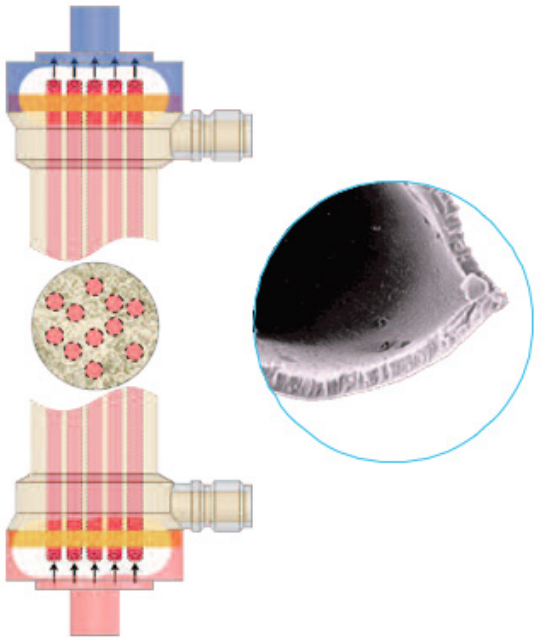
CELL CULTURE COMPANY

Hollow Fiber Bioreactors

Product Line Introduction



Proven Technology Cost-Effective Production

C3 has provided hollow fiber bioreactor systems since the 1980s, and they have been used to produce numerous regulated biologics and other materials.

This bulletin highlights the features of and differences between C3's six hollow fiber bioreactor systems. A separate bulletin provides an introduction to the unique aspects and advantages of hollow fiber bioreactor technology.

For this latter document and any other technical information, please contact C3 using the contact information on the back of this brochure.

Introduction

Achieving high cell densities and reducing the costs to produce biologics are desirable but not always simple or inexpensive goals. C3's hollow fiber bioreactor systems are a solution to both goals. C3 has four hollow fiber bioreactor (HFBrx) systems to address a wide range of production applications. We offer one small-scale system, two pilot-scale systems and one production-scale system.

- HF Primer™

- AutovaxID®

- AcuSyst-MAXIMIZER®

- AcuSyst-XCELLERATOR™

C3's Bioreactor Systems

A range of capacities and automation to accommodate your production needs.

	Highlights	Equipment Needed	Achievable Cell Counts
HF Primer™	Replaces: • T-Flasks & Spinner Flasks • Roller Bottles • Ascites • Wave and Others... • Low-Cost Feasibility System Before Scaling-up	• CO_2 Incubator • One Masterflex Pump System	1-10 x 10^6
AutovaxID®	• Simultaneous Production from 1-3 Cell Lines • Most Automated System, Controlling: - pH, Incubator Temperature, - Lactate, ICS & ECS Perfusion and Others • Simplest Setup & Operation of all Pilot-Scale Systems • Web Browser Remote Control • Integral Refrigerator for Supernatant Storage During Collection	• CO_2 Supply • 100-240 VAC • One Masterflex Pump System • LAN Connection	1.5 x 10^{11}
MAXIMIZER®	Automated Control of: • pH, Incubator Temperature, ICS & ECS, Perfusion, and Others • 1 Cell Line at a Time	• CO_2 Supply • 100-240 VAC	2-4 x 10^{11}
XCELLERATOR™	Automated control of: • pH Control, Incubator Temperature, ICS & ECS Perfusion, and Others • 1-2 Cell Lines at a Time • Web Browser Remote Control • Integral Refrigerator For Supernatant Storage During Collection	• CO_2 Supply • 100-240 VAC • LAN Connection	1-2 x 10^{12}

Small-Scale Systems

	HF Primer™
Excellent alternative to	T-Flasks, Spinners, Roller Bottles, Ascites, Wave, CelliGen…
Runs weeks to months	Yes
Uses single-use disposables	Yes
Culture suspension or adherent cells	Yes
Bioreactor culture volume and size	80 mL ,1.1 m^2
Number of bioreactors	1
Simultaneous cell lines in culture	1
Cells supported	~$5x10^{10}$
pH control	via CO_2 Incubator
Temperature control	via CO_2 Incubator
Unsupplemented media change method	Manual, open system
Unsupplemented media change frequency	1-7 days
Supplemented media changes	Manual (using syringes)
Harvest supernatant	Manual (using syringes)
Footprint	12 cm W x 20 cm D x 33 cm H

Pilot-Scale Systems

	 AutovaxID®	 AcuSyst-MAXIMIZER™
Excellent alternative to	Wave, CelliGen, Stirred-Tank Reactors and Others…	
Example fed-batch STR equivalent	80L	80L or 160L
Runs weeks to months	Yes	
Uses single-use disposables	Yes	
Culture suspension or adherent cells	Yes	
Bioreactor culture volume and size	160 mL, 2.1 m^2	
Number of bioreactors	1 (2.1 m^2) or 3 (0.5 m^2)	1 or 2 (2.1 m^2) Also available in 1.5m2 with 1 or 2 cartridges
Simultaneous cell lines in culture	1	1
Low-cost R&D Disposables options	Yes	No
Cells supported	~$2x10^{11}$	~$4x10^{11}$
Closed system operation	Yes	
Automatic Control of: pH, temp. and others	Yes	
Automatic lactate control (automated media feed rate changes)	Yes	No
Integral refrigerator	Yes	No
21 CFR Part 11 Compliant	Yes	Not applicable
Touch screen and remote monitor & control capable	Yes	No
Footprint	51 cm W x 51 cm D x 48 cm H	70 cm W x 66 cm D x 52 cm H

Production-Scale Systems

AcuSyst-XCELLERATOR™

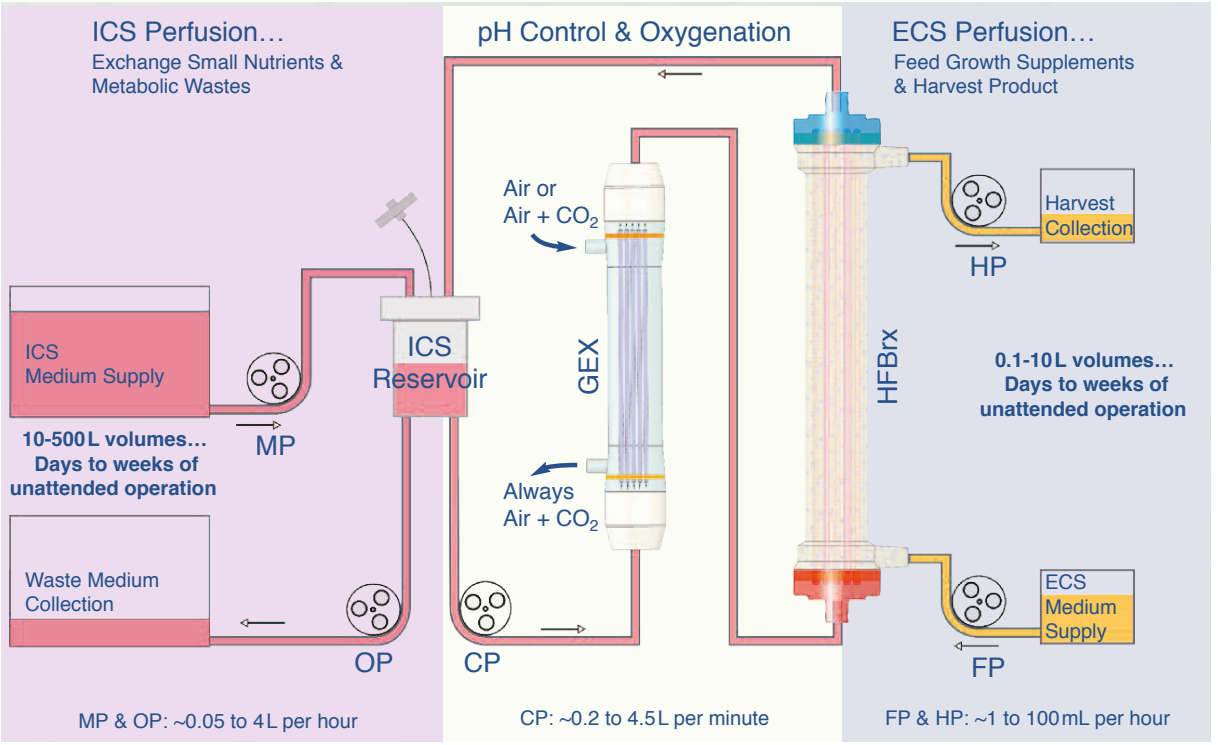
Excellent alternative to	Stainless Steel Stirred tank bioreactors and Single-Use bioreactors
Example fed-batch STR equivalent	500-1,600L Depending on Disposable and Usage
Runs weeks to months	Yes
Uses single-use disposables	Yes
Culture suspension or adherent cells	Yes
Bioreactor culture volume and size	160 mL, 2.1 m^2
Number of bioreactors per cultureware (the disposable)	6 (2.1 m^2) 10 (2.1 m^2)
Simultaneous cultureware in use	1 or 2 (One Cultureware Shown in Picture Above)
Simultaneous cell lines in culture	1 or 2
Cells supported	1-2 x 10^{12}
Closed system operation	Yes
Automatic Control of: pH, temp. and others	Yes
Integral refrigerator	Yes
21 CFR Part 11 Compliant	Yes
Touch screen and remote monitor & control capable	Yes
Footprint	134 cm W x 85 cm D x 203 cm H

Predictable & Linear Scale-Up

C3's pilot- and production-scale systems all use the same 2.1 m^2 bioreactor in their single-use disposable cultureware. Once the ICS Perfusion rate, ECS Perfusion rate and Circulation rate to support a single 2.1 m^2 bioreactor are determined, scale-up is a predictable, linear process because multiple 2.1 m^2 bioreactors are run in parallel. An example: A pilot-scale AutovaxID® run using a single 2.1 m^2 bioreactor determines the following steady-state rates for a cell line. A production-scale run in the AcuSyst-XCELLERATOR™ using a cultureware with ten 2.1 m^2 bioreactors would be planned to use the following rates:

Rate	AutovaxID®	AcuSyst-XCELLERATOR™
ICS Perfusion, mL/hour	350	3,500
ECS Perfusion, mL/hour	9	90
Circulation, mL/min.	400	4,000

Photo showing five of the ten bioreactors during a production-scale run in AcuSyst-XCELLERATOR™



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Cell Culture Company is very interested in hearing from you, and upon request, it would be our pleasure to email you with news and updates.

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