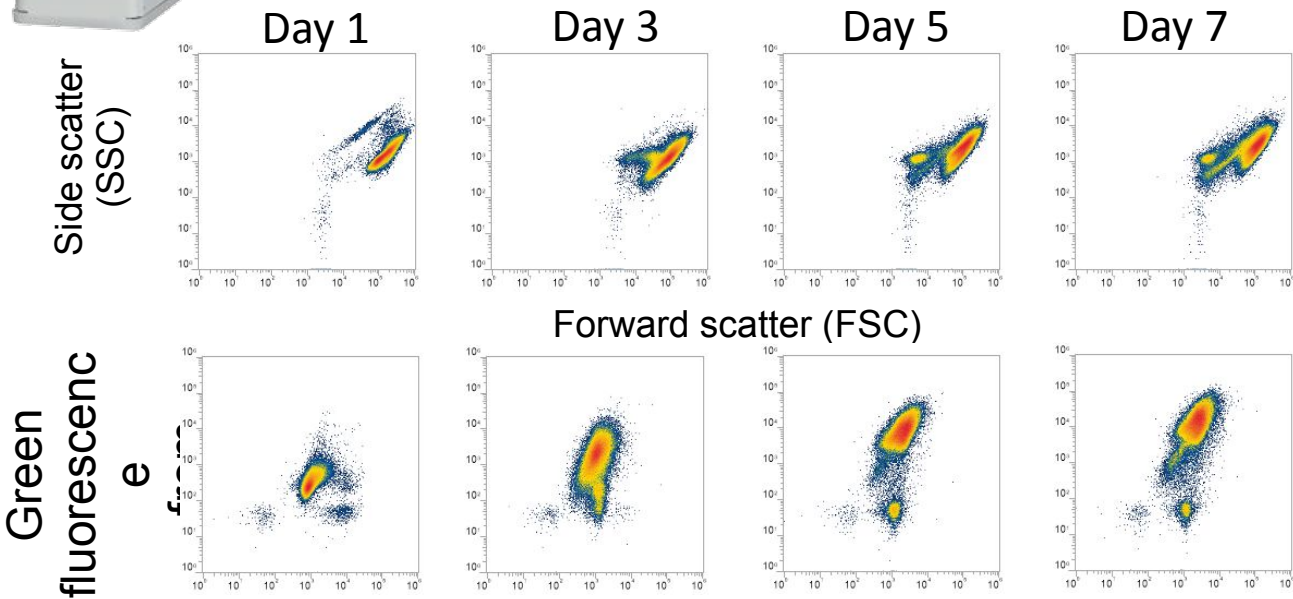
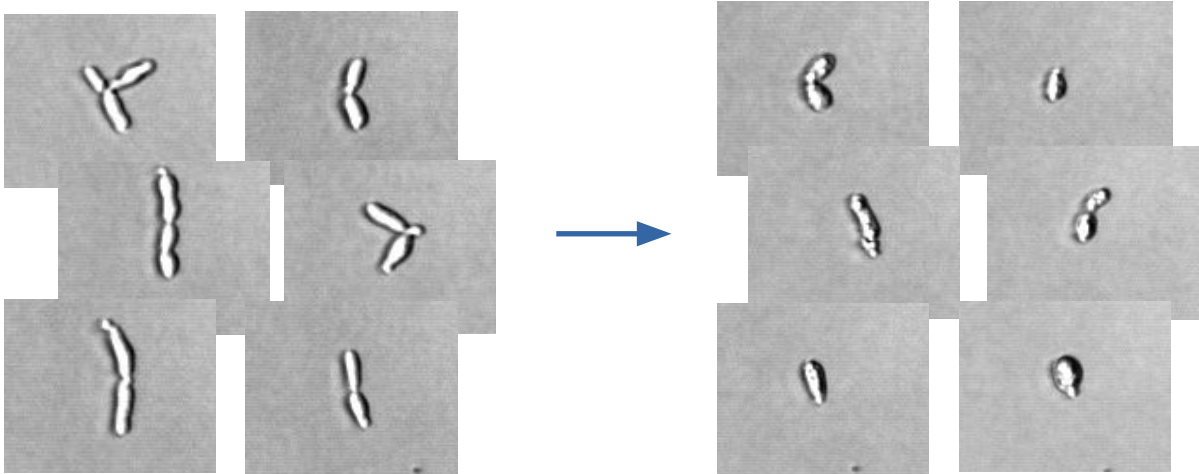
	1	2	3	4	5	6	7	8
A	0.05	0.364	0.049	0.303	0.054	0.322	0.053	0.313
B	0.334	0.043	0.4	0.047	0.32	0.046	0.284	0.043
C	0.047	0.383	0.047	0.414	0.053	0.357	0.044	0.322
D	0.368	0.051	0.416	0.042	0.409	0.044	0.326	0.044
E	0.038	0.317	0.042	0.357	0.041	0.341	0.048	0.32
F	0.328	0.046	0.326	0.038	0.34	0.034	0.302	0.036

Self-driving Bioreactor R&D



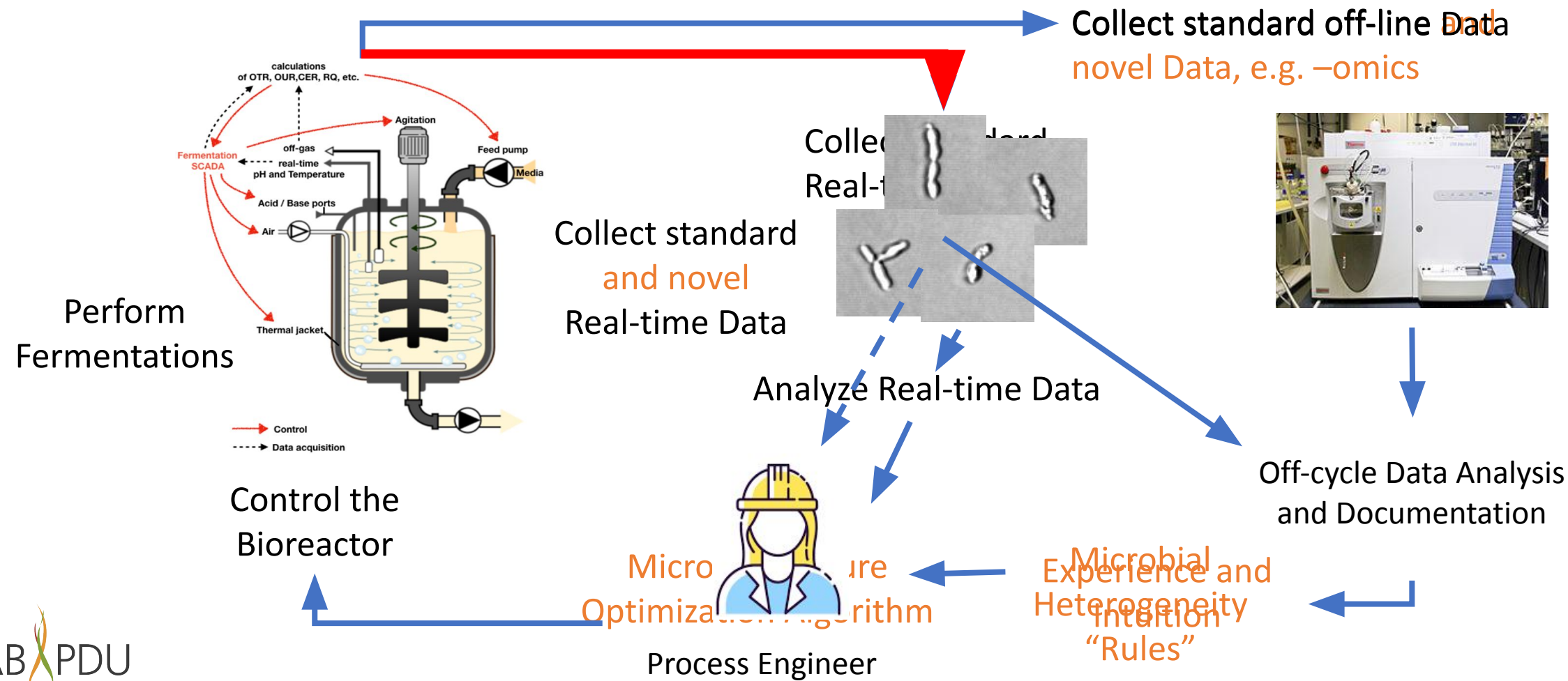
Attune CytPix Flow Cytometer
Thermofisher

Developing Imaging as a Process Analytical Tool



Self-driving Bioreactor R&D

State-of-the-Art Bioreactor Operating with Biological Changes



Industry Listening Day: High Throughput (e.g. Testing Ag Residue Hydrolysates)

BioLector: Data-rich, \$\$, 1 PAAT

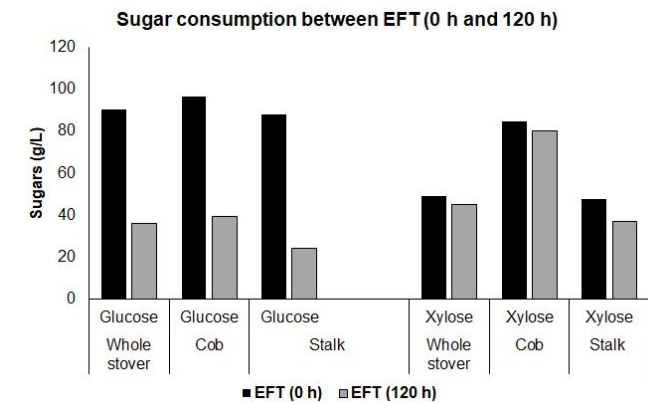
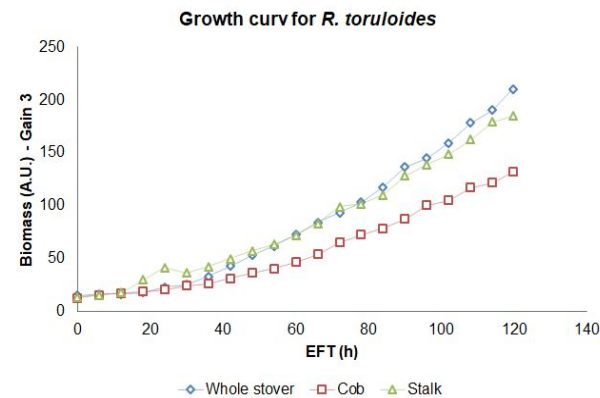
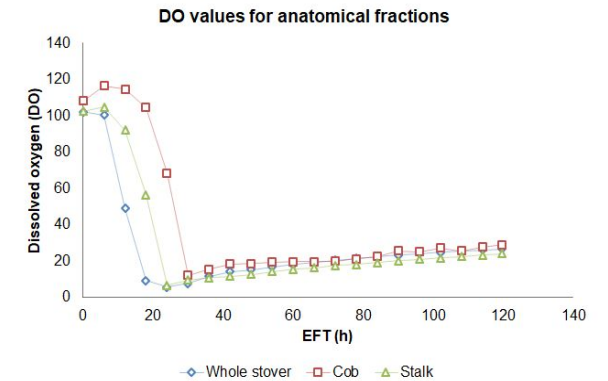
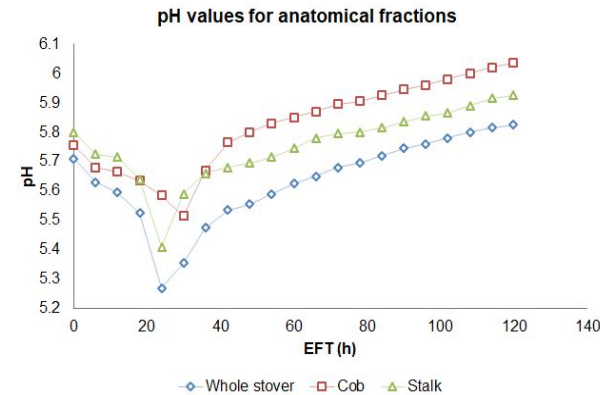
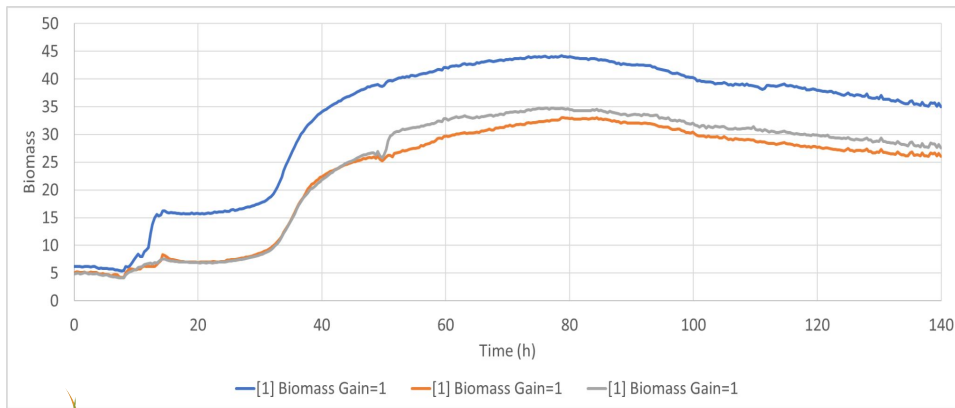


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BioLector:
pH, DO, Biomass

Real time measurement at different amplification levels (Gain)



- Buffer was added to hydrolysate to resist pH change
- DO on the biolector was set at 20%
- Hydrolysate from corn stover fractions showed variability in growth and sugar consumption profile

Industry Listening Day: High Throughput (e.g. Testing Ag Residue Hydrolysates)

Shaker plate: Rapid, cheap, X PAAT



48-well plate: \$2.0



Shaker: controlled temperature and humidity



microplate reader - Abs

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