Cell Preparation & Processing

1997, Dr. Christine Jacobs

Life in the balance: cell walls and antibiotic resistance

Dr. Jacob's essay on β-lactam antibiotic resistance and cell wall sensing in Gram-negative bacteria reports her doctoral research under the shared supervision of Jean-Marie Frère (Center for Protein Engineering, University of Liège, Belgium) and Staffan Normark (Microbiology and Tumor Biology Center, Karolinska Institute, Stockholm, Sweden).

She was awarded an MS in biochemistry at the University of Liège, Belgium in 1991. For her masters thesis on β-lactamase kinetics, she spent 6 months in the laboratory of Staffan Normark at the Department of Molecular Microbiology, Washington University Medical School, St. Louis, where she became interested in bacterial resistance to antibiotics. Her doctoral training was received in three different laboratories: Staffan Normark at Washington University Medical School, St. Louis; the laboratory of Jean-Marie Frère at the University of Liège and, lastly, in a very fruitful scientific collaboration with James T. Park, where she spent 5 months at the Department of Molecular Biology and Microbiology, Tufts University Health Sciences Campus, Boston, to study the relation between β-lactamase regulation and cell wall metabolism. She completed her doctoral work at Karolinska Institute, Stockholm, in the laboratory of Staffan Normark.

GE & Science Prize for Young Life Scientists is supported by GE Healthcare and the journal Science, which is published by AAAS, the nonprofit society.

Further information on how to enter, plus past winners and their essays can be found at:
www.gelifesciences.com/science

Chapter 2

made2measure

Products in this chapter can be customized to your precise requirements, including small-scale packs, concentrations, special blends, specific QC testing, and scale-up.

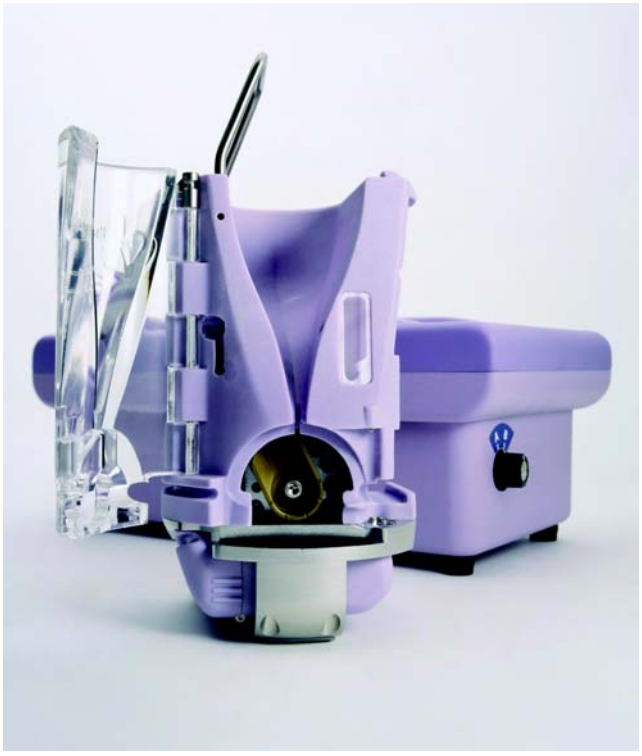
In addition, we offer a "Room-Temperature Stable" reagent development and manufacturing service where we develop your -20°C reagents and kits for storage and shipping at room temperature.

Our manufacturing standards are certified to ISO 9001:2000 with Six Sigma implementation throughout the manufacturing process.

Contact us for more information at made2measure@ge.com, and visit us on the web at www.gelifesciences.com/custom.

To ensure that we handle your inquiry efficiently, please provide the product name, catalog code, and volume requirements.

AXP AutoXpress Platform



The AXP AutoXpress Platform delivers precise cord blood processing and data tracking.

- ***Automated, functionally closed, and sterile system for volume reduction of blood components.***
- Consistently high recoveries of stem-cell rich, mononucleated cells (MNCs) from cord blood.
- Simultaneous processing of multiple cord blood units.
- Sterile sample collection through integrated sample pillows.
- Quick and accurate data tracking with XpressTRAK software.
- No HESpan required.

The AXP AutoXpress Platform[1] is an automated, functionally closed, sterile system that volume reduces cord blood to a precise 20 ml in less than 40 min, while retaining > 97% mononucleated cells (MNCs). Data provided by New York Blood Center (97.9%. sd 4.9%). The AXP Platform comprises the AXP device, docking station, processing set, and XpressTRAK software that assists with cGMP and cGTP compliance. A range of accessories for the platform is also available.

The AXP device is self-powered and microprocessor-controlled. It contains flow control optical sensors that are used to achieve the separation of a concentrated MNC fraction of uniform volume (nominally 20 ml). The device is powered by a NiMH battery that is recharged concurrent with data downloading in a docking station.

Cord blood, transferred to the processing set, is placed in the device and centrifuged. An MNC fraction is established, separated and automatically delivered to a blow-molded freezing bag designed for optimal space-saving storage. The AXP device fits into standard, refrigerated blood bank centrifuge buckets, and six units of cord blood can be processed at one time. MNC separation in the AXP system does not require hetastarch.

[1] *Designed by and trademark of Thermogenesis Corp.*

ORDERING INFORMATION

Product	Quantity	Code Number
AXP Startup Accessory Kit *NEW**	1	28-9137-65
AXP Cell Preparation Device†	1	28-4044-58
Docking Station, Main	1	28-4044-59
Docking Station, Satellite	1	28-4044-65
AXP Device Stand	1	28-4044-66
Counterweight	1	28-4044-60
Weight Kit	1	28-4044-62
Processing Set	24	28-4044-64
QC Bag Set *NEW*	10	28-4044-72
Battery Replacement Kit for AXP *NEW*	1	28-4052-22
AXP Freezing/Processing Bag Labels *NEW*	1	28-9079-20
Weight Compensation Cap	1	28-4044-67
ABC Switch Box	1	28-4044-68
Oval Bucket Adapter	2	28-4044-69
Wireless Barcode Scanner	1	28-4044-70

For pricing information, visit www.gelifesciences.com/orderonline

** Includes: XpressTrak Software, Device Stand, Counterweight, Weight Kit, Wireless Barcode Scanner, and Operator Manual.*
† Includes: Weight Compensation Cap.

The AXP platform is designed to capture essential data for quality assurance and compliance with current good tissue practices (cGTP). XpressTRAK software tracks and documents each cord blood unit's separation data during and after centrifugation. Other data fields (blood unit ID, user ID, centrifuge ID, and processing bag lot number/expiration date) are entered via a keyboard or a wireless scanner. The software produces a printable report of the processing cycle and stores the data in a searchable, sortable database. Additional features of the software include the ability to modify an ISBT 128 barcode to identify a split-bag sample, run QC testing on AXP devices, assist with troubleshooting, and prepare reports on device history.

Components of the AXP AutoXpress Platform.

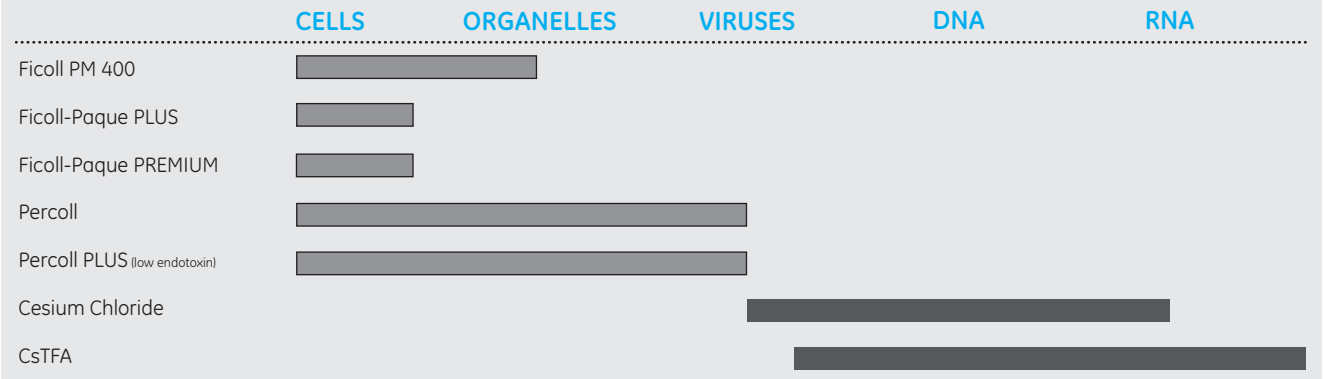
Introduction to Centrifugation Media

Sedimentation through a density gradient, either at unit gravity or by centrifugation, is often used to separate and characterize biological particles such as cells, organelles, viruses, and nucleic acids. The following important criteria must be considered when choosing a density gradient medium for separation.

- ***The medium should form a gradient over the desired density range.***
- The pH and osmolality of the medium should be easily adjustable.
- The medium should form solutions of low viscosity at high density.
- The medium should preserve the integrity of the cell or particle.

Our density gradient media fulfill all of these criteria and allow you to prepare density gradients according to your own specifications.

SELECTION GUIDE – How to Choose Centrifugation Media



Ficoll PM400

- ***For producing density gradients for separation of cells and subcellular components by centrifugation or by sedimentation at unit gravity.***
- Neutral, highly-branched, hydrophilic polymer of sucrose which dissolves readily in aqueous solution.
- Concentrations of up to 50% (w/v) covering densities of up to 1.2 g/ml can be achieved.
- Better osmotic properties than sucrose.
- Preserves functional and morphological integrity.
- Useful for separating cells that are sensitive to centrifugation and for separating cells of similar density but different size (under conditions of sedimentation at unit gravity).
- Does not penetrate biological membranes.
- Serves as the raw material for preparation of Ficoll-Paque gradients.
- Used in other applications such as electrophoresis, hybridization, cryopreservation, and as a hapten carrier.

ORDERING INFORMATION

Product	Quantity	Code Number
Ficoll PM400 (Dry Powder)	100 g	17-0300-10
Ficoll PM400 (Dry Powder)	500 g	17-0300-50

For pricing information, visit www.gelifesciences.com/orderonline

TECHNICAL SPECIFICATIONS

Physical properties of Ficoll PM400

Molecular weight	3×10^5 to 5×10^5
Specific rotation	+50° to +65°
Stokes radius	10 nm
Sodium chloride	< 1%

Reactivity and stability

The reactivity and stability of Ficoll PM400 are determined by its hydroxyl groups and the glycosidic bonds in the sucrose residues. It is stable in alkaline and neutral solutions. At pH values lower than 3, it is rapidly hydrolyzed, especially at elevated temperatures. In neutral solutions, however, Ficoll PM 400 can be sterilized by autoclaving at 110°C for 30 min without degradation. Strong oxidizing and reducing agents should be avoided.

Solubility

Ficoll PM400 is delivered as a spray-dried powder and is therefore readily soluble in aqueous media when it is added slowly with concomitant stirring. Any lumps formed during this procedure will dissolve fairly quickly. Concentrations up to 50% (w/v) can easily be attained. The relative viscosity (η_r) of Ficoll PM400 solutions at different concentrations is tabulated as follows:

Ficoll PM400 (% w/v)	10	20	30	40	50
η_r at 20°C	5	20	60	180	600

Centrifugation Media

Ficoll-Paque PREMIUM products

Ficoll-Paque PREMIUM products are available in densities of 1.073, 1.077, and 1.084 g/ml.

- ***Reagents used to prepare different density preparations of mononuclear cells from peripheral blood, bone marrow, and umbilical cord blood by density gradient centrifugation.***
- Manufactured according to GMP[1] and ISO 13485:2003 standards and the recommendations of the United States Pharmacopeia[2].
- Sterile and ready-to-use.
- Low levels of endotoxin (< 0.12 EU/ml) secured and tested.
- A Regulatory Support File (RSF) is available for Ficoll-Paque PREMIUM, for information on how to order an RSF, please visit our Regulatory Support Web site at www.gelifesciences.com/rsf.

Ficoll-Paque PREMIUM products are based on Ficoll-Paque PLUS (see page 63) which has been used for more than 30 yr as a sterile density medium for the isolation of high yields of mononuclear cells from bone marrow, peripheral blood, and cord blood. All Ficoll-Paque PREMIUM products differ from Ficoll-Paque PLUS in that they are manufactured in a strictly controlled environment compliant with ISO 13485:2003 and in accordance with GMP[1] and the recommendations of the United States Pharmacopeia[2] for the manufacture of cell therapy products.

Applications

Ficoll-Paque PREMIUM
Optimized for the isolation of mononuclear cells from human peripheral blood, bone marrow, and umbilical cord blood.

Ficoll-Paque PREMIUM 1.084
Can be used for isolating a broad range of human mononuclear cells including those of a higher density and for separating blood cells from mice or rats.

Ficoll-Paque PREMIUM 1.073
Can be used when isolating lower-density human mononuclear cells (e.g., mesenchymal stromal cells or monocytes).

ORDERING INFORMATION

Product	Quantity	Code Number
Ficoll-Paque PREMIUM (density: 1.077 g/ml)	6 × 100 ml	**17-5442-02**
Ficoll-Paque PREMIUM (density: 1.077 g/ml)	6 × 500 ml	**17-5442-03**
Ficoll-Paque PREMIUM 1.084 ***NEW*** **(density: 1.084 g/ml)**	6 × 100 ml	**17-5446-02**
Ficoll-Paque PREMIUM 1.073 ***NEW*** **(density: 1.073 g/ml)**	6 × 100 ml	**17-5446-52**

For pricing information, visit www.gelifesciences.com/orderonline

Related Products	Refer To
Percoll PLUS	page 64
Ficoll PM400 (Dry Powder)	page 61

TECHNICAL SPECIFICATIONS

Properties
Ficoll-Paque PREMIUM products constitute a range of sterile, ready-to-use density media containing Ficoll PM400, sodium diatrizoate and disodium calcium EDTA in water for injection (WFI). The densities and osmolalities of the different products have been optimized for the isolation of mononuclear cells from blood and bone marrow.

Density
Ficoll-Paque PREMIUM: 1.077 ±0.001 g/ml
Ficoll-Paque PREMIUM 1.084: 1.084 ±0.001 g/ml
Ficoll-Paque PREMIUM 1.073: 1.073 ±0.001 g/ml

Stability
Ficoll-Paque PREMIUM products are provided as sterile solutions which are stable for at least 3 yr when stored between 4°C and 30°C and protected from light. Deterioration of Ficoll-Paque PREMIUM products is indicated by the appearance of a yellow color or particulate material in the solution.

Endotoxins
Contains < 0.12 EU/ml

Typical results from our laboratories using Ficoll-Paque PREMIUM (density 1.077 g/ml) and fresh peripheral blood (≤ 2 h old)

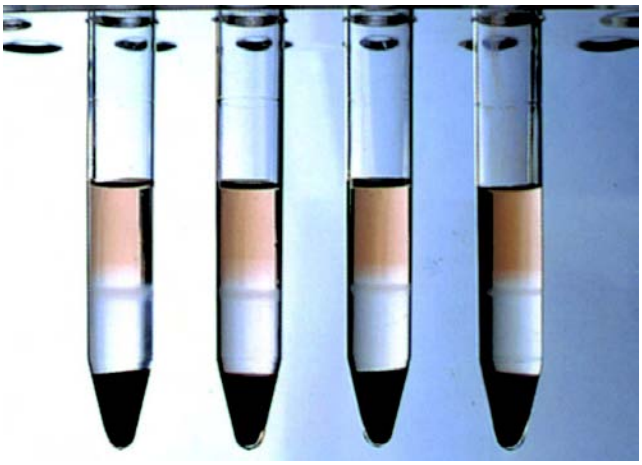
Mononuclear cells
- 60 ±20% recovery of mononuclear cells from the original blood sample
- > 90% of cells present in the final preparation are mononuclear cells
- > 90% viability (measured by trypan blue exclusion)

Other cells
- Maximum 5% granulocytes
- Maximum 10% erythrocytes

References

1. EC Guide to GMP (Good Manufacturing Practice) annex 1 "Manufacture of Sterile Medicinal Products"
2. United States Pharmacopeia. Recommendations for ancillary materials, Chapter <1043>.

Ficoll-Paque PLUS



Isolation of human lymphocytes (interface) from peripheral blood using Ficoll-Paque PLUS.

- ***Ready to use sterile medium for isolation of human lymphocytes in high yield from peripheral blood.***
- Maintains viability and representative distribution of B and T lymphocytes.
- Low levels of endotoxin (< 0.12 EU/ml).

A step-by-step procedure is included with every box of Ficoll-Paque PLUS.

For technical specifications, see page 62, Ficoll-Paque PREMIUM.

ORDERING INFORMATION

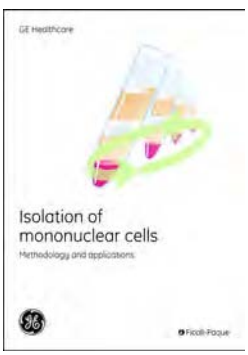
Product	Quantity	Code Number
Ficoll-Paque PLUS *	6 × 100 ml	**17-1440-02**
Ficoll-Paque PLUS *	6 × 500 ml	**17-1440-03**

For pricing information, visit www.gelifesciences.com/orderonline

** For research use only.*

Related Products	Refer To
Ficoll-Paque PREMIUM products	page 62
Percoll	page 65
Percoll PLUS	page 64

Isolation of Mononuclear Cells Handbook



The revised handbook *Isolation of mononuclear cells* (18-1152-69) describes the methodology for using Ficoll-Paque media for density centrifugation of human mononuclear cells. Methodology and applications of Ficoll-Paque PLUS, a sterile, ready to use density gradient medium originally introduced for the purification of lymphocytes in high yields from small or large volumes of human peripheral blood, are described in detail. The use of Ficoll-Paque PREMIUM, a centrifugation medium developed for the isolation of mononuclear cells for clinical applications, is also described.

A copy of the handbook can be downloaded at www.gelifesciences.com/handbooks.

Centrifugation Media

Percoll PLUS

Percoll PLUS reagent to separate various cell types for clinical research applications.

- ***For preparation of cells, subcellular particles and larger viruses. Percoll PLUS* has verified low endotoxin level, and is non-toxic, sterile and re-sterilizable, even after adjustment to physiological ionic strength.***
- Gradients can either be preformed or spontaneously generated by centrifugation at moderate speeds in an angle-head rotor.
- Iso-osmotic gradients throughout cover a range of densities up to 1.3 g/ml.
- Low viscosity allows cell isolations on preformed gradients in only a few minutes using low centrifugal forces (200 to 1000 × g).
- Available in easy-to-open, resealable 250 ml and 1 l bottles.
- Offers maximum flexibility in clinical research.

* *See licensing information at back of catalog.*

ORDERING INFORMATION

Product	Quantity	Code Number
Percoll PLUS	1 l	**17-5445-01**
Percoll PLUS	250 ml	**17-5445-02**

For pricing information, visit www.gelifesciences.com/orderonline

Note: Percoll PLUS is for in vitro *research use only.*

Related Products	Refer To
Percoll	page 65
Ficoll-Paque PREMIUM products	page 62
Ficoll-Paque PLUS	page 63

TECHNICAL SPECIFICATIONS

Composition	Silica sol with covalently linked silane, 15–30 nm diameter
Density	1.13 ± 0.005 g/ml
Osmolality, max.	30 mOsm/kg
Viscosity, max.	15 cP at 20°C
Carbon content in dry residue	4.0–5.5% w/w
pH	9.4 ±0.5 at 20°C
Endotoxin activity, max.*	2 EU/ml

** Typical result <0.75 EU/ml*

Percoll PLUS is non-toxic, almost chemically inert, and does not adhere to membranes. Percoll PLUS is provided sterile and can be stored unopened for at least five years. Preformed gradients can be stored for weeks without change in gradient shape, provided that the gradient is sterile, and remains unfrozen. Percoll PLUS can be buffered within the pH range 5.5 to 10 without change in properties. Both concentrated and diluted Percoll PLUS can be resterilized by autoclaving for 30 min at 120°C.

Percoll

Separation of human blood cells in a gradient of Percoll. Bottom layer contains red blood cells, the middle band is polymorpho-nuclear cells (i.e. granulocytes) and the top band is mononuclear cells.

Percoll*, our innovative density gradient medium, is available in easy-to-open, resealable bottles.

- ***For separation of cells, subcellular particles and larger viruses (down to ~ 70S) under gentle conditions which preserve viability and morphological integrity.***
- Non-toxic to cells.
- Adjustable to physiological ionic strength and pH.
- Gradients can either be preformed or spontaneously generated by centrifugation at moderate speeds in an angle-head rotor.
- Gradients are iso-osmotic throughout and cover a range of densities up to 1.3 g/ml.

Percoll is a low viscosity density gradient medium for preparation of cells, subcellular particles, and larger viruses. The low viscosity of the medium enables cell preparation on preformed gradients in only a few minutes using low centrifugal forces (200 to 1000 × g). Percoll is supplied sterile and is easily resterilizable. The medium is avaialble in easy-to-open, resealable 250 ml and 1 l bottles.

** Note: Percoll is for in vitro research use only.*

ORDERING INFORMATION

Product	Quantity	Code Number
Percoll	1 l	**17-0891-01**
Percoll	250 ml	**17-0891-02**

For pricing information, visit www.gelifesciences.com/orderonline

Related Products	Refer To
Percoll PLUS	page 64
Ficoll-Paque PREMIUM products	page 62
Ficoll-Paque PLUS	page 63

TECHNICAL INFORMATION

Percoll consists of silica particles (15–30 nm diameter) coated with non-dialyzable polyvinylpyrrolidone (PVP). Free PVP is present at only 1–2%. Percoll is non-toxic, almost chemically inert and does not adhere to membranes. Percoll gradients can be formed within the density range of 1.0–1.3 g/ml, and are iso-osmotic throughout.

Percoll is provided as a sterile solution and can be stored unopened at room temperature for five y. At -20°C, it can only be stored for up to six months. If stored at -20°C, gradients form upon thawing, necessitating a mixing of the bottle before use. Preformed gradients can be stored for weeks without a change in gradient shape, provided that the gradient is sterile and remains unfrozen. Percoll can be buffered within the pH range 5.5–10.0 without any changes in properties. If the pH is dropped below 5.5, gelling may occur. Gelling can also be caused by the presence of divalent cations, an effect which is exacerbated by elevated temperatures. Undiluted Percoll can be resterilized by autoclaving for 30 min at 120°C.

Percoll is guaranteed to meet the following specifications

Composition	Silica sol with non-dialyzable PVP coating, 15–30 nm diameter
Density	1.13 ± 0.005 g/ml
Conductivity, max.	100 mS/m
Osmolality, max.	25 mOsm/kg
Viscosity	10 ± 5 cP at 20°C
pH	9.0 ± 0.5 at 20°C

TECHNICAL INFORMATION

Examples of separations in Percoll

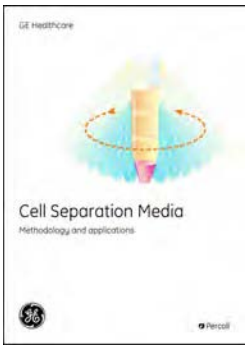
Source	Density (g/ml)*	Centrifugation conditions (× g)
Rat liver cells		
Hepatocytes	1.07–1.10	30000 for 30 min
Kupffer cells	1.05–1.06	30000 for 30 min
Human blood cells		
Thrombocytes	1.04–1.06	†
Lymphocytes	1.06–1.08	†
Granulocytes	1.08–1.09	†
Erythrocytes	1.09–1.10	†
E. coli	1.13	30000 for 20 min
Viruses		
Tobacco mosaic virus	1.06	100000 for 45 min
Equine abortion virus	1.08	40000 for 45 min
Influenza virus	1.06	25000 for 25 min
Organelles		
Mitochondria	1.09–1.11	50000 for 45 min
Lysosomes	1.04–1.07	50000 for 45 min
	1.08–1.11	50000 for 45 min
Peroxisomes	1.05–1.07	63000 for 30 min
Synaptosomes	1.04–1.06	50000 for 45 min
Nuclei	1.08–1.12	100000 for 60 min

** Density is given as recorded density in a Percoll gradient.*

† Separation of blood cells is best achieved using a preformed gradient (starting density 1.090 g/ml) prepared by centrifuging at 20000 × g for 20 min. Blood is layered on top of the gradient and centrifuged at 1000 × g for 5 min in a swinging-bucket rotor. Thrombocytes remain in the serum layer above the gradient; this layer can be removed with a pipette (rate-zonal separation). An additional spin for 20 min at 1000 × g separates the other cell types at their isopycnic densities.

Centrifugation Media / Affinity Media and Reagents

Cell Separation Media Handbook



The revised handbook *Cell Separation Media* (18-1115-69) provides the basic methodology for making and using Percoll density gradients and includes information on Percoll PLUS, a silica-based colloidal medium optimized for cell separation in clinical research applications. In addition, the Application Tables in the latter part of the handbook provide numerous references for using Percoll to isolate various cells, microorganisms, organelles, and other subcellular particles. All experiments described in the literature using Percoll can also be performed with Percoll PLUS.

A copy of the handbook can be downloaded at www.gelifesciences.com/handbooks.

Introduction to Affinity, Media and Reagents

- ***Cells are fractionated on the basis of their surface molecules through which they can bind to a specific adsorbent.***
- Simple to perform, with no need for complex or expensive equipment.
- Can select functionally defined cell populations in high yield and purity.
- Can be used to prepare cell populations depleted of specific functionally defined cells.

Cell-affinity chromatography
Cell-affinity chromatography uses Macrobeads, a special matrix based on Sepharose. These large beads (250–350 µm) pack evenly, leaving sufficient interbead space for free passage of cells.

Panning
Panning is a simple and inexpensive procedure for cell separation by immunoselection using plastic surfaces, such as Petri dishes, coated with Protein A or Protein G alone or in combination with antibodies. Cell mixtures added to the dish display molecules on their surfaces that interact with the immunosorbent and will bind. Unbound cells can be washed off and the selected population eluted with a suitable buffer.

CNBr-Activated Sepharose 6MB

- ***For preparing cell-affinity adsorbents carrying immobilized ligands of your choice.***
- Safe: No handling of cyanogen bromide.
- Easy to use: Gives high-efficiency coupling.
- Rapid: Reacts at pH 8–9 with free amino groups in the protein or other ligand to give a covalently linked product.

ORDERING INFORMATION		
Product	**Quantity**	**Code Number**
CNBr-activated Sepharose 6MB	15 g	**17-0820-01**

For pricing information, visit www.gelifesciences.com/orderonline

Protein A Sepharose 6MB

- ***For separation of cells coated with antibodies.***
- Versatile: Binds the Fc portion of IgG antibodies from a wide variety of species.
- Economical: Eliminates the need for a range of immunoadsorbent columns.
- Easy to use: Column may be regenerated between separations by washing with low-pH buffer.
- Supplied at ~ 1 mg Protein A/ml gel.
- Binds ~ 5 mg human IgG/ml gel.

Antibodies against cell-surface antigens have been used extensively in the preparation of affinity media for cell separation. Although, in theory, any antibody can be directly coupled to Macrobeads, in practice it is usually better to first coat target cells with the antibody and then use Protein A Sepharose 6MB to separate the cells.

ORDERING INFORMATION		
Product	**Quantity**	**Code Number**
Protein A Sepharose 6MB	10 ml	**17-0469-01**

For pricing information, visit www.gelifesciences.com/orderonline

This latter approach has two main advantages over the former. Firstly, there is no need to prepare a new affinity adsorbent for each new antibody of interest. Secondly, bound cells can be recovered undamaged, using competitive elution with excess IgG. In contrast, when antibodies are directly coupled to a matrix, their interactions with cell-surface antigens may be so strong that bound cells cannot be eluted without damaging them.

Protein A and Protein G

- ***For simple, inexpensive immunoselection of cells by "panning".***
- Protein A and G bind the Fc regions of IgG antibodies from a variety of species, making them convenient for antibody purification.

ORDERING INFORMATION

Product	Quantity	Code Number
Protein A (Freeze dried)	50 mg	17-0872-50
Protein A (Freeze dried)	1 g	17-0872-01
Protein A (Freeze dried)	10 g	17-0872-02
Protein G (Freeze dried)	5 mg	17-0619-01
Protein G (Freeze dried)	1 g	17-0619-09
Protein G (Freeze dried)	10 g	17-0619-10

For pricing information, visit www.gelifesciences.com/orderonline

GammaBind G Type 2

- Recombinant engineered form of streptococcal protein G produced in *Escherichia coli*.
- Binds to the constant region of many types of immunoglobulin G, and can be used to detect, quantify and purify IgG antibodies and antigen/antibody complexes.
- GammaBind G Type 2 and Protein G are the most universally applicable antibody binding proteins available because they bind tightly and specifically to antibodies from many different species compared with protein A.
- Unlike non-recombinant Protein G, GammaBind G Type 2 does not cross-react with human serum albumin, IgM, IgA, IgE, IgD or cat/chicken IgG.

ORDERING INFORMATION

Product	Quantity	Code Number
GammaBind G type 2	1 g	17-0884-06
GammaBind G type 2	10 g	17-0884-08

For pricing information, visit www.gelifesciences.com/orderonline

Disposable cell processing solutions

The GE Healthcare WAVE Bioreactor platform provides a disposable solution for your cell processing needs. Featuring a range of patented devices made from disposable contact materials to minimize cleaning and validation, the WAVE platform reduces costs in operations including cell culture, and can drastically reduce the time-to-market for biological products.

ReadyToProcess
WAVE Bioreactor systems, mixers, and associated devices are an integral part of the ReadyToProcess platform. ReadyToProcess products contain features that effectively eliminate the need to clean, sterilize, or validate single-use systems in the manufacturing process. Other products with ReadyToProcess features include a set of newly developed, ready-to-use filtration and chromatography tools (Chapter 11) that bring improved cost efficiency and a greater level of convenience to the manufacture of biopharmaceuticals.

Bioreactor Systems

WAVE Bioreactor System *NEW*

- ***Single-use system means no cleaning, cross-contamination, or validation. Cells contact only disposable sterile biocompatible plastics.***
- Cellbag* based bioreactors, including all fittings and filters, are supplied sterile and ready for use. They are suitable for cGMP commercial production and a biosafety cabinet is not required for inoculation or sampling.
- Multiple instrument configurations for suspension, microcarrier, batch, fed-batch, or perfusion culture.
- Four different systems are capable of handling culture volumes from 50 ml to 500 l.

The WAVE Bioreactor is the ideal device for cell culture. Culture medium and cells contact only a presterile, disposable chamber called a Cellbag that is placed on a special rocking platform. The rocking motion of this platform induces waves in the culture fluid. These waves provide mixing and oxygen transfer, resulting in a perfect environment for cell growth that can easily support over 10×10^6 cells/ml. The WAVE Bioreactor requires no cleaning or sterilization, providing the ultimate ease in operation and protection against cross-contamination.

To select the correct system for your application, first determine the Cellbag size you need by establishing the culture volume you wish to cultivate and then select the instrumentation and options you need.

** Cell Culture Bag in Switzerland.*

SELECTION GUIDE – Systems

Culture volume	Cellbag	WAVE Bioreactor
50 to 250 ml	CELLBAG-500 ml	System 2/10
50 to 500 ml	CELLBAG-1 l	System 2/10
100 to 1000 ml	CELLBAG-2 l	System 2/10; System 20/50 + Kit 20
500 ml to 5 l	CELLBAG-10 l	System 2/10; System 20/50 + Kit 20
1 to 10 l	CELLBAG-20 l	System 20/50 + Kit 20
1 to 10 l	CELLBAG-22 l	System 20/50 + Kit 50
5 to 25 l	CELLBAG-50 l	System 20/50 + Kit 50
5 to 50 l	CELLBAG-100 l	System 200
10 to 100 l	CELLBAG-200 l	System 200
50 to 250 l	CELLBAG-500 l	System 500/1000 + Kit 500EH
100 to 500 l	CELLBAG-1000 l	System 500/1000 + Kit 1000EH

Applications

Monoclonal antibodies
The WAVE Bioreactor has been used extensively for monoclonal antibody production. Culture can be started at low volume and then fresh media added whenever the cell count is sufficiently high. This enables inoculum scaleup without transfers. Batches ranging from 100 ml to 580 l have been run with cell densities over 10×10^6 cells/ml and productivity and product quality comparable to stirred tank bioreactors. Dissolved oxygen concentrations are not limiting and remain above 50% saturation.

Anchorage-dependent cells
Agitation in the WAVE Bioreactor is powerful enough to mix and aerate the culture, yet it is gentle enough to cultivate anchorage-dependent cells on various microcarriers. The wave motion prevents settling and provides oxygenation without bubbles.

Insect cell/baculovirus
The high oxygen supply capability of the WAVE Bioreactor makes it ideal for insect cell culture. Cell densities over 9×10^6 cells/ml are routinely achieved. Baculovirus yields are higher than with conventional bioreactors. The WAVE Bioreactor System is extremely easy to operate and inoculum scale-up and infection can be done inside the bioreactor, reducing the need for transfers.

Virus production
The WAVE Bioreactor provides a closed system that is ideal for virus production. In a gene therapy application, human 293 cells have been grown in suspension and then infected with recombinant adenovirus. Cells grew to 4×10^6 cells/ml and virus production was 1×10^5 virus particles/cell. The WAVE Bioreactor produces viruses under complete containment without the need for a biosafety cabinet.

cGMP production
Wave Bioreactors are in use in cGMP applications producing inoculum for large conventional bioreactors, and also for clinical and commercial production of human therapeutics. Reduced cleaning and validation requirements make this an ideal system for cGMP applications.

Custom uses
The WAVE Bioreactor has many other uses, such as keeping in-process inoculum pools agitated and aerated prior to use; bead-to-bead transfer; thawing, and media mixing. Custom Cellbags can be provided for the WAVE Bioreactor for any working volume between 100 ml and 500 l.

SELECTION GUIDE – Instrumentation Options

Module[1]	Description
CO_2 /Air Mix Plug-in Controller	Infrared CO_2 sensor and aeration system provides a continuous supply of CO_2 conditioned air to the Cellbag Range: 0 to 15% CO_2
Dissolved Oxygen Optical Monitor	Monitor with miniature fiber-optic microprobes enabling real-time measurement of dissolved oxygen High accuracy PMT optical detector with phase shift measurement Range: 0 to 250% saturation with autozero Reusable DOOPT-PROBE purchased separately
O_2/Air Mix Plug-in Controller	Provides continuous supply of O_2 enriched gas to the Cellbag for insect cell, virus, and high cell density applications. Maintains low-oxygen environment for near-anaerobic applications Range 0 to 50% O_2
pH Controller	Enables continuous pH measurement and control using CO_2 or acid/base addition. Electrochemical probe is single use, and available pre-installed in Cellbags.
Loadcell[2]	Enables online measurement of weight. Used for automated fill/harvest and perfusion operations where precise volume control is critical.
Perfusion Controller[3]	Perfusion Controller with Loadcell

[1] Instrument Modules are available in WAVEPOD or as stand-alone units for System 2/10 and System 20/50. Fully integrated modules are available for System 200 and System 500/1000.
[2] Fully integrated in System 20/50 (option); System 200 and System 500/1000 (standard).
[3] For System 2/10 instrument only.

WAVE Bioreactor System (continued)

TECHNICAL SPECIFICATIONS - Systems				
Unit	System 2/10	System 20/50[1]	System 200[2]	System 500/1000[2,3]
Working volume range	• 0.1 to 5 l	0.1 to 25 l	5 to 100 l	50 to 500 l
Integral features	• Speed/angle control • Temperature control • Aeration	Speed/angle control Temperature control Aeration	Speed/angle control Temperature control Aeration Loadcell	Speed/angle control Temperature control Aeration Loadcell
Options	• CO2MIX • O2MIX • DO • pH • Perfusion Controller	• WAVEPOD • CO2MIX • O2MIX • DO • pH • Loadcell • Dual air/temperature	• CO2MIX • O2MIX • DO • pH • Dual air/temperature	• CO2MIX • O2MIX • DO • pH
Weight	• 4.2 kg	• 15.5 kg	• 350 kg	• With Kit 500EH: 925 kg • with Kit 1000EH: 1020 kg
Dimensions	• 489 × 330 × 200 mm	• 573 × 465 × 179 mm • with Kit 20: 711 × 575 × 254 mm • with Kit 50: 775 × 700 × 254 mm	• 185 × 110 × 112 cm • For installation, if required, unit can be tilted	• 201 × 124 × 160 cm • with Kit 500EH: 226 × 124 × 160 cm • with Kit 1000EH: 226 × 231 × 160 cm
Power	• 110/220 VAC	• 100/240 VAC • 50/60 Hz, 6/3 A	• 200 to 240 VAC • 50/60 Hz, 15 A • 3-Phase • Phase-phase ±5% • NEMA L2130 plug	• 200 to 240 VAC • 50/60 Hz, 30 A • 3-Phase • Phase-phase ±5% • NEMA L2130 plug

[1] System 20/50 requires selection of Kit 20 or Kit 50.
[2] Unit provided with casters.
[3] System 500/1000 requires selection of Kit 500EH or Kit 1000EH.
All BASE units are CE/CSA certified.

WAVE Bioreactor System 2/10 *NEW*

WAVE Bioreactor System 2/10 with optional Perfusion Controller

- ***Includes Cellbag* Holder.***
- LCD display and control interface.
- Integral airpump with mass flow meter.
- Temperature control with heater and sensor.

WAVE Bioreactor 2/10EH is for use only with working culture volumes between of 50 ml and 5 l. This compact unit is ideal for animal, insect, and plant cell culture with integral features such as aeration, heating, and temperature control.

** Cell Culture Bag in Switzerland.*

ORDERING INFORMATION

Product	Quantity	Code Number
WAVE Bioreactor 2/10EH *(includes Cellbag Holder)*	1	**28-4115-00**
System 2/10 Perfusion Controller for use with Cellbag2L/P only *(includes two Watson-Marlow pumps for feed and harvest)*	1	**28-4116-35**
System 2/10 Perfusion Controller for use with Cellbag2L/P only *(includes two pinch valves for feed and harvest)*	1	**28-4116-36**
Protective white opaque PVC lid for use with BASE2/10EH	1	**28-4115-33**

For pricing information, visit www.gelifesciences.com/orderonline

Orders in the US can be placed by:
e-mail: cs-us@ge.com
Phone: 800-526-3593
Fax: 732-457-8325

TECHNICAL SPECIFICATIONS

Performance	• Adjustable rock rate 3 to 40 rocks/min • Adjustable angle from 2 to 9° • Integral airpump with mass flow meter • RS-485 communications port • LCD display and control interface • Temperature control with heater and sensor
Dimensions	• 230 × 330 × 160 mm • With Kit 2EH: 489 × 330 × 200 mm
Weight	• 4.2 kg
Power	• 110 or 220 VAC • User-programmable
Options	• Optional PERFCONT2E weight-based Perfusion Controller with integral feed/harvest pumps

Related Products	Refer To
Cellbag-500 ml	page 75
Cellbag-1 l	page 75
Cellbag-2 l	page 75
Cellbag-10 l	page 75

WAVE Bioreactor System 20/50 *NEW*

WAVE Bioreactor System 20/50 EHT

WAVE Bioreactor 20/50 is very versatile and designed for R & D and production use. It is a modular system consisting of a base unit with various integral options suitable for culture of multiple cell lines.

The WAVE Bioreactor System 20/50 has an extensive line of instrumentation. Choose from weight controllers for perfusion culture, dissolved oxygen amplifiers and pH controllers. Available in integrated WAVEPOD configuations or stand alone options.

For benchtop operation, covering the Cellbag* with a lid is recommended. This prevents accidental damage to the bag. A filter heater for the exhaust filter is strongly recommended otherwise water will condense in the filter and may lead to clogging and overpressure in the bag.

** Cell Culture Bag in Switzerland.*

Related Products	Refer To
Cellbag-2 l	page 75
Cellbag-10 l	page 75
Cellbag-20 l	page 75
Cellbag-22 l	page 75
Cellbag-50 l	page 75

ORDERING INFORMATION

Product	Quantity	Code Number
Electric Rocker Base for 20/50EHT	1	28-4115-08
Electric Rocker Base for 20/50EHT with Loadcell module installed	1	28-4115-10
Electric Rocker Base for 20/50EHT dual-sided air/dual temperature model	1	28-4115-12
Electric Rocker Base for 20/50EHT dual-sided air/dual temperature model with Loadcell module installed	1	28-4115-14
Electric Rocker Base for 20/50EHT	1	28-4115-16
(includes CO2MIX20 for mammalian cell culture)		
Electric Rocker Base for 20/50EHT	1	28-4115-18
(includes CO2MIX20 for mammalian cell culture with Loadcell module installed)		
Electric Rocker Base for 20/50EHT	1	28-4115-20
(includes O2MIX20 for insect cell culture)		
Electric Rocker Base for 20/50EHT	1	28-4115-22
(includes O2MIX20 for insect cell culture with Loadcell module installed)		
Kit 20EHT for BASE20/50EHT units	1	28-4115-26 [1]
KIT20EHTD for dual-sided model	1	28-4115-27 [1]
(includes mounting plate + HOLDER20T + HEATERPAD20 + SRTDX temperature probe)		
Kit 50EHT for BASE20/50EHT units	1	28-4115-28 [2]
KIT50EHTD for dual-sided model	1	28-4115-30 [2]
(includes mounting plate + HOLDER50T + HEATERPAD50 + SRTDX temperature probe(s))		
Protective rigid, clear PVC lid for use with Kit 20 series	1	28-4115-34
Protective rigid, white PVC lid for use with Kit 20 series	1	28-4115-35
(opaque version for light-sensitive applications)		
Protective rigid, clear PVC lid for use with Kit 50 series	1	28-4115-37
Protective rigid, white PVC lid for use with Kit 50 series	1	28-4115-38
(opaque version for light-sensitive applications)		
Electric exhaust filter heater, 5 VDC, 4 W.LED indicator	1	28-4116-39

For pricing information, visit www.gelifesciences.com/orderonline

Orders in the US can be placed by:
e-mail: cs-us@ge.com
Phone: 800-526-3593
Fax: 732-457-8325

[1] Accommodates 1 × 20 l, 2 × 10 l, 2 × 2 l, Cellbags.
[2] Accommodates 1 × 50 l or 2 × 22 l Cellbags.

TECHNICAL SPECIFICATIONS

20/50EHT Electric Model

Dimensions	• BASE20/50EHT: 573 × 465 × 179 mm • With Kit 20EHT: 711 × 575 × 254 mm • With Kit 50EHT: 775 × 700 × 254 mm *(for Loadcell models, add 32 mm to height dimension)*
Weight (base only)	• 16 kg
Environmental	• Operating conditions: 0 to 50°C. < 95% rh, non-condensing • Storage conditions: -40 to +80°C
Power	• 100/240 VAC, 6/3 A, 50/60 Hz (user selected) • Fuse: 20 × 10 A (Slow blow, long time lag)
Additional configurations	• Dual bag temperature and aeration controls (20/50EHTD) • Integral CO_2 controller (20/50EHT-CO2) • Integral O_2 controller (20/50EHT-O2) • Integral Loadcell Module (all "L" models)
Options	• Optional data acquisition and PC monitor interface (PCDAQ) • Optional RS485/Ethernet (ETHERNET485)

Bioreactor Systems

WAVE Bioreactor System 200 *NEW*

WAVE Bioreactor System 200

- ***Stainless steel construction with fully gasketed chamber and linear motor rocking control system.***
- Integral heaterpad with temperature controller.
- Integral Loadcell.
- Adjustable color touchpanel operator interface.
- Aeration controller.
- Dual Cellbag* controller systems available.

Designed for R & D and cGMP production use. The WAVE Bioreactor 200 is a self-contained system with integral temperature control, aeration pump, and rocking controller for use with working culture volumes between 5 and 100 l.

** Cell Culture Bag in Switzerland.*

ORDERING INFORMATION

Product	Quantity	Code Number
SYSTEM200EHDual with CO_2,O_2, DO, ANALOG	1	28-4115-43
SYSTEM200EHDual with CO_2,O_2, ANALOG	1	28-4115-44
SYSTEM200EHDual with CO_2, ANALOG	1	28-4115-45
SYSTEM200EHDual with CO_2, O_2, DO	1	28-4115-47
SYSTEM200EHDual with CO_2, O_2, DO, PH	1	28-4115-48
SYSTEM200EHDual with CO_2, DO, PH	1	28-4115-49
SYSTEM200EH Dual with CO_2	1	28-4126-02
SYSTEM200EH Dual with Dual Temperature, Dual Air	1	28-9366-86
SYSTEM200EH withCO2, O_2, DO, PH, ANALOG	1	28-4115-50
SYSTEM200EH with CO_2, O_2, DO, ANALOG	1	28-4115-51
SYSTEM200EH with CO_2, O_2, ANALOG	1	28-4115-52
SYSTEM200EH with O_2, DO, ANALOG	1	28-4115-53
SYSTEM200EH with CO_2, O_2, DO, PH	1	28-4115-54
SYSTEM200EH with CO_2, O_2	1	28-4115-55
SYSTEM200EH with CO_2, ANALOG	1	28-4125-89
SYSTEM200EH with CO_2, DO, PH	1	28-4115-56
SYSTEM200EH with CO_2	1	28-4115-57
SYSTEM200EH with CO_2, PH	1	28-4126-29
SYSTEM200EH with O_2, DO, PH	1	28-4115-58

Key
CO_2 = CO_2-air gas mix controller, O_2 = O_2-air gas mix controller, DO = Optical dissolved oxygen monitor, PH = pH controller, ANALOG = Analog output card

For pricing information, visit www.gelifesciences.com/orderonline

Orders in the US can be placed by:
e-mail: cs-us@ge.com
Phone: 800-526-3593
Fax: 732-457-8325

TECHNICAL SPECIFICATIONS

Dual control	• Requires second set of gas mixers and instrumentation if desired
Base Dimensions	• 185 × 110 × 112 cm
Weight	• 350 Kg
Power	• 200 to 240 VAC • 50/60 Hz, 15 A • 3-phase operation • Phase-Phase ±5% • NEMA L2130 plug

Related Products	Refer To
Cellbag-100 l	page 75
Cellbag-200 l	page 75

WAVE Bioreactor System 500/1000 *NEW*

WAVE Bioreactor 500/1000EH

- ***Stainless steel construction with linear motor rocking system.***
- Integral temperature controller.
- Integral Loadcell with adjustable color touchpanel operator interface.
- Aeration controller.

Designed for R & D, process development, and cGMP production use, the WAVE Bioreactor System 500/1000 is a self-contained system with integral temperature control, aeration pump, and rocking controller for use with working culture volumes between 50 and 500 l.

ORDERING INFORMATION

Product	Quantity	Code Number
System1000EH with DO	1	28-4115-46
SYSTEM1000EH with CO_2, O_2, DO, PH, ANALOG	1	28-4115-59
SYSTEM1000EH with O_2, DO, ANALOG	1	28-4115-60
SYSTEM1000EH with CO_2, O_2, DO, PH	1	28-4115-61
SYSTEM1000EH with O_2, DO	1	28-4115-62
SYSTEM1000EH with CO_2, PH	1	28-4115-63
Kit 500EH for Base 500/1000EH (includes HOLDER500 and HEATERPAD500)	1	28-4115-31 [1]
Kit 1000EH for Base 500/1000EH (includes HOLDER1000 and HEATERPAD1000)	1	28-4115-32 [2]

Key
CO_2 = CO_2-air gas mix controller, O_2 = O_2-air gas mix controller, DO = Dissolved oxygen monitor (optical), PH = pH controller, ANALOG = Analog output card

For pricing information, visit www.gelifesciences.com/orderonline

[1] *Accomodates 1 ×500 l Cellbag only.*
[2] *Accomodates 1 ×1000 l Cellbag only.*

Orders in the US can be placed by:
e-mail: cs-us@ge.com
Phone: 800-526-3593
Fax: 732-457-8325

TECHNICAL SPECIFICATIONS

Base Dimensions	• 201 × 124 × 160 cm
With Kit 500EH installed	• 226 × 124 × 160 cm
With Kit 1000EH installed	• 226 × 231 × 160 cm
Power	• 200 to 240 VAC, 50/60 Hz, 30A • 3-phase operation • Phase-phase ± 5% • NEMA L2130 plug
Weight	
With Kit 500EH	• 925 kg
With Kit 1000EH	• 1020 kg

Related Products	Refer To
Cellbag-500 l	page 75
Cellbag-1000 l	page 75

WAVEPOD Integrated Controller *NEW*

WAVEPOD Integrated Controllers are available with left- or right-facing probe connections for ease of use.

The WAVEPOD module integrates all instrumentation associated with WAVE Bioreactor 20/50EHT, including dissolved oxygen, pH, and CO_2/O_2 gas mixing controls, to meet individual cell culture needs for insect cell, mammalian cell, perfusion, or cell therapy applications. The unit combines these four key instruments into a single compact device, which connects via a digital link to the WAVE Bioreactor base. A large color touchscreen allows easy access to all parameters, including data from the bioreactor.

- ***DOOPT: Dissolved oxygen optical monitor with miniature fiber-optic microprobes allows real-time measurement of dissolved oxygen. DOOPT is the only optical DO detector resistant to photobleaching and ambient light and capable of high accuracy measurement.***
- **pH:** Enables continuous pH measurement and control using CO_2 or acid/base addition. Electrochemical probe is also available pre-installed in Cellbags.
- **CO2MIX:** Infrared CO_2 sensor and aeration system provides a continuous supply of CO_2 conditioned air to the Cellbag*.
- **O2MIX:** Oxygen-air mixing controller provides continuous supply of O_2 enriched gas to the Cellbag for insect cell, virus, and high cell density applications. O2MIX can also be used to maintain low-oxygen environment for near-anaerobic applications.

ORDERING INFORMATION

Product	Quantity	Code Number
WavePOD Integrated controller and instruments for WAVE Bioreactor 20/50EHT models.	1	28-4116-06
(Includes pH, DOOPT, CO2MIX and O2MIX modules, right-facing (R) probe connections)		
WavePOD Integrated controller and instruments for WAVE Bioreactor 20/50EHT models.	1	28-4115-96
(Includes pH, DOOPT, CO2MIX and O2MIX modules, left-facing (L) probe connections)		
WavePOD Integrated controller and instruments for WAVE Bioreactor 20/50EHT models.	1	28-4116-04
(Includes pH, DOOPT and CO2MIX modules, right-facing (R) probe connections)		
WavePOD Integrated controller and instruments for WAVE Bioreactor 20/50EHT models.	1	28-4115-94
(Includes pH, DOOPT and CO2MIX modules, left-facing (L) probe connections)		
WavePOD Integrated controller & instruments for WAVE Bioreactor 20/50EHT models.	1	28-4115-98
(Includes DOOPT and O2MIX modules, right-facing (R) probe connections)		
WavePOD Integrated controller & instruments for WAVE Bioreactor 20/50EHT models.	1	28-4115-88
(Includes DOOPT and O2MIX modules, left-facing (L) probe connections)		
WavePOD Integrated controller & instruments for WAVE Bioreactor 20/50EHT models.	1	28-4116-00
(Includes DOOPT, CO2MIX and O2MIX modules, right-facing (R) probe connections)		
WavePOD Integrated controller & instruments for WAVE Bioreactor 20/50EHT models.	1	28-4115-90
(Includes DOOPT, CO2MIX and O2MIX modules, left-facing (L) probe connections)		
WavePOD Integrated controller & instruments for WAVE Bioreactor 20/50EHT models.	1	28-4116-02
(Includes pH and CO2MIX modules, right-facing (R) probe connections)		
WavePOD Integrated controller & instruments for WAVE Bioreactor 20/50EHT models.	1	28-4115-92
(Includes pH and CO2MIX modules, left-facing (L) probe connections)		
pH probe	1	28-4116-71
DOOPT-Probe	1	28-4116-72
RTD temperature probe	1	28-4116-67
SRTDX Surface Probe	1	28-4116-65

For pricing information, visit www.gelifesciences.com/orderonline

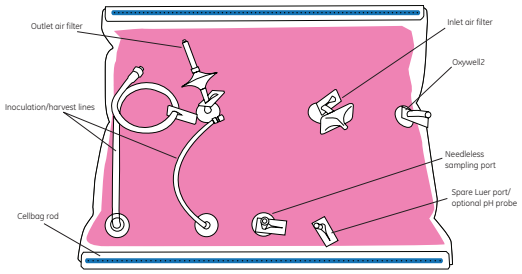
Orders in the US can be placed by:
e-mail: cs-us@ge.com
Phone: 800-526-3593
Fax: 732-457-8325

By integrating all the controls associated with a WAVE Bioreactor, it is possible to develop complex control schemes by automatically varying rocker speed or oxygen concentration supplied to the Cellbag.

The WAVEPOD and WAVE Bioreactor 20/50EHT form a control cluster that can be accessed remotely over the built-in Ethernet interface for remote data acquisition and supervisory control.

** Cell Culture Bag in Switzerland.*

Cellbag Bioreactor Chambers *NEW*



Cellbag Bioreactor Chambers

- ***Presterile, single-use chambers for the non-invasive mixing of fluids using a WAVE Bioreactor.***
- Designed to provide high mechanical strength and bio-inert fluid contact.
- Fluid contact layer is a medical grade low density polyethylene.
- Outer non-contact layer is made of low density polyethylene, EVA or nylon/EVOH copolymers.

Manufactured from multilayered laminated clear plastic, Cellbag* disposable bioreactors are suitable for your specific cell culture process needs for research, development, or cGMP manufacturing operations.

Cellbag components are similar to those used for biological storage bags and meet USP Class VI specifications for plastics. Validation data and Cellbag DMF are available to demonstrate biocompatibility. However, we recommend validation for specific applications such as:

- Monoclonal antibodies
- Anchorage-dependent cells
- Virus production
- Vaccine production
- Insect cell/baculovirus

The Cellbag size you need depends on the culture volume you wish to cultivate.

SELECTION GUIDE – Cellbag Options

Culture volume	Cellbag
50 to 250 ml	Cellbag-500 ml
50 to 500 ml	Cellbag-1 l
100 to 1000 ml	Cellbag-2 l
500 ml to 5 l	Cellbag-10 l
1 to 10 l	Cellbag-20 l or Cellbag-22 l
5 to 25 l	Cellbag-50 l
5 to 50 l	Cellbag-100 l
10 to 100 l	Cellbag-200 l
50 to 250 l	Cellbag-500 l
100 to 500 l	Cellbag-1000 l

All Cellbags have air inlet and outlet filters, a needleless sampling port, an Oxywell2 dissolved oxygen probe insertion port, and a fill/harvest port. However, Cellbags can be customized with optional fittings such as pH probes, dip tubes, screw cap ports, temperature ports, perfusion filters, and special tubing ports.

Extensive literature is available at www.wavebiotech.com. If you need assistance for your application, please contact us at Wave.info@ge.com.

** Cell Culture Bag in Switzerland.*

ORDERING INFORMATION

Product	Quantity	Code Number
Cellbag-500 ml	1	CB500ML10-01
Cellbag-1 l	1	CB0001L10-01
Cellbag-2 l	1	CB0002L10-01
Cellbag-2 l (includes 20 g FibraCel)	1	CB0002L10-07
Cellbag-2 l (Oxywell version)	1	CB0002L10-02
Cellbag-2 l (perfusion version)	1	CB0002L10-04
Cellbag-2 l (screw cap port)	1	CB0002L10-03
Cellbag-10 l	1	CB0010L10-01
Cellbag-10 l (includes 100 g FibraCel)	1	CB0010L10-07
Cellbag-10 l (Oxywell version)	1	CB0010L10-02
Cellbag-10 l (perfusion version)	1	CB0010L10-04
Cellbag-10 l (pH version)	1	CB0010L10-05
Cellbag-10 l (screw cap port)	1	CB0010L10-03
Cellbag-20 l	1	CB0020L10-01
Cellbag-20 l (includes 200 g FibraCel)	1	CB0020L10-07
Cellbag-20 l (Oxywell version)	1	CB0020L10-02
Cellbag-20l (perfusion version)	1	CB0020L10-04
Cellbag-20 l (pH version)	1	CB0020L10-05
Cellbag-20 l (screw cap port)	1	CB0020L10-03
Cellbag-22 l (includes 200 g FibraCel)	1	CB0022L10-07
Cellbag-22 l (Oxywell version)	1	CB0022L10-02
Cellbag-22 l (pH version)	1	CB0022L10-05
Cellbag-50 l	1	CB0050L10-01
Cellbag-50 l (includes 500 g FibraCel)	1	CB0050L10-07
Cellbag-50 l (Oxywell version)	1	CB0050L10-02
Cellbag-50 l (perfusion version)	1	CB0050L10-04
Cellbag-50 l (pH version)	1	CB0050L10-05
Cellbag-100 l (Oxywell version)	1	CB0100L10-02
Cellbag-100 l (pH version)	1	CB0100L10-05
Cellbag-200 l (Oxywell version)	1	CB0200L10-02
Cellbag-200 l (pH version)	1	CB0200L10-05
Cellbag-500 l (pH version)	1	CB0500L10-05
Cellbag-1000 l (pH version)	1	CB1000L10-05
Clave Sampling Valve on 6.4 mm O.D. C-Flex Tubing	1	TK001
PVC tubing with press-in plug	1	TK002
Tube Kit, PVC and Silicone Tubing with T-connectors	1	TK003
Check valve, 2—50 l (pack of 25)	1	WV050087
Check valve, 100—200 l (pack of 50)	1	WV050088

For pricing information, visit www.gelifesciences.com/orderonline

Orders in the US can be placed by e-mail: cs-us@ge.com, phone: 800-526-3593, or fax: 732-457-8325.

TECHNICAL SPECIFICATIONS

Typical connectors	• Air inlet: 0.2 µm gas filter • Air outlet: 0.2 µm gas filter with check valve • Sampling: Needleless self-sealing syringe port. No laminar hood required • Fill/harvest: C-Flex tubing suitable for sterile fusing terminated with Luer* or MPC coupling • Multiuse: Luer port with cap • Oxywell2: Silicone sheath for DO probe
Biocompatability	• Testing is performed on irradiated film (50 kGy): • USP XXII plastic class VI and ISO 10993: • ISO 10993-4 Hemolysis study *in vivo* extraction method • ISO 10993-5 Cytotoxicity study using ISO elution method • ISO 10993-6 Muscle implantation study in rabbit • ISO 10993-10 Acute intracutaneous reactivity study in rabbit • ISO 10993-11 Acute systemic toxicity in mouse
Sterility and endotoxin	• Sterilized by gamma radiation at 25 to 40 kGy • Lot release requires < 0.125 EU/ml endotoxin
Temperature rating	• Cellbags may be used from 0°C to 50°C
Pressure rating	• Maximum operating pressure 1.5 psig (0.1 bar)
Mechanical strength	• Film seal strength > 67 N/cm

Mixers

WAVE Mixer *NEW*

WAVE Mixer

- ***Disposable, single-use system for mixing liquids without the need for a mixing tank or conventional mixer.***
- No equipment cleaning, sterilization, validation, or cross-contamination.
- Mixes liquid volumes from 1 to 35 l in 20 and 50 l mixing bags. Larger bag sizes are available on request.
- All M*Bag* Mixing Chambers are provided with a large screw cap port for the easy addition of powders and solids.

The WAVE Mixer makes it possible to mix materials contained in bags in a completely sterile manner. The rocking platform induces a wave motion in the liquid without an impeller or other invasive mixer. The WAVE Mixer has been optimized for efficient mixing and dispersion of up to 35 l of liquid in a choice of 20 or 50 l M*Bags and 10 l of liquid can be mixed to homogeneity in less than 7 s. Applications include thawing, pooling, mixing, and media and buffer preparation.

M*bag
The M*Bag allows ingredients to be mixed and dissolved using the WAVE Mixer. Made of a multilayer laminated clear plastic, the outer layer provides high mechanical strength and a gas impermeable barrier while the fluid contact layer is typically a medical grade low density polyethylene. A large screw cap port allows powders or other solids to be easily poured into the bag and a probe to measure pH can be inserted. A large outlet port allows the M*Bag to be drained completely.

ORDERING INFORMATION

Product	Quantity	Code Number
WAVE Mixer 20/50ET	1	28-4115-65
WAVE Mixer 20/50EHT	1	28-4115-67
WAVE Mixer 500/1000E	1	28-4115-69
WAVE Mixer 500/1000EH	1	28-4115-70
MIXKIT20	1	28-4115-73 [1]
MIXKIT20EH	1	28-4115-74 [1]
MIXKIT50	1	28-4115-76 [2]
MIXKIT50EH	1	28-4115-77 [2]
MIXKIT500	1	28-4115-78 [3]
MIXKIT500EH	1	28-4115-79 [3]
MIXKIT1000	1	28-4115-80 [4]
MIXKIT1000EH	1	28-4115-81 [4]
MIXLID	1	28-4115-71
pH probe	1	28-4116-71 [5]
RTD temperature probe	1	28-4116-67
*(for use with M*Bag500L or M*Bag1000L only)*		
M*Bag-20 l	1	MB0020L10-01
M*Bag-50 l	1	MB0050L10-01
M*Bag-500 l	1	MB0500L10-01
M*Bag-1000 l	1	MB1000L10-01

For pricing information, visit www.gelifesciences.com/orderonline

Orders in the US can be placed by:
e-mail: cs-us@ge.com
Phone: 800-526-3593
Fax: 732-457-8325

[1] *Accommodates M*BAG-20 l.*
[2] *Accommodates M*BAG-50 l.*
[3] *Accommodates M*BAG-500 l.*
[4] *Accommodates M*BAG-1000 l.*
[5] *Specially developed probes with a diameter <2.5 mm for easy insertion in to the M*Bag.*

TECHNICAL SPECIFICATIONS

M*Bag

Film	• Fluid contact layer: medical grade low density polyethylene (LDPE) • Non-contact outer layer: LPDE + EVA or nylon/EVOH copolymer
Biocompatability	• Testing is performed on irradiated film at 50 kGy • USP XXII plastic class VI test and ISO 10993 • Acute intracutaneous reactivity study in rabbit ISO 10993-10 • Acute systemic toxicity in mouse ISO 10993-11 • Muscle implantation study in rabbit ISO 10993-6 • Cytotoxicity study using ISO elution method ISO 10993-5 • Hemolysis study *in vitro*, extraction method ISO 10993-4
Maximum operating pressure	• 0.1 bar
Temperature rating	• M*Bags may be used from 0 to 50°C
Endotoxin	• Lot release requires < 0.125 EU/ml endotoxin

WAVE Mixer (continued)

APPLICATION GUIDE – WAVE Mixers
Mixer 20/50E
In-process blending In-process intermediates can be mixed and various ingredients can be added.
In-process pooling In-process samples collected during chromatography or other operations can be pooled together in a single bag and mixed to form a homogeneous intermediate for sampling and further processing.
Blending for sampling Mixing stored materials in bags in order to obtain a representative sample for stability and process optimization studies.
Mixing prior to fill Mixing stored or collected product prior to dispensing in to final vials, bags, or other containers. Mixing the bag ensures each aliquot is identical. Using the bag as the mixing container ensures sterility and GMP operation.
Reconstitution and dissolution Preparation of media from powdered and concentrated components and preparation of sterile buffers.
In process reactions Reactions can be carried out in the bag. This may involve adding oxidants or reductants. The headspace in the bag can be controlled to maintain the desired oxygen level.
Mixer 20/50EHT
Thawing of frozen materials.
Warming blood and other biological fluids.
Maintaining temperature during pooling operations.

SELECTION GUIDE – WAVE Mixers		
	MIXER20/50ET[1] **MIXER20/50EHT[1]**	**MIXER500/1000E[2,3]** **MIXER500/1000EH[2,3]**
Working volume Range	1 to 35 l	50 to 500 l
Integral features	Speed/angle control Temperature control (EHT)	Speed/angle control Temperature control (EH) Loadcell
Options	pH	pH
Weight	18 kg	With MIXKIT500: 925 kg With MIXKIT1000: 1020 kg
Dimensions	502 × 381 × 172 mm with MIXKIT20: 502 × 654 × 254 mm with MIXKIT50: 740 × 635 × 300 mm	201 × 124 × 160 cm with MIXKIT500: 226 × 124 × 160 cm with MIXKIT1000: 226 × 231 × 160 cm
Power	110/220 VAC, 10 A	208 to 240 VAC, 30 A 3-Phase

*[1] MIXER 20/50 requires selection of MIXKIT20 or MIXKIT50. MIXKIT20 accommodates M*BAG20L. MIXKIT50 accommodates M*BAG50L.*
*[2] MIXER 500/1000 requires selection of MIXKIT500 or MIXKIT1000. MIXKIT500 accommodates M*BAG500L. MIXKIT1000 accommodates M*BAG1000L.*
[3] Unit provided with casters.

Fluid Transfer Systems

Sterile Tube Fuser *NEW*

Sterile Tube Fuser

- ***Enables safe and rapid fluid transfer.***
- User programmable parameters for different types of tubing.
- LCD display for prompts and data.
- Infrared blade temperature sensor.
- PC interface for data printing and parameter download.
- Uses PTFE-coated blades for stronger welds.

The Sterile Tube Fuser is a fully automated device for welding together dry or fluid-filled thermoplastic tubing in a sterile operation without the need for a laminar flow cabinet or similar environmental control device. The instrument is useful for connecting tubing between sterile containers, bioreactor bags, and process equipment. The unit can connect large diameter (up to 22.2 mm OD; dry only) tubing for the rapid and safe transfer of large volumes of inoculum, media buffers, process intermediates, and products.

Applications include:
- Sterile media transfer
- Vaccine manufacture
- Filling and formulation
- Bioreactors feed and harvest
- Pharmaceutical process fluid transfer
- High containment operations
- In-process pooling
- Transferring buffers

ORDERING INFORMATION

Product	Quantity	Code Number
Sterile Tube Fuser-IRc-Compact	1	28-4116-77
Sterile Tube Fuser-IRc for liquid-filled welding	1	28-4116-89
Tube Holder Set for 15.5 mm (5/8") OD tubing	1	28-4116-81
Tube Holder Set for 15.5 mm (5/8") OD tubing	1	28-4116-92
(clamped tube holder set for wet welding; for use with STF-IRcWW)		
Tube Holder Set for 19.1 mm (3/4") OD tubing	1	28-4116-82
Tube Holder Set for 11.2 mm (7/16") OD tubing	1	28-4116-83
Tube Holder Set for 11.2 mm (7/16") OD tubing	1	28-4116-93
(clamped tube holder set for wet welding; for use with STF-IRcWW)		
Tube Holder Set for 6.4 mm (1/4") OD tubing	1	28-4116-84
Tube Holder Set for 6.4 mm (1/4") OD tubing	1	28-4116-94
(clamped tube holder set for wet welding; for use with STF-IRcWW)		
Tube Holder Set for 8.0 mm (5/16") OD tubing	1	28-4116-85
Tube Holder Set for 9.6 mm (3/8") OD tubing	1	28-4116-86
Tube Holder Set for 12.5 mm (1/2") OD tubing	1	28-4116-87
Tube Holder Set for 12.5 mm (1/2") OD tubing	1	28-4116-95
(clamped tube holder set for wet welding; for use with STF-IRcWW)		
Tube Holder Set for 22.2 mm (7/8") OD tubing	1	28-4116-88
Single use stainless steel cutting blades with PTFE coating. Non-sterile (50 blades/package)	1	28-4117-01
Calibration Verification Kit for Sterile Tube Fuser	1	28-4116-98
(includes maintenance manual, validation documents, PC Kit, blade sensor, and security key)		

For pricing information, visit www.gelifesciences.com/orderonline

Orders in the US can be placed by:
e-mail: cs-us@ge.com
Phone: 800-526-3593
Fax: 732-457-8325

TECHNICAL SPECIFICATIONS

Sterile Tube Fixer

Tubing OD range	• 6.4 to 22.2 mm (dry tubing model) • 6.4 to 15.5 mm (fluid-filled tubing model)	
Tubing condition	• STF-IRc: Dry thermoplastic • STF-IRcWW: Fluid-filled thermoplastic	
Fusing cycle	• 2 to 3 min	
Weight	• 16 kg	
Dimensions	• 395 × 355 × 265 mm	
Power	• 110/220 VAC, 1 A, autoswitching	
Options	**for STF-IRc** • Tube Holder Set for 15.5 mm OD Tubing • Tube Holder Set for 19.1 mm OD Tubing • Tube Holder Set for 11.2 mm OD Tubing • Tube Holder Set for 6.4 mm OD Tubing • Tube Holder Set for 8 mm OD Tubing • Tube Holder Set for 9.6 mm OD Tubing • Tube Holder Set for 12.5 mm OD Tubing • Tube Holder Set for 22.2 mm OD Tubing • Calibration Verification Kit	**for STF-IRcWW** • Tube Holder Set for 15.5 mm OD Tubing[1] • Tube Holder Set for 11.2 mm OD Tubing[1] • Tube Holder Set for 6.4 mm OD Tubing[1] • Tube Holder Set for 12.5 mm OD Tubing[1] • Calibration Verification Kit

[1] Clamped tube holder set for wet welding. Use with STF-IRcWW only.

Hot Lips Tube Sealer *NEW*

Hotlips Tube Sealer

- ***Keypad-selectable programs for virtually all types and sizes of thermoplastic tubing up to 31.8 mm OD.***
- No adapters required over the entire size range.
- Lightweight unit can be used anywhere in the plant or laboratory.
- Microprocessor controlled motor ensures reproducible and validatable performance.

The Hot Lips Tube Sealer is a portable device that can heat-seal thermoplastic tubing from 6.4 to 31.8 mm OD. The seal forms a tamperproof and leakproof closure for securing tubes from bags, bottles, and other vessels. The Hot Lips Tube Sealer is preprogrammed for many brands of tubing, is fully automated for validatable operation, and prevents fluids such as inoculum, products, media, and buffers from leaking through tubing, clamps, and plugs.

ORDERING INFORMATION

Product	Quantity	Code Number
Hot Lips Tube Sealer II	1	**28-4117-04**
(preprogrammed to thermally seal C-Flex*, Sanipure*, PVC, Tygon*, and PharMed* thermoplastic tubing from 6.4 to 31.8 mm OD).		
Calibration Verification Kit	1	**28-4117-07**
(includes maintenance manual, validation documents, PC Kit with security key, and jaw distance calibration tool)		

For pricing information, visit www.gelifesciences.com/orderonline

Orders in the US can be placed by:
e-mail: cs-us@ge.com
Phone: 800-526-3593
Fax: 732-457-8325

TECHNICAL SPECIFICATIONS

Tubing OD range	6.4 to 31.8 mm
Tubing condition	Dry or fluid-filled thermoplastic
Fusing cycle	~ 2 min
Weight	8 kg
Dimensions	356 × 165 × 203 mm
Power	110/220 VAC, 6 A (maximum), autoswitching

Applications include:
- Sealing tubing attached to bags
- Tamperproof sealing
- Sampling
- Shipping/storage
- Sealing transfer/sampling lines

Microcarriers and Reagents

Overview

Cell culture on microcarriers offers enormous advantages over traditional roller-bottle and stirred-tank, perfusion or air-lift culture methods. Microcarriers provide anchorage for cells with an enormous increase in surface area, improved exposure to nutrients, and protection from shearing forces, all contributing to optimal cell growth.

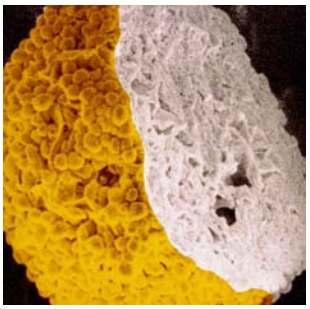
Microcarriers have proven to be reliable and cost-effective for both laboratory-scale and industrial-scale culture of eukaryotic cells and some prokaryotic cells. The media protect cells and increase downstream purity, especially in serum-free recombinant processes.

Our microcarriers make possible to reduce culture medium costs by over 50% whilst decreasing labor and lowering the risk of contamination. Three lines of microcarrier products are available; Cytodex, Cytopore and Cytoline, each designed for different cell types and culture techniques.

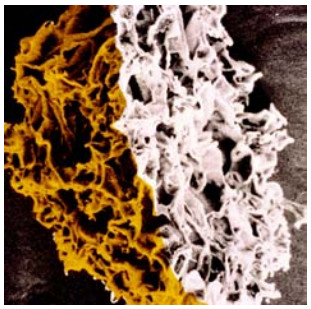
SELECTION GUIDE – Microcarriers

Product	Matrix	Charge/coating	Porosity density	Charge (in 0.9% NaCl)	Density (in 0.9% NaCl)	Intended Culture	Cell type	Application
Cytopore 1	Cross-linked cotton cellulose	DEAE/hydrophilic	Microporous and macroporous	1.0 meq/g	1.03 g/ml	Stirred tank, perfusion cultures	Shear-sensitive cells in stirred tank culture	r-CHO
Cytopore 2	Cross-linked cotton cellulose	DEAE/hydrophilic	Microporous and macroporous	1.8 meq/g	1.03 g/ml	Stirred tank, perfusion cultures	Truly anchorage-dependent, shear-sensitive cells	Primary cells or established cell lines
Cytodex 1	Cross-linked dextran	Positive throughout matrix/hydrophilic	Microporous	1.4–1.6 meq/g	1.03 g/ml	Stirred tank cultures	Truly anchorage-dependent	General purpose/ Most established lines
Cytodex 3	Cross-linked dextran with gelatin coating	Positive/ hydrophilic/ gelatin	Microporous		1.04 g/ml	Stirred tank cultures	Truly anchorage-dependent	Primary cells or cells with epithelioid morphology
Cytoline 1	Polyethylene/ silica	Slightly negative/ hydrophobic	Macroporous		1.32 g/ml	Fluidized bed reactors	Cells which attach well, less shear-sensitive, require high circulation	CHO and similar cell types
Cytoline 2	Polyethylene/ silica	Slightly negative/ hydrophobic	Macroporous		1.03 g/ml	Fluidized bed reactors	Cells which attach less well	Hybridomas, insect cells, bacteria

Cytopore 1 and Cytopore 2



Cytopore 1 filled with CHO cells.



The macroporous structure of Cytopore 1 is clearly seen on an "empty" microcarrier.

- ***The macroporous structure of Cytopore microcarriers encourages cell growth into the bead, while the micropores provide maximum nutrient availability. The characteristics enable growth of cells which require high recirculation rates and high nutrient-availability.***
- Cytopore 1 is optimized for growth of r-CHO in stirred tank cultures but is applicable to cell lines requiring similar surface charge.
- Cytopore 2 is intended for culture of truly anchorage-dependent cells which require a very high charge-density for optimal growth.
- Transparent for easy microscopic examination of attached cells.

ORDERING INFORMATION

Product	Quantity	Code Number
Cytopore 1	20 g	**17-0911-01**
Cytopore 1	100 g	**17-0911-02**
Cytopore 1	500 g	**17-0911-03**
Cytopore 2	20 g	**17-1271-01**
Cytopore 2	100 g	**17-1271-02**
Cytopore 2	500 g	**17-1271-03**

For pricing information, visit www.gelifesciences.com/orderonline

TECHNICAL SPECIFICATIONS

Matrix	Cross-linked cotton cellulose
Surface	Hydrophilic DEAE exchanger, positive charge
Average particle size*	230 µm
Charge density:	
Cytopore 1	1.0 meq/g
Cytopore 2	1.8 meq/g
Density*	1.03 g/ml
Approximate surface area*	1.1 m^2/g dry weight
Average pore diameter	30 µm

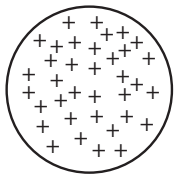
** In 0.9 % NaCl*

Microcarriers and Reagents

SELECTION GUIDE – Cytodex					
Product	**Matrix**	**Average particle size***	**Density***	**Approximate surface area***	**Swelling***
Cytodex 1	Cross-linked dextran	190 µm	1.03 g/ml	0.44 m^2/g dry weight	20 ml/g dry weight
Cytodex 3	Cross-linked dextran with gelatin coating	175 µm	1.04 g/ml	0.27 m^2/g dry weight	15 ml/g dry weight

* *In 0.9% NaCl*

Cytodex 1



Cytodex 1 charges throughout matrix

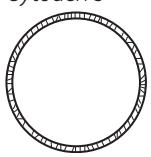
cross-linked dextran – O – CH_2CH_2 – N (CH_2CH_2, CH_2CH_3) + HCl

- ***General-purpose microcarrier for most established, anchorage-dependent cell lines.***
- Contains positive charges throughout the microporous matrix.
- Transparent for easy microscopic examination of attached cells.

ORDERING INFORMATION		
Product	**Quantity**	**Code Number**
Cytodex 1 (Dry Powder)	25 g	**17-0448-01**
Cytodex 1 (Dry Powder)	100 g	**17-0448-02**
Cytodex 1 (Dry Powder)	500 g	**17-0448-03**
Cytodex 1 (Dry Powder)	2.5 kg	**17-0448-25**
Cytodex 1 (Dry Powder)	5 kg	**17-0448-04**

For pricing information, visit www.gelifesciences.com/orderonline

Cytodex 3



Cytodex 3 collagen layer coupled to surface

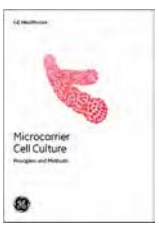
cross-linked dextran – O – CH_2 – CH(OH) – CH_2 – NH – (eLys collagen)

- ***Designed for culture of primary cells or those with an epithelioid morphology, especially cells with low plating-efficiency or differentiated or sensitive cell-types which are normally difficult to grow, e.g. hepatocytes, endocrine cells.***
- Contains a layer of acid-denatured porcine collagen (gelatin) on the surface of the microporous matrix.
- Designed to yield harvested cells of the highest viability.
- Transparent for easy microscopic examination of attached cells.

ORDERING INFORMATION		
Product	**Quantity**	**Code Number**
Cytodex 3 (Dry Powder)	10 g	**17-0485-01**
Cytodex 3 (Dry Powder)	100 g	**17-0485-02**
Cytodex 3 (Dry Powder)	500 g	**17-0485-03**
Cytodex 3 (Dry Powder)	2.5 kg	**17-0485-25**
Cytodex 3 (Dry Powder)	5 kg	**17-0485-04**

For pricing information, visit www.gelifesciences.com/orderonline

Microcarrier Cell Culture Handbook



- ***Microcarrier development, technology and applications.***
- Cell culture media & cell culture conditions.
- Fermentation technology.
- Production considerations.
- Troubleshooting.

ORDERING INFORMATION		
Product	**Quantity**	**Code Number**
Microcarrier Cell Culture - Principles and Methods	1	**18-1140-62**

For pricing information, visit www.gelifesciences.com/orderonline

The handbook offers professionals and students quick access to a wide range of important information and techniques needed for cell culture. The work has been used extensively in cell culture tutorials and has now been updated to include recent developments, such as, testing of microcarriers for stem cell expansion purposes.

Cytoline 1 and Cytoline 2

Cytoline 1 with recombinant CHO attached.

- ***Cytoline microcarriers are solid with a macroporous structure allowing cell growth into the bead and concomitant protection from shear forces. The high density and large bead size enables use with fluidized bed reactors.***
- Cytoline 1 is suited for cells that attach well, are less sensitive to shear forces and require high recirculation rates e.g. CHO cells.
- Cytoline 2 is more suited to hybridomas and other cells which attach less well. Its lower density allows lower recirculation rates which cause lower shear forces.
- Optimal results are achieved when used in conjunction with Cytopilot Mini fluidized bed reactor.

ORDERING INFORMATION

Product	Quantity	Code Number
Cytoline 1 (Dry)	50 ml	17-1268-01
Cytoline 1 (Dry)	500 ml	17-1268-02
Cytoline 1 (Dry)	5 l	17-1268-03
Cytoline 2 (Dry)	50 ml	17-1269-01
Cytoline 2 (Dry)	500 ml	17-1269-02
Cytoline 2 (Dry)	5 l	17-1269-03

For pricing information, visit www.gelifesciences.com/orderonline

TECHNICAL SPECIFICATIONS

Matrix	Polyethylene and silica
Surface	Slight negative charge
Average particle size	0.5–1 mm thick 1.7–2.5 mm length
Density:	
Cytoline 1	1.32 g/ml
Cytoline 2	1.03 g/ml
Approximate surface area:	
Cytoline 1	> 0.3 m^2/g
Cytoline 2	> 0.1 m^2/g
Pore diameter	10–400 µm

Protein A

- ***For activation of B and T lymphocytes.***
- Mitogenic activity does not involve the F_c-binding regions of the molecule and is not mediated through cell-surface immunoglobulins.
- High purity and stability make it a useful reagent for studies of cell stimulation and the secretion and purification of released cell products.
- Store below 8°C.

ORDERING INFORMATION

Product	Quantity	Code Number
Protein A (Freeze dried)	5 mg	17-0872-05

For pricing information, visit www.gelifesciences.com/orderonline

Concanavalin A (Con A)

- ***A lymphocyte mitogen acting principally on T lymphocytes; also a hemagglutinin.***
- Specifically binds glucose/mannose.
- Isolated from the jack bean *Canavalia ensiformis.*
- Highly purified and well-characterized protein.
- Store below 8°C.

ORDERING INFORMATION

Product	Quantity	Code Number
Concanavalin A (Lyophilized)	500 mg	17-0450-01

For pricing information, visit www.gelifesciences.com/orderonline

Poly(I)·Poly(C)

For main product entry, see page 138.