culture

BIOSCIENCES

FERMENTATION ON DEMAND

CULTURE BIOSCIENCES

At Culture, we leverage automation to enable accelerated bench-scale fermentation experiments.

Fermentation teams spend tremendous time and labor running experiments to screen new organisms and optimize fermentation processes. Culture Biosciences' automated fermentation service allows for high-throughput data generation with very rapid time-lines. Our high-throughput reactors and ability to elastically scale up and down capacity enable Pharmaceutical and Industrial clients to accelerate their fermentation process development to bring products to market faster.

Introducing Culture

Companies need a faster, more convenient way to perform fermentation experiments that provide predictive data for scale up to accelerate bringing products to market.

We run fermentation experiments with our automated fermentation technology. Our fermentors provide a highly controlled environment for executing complex fermentation protocols. The operating parameters of our system (such as k_La and OUR) encompass industrially relevant ranges, allowing for accurate scale-up models. Our service enables strain screening, media optimization, process development and in addition, our infrastructure for cloud-enabled fermentation unlocks the following benefits:

SPEED

Fast tech transfer, same-day process design changes, live process data updates, and next-day sample shipping.

CONVENIENCE

No need for buying, installing, and maintaining fermentors and lab facilities, or hiring and training technicians.

FLEXIBILITY

Expand capacity elastically to meet your team's growing scientific needs.

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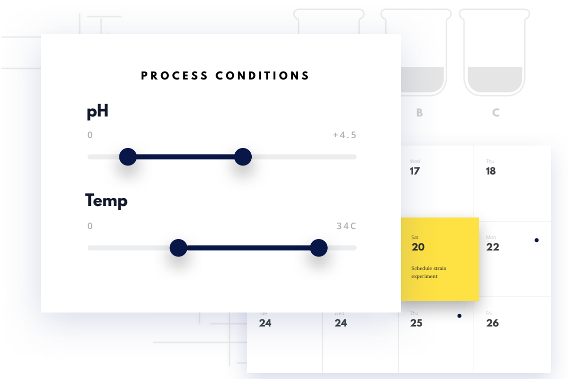
How it works

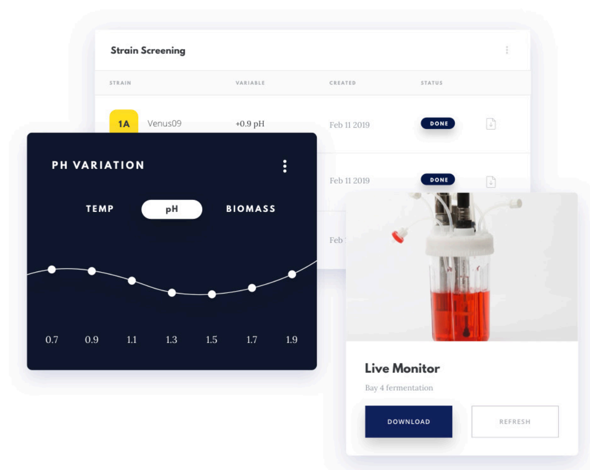


01

We review your protocol and program it into our software.

02

We pick up your strains and transport them to our facilities.



03

We run your protocol. You can monitor your progress in real-time.

04

You review, analyze, and export data on our website and receive samples.

DESIGNED FOR

High-Cell Density Fermentation

Our bench scale single-use reactors (250 mL) are designed for aerobic fermentation at high cell density with DO, pH, and temperature control. We have a full suite of online monitoring and data collection of process variables, including off-gas O_2 and CO_2 concentration. The reactors are fully programmable and can be easily adapted to your custom process on a per-reactor basis. Our reactors allow for multiple feed and control strategies, and custom control logic.

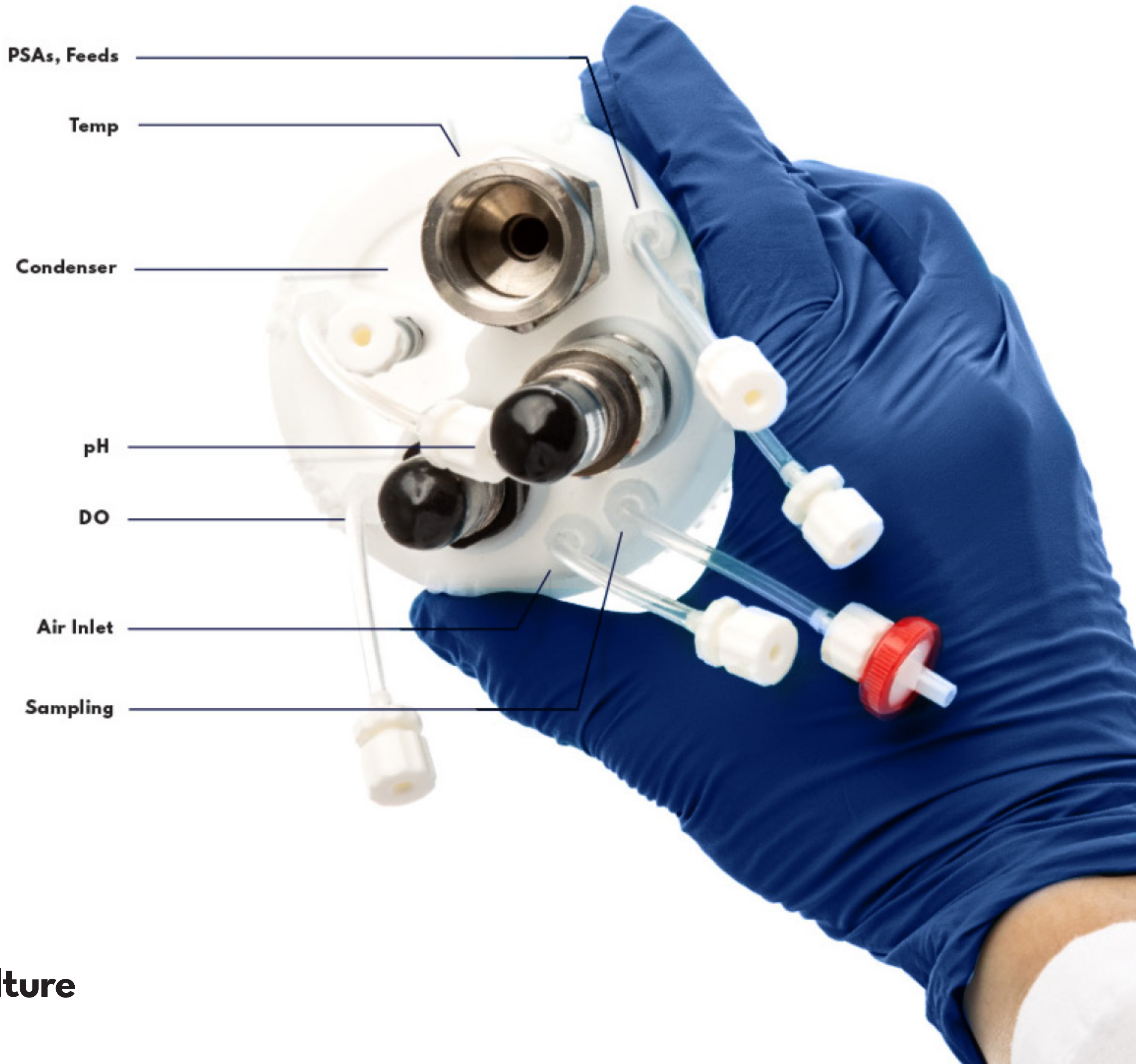


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TABLE OF SPECIFICATIONS

Stirred tank reactors	250ml max WV (65mm i.d.) 2x Rushton impellers (24mm) USP Class VI medical-grade polymer
Operating parameters	0-4000 rpm agitation 0-1000 sccm air flow rate 0-14 pH 0-100% DO 4-60°C temperature Post-sterile additions available

Online data	DO, pH, temperature, mass of substrate added, mass flow rate of sparged air, agitation, off-gas (O_2 and CO_2), imagery
Offline data	OD, WCW, mass balance, 25+ assays available with Cedex Bio HT
Transport properties	Max OUR > 500 mmol/L•hr, k_La > 350 hr^{-1}, $6•10^4$ max Re number

USP Class VI
Nylon, Single Use Headplate

USP Class VI
Polycarbonate, Single Use Vessel

REACTORS GENERATE

Reproducible Data

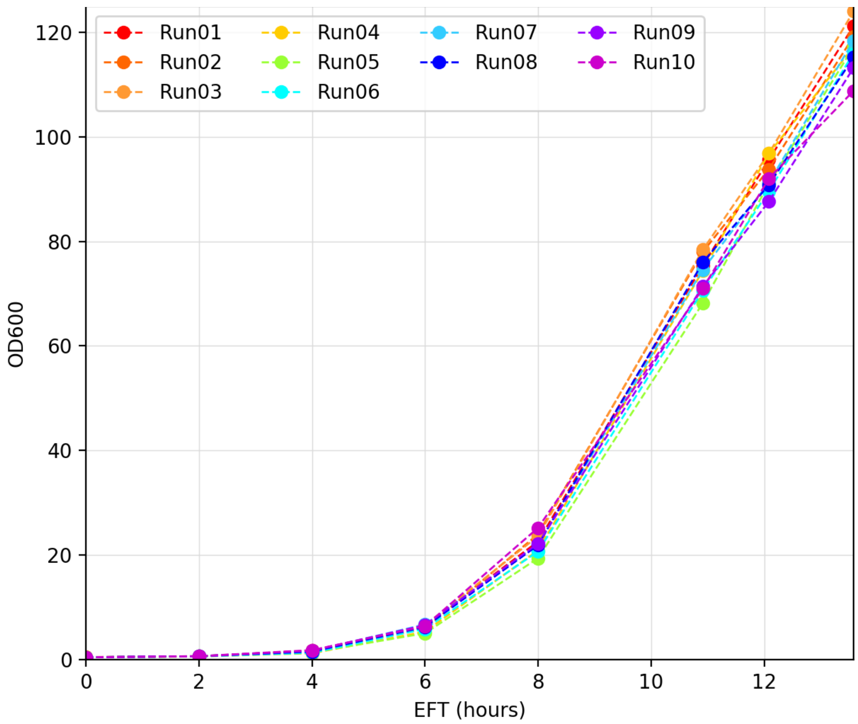


Figure 1

E. coli growth curves tracked by OD600. Researchers inoculated all bioreactors to an initial OD600 of ~0.4 with an initial glucose concentration of 30 g/L. Reactors were controlled at pH 7 at 37°C, with DO controlled to 20% by cascading agitation and air flow. A complex, glucose-limiting feed strategy was implemented where feeding is triggered by DO spikes.

The reactors generate reproducible results, which we demonstrated by conducting an *E. coli* fermentation study where we ran ten parallel fermentations. We implemented a complex, glucose- limiting feed strategy where feeding is triggered by DO spikes.

After inoculation, the feed was initiated after DO spike detection for all ten vessels at 9.0±0.3 h, showing very consistent behavior in all parallel experiments. Growth curves are similarly very consistent across the ten bioreactors with biomass CV < 5% at the final time point.

Our bioreactors are designed with high resolution monitoring of important process parameters. We monitor pH, temperature, DO, feed rate, agitation, and gas flow rate. We also have off-gas analyzers for monitoring O_2 and CO_2 concentration to calculate OUR, CER, and RQ in real-time. Reactors can be run at high biomass density. They maintain agitation and aeration at WCW > 600 g/kg and can achieve high oxygen transfer rates with OURs > 500 mmol/L•hr.

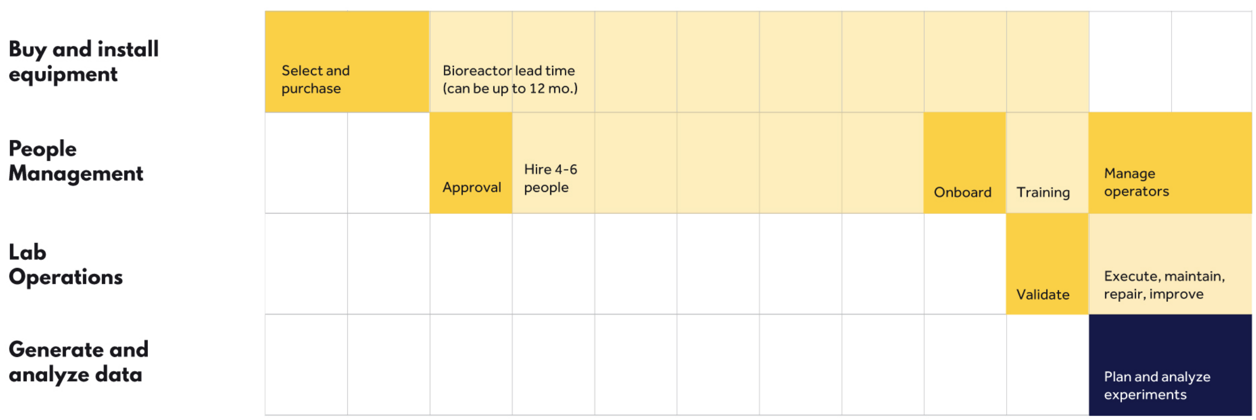
BENEFITS

Speed to Market

Typically, building out or expanding internal fermentation capacity requires a large upfront investment in capital infrastructure, new employees, and months of planning. We offer the ability to start running bench-scale fermentation experiments in <1 month. We can accelerate your research by over a year. Nick Ouzounov, Chief Scientific Officer at Geltor was able to accelerate production of animal-free collagen: "Culture's service is fast and provides fermentation capacity flexibly and on-demand. Culture has made it simple to get fermentation data."

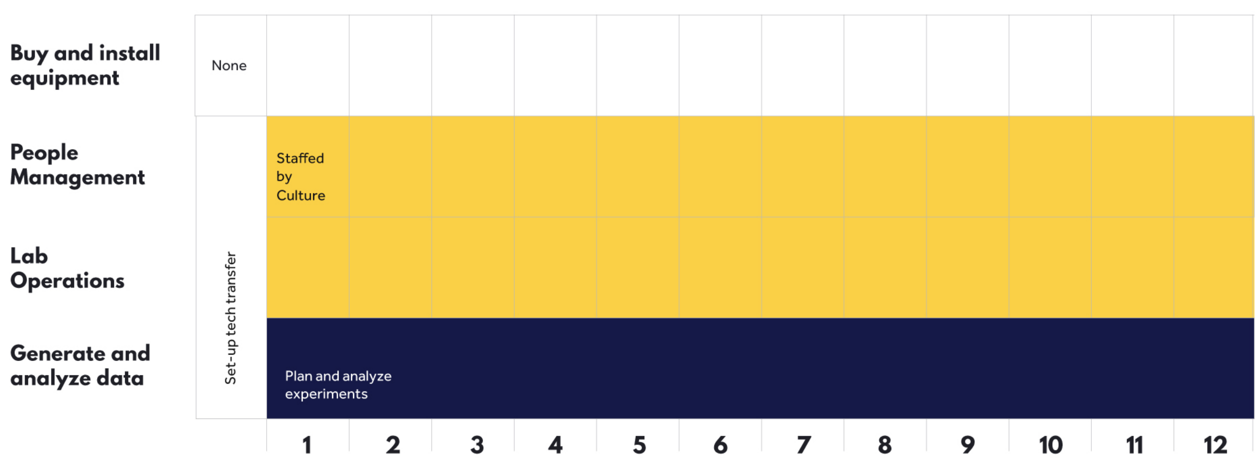
Traditional Lab Operations

Start running experiments in 6-18 months



Fermentation with Culture

Start running experiments in < 1 month

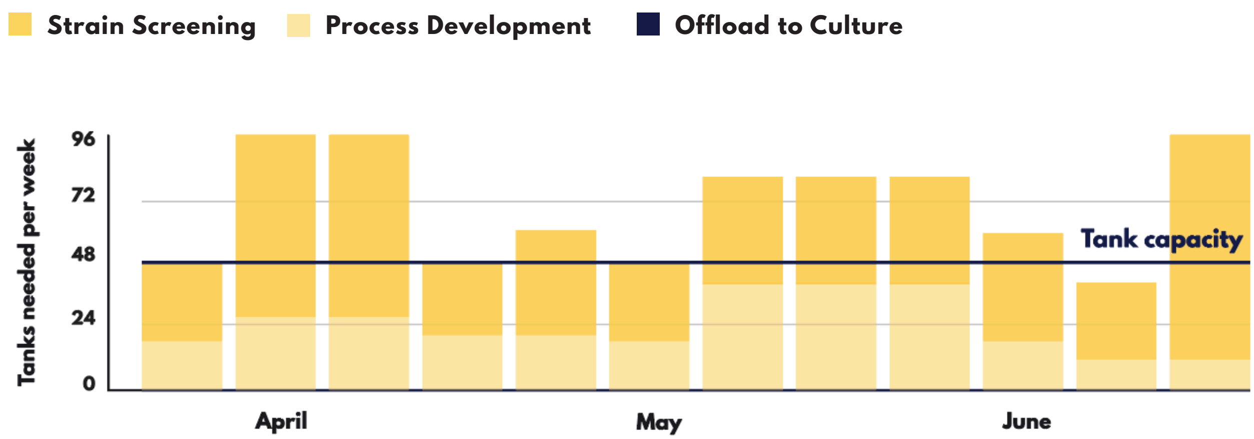


BENEFITS

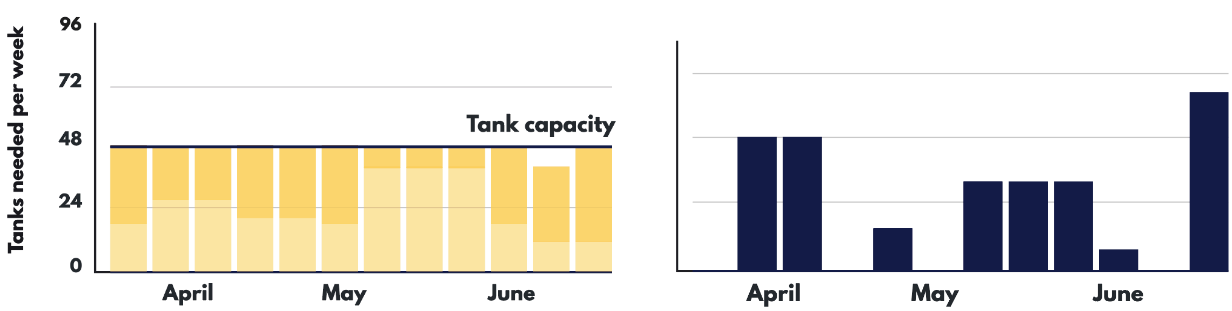
Flexible Capacity

Fermentation development needs are often highly variable and depend on your scientific research and development, which can be inherently unpredictable. However, fermentation throughput is typically limited from a fixed set of equipment and operators. A surge of new projects can overwhelm the existing lab resources, bottlenecking development for weeks or months. Running experiments with Culture allows you to expand your capacity, on-demand, to meet the needs of your scientific teams.

YOUR OVERLOADED LAB



EXPAND CAPACITY WITH CULTURE



BENEFITS

Lower Cost

Building out new bench-scale bioreactors is expensive, time-consuming, and laborious. Each bioreactor costs approximately $30,000 - $50,000 and lead times are typically between 3-9 months. Operating bioreactors requires many physical operations during a run: setting up reactors, monitoring the process and making adjustments, frequent sampling and sample analysis, and cleaning bioreactors. Due the complexity of the operations, typically one technician can operate only 4-6 bioreactors, depending on the specific process requirements.

To add 24 new bioreactors of capacity:

New internal fermentation lab	Fermentations with Culture
6-18 months from purchase decision to commissioned tanks	Tech transfer < 1 month
$1-2 million capex for new tanks	0 capex
4-8 new hires	0 new hires

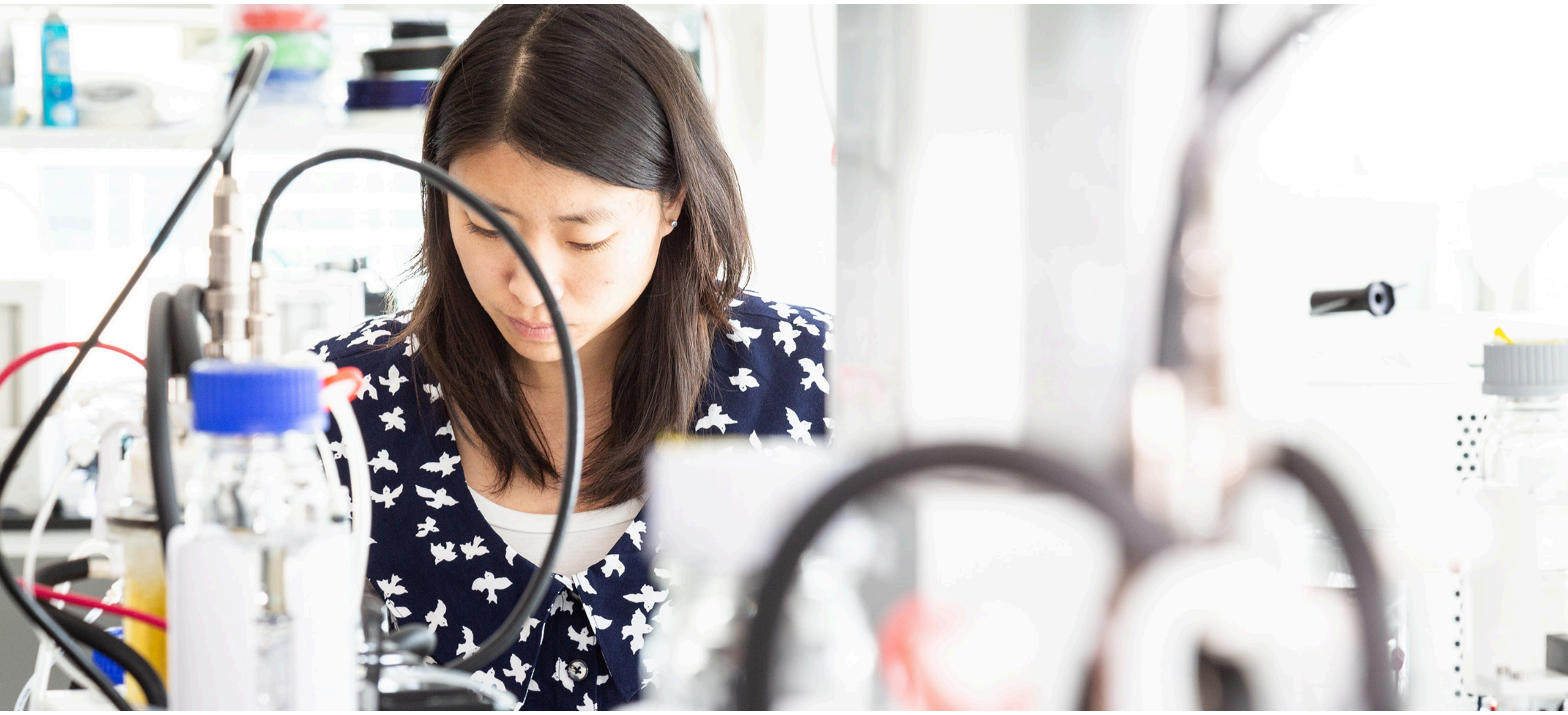
Let's grow together

Culture Biosciences already partners with innovative clients to run strain screening and process development fermentation experiments. Our automated fermentation lab allows for flexible scale up of fermentation capacity with no capital expenditure up front. We constantly upgrade our equipment and software to adapt to new advancements in fermentation technology. Customization of novel fermentation workloads makes automation instantly accessible to Pharmaceutical and Industrial clients, delivering results within weeks. For example, Harry McNamara Chief Scientific Officer at C16 Biosciences was able to augment the technology build out for sustainable palm oil.

By saving time and resources, Culture Biosciences allows clients to accelerate process development to bring products to market faster.

"Being able to build on top of Culture's strain screening and process development capabilities is important for our R&D. We're spending our time building better strains and processes, instead of building out a lab."

Harry McNamara, Chief Scientific Officer at C16Biosciences



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