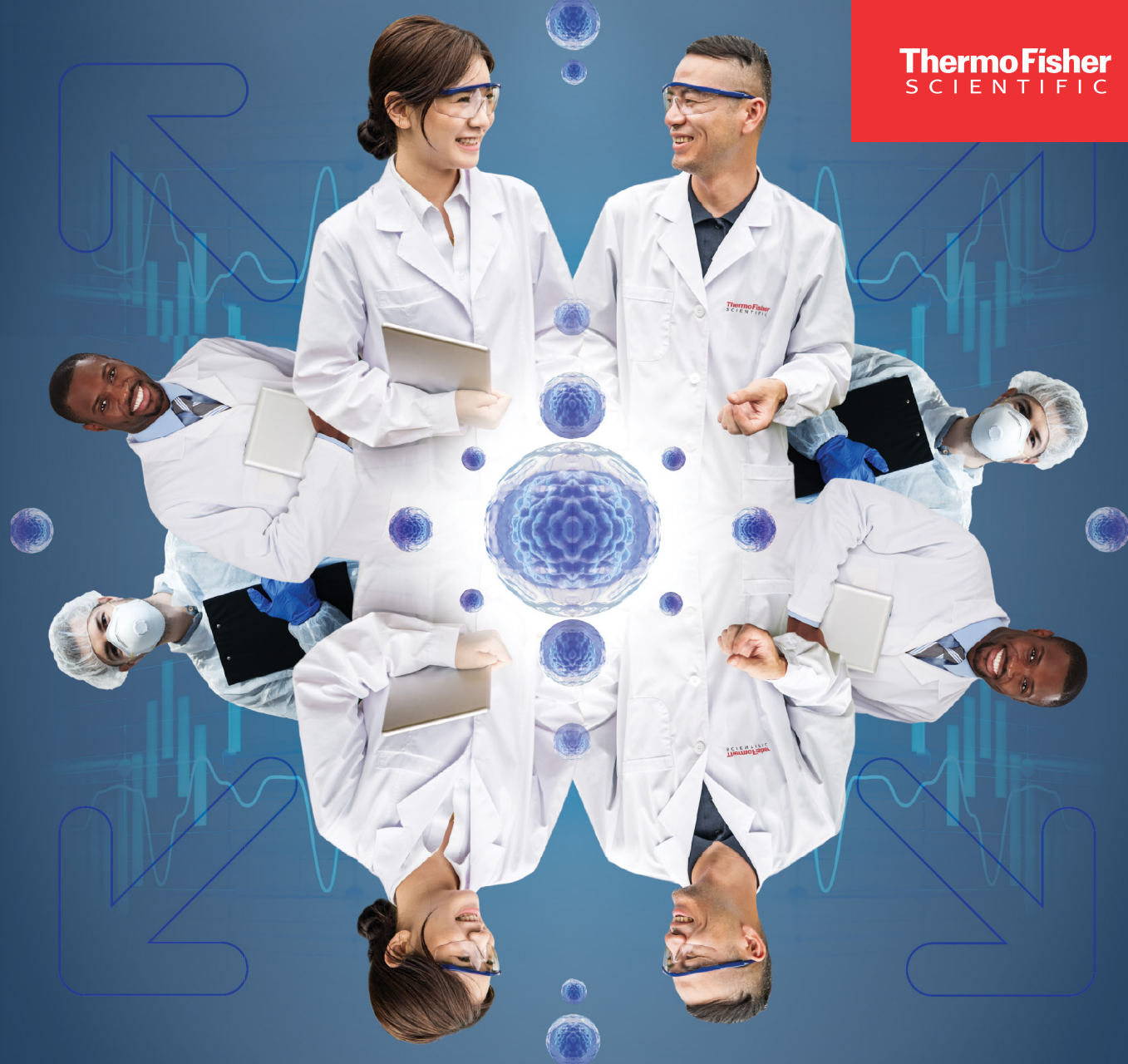


**ThermoFisher**  
SCIENTIFIC



# CHO Playbook

Gibco™ CHO cell culture solutions for  
biomanufacturing

## Foreword

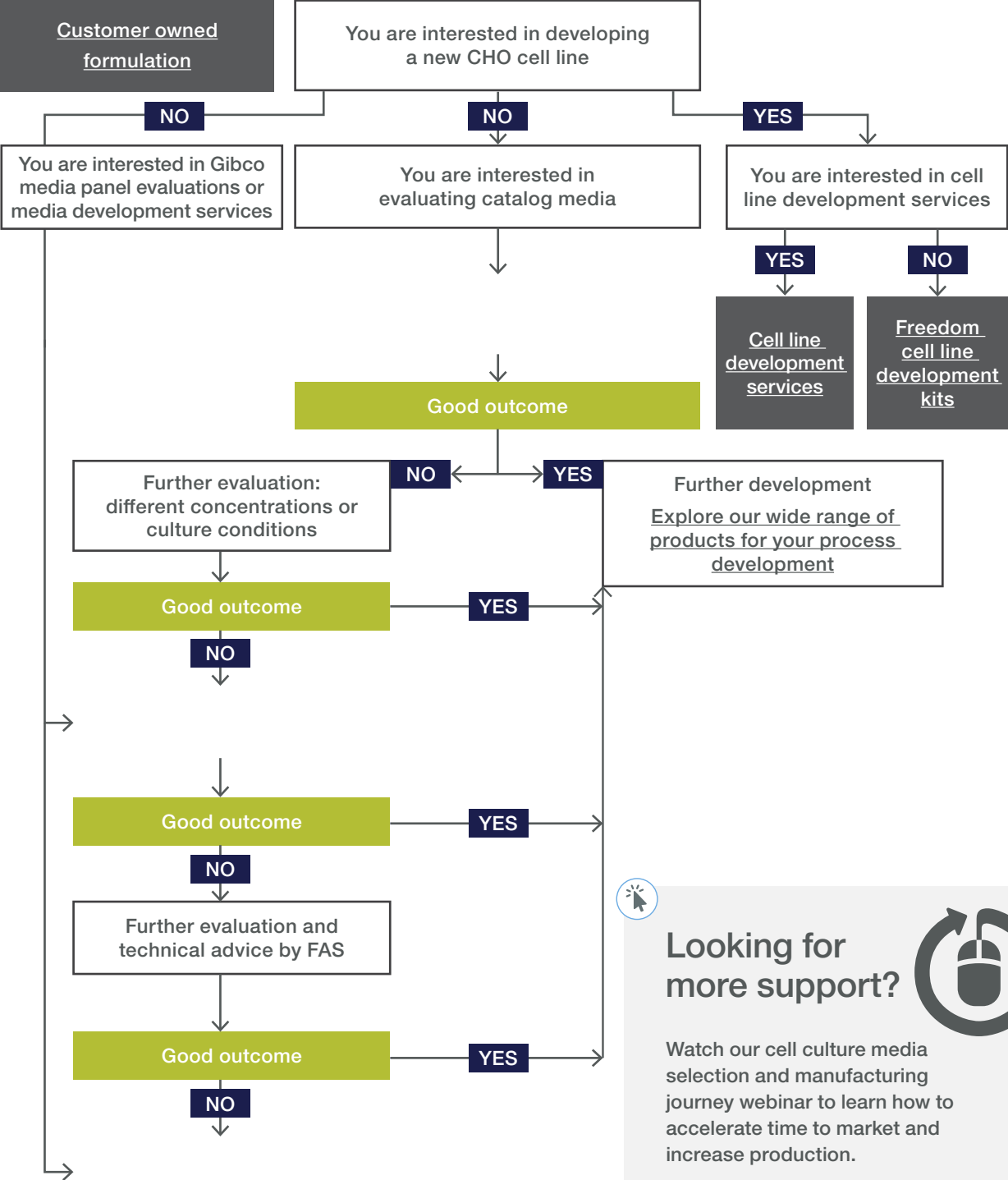
Optimizing process productivity, improving scalability, and increasing efficiency are central to developing a successful biopharmaceutical manufacturing process.

To help you improve performance and maintain consistent product quality, Thermo Fisher Scientific offers a broad portfolio of high-performance CHO media, feeds, supplements, cell line development kits, and media manufacturing and optimizing services.



# CHO solution process flow chart

**Customer owned formulation**



**Looking for more support?**

Watch our cell culture media selection and manufacturing journey webinar to learn how to accelerate time to market and increase production.

[Watch the webinar](#)

# CHO catalog media, feed, and supplement navigation guide

Identify your cell line	Select your Gibco™ Medium	Select your Gibco™ feed	Predictably and accurately achieve a targeted Glycan profile
<b>DXBq11</b>	CD OptiCHO™ Medium	Efficient Feed™ A+ Supplement	GlycanTune™ A+ Total Feed
<b>DG44</b>	CD OptiCHO™ Medium	Efficient Feed™ A+ Supplement	GlycanTune™ A+ Total Feed
	Dynamis™ Medium	Efficient Feed™ C+ Supplement	GlycanTune™ C+ Total Feed
	Efficient-Pro™ Medium	Efficient-Pro™ Feed 2	-
<b>CHO-K1</b>	Dynamis™ Medium	Efficient Feed™ C+ Supplement	GlycanTune™ C+ Total Feed
	Efficient-Pro™ Medium	Efficient-Pro™ Feed 1	-
<b>CHO-S</b>	ExpiCHO™ Stable Production Medium (SPM)	Efficient Feed™ C+ Supplement	GlycanTune™ C+ Total Feed
	Dynamis™ Medium	Efficient Feed™ C+ Supplement	GlycanTune™ C+ Total Feed
	Efficient-Pro™ Medium	Efficient-Pro™ Feed 2	-
<b>CHO-K1 GS</b>	CD CHO Medium	Efficient Feed™ B+ Supplement	GlycanTune™ B+ Total Feed
	Dynamis™ Medium	Efficient Feed™ C+ Supplement	GlycanTune™ C+ Total Feed
	ExpiCHO™ Stable Production Medium (SPM)	Efficient-Pro™ Feed 2	-
	Efficient-Pro™ Medium	Efficient-Pro™ Feed 3 + Efficient-Pro™ Feed Enhancer	-
<b>ExpiCHO</b>	ExpiCHO™ Stable Production Medium (SPM)	Efficient Feed™ C+ Supplement	GlycanTune™ C+ Total Feed
<b>Other CHO</b>	CD CHO Medium	Efficient Feed™ B+ Supplement	GlycanTune™ B+ Total Feed

Boost your titers by adding Gibco™ FunctionMAX™ TiterEnhancer to any medium and feed

## Spotlight on perfusion

- Savings that speak volumes - the economic benefits of perfusion bioprocessing.

Learn more in the white paper

- Perfusion medium considerations.

Discover more in the ebook

- Gibco perfusion medium.

Watch the video

White paper | High Intensity Perfusion CHO Medium

**Bioproduction**

**High-Intensity Perfusion CHO Medium supports efficient and consistently high mAb production and product quality in continuous perfusion with CHO-K1 cells**

**Introduction**  
Continuous perfusion (CP) has been used successfully for commercial biopharmaceutical manufacturing since the 1970s and was developed mainly for culture of stable monoclonal antibodies and to avoid dilution to produce or low production rates. A CP process can improve product quality and productivity by creating a sustained stable healthy cell environment steadily scaled through the maintenance of super conditions with fresh medium. CP processes are capable of sustaining cultures at high cell densities and densities of more than 100 million cells/ml, that consistently produce high titer and product quality over extended durations [1-3].

**Consistent production and product quality**  
In collaboration with the Center for Bioprocess Engineering and Cell Cultivation at the Zurich University of Applied Sciences (ZHAW), a study was conducted using a CHO-K1 IgG producing cell line with HIP-CHO Medium in 50-day CP runs. Objectives performed at CP, working performance (1), Thermo Scientific™ HyperMedia™ Glass Bioreactor, and two runs were performed at a 50L working volume in a 10L Thermo Scientific™ Cyclone™ Single-Use Bioreactor (SAB). Working study parameters are outlined in Table 1. Each culture was sampled on multiple days and measured for viable cell density (VCD), cell stability, IgG titer, glucose, lactate, glutamine, and ammonia. Full bioreactor samples were collected, frozen, and later analyzed.

The product quality and productivity benefits of CP showed

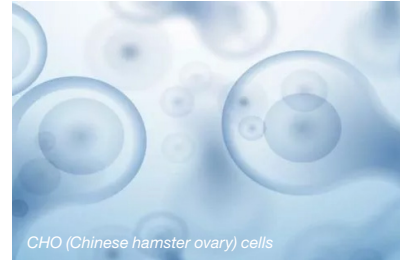
**Perfusion process: Gibco™ High-Intensity Perfusion (HIP) CHO Medium**

- Perfusion medium supports efficient and consistently high mAb production.

Read the white paper

# Description of CHO (Chinese hamster ovary) cells

- Predominant host cell line for stable expression in large-scale production and manufacturing of biotherapeutic proteins
- Robust, scalable, and high titer
- Enables various post-translational modifications
- Well-adapted to suspension culture and can grow to high densities, and particularly in bioreactors
- Trusted production platform (low human virus susceptibility)
- Some proteins that are difficult to express in HEK293 cells may be expressed better in CHO cells
- Common variants for biomanufacturing CHO-K1, CHO DG44, CHO-S, CHO-GS, etc.
- Different CHO clones often possess diverse nutritional requirements that are unique to each clone



CHO (Chinese hamster ovary) cells



## Could cell line development kits help enhance your CHO processes?

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# Media by Design Services

Cell culture

## Freedom cell line development kits

**Licensing simplicity. Workflow scalability. Superior technical support.**

**Discover cell line development freedom and advance your process**

Cell line development involves multiple complex processes requiring consistency and reproducible results. That's why Gibco® Freedom™ cell line development kits are designed to provide you with integrated, stable cell line development solutions to simplify your development workflow and accelerate your journey to commercial manufacturing.

**Freedom kits contain the components for beginning-to-end cloning and expression**

**Benefits include:**

- Regulatory-friendly, cGMP-banked cell lines
- Fast and efficient workflow for the creation of stable clones
- Proven for IgG production

**Collaboration options and flexible licensing**

Choose to work internally using our Freedom kit solutions; work with dedicated technical assistance from the Gibco® Media by Design™ Services team; or work in collaboration with a contracted vendor of your choice. Freedom cell line development kits also provide you with simplified, royalty-free licensing options. (See Table 1 on page 3.)



The new Gibco® Freedom™ ExpiCHO-S Kit joins the other kits, including the Gibco® Freedom™ CHO-S™ and Gibco® Freedom™ DG44 kits.

**ProBioGen**  
Gibco Freedom ExpiCHO-S and CHO-S kits were developed in collaboration with ProBioGen AG.

gibco

Freedom cell line development kits.

[Learn more here](#)

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Application note | Freedom ExpiCHO-S Kit

Bioproduction

## The Freedom ExpiCHO-S Kit generates stable clones and delivers enhanced productivity

**Introduction**

In bioproduction, once the desired therapeutic protein is identified, an expression system capable of generating high-producing stable clones is required to support output and quality requirements for commercial scale-up [1]. The in-house development of cell lines and identification of optimal workflow components and processes can be time-consuming and costly. An optimized and robust commercially available cloning and expression system kit would support streamlining product development to reduce time to market.

The Gibco® Freedom™ ExpiCHO-S™ Kit was developed with these goals in mind. It provides a cGMP cell line with regulatory-friendly components and royalty-free licensing. Additionally, the kit includes a dual-vector system, Gibco® Freedom™ pCHOm 3.1 and Freedom™ pCHOOp 3.2 (designed by ProBioGen AG), for insertion of genes of interest and control of antibody heavy and light chain ratios.

Studies were conducted to evaluate the capability to generate IgG-producing Gibco® ExpiCHO-S™ cells using the Freedom ExpiCHO-S Kit. After transfection, the clonal pools were subjected to selection, limiting dilution cloning, scale-up, and initial productive screening to identify lead candidate clones (data not shown). Here we present the studies conducted to identify the top-performing clones and evaluate production stability. The lead candidate clones were tested under fed-batch conditions in an automated microbioreactor system with assessments of cell growth, titer, and specific productivity, as well as analysis of the IgG N-glycan profile of the top clone. Additionally, a clone stability study was conducted with productivity assessments over a period of 60 generations.

**Materials and methods**

**Microbioreactor fed-batch study**

Seven of the leading candidate clones (A–G) were scaled up in shake flasks, and duplicate cultures were set up in an Ambr® 15 microbioreactor (Sartorius) at a cell density of  $3 \times 10^7$  cells/mL with Gibco® ExpiCHO™ Stable Production Medium (SPM) (Cat. No. A311003) supplemented with 4 mM Gibco® GlutaMAX™ Supplement (Cat. No. 35050069) and 1% Gibco® Anti-Clumping Agent (Cat. No. 001002AE). Culture conditions were set at 37°C, 50% dissolved oxygen (DO), pH 7, and 1,200 rpm. Each culture was fed glucose to 4 g/L as needed when glucose measured below 2 g/L. From days 3 to 16, cultures were fed with a 2.5% daily volume of Gibco® Efficient-Pro™ Feed 2 (Cat. No. A5221404). Cell counts and viability were evaluated using a Vi-CELL™ XR Analyzer (Beckman Coulter), and antibody titers and metabolites were assessed using a Cytex™ Bio HT Analyzer (Roche). Specific productivity (SP) was calculated as IgG produced in g/g cell/day based on Equation 1, where  $[IgG]_t$  and  $[IgG]_0$  represent the IgG product concentration at time 0 (t0) or time t (t1) in days and  $VCD_0$  and  $VCD_t$  represent the total viable cell density at t0 or t1.

Equation 1:

$$SP = \frac{[IgG]_t - [IgG]_0}{(t - t_0) \times (VCD_t - VCD_0) \ln(VCD_t / VCD_0)} \times 10^3$$

**N-glycan analysis**

IgG antibodies from lead candidate clones from the microbioreactor fed-batch study were evaluated for N-glycan structures by releasing glycan from the mAb by treatment with PNAase F, followed by an amination reaction with a 2-aminobenzamide (2-AB) labeling reagent. The 2-AB labeled N-glycans were separated by hydrophilic interaction ultra performance liquid chromatography (HILIC-UPLC) and detected by fluorescence.

gibco

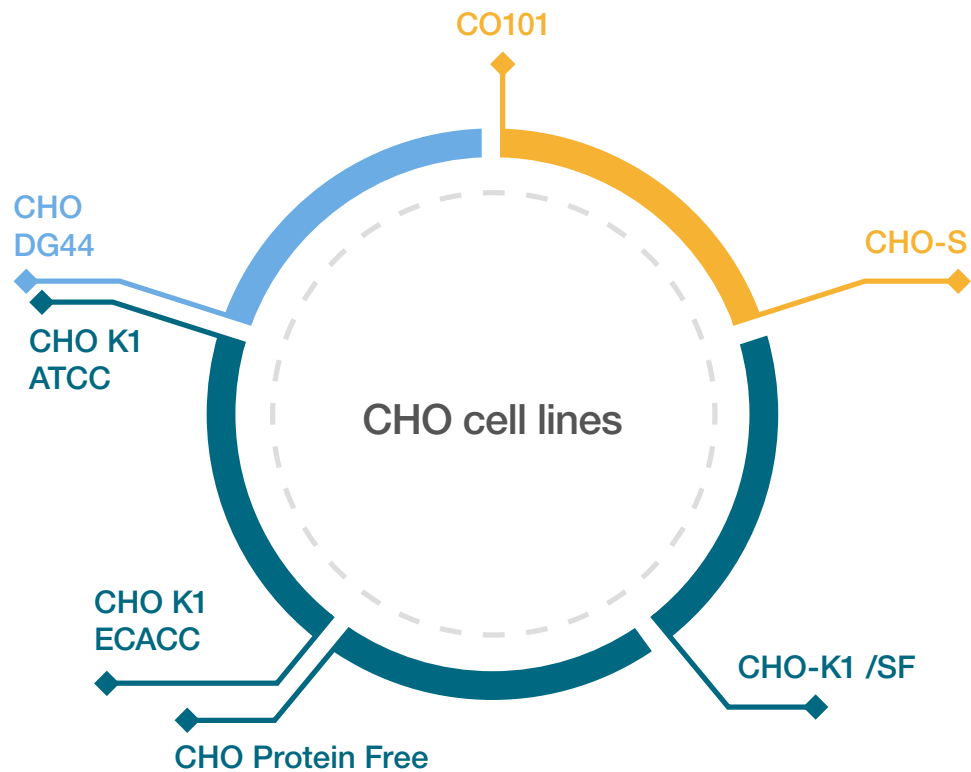
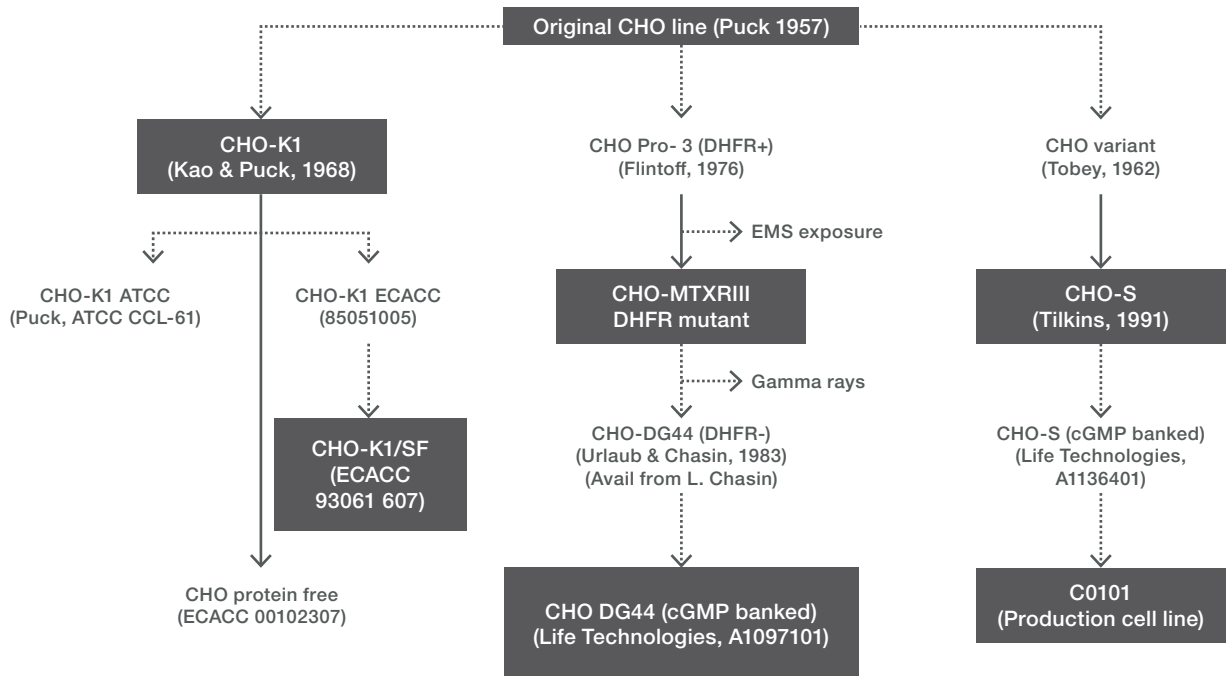
Learn how the Freedom ExpiCHO-S kit enhances productivity.

[Read the app note](#)

## Gibco™ Freedom™ cell line development kits

- Save 40% on Gibco™ Freedom™ ExpiCHO-S and DG44 kits through September 30, 2025. For cell line development services, please contact us at our website

# Mutation landscape of CHO cell lines



# Peptones for CHO cell culture applications

## CHO (Chinese hamster ovary) cells

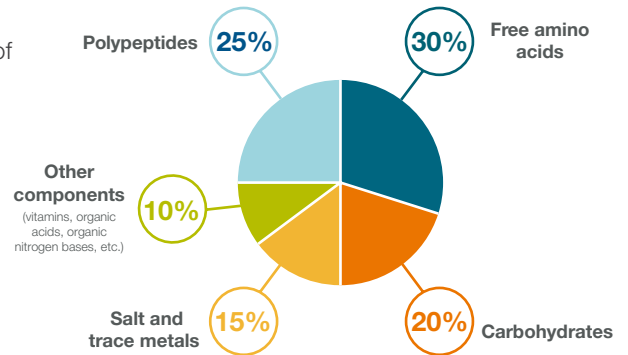
### Nutritional diversity

- Balanced composition to meet specific requirements of all cell types

### Protective effects

- Nutritional buffering
- Protects cells from toxic levels of media components
- Allows for higher concentrations of key components
- Delays onset of apoptosis

### Components of a typical peptone



## Peptone selection in CHO cell cultures

How to choose the right peptone for CHO cell culture processes

### Select a good complete base medium

- More enriched base media yield better results than deficient media (e.g., CD or SF complete media)

### Select from a wide variety of peptones to evaluate as supplement and feed

- Different substrates (e.g., yeast, soy, cotton, or wheat)
- Multiple products from the same substrate

### Create a thorough experimental design

- Multiple concentrations (e.g., 1g/L, 3g/L, 5g/L, 7g/L, and 9g/L)
- Individual and blended conditions (e.g., blend of yeast and soy peptones)

### Characterize the culture throughout the process using analytical techniques

- Establish baseline data using spent media in multiple runs with multiple lots of peptones (e.g., feed strategy: timing and concentration of feed addition)

### Evaluate performance on proliferation, production, and protein quality

- Monitoring only one attribute does not always predict overall performance (e.g., glycosylation and charge variant profiles)



Adding the right peptone to your process can help dramatically improve the culture environment to achieve production goals.

Learn more about how to screen and select the right peptone for your process.

[Watch the video](#)



Peptones: a powerful tool for manufacturing complex protein therapies such as bispecific antibodies and antibody–drug conjugates (ADCs).

[Read the white paper](#)



The power of peptones: establishing consistency across a portfolio of products.

[Read the data sheet](#)

# Gibco peptone starter packs

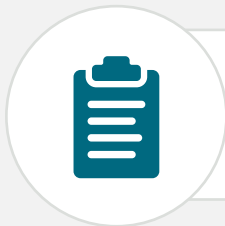
## Get started with the Gibco™ Starter Paks

Product	Description	Contents
<b>Starter Pak No. 1</b>	Ultra-filtered peptones ideal for human health applications	Difco™ Yeast Extract, UF Bacto™ TC Yeastolate Difco™ TC Yeastolate, UF Difco™ Phytone Supplement, UF Bacto™ Yeast Extract, Technical
<b>Starter Pak No. 2</b>	Animal origin-free and animal origin peptones best suited for vaccine production	Bacto™ Yeast Extract Difco™ Soytone Phytone™ Peptone Bacto™ Proteose Peptone No. 2 Bacto™ Proteose Peptone No. 3 Bacto™ Casamino Acids
<b>Starter Pak No. 3</b>	Animal origin-free peptones for animal and human vaccine production	Bacto™ Malt Extract Bacto™ Yeast Extract Yeast Extract Bacto™ TC Yeastolate Phytone™ Peptone Difco™ Soytone
<b>Preview Pak</b>	Provide new peptones with unique nutritional profiles, suitable for mammalian and microbial applications	Wheat 100 UF Cotton 100 UF Cotton 200 UF Soy 100 Yeast 100

Click on the product name to open the product details page.



## Looking for more information to support your peptone selection:



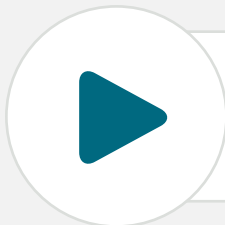
Technical guide to peptones, supplements, and feeds.

[Read more here](#)



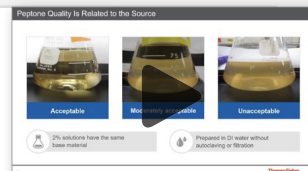
Discover how peptones can increase titer and optimize productivity.

[Read the case study](#)



Using peptones to achieve demanding bioproduction goals.

[Watch the webinar](#)

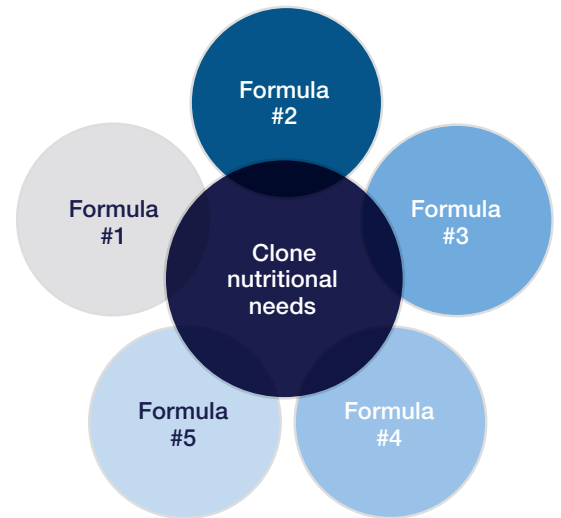


# Gibco media and feed panel evaluations





## CHO media and feed panels



Testing a broad range of formulations increases the possibility that you will be able to zero in on a nutrient composition that best supports your clone's specific needs.

The Gibco™ Media Panel Evaluation was developed with diversity in mind, providing you a panel of products that each have distinct formulations and nutrient levels. This can enable you to quickly identify the components driving your increases in productivity and quality.



## What's included in a panel evaluation



-  500 mL bottles of ready-to-use media and feed formulations
-  Consultation by FAS and R&D teams
-  Detailed protocol
-  Data analysis and report

### Could panels benefit your media development process?

We spoke to Thermo Fisher media and feed panel specialists to learn more.

[Read the Q&A here](#)

### Discover how to simplify evaluations and improve performance

Find out more about our panel evaluations and discover how we can help you accelerate your media and feed development.

[Find out more](#)

# Gibco media and feed panel evaluations

Discover the diversity you can find in our Gibco panels

## Gibco CHO Media Panel

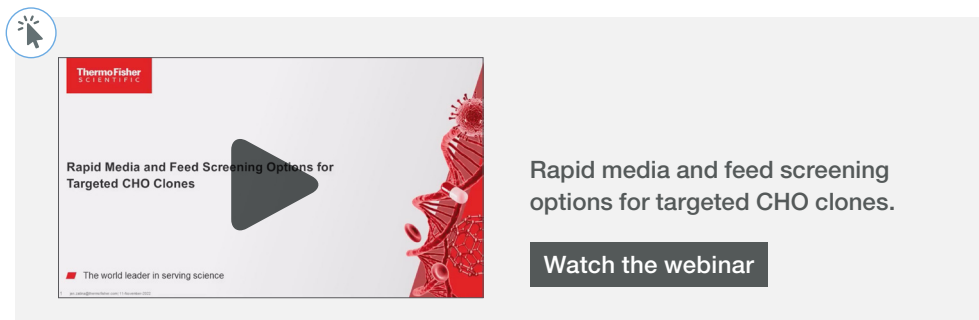
Components	Medium #1	Medium #2	Medium #3	Medium #4	Medium #5	Medium #6	Medium #9A	Medium #13	Medium #14
Amino acids	High	Medium	Low	None	Low	Medium	High	Medium	Low
Vitamins	High	Medium	Low	None	Low	High	Medium	High	Low
Lipids	None	Medium	Low	High	Medium	Low	High	High	Low
Trace metals	None	Medium	Low	High	Medium	High	High	High	Low
Amines	High	Medium	Low	None	High	Medium	Low	Medium	Low
Nucleosides	None	None	None	None	None	High	High	High	Low
Organic acids	Low	None	None	None	None	High	High	High	Low

## Gibco CHO Feed Panel

	Medium #1	Medium #2	Medium #3	Medium #4	Medium #5
Amino acids	Medium	None	High	Medium	High
Vitamins	Medium	High	Medium	High	None
Lipids	None	High	None	High	None
Trace metals	Medium	Medium	High	None	High
Amines	Medium	Medium	None	High	None
Nucleosides	None	High	Medium	Medium	Medium
Organic acids	None	None	High	None	High

[Please visit our website on CHO media and feed panel to learn more.](#)

High level  Low level



**Rapid Media and Feed Screening Options for Targeted CHO Clones**

Rapid media and feed screening options for targeted CHO clones.

[Watch the webinar](#)

## Gibco™ GlycanMod Panel

A library designed to increase mAb galactosylation across multiple cell lines, improving protein production and developing more therapeutically effective antibodies.

**Diverse formulations**

Gain access to four 100 mL diverse, ready-to-use and chemically defined, formulations to quickly identify the product that achieves your desired protein quality profile.

**Flexibility**

Easily integrate into existing workflows, regardless of scale or current process.

**Simplified screenings**

Receive a protocol and technical support from our FAS and R&D teams to help with experimental design and data analysis.

# Gibco media development services

## Why choose Thermo Fisher for media development

Optimize your unique medium and process for increased titers, quality and manufacturability by collaborating with Gibco™ Media by Design™ Services. Our flexible media development options include traditional and multiomics workflows. The multi-omics option incorporates insights from our analyses of thousands of components (proteins and metabolites) within the cell, in addition to spent media analysis, to more fully characterize the nutritional requirements of your cell line.

## Experience and knowledge



- More than 60 years of cell line / media development experience
- 170+ projects completed since 2006
- Decades of tech transfer knowledge
- Offering best-in-class technology to support our data intelligence, including high resolution UPLC-MS instrumentation and predictive analytics

## Collaborative

- Worked with >100 client process development groups
- 35% of projects from repeat customers
- Dedicated business team, support team and program managers

## Consistency



- World-class processes and facilities
- Assurance of supply to meet demands
- Scalability to GMP
- Rapid Prototyping Service



### Are you considering outsourcing your media development?

Discover the benefits of working with a third-party custom media development collaborator.

[Learn more in the article](#)



### Discover the power analytics can bring to your performance

Actionable insights to help you implement process improvements, powered by industry-leading technology and trusted knowledge.

[Read the brochure](#)

# Gibco media development services

## Traditional workflow option

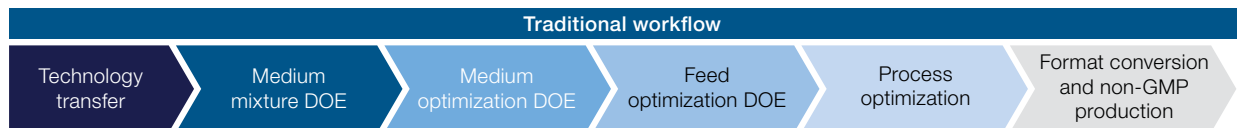
Our traditional development workflow uses spent media analyses of key components, including selected water-soluble vitamins and amino acids. These insights are used in an iterative design of experiments (DOE) process to develop optimized formulations.

## Multi-omics workflow option

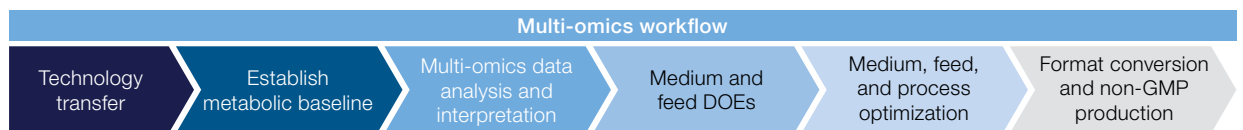
Combining proteomics and metabolomics, our multi-omics workflow employs cellular component analyses of thousands of proteins and metabolites to fully understand the nutritional requirements of your cell line.

## This results in a final formulation that can help you

- Increase titers
- Enhance protein quality
- Improve productivity and cost efficiencies



**Traditional workflow.** A typical full traditional optimization project workflow follows these phases and evaluates up to 50 metabolites.



**Multi-omics workflow.** A typical multi-omics optimization project involves these phases and can evaluate up to 1,000 metabolites and 7,000 proteins.

[Please visit our website on media development services to learn more.](#)



## Could multi-omics enhance your production and maximize your cell line potential?

**Media by Design Services**  
**Optimized media. Maximized performance. Long-term success.**  
 Identify your unique media and process for maximum yield, quality and reproducibility by utilizing our state-of-the-art technology.  
 Our solutions are tailored to your goals and performance, including customized growth and media optimization, identifying your unique media requirements, and defining the optimal media formulation. Additionally, our advanced media development services are designed to enhance your production and reduce your media costs. Our media development services are designed to enhance your production and reduce your media costs. Our media development services are designed to enhance your production and reduce your media costs.

Learn more about the Gibco multi-omics difference.

[Read the flyer](#)

**Case Study | Media by Design Services**  
**Antibodies**  
**Custom traditional and multi-omics media development enhances antibody production in CHO cells**  
**Achieving 60% increase up to 4-fold while maintaining product quality**  
**Challenge**  
 The client's CHO cell line was producing low antibody titers. The client's CHO cell line was producing low antibody titers. The client's CHO cell line was producing low antibody titers. The client's CHO cell line was producing low antibody titers. The client's CHO cell line was producing low antibody titers.

Custom traditional and multi-omics media development enhances antibody production in CHO cells.

[Read the case study](#)

**Advances in custom medium development: the multi-omics difference**

Advances in custom media development: the multi-omics difference.

[Watch the video](#)

**Case Study | Media by Design Services**  
**Antibodies**  
**Optimization of antibody production in a CHO-K1 cell line with a multi-omics strategy from Media by Design Services**  
**Cell-line-specific requirements identified for achieving over 60% titer increase**  
**Challenge**  
 The client's CHO-K1 cell line was producing low antibody titers. The client's CHO-K1 cell line was producing low antibody titers. The client's CHO-K1 cell line was producing low antibody titers. The client's CHO-K1 cell line was producing low antibody titers. The client's CHO-K1 cell line was producing low antibody titers.

Optimization of antibody production with multi-omics.

[Read the case study](#)

# Product list for CHO cells

## Chinese hamster ovary (CHO) media

For production of recombinant proteins and monoclonal antibodies (mAbs) in CHO suspension cell culture; all are AOF, chemically defined and protein-free without phenol red, glutamine, hydrolysates, hypoxanthine\*, or thymidine\*, unless noted otherwise.

Gibco product and format	Quantity	Gibco optimized cell lines	Gibco recommended feeds and supplements	Features	Cat. No.
CD DG44 Medium, liquid	1,000 mL	DG44, DXB11, and other DHFR <sup>-</sup> cell lines	Once transfected, scale-up is recommended in CD OptiCHO <sup>™</sup> Medium and EfficientFeed <sup>™</sup> A+ Supplement	<ul style="list-style-type: none"> <li>Optimized for the growth of dihydrofolate reductase-deficient (DHFR<sup>-</sup>) cells in suspension, contains hypoxanthine and thymidine (HT), without surfactant</li> <li>Also available in Gibco<sup>™</sup> Freedom<sup>™</sup> DG44 Kit with cGMP-banked cells (Cat. No. A13737-01)</li> </ul>	12610-010
Freedom <sup>™</sup> CHO-S Kit	–	Kit contains CHO-S <sup>™</sup> cells (cGMP-banked) and media	EfficientFeed <sup>™</sup> C+ Supplement	<ul style="list-style-type: none"> <li>Easy-to-use, beginning-to-end product, for cloning and expression of recombinant proteins in CHO-derived suspension culture</li> <li>The Freedom CHO-S Kit includes components for transfection, expression, clone creation, and stable cell line selection, all in a conveniently packaged kit</li> </ul>	A1369601
Freedom <sup>™</sup> DG44 Kit	–	Kit contains DG44 cells (cGMP-banked) and media	NA	<ul style="list-style-type: none"> <li>Easy-to-use, beginning-to-end product, for cloning and expression of recombinant proteins in DHFR<sup>-</sup> CHO cells</li> <li>The Freedom DG44 Kit includes components for transfection, expression, clone creation, and stable cell line selection, all in a conveniently packaged kit</li> </ul>	A1373701
CD CHO Medium, liquid	500 mL	CHO-S and glutamine synthetase (GS) CHO	EfficientFeed <sup>™</sup> B+ Supplement, GlycanTune <sup>™</sup> B+ Total Feed, GlycanTune <sup>™</sup> Feed Kit B+	<ul style="list-style-type: none"> <li>Best with past culture success in CD CHO cells, and process is nearing regulatory filing</li> </ul>	10743-011
	1,000 mL				10743-029
	10 L BPC				10743-001
	20 L BPC				10743-002
CD CHO AGT Medium, granulated powder	1 L	NA		<ul style="list-style-type: none"> <li>Also available: CHO-S cells (cGMP-banked) and Media Kit (Cat. No. A11557-01)</li> </ul>	12490-017
	10 L				12490-025
	100 L				12490-001
	10 kg				12490-003
CD OptiCHO <sup>™</sup> Medium, liquid	1,000 mL	DG44, DXB11, and CHO cells except CHO K1, GS CHO, and CHO-S	EfficientFeed <sup>™</sup> A+ Supplement, GlycanTune <sup>™</sup> A+ Total Feed, GlycanTune <sup>™</sup> Feed Kit A+	<ul style="list-style-type: none"> <li>Lower osmolality formulation when feeding optimization is important and best for hard-to-grow or hard-to-adapt cells</li> </ul>	12681-011
	6 x 1,000 mL				12681-029
CD OptiCHO AGT Medium, granulated powder	1 L				A11222-04
	10 L				A11222-05
	100 L				A11222-01
	10 kg				A11222-03
Dynamis <sup>™</sup> Medium, liquid	1,000 mL	DG44, CHO K1, GS CHO, and CHO-S	EfficientFeed <sup>™</sup> C+ Supplement, GlycanTune <sup>™</sup> C+ Total Feed, GlycanTune <sup>™</sup> Feed Kit C+	<ul style="list-style-type: none"> <li>Best for achieving maximal productivity with high cell densities and cell viability at harvest</li> </ul>	A26615-01
	1 L				A26175-04
	10 L				A26175-01
	100 L				A26175-02
ExpiCHO <sup>™</sup> Stable Production Medium (SPM), liquid	1,000 mL	ExpiCHO-S <sup>™</sup> cells (cGMP-banked, Cat. No. A37785)	EfficientFeed C+ Supplement, GlycanTune C+ Total Feed, GlycanTune Feed Kit C+	<ul style="list-style-type: none"> <li>Enables seamless transition from transient to stable production without additional medium optimization</li> <li>Use ExpiCHO<sup>™</sup> Expression Medium (Cat. No. A29100) for transfection</li> </ul>	A37110-01
	10 L				A37111-01
	100 L				A37111-02
	450 L				A37111-03
High-Intensity Perfusion CHO Medium (HIP CHO), AGT granulated powder	1 x 2 L	DG44, CHO K1, GS CHO, and CHO-S cell lines designed for high-density perfusion workflows	At full medium concentration, designed to be used without additional feed	<ul style="list-style-type: none"> <li>Designed to work with all types of suspension perfusion applications including intensified seed trains, concentrated or intensified fed-batch and continuous perfusion processes</li> <li>Ease of use with AGT format—flexible reconstituted concentrations for both seed train and production work with cell lines that may be sensitive to more concentrated media</li> <li>Supports high cell densities while reducing medium exchange rates—results from continuous perfusion of &gt;100 million cells/mL at 1 VVD</li> </ul>	A42302-01
	15 x 2 L				A42302-02
	100 x 2 L				A42302-03
	370 x 2 L				A42302-03
CHO Medium, dry powder	10 kg	DG44, CHO-K1, other CHO cell lines, and BHK-21 cells	NA	<ul style="list-style-type: none"> <li>A high-performance, complete formulation yielding cell growth and production of antibodies and recombinant proteins in suspension without the need for further supplementation</li> <li>Contains Gibco<sup>™</sup> Difco<sup>™</sup> TC Yeastolate (ultra-filtered) plant hydrolysate, not fully chemically defined</li> </ul>	670006
CHO Media Panel	9 x 500 mL	Diverse media panel designed to identify optimal formulation for various CHO cell lines	CHO catalog feeds or CHO feed panel	<ul style="list-style-type: none"> <li>Diverse library of formulations</li> <li>Evaluation protocol</li> <li>Technical evaluation support</li> <li>Easy to customize</li> <li>Scalable to rapid prototyping and GMP</li> </ul>	<a href="#">Order through Gibco Media by Design Services</a>

\* Hypoxanthine and thymidine are used in dihydrofolate reductase (DHFR)-amplified systems. If needed, add Gibco<sup>™</sup> HT Supplement (Cat. No. 11067).

**Note:** This table provides guidance and recommendations for initial studies, but individual cell lines and clones may respond differently with these recommendations. Additional cell-specific formulations, supplements, or process modifications may be necessary. Contact Gibco Media by Design Services, go to [thermofisher.com/mediabydesign](https://thermofisher.com/mediabydesign), or contact your local FAS through your account manager.

Click on the product name to open the product details page.



## Advanced Granulation Technology

Advanced Granulation Technology (AGT) media is a granular dry media format produced through a technologically advanced process which allows manufacturing of complete formulations in a variety of serum-free, protein-free and chemically-defined media in a dry format. [Click here to learn more](#)

# Product list for CHO cells

## Chemically defined feed supplements

For nutrient replacement or glycan modulation in cell culture production of recombinant proteins, monoclonal antibodies, and vaccines; all are chemically defined, AOF, protein-free, and without phenol red, glutamine, hydrolysates, lipids, or growth factors, unless noted otherwise.

Gibco product and format	Quantity	Features	Recommended Gibco basal medium	Cat. No.		
EfficientFeed™ A+ Supplement Concentrated 3X, liquid	1,000 mL	<ul style="list-style-type: none"> <li>Liquid is pH neutral at 3X concentrate</li> <li>AGT format can be used from 1x to 3x by altering the ratio of powder to water</li> <li>Total feed volumes generally range from 10–45% (1x) to 3–15% (3x) of the starting culture volume as further outlined in the user guide</li> </ul>	CD OptiCHO Medium	A39374-01		
	10 L BPC			A39374-02		
EfficientFeed A+ AGT Supplement, granulated powder	1 L			A25023-04		
	10 L			A25023-05		
	100 L			A25023-01		
GlycanTune™ A+ Total Feed, AGT granulated powder	1 L			<ul style="list-style-type: none"> <li>Modulates glycan expression from G0F to desired G1F and G2F profile based on shifting the timing of existing feed replacement with the GlycanTune feed</li> </ul>	A29719-04	
	10 L				A29719-05	
	100 L				A29719-01	
GlycanTune Feed Kit A+, AGT granulated powder	2 L (1 L each)			<ul style="list-style-type: none"> <li>Contains 1 L each of EfficientFeed A+ AGT Supplement and GlycanTune A+ Total Feed</li> </ul>	A33159-01	
EfficientFeed™ B+ Supplement Concentrated 3X, liquid	1,000 mL			<ul style="list-style-type: none"> <li>Liquid is a pH-neutral 3X concentrate</li> <li>AGT medium can be used from 1x to 3x by adding different amounts of powder to water</li> <li>Total feed volumes typically range from 10–45% (1x) to 3–15% (3x) of the starting culture volume, as further outlined in the user guide</li> </ul>	CD CHO Medium	A39375-01
	10 L BPC	A39375-02				
EfficientFeed B+ AGT Supplement, granulated powder	1 L	A25030-04				
	10 L	A25030-05				
	100 L	A25030-01				
GlycanTune™ B+ Total Feed, AGT granulated powder	1 L	<ul style="list-style-type: none"> <li>Modulates glycan expression from G0F to desired G1F and G2F profiles based on shifting the timing of existing feed replacement with the GlycanTune feed</li> </ul>	A29720-04			
	10 L		A29720-05			
	100 L		A29720-01			
GlycanTune Feed Kit B+, AGT granulated powder	2 L (1 L each)	<ul style="list-style-type: none"> <li>Contains 1 L each of EfficientFeed B+ AGT Supplement and GlycanTune B+ Total Feed</li> </ul>	A33160-01			
Resurge™ CD1 Supplement, dry powder (Also see Resurge CD Pak)	100 g	<ul style="list-style-type: none"> <li>A 5-member family of diverse nutritional feed supplements, without glucose and glutamine, developed using several CHO cell lines and various batch or fed-batch culture systems</li> <li>Improves product yield without sacrificing product quality and allows greater flexibility in the glucose feeding strategy</li> <li>All 5 supplements should be concurrently evaluated to determine the supplement(s) most beneficial for your cell line and system</li> </ul>	Various basal media for CHO cell lines			670011
	1 kg			670012		
	5 kg			670013		
Resurge CD2 Supplement, dry powder (Also see Resurge CD Pak)	100 g			670015		
	1 kg			670016		
	5 kg			670017		
Resurge CD3 Supplement, dry powder (Also see Resurge CD Pak)	100 g			670018		
	1 kg			670019		
	5 kg			670020		
Resurge CD4 Supplement, dry powder (Also see Resurge CD Pak)	100 g			670021		
	1 kg			670022		
	5 kg			670023		
Resurge CD5 Supplement, dry powder (Also see Resurge CD Pak)	100 g			670024		
	1 kg			670025		
	5 kg			670026		
Resurge CD Pak 5 dry powder supplements	100 g of each					670030
1. Resurge CD1 Supplement (Cat. No. 670011)						
2. Resurge CD2 Supplement (Cat. No. 670015)						
3. Resurge CD3 Supplement (Cat. No. 670018)						
4. Resurge CD4 Supplement (Cat. No. 670021)						
5. Resurge CD5 Supplement (Cat. No. 670024)						
CHO Feed Panel	5 x 100 mL	<ul style="list-style-type: none"> <li>Diverse library of feeds designed to identify optimal formulation</li> <li>Evaluation protocol</li> <li>Technical evaluation support</li> <li>Easy to customize</li> <li>Scalable to rapid prototyping and GMP</li> </ul>	CHO catalog media or CHO media panel formulation	<a href="#">Contact Gibco Media by Design Services for details</a>		

**Note:** This table provides guidance and recommendations for initial studies, but individual cell lines and clones may respond differently with these recommendations. Additional cell-specific formulations, supplements, or process modifications may be necessary. Contact Gibco Media by Design Services, go to [thermofisher.com/mediabydesign](https://thermofisher.com/mediabydesign), or contact your local FAS through your account manager.

[Click on the product name to open the product details page.](#)

# Product list for CHO cells

## Chemically defined feed supplements

Gibco™ product and format	Quantity	Features	Recommended Gibco basal medium	Cat. No.	
EfficientFeed™ C+ Supplement Concentrated 2X, liquid	1,000 mL	<ul style="list-style-type: none"> <li>Liquid is pH neutral at 2X concentrate</li> <li>AGT format can be used from 1x to 2x by altering the ratio of powder to water</li> </ul>	Dynamis Medium, ExpiCHO Stable Production Medium	A39376-01	
	10 L BPC			A39376-02	
EfficientFeed C+ AGT, Supplement, granulated powder	1 L	<ul style="list-style-type: none"> <li>Total feed volumes generally range from 10–40 (1x) to 5–20% (2x) of the starting culture volume as further outlined in the user guide</li> </ul>		A25031-04	
	10 L			A25031-05	
	100 L			A25031-01	
GlycanTune™ C+ Total Feed, AGT granulated powder	1 L	<ul style="list-style-type: none"> <li>Modulates glycan expression from G0F to desired G1F and G2F profile based on shifting the timing of existing feed replacement with the GlycanTune feed</li> </ul>		A29721-04	
	10 L			A29721-05	
	100 L			A29721-01	
GlycanTune Feed Kit C+, AGT granulated powder	2 L (1 L each)	<ul style="list-style-type: none"> <li>Contains 1L each of EfficientFeed C+ AGT supplement and GlycanTune C+ Total Feed</li> </ul>			A33161-01

## Peptone selection in CHO cell cultures

For nutrient supplementation in mammalian, insect, and microbial cell culture production of recombinant proteins, monoclonal antibodies, and vaccine products.

Gibco product and format	Quantity	Features	Cat. No.
Starter Pak No. 1 5 dehydrated powders*: 1. Difco™ Yeast Extract, ultra-filtered (UF) (Cat. No. 210929) 2. Bacto™ Yeast Extract, technical (Cat. No. 288620) 3. Bacto TC Yeastolate (Cat. No. 255772) 4. Difco TC Yeastolate, UF (Cat. No. 292804) 5. Difco Phytone Supplement, UF (Cat. No. 210931)	100 g of each	<ul style="list-style-type: none"> <li>Starter sample package of five AOF Difco and Bacto peptones for use with mammalian and microbial cell cultures to enhance growth and production in batch or fed-batch processes</li> <li>Evaluation of all five peptones in concurrent testing is recommended to determine which nutritional profiles are most beneficial to your culture</li> </ul>	215366
* These are non-GMP samples of the same formulation as the catalog products listed; see footnote below.			
Starter Pak No. 2 6 dehydrated powders*: 1. Phytone™ Peptone (Cat. No. 211906) 2. Difco Soytone (Cat. No. 212488) 3. Bacto Yeast Extract (Cat. No. 212750) 4. Bacto Proteose Peptone No. 2 (Cat. No. 212120) 5. Bacto Proteose Peptone No. 3 (Cat. No. 211693) 6. Bacto Casamino Acids (Cat. No. 223050)	100 g of each	<ul style="list-style-type: none"> <li>Starter sample package of three AOF and three animal-origin (AO) Difco and Bacto peptones for use with mammalian and microbial cell cultures to enhance growth and production in batch or fed-batch processes</li> <li>Evaluation of all six peptones in concurrent testing is recommended to determine which nutritional profiles are most beneficial to your culture</li> </ul>	215367
* These are non-GMP samples of the same formulation as the catalog products listed; see footnote below.			
Starter Pak No. 3 6 dehydrated powders*: 1. Bacto TC Yeastolate (Cat. No. 255772) 2. Phytone Peptone (Cat. No. 211906) 3. Difco Soytone (Cat. No. 212488) 4. Bacto Yeast Extract (Cat. No. 212750) 5. Bacto Malt Extract (Cat. No. 218630) 6. Yeast Extract (Cat. No. 211929)	100 g of each	<ul style="list-style-type: none"> <li>Starter sample package of six AOF Difco and Bacto peptones for use with mammalian and microbial cell cultures to enhance growth and production in batch or fed-batch processes</li> <li>Evaluation of all six peptones in concurrent testing is recommended to determine which nutritional profiles are most beneficial to your culture</li> </ul>	215368
* These are non-GMP samples of the same formulation as the catalog products listed; see footnote below.			
Peptone Preview Pak 5 dehydrated powders*: 1. Wheat 100, UF (Cat. No. 215380) 2. Cotton Peptone 100, UF (Cat. No. 215381) 3. Cotton Peptone 200, UF (Cat. No. 215382) 4. Soy 100 (Cat. No. 215383) 5. Yeast 100 (Cat. No. 215384)	100 g of each	<ul style="list-style-type: none"> <li>Features new wheat, cotton, soy, and yeast peptones which provide unique nutritional profiles compared to other cell culture supplements</li> <li>Suitable for use with mammalian and microbial cell cultures to enhance growth and production in batch or fed-batch processes</li> <li>Evaluation of all five peptones in concurrent testing is recommended to determine which nutritional profiles are most beneficial to your culture</li> </ul>	215379
* These are non-GMP samples of the same formulation as the catalog products listed; see footnote below.			

**Note:** This chart provides information pertaining to Peptone Starter and Preview Paks for evaluation purposes. A complete listing of all catalog peptones supplements can be found in our Technical Guide to Peptones, Supplements, and Feeds at [thermofisher.com/peptones](https://www.thermofisher.com/peptones)

[Click on the product name to open the product details page.](#)

# Product list for CHO cells

## Additional products

### Chinese hamster ovary (CHO) media

Gibco product and format	Quantity	Gibco optimized cell lines	Gibco recommended feeds and supplements	Features	Cat. No.
Efficient-Pro™ Medium, Liquid	1000 mL	CHO-DG44, CHO-S, CHO-K1, GS-CHO	Efficient-Pro Feed 1, Efficient-Pro Feed 2, Efficient-Pro Feed 3, Efficient-Pro Feed Enhancer	<ul style="list-style-type: none"> <li>AGT type: Ease-of-use with auto-pH and simplified dissolution</li> <li>Sustain cell viability for longer bioreactor runs and maximized titer</li> <li>Improve downstream outputs such as protein glycosylation, charge-variants, and aggregation</li> <li>Speed up process development and streamline transfer to manufacturing scale</li> <li>Increase flexibility with a range of format and packaging configurations</li> <li>Decrease cell shock with simplified adaptation protocols</li> </ul>	A5322201
	10 L				A5322202
	20 L				A5322203
Efficient-Pro™ AGT™ Medium, granulated powder	1 L				A5322301
	10 L				A5322302
	100 L				A5322303
	500 L	A5322304			

### Chemically defined feed supplements

Gibco™ product and format	Quantity	Features	Recommended Gibco basal medium	Cat. No.
Efficient-Pro™ Feed 1, Liquid	1000 mL	<ul style="list-style-type: none"> <li>Efficient-Pro Feed 1 for CHO-K1</li> <li>Efficient-Pro Feed 2 for CHO-S and DG44</li> <li>Efficient-Pro Feed 3 and Feed Enhancer for CHO-K1 GS</li> <li>AGT type: Ease-of-use associated with auto-pH and simplified dissolution</li> <li>The Efficient-Pro system increases titer and specific productivity, improves protein quality and metabolite profiles, and is easier to use with less solubility issues than other CHO media and feed offerings</li> </ul>	Efficient-Pro Medium	A5208801
Efficient-Pro™ AGT™ Feed 1, granulated powder	1 L			A5209101
	10 L			A5209102
	100 L			A5209103
	Efficient-Pro™ Feed 2, Liquid			1000 mL
Efficient-Pro™ AGT™ Feed 2, granulated powder	1 L			A5221601
	10 L			A5221602
	100 L			A5221603
Efficient-Pro™ Feed 3, Liquid	1000 mL			A4000135701
Efficient-Pro™ AGT™ Feed 3, granulated powder	1 L			A4000222001
	10 L			A4000222002
	100 L			A4000222003
Efficient-Pro™ Feed Enhancer, Liquid	100 mL			A4000135801
Efficient-Pro™ DPM Feed Enhancer, dry powder	1 L			A4000175501
	10 L			A4000175502

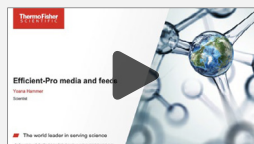


## Efficient-Pro spotlight

Learn more about our Gibco Efficient-Pro Medium and Feed System, designed to drive productivity in your batch or fed-batch CHO process.



Watch the video



Watch our webinar



Read the application note



Read the white paper

### Chinese hamster ovary (CHO) cell line

Gibco™ product and format	Quantity	Gibco optimized cell lines	Gibco recommended feeds and supplements	Features	Cat. No.
Freedom™ ExpiCHO-S kit	-	Kit contains ExpiCHO-S cells (cGMP-banked) and media	EfficientFeed™ C+ Supplement or Efficient-Pro™ Feed 2	<ul style="list-style-type: none"> <li>Easy-to-use, beginning-to-end product, for the cloning and expression of recombinant proteins in CHO-derived suspension culture</li> <li>Freedom ExpiCHO-S Kit includes components for transfection, expression, clone creation, and stable cell line selection, all in a conveniently packaged kit</li> </ul>	A46847

# Global network of R&D and manufacturing facilities

## North America

- **Grand Island, New York**
  - Media, reagents, sera
  - Media & analytical services
  - Gibco rapid prototyping services
  - ISO 13485, 21 CFR 820
  - MDSAP certified
  - FDA registered
- **Miami, Florida**
  - Media, reagents
  - Animal-free facility
  - ISO 9001
- **Detroit, Michigan**
  - Peptones
  - ISO 13485
- **Baltimore, Maryland**
  - Media & analytical services
  - Gibco rapid prototyping services

## Europe

- **Paisley, Scotland**
  - Media, reagents, sera
  - ISO 13485, 21 CFR 820
  - FDA registered
- **Vilnius, Lithuania**
  - Magnetic beads

## Asia-Pacific

- **New Zealand & Australia**
  - Sera, animal proteins
  - ISO 13485, 21 CFR 820
  - FDA registered
- **Shanghai & Suzhou, China**
  - Media & analytical services (Shanghai)
  - Gibco rapid prototyping services (Suzhou)

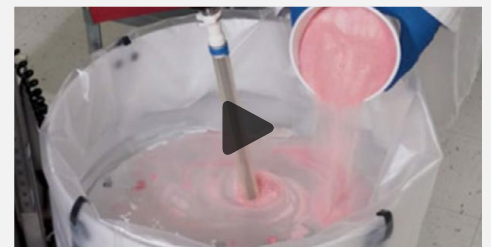


\*R&D facilities: Grand Island (NY, USA), Baltimore (MD, USA), and Shanghai (China)

\*Bioprocess Design Center: Singapore, Korea, and China



Learn more about our innovative Advanced Granulation Technology (AGT) media format and how it can benefit your process.



### Media format of manufacturing facilities

Media format	Grand Island, NY	Paisley, Scotland	Miami, FL	Detroit, MI
Advanced Granulation Tehnology (AGT™)	✓	✓		
Animal origin-free dry powder	✓	✓	✓	
Animal origin dry powder	✓	✓		
Animal origin peptones				✓

Pin mill and FitzMill™ milling technology offered

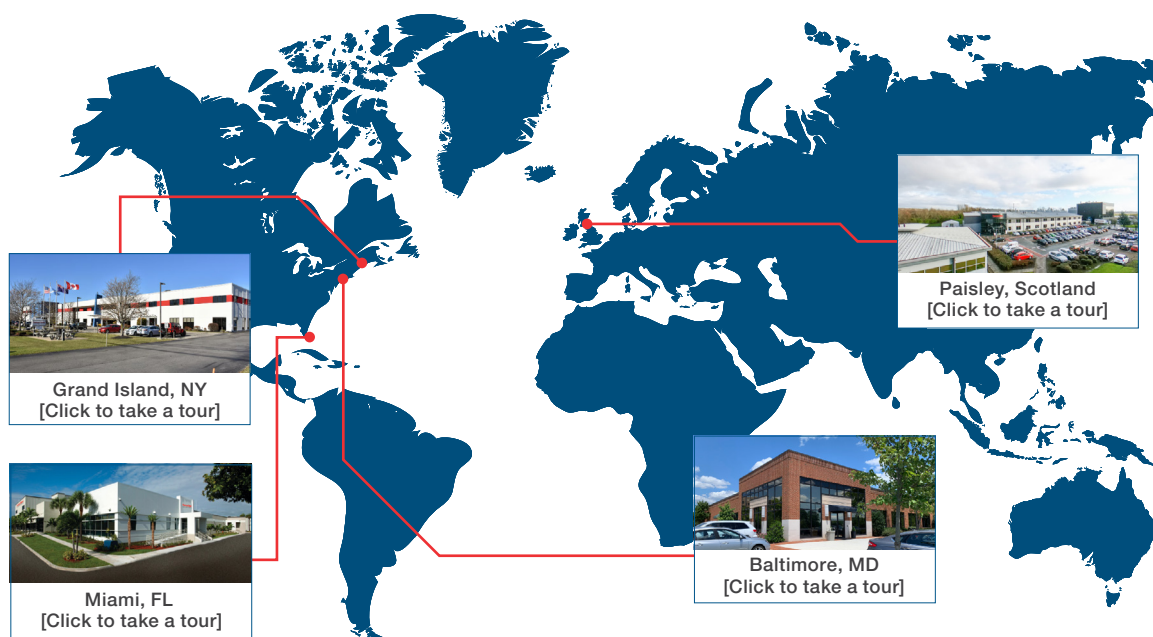
# Tour our facilities virtually

Take a 360° tour of any one of our cell culture media manufacturing facilities today

Learn about our approach to site-to-site equivalency.



Learn more about our global facilities



## Want to learn more about how we can support your scale-up journey?

Whether you're looking to reduce risk from supply chains or increase your capacity, you may need to consider an additional supplier. Discover more by clicking on the resources below.

- Discover how to successfully qualify a reliable secondary supplier [Read the article](#)
- Streamline your supply assurance and scale up with Gibco [Learn more in the brochure](#)
- Accelerate your cell culture media manufacturing from rapid prototyping through cGMP [Discover more in the case study vs article](#)
- Optimize efficiency and reduce risk with a trusted media collaborator [Read the article](#)



## Contact us

Could our CHO cell culture solutions meet your biomanufacturing needs?

[Contact us to learn more and talk to our team](#)

Learn more at [thermofisher.com/chomedia](https://thermofisher.com/chomedia)