Miltenyi Biotec

MACS® Cell Culture Reagents

Product list

January 1, 2022

- MACS® Media
- MACS® Cytokines
- Polyclonal stimulation
- Antigens and peptide pools
- TLR ligands
- StemMACS™ Small Molecules



► miltenyibiotec.com/cellculture

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MACS® GMP Products are for research use and *ex vivo* cell culture processing only, and are not intended for human *in vivo* applications. For regulatory status in the USA, please contact your local representative. MACS GMP Products are manufactured and tested under a quality system certified to ISO 13485 and are in compliance with relevant GMP guidelines. They are designed following the recommendations of USP <1043> on ancillary materials.

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Culture is key

Miltenyi Biotec is a global provider of products and services that advance biomedical research and cellular therapy. Our integrated tools support research at every level, from basic to translational research and clinical settings. As a leader in regenerative medicine and immunotherapy, we recognize the importance of high-quality cytokines and cell culture reagents for the reliable expansion, stimulation, and differentiation of target cells.

Our cell culture and stimulation portfolio offers a specialized and versatile range of cell culture media and reagents for the work with human and mouse cells, including immune, stem, and neural cells. Small molecules and reprogramming reagents are available for stem cell research.

Up to MACS® GMP Grade

One of the keys for the successful translation of scientific discovery into clinical application is the necessity for high-quality data right from the beginning. We understand how important it is for you to be able to reach this level consistently and reproducibly. To achieve this, Miltenyi Biotec has developed a spectrum of products for all aspects of translational research that allows you to go from bench to bedside without unnecessary, time-consuming, and expensive extra rounds. As an example, a project can start with our premium-grade products for research use only, and move seamlessly to MACS® GMP Grade, which would be the most adequate grade for, e.g., the development of a cellular therapy to be tested in the clinic. This approach helps to accomplish a truly smooth and seamless translation.

Premium-grade products share major characteristics with MACS GMP Products, such as identical protein sequence, same formulation, and hence very similar performance.



Turn cell therapies into clinical reality with MACS® GMP Products

The success of your cellular products depends on the quality of the raw materials. MACS® GMP Products are designed for *ex vivo* processing of human cells and are manufactured in compliance with relevant GMP guidelines. The quality of raw or ancillary materials used for the manufacture of cell-based and gene therapy products needs to meet strict regulatory specifications in order to ensure quality, safety, and efficacy of the final product.



Available MACS® GMP Products

- **Media**
- **Cytokines**
- **Antigens**
- **T cell activation and expansion tools**

MACS® GMP



Production

- ISO 13485 quality management system
- Qualified equipment and personnel
- Vendor qualification of raw materials



Filling / Lyophilization

- Automated and aseptic filling
- Clean room environment (class A isolator)



Quality control

- Extensive stability studies
- Functionality testing
- Tested to regulatory standards
  USP <1043>, EP 26.4; 5.2.12



Final products

- High lot-to-lot consistency
- Regulatory support
- Lot-specific Product Quality Certificate (PQC; former CoA)

Cell culture is key for efficient and reliable research

Cell culture is a crucial part of many research applications. Therefore, it is important to implement standardized and proven methods for the best treatment of your target cells. Miltenyi Biotec's cell culture and stimulation portfolio offers a specialized and versatile range of cell culture media and reagents for the stimulation, expansion, and differentiation of human and mouse cells, including immune, stem, and neural cells.

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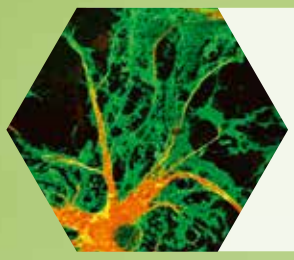
PepTivator® Peptide Pools

- Antigen-specific stimulation of $CD4^+$ and $CD8^+$ T cells
- Easy reconstitution and handling
- 15-mer peptides with 11-amino-acid overlaps



StemMACS™ Small Molecules

- Chemically defined
- Highly pure
- Ready-to-use in solution



Cell culture media

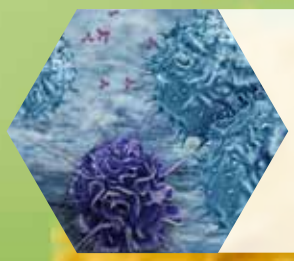
- Serum free
- Specialized media for primary cells
- High-quality growth factors

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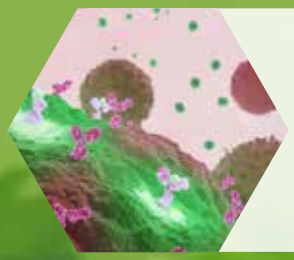
Polyclonal stimulation reagents

- T Cell TransAct™ CD3 / CD28 Polymeric Nanomatrix
- MACSiBead™-based T Cell Activation / Expansion Kits
- CytoStim™ TCR/MHC Crosslinking Reagent



TLR ligands

- Stimulation of human and murine immune cells
- Potent ligands for high specificity
- Tested rigorously for purity and functionality



MACS® Premium-Grade Cytokines

- Lot-specific activity
- High reproducibility
- Flexible custom production

FAQs – MACS® Media

What does xeno-free stand for?
The term xeno-free or xenogeneic-free (XF) refers to the absence of any "foreign" component, relative to the native species you are working with, within the cell culture media formulation. For example, a designated XF medium for human cell lines contains human-derived components, such as human serum. It would be free of components like fetal bovine serum or growth factors from other species.

What is the definition of "animal component–free"?
The product is entirely free of non-human, animal-derived components. During the production process no animal components were used.

Which QC tests are performed for MACS® Media?
All media are extensively tested for their performance. This includes functionality tests using the corresponding cell type in an appropriate experimental setting. Osmolality, pH, and endotoxin levels are specified for complete and basal media.

How should I thaw MACS® Media prior to use?
MACS® Media are generally thawed overnight at 2–8 °C unless otherwise stated in the data sheet.

What is the shelf life of MACS® Media?
You can find information about the shelf life and storage temperature on the label of your product. Furthermore, we provide data sheets for every cell culture medium including specifications on the product website.

FAQs – MACS® Cytokines

What is the difference between the three quality grades of cytokines Miltenyi Biotec offers?
The quality grades of MACS® Cytokines are distinguished as follows:

Research-grade MACS® Cytokines are cost-effective recombinant cytokines suitable for cell culture applications, differentiation studies, and functional assays.

- Biological activity determined by appropriate bioassay
- Minimal biological activity is given
- Endotoxin levels usually below 1 EU/µg cytokine (0.1 ng/µg cytokine)
- Purity generally above 95%

Premium-grade MACS® Cytokines are highly active and low-endotoxin recombinant cytokines, ideal for cell culture applications in pre-clinical research.

- Lyophilized without carrier proteins or preservatives
- Endotoxin levels usually below 0.1 EU/µg cytokine (0.01 ng/µg cytokine)
- Purity generally between 97% and 99%
- Special formulation with mannitol and trehalose for fast, reliable reconstitution and increased stability

Lot-specific biological activity: Biological activity is given for each lot after lyophilization and calibrated with international standards (if available), provided by the National Institute for Biological Standards and Control (NIBSC). Lot-specific certificates of analysis (CoA), stating the respective biological activity, are available for download on our website (miltenyibiotec.com/certificates).

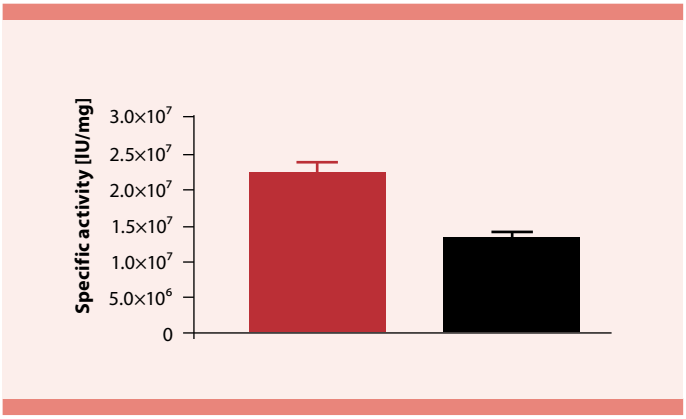
MACS® GMP Cytokines facilitate *ex vivo* cell culture processing. They are manufactured in a GMP-certified facility equipped with production areas from class A to D.

- Manufactured and tested under a quality management system (ISO 13485) in compliance with relevant GMP guidelines and the requirements laid down in the Ph. Eur. Chapter 5.2.12.
- Designed following the recommendations of USP <1043> on ancillary materials.
- Lyophilized without carrier proteins or preservatives

Stringent quality control (QC) tests are performed and thoroughly documented. Lot-specific certificates of analysis specify biological activity, sterility (European Pharmacopoeia, Ph. Eur.), purity, identity (isoelectric focusing or mass spectrometry), endotoxin content (LAL assay according to Ph. Eur.), protein content, and host cell DNA content.

What is the biological activity of a cytokine?
The biological activity of a cytokine is the effect on cells after incubation with the cytokine. Typically, a cytokine binds to a specific receptor on the cell surface and induces intracellular signaling. This can lead to measurable changes in DNA and protein synthesis, which usually results in induction or inhibition of cellular activities such as proliferation or activation.

How is the biological activity of a cytokine measured?
The biological activity of a cytokine is determined by a standardized assay that measures its effect on cytokine-dependent cell lines or primary cells. Typical assays measure the induction or inhibition of cell proliferation. Biological activity is usually expressed as ED_{50} (ng/mL) or units (U/mg). The ED_{50} value is the concentration of the cytokine at which 50% of the maximum biological activity is reached. The units/mg are calculated based on the ED_{50} value and describe the biological activity per mg of the cytokine. If the bioassay is calibrated with a protein certified by the NIBSC (National Institute for Biological Standards and Control) international standard, the activity is expressed in international units/mg (IU/mg).



Human GM-CSF biological activity varies between vendors. Miltenyi Biotec's Human GM-CSF, premium grade (red bar) shows higher specific activity than another commercially available product (black bar) when performing a calibrated proliferation assay using TF-1 cells (NIBSC 88/646).

What is an NIBSC cytokine standard?

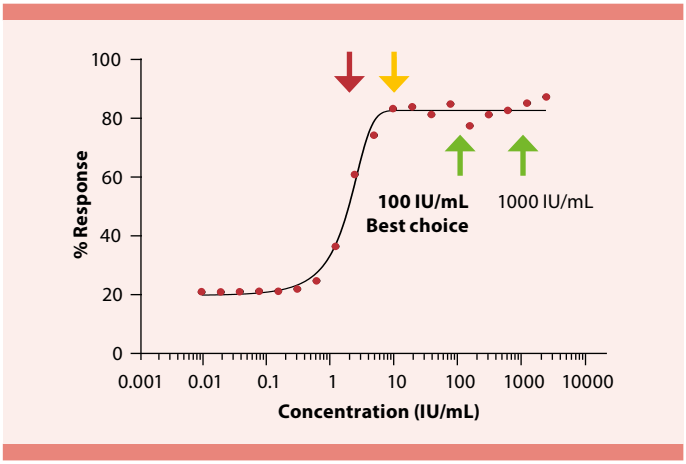
The NIBSC is an Official Medicines Control Laboratory (OMCL), associated with the World Health Organization (WHO). They produce and maintain more than 98% of international biological standards used as primary reference materials to ensure the safety and potency of biological medicines. They offer several reference cytokines (standards) with approved activities. These are used to calibrate assays for the accurate determination of cytokine activity.

Why does Miltenyi Biotec calibrate cytokine activity assays using the NIBSC standard?

The ED_{50} value and units/mg determined by an assay are only valid for that respective assay. Even minor variations in the assay conditions can result in a different activity. ED_{50} value and units/mg determined by different assays usually result in completely different values and cannot be compared. This can only be overcome by calibration of the assay with a defined standard, a reference cytokine with an approved activity. This standard is measured in our assay, and we adjust the assay conditions to measure exactly the activity stated by NIBSC (= assay calibration). As a result, the measured activity of our cytokines is not dependent on the assay and assay variations anymore. It should be kept in mind that activity values from different suppliers are only comparable when such a standard is used in all assays.

How important is the biological activity?

Accurate dosing without over- or undersaturation increases the reproducibility and biological relevance. This can only be achieved when the biological activity is used for the assays. Therefore it is important to calculate how many active units of cytokine are available in the product. The most precise and reliable way to add a recombinant cytokine to your cell culture is to dose units/mL (U/mL). This will increase the reproducibility of your experiments as compared to ng/mL dosing. It is recommended to use units that were determined by a calibrated assay, as this will give you the highest reliability for reproducible results.



Efficient cytokine usage with specific unit dosing. Green arrows indicate concentration of cytokine input to reach maximum cellular response. Identical activity can be reached with cytokine concentrations of 100 IU/mL and 1000 IU/mL. Red arrow indicates insufficient cytokine input and the yellow arrow a critical cytokine usage.

Where can I find the biological activity of a MACS® Cytokine?

The minimal biological activity of any MACS® Cytokine can be found in the product data sheet. The lot-specific biological activity of a premium-grade or MACS GMP Cytokine is indicated in the Certificate of Analysis (CoA; available on our website (miltenyibiotec.com/certificates). It is important to know that the minimal biological activity is specific to the product and therefore you can always expect at least this amount of activity. The lot-specific biological activity is not a product specification, but the measured value of a production lot, which is usually higher than the minimal biological activity. To calculate the exact units to be used in your application, please use the lot-specific biological activity.

What are the benefits of knowing the lot-specific activity value of a MACS® Cytokine?

The lot-specific biological activity of a premium-grade or MACS® GMP Cytokine is indicated in the Certificate of Analysis (CoA). Knowing the lot-specific activity value, it is not necessary to test each new lot of cytokine to define the right input for your specific application. In addition, no oversaturation is needed as the specific value enables you to choose the appropriate cytokine amount for your experiment very precisely.

How do I calculate the biological activity in U/mg from the ED_{50} values?

Our product data sheet provides both values. However, you can also calculate the value using the simple formula:

$$\text{biological activity in U/mg} = \frac{1}{ED_{50} \text{ in ng/mL}} \times 10^6$$

Please keep in mind that this formula simply converts ED_{50} values into U/mg, but it does not generate a calibrated activity. This still requires the calibration with a reference standard.

How do I know how many U/mL are available in a MACS® Cytokine product after reconstitution?

To calculate how many U/mL are available in a MACS® Cytokine vial after reconstitution, you need to know the cytokine concentration in your vial after reconstitution with a certain amount of water (mg/mL) and the specific biological activity of the cytokine (U/mg). For premium-grade and MACS GMP Cytokines, please use the lot-specific activity. U/mL are calculated with the formula:

$$\text{vial concentration in U/mL} = \text{biological activity in U/mg} \times \text{vial concentration in mg/mL}$$

Example:

Cytokine content in the vial: 250 µg
Reconstitution volume: 1 mL
Lot-specific activity: 5.0×10^5 U/mg
To calculate the vial concentration in U/mL:
5.0×10^5 U/mg × 0.25 mg/1 mL = 125,000 U/mL

My current protocol indicates a cytokine concentration in ng/mL. How do I convert it to U/mL?

To calculate how many U/mL correspond to the ng/mL of your protocol, you need to know the specific biological activity of the cytokine. For premium-grade and MACS GMP Cytokines, please use the lot-specific activity. Convert to U/mL with the formula:

$$\text{protocol concentration in U/mL} = \frac{\text{biological activity in U/mg} \times \text{protocol concentration in ng/mL}}{10^6}$$

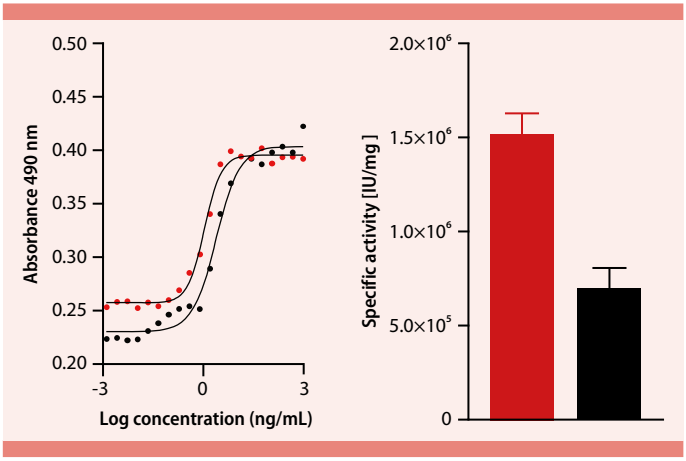
Once you have calculated the concentration in U/mL, we suggest using the same concentration in U/mL for subsequent experiments.

Example:

Cytokine concentration in the protocol: 10 ng/mL
Lot-specific activity: 5.0×10^5 U/mg
To calculate the cytokine concentration in U/mL:
5.0×10^5 U/mg × 10 ng/mL / 10^6 = 5 U/mL

How can I compare biological activities of products from different vendors?

Biological activities of products from different vendors can only be compared if the cellular assays are calibrated with a defined international standard (from the NIBSC), or if the samples are measured in parallel using the same assay, the same batch of cells, and the same conditions. Because even minor variations in assay conditions can result in different activities, we use the NIBSC standard whenever possible. For product-specific comparison data, please have a look at the product pages online. In addition, it is recommended to determine the optimal concentration for your specific application by a dose-response experiment, because the standardized assay for determination of the biological activity cannot comprise all possible aspects of different applications.



The biological activity of Human EGF was determined by a proliferation assay using 3T3 cells. Human EGF, premium grade, (red) was compared to another commercially available product (black).

How do I reconstitute and store MACS® Cytokines?

Most MACS® Cytokines are provided as lyophilized (freeze-dried) products. If not stated otherwise, it is recommended to reconstitute lyophilized cytokines with deionized sterile-filtered water to a final concentration of 0.1–1.0 mg/mL in a minimal volume of 100 µL. Further dilutions should be prepared with 0.1% bovine serum albumin (BSA) or human serum albumin (HSA) in phosphate-buffered saline.

Upon reconstitution, store working aliquots at –20 °C or below, and avoid repeated freeze-thaw cycles. Shipment or short term storage of the lyophilized products at room temperature will not alter the performance.

What does IS stand for?

You can recognize our engineered cytokines by the acronym "IS" in the product name. IS stands for improved sequence. Currently we offer human IL-2, FGF-2, Oncostatin M, PDGF-BB, VEGF, and murine IL-2 and IL-3 as variants with an improved sequence. These engineered variants guarantee high stability, better solubility during reconstitution and high activity in culture.

Are all MACS® Cytokines animal component free?

In general, all our premium-grade and MACS® GMP Cytokines have an animal component-free formulation.

Which QC tests are applied to the products?

All our premium-grade cytokines are tested as follows:

- **Specific biological activity:** bioassay, calibrated when NIBSC standard is available
- **Identity:** mass spectrometry (intact mass determination)
- **Purity:** SDS-PAGE or chip electrophoresis
- **Endotoxin:** kinetic LAL assay

Do I need to add any additional substances after reconstitution?
Our cytokines can be simply re-solubilized in water (recommended: deionized sterile-filtered water). The buffer formulation ensures high stability of the freeze-dried cytokine, as well as quick re-solubilization after the addition of water and preserves maximum biological activity. In addition, it avoids disulfide-mediated protein aggregation by optimizing pH and free cysteine properties. Therefore, there is no need to add further substances. The only point to consider is the addition of BSA/HSA when the cytokine is diluted below 0.1 mg/mL.

Is human IL-2 IS calibrated using proleukin?
All human IL-2 IS product lots are calibrated using the NIBSC standard. You will find a general advice in the data sheet. For details please contact the Miltenyi Biotec technical support.

Why does the formulation of premium-grade and MACS® GMP Cytokines contain the stabilizers mannitol and trehalose?
The mannitol and trehalose formulation increases stability and solubility of the cytokines. Trehalose replaces the hydration shell of cytokines for long-term stabilization. Mannitol improves the solubility characteristics to ensure a reliable and fast reconstitution.

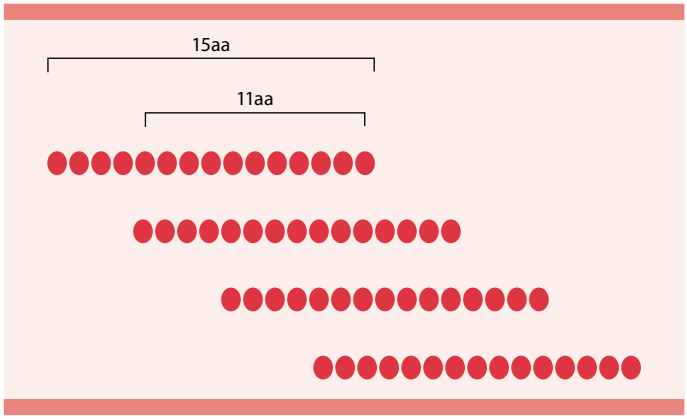
Do the stabilizers trehalose and mannitol affect my assay?
Trehalose and mannitol are widely used sugars of pharmaceutical compositions, such as monoclonal antibody formulations that are applied directly into patients. Trehalose has been accepted as a food ingredient under the GRAS terms in the US and the EU and is used in a variety of processed foods. It is a disaccharide (consisting of two glucose units) that cannot enter mammalian cells because the lack of a trehalose transporter. Mannitol, which is also used as sweetener in foods, also cannot be imported by mammalian cells due to a missing mannitol transporter. Our formulation does not change the osmotic pressure of the cell culture medium when applied in typical concentrations; trehalose and mannitol are used in final concentrations of about 0.0001 – 0.001%. We have extensively tested several of our cytokines containing trehalose and mannitol in different cellular applications.

Which protein sequences are used to generate MACS® Cytokines?
We use the entries in the UniProt database (http://www.uniprot.org) as a reference. Some cytokines naturally exist in several isoforms, and we generally use the isoform named "canonical" sequence as described in UniProt. For some cytokines, we have chosen other isoforms that are known to be more beneficial for cellular applications. Cytokines with improved sequences are the result of our research and development and cannot be found in the database.

Why does the primary structure information in the datasheet contain the description "including an N-terminal methionine" for some cytokines, but not for all?
The active natural form of cytokines does not contain an N-terminal methionine. However, when proteins are expressed in a recombinant form, an N-terminal methionine is often beneficial for the recombinant manufacturing of proteins, and many commercial cytokine preparations have an N-terminal methionine. Our goal is to manufacture authentic cytokines that are most similar to the natural form, and therefore most of our cytokines do not have an N-terminal methionine. Unfortunately, sometimes it is technically not possible, and these cases are marked by the description "including an N-terminal methionine".

FAQs – PepTivator® Peptide Pools

What are PepTivator® Peptide Pools?
PepTivator® Peptide Pools consist of 15-mer peptides with 11-amino-acid overlaps, covering the complete sequence of the respective antigen. The peptide composition ensures the optimal antigen-specific stimulation of both $CD4^+$ and $CD8^+$ T cells.



PepTivator® Peptide Pools consist mainly of 15-mer peptides with 11-amino-acid overlap spanning the complete sequence of an antigen.

How should I handle and store PepTivator® Peptide Pools?
PepTivator® Peptide Pools are supplied as lyophilized synthetic peptides, containing stabilizers. They are stored at –20 °C. PepTivator Peptide Pools should be reconstituted in sterile water. Alternatively, up to 20% DMSO can be used for reconstitution. As DMSO can lead to unspecific cell stimulation, final DMSO concentrations should be below 1% and tested in the respective assays.

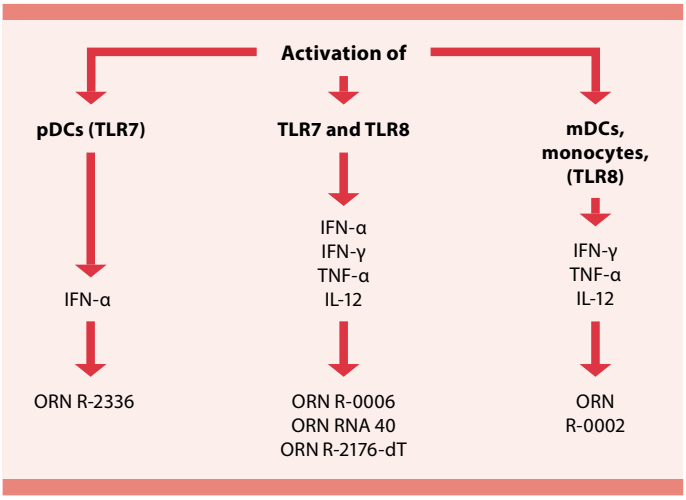
How many cells can I stimulate with one vial of PepTivator® Peptide Pool?
PepTivator® Peptide Pools are available in two formats providing 6 nmol of each peptide (approximately 10 µg in total) or 60 nmol of each peptide. 6 nmol are sufficient to stimulate 10^8 total cells. 60 nmol are sufficient to stimulate 10^9 total cells.

How are PepTivator® Peptide Pools designed?
We use the entries in the UniProt database (http://www.uniprot.org) as reference. Some proteins naturally exist in several isoforms, and we generally use isoform 1 in UniProt / the isoform named "canonical" sequence as described in UniProt for the PepTivator® Peptide Pool. Exceptions thereof are clearly indicated in the data sheet.

How do PepTivator® Peptide Pools work?
A PepTivator® Peptide Pool is a well-defined pool of freeze-dried peptides displaying the amino acid sequence of a particular virus-, tumor-, or auto-antigen. The short overlapping peptides cover the protein's complete sequence and are suitable for binding to MHC class I as well as MHC class II complexes.

FAQs – TLR ligands

How do I choose the appropriate TLR ligand for my cell culture experiment?
Choose the TLR ligand according to the cell type you wish to stimulate and the downstream immune response under investigation. TLR7 is expressed predominantly in human and murine B cells and plasmacytoid dendritic cells (pDCs). In contrast, TLR8 is mainly expressed in human myeloid cells, such as monocytes, macrophages, and myeloid dendritic cells, but not on mouse cells. Among our TLR ligands you can choose ORNs suitable for stimulation of TLR7 only, TLR8 only, or both receptors. TLR9 is mainly expressed in B cells and pDCs. TLR9 agonists are ODNs, which are divided into four classes based on their structure and effect. The various ODN classes induce distinct responses in the different target cells. The P-Class ODN is the most potent agonist and is an exclusive product of Miltenyi Biotec. For more information about the most suitable TLR9 agonist for your experiment, please visit our website or contact our technical support team.



TLR7/8 ligand applications can be used for the study of several immune cells.

How should I prepare TLR7/8 ligands for use in cell culture experiments?
To enable cellular uptake of TLR7/8 ligands and protect them from degradation, ORNs need to be formulated with cationic lipids. All TLR7/8 ligands from Miltenyi Biotec come with the transfection reagent DOTAP-Cl allowing for optimal formulation. To achieve reproducible results, it is important to prepare the ligands according to the instruction indicated in the data sheet, which ensures appropriate complex formation.

FAQs – StemMACS™ Small Molecules

How should I dissolve StemMACS™ Small Molecules?
All StemMACS™ Small Molecules are soluble in DMSO. To prepare an appropriate stock solution, follow the instructions in the product data sheet. Store the stock solution in aliquots at –20 °C and avoid multiple freeze-thaw cycles.

I followed the instructions in the data sheet, but still see solid substance. How should I proceed?
Warm the DMSO solution to 37 °C and vortex for 1–3 minutes. If you still see solid substance, please contact our technical support team. Many StemMACS Small Molecules are available in liquid form.

I see precipitation when diluting my DMSO-based stock solution into aqueous medium. How can I avoid this?
Many small molecules have low solubility in aqueous solution. It is common to see precipitation when diluting from a concentrated stock. To avoid this, pre-warm your culture medium, add the DMSO-based solution swiftly, and vortex until the precipitate has dissolved. Make sure that you have a clear solution before passing the supplemented medium through a 0.2 µM filter and adding it to your cell culture.

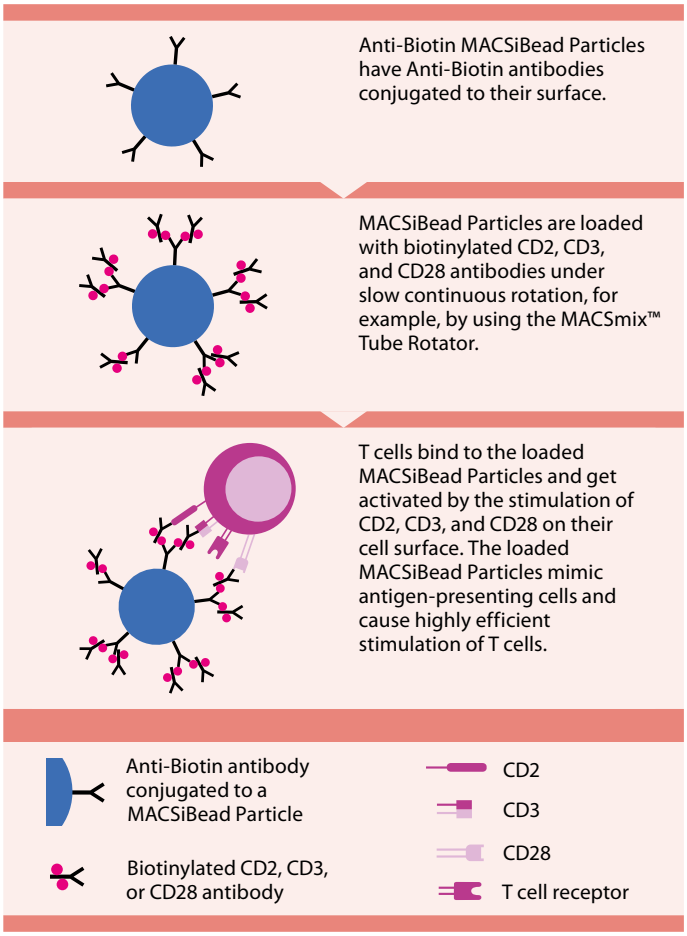
The vial label recommends storage of the product at –20 °C. Can I still use the product if it was delivered at 2–8 °C?
All StemMACS Small Molecules are tested for their long- and short-term stability at different temperatures. The storage temperature indicated on the vial label is the optimal temperature for long-term storage. However, all StemMACS Small Molecules can be kept at 2–8 °C for at least one week without any impact on performance. Our standard shipping procedure for StemMACS Small Molecules arranges for delivery at 2–8 °C.

FAQs – polyclonal stimulation reagents

What are the recommendations for cell density, medium volume, and culture vessel size when expanding T cells?
To ensure optimal stimulation and cell growth it is important to start the culture with appropriate cell densities and medium volumes. Ideal starting conditions for human T cell expansion are 2.5×10^6 cells/mL/cm^2 and for mouse T cells 1×10^6 cells/mL/cm^2. For more details about cell numbers and medium volumes that are appropriate for starting cultures in commonly used formats of culture plates, dishes, and flasks, please refer to the data sheet.

Do MACSiBead™ Particles affect downstream applications?
Cells stimulated with antibody-loaded Anti-Biotin MACSiBead™ Particles can be directly used for any downstream processing such as cytokine analysis or immunoprecipitation. Stimulated cells can also be transfected with high efficiency. Anti-Biotin MACSiBead Particles show no autofluorescence and do not need to be removed prior to flow cytometry. However, when removal of Anti-Biotin MACSiBead Particles is desired, e.g., for restimulation with the particles, this is easily achieved by using the MACSiMAG™ Separator.

Do I have to prepare the MACSiBead™ Particles for cell stimulation?
Yes, you need to load the MACSiBead™ Particles with the biotinylated antibodies prior to the experiment, as described in the data sheet. If a stronger or weaker stimulation is needed, you can adjust the amount of pre-loaded MACSiBead Particles used for cell stimulation accordingly.

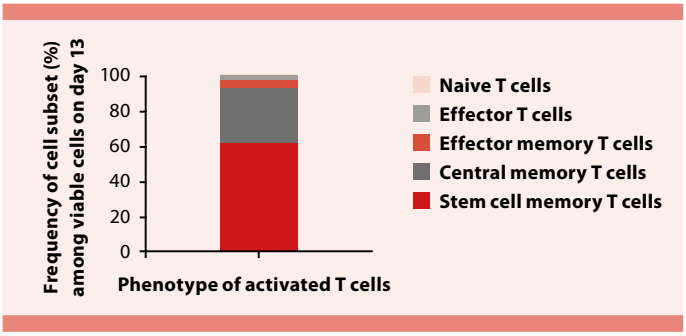


MACSiBead Particles can be loaded with appropriate biotinylated antibodies or ligands and subsequently used to stimulate cells. An example of T cell stimulation using MACSiBead Particles is displayed here.

What is the difference between the T Cell Activation/Expansion Kit and T Cell TransAct™?
With the research-grade T Cell Activation/Expansion Kit you enjoy full flexibility of loading the MACSiBead matrix with any kind of activation antibodies. The T Cell Activation/Expansion Kit has to be used according to a bead to cell ratio, and includes CD2, CD3, and CD28 antibodies already, but can be used with any other biotinylated antibody as well. In contrast, T Cell TransAct™ is a ready-to-use reagent and comes pre-loaded with CD3 and CD28 agonists. For simplicity and ease-of-use, its dosage is based on volume and not on bead to cell ratio. Finally, T Cell TransAct is available in both research grade and MACS® GMP Grade, making a seamless transfer of your T cell process into a clinical setting possible.

What does "TransAct" stand for?
TransAct is an acronym for "TRANSduction" and "ACTivation" as the main applications are the activation and transduction of T cells.

Which other products are recommended for the use with MACS® GMP T Cell TransAct™?
MACS® GMP T Cell TransAct™ has been developed in the context of TexMACS™ GMP Medium. Therefore, only this combination can ensure highest performance. Additionally, MACS GMP Recombinant Cytokines, such as IL-2, IL-7, and IL-15 are used within the manufacturing process of T cells. For the GMP-compliant transduction of T cells, an automated process has been established on the CliniMACS Prodigy®, e.g., to generate CAR T cells. To standardize this process an initial enrichment step with the CliniMACS® CD4 Reagent, CliniMACS CD8 Reagent, or CliniMACS CD62L Reagent is recommended.



The results shown were acquired after given days of cell culture in TexMACS Medium supplemented with MACS Cytokines Human IL-7, premium grade and Human IL15, premium grade. Recommended concentrations can be found in the respective data sheet.

FAQs – MACS® GMP Quality

What is the regulatory status of MACS® GMP Products?
MACS® GMP Products are manufactured and tested under a quality management system (ISO 13485) and are in compliance with relevant GMP guidelines. They are designed following the recommendations of USP <1043> on ancillary materials. For regulatory status in the USA, please contact your local representative.

	Premium grade	MACS GMP Grade
Quality management system	–	Produced under ISO13485
Product-specific documentation	Lot-specific CoA	Lot-specific PQC (former CoA) CoO Product information file
Design control	–	+
Sterility	sterile-filtered	Aseptically filled and tested for sterility (Ph. Eur.)
Biological activity	Lot-specific, standardized with international standard, determined after lyophilization	
Formulation	Without carrier protein, animal component–free	

Are there any restrictions in the availability of MACS® GMP Products?
MACS® GMP Products are available worldwide.

Does Miltenyi Biotec use any animal- or human-derived materials during the manufacturing process of MACS® GMP Products?
Production processes at Miltenyi Biotec are developed to avoid the use of animal, human, or viral components. Information and review regarding the origin of all materials used for the manufacturing of Miltenyi Biotec products is part of the release process of the raw material before using the components in manufacturing. For further Information please refer to our Animal Origin Policy Statement for MACS® GMP Products which can be found on our website (miltenyibiotec.com/gmp) and the product-specific certificates of origin (CoO).

Can I get any additional documentation in order to facilitate communication with regulatory authorities?
MACS GMP Products are shipped with a lot-specific Product Quality Certificate (PQC, former CoA). The PQC gives details about the specifications of the product, the release tests performed, and the results thereof. For information about any animal material eventually used during the manufacturing process, product-specific certificates of origin (CoO) are available. In order to further support our customers Miltenyi Biotec can provide Product Information Files (PIF). These documents provide supporting documentation for customers when general regulatory and design information on a product is required (e.g. clinical trial applications) and are also meant to support discussions with local regulatory bodies (e.g. in the course of product registrations or manufacturing license applications).

Is it possible to use MACS® GMP Products for cell therapy research manufacturing processes?
MACS® GMP Products are ancillary or raw materials for *ex vivo* cell culture processing only, and are not intended for human *in vivo* applications. They are used in clinical trials from stage I to stage III in different applications, such as dendritic cell vaccination or manufacturing of genetically engineered T cells.

How are ancillary/raw materials defined?
Ancillary/raw materials are substances used for manufacturing or extracting the active substance(s) but from which this active substance is not directly derived and which are not intended to be part of the final product. Examples are cytokines, synthetic peptide pools, cell culture media, and activation and expansion tools.

Do you test MACS® GMP Products in CliniMACS Prodigy® Applications?
In order to supply our customers with workflow solutions which seamlessly integrate as many cell therapy manufacturing steps in a closed automated system as possible, we test all the applicable MACS® GMP Products in the corresponding CliniMACS Prodigy® Applications.

Is there an intended use for MACS® GMP Products?
MACS® GMP Products can be used for a wide range of applications without any specific intended use.

Find the MACS® Cytokines and cell culture reagents you need for your cell culture applications

Immunology – lymphoid cells

Application	Reagents
T cell activation and expansion	IL-2, IL-15, IL-7 anti-CD3, anti-CD28 PepTivator® Peptide Pools
Th1 polarization	IL-12, IL-18, IL-27, IFN-γ anti-IL-4
Th2 polarization	IL-4, IL-6, IL-33, TSLP anti-IFN-γ, anti-IL-12
Th17 polarization	TGF-β1, IL-6, IL-1β, IL-23, IL-21 anti-IFN-γ, anti-IL-4, anti-IL-2
Treg polarization	IL-2, TGF-β1
Lymphoid differentiation	SCF, IL-7, IL-2, IL-6
NK cell activation	IL-2, IL-12, IL-15, IL-15Rα sushi
B cell activation	IL-4, IFN-γ, TGF-β1, CD40L anti-CD40 TLR ligands

Immunology – myeloid cells

Application	Reagents
Macrophage (Mφ) generation	M-CSF, IFN-γ, IL-34
Dendritic cell (DC) generation	IL-4, GM-CSF, Flt3-Ligand, IL-34
Plasmacytoid DC generation	Flt3-Ligand
Monocyte (Mo) generation	Flt3-Ligand, GM-CSF, IL-34
Mo, Mφ, and DC maturation	IL-1β, IL-6, IL-12, TNF-α, CD40L TLR ligands PepTivator Peptide Pools
Granulocyte cultures	SCF, GM-CSF, G-CSF, IL-3, IL-4, TGF-β1
Osteoclast differentiation	M-CSF, RANK-Ligand

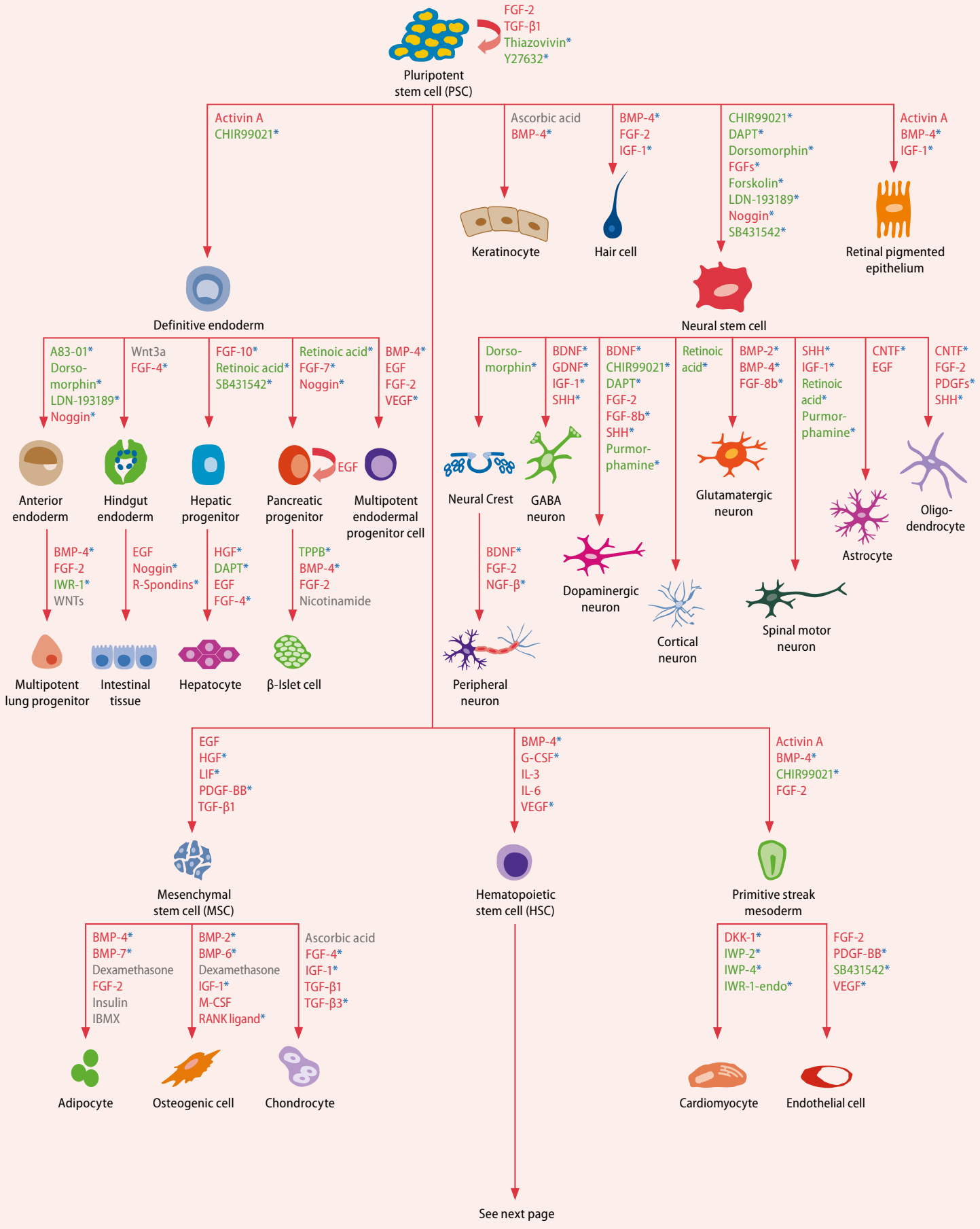
Stem cell research

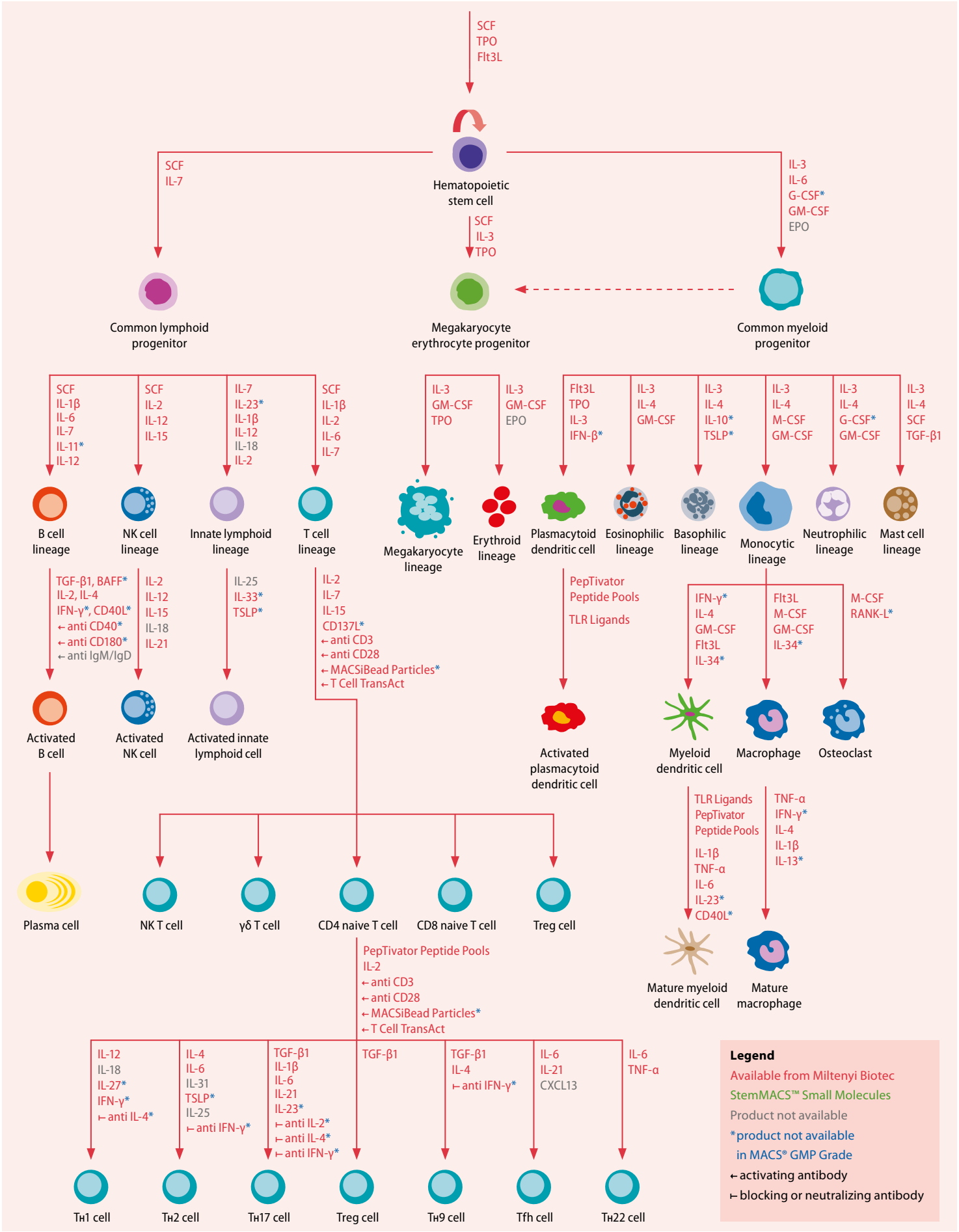
Application	Reagents
ES/iPS cell maintenance	TGF-β1, FGF-2 (human), LIF (mouse) Thiazovivin, Y27632
HSC expansion and differentiation	SCF, Flt3-Ligand, TPO, IL-3, IL-6
Cardiovascular differentiation from ES/iPS cells	BMP-4, Activin A, FGF-2, VEGF, DKK-1 CHIR99021
Hepatic differentiation from ES/iPS cells	Activin-A, HGF, FGF-10, FGF-4, EGF CHIR99021
Pancreatic differentiation from ES/iPS cells	Activin-A, Noggin, FGF-7, FGF-2, BMP-4, EGF CHIR99021
Intestinal cell differentiation from ES/iPS cells	Activin-A, FGF-4, R-Spondins, Noggin, EGF CHIR99021
MSC expansion and differentiation	FGF-2, VEGF, PDGF-BB, TGF-β

Neuroscience

Application	Reagents
Peripheral neuron differentiation from ES/iPS cells	FGF-2, NGF, Noggin, BDNF SB431542, LDN-193189
Dopaminergic neuron generation from ES/iPS cells	FGF-2, FGF-8b, SHH SB431542, LDN-193189
Neurosphere assay	EGF, FGF-2
Primary motoneuron cell culture	BDNF, CTNF, GDNF
Primary retinal ganglion cell culture	BDNF, CNTF
Primary oligodendrocyte culture	PDGF-AA, FGF-2

Find the MACS® Cytokines and StemMACS™ Small Molecules you need for cell differentiation and activation




SCF
TPO
Flt3L
Hematopoietic stem cell
SCF
IL-7
SCF
IL-3
TPO
IL-3
IL-6
G-CSF*
GM-CSF
EPO
Common lymphoid progenitor
Megakaryocyte erythrocyte progenitor
Common myeloid progenitor
SCF
IL-1β
IL-6
IL-7
IL-11*
IL-12
SCF
IL-2
IL-12
IL-15
IL-7
IL-23*
IL-1β
IL-12
IL-18
IL-2
SCF
IL-1β
IL-2
IL-6
IL-7
IL-3
GM-CSF
TPO
IL-3
GM-CSF
EPO
Flt3L
TPO
IL-3
IFN-β*
IL-3
IL-4
GM-CSF
IL-3
IL-4
IL-10*
TSLP*
IL-3
IL-4
M-CSF
GM-CSF
IL-3
IL-4
G-CSF*
GM-CSF
IL-3
IL-4
SCF
TGF-β1
B cell lineage
NK cell lineage
Innate lymphoid lineage
T cell lineage
Megakaryocyte lineage
Erythroid lineage
Plasmacytoid dendritic cell
Eosinophilic lineage
Basophilic lineage
Monocytic lineage
Neutrophilic lineage
Mast cell lineage
TGF-β1, BAFF*
IL-2, IL-4
IFN-γ*, CD40L*
← anti CD40*
← anti CD180*
← anti IgM/IgD
IL-2
IL-12
IL-15
IL-18
IL-21
IL-25
IL-33*
TSLP*
IL-2
IL-7
IL-15
CD137L*
← anti CD3
← anti CD28
← MACSiBead Particles*
← T Cell TransAct
PepTivator Peptide Pools
TLR Ligands
IFN-γ*
IL-4
GM-CSF
Flt3L
IL-34*
Flt3L
M-CSF
GM-CSF
IL-34*
M-CSF
RANK-L*
Activated B cell
Activated NK cell
Activated innate lymphoid cell
Activated plasmacytoid dendritic cell
Myeloid dendritic cell
Macrophage
Osteoclast
TLR Ligands
PepTivator
Peptide Pools
IL-1β
TNF-α
IL-6
IL-23*
CD40L*
TNF-α
IFN-γ*
IL-4
IL-1β
IL-13*
Plasma cell
NK T cell
γδ T cell
CD4 naive T cell
CD8 naive T cell
Treg cell
Mature myeloid dendritic cell
Mature macrophage
PepTivator Peptide Pools
IL-2
← anti CD3
← anti CD28
← MACSiBead Particles*
← T Cell TransAct
IL-12
IL-18
IL-27*
IFN-γ*
⊢ anti IL-4*
IL-4
IL-6
IL-31
TSLP*
IL-25
⊢ anti IFN-γ*
TGF-β1
IL-1β
IL-6
IL-21
IL-23*
⊢ anti IL-2*
⊢ anti IL-4*
⊢ anti IFN-γ*
TGF-β1
TGF-β1
IL-4
⊢ anti IFN-γ*
IL-6
IL-21
CXCL13
IL-6
TNF-α
Th1 cell
Th2 cell
Th17 cell
Treg cell
Th9 cell
Tfh cell
Th22 cell
Legend
Available from Miltenyi Biotec
StemMACS™ Small Molecules
Product not available
*product not available in MACS® GMP Grade
← activating antibody
⊢ blocking or neutralizing antibody

Stem cell media

Product	Description	Capacity/Content/Components	Order no.
CytoMix™ – MSC, human	Composition of cytokines for efficient expansion of human mesenchymal stromal cells	100 µg	130-093-552
StemMACS™ AdipoDiff Media, human	Media for the differentiation of human mesenchymal stem cells into adipocytes	100 mL	130-091-677
StemMACS™ Cardiac Cultivation Medium XF, human *see page 22*	Medium for cultivation of human cardiomyocytes	500 mL 500 mL StemMACS™ CardioDiff Basal Medium XF 10 mL StemMACS™ CardioDiff Cardiac Cultivation Supplement XF	130-125-287
StemMACS™ CardioDiff Kit XF, human *see page 22*	Medium kit for differentiation of human pluripotent stem cells to cardiomyocytes	for 48 assays 2×500 mL StemMACS™ CardioDiff Basal Medium XF 5 mL StemMACS™ CardioDiff Mesoderm Induction Supplement XF 2×10 mL StemMACS™ CardioDiff Cardiac Cultivation Supplement XF 5 mL StemMACS™ CardioDiff Cardiac Induction Supplement XF	130-125-289
StemMACS™ ChondroDiff Media, human	Media for the differentiation of human mesenchymal stem cells into chondrocytes	100 mL	130-091-679
StemMACS™ Cryo-Brew	An animal component-free media for the cryopreservation of human pluripotent and mesenchymal stem cells	50 mL	130-109-558
StemMACS™ DiffBase XF, human	Base medium for differentiation of human pluripotent stem cells (hPSC)	500 mL 500 mL StemMACS™ iPS-Brew XF, Basal Medium 10 mL StemMACS™ DiffBase XF, (50×) Supplement	130-126-015
StemMACS™ HSC Expansion Cocktail, human *see page 23*	Cytokine cocktail for the expansion of hematopoietic stem cells	for 100 mL medium	130-100-843
StemMACS™ HSC Expansion Media XF, human *see page 23*	Expansion media for hematopoietic stem cells (HSCs)	100 mL 500 mL	130-100-473 130-100-463
StemMACS™ HSC-CFU Assay Kit, human	Medium for analyzing hematopoietic stem and progenitor cells	450 mL 450 mL StemMACS™ HSC-CFU Assay Medium 1.35 mL StemMACS™ HSC-CFU Assay Cocktail	130-125-042
StemMACS™ HSC-CFU complete w/o Epo, human	HSC enumeration medium without Epo	100 mL	130-091-277
StemMACS™ HSC-CFU complete with Epo, human	HSC enumeration medium with Epo	100 mL	130-091-280
StemMACS™ HSC-CFU lite with Epo, human	HSC enumeration medium with Epo but without G-CSF or IL-6	100 mL	130-091-281
StemMACS™ iPS-Brew XF, human *see page 23*	Xeno-free cell culture medium for maintenance of human ES and iPS cells under feeder-free conditions	500 mL 500 mL StemMACS™ iPS-Brew XF, Basal Medium 10 mL StemMACS™ iPS Brew XF, 50x Supplement	130-104-368
StemMACS™ MSC Expansion Media Kit XF, human *see page 24*	Xeno-free expansion media for human mesenchymal stem cells	500 mL 500 mL StemMACS™ MSC Expansion Media XF, Basal Media 7 mL StemMACS™ MSC Expansion Media XF Supplement	130-104-182
StemMACS™ MSC Expansion Media, human	Expansion media for human mesenchymal stem cells	500 mL	130-091-680
StemMACS™ OsteoDiff Media, human	Media for the differentiation of human mesenchymal stem cells into osteoblasts	100 mL	130-091-678
StemMACS™ Passaging Solution XF	Xeno-free passaging solution for human ES and iPS cells	100 mL	130-104-688

Product	Description	Capacity/Content/Components		Order no.
StemMACS™ PSC-Brew XF, human *see page 24*	Culture medium for human pluripotent stem cells (hPSC)	500 mL 500 mL StemMACS PSC-Brew Basal Medium XF, human 10 mL StemMACS PSC-Brew 50x Supplement XF, human	*new*	130-127-865
StemMACS™ PSC-Support XF, human	Supplement for culture of human pluripotent stem cells (hPSC)	8 mL	*new*	130-127-287
StemMACS™ Trilineage Differentiation Kit, human *see page 25*	Kit for assessment of differentiation potential of human pluripotent stem cells	for 12 assays 36 mL StemMACS™ Trilineage MesoDiff Medium I 72 mL StemMACS™ Trilineage MesoDiff Medium II 60 mL StemMACS™ Trilineage EndoDiff Medium 84 mL StemMACS™ Trilineage EctoDiff Medium		130-115-660

Immune cell media

Product	Description	Content/Components	Order no.
Mo-DC Differentiation Medium, human	For the *in vitro* differentiation of up to 2×10^8 monocytes	400 mL	130-094-812
NK MACS® Medium *see page 25*	Medium for the activation and expansion of human NK cells	500 mL 500 mL NK MACS® Basal Medium 5 mL NK MACS® Supplement	130-114-429
TexMACS™ Medium *see page 26*	Serum-free cultivation and expansion medium for T cells	500 mL	130-097-196

Cancer cell media

Product	Description	Content/Components	Order no.
Colon TumorMACS™ Medium	Cell culture medium for the cultivation and expansion of tumor cells from primary and xenotransplanted colorectal tumors.	500 mL 500 mL TumorMACS™ Basal Medium 10 mL Colon TumorMACS™ Supplement	130-127-169
Ovarian TumorMACS™ Medium	Cell culture medium for the cultivation and expansion of tumor cells from primary and xenotransplanted ovarian tumors	500 mL 500 mL TumorMACS™ Basal Medium 10 mL Ovarian TumorMACS™ Supplement	130-119-483
Pancreas TumorMACS™ Medium *see page 26*	Cell culture medium for the cultivation and expansion of tumor cells from primary and xenotransplanted pancreatic tumors	500 mL 500 mL TumorMACS™ Basal Medium 10 mL Pancreas TumorMACS™ Supplement	130-119-484
Renal TumorMACS™ Medium	Cell culture medium for the cultivation and expansion of tumor cells from primary and xenotransplanted renal tumors	500 mL 500 mL TumorMACS™ Basal Medium 10 mL Renal TumorMACS™ Supplement	130-119-482

Neural cell media

Product	Description	Content/Components	Order no.
AstroMACS Medium	Medium for astrocyte cultivation	500 mL MACS® Neuro Medium (130-093-570) MACS® NeuroBrew®-21 (130-093-566) 1 vial AstroMACS Supplement, lyophilized	130-117-031
MACS® Neuro Medium	Culture of neural cells of the central and peripheral nervous system	500 mL	130-093-570
MACS® NeuroBrew®-21 *see page 27*	Serum-free supplement developed for low density plating and long-term viability and growth of neural cells of the central and peripheral nervous system	10 mL	130-093-566
MACS® NeuroBrew®-21 w/o Vitamin A *see page 27*	Serum-free supplement developed for low density plating and long-term viability and growth of neural cells of the central and peripheral nervous system	10 mL	130-097-263

StemMACS™ Cardiac Cultivation Medium XF, human

Overview
StemMACS Cardiac Cultivation Medium is a complete ready-to-use xeno-free cell culture medium for the cultivation of human cardiomyocytes.

Background information
Directed differentiation of specific lineages from human pluripotent stem cells (hPSCs) is a major tool for developmental or disease models, drug screening platforms, or cellular therapies from hPSCs. In this regard, cardiomyocytes generated from pluripotent stem cells are widely used as a model system in basic and translational research.

StemMACS Cardiac Cultivation Medium XF is a complete and xeno-free cell culture media for consistent and reliable cultivation of cardiomyocytes derived from hPSCs. After directed differentiation using StemMACS CardioDiff Kit XF (# 130-125-289), PSC-derived cardiomyocytes can be maintained in culture in StemMACS Cardiac Cultivation Medium XF for more than 30 days. Additionally, StemMACS Cardiac Cultivation Medium XF facilitates a fast recovery after thawing of PSC-derived cardiomyocytes frozen in StemMACS Cryo-Brew (# 130-109-558). StemMACS Cardiac Cultivation Medium XF does not contain phenol red.

Applications
- Cultivation of cardiomyocytes derived from human PSC lines

Product	Content/ Components	Order no.
StemMACS™ Cardiac Cultivation Medium XF, human For research use only	500 mL 500 mL StemMACS™ CardioDiff Basal Medium XF 10 mL StemMACS™ CardioDiff Cardiac Cultivation Supplement XF	130-125-287

StemMACS™ CardioDiff Kit XF, human

Overview
StemMACS CardioDiff Kit XF is a complete ready-to-use, and xeno-free cell culture system for efficient and fast differentiation of human pluripotent stem cells (PSCs) into cardiomyocytes.

Background information
Directed differentiation of specific lineages from human pluripotent stem cells (hPSCs) is a major tool for developmental or disease models, drug screening platforms, and cellular therapies. For all these applications, it is pivotal to have a consistent, time-saving, and reliable differentiation method.

StemMACS CardioDiff Kit XF is a complete, ready-to-use, and xeno-free cell culture system for efficient and fast differentiation of hPSCs into cardiomyocytes. The kit is composed of three phenol red–free media that progressively restrict the cellular fate and promote the differentiation into cardiomyocytes in just 8 days of culture. Depending on the cellular line, first contracting cardiomyocytes can be observed already after 6 days of culture. Moreover, the protocol can be up-scaled without differences in the efficiency rates. PSCs-derived cardiomyocytes can be further expanded in StemMACS Cardiac Cultivation Medium and cultivated for more than 30 days.

Applications
- Directed differentiation of cardiomyocytes from hPSCs lines

Product	Capacity/ Components	Order no.
StemMACS™ CardioDiff Kit XF, human For research use only	for 48 assays 2×500 mL StemMACS™ CardioDiff Basal Medium XF 5 mL StemMACS™ CardioDiff Mesoderm Induction Supplement XF 2×10 mL StemMACS™ CardioDiff Cardiac Cultivation Supplement XF 5 mL StemMACS™ CardioDiff Cardiac Induction Supplement XF	130-125-289

StemMACS™ HSC Expansion Media, human

Overview
StemMACS HSC Expansion Media XF (xeno-free) have been developed for the expansion of isolated CD34$^+$ hematopoietic stem and progenitor cells. They are ideally suited for the expansion of CD34$^+$ cells from cord blood, peripheral blood, or bone marrow.

Background information
StemMACS HSC Expansion Media XF (xeno-free) is an optimized and standardized medium for the expansion of isolated CD34$^+$ hematopoietic stem and progenitor cells. The media formulation is serum-free and xeno-free and is manufactured under strictly controlled conditions. StemMACS HSC Expansion Media XF offers consistent lot-to-lot performance. Recombinant growth factors, required for the optimal growth and expansion of hematopoietic stem cells (HSCs), have not been added to the media. They are available as separate product and have to be added prior to use. StemMACS HSC Expansion Cocktail (# 130-100-843) contains a combination of recombinant human cytokines designed to support the proliferation of human hematopoietic progenitor cells. It contains recombinant human stem cell factor (SCF), Flt3- ligand, and thrombopoietin (TPO). This combination of cytokines induces the proliferation of HSCs and immature progenitors.

Applications
- Expansion of CD34$^+$ cells from cord blood, peripheral blood, or bone marrow
- Retroviral transduction of CD34$^+$ cells[1]

Product	Capacity/ Content	Order no.
StemMACS™ HSC Expansion Media XF, human For research use only	100 mL	130-100-473
StemMACS™ HSC Expansion Media XF, human For research use only	500 mL	130-100-463
StemMACS™ HSC Expansion Cocktail, human For research use only	for 100 mL medium	130-100-843

Selected references
1. van Til, N.P. and Wagemaker, G. (2014) Methods Mol. Biol. 1185: 311–319.

StemMACS™ iPS-Brew XF, human

Overview
StemMACS iPS-Brew XF is a xeno-free cell culture medium for the maintenance of human ES and iPS cells under feeder-free conditions.

Background information
StemMACS iPS-Brew XF is a xeno-free cell culture media formulation for the maintenance and expansion of human pluripotent stem cells under feeder-free conditions. The formulation supports rapid adaption of feeder-based cell cultures to a feeder-free environment and is compatible with commonly used cell attachment matrices, e.g. Matrigel or Laminin-521. StemMACS iPS-Brew XF enables robust and efficient expansion of human embryonic stem (ES) cells or induced pluripotent stem (iPS) cells over multiple passages while maintaining a pluripotent phenotype as well as pluripotent differentiation potential. StemMACS iPS-Brew XF allows rapid culture re-initiation of pluripotent stem cell cultures after cryopreservation.

Applications
- Culture of human ES or iPS cells under xeno- and feeder-free conditions
- Rapid and easy adaption of feeder-based cell cultures to a feeder-free environment
- Rapid culture initiation after cryopreservation

Product	Content/ Components	Order no.
StemMACS™ iPS-Brew XF, human For research use only	500 mL 500 mL StemMACS™ iPS-Brew XF, Basal Medium 10 mL StemMACS™ iPS Brew XF, 50x Supplement	130-104-368

Selected references
1. Solbrant, S. *et al.* (2017) Nat. Protoc. 12 (9): 1962–1979.
2. Lorenz, C. *et al.* (2017) Cell Stem Cell 20 (5): 659–674.
3. Es-Salah-Lamoureux, Z. *et al.* (2016) J. Mol. Cell. Cardiol. 99: 1–13.
4. Kirkeby, A. *et al.* (2017) Cell Stem Cell 20: 1–14.
5. Park, C.-Y. *et al.* (2016) Nat. Protoc. 11: 2154–2169.
6. Si-Tayeb, K. *et al.* (2016) Dis Model Mech 9 (1): 81–90.
7. Mitzelfeld, K. *et al.* (2016) J. Biol. Chem. 291 (29): 14939–14953.
8. Giobbe, G.G. *et al.* (2015) Nat. Methods 12: 637–640.

StemMACS™ MSC Expansion Media Kit XF, human

Overview
The StemMACS MSC Expansion Media Kit is an optimized and standardized serum- and xeno-free medium for the reproducible and reliable expansion and enumeration of MSCs from human BM samples or other tissue sources, while maintaining the cells' multi-lineage differentiation potential. StemMACS MSC Expansion Media Kit XF is completely free of non-human animal derived components and does not require the use of cell attachment substrates.

Detailed procotols for MSC culture can be found on the Resource tab.

Background information
The StemMACS MSC Expansion Media Kit XF is an optimized and standardized serum-free and xeno-free medium for the reproducible and reliable generation and expansion of mesenchymal stem cells (MSCs) from human bone marrow (BM) samples or other tissue sources. As MSCs appear at relatively low frequency in human BM samples and other tissues, their *in vitro* propagation is often necessary in order to obtain sufficient cell numbers for further experiments, such as *in vivo* transplantation studies in animals or *in vitro* differentiation or functional characterization. The formulation of StemMACS MSC Expansion Media Kit XF was designed to efficiently support the expansion of MSCs *in vitro* while maintaining their differentiation potential. The media formulation is xeno- and serum-free and is manufactured under strictly controlled conditions using ingredients of the highest quality. StemMACS Expansion Media Kit XF offers consistent lot-to-lot performance and optimal conditions for the cultivation of MSCs. It is suitable for the derivation, expansion, and enumeration using the colony-forming–unit fibroblast (CFU-F) assay and does not require the use of any cell attachment substrate for optimal performance.

Product	Content/ Components	Order no.
StemMACS™ MSC Expansion Media Kit XF, human For research use only	500 mL 500 mL StemMACS™ MSC Expansion Media XF, Basal Media 7 mL StemMACS™ MSC Expansion Media XF Supplement	130-104-182

StemMACS™ PSC-Brew XF, human

Overview
StemMACS PSC-Brew XF, human is a new generation culturing medium for highly efficient maintenance and expansion of human pluripotent stem cells (hPSC).

Background information
StemMACS PSC-Brew XF, human is a new generation cell culture medium for highly efficient maintenance and expansion of human pluripotent stem cells (hPSC). It has a xeno-free and serum-free formulation that ensures a reduced variability and standardized performances during culture. The carefully balanced composition and the presence of stable FGF-2 ensures constant exposure levels and provides flexibility with feeding schedules.

StemMACS PSC-Brew XF, human is compatible with both defined and undefined cell attachment matrices and allows the maintenance of a highly consistent pluripotent phenotype even in low density cultures. hPSCs grown in StemMACS PSC-Brew XF, human show a typical morphology, expression of pluripotency-associated markers and retain the ability to differentiate into cell types that derive from the three embryonic germ layers. Moreover, the maintenance of a stable karyotype in long-term cultivation is supported.

StemMACS PSC-Brew XF, human allows rapid culture re-initiation of hPSC cultures after cryopreservation and enables cluster passaging without the addition of any inhibitor.

StemMACS PSC-Brew XF, human is fully compatible with StemMACS PSC-Support XF, human and, when combined, can be used in challenging applications that would normally stress the cells, such as gene editing approaches or after reprogramming.

Applications
Highly efficient maintenance and expansion of hPSCs under xeno- and feeder-free conditions.

Product	Content/ Components		Order no.
StemMACS™ PSC-Brew XF, human For research use only	500 mL 10 mL StemMACS PSC-Brew 50x Supplement XF, human 500 mL StemMACS PSC-Brew Basal Medium XF, human	*new*	130-127-865

StemMACS™ Trilineage Differentiation Kit, human

Overview
The StemMACS Trilineage Differentiation Kit enables directed differentiation of pluripotent stem cells into ecto-, meso- and endoderm. Combined with immunofluorescent or flow cytometric analysis it provides a simple 7-day assay for functional characterization of ES and iPS cell lines.

Background information
Pluripotency is the ability to differentiate into the three embryonal germ layers, ectoderm, mesoderm, and endoderm, and is a defining characteristic of pluripotent stem cells (PSCs). Therefore, basic characterization of PSC lines includes typically a test for pluripotency in addition to surface marker expression and morphology. However, traditional pluripotency assays such as embryoid body and teratoma formation are both time-consuming and difficult to quantitate.

The StemMACS Trilineage Differentiation Kit provides a functional assay that can be completed in 7 days. In contrast to other pluripotency assays, the StemMACS Trilineage Differentiation Kit allows either analysis by immunocytochemistry or quantitative analysis by flow cytometry. The kit is enabling parallel assessment of multiple hPSC lines. The 12-well format is optimal for flow cytometric analysis. For immunocytochemistry, the 24-well format may be sufficient.

Applications
Assessment of differentiation potential of human pluripotent stem cells.

Product	Capacity/ Components	Order no.
StemMACS™ Trilineage Differentiation Kit, human For research use only	for 12 assays 36 mL StemMACS™ Trilineage MesoDiff Medium I 72 mL StemMACS™ Trilineage MesoDiff Medium II 60 mL StemMACS™ Trilineage EndoDiff Medium 84 mL StemMACS™ Trilineage EctoDiff Medium	130-115-660

Selected references
1. Gaignerie, A. *et al.* (2018) Sci Rep (8): 14363.

NK MACS® Medium

Overview
NK MACS Medium is an optimized cell culture medium for the cultivation and expansion of human NK cells. It is produced without animal derived components but contains stable glutamine, and phenol red.

Background information
NK MACS Medium was developed for the cultivation, activation, and expansion of human NK cells. Expanded NK cells are fully functional and can be used in any downstream assay, e.g. killing assays.

As starting material isolated human NK cells or PBMCs can be used.

When starting the expansion from PBMCs, growth and expansion of unwanted cells (T cells, NKT cells) is minimal.

Product	Content/ Components	Order no.
NK MACS® Medium For research use only	500 mL 500 mL NK MACS® Basal Medium 5 mL NK MACS® Supplement	130-114-429

TexMACS™ Medium

Overview

TexMACS Medium is an optimized serum-free cell culture medium developed for the cultivation and expansion of human and mouse T cells and regulatory T cells. This complete medium enables reproducible application in human and mouse cell culture. It is manufactured without animal-derived components.

Background information

TexMACS Medium has been designed for high-performance T cell growth, high cell viability, and consistency under serum-free conditions. It has been optimized for the serum-free cultivation and expansion of human and mouse T cells and regulatory T cells. TexMACS Medium has a defined formulation enabling reproducible application in human and mouse cell culture. It is produced without animal-derived components, but contains pre-selected human serum albumin, stable glutamine, and phenol red. TexMACS Medium has been developed based on the TexMACS GMP Medium (# 170-076-306).

Product	Content	Order no.
TexMACS™ Medium For research use only	500 mL	130-097-196

Selected references
1. Bacher, P. *et al.* (2013) J. Immunol. 190 (8): 3967–3976.
2. Saito, S. *et al.* (2014) Cytotherapy 16: 1257–1269.

Pancreas TumorMACS™ Medium

Overview

Pancreas TumorMACS Medium is an optimized serum-free cell culture medium for the cultivation and expansion of tumor cells from primary and xenotransplanted pancreatic tumors. It enables the establishment of stable cell lines from freshly dissociated tumor tissue.

Background information

The Pancreas TumorMACS Medium is an optimized and standardized medium for the reliable expansion of tumor cells from primary or xenotransplanted human pancreatic tumor samples. Tumor cells from freshly dissociated tissue can be cultured over multiple passages, allowing for *in vitro* assays, such as drug screenings on primary cell cultures or characterization studies including gene expression or protein profiling. In addition, the Pancreas TumorMACS Medium supports the establishment of new cell lines and thereby obtaining sufficient cell numbers for further experiments, such as *in vivo* transplantation studies in animals. Pancreas TumorMACS Medium efficiently expands cultures of primary pancreatic tumor cells *in vitro* while maintaining the cell populations' heterogeneity and tumorigenic potential. The medium is manufactured under strictly controlled conditions using ingredients of the highest quality. Pancreas TumorMACS Medium offers consistent lot-to-lot performance and optimal conditions for the cultivation of primary pancreatic tumor cells.

Product	Content/ Components	Order no.
Pancreas TumorMACS™ Medium For research use only	500 mL 500 mL TumorMACS™ Basal Medium 10 mL Pancreas TumorMACS™ Supplement	130-119-484

MACS® NeuroBrew®-21

Overview
MACS NeuroBrew-21 are serum-free neural supplements designed for use in combination with MACS Neuro Medium for the *in vitro* propagation of mature neural cells of the central and peripheral nervous system, or neural stem cells of primary or ES/iPS cell origin.

Background information
MACS NeuroBrew-21 is a re-optimized formulation of the B27 components designed to improve performance.[1] It has been developed for the *in vitro* propagation of neural cells of the central and peripheral nervous system.

MACS NeuroBrew-21 has been designed for
- optimal growth and long term viability of neural cells of the central and peripheral nervous system
- the growth of nearly pure populations of neural cells without the need of an astrocyte feeder layer

MACS NeuroBrew-21 w/o Vitamin A is identical to MACS NeuroBrew-21, but without the addition of Vitamin A or other retinoid related components. Vitamin A induces the differentiation of neural stem cells into mature neural cells. MACS NeuroBrew-21 w/o Vitamin A is suitable for use with studies of neural stem cells, neural development and neural cell differentiation.

MACS NeuroBrew-21 w/o Vitamin A has been designed for use with
- primary neural stem or progenitor cells
- primary neurospheres
- ES/iPS cell derived neural stem cells and neurosphere

Product	Content	Order no.
MACS® NeuroBrew®-21 For research use only	10 mL	130-093-566
MACS® NeuroBrew®-21 w/o Vitamin A For research use only	10 mL	130-097-263

Selected references
1. Chen, Y. *et al.* (2008) J. Neurosci. Methods 171: 239–247.

CytoBoxes and Kits

Product	Description	Content/Components	Order no.
B Cell Expansion Kit, human	Kit containing cytokines and medium for expansion of B cells isolated from human PBMC	1 kit 2×Human CD40-Ligand Multimer Kit (130-098-776) Human IL-4, premium grade (130-093-919) StemMACS™ HSC Expansion Media XF, human (130-100-463)	130-106-196
B Cell Expansion Kit, human – small size	Kit containing cytokines and medium for expansion of B cells isolated from human PBMC	1 kit 2×Human CD40-Ligand Multimer Kit (130-098-775) Human IL-4, premium grade (130-093-919) StemMACS™ HSC Expansion Media XF, human (130-100-473)	130-124-195
CytoBox Mo-DC – premium grade, human	Recombinant human granulocyte macrophage colony-stimulating factor (500 µg) and recombinant human interleukin 4 (2×100 µg)	1 kit Human GM-CSF, premium grade (130-093-867) 2×Human IL-4, premium grade (130-093-922)	130-100-842
CytoBox Th1, mouse	Starting kit for polarization of mouse T_H1 cells	1 kit Mouse IL-12, research grade (130-096-707) Mouse IL-2 IS, premium grade (130-120-331) IL-4 Antibody, anti-mouse, pure-functional grade (130-095-709)	130-107-761
CytoBox Th17, mouse	Starting kit for polarization of mouse T_H17 cells	1 kit Mouse IL-6, premium grade (130-096-682) Human TGF-β1, premium grade (130-095-067) Mouse IL-1β, premium grade (130-101-681) Mouse IL-23, research grade (130-096-676) IL-4 Antibody, anti-mouse, pure-functional grade (130-095-709) IFN-γ Antibody, anti-mouse, pure-functional grade (130-095-729) IL-2 Antibody, anti-mouse, pure-functional grade (130-095-736)	130-107-758
CytoBox Th2, mouse	Starting kit for polarization of mouse T_H2 cells	1 kit Mouse IL-4, premium grade (130-097-761) Mouse IL-2 IS, premium grade (130-120-331) IFN-γ Antibody, anti-mouse, pure-functional grade (130-095-729)	130-107-760
Human CD40-Ligand Multimer Kit	Recombinant Human CD40-Ligand and Cross-Linking Antibody	1 kit Human CD40-Ligand, premium grade (130-096-713) 0.2 mL Cross-Linking Antibody	130-098-775
		1 kit Human CD40-Ligand, premium grade (130-096-714) 1 mL Cross-Linking Antibody	130-098-776

Human cytokines & growth factors

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Custom Cytokine			Customized fillings, bulk quantities and cytokines not available off-the-shelf can be requested under this number			130-094-808
Human Activin A	research grade		Recombinant human activin A	CHO cells	10 µg	130-115-012
				CHO cells	25 µg	130-115-013
	premium grade		Recombinant human activin A	CHO cells	10 µg	130-115-008
				CHO cells	25 µg	130-115-009
				CHO cells	100 µg	130-115-010
				CHO cells	1000 µg	130-115-011

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human ANGPTL5	research grade		Recombinant human angiopoietin-like 5	HEK293 cells	5 µg	130-096-125
				HEK293 cells	25 µg	130-096-126
Human BAFF	research grade	TNFSF13B, BLys	Recombinant human B cell activating factor belonging to the TNF family	*E. coli*	5 µg	130-093-806
				E. coli	20 µg	130-093-807
				E. coli	100 µg	130-108-987
Human BDNF	research grade	ANON2, BULN2	Recombinant human brain-derived neurotrophic factor	*E. coli*	2 µg	130-096-285
				E. coli	10 µg	130-093-811
				E. coli	100 µg	130-096-286
				E. coli	1000 µg	130-103-435
Human BMP-2	research grade		Recombinant human bone morphogenetic protein 2	*E. coli*	10 µg	130-110-923
				E. coli	25 µg	130-110-922
	premium grade		Recombinant human bone morphogenetic protein 2	*E. coli*	10 µg	130-110-924
				E. coli	25 µg	130-110-925
				E. coli	100 µg	130-110-926
				E. coli	1000 µg	130-110-927
Human BMP-4	research grade		Recombinant human bone morphogenetic protein 4	*Pichia pastoris*	10 µg	130-110-921
				Pichia pastoris	25 µg	130-111-168
	premium grade		Recombinant human bone morphogenetic protein 4	*Pichia pastoris*	10 µg	130-111-164
				Pichia pastoris	25 µg	130-111-167
				Pichia pastoris	100 µg	130-111-165
				Pichia pastoris	1000 µg	130-111-166
Human BMP-6	research grade		Recombinant human bone morphogenetic protein 6	HEK293 cells	2 µg	130-112-951
				HEK293 cells	10 µg	130-112-948
Human BMP-7	research grade		Recombinant human bone morphogenetic protein 7	CHO cells	10 µg	130-093-818
				CHO cells	100 µg	130-103-436
				CHO cells	10×100 µg	130-108-988
Human BMP-10	research grade		Recombinant human bone morphogenetic protein 10	HEK293 cells	2 µg	130-112-946
				HEK293 cells	10 µg	130-112-944
Human Cardiotrophin-1	research grade	CT-1	Recombinant human cardiotrophin 1	*E. coli*	10 µg	130-093-820
Human CCL19 (MIP-3β)	research grade	CCL19, ELC, Exodus 3	Recombinant human chemokine (C-C motif) ligand 19 or inflammatory protein 3β	*E. coli*	10 µg	130-105-744
				E. coli	25 µg	130-105-743
				E. coli	100 µg	130-093-969
Human CD40-Ligand	premium grade	TRAP, CD154, TNFSF5	Recombinant human CD40 ligand	*E. coli*	10 µg	130-096-711
				E. coli	25 µg	130-096-712
				E. coli	100 µg	130-096-713
				E. coli	500 µg	130-096-714
Human CD137 (4-1BB)-Ligand	research grade	4-1BB ligand, TNFRSF9-Ligand	Recombinant human CD137 (4-1BB)-Ligand	*E. coli*	5 µg	130-105-768
				E. coli	20 µg	130-105-767
Human CNTF	research grade		Recombinant human ciliary neurotrophic factor	*E. coli*	5 µg	130-096-337
				E. coli	20 µg	130-096-336
				E. coli	100 µg	130-108-972
				E. coli	1000 µg	130-123-659

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human CTGF	research grade		Recombinant human connective tissue growth factor	*E. coli*	5 µg	130-115-648
				E. coli	20 µg	130-115-647
Human CXCL13	research grade	BLC, BAC-1	Recombinant human C-X-C motif chemokine 13	*E. coli*	5 µg	130-112-953
				E. coli	20 µg	130-112-952
Human DKK-1	research grade		Recombinant human dickkopf-related protein 1	HEK293 cells	2 µg	130-103-443
				HEK293 cells	10 µg	130-103-444
				HEK293 cells	100 µg	130-103-445
Human DLL1	research grade		Recombinant human delta-like protein 1	HEK293 cells	5 µg	130-112-964
				HEK293 cells	25 µg	130-112-943
Human EGF *see page 42*	research grade		Recombinant human epidermal growth factor	*E. coli*	100 µg	130-093-825
	premium grade		Recombinant human epidermal growth factor	*E. coli*	100 µg	130-097-749
				E. coli	500 µg	130-097-750
				E. coli	1000 µg	130-097-751
Human FGF-1	research grade	acidic FGF, aFGF, HBGF-1	Recombinant human fibroblast growth factor 1	*E. coli*	10 µg	130-093-835
				E. coli	25 µg	130-095-789
	premium grade	acidic FGF, aFGF, HBGF-1	Recombinant human fibroblast growth factor 1	*E. coli*	10 µg	130-095-790
				E. coli	25 µg	130-095-763
				E. coli	100 µg	130-095-761
				E. coli	1000 µg	130-095-756
Human FGF-2	research grade	basic FGF, HBGF-2	Recombinant human fibroblast growth factor 2	*E. coli*	10 µg	130-093-837
				E. coli	50 µg	130-093-838
	premium grade	basic FGF, HBGF-2	Recombinant human fibroblast growth factor 2	*E. coli*	10 µg	130-093-839
				E. coli	50 µg	130-093-840
				E. coli	100 µg	130-093-564
				E. coli	2×100 µg	130-093-841
				E. coli	1000 µg	130-093-842
				E. coli	2×1000 µg	130-093-843
Human FGF-2 IS *see page 43*	research grade	basic FGF	Recombinant human fibroblast growth factor 2 IS (improved sequence)	*E. coli*	10 µg	130-104-925
				E. coli	50 µg	130-104-921
	premium grade	basic FGF	Recombinant human fibroblast growth factor 2 IS (improved sequence)	*E. coli*	10 µg	130-104-918
				E. coli	50 µg	130-104-924
				E. coli	200 µg	130-104-922
				E. coli	1000 µg	130-104-923
Human FGF-4	research grade	HBGF-4	Recombinant human fibroblast growth factor 4	*E. coli*	10 µg	130-109-387
				E. coli	25 µg	130-109-388
	premium grade	HBGF-4	Recombinant human fibroblast growth factor 4	*E. coli*	10 µg	130-109-389
				E. coli	25 µg	130-109-390
				E. coli	100 µg	130-109-394
				E. coli	1000 µg	130-109-391
Human FGF-7	research grade	KGF, HBGF-7	Recombinant human fibroblast growth factor 7	*E. coli*	10 µg	130-093-849
				E. coli	25 µg	130-097-175
	premium grade	KGF, HBGF-7	Recombinant human fibroblast growth factor 7	*E. coli*	10 µg	130-097-173
				E. coli	25 µg	130-097-178
				E. coli	100 µg	130-097-176

Product	Quality grade	Alternative name	Description	Source	Content		Order no.
Human FGF-8b	research grade		Recombinant human fibroblast growth factor 8b	*E. coli*	10 µg		130-095-731
				E. coli	25 µg		130-095-733
	premium grade		Recombinant human fibroblast growth factor 8b	*E. coli*	10 µg		130-095-737
				E. coli	25 µg		130-095-738
				E. coli	100 µg		130-095-740
				E. coli	1000 µg		130-095-741
Human FGF-9	research grade		Recombinant human fibroblast growth factor 9	*E. coli*	5 µg		130-103-446
				E. coli	20 µg		130-110-920
Human FGF-10	research grade	KGF-2	Recombinant human fibroblast growth factor 10	*E. coli*	10 µg		130-127-859
				E. coli	25 µg		130-127-858
	premium grade	KGF-2	Recombinant human fibroblast growth factor 10	*E. coli*	10 µg		130-127-849
				E. coli	25 µg		130-127-855
				E. coli	100 µg		130-127-856
				E. coli	1000 µg		130-127-857
Human Flt3-Ligand *see page 44*	research grade		Recombinant human Flt3-ligand	*E. coli*	10 µg		130-093-854
				E. coli	25 µg		130-096-474
	premium grade		Recombinant human Flt3-ligand	*E. coli*	10 µg		130-096-476
				E. coli	25 µg		130-096-477
				E. coli	100 µg		130-096-479
				E. coli	1000 µg		130-096-480
Human G-CSF *see page 45*	research grade		Recombinant human granulocyte colony-stimulating factor	*E. coli*	10 µg		130-096-345
				E. coli	25 µg		130-096-346
	premium grade		Recombinant human granulocyte colony-stimulating factor	*E. coli*	10 µg		130-093-860
				E. coli	25 µg		130-096-347
				E. coli	100 µg		130-093-861
				E. coli	1000 µg		130-094-265
Human GDF-11	research grade	BMP-11	Recombinant human growth differentiation factor 11	*E. coli*	5 µg		130-105-776
				E. coli	20 µg		130-105-775
Human GDNF	research grade		Recombinant human glial cell line-derived neurotrophic factor	*E. coli*	10 µg	***new***	130-129-547
				E. coli	25 µg	***new***	130-129-548
	premium grade		Recombinant human glial cell line-derived neurotrophic factor	*E. coli*	10 µg	***new***	130-129-544
				E. coli	25 µg	***new***	130-129-543
				E. coli	100 µg	***new***	130-129-542
				E. coli	1000 µg	***new***	130-129-546
Human GM-CSF *see page 46*	research grade	CSF2	Recombinant human granulocyte macrophage colony–stimulating factor	*E. coli*	10 µg		130-093-862
				E. coli	50 µg		130-095-372
	premium grade	CSF2	Recombinant human granulocyte macrophage colony–stimulating factor	*E. coli*	10 µg		130-093-864
				E. coli	50 µg		130-093-865
				E. coli	100 µg		130-093-866
				E. coli	500 µg		130-093-867
				E. coli	1000 µg		130-093-868
Human GRO-α	research grade	CXCL1, MGSAα	Recombinant human growth-regulated oncogene α	*E. coli*	5 µg		130-094-620
				E. coli	25 µg		130-093-869
				E. coli	100 µg		130-108-974
Human GRO-β	research grade	CXCL2, MGSAβ, MIP-2α	Recombinant human growth regulated oncogene β	*E. coli*	2 µg		130-093-870
				E. coli	10 µg		130-094-621

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human HGF	research grade	HPTA, SF	Recombinant human hepatocyte growth factor	Insect cells	5 µg	130-093-871
				Insect cells	25 µg	130-093-872
				Insect cells	100 µg	130-103-437
Human IFN-α2a	research grade		Recombinant human interferon α2a	*E. coli*	20 µg	130-093-873
				E. coli	100 µg	130-093-874
				E. coli	1000 µg	130-108-984
Human IFN-α2b	research grade		Recombinant human interferon α2b	*E. coli*	20 µg	130-093-875
				E. coli	100 µg	130-093-876
				E. coli	1000 µg	130-108-967
Human IFN-β1a	research grade		Recombinant human interferon β1a	CHO cells	5 µg	130-107-889
				CHO cells	20 µg	130-107-888
Human IFN-γ1b	research grade	IFN-γ	Recombinant human interferon γ1b	*E. coli*	10 µg	130-096-872
				E. coli	25 µg	130-096-873
	premium grade	IFN-γ	Recombinant human interferon γ1b	*E. coli*	10 µg	130-096-481
				E. coli	25 µg	130-096-482
				E. coli	100 µg	130-096-484
				E. coli	1000 µg	130-096-486
Human IGF-1	research grade	IGF-I	Recombinant human insulin-like growth factor 1	*E. coli*	100 µg	130-093-886
				E. coli	1000 µg	130-093-887
Human IGF-2	research grade	IGF-II	Recombinant human insulin-like growth factor 2	*E. coli*	10 µg	130-093-888
				E. coli	50 µg	130-093-889
				E. coli	1000 µg	130-093-890
Human IL-1α	research grade		Recombinant human interleukin 1α	*E. coli*	2 µg	130-093-893
				E. coli	10 µg	130-093-894
Human IL-1β	research grade	IL1F2	Recombinant human interleukin 1β	*E. coli*	10 µg	130-093-895
				E. coli	25 µg	130-095-374
	premium grade	IL1F2	Recombinant human interleukin 1β	*E. coli*	10 µg	130-093-897
				E. coli	25 µg	130-093-563
				E. coli	100 µg	130-093-898
				E. coli	1000 µg	130-093-899
Human IL-2 IS *see page 47*	research grade		Recombinant human interleukin 2 IS (improved sequence)	*E. coli*	10 µg	130-097-742
				E. coli	50 µg	130-097-743
	premium grade		Recombinant human interleukin 2 IS (improved sequence)	*E. coli*	10 µg	130-097-744
				E. coli	50 µg	130-097-745
				E. coli	200 µg	130-097-746
				E. coli	1000 µg	130-097-748
Human IL-3	research grade		Recombinant human interleukin 3	*E. coli*	10 µg	130-093-908
				E. coli	25 µg	130-093-909
	premium grade		Recombinant human interleukin 3	*E. coli*	10 µg	130-095-071
				E. coli	25 µg	130-095-070
				E. coli	100 µg	130-095-069
				E. coli	1000 µg	130-095-068

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human IL-4 *see page 48*	research grade		Recombinant human interleukin 4	*E. coli*	5 µg	130-093-915
				E. coli	10 µg	130-095-373
				E. coli	25 µg	130-093-917
				E. coli	100 µg	130-094-117
	premium grade		Recombinant human interleukin 4	*E. coli*	5 µg	130-093-919
				E. coli	10 µg	130-093-920
				E. coli	25 µg	130-093-921
				E. coli	100 µg	130-093-922
				E. coli	1000 µg	130-093-924
Human IL-5	research grade		Recombinant human interleukin 5	*E. coli*	2 µg	130-093-926
				E. coli	10 µg	130-093-927
Human IL-6	research grade		Recombinant human interleukin 6	*E. coli*	10 µg	130-095-365
				E. coli	25 µg	130-093-929
	premium grade		Recombinant human interleukin 6	*E. coli*	10 µg	130-095-352
				E. coli	25 µg	130-093-931
				E. coli	100 µg	130-093-932
				E. coli	500 µg	130-093-933
				E. coli	1000 µg	130-093-934
Human IL-7 *see page 49*	research grade		Recombinant human interleukin 7	*E. coli*	10 µg	130-093-937
				E. coli	25 µg	130-095-367
	premium grade		Recombinant human interleukin 7	*E. coli*	10 µg	130-095-361
				E. coli	25 µg	130-095-362
				E. coli	100 µg	130-095-363
				E. coli	1000 µg	130-095-364
Human IL-8	research grade		Recombinant human interleukin 8	*E. coli*	10 µg	130-122-354
				E. coli	25 µg	130-122-353
	premium grade		Recombinant human interleukin 8	*E. coli*	10 µg	130-122-357
				E. coli	25 µg	130-122-359
				E. coli	100 µg	130-122-360
				E. coli	1000 µg	130-122-361
Human IL-9	research grade		Recombinant human interleukin 9	*E. coli*	2 µg	130-093-945
				E. coli	10 µg	130-093-946
				E. coli	100 µg	130-103-438
Human IL-10	research grade		Recombinant human interleukin 10	*E. coli*	2 µg	130-093-947
				E. coli	10 µg	130-093-948
				E. coli	100 µg	130-098-448
				E. coli	1000 µg	130-108-985
Human IL-11	research grade		Recombinant human interleukin 11	*E. coli*	2 µg	130-094-623
				E. coli	10 µg	130-093-950
				E. coli	100 µg	130-103-439
Human IL-12	premium grade		Recombinant human interleukin 12	HEK293 cells	5 µg	130-096-704
				HEK293 cells	25 µg	130-096-705
				HEK293 cells	100 µg	130-096-798

Product	Quality grade	Alternative name	Description	Source	Content		Order no.
Human IL-12 (CHO)	research grade		Recombinant human interleukin 12	CHO cells	10 µg	*new*	130-129-723
				CHO cells	25 µg	*new*	130-129-722
	premium grade		Recombinant human interleukin 12	CHO cells	10 µg	*new*	130-129-721
				CHO cells	25 µg	*new*	130-129-720
				CHO cells	100 µg	*new*	130-129-719
				CHO cells	1000 µg	*new*	130-129-718
Human IL-13	research grade		Recombinant human interleukin 13	*E. coli*	10 µg		130-112-409
				E. coli	25 µg		130-112-410
	premium grade		Recombinant human interleukin 13	*E. coli*	10 µg		130-112-411
				E. coli	25 µg		130-112-408
				E. coli	100 µg		130-112-412
Human IL-15 *see page 50*	research grade		Recombinant human interleukin 15	*E. coli*	10 µg		130-093-955
				E. coli	25 µg		130-095-760
	premium grade		Recombinant human interleukin 15	*E. coli*	10 µg		130-095-762
				E. coli	25 µg		130-095-764
				E. coli	100 µg		130-095-765
				E. coli	1000 µg		130-095-766
Human IL-15Rα sushi	research grade		Recombinant human interleukin 15 receptor alpha, soluble sushi domain	*E. coli*	10 µg		130-104-919
				E. coli	25 µg		130-104-920
	premium grade		Recombinant human interleukin 15 receptor alpha, soluble sushi domain	*E. coli*	10 µg		130-104-912
				E. coli	25 µg		130-104-916
				E. coli	100 µg		130-104-914
Human IL-17	research grade	IL-17A	Recombinant human interleukin 17	*E. coli*	5 µg		130-093-958
				E. coli	25 µg		130-093-959
				E. coli	100 µg		130-094-625
Human IL-17F	research grade		Recombinant human interleukin 17F	*E. coli*	5 µg		130-103-452
				E. coli	25 µg		130-103-453
Human IL-21 *see page 51*	research grade		Recombinant human interleukin 21	*E. coli*	10 µg		130-094-563
				E. coli	25 µg		130-095-767
	premium grade		Recombinant human interleukin 21	*E. coli*	10 µg		130-095-768
				E. coli	25 µg		130-095-769
				E. coli	100 µg		130-095-784
Human IL-22	research grade		Recombinant human interleukin 22	*E. coli*	2 µg		130-096-294
				E. coli	10 µg		130-096-295
				E. coli	100 µg		130-096-297
Human IL-23	research grade		Recombinant human interleukin 23	HEK293 cells	5 µg		130-095-757
				HEK293 cells	25 µg		130-095-758
				HEK293 cells	100 µg		130-095-759
Human IL-24	research grade		Recombinant human interleukin 24	CHO cells	5 µg		130-105-779
				CHO cells	20 µg		130-105-777
Human IL-25	research grade	IL-17E	Recombinant human interleukin 25	*E. coli*	5 µg		130-115-646
				E. coli	25 µg		130-115-644
Human IL-27	research grade		Recombinant human interleukin 27	HEK293 cells	2 µg		130-108-960
				HEK293 cells	10 µg		130-108-961
Human IL-31	research grade		Recombinant human interleukin 31	*E. coli*	2 µg		130-112-956
				E. coli	10 µg		130-112-955

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human IL-33	research grade		Recombinant human interleukin 33	*E. coli*	10 µg	130-109-378
				E. coli	25 µg	130-109-379
	premium grade		Recombinant human interleukin 33	*E. coli*	10 µg	130-109-380
				E. coli	25 µg	130-109-677
				E. coli	100 µg	130-109-381
				E. coli	1000 µg	130-109-382
Human IL-34	research grade		Recombinant human interleukin 34	HEK293 cells	2 µg	130-105-781
				HEK293 cells	10 µg	130-105-780
				HEK293 cells	100 µg	130-108-977
Human IL-35	research grade		Recombinant human interleukin 35	HEK293 cells	2 µg	130-112-947
				HEK293 cells	10 µg	130-112-950
Human LIF	research grade		Recombinant human leukemia inhibitory factor	*E. coli*	5 µg	130-108-159
				E. coli	25 µg	130-108-157
				E. coli	100 µg	130-108-156
				E. coli	1000 µg	130-108-155
Human M-CSF *see page 52*	research grade		Recombinant human macrophage-colony stimulating factor	*E. coli*	10 µg	130-093-963
				E. coli	25 µg	130-096-491
	premium grade		Recombinant human macrophage-colony stimulating factor	*E. coli*	10 µg	130-096-485
				E. coli	25 µg	130-096-489
				E. coli	100 µg	130-096-492
				E. coli	1000 µg	130-096-493
Human MCP-1	research grade	CCL2, MCAF	Recombinant human monocyte chemotactic protein 1	*E. coli*	5 µg	130-093-961
				E. coli	20 µg	130-093-962
Human MIF	research grade		Recombinant human macrophage migration inhibitory factor	Insect cells	5 µg	130-112-954
				Insect cells	25 µg	130-112-957
Human MIP-3α	research grade	CCL20, Exodus 1	Recombinant human macrophage inflammatory protein 3α	*E. coli*	20 µg	130-093-966
Human NGF-β	research grade		Recombinant human nerve growth factor β	*E. coli*	20 µg	130-127-430
				E. coli	100 µg	130-127-431
				E. coli	1000 µg	130-127-432
Human Noggin	research grade		Recombinant human noggin	HEK293 cells	5 µg	130-103-454
				HEK293 cells	20 µg	130-103-455
				HEK293 cells	100 µg	130-103-456
				HEK293 cells	2×500 µg	130-108-982
Human NT-3	research grade	NTF-3, HDNF	Recombinant human neurotrophin 3	*E. coli*	2 µg	130-096-287
				E. coli	10 µg	130-093-973
				E. coli	100 µg	130-096-288
Human NT-4	research grade	NTF-4	Recombinant human neurotrophin 4	*E. coli*	2 µg	130-096-289
				E. coli	10 µg	130-093-974
Human Oncostatin M IS	research grade	OSM	Recombinant human oncostatin M IS (improved sequence)	*E. coli*	10 µg	130-114-939
				E. coli	25 µg	130-114-942
	premium grade	OSM	Recombinant human oncostatin M IS (improved sequence)	*E. coli*	10 µg	130-114-933
				E. coli	25 µg	130-114-934
				E. coli	100 µg	130-114-936
				E. coli	1000 µg	130-114-937

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human PDGF-AA	research grade		Recombinant human platelet-derived growth factor AA	*E. coli*	2 µg	130-093-977
				E. coli	10 µg	130-093-978
				E. coli	100 µg	130-108-983
Human PDGF-AB	research grade		Recombinant human platelet-derived growth factor AB	*E. coli*	2 µg	130-094-629
				E. coli	10 µg	130-093-979
				E. coli	100 µg	130-103-442
				E. coli	1000 µg	130-108-965
Human PDGF-BB IS	research grade		Recombinant human platelet derived growth factor BB IS (improved sequence)	*Pichia pastoris*	10 µg	130-108-165
				Pichia pastoris	25 µg	130-108-164
	premium grade		Recombinant human platelet derived growth factor BB IS (improved sequence)	*Pichia pastoris*	10 µg	130-108-163
				Pichia pastoris	25 µg	130-108-162
				Pichia pastoris	100 µg	130-108-161
				Pichia pastoris	1000 µg	130-108-160
Human Pleiotrophin	research grade		Recombinant human pleiotrophin	*E. coli*	5 µg	130-108-964
				E. coli	20 µg	130-108-966
Human Prolactin	research grade	Mammo-tropin	Recombinant human prolactin	*E. coli*	50 µg	130-093-985
Human R-Spondin 1	research grade	F-spondin	Recombinant human roof plate-specific spondin 1	CHO cells	5 µg	130-105-799
				CHO cells	20 µg	130-105-800
				CHO cells	100 µg	130-108-978
				CHO cells	500 µg	130-114-824
Human R-Spondin 2	research grade		Recombinant human roof plate-specific spondin 2	CHO cells	5 µg	130-105-803
				CHO cells	20 µg	130-105-802
Human R-Spondin 3	research grade	RSPO-3	Recombinant human roof plate-specific spondin 3	CHO cells	5 µg	130-105-801
				CHO cells	20 µg	130-105-804
				CHO cells	100 µg	130-108-962
Human RANK-Ligand – soluble	research grade	TNFSF11, TRANCE, ODF	Recombinant soluble human receptor activator of NF-κB ligand	*E. coli*	2 µg	130-093-987
				E. coli	10 µg	130-093-988
				E. coli	100 µg	130-094-631
				E. coli	1000 µg	130-108-963
Human RANTES	research grade	CCL5	Recombinant human RANTES	*E. coli*	5 µg	130-093-989
				E. coli	20 µg	130-094-632
Human SCF *see page 53*	research grade	c-kit ligand, steel factor, MGF	Recombinant human stem cell factor	*E. coli*	10 µg	130-093-991
				E. coli	25 µg	130-096-692
	premium grade	c-kit ligand, steel factor, MGF	Recombinant human stem cell factor	*E. coli*	10 µg	130-096-693
				E. coli	25 µg	130-096-694
				E. coli	100 µg	130-096-695
				E. coli	1000 µg	130-096-696
Human SDF-1α	research grade	CXCL12	Recombinant human stromal cell-derived factor 1α	*E. coli*	10 µg	130-093-996
				E. coli	25 µg	130-096-137
				E. coli	100 µg	130-093-997
				E. coli	1000 µg	130-093-998

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human SHH (C24II)	research grade		Recombinant human sonic hedgehog (C24II)	*E. coli*	10 µg	130-095-717
				E. coli	25 µg	130-095-718
	premium grade		Recombinant human sonic hedgehog (C24II)	*E. coli*	10 µg	130-095-721
				E. coli	25 µg	130-095-723
				E. coli	100 µg	130-095-727
				E. coli	1000 µg	130-095-730
Human TGF-β1	premium grade		Recombinant human transforming growth factor β1	HEK293 cells	5 µg	130-095-067
				HEK293 cells	25 µg	130-095-066
				HEK293 cells	100 µg	130-108-969
				HEK293 cells	1000 µg (liquid)	130-108-971
Human TGF-β1 (CHO)	premium grade		Recombinant human transforming growth factor β1	CHO cells	5 µg	130-126-723
				CHO cells	25 µg	130-126-721
				CHO cells	100 µg	130-126-724
				CHO cells	1000 µg (liquid)	130-126-722
Human TGF-β2	research grade		Recombinant human transforming growth factor β2	HEK293 cells	10 µg	130-123-657
Human TGF-β3	research grade		Recombinant human transforming growth factor β3	HEK293 cells	5 µg (liquid)	130-094-007
				HEK293 cells	20 µg (liquid)	130-094-008
				HEK293 cells	100 µg (liquid)	130-108-981
Human TNF-α	premium grade	TNFSF2	Recombinant human tumor necrosis factor α	*E. coli*	10 µg	130-094-014
Human TNF-α	research grade	TNFSF2	Recombinant human tumor necrosis factor α	Yeast	10 µg	130-094-015
				Yeast	50 µg	130-094-017
				Yeast	100 µg	130-094-018
				Yeast	750 µg	130-094-019
				Yeast	1000 µg	130-094-020
	premium grade	TNFSF2	Recombinant human tumor necrosis factor α	Yeast	10 µg	130-094-022
				Yeast	50 µg	130-094-023
				Yeast	100 µg	130-094-024
				Yeast	1000 µg	130-094-562
Human TPO	research grade	MDGF	Recombinant human thrombopoietin	*E. coli*	10 µg	130-094-011
				E. coli	25 µg	130-095-745
				E. coli	100 µg	130-094-013
	premium grade	MDGF	Recombinant human thrombopoietin	*E. coli*	10 µg	130-095-747
				E. coli	25 µg	130-095-750
				E. coli	100 µg	130-095-752
				E. coli	1000 µg	130-095-754
Human TSLP	research grade		Recombinant human thymic stromal lymphopoietin	*E. coli*	2 µg	130-106-271
				E. coli	10 µg	130-106-270
Human VEGF (121 aa)	research grade		Recombinant human vascular endothelial growth factor (121 aa)	*E. coli*	10 µg	130-108-956
				E. coli	100 µg	130-127-426

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human VEGF (165) IS	research grade		Recombinant human vascular endothelial growth factor (165) IS (improved sequence)	*Pichia pastoris*	10 µg	130-109-383
				Pichia pastoris	25 µg	130-109-384
	premium grade		Recombinant human vascular endothelial growth factor (165) IS (improved sequence)	*Pichia pastoris*	10 µg	130-109-395
				Pichia pastoris	25 µg	130-109-396
				Pichia pastoris	100 µg	130-109-385
				Pichia pastoris	1000 µg	130-109-386

Mouse cytokines & growth factors

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Custom Cytokine			Customized fillings, bulk quantities and cytokines not available off-the-shelf can be requested under this number			130-094-808
Mouse EGF	research grade		Recombinant mouse epidermal growth factor	*E. coli*	100 µg	130-094-036
				E. coli	500 µg	130-094-037
Mouse FGF-2	research grade		Recombinant mouse fibroblast growth factor 2	*E. coli*	10 µg	130-105-787
				E. coli	50 µg	130-105-786
Mouse FGF-8b	research grade		Recombinant mouse fibroblast growth factor 8b	*E. coli*	10 µg	130-096-100
				E. coli	25 µg	130-096-101
	premium grade		Recombinant mouse fibroblast growth factor 8b	*E. coli*	10 µg	130-096-102
				E. coli	25 µg	130-096-103
				E. coli	100 µg	130-096-104
				E. coli	1000 µg	130-096-105
Mouse Flt3-Ligand	research grade		Recombinant mouse fms-related tyrosine kinase 3 ligand	*E. coli*	10 µg	130-094-038
				E. coli	100 µg	130-097-372
Mouse G-CSF	research grade		Recombinant mouse granulocyte colony-stimulating factor	*E. coli*	2 µg	130-094-039
				E. coli	10 µg	130-094-040
				E. coli	100 µg	130-094-041
Mouse GM-CSF *see page 54*	research grade		Recombinant mouse granulocyte macrophage colony-stimulating factor	*E. coli*	10 µg	130-094-043
				E. coli	25 µg	130-095-746
	premium grade		Recombinant mouse granulocyte macrophage colony-stimulating factor	*E. coli*	10 µg	130-095-742
				E. coli	25 µg	130-095-793
				E. coli	100 µg	130-095-739
				E. coli	1000 µg	130-095-735
Mouse IFN-α	research grade		Recombinant mouse interferon α	HEK293 cells	200 µL	130-093-131
				HEK293 cells	1 mL	130-093-130
Mouse IFN-γ	research grade		Recombinant mouse interferon γ	*E. coli*	10 µg	130-105-790
				E. coli	25 µg	130-105-785
	premium grade		Recombinant mouse interferon γ	*E. coli*	10 µg	130-105-782
				E. coli	25 µg	130-105-778
				E. coli	100 µg	130-105-774
				E. coli	1000 µg	130-105-773

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Mouse IL-1α	research grade		Recombinant mouse interleukin 1α	*E. coli*	2 µg	130-094-050
				E. coli	10 µg	130-094-051
Mouse IL-1β	research grade	IL-1F2, Catabolin, MCF	Recombinant mouse interleukin 1β	*E. coli*	10 µg	130-094-053
				E. coli	25 µg	130-101-680
	premium grade	IL-1F2, Catabolin, MCF	Recombinant mouse interleukin 1β	*E. coli*	10 µg	130-101-681
				E. coli	25 µg	130-101-682
				E. coli	100 µg	130-101-683
				E. coli	1000 µg	130-101-684
Mouse IL-2 IS	research grade		Recombinant mouse interleukin 2 IS (improved sequence)	*E. coli*	10 µg	130-120-330
				E. coli	25 µg	130-120-662
	premium grade		Recombinant mouse interleukin 2 IS (improved sequence)	*E. coli*	10 µg	130-120-331
				E. coli	25 µg	130-120-332
				E. coli	100 µg	130-120-333
				E. coli	1000 µg	130-120-334
Mouse IL-3 IS	research grade		Recombinant mouse interleukin 3 IS (improved sequence)	*E. coli*	10 µg	130-096-687
				E. coli	25 µg	130-096-688
	premium grade		Recombinant mouse interleukin 3 IS (improved sequence)	*E. coli*	10 µg	130-099-508
				E. coli	25 µg	130-099-509
				E. coli	100 µg	130-099-510
				E. coli	1000 µg	130-099-511
Mouse IL-4 *see page 55*	research grade		Recombinant mouse interleukin 4	*E. coli*	10 µg	130-094-061
				E. coli	25 µg	130-097-757
	premium grade		Recombinant mouse interleukin 4	*E. coli*	10 µg	130-097-761
				E. coli	25 µg	130-097-760
				E. coli	100 µg	130-097-759
				E. coli	1000 µg	130-097-758
Mouse IL-5	research grade		Recombinant mouse interleukin 5	*E. coli*	5 µg	130-105-789
				E. coli	25 µg	130-105-788
Mouse IL-6 *see page 56*	research grade		Recombinant mouse interleukin 6	*E. coli*	10 µg	130-094-065
				E. coli	25 µg	130-096-683
	premium grade		Recombinant mouse interleukin 6	*E. coli*	10 µg	130-096-682
				E. coli	25 µg	130-096-684
				E. coli	100 µg	130-096-685
				E. coli	1000 µg	130-096-686
Mouse IL-7	research grade		Recombinant mouse interleukin 7	*E. coli*	2 µg	130-094-636
				E. coli	10 µg	130-094-066
				E. coli	100 µg	130-098-222
				E. coli	2×500 µg	130-108-957
Mouse IL-10	research grade		Recombinant mouse interleukin 10	*E. coli*	2 µg	130-094-067
				E. coli	10 µg	130-094-068
Mouse IL-12	research grade		Recombinant mouse interleukin 12	HEK293 cells	5 µg	130-096-707
				HEK293 cells	25 µg	130-096-708
				HEK293 cells	100 µg	130-096-795
Mouse IL-13	research grade		Recombinant mouse interleukin 13	*E. coli*	2 µg	130-094-639
				E. coli	10 µg	130-094-070

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Mouse IL-15	research grade		Recombinant mouse interleukin 15	*E. coli*	2 µg	130-094-071
				E. coli	10 µg	130-094-072
				E. coli	100 µg	130-094-640
Mouse IL-17A	research grade	IL-17	Recombinant mouse interleukin 17A	*E. coli*	5 µg	130-103-448
				E. coli	25 µg	130-103-449
				E. coli	100 µg	130-108-954
Mouse IL-17F	research grade		Recombinant mouse interleukin 17F	*E. coli*	5 µg	130-103-450
				E. coli	25 µg	130-103-451
Mouse IL-21	research grade		Recombinant mouse interleukin 21	*E. coli*	2 µg	130-108-948
				E. coli	10 µg	130-108-949
Mouse IL-22	research grade		Recombinant mouse interleukin 22	*E. coli*	2 µg	130-096-298
				E. coli	10 µg	130-096-283
				E. coli	100 µg	130-108-955
Mouse IL-23	research grade		Recombinant mouse interleukin 23	HEK293 cells	5 µg	130-096-676
				HEK293 cells	25 µg	130-096-677
Mouse IL-25	research grade	IL-17E	Recombinant mouse interleukin 25	*E. coli*	5 µg	130-115-653
Mouse IL-33	research grade		Recombinant mouse interleukin 33	*E. coli*	2 µg	130-112-958
				E. coli	10 µg	130-112-961
Mouse LIF *see page 57*	research grade		Recombinant mouse leukemia inhibitory factor	*E. coli*	10 µg	130-095-772
				E. coli	25 µg	130-095-775
	premium grade		Recombinant mouse leukemia inhibitory factor	*E. coli*	10 µg	130-095-777
				E. coli	25 µg	130-095-778
				E. coli	100 µg	130-095-779
				E. coli	10×100 µg	130-099-895
Mouse M-CSF *see page 58*	research grade		Recombinant mouse macrophage colony-stimulating factor	*E. coli*	10 µg	130-094-129
				E. coli	25 µg	130-101-706
	premium grade		Recombinant mouse macrophage colony-stimulating factor	*E. coli*	10 µg	130-101-703
				E. coli	25 µg	130-101-700
				E. coli	100 µg	130-101-704
				E. coli	1000 µg	130-101-705
Mouse MIG	research grade	CXCL9	Recombinant mouse monokine induced by interferon γ	*E. coli*	5 µg	130-094-644
				E. coli	20 µg	130-094-128
Mouse Noggin	research grade		Recombinant mouse noggin	*E. coli*	5 µg	130-103-457
				E. coli	20 µg	130-103-458
				E. coli	100 µg	130-103-459
Mouse RANK-Ligand – soluble	research grade	TNFSF11	Recombinant soluble mouse receptor activator of NF-κB ligand	*E. coli*	2 µg	130-094-645
				E. coli	10 µg	130-094-076
				E. coli	100 µg	130-094-646
Mouse RANTES	research grade	CCL5	Recombinant mouse RANTES	*E. coli*	20 µg	130-094-077
Mouse SCF	research grade	c-kit ligand, steel factor, MGF	Recombinant mouse stem cell factor	*E. coli*	10 µg	130-094-079
				E. coli	25 µg	130-101-741
	premium grade	c-kit ligand, steel factor, MGF	Recombinant mouse stem cell factor	*E. coli*	10 µg	130-101-693
				E. coli	25 µg	130-101-694
				E. coli	100 µg	130-101-697
				E. coli	1000 µg	130-101-698

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Mouse SDF-1α	research grade	CXCL12	Recombinant mouse stromal cell–derived factor 1α	*E. coli*	2 µg	130-094-081
				E. coli	10 µg	130-094-647
Mouse TNF-α	research grade	TNFSF2	Recombinant mouse tumor necrosis factor α	*E. coli*	10 µg	130-101-688
				E. coli	25 µg	130-101-687
	premium grade	TNFSF2	Recombinant mouse tumor necrosis factor α	*E. coli*	10 µg	130-101-689
				E. coli	25 µg	130-101-690
				E. coli	100 µg	130-101-691
				E. coli	1000 µg	130-101-692
Mouse TPO	research grade	MDGF	Recombinant mouse thrombopoietin	*E. coli*	2 µg	130-094-082
				E. coli	10 µg	130-094-083
				E. coli	100 µg	130-096-301
				E. coli	1000 µg	130-108-958
Mouse VEGF	research grade		Recombinant mouse vascular endothelial growth factor	Insect cells	5 µg	130-094-086
				Insect cells	20 µg	130-094-087

Rat cytokines & growth factors

Product	Quality grade	Description	Source	Content	Order no.
Rat IFN-γ	research grade	Recombinant rat interferon γ	*E. coli*	100 µg	130-094-089
Rat IL-2	research grade	Recombinant rat interleukin 2	*E. coli*	5 µg	130-127-429
			E. coli	20 µg	130-127-428

Human EGF

Overview
EGF stands for epidermal growth factor. Human EGF is a recombinant protein optimized for use in cell culture, differentiation studies, and functional assays.

Background information
Epidermal growth factor (EGF) is the prototype of the large family of EGF-like proteins with a common structural motif comprising three intramolecular disulfide bonds. EGF is produced by various cell types like mammary gland cells, gut epithelial cells, and cells in the nervous system and the kidney. Production of EGF is induced by testosterone and inhibited by estrogens. EGF stimulates the proliferation and differentiation of mesenchymal cells, acts as a mitogen for fibroblasts, epithelial and endothelial cells, and promotes colony formation of epidermal cells.

Applications
Human EGF can be used for a variety of applications, including:
- Proliferation and differentiation of a wide variety of cell types deriving from ectoderm and mesoderm.

Biological activity
Proliferation of 3T3 cells
Premium grade: ≥ 0.8×10^6 IU/mg (typical activity: 2×10^6 IU/mg)
Research grade: ≥ 0.5×10^6 IU/mg

Product	Source	Content	Order no.
Human EGF – research grade For research use only	*E. coli*	100 µg	130-093-825
Human EGF – premium grade For research use only	*E. coli*	100 µg	130-097-749
Human EGF – premium grade For research use only	*E. coli*	500 µg	130-097-750
Human EGF – premium grade For research use only	*E. coli*	1000 µg	130-097-751

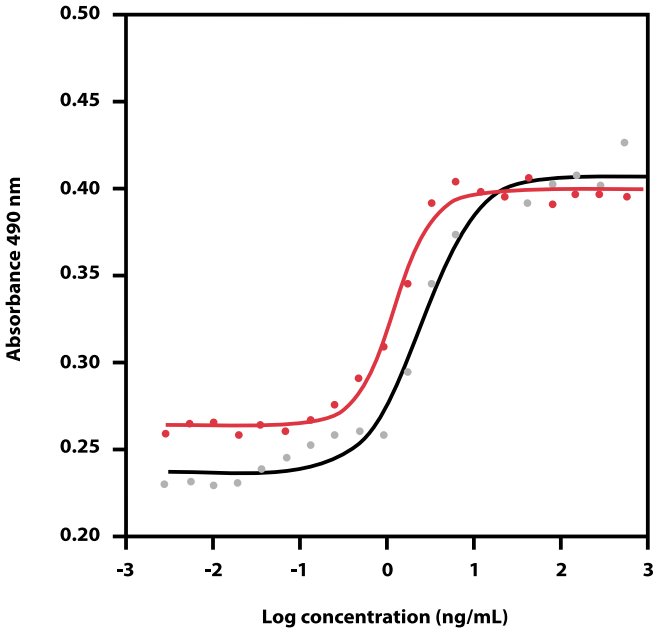


Figure 1: Human EGF activity assay. The biological activity of Human EGF is determined by proliferation assay using 3T3 cells. Activity of Human EGF, premium grade, (red line) was compared to another commercially available product (black line).

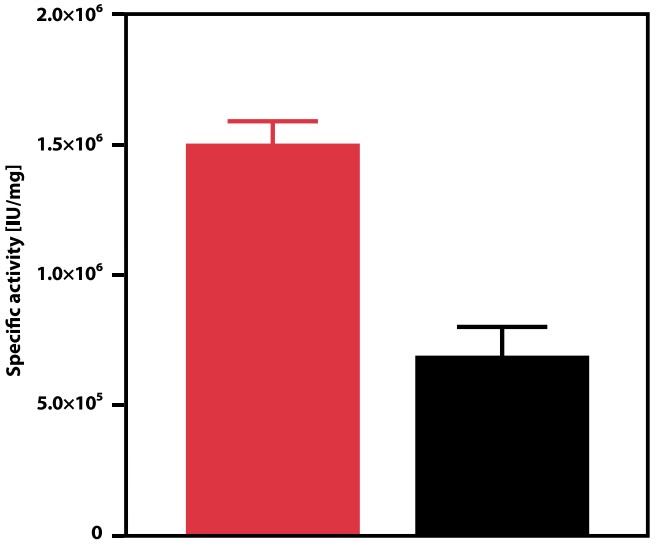


Figure 2: Human EGF biological activity. Activity of Human EGF, premium grade, (red bar) was compared to another commercially available product (black bar).

Selected references
1. Diaz-Guerra E. *et al.* (2012) FASEB J. 26 (9): 3844–3853.
2. Robinson, C. J. and Gaines-Das, R. (1996) Growth Factors 13: 163–170.

Human FGF-2 IS

Overview

FGF-2 IS stands for fibroblast growth factor 2 "Improved Sequence", also termed fibroblast growth factor basic (FGF-b) or basic FGF. Human FGF-2 IS is a variant of Human FGF-2 with a proprietary amino acid substitution. Human FGF-2 IS is covered by patent nos. US10,336,799 and EP2930181B1. Human FGF-2 IS is a recombinant protein optimized for use in cell culture, differentiation studies, and functional assays.

Background information

Fibroblast growth factor 2 (FGF-2), also termed fibroblast growth factor basic (FGF-b) or basic FGF (bFGF), belongs to the FGF family. It functions as a wide-spectrum mitogenic, angiogenic, and neurotrophic factor and stimulates the proliferation of a wide variety of cells including mesenchymal, neuroectodermal, and endothelial cells. FGF-2 has been implicated in a multitude of physiological and pathological processes, including limb development, angiogenesis, wound healing, and tumor growth. Human FGF-2 IS is an engineered FGF-2 variant with increased thermostability and higher resistance to proteases, and retains the same biological properties as naturally occurring FGF-2.

Applications

Human FGF-2 can be used for a variety of applications, including:

- Stimulation of proliferation and differentiation of several cell types, such as mesenchymal stromal cells, neural cells, and endothelial cells.
- Long-term maintenance and propagation of undifferentiated embryonic and induced pluripotent stem cells.
- Differentiation of neural cells starting from embryonic and induced pluripotent stem cell cultures.

Biological activity

Proliferation of 3T3 cells (NIBSC 90/712)
Premium grade: ≥ 2×10^6 IU/mg
Research grade: ≥ 1×10^6 IU/mg

Product	Source	Content	Order no.
Human FGF-2 IS – research grade For research use only	*E. coli*	10 µg	130-104-925
Human FGF-2 IS – research grade For research use only	*E. coli*	50 µg	130-104-921
Human FGF-2 IS – premium grade For research use only	*E. coli*	10 µg	130-104-918
Human FGF-2 IS – premium grade For research use only	*E. coli*	50 µg	130-104-924
Human FGF-2 IS – premium grade For research use only	*E. coli*	200 µg	130-104-922
Human FGF-2 IS – premium grade For research use only	*E. coli*	1000 µg	130-104-923

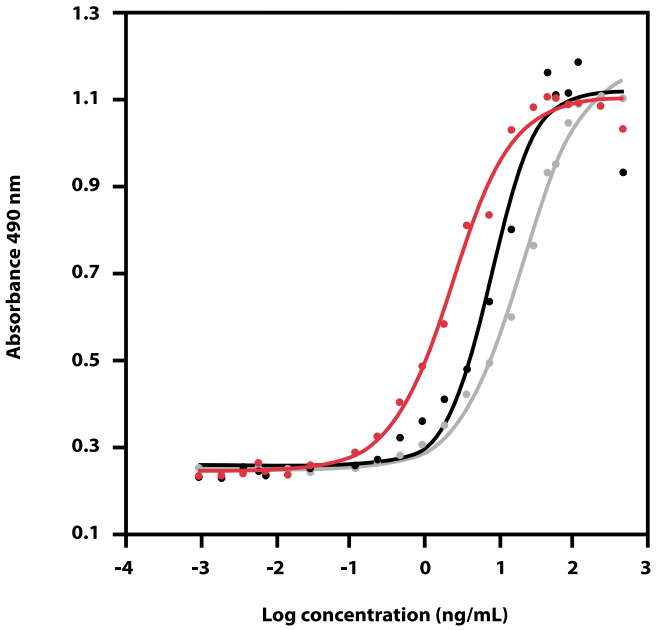


Figure 1: Human FGF-2 IS activity assay. The biological activity of Human FGF-2 IS, premium grade, was determined by proliferation assay using 3T3 cells. Activity of Human FGF-2 IS, premium grade, (red line) was compared to wild type Human FGF-2 (black line), and another commercially available product (gray line).

Selected references

1. Robinson, C. J. and Gaines-Das, R. (1994) Growth Factors 11: 9–16.

Human Flt3-Ligand

Overview

Recombinant human Flt3-Ligand can be used to generate and expand hematopoietic stem cells or to differentiate the hematopoietic progenitors. In the myeloid lineage this cytokine is crucial for dendritic cells and in the lymphoid lineage it its involved in B and NK cell differentiation. Human Flt3-Ligand recombinant protein is developed for use in cell culture, differentiation studies, and functional assays.

Background information

Fms-related tyrosin kinase 3 ligand (Flt3-Ligand) is a growth factor that regulates early hematopoiesis. Flt3-Ligand belongs to a small family of α-helical cytokines and promotes in synergy with other growth factors like G-CSF, GM-CSF, SCF, and IL-3 the proliferation and differentiation of primitive hematopoietic stem cells. Early B cell lineage differentiation as well as expansion of monocytes and immature dendritic cells is stimulated. Flt3-Ligand is expressed by T lymphocytes and bone marrow stromal fibroblasts as a membrane-bound and a soluble isoform. Both isoforms signal through the tyrosine kinase receptor Flt3/Flk-2, which is restricted to cells of hematopoietic origin. Human Flt3-Ligand is also active on mouse cells.

Applications

Human Flt3-Ligand can be used for a variety of applications, including:

- *In vitro* expansion of $CD34^+$ hematopoietic progenitor cells.
- Differentiation of ES-derived cells towards the hematopoietic lineage.
- *In vitro* generation of Langerhans cells, dendritic cells, or eosinophils from $CD34^+$ cells.

Biological activity

Proliferation of OCI-AML5 cells (NIBSC 96/532)
Premium grade: ≥ 5×10^5 U/mg
Research grade: ≥ 2×10^5 U/mg

Product	Source	Content	Order no.
Human Flt3-Ligand – research grade For research use only	*E. coli*	10 µg	130-093-854
Human Flt3-Ligand – research grade For research use only	*E. coli*	25 µg	130-096-474
Human Flt3-Ligand – premium grade For research use only	*E. coli*	10 µg	130-096-476
Human Flt3-Ligand – premium grade For research use only	*E. coli*	25 µg	130-096-477
Human Flt3-Ligand – premium grade For research use only	*E. coli*	100 µg	130-096-479
Human Flt3-Ligand – premium grade For research use only	*E. coli*	1000 µg	130-096-480

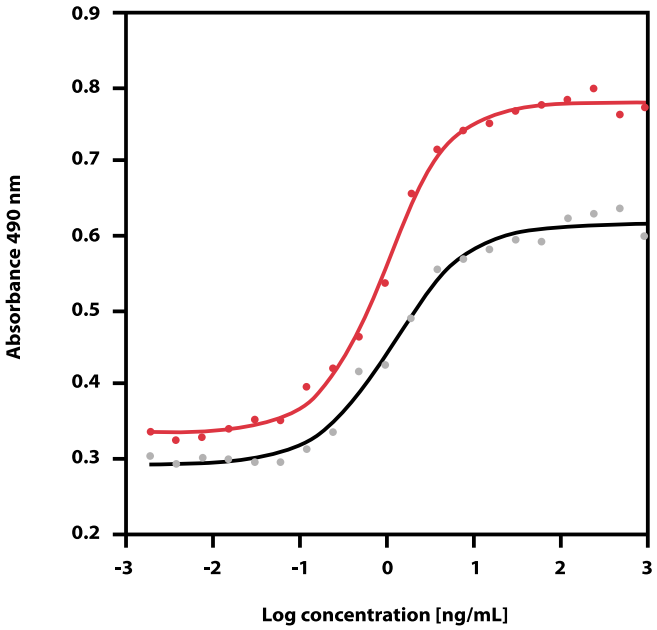


Figure 1: Human Flt3-Ligand activity assay. The biological activity of Human Flt3-Ligand is determined by proliferation assay using OCI-AML5 cells. Activity of Human Flt3-Ligand, premium grade, (red line) was compared to another commercially available product (black line).

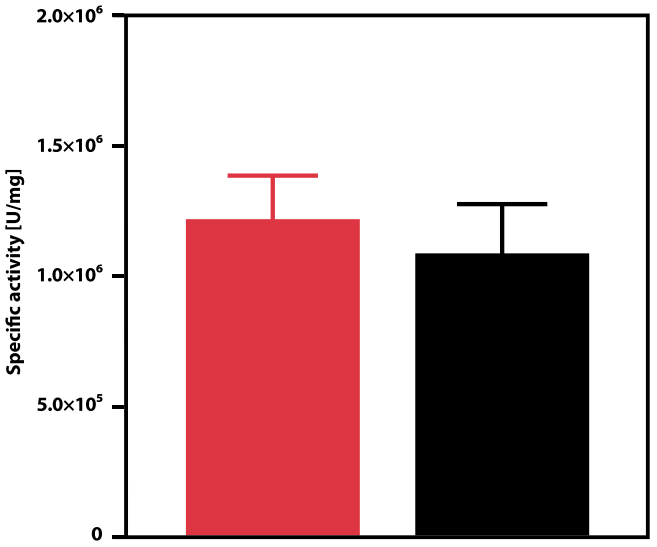


Figure 2: Human Flt3-Ligand biological activity. Activity of Human Flt3-Ligand, premium grade, (red bar) was compared to another commercially available product (black bar).

Selected references
1. Dussiau, C. *et al.* (2015) Oncotarget. 6: 18956–18965.
2. Laurenti, E. *et al.* (2015) Cell Stem Cell 16 (3): 302–313.
3. Brault, J. *et al.* (2014) Biores Open Access 3 (6): 311–326.
4. Velardi, E. *et al.* (2014) J. Exp. Med. 211 (12): 2341–2349.
5. Narla, A. *et al.* (2011) Blood 118 (8): 2296–2304.
6. Meyer, C. and Drexler, H.G. (1999) Leuk. Lymphoma 32: 577–581.

Human G-CSF

Overview
G-CSF stands for granulocyte colony stimulating factor. Human G-CSF is a recombinant protein optimized for use in cell culture, differentiation studies, and functional assays.

Background information
Granulocyte colony stimulating factor (G-CSF) is a hematopoietic growth factor that affects proliferation and differentiation especially of progenitors of the neutrophil and granulocyte lineages. It is produced mainly by monocytes and macrophages and a variety of other cells like astrocytes, fibroblasts and endothelial cells in response to specific stimulation, for instance by endotoxin, TNF-α and IFN-γ. Furthermore, G-CSF enhances the survival and influences the immunological functions of mature neutrophils. Thus, in addition to its properties as a hematopoietic growth factor G-CSF also acts as a mediator of host defense against infection and inflammatory response.

Applications
Human G-CSF can be used for a variety of applications, including:
- Growth promotion and differentiation of cells of the neutrophil lineage.
- Induction of colony formation of normal and leukemic bone marrow cells in soft agar cultures.

Biological activity
Proliferation of NFS-60 cells (NIBSC 88/502)
Premium grade: ≥ 4×10^7 IU/mg
Research grade: ≥ 2×10^7 IU/mg

Product	Source	Content	Order no.
Human G-CSF – research grade For research use only	*E. coli*	10 µg	130-096-345
Human G-CSF – research grade For research use only	*E. coli*	25 µg	130-096-346
Human G-CSF – premium grade For research use only	*E. coli*	10 µg	130-093-860
Human G-CSF – premium grade For research use only	*E. coli*	25 µg	130-096-347
Human G-CSF – premium grade For research use only	*E. coli*	100 µg	130-093-861
Human G-CSF – premium grade For research use only	*E. coli*	1000 µg	130-094-265

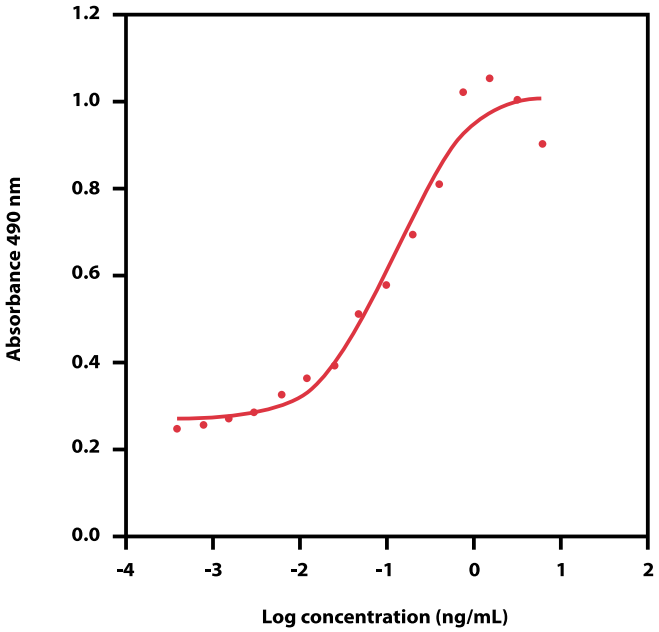


Figure 1: Human G-CSF activity assay. The biological activity of Human G-CSF is determined by proliferation assay using NFS-60 cells.

Selected references
1. Shirafuji, N. *et al.* (1989) Exp. Hematol. 17: 116–119.
2. Dighe N. *et al.* (2014) PLoS One 9 (8): e104805.

Human GM-CSF

Overview

Recombinant human GM-CSF induces the differentiation of granulocytes, monocytes, and macrophages. The hematopoietic cytokine is a crucial part of the immune/inflammatory path and serves as both a survival and activation signal for mature myeloid cells. The recombinant granulocyte-macrophage colony-stimulating factor (GM-CSF) has been developed for use in cell culture, differentiation studies, and functional assays.

Background information

GM-CSF is a hematopoietic growth factor, which is essential for proliferation and development of granulocyte and monocyte/macrophage progenitors. It also functions as a growth factor for erythroid and megakaryocytic precursor cells in conjunction with erythropoietin. GM-CSF is secreted by various cell types including T cells, macrophages, endothelial cells, and fibroblasts in response to inflammatory stimuli and cytokines. In addition, GM-CSF is a potent chemoattractant for neutrophils and eosinophils and enhances the effector functions of neutrophils and macrophages.

Applications

Human GM-CSF can be used for a variety of applications including:

- Cultivation of hematopoietic progenitor cells from human bone marrow in semi-solid medium.
- *In vitro* generation of Mo-DCs together with Human IL-4.
- *In vitro* differentiation of $CD34^+$ cells towards eosinophils.
- Migration assays for eosinophils.

Biological activity

Proliferation of TF-1 cells (NIBSC 88/646)
Premium grade: ≥ 5×10^6 IU/mg (typical activity: 1.2×10^7 IU/mg)
Research grade: ≥ 2×10^6 IU/mg

Product	Source	Content	Order no.
Human GM-CSF – research grade For research use only	*E. coli*	10 µg	130-093-862
Human GM-CSF – research grade For research use only	*E. coli*	50 µg	130-095-372
Human GM-CSF – premium grade For research use only	*E. coli*	10 µg	130-093-864
Human GM-CSF – premium grade For research use only	*E. coli*	50 µg	130-093-865
Human GM-CSF – premium grade For research use only	*E. coli*	100 µg	130-093-866
Human GM-CSF – premium grade For research use only	*E. coli*	500 µg	130-093-867
Human GM-CSF – premium grade For research use only	*E. coli*	1000 µg	130-093-868

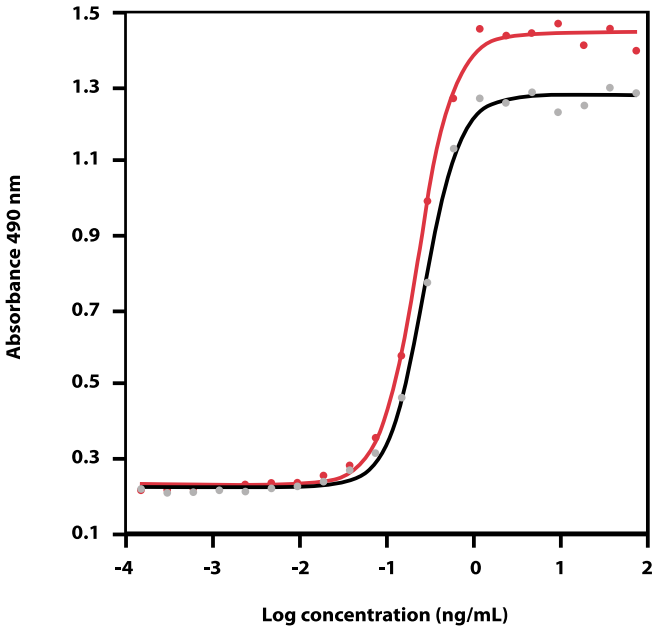


Figure 1: Human GM-CSF activity assay. The biological activity of Human GM-CSF, premium grade was determined by proliferation assay using TF-1 cells. Activity of Human GM-CSF, premium grade, (red line) was compared to another commercially available product (black line).

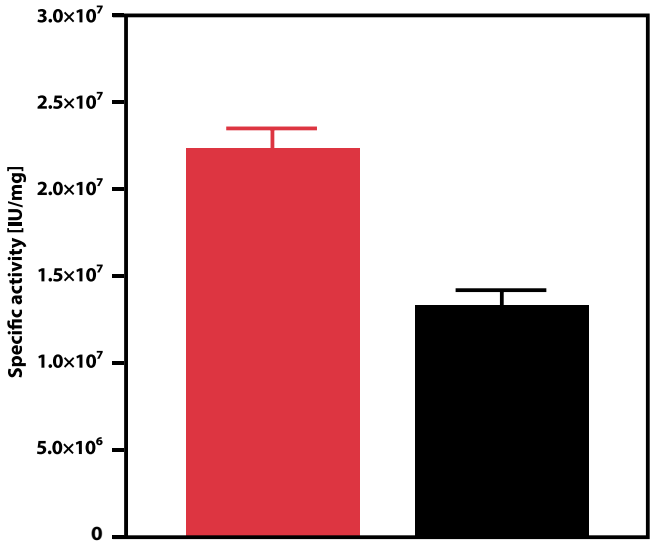


Figure 2: Human GM-CSF biological activity. Activity of Human GM-CSF, premium grade (red bar) was compared to another commercially available product (black bar).

Selected references
1. Kitamura, T. *et al.* (1989) J. Cell. Physiol. 140: 323–334.
2. Ulfman, L. H. *et al.* (2008) J. Immunol. 180: 5512–5519.
3. Bacher, P. *et al.* (2014) Mucosal Immunol 7 (4): 916–928.
4. Brault, J. *et al.* (2014) Biores Open Access 3 (6): 311–326.
5. Chase A. J. *et al.* (2011) J. Infect. Dis. 203: 1763–1774.
6. Dighe N. *et al.* (2014) PLoS One 9 (8): e104805.
7. Kaebisch R. *et al.* (2014) J. Immunol. 192: 316–323.
8. Koning F. A. *et al.* (2009) J. Virol. 83: 9474–9485.
9. Laurenti, E. *et al.* (2015) Cell Stem Cell 16 (3): 302–313.
10. Guery L. *et al.* (2014) Blood 118: 4694–4704.

Human IL-2 IS

Overview

Recombinant human IL-2 (interleukin 2) stimulates growth and differentiation of cells of the lymphoid lineage, such as T, NK, and B cells. IL-2 is a potent immunomodulatory cytokine, as it prevents autoimmunity and has key functions during infections. IL-2 IS stands for interleukin 2 "Improved Sequence", also termed aldesleukin, and is a variant of IL-2 with a serine substitution for the native cysteine at amino acid position 125. Human IL-2 IS is a recombinant protein optimized for use in cell culture, differentiation studies, and functional assays, and possesses the same biological properties as naturally occurring IL-2.

Background information

IL-2, a potent lymphoid cell growth factor, is a typical four α-helix bundle cytokine. It is produced by activated T cells, especially the $CD4^+$ T helper cell population. It plays an important role in both the activation and maintenance of immune responses and in lymphocyte development. IL-2 promotes proliferation and differentiation of T cells, NK cells and B cells and is involved in the elimination of self-reactive T cells. IL-2 signals through a receptor complex consisting of IL-2 receptor α-chain (CD25), β- chain, and common γ-chain. The latter two are also used for IL-15 signaling.

Applications

Human IL-2 IS can be used for a variety of applications including:

- *In vitro* activation and propagation of T cells, e.g., in combination with the T Cell Activation/Expansion Kit, human.
- *In vitro* stimulation of cytolytic function and expansion of NK cells, e.g., using the NK Cell Activation/Expansion Kit, human.
- Generation of lymphokine-activated killer (LAK) cells or cytokine-induced killer (CIK) cells.

Biological activity

Proliferation of CTLL-2 cells (NIBSC 86/504)
Premium grade: ≥ 5×10^6 IU/mg (typical activity: 9×10^6 IU/mg)
Research grade: ≥ 3×10^6 IU/mg

Product	Source	Content	Order no.
Human IL-2 IS – research grade For research use only	*E. coli*	10 µg	130-097-742
Human IL-2 IS – research grade For research use only	*E. coli*	50 µg	130-097-743
Human IL-2 IS – premium grade For research use only	*E. coli*	10 µg	130-097-744
Human IL-2 IS – premium grade For research use only	*E. coli*	50 µg	130-097-745
Human IL-2 IS – premium grade For research use only	*E. coli*	200 µg	130-097-746
Human IL-2 IS – premium grade For research use only	*E. coli*	1000 µg	130-097-748

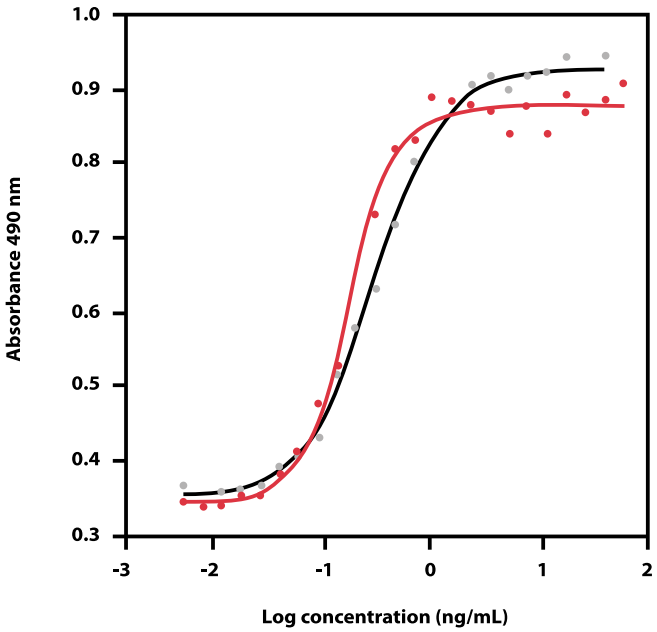


Figure 1: Human IL-2 IS activity assay. Activity of Human IL-2 IS, premium grade (red line) was compared to commercially available aldesleukin (black line).

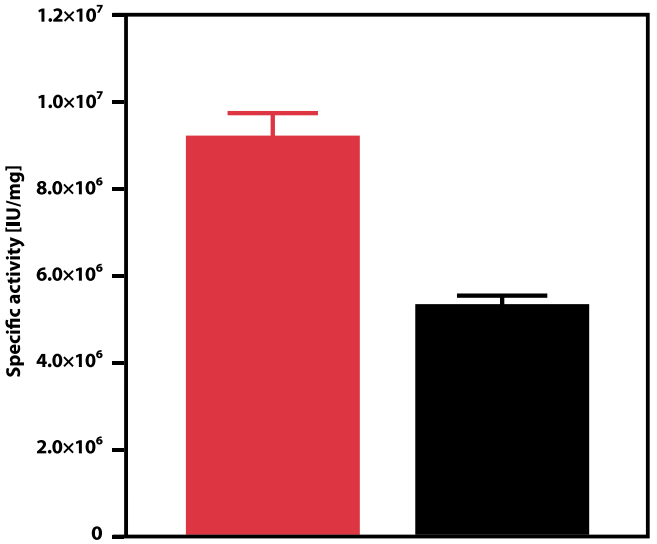


Figure 2: Human IL-2 IS biological activity. Activity of Human IL-2 IS, premium grade, (red bar) was compared to another commercially available product (black bar).

Selected references
1. Pallett, L. J. *et al.* (2015) Nat Med 21 (6): 591–600.
2. Fuchs, S. *et al.* (2014) Eur. J. Immunol. 44 (10): 3129–3140.
3. Engelmann S. *et al.* (2013) J. Immunol. 191 (10): 4950–4959.
4. Valignat, M. P. *et al.* (2013) Biophys. J. 104 (2): 322–331.
5. Fallarini S. *et al.* (2012) Br J Pharmakon 167 (7): 1533–1549.
6. Ng, S. B. *et al.* (2011) Blood 118 (18): 4919–4929.
7. Nguyen, T. L. *et al.* (2011) J. Immunol. 187 (4): 1745–1753.

Human IL-4

Overview

Recombinant human IL-4 (interleukin 4) can be used for T_H2 differentiation of T cells and stimulation of B cells. The pleiotropic cytokine is associated with allergies and asthma, as it plays a central role in humoral and adaptive immune responses. The recombinant protein IL-4 is optimized for use in functional assays, differentiation studies, and cell culture.

Background information

Interleukin 4 (IL-4) is a pleiotropic cytokine and plays a central role in humoral and adaptive immune responses. IL-4 is predominantly secreted by activated $CD4^+$ memory and effector T_H2 cells, basophils, and mast cells. It promotes the proliferation and differentiation of B cells, as well as immunoglobulin isotype switching, and MHC class II antigen and low-affinity IgE receptor expression. Furthermore, IL-4 induces the differentiation of naive $CD4^+$ T cells into helper T_H2 cells, while suppressing T_H1 development, and promotes chemotaxis of mast cells and basophils. Excessive IL-4 production and mechanisms involving T_H2 types have been associated with immunological disorders, such as IgE-mediated allergy.

Applications

Human IL-4 can be used for a variety of applications including:

- *In vitro* generation of Mo-DCs together with GM-CSF.
- *In vitro* differentiation of naive $CD4^+$ T cells towards T_H2 cells.

Biological activity

Proliferation of TF-1 cells (NIBSC 88/656)
Premium grade: ≥ 5×10^6 IU/mg (typical activity: 8×10^6 IU/mg)
Research grade: ≥ 2×10^6 IU/mg

Product	Source	Content	Order no.
Human IL-4 – research grade For research use only	*E. coli*	5 µg	130-093-915
Human IL-4 – research grade For research use only	*E. coli*	10 µg	130-095-373
Human IL-4 – research grade For research use only	*E. coli*	25 µg	130-093-917
Human IL-4 – research grade For research use only	*E. coli*	100 µg	130-094-117
Human IL-4 – premium grade For research use only	*E. coli*	5 µg	130-093-919
Human IL-4 – premium grade For research use only	*E. coli*	10 µg	130-093-920
Human IL-4 – premium grade For research use only	*E. coli*	25 µg	130-093-921
Human IL-4 – premium grade For research use only	*E. coli*	100 µg	130-093-922
Human IL-4 – premium grade For research use only	*E. coli*	1000 µg	130-093-924

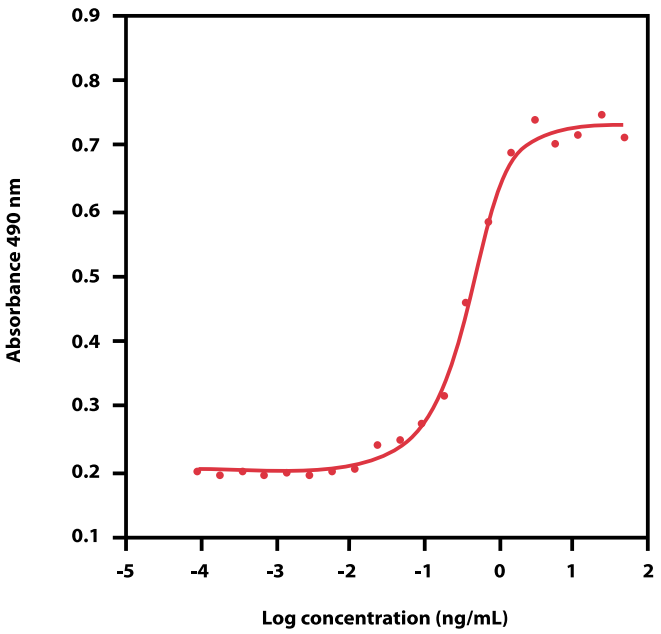


Figure 1: Human IL-4 activity assay. The biological activity of Human IL-4, premium grade was determined by proliferation assay using TF-1 cells.

Selected references
1. Kitamura, T. *et al.* (1991) Int. Immunol. 3: 571–577.
2. Zhu, J. *et al.* (2006) Proc. Natl. Acad. Sci. U.S.A. 103: 18214–18219.
3. Kandler *et al.* (2006) Int. Immunol. 18: 1729–1736.
4. Bacher, P. *et al.* (2014) Mucosal Immunol 7 (4): 916–928.
5. Chase A. J. *et al.* (2011) J. Infect. Dis. 203: 1763–1774.
6. Grötsch, B. *et al.* (2014) J. Exp. Med. 211 (11): 2199–2212.
7. Herr, F. *et al.* (2014) J. Immunol. 192: 5660–5670.
8. Kaebisch R. *et al.* (2014) J. Immunol. 192: 316–323.
9. Kassianos A. J. *et al.* (2013) Nephrol. Dial. Transplant. 28: 303–312.
10. Perriard G. *et al.* (2015) J. Neuroinflammation 12: 119.
11. Guery L. *et al.* (2014) Blood 118: 4694–4704.

Human IL-7

Overview

Recombinant human IL-7 (interleukin 7) stimulates the development of lymphoid progenitors, T, and B cells. The hematopoietic cytokine is crucial for the proliferation of T and B cells, their survival, and homeostasis. Optimized for use in cell culture, functional assays, and differentiation studies.

Background information

IL-7 is a member of the type I cytokine family. The primary sources of IL-7 are non-hematopoietic stromal cells in bone marrow, thymus, and lymphoid organs and tissues. It is a pleiotropic cytokine with central roles in modulating T cell development and peripheral T cell homeostasis. IL-7 can act both as a T cell growth factor as well as a critical anti-apoptotic survival factor for naive and memory T cells. IL-7 is related to IL-2 and signals through a heterodimeric receptor composed of the common cytokine signaling γ-chain and IL-7 receptor α-chain.

Applications

Human IL-7 can be used for a variety of applications, including:

- *In vitro* T cell expansion.
- *In vitro* T cell priming.
- *In vitro* differentiation of T cells and iNKT cells.
- Investigation of IL-7 mediated signaling pathways.

Biological activity

Proliferation of 2E8 cells (NIBSC 90/530)
Premium grade: ≥ 5×10^7 U/mg (typical activity: 1.5×10^8 U/mg)
Research grade: ≥ 2×10^7 U/mg

Product	Source	Content	Order no.
Human IL-7 – research grade For research use only	*E. coli*	10 µg	130-093-937
Human IL-7 – research grade For research use only	*E. coli*	25 µg	130-095-367
Human IL-7 – premium grade For research use only	*E. coli*	10 µg	130-095-361
Human IL-7 – premium grade For research use only	*E. coli*	25 µg	130-095-362
Human IL-7 – premium grade For research use only	*E. coli*	100 µg	130-095-363
Human IL-7 – premium grade For research use only	*E. coli*	1000 µg	130-095-364

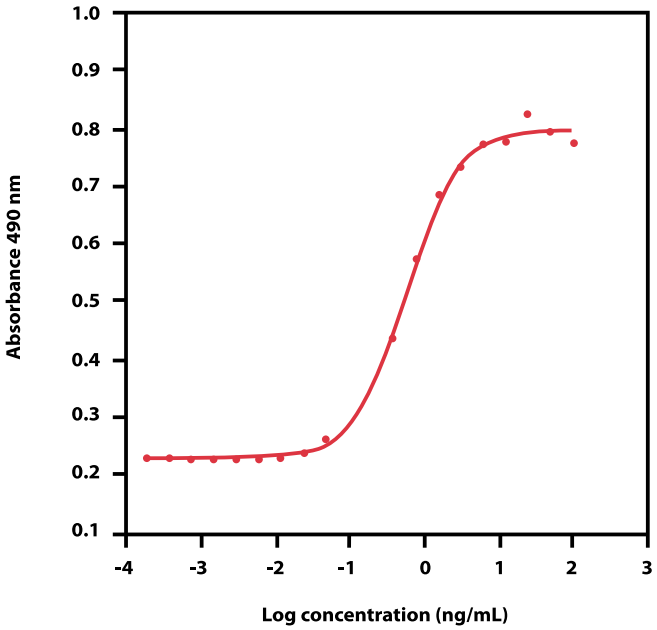


Figure 1: Human IL-7 activity assay. The biological activity of Human IL-7, premium grade was determined by proliferation assay using mouse 2E8 cells. The assay was calibrated with the reference standard for human IL-7 (NIBSC 90/530) provided by the National Institute for Biological Standards and Control.

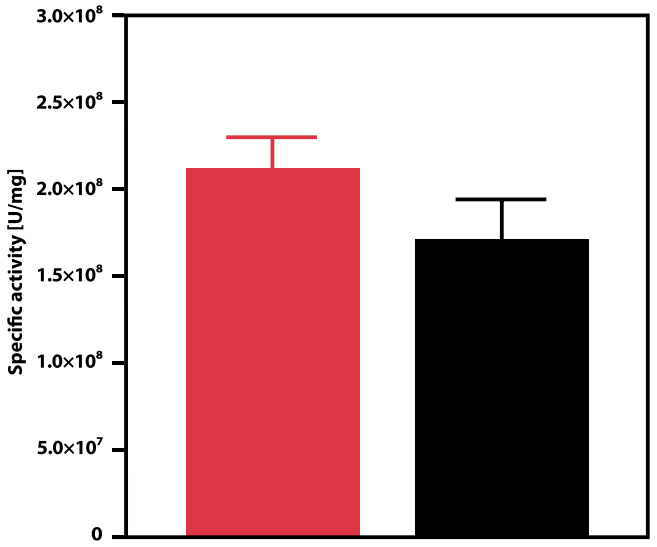


Figure 2: Human IL-7 biological activity. Activity of Human IL-7, premium grade (red bar) was compared to another commercially available product (black bar).

Selected references
1. Ishihara, K. *et al.* (1991) Dev. Immunol. 1: 149–161.
2. Dietz, L. *et al.* (2010) Toxicol. Sci. 117 (2): 336–347.
3. Dussiau, C. *et al.* (2015) Oncotarget. 6: 18956–18965.
4. Engelmann S. *et al.* (2013) J. Immunol. 191 (10): 4950–4959.
5. Laurenti, E. *et al.* (2015) Cell Stem Cell 16 (3): 302–313.
6. Velardi, E. *et al.* (2014) J. Exp. Med. 211 (12): 2341–2349.

Human IL-15

Overview

Recombinant human IL-15 (interleukin 15) promotes proliferation of activated T, NK, and B cells . The regulatory cytokine IL-15 has important diverse roles in the immune system. It is structurally related to IL-2 and they share many functional characteristics. The recombinant protein is optimized for use in cell culture, differentiation studies, and functional assays.

Background information

IL-15 is a member of the four α-helix bundle cytokine family. It is produced by different cell types, including epithelial cells, monocytes, muscle and placenta cells. IL-15 is a potent lymphoid cell growth factor. It stimulates the proliferation of activated T cells and promotes the generation of cytotoxic T lymphocytes (CTLs). IL-15 also induces the generation, proliferation, and activation of NK cells as well as B cell growth and immunoglobulin production. In addition, IL-15 is important for the maintenance of $CD8^+$ memory T cells. For binding and signaling IL-15 uses the unique IL-15 receptor α-chain, but shares the β- and γ-chain of the IL-2 receptor.

Applications

Human IL-15 can be used for a variety of applications, including:

- Activation and expansion of NK and NKT cells.
- *In vitro* differentiation of NK cells, e.g., from purified $CD34^+$ cells.
- *In vitro* T cell expansion, e.g., of naive $CD8^+$ T cells, and T cell activation, e.g., of CTLs.

Biological activity

Proliferation of CTLL-2 cells (NIBSC 95/554)
Premium grade: ≥ 5×10^6 U/mg (typical activity: 1.1×10^7 U/mg)
Research grade: ≥ 2×10^6 U/mg

Product	Source	Content	Order no.
Human IL-15 – research grade For research use only	*E. coli*	10 µg	130-093-955
Human IL-15 – research grade For research use only	*E. coli*	25 µg	130-095-760
Human IL-15 – premium grade For research use only	*E. coli*	10 µg	130-095-762
Human IL-15 – premium grade For research use only	*E. coli*	25 µg	130-095-764
Human IL-15 – premium grade For research use only	*E. coli*	100 µg	130-095-765
Human IL-15 – premium grade For research use only	*E. coli*	1000 µg	130-095-766

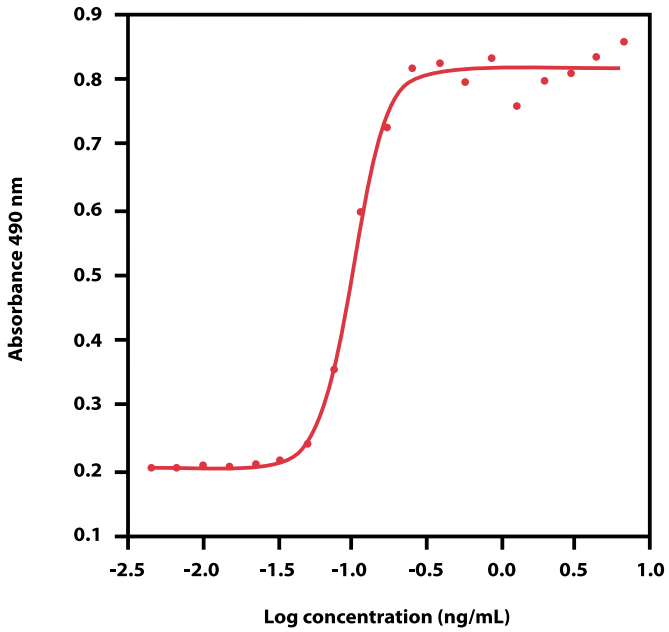


Figure 1: Human IL-15 activity assay. The biological activity of Human IL-15 is determined by proliferation assay using CTLL2 cells.

Selected references
1. Soman, G. *et al.* (2009) J. Immunol. Methods 348: 83–94.
2. Dietz, L. *et al.* (2010) Toxicol. Sci. 117 (2): 336–347.
3. Fuchs, S. *et al.* (2014) Eur. J. Immunol. 44 (10): 3129–3140.
4. Alvarez-Breckenridge, C. A. *et al.* (2012) J. Virol. 86 (8): 4566–4577.
5. Gordy, L. E. *et al.* (2011) J. Immunol. 187 (12): 6335–6345.
6. Juelke, K. *et al.* (2010) Blood 116 (8): 1299–1307.

Human IL-21

Overview

Recombinant human IL-21 (interleukin 21) can promote differentiation of T_H17 or T follicular helper (Tfh) cells, expansion of $CD8^+$ T cells, as well as B and NK cell development. Thus, the pleiotropic cytokine regulates several aspects of lymphoid cell function and has central roles for humoral immunity. IL-21 has been associated with allergies, cancer, and viral infections. Recombinant protein human IL-21 was developed for use in various applications, such as cell culture, differentiation studies, and functional assays.

Background information

Interleukin 21 (IL-21) is a four α-helix bundle cytokine and closely related to IL-2, IL-4, and IL-15. IL-21 expression is restricted to activated $CD4^+$ T helper cells and NKT cells. Among T helper subsets, IL-21 is strongly produced by follicular T helper cells and T_H17 cells, where IL-21 serves as an autocrine regulator and seems to sustain T_H17 development. The functional receptor for IL-21, composed of the IL-21 receptor- and the common γ-chain, is expressed on various hematopoietic cells including T, B, NK, and dendritic cells. Accordingly, IL-21 exerts pleiotropic effects on both cellular and humoral immune responses, such as stimulation of lymphocyte proliferation, promotion of $CD8^+$ T cell and NK cell cytotoxicity, and differentiation of B cells into plasma cells. Important roles for IL-21 have been proposed with regard to its anti-tumor activity and for the development of autoimmune diseases.

Applications

Human IL-21 can be used for a variety of applications, including:

- *In vitro* differentiation of naive $CD4^+$ T cells towards T_H17 and Tfh cells.
- *In vitro* expansion of $CD8^+$ T cells and enhancement of cytotoxic T cell function.
- Study of NK cell development and function.
- *In vitro* differentiation of plasma cells from naive B cells.
- Investigation of IL-21–mediated molecular signaling pathways.

Biological activity

Proliferation of B9 hybridoma cells
Premium grade: ≥ 2×10^4 U/mg (typical activity: 3×10^4 U/mg)
Research grade: ≥ 1×10^4 U/mg

Product	Source	Content	Order no.
Human IL-21 – research grade For research use only	*E. coli*	10 µg	130-094-563
Human IL-21 – research grade For research use only	*E. coli*	25 µg	130-095-767
Human IL-21 – premium grade For research use only	*E. coli*	10 µg	130-095-768
Human IL-21 – premium grade For research use only	*E. coli*	25 µg	130-095-769
Human IL-21 – premium grade For research use only	*E. coli*	100 µg	130-095-784

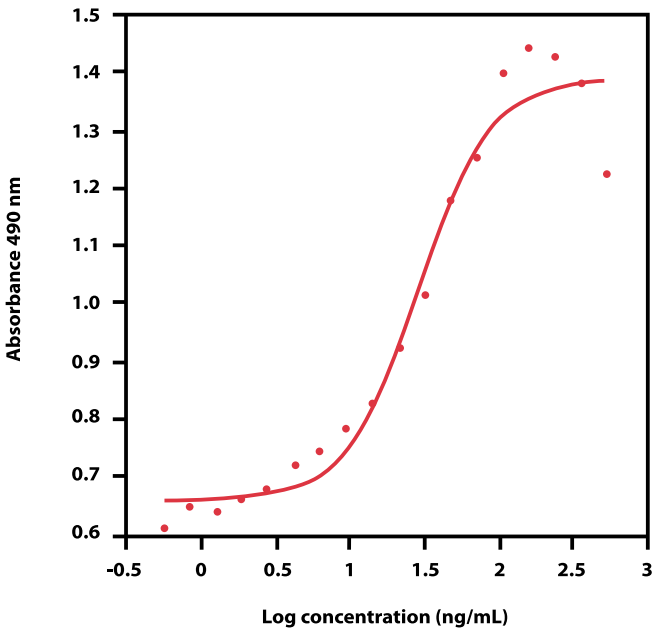


Figure 1: Human IL-21, activity assay. The biological activity of Human IL-21 is determined by proliferation assay using mouse B9 hybridoma cells.

Selected references
1. Spolski, R. and Leonard, W. J. (2008) Annu. Rev. Immunol. 26: 57–79.
2. Fuchs, S. *et al.* (2014) Eur. J. Immunol. 44 (10): 3129–3140.
3. Jabara, H. H. *et al.* (2012) Nat. Immunol. 13 (6): 612–620.
4. Nielsen, N. *et al.* (2012) PLoS One 7 (2): e31959.

Human M-CSF

Overview

Recombinant human M-CSF can regulate the proliferation, differentiation, and survival of monocytes, macrophages, osteoclasts and their hematopoietic progenitors . The macrophage colony-stimulating factor (M-CSF) is a potent hematopoietic cytokine that is involved in diverse processes, such as regulation of inflammatory responses, bone resorption, atherosclerosis or brain and placental development. M-CSF recombinant protein can be especially used in differentiation studies, cell culture and functional assays.

Background information

Macrophage-colony stimulating factor (M-CSF), a four α-helical bundle cytokine, is a potent hematopoietic regulator. It is primarily produced by monocytes, granulocytes, endothelial cells, and fibroblasts. The main function of M-CSF is the regulation of proliferation, differentiation, and survival of monocytes, macrophages and their hematopoietic progenitors. Furthermore, M-CSF has been shown to play an important role in immunological defense, bone metabolism, fertility, and pregnancy.

Applications

Human M-CSF can be used for a variety of applications, including:

- Survival studies and apoptosis assays, for example, using peripheral blood monocytes.
- Differentiation of macrophages from peripheral blood monocytes.
- Differentiation of osteoclasts from $CD14^+$ monocytes.

Biological activity

Proliferation of NFS-60 cells (NIBSC 89/512)
Premium grade: ≥ 2×10^7 IU/mg (typical activity: 7×10^7 IU/mg)
Research grade: ≥ 1×10^7 IU/mg

Product	Source	Content	Order no.
Human M-CSF – research grade For research use only	*E. coli*	10 µg	130-093-963
Human M-CSF – research grade For research use only	*E. coli*	25 µg	130-096-491
Human M-CSF – premium grade For research use only	*E. coli*	10 µg	130-096-485
Human M-CSF – premium grade For research use only	*E. coli*	25 µg	130-096-489
Human M-CSF – premium grade For research use only	*E. coli*	100 µg	130-096-492
Human M-CSF – premium grade For research use only	*E. coli*	1000 µg	130-096-493

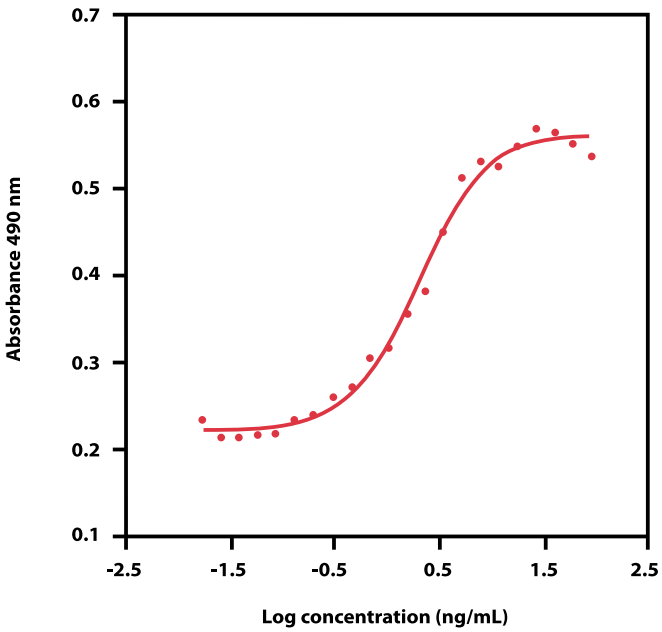


Figure 1: Human M-CSF activity assay. The biological activity of Human M-CSF is determined by proliferation assay using NFS-60 cells.

Selected references
1. Mire-Sluis, A.R. *et al.* (1995) J. Immunol. Methods 179: 141–151.
2. Michelet, X. *et al.* (2015) J. Immunol. 194 (5): 2079–2088.
3. Vogel, S. Z. *et al.* (2015) J. Immunol. 194 (7): 3136–3146.
4. Guery L. *et al.* (2014) Blood 118: 4694–4704.
5. McEwan, W. A. *et al.* (2013) Nat. Immunol. 14 (4): 327–336.
6. Bénéteau, M. *et al.* (2012) Proc. Natl. Acad. Sci. U.S.A. 109 (49): 20071–20076.
7. Wang, C. *et al.* (2010) PLoS One 5 (10): e13594.
8. Meissner, F. *et al.* (2010) Blood 116 (9): 1570–1573.

Human SCF

Overview

Recombinant human SCF (stem cell factor) can stimulate growth and activation of mast cells, as well as expansion of hematopoietic stem cells and myeloid, erythroid, or lymphoid progenitors. The c-Kit receptor transmits the SCF signal, which acts at different levels of embryonic and adult hematopoiesis. For successful use in cell culture, differentiation studies, and functional assays, the recombinant protein human SCF has been optimized.

Background information

SCF is a hematopoietic growth factor important for the survival, proliferation, and differentiation of hematopoietic stem cells and progenitor cells. Besides its pivotal role in mast cell development, SCF acts as a potent mast cell chemoattractant and upregulates mast cell adhesion and migration. SCF signals through the c-kit receptor (CD117) and exists in two forms; cell surface bound SCF and soluble SCF. The secreted soluble form of SCF is produced by the proteolytic processing of the cell surface anchored precursor molecule.

Applications

Human SCF can be used for a variety of applications, including:

- Stimulation of proliferation of myeloid, erythroid, and lymphoid progenitors in bone marrow cultures.
- *In vitro* expansion of $CD34^+$ hematopoietic progenitor cells.
- Differentiation of ES-derived cells towards the hematopoietic lineage.
- Mast cell differentiation and maintenance.
- Mast cell chemotaxis assays.

Biological activity

Proliferation of TF-1 cells (NIBSC 91/682)
Premium grade: ≥ 4×10^5 U/mg (typical activity: 9×10^5 U/mg)
Research grade: ≥ 2×10^5 U/mg

Product	Source	Content	Order no.
Human SCF – research grade For research use only	*E. coli*	10 µg	130-093-991
Human SCF – research grade For research use only	*E. coli*	25 µg	130-096-692
Human SCF – premium grade For research use only	*E. coli*	10 µg	130-096-693
Human SCF – premium grade For research use only	*E. coli*	25 µg	130-096-694
Human SCF – premium grade For research use only	*E. coli*	100 µg	130-096-695
Human SCF – premium grade For research use only	*E. coli*	1000 µg	130-096-696

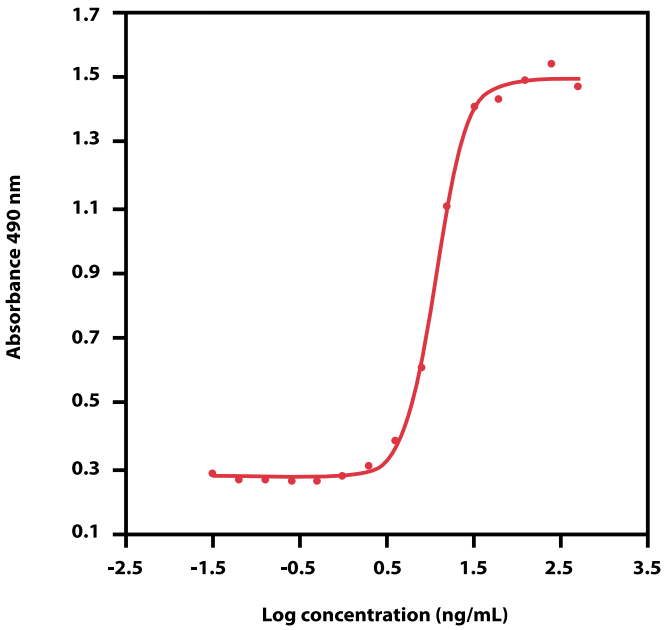


Figure 1: Human SCF activity assay. The biological activity of Human SCF is determined by proliferation assay using TF-1 cells.

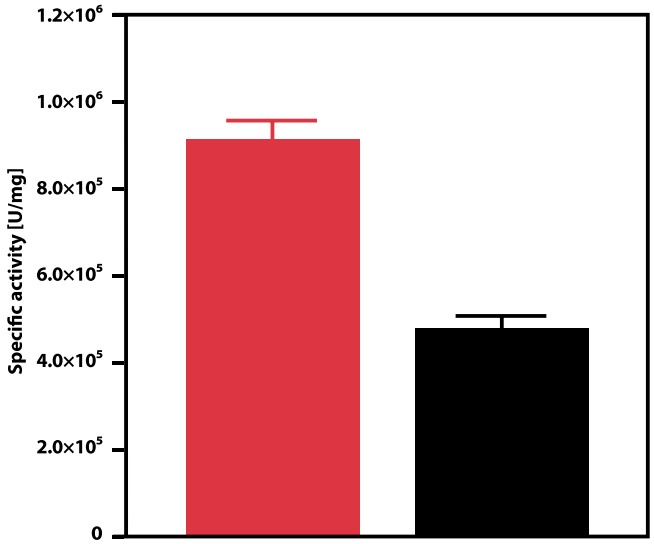


Figure 2: Human SCF biological activity. Activity of Human SCF, premium grade (red bar) was compared to another commercially available product (black bar).

Selected references
1. Kitumura, T. *et al.* (1989) J. Cell. Physiol. 140: 323–334.
2. Dussiau, C. *et al.* (2015) Oncotarget. 6: 18956–18965.
3. Laurenti, E. *et al.* (2015) Cell Stem Cell 16 (3): 302–313.
4. Brault, J. *et al.* (2014) Biores Open Access 3 (6): 311–326.
5. Velardi, E. *et al.* (2014) J. Exp. Med. 211 (12): 2341–2349.
6. Dighe N. *et al.* (2014) PLoS One 9 (8): e104805.
7. Steinleitner, K. *et al.* (2012) Anticancer Res. 32 (11): 4883–4889.
8. Narla, A. *et al.* (2011) Blood 118 (8): 2296–2304.

Mouse GM-CSF

Overview

Recombinant mouse GM-CSF can regulate growth and differentiation of cells of the myeloid lineage such as DCs, granulocytes, monocytes, and macrophages. As a crucial part of the immune/inflammatory path, the hematopoietic cytokine serves as both an activation signal for mature myeloid cells and survival. The recombinant granulocyte-macrophage colony-stimulating factor (GM-CSF) is developed for use in functional assays, differentiation studies, and cell culture.

Background information

GM-CSF is a hematopoietic growth factor, which is essential for proliferation and development of granulocyte and monocyte/macrophage progenitors. It also functions as a growth factor for erythroid and megakaryocytic precursor cells in conjunction with erythropoietin. GM-CSF is secreted by various cell types including T cells, macrophages, endothelial cells, and fibroblasts in response to inflammatory stimuli and cytokines. In addition, GM-CSF strongly chemoattracts neutrophils and eosinophils and enhances the effector functions of neutrophils and macrophages.

Applications

Mouse GM-CSF can be used for a variety of applications, including:

- Induction of colony formation of granulocyte/macrophage progenitors in semi-solid medium.
- *In vitro* generation of DCs from bone marrow or maturation of $CD11c^+$ splenocytes.
- Generation of antigen-presenting (DC-like) cells in primary brain cell culture.

Biological activity

Proliferation of FDC-P1 cells (NIBSC 91/658)
Premium grade: ≥ 5×10^7 U/mg
Research grade: ≥ 1×10^7 U/mg

Product	Source	Content	Order no.
Mouse GM-CSF – research grade For research use only	*E. coli*	10 µg	130-094-043
Mouse GM-CSF – research grade For research use only	*E. coli*	25 µg	130-095-746
Mouse GM-CSF – premium grade For research use only	*E. coli*	10 µg	130-095-742
Mouse GM-CSF – premium grade For research use only	*E. coli*	25 µg	130-095-793
Mouse GM-CSF – premium grade For research use only	*E. coli*	100 µg	130-095-739
Mouse GM-CSF – premium grade For research use only	*E. coli*	1000 µg	130-095-735

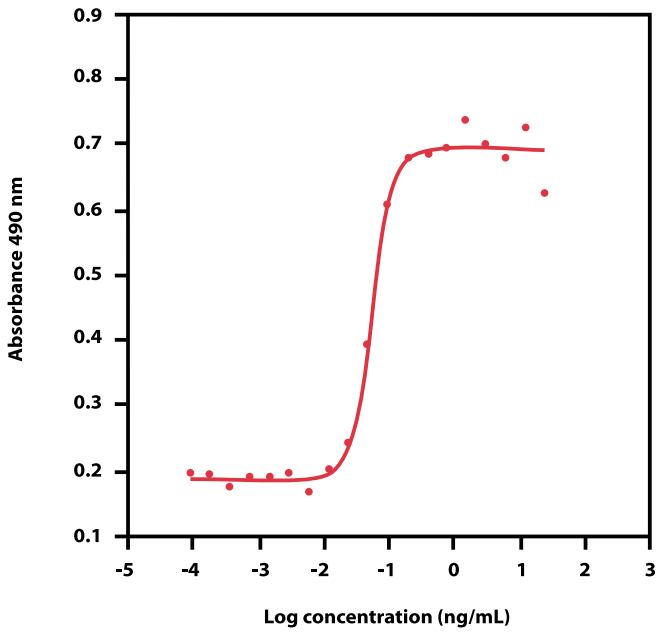


Figure 1: Mouse GM-CSF activity assay. The biological activity of Mouse GM-CSF was determined by proliferation assay using mouse FDC-P1 cells. The bioassay was calibrated with the non WHO reference material for mouse GM-CSF (NIBSC code 91/658) provided by the National Institute for Biological Standards and Control.

Selected references
1. Ait-Oufella *et al.* (2010) J. Exp. Med. 207: 1579–1587.
2. DeLamarter, J.F. *et al.* (1985) EMBO J. 4: 2575–2581.
3. Cantini, G. *et al.* (2012) Oncoimmunology 1 (6): 884–893.

Mouse IL-4

Overview
IL-4 stands for interleukin 4. Mouse IL-4 is a recombinant protein optimized for use in cell culture, differentiation studies, and functional assays.

Background information
IL-4 is produced mainly by activated T_H2 cells and, to a lesser extent, by T_H1 cells. It binds to the IL-4 receptor α (CD124), followed by the dimerization with other receptor chains to generate type 1 and type 2 receptors. IL-4 promotes the proliferation and differentiation of activated B cells and the expression of MHC class II antigens. Mice over expressing IL-4 have elevated levels of IgE and IgG1 and show a deficiency in T cell maturation. $CD4^+$ T cells from knockout mice lacking IL-4 are not able to produce T_H2 cytokines after *in vitro* stimulation. The biological activity of IL-4 is species-specific, i.e. murine IL-4 is inactive on human cells and *vice versa*.

Applications
Mouse IL-4 can be used for a variety of applications, including:
- *In vitro* differentiation of naive $CD4^+$ T cells towards T_H2 cells.
- *In vitro* studies of bone marrow precursor development to DCs, together with GM-CSF.
- *In vitro* investigation of B cell-T cell interaction, together with CD40-Ligand.

Biological activity
Proliferation of HT-2 cells (NIBSC 91/656)
Premium grade: ≥ 8×10^6 U/mg
Research grade: ≥ 5×10^6 U/mg

Product	Source	Content	Order no.
Mouse IL-4 – research grade For research use only	*E. coli*	10 µg	130-094-061
Mouse IL-4 – research grade For research use only	*E. coli*	25 µg	130-097-757
Mouse IL-4 – premium grade For research use only	*E. coli*	10 µg	130-097-761
Mouse IL-4 – premium grade For research use only	*E. coli*	25 µg	130-097-760
Mouse IL-4 – premium grade For research use only	*E. coli*	100 µg	130-097-759
Mouse IL-4 – premium grade For research use only	*E. coli*	1000 µg	130-097-758

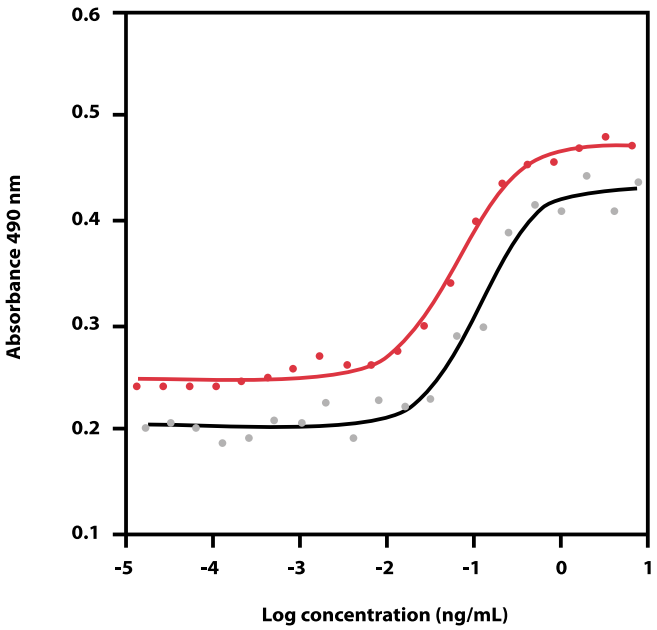


Figure 1: Mouse IL-4 activity assay: The specific activity is determined by proliferation assay using mouse HT-2 cells. Activity of Mouse IL-4, premium grade (red line) was compared to another commercially available product (black line) with equivalent outcome.

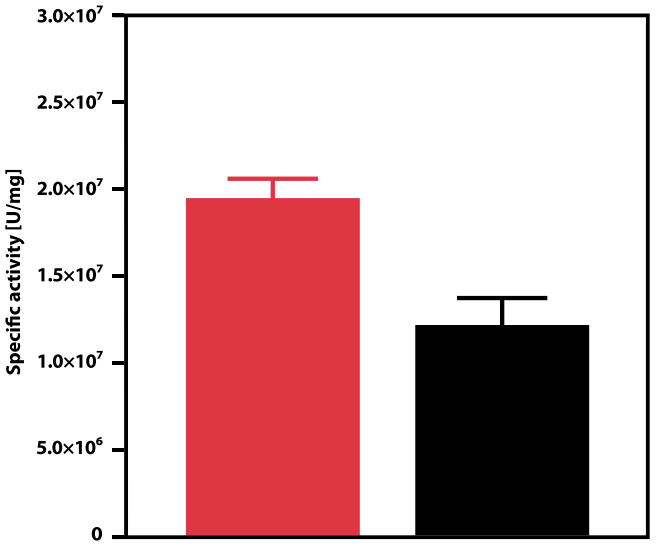


Figure 2: Mouse IL-4 biological activity. Activity of Mouse IL-4, premium grade, (red bar) was compared to another commercially available product (black bar).

Mouse IL-6

Overview
IL-6 stands for interleukin 6. Mouse IL-6 is a recombinant protein optimized for use in cell culture, differentiation studies, and functional assays.

Background information
Interleukin 6 (IL-6), originally identified as a B cell differentiation factor, is a multifunctional cytokine which regulates immune responses, hematopoiesis, acute phase responses, and inflammatory reactions. It induces, for instance, the terminal maturation of activated B cells into antibody-secreting plasma cells and acts in synergy with IL-3 to support the proliferation of hematopoietic stem cells. IL-6 is produced by many cell types, such as monocytes, macrophages, fibroblasts, endothelial cells, and T cells. Disturbed IL-6 production has been associated with pathological processes, including inflammatory autoimmune diseases and cancer.

Applications
Mouse IL-6 can be used for a variety of applications, including:
- Induction of colony formation from hematopoietic progenitor cells in semi-solid medium.
- Replacement of feeder cells in the preparation of murine hybridomas.
- *In vitro* differentiation of T_H17 cells.
- Cultivation of bone marrow cells for retroviral transduction.

Biological activity
Proliferation of 7TD1 cells (NIBSC 93/730)
Premium grade: ≥ 4×10^8 U/mg
Research grade: ≥ 2×10^8 U/mg

Product	Source	Content	Order no.
Mouse IL-6 – research grade For research use only	*E. coli*	10 µg	130-094-065
Mouse IL-6 – research grade For research use only	*E. coli*	25 µg	130-096-683
Mouse IL-6 – premium grade For research use only	*E. coli*	10 µg	130-096-682
Mouse IL-6 – premium grade For research use only	*E. coli*	25 µg	130-096-684
Mouse IL-6 – premium grade For research use only	*E. coli*	100 µg	130-096-685
Mouse IL-6 – premium grade For research use only	*E. coli*	1000 µg	130-096-686

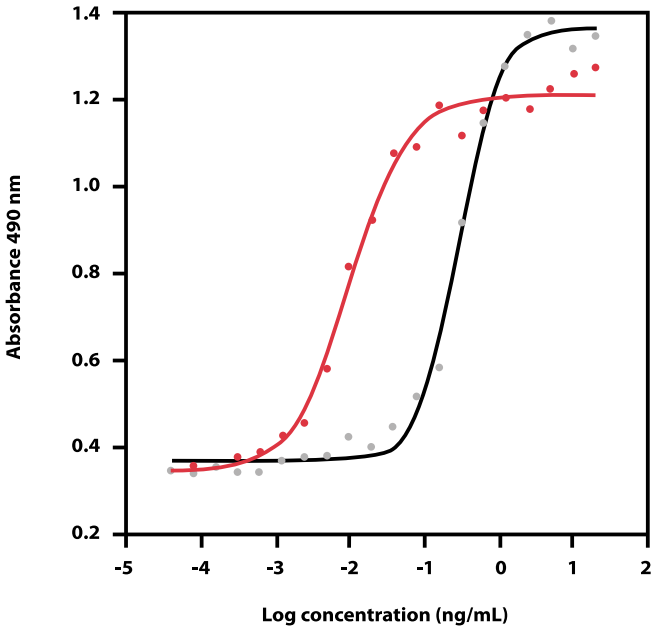


Figure 1: Mouse IL-6, activity assay. The biological activity was determined by proliferation assay using mouse 7TD1 cells. Activity of Mouse IL-6, premium grade (red line) was compared to another commercially available product (black line).

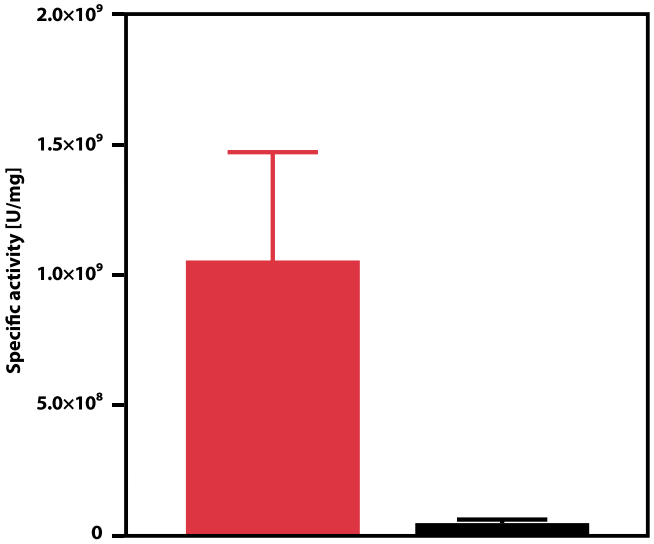


Figure 2: Mouse IL-6 biological activity. Activity of Mouse IL-6, premium grade, (red bar) was compared to another commercially available product (black bar).

Mouse LIF

Overview
LIF stands for leukemia inhibitory factor. Mouse LIF is a recombinant protein optimized for use in cell culture, differentiation studies, and functional assays.

Background information
LIF is a pleiotropic cytokine, which is critically involved in embryonic development and blastocyst implantation. LIF belongs to the interleukin 6 family and functions through the gp130 activation of STAT3. In mice LIF is a key factor that prevents embryonic stem cells (ESC) to differentiate. Additionally, LIF affects hematopoiesis, neural development, bone and energy metabolism, and inflammation.

Applications
Mouse LIF can be used for a variety of applications including:
- Maintenance of self-renewal and pluripotency in conventional mouse ESC cultures.

Biological activity
Inhibition of M1 cells
Premium grade: ≥ 2×10^6 U/mg (typical activity: 2.5×10^6 U/mg)
Research grade: ≥ 1×10^6 U/mg

Product	Source	Content	Order no.
Mouse LIF – research grade For research use only	*E. coli*	10 µg	130-095-772
Mouse LIF – research grade For research use only	*E. coli*	25 µg	130-095-775
Mouse LIF – premium grade For research use only	*E. coli*	10 µg	130-095-777
Mouse LIF – premium grade For research use only	*E. coli*	25 µg	130-095-778
Mouse LIF – premium grade For research use only	*E. coli*	100 µg	130-095-779
Mouse LIF – premium grade For research use only	*E. coli*	10×100 µg	130-099-895

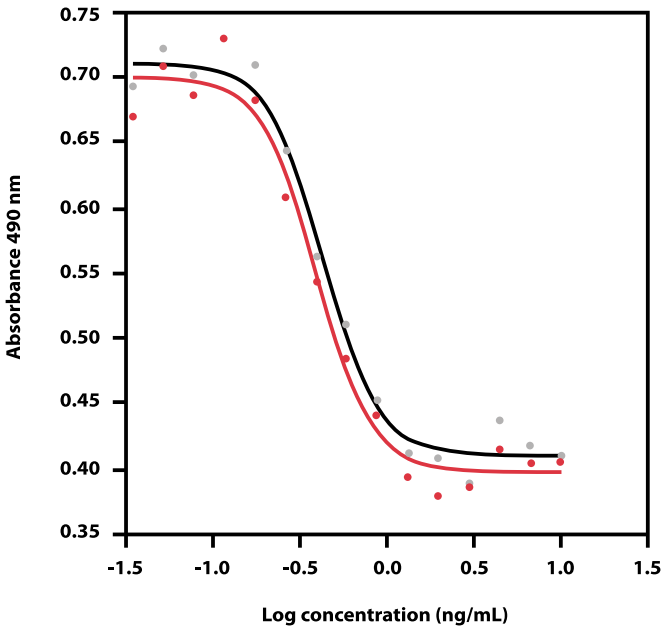


Figure 1: Mouse LIF activity assay. The biological activity of Mouse LIF was determined by inhibition assay using mouse M1 cells. Activity of Mouse LIF, premium grade (red line) was compared to another commercially available product (black line) with fully equivalent results.

Selected references
1. Rose, T.M. and Bruce, A.G. (1991) Proc. Natl. Acad. Sci. U.S.A. 88: 8641–8645.
2. Barral, S. *et al.* (2013) Stem Cell Res. 10 (2): 133–46.

Mouse M-CSF

Overview

Recombinant mouse M-CSF regulates the differentiation, proliferation, and survival of osteoclasts, macrophages, monocytes, and their hematopoietic progenitors. As a potent hematopoietic cytokine, macrophage colony-stimulating factor (M-CSF) is involved in diverse processes, such as regulation of atherosclerosis or brain, bone resorption, placental development, and inflammatory responses. This recombinant protein has been optimized for use in cell culture, differentiation studies, and functional assays.

Background information

Macrophage-colony stimulating factor (M-CSF), a four α-helical bundle cytokine, is a potent hematopoietic regulator. It is primarily produced by monocytes, granulocytes, endothelial cells, and fibroblasts. The main function of M-CSF is the regulation of proliferation, differentiation, and survival of monocytes, macrophages and their hematopoietic progenitors. Furthermore, M-CSF has been shown to play an important role in immunological defense, bone metabolism, fertility, and pregnancy.

Applications

Mouse M-CSF can be used for a variety of applications, including:

- Generation of bone marrow-derived macrophages.
- Differentiation of osteoclasts.
- Proliferation and apoptosis assays.

Biological activity

Proliferation of M-NFS-60 cells
Premium grade: ≥ 2×10^5 U/mg
Research grade: ≥ 1×10^5 U/mg

Product	Source	Content	Order no.
Mouse M-CSF – research grade For research use only	*E. coli*	10 µg	130-094-129
Mouse M-CSF – research grade For research use only	*E. coli*	25 µg	130-101-706
Mouse M-CSF – premium grade For research use only	*E. coli*	10 µg	130-101-703
Mouse M-CSF – premium grade For research use only	*E. coli*	25 µg	130-101-700
Mouse M-CSF – premium grade For research use only	*E. coli*	100 µg	130-101-704
Mouse M-CSF – premium grade For research use only	*E. coli*	1000 µg	130-101-705

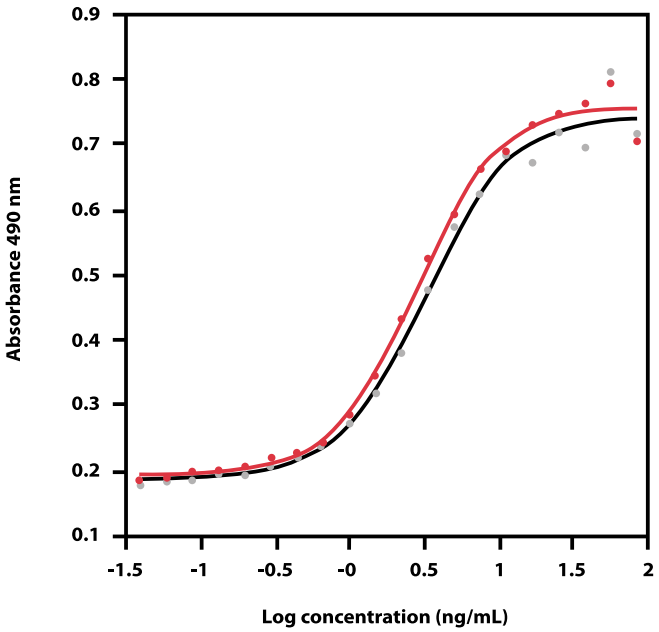


Figure 1: Mouse M-CSF activity assay. The biological activity of Mouse M-CSF, premium grade, was determined by proliferation assay using M-NFS-60 cells. Activity of Mouse M-CSF, premium grade, (red line) was compared to another commercially available product (black line).

Selected references

1. Tanne, A. *et al.* (2009) J. Exp. Med. 206 (10): 2205–2220.
2. Herold, J. *et al.* (2014) J Am Heart Assoc. 3 (2): e000611.
3. Guery L. *et al.* (2014) Blood 118: 4694–4704.

Polyclonal stimulation

Product	Description	Capacity/Content	Order no.
Anti-Biotin MACSiBead™ Particles – cell culture grade	Anti-Biotin MACSiBead Particles, ready for loading with biotinylated antibodies, for activation, expansion, and differentiation of cells	2 mL	130-092-357
CytoStim™, human	Rapid and efficient restimulation of human effector/memory T cells	for 1×10^8 total cells 200 µL	130-092-172
		for 5×10^8 total cells 1 mL	130-092-173
CytoStim™, non-human primate	Rapid and efficient restimulation of non-human primate effector/memory T cells	for 1×10^8 total cells 200 µL	130-094-447
		for 5×10^8 total cells 1 mL	130-094-442
MSC Suppression Inspector, human	Preloaded MACSiBead Particles for investigation of immunomodulatory properties of human mesenchymal stem cells (MSCs)	2.5 mL	130-096-207
NK Cell Activation/Expansion Kit, human	Kit containing biotinylated antibodies and Anti-Biotin MACSiBead Particles, cell culture grade, for the activation and expansion of human NK cells	1 kit	130-094-483
T Cell Activation/Expansion Kit, human	Kit containing biotinylated antibodies and Anti-Biotin MACSiBead Particles, cell culture grade, for the activation and/or expansion of human T cells	1 kit	130-091-441
T Cell Activation/Expansion Kit, mouse	Kit containing biotinylated antibodies and Anti-Biotin MACSiBead Particles, cell culture grade, for the activation and/or expansion of mouse T cells	1 kit	130-093-627
T Cell Activation/Expansion Kit, non-human primate	Kit containing biotinylated antibodies and Anti-Biotin MACSiBead Particles, cell culture grade, for the activation and/or expansion of rhesus monkey T cells	1 kit	130-092-919
T Cell TransAct™, human	T Cell TransAct is intended for the *in vitro* stimulation and expansion of human T cells from PBMCs or enriched T cells	2 mL	130-128-758
		2×2 mL	130-111-160
Treg Expansion Kit, human	MACSiBead Particles, cell culture grade, pre-loaded with CD3 and CD28 antibodies for the *in vitro* expansion of human regulatory T cells	2 mL	130-095-345
		2×2 mL	130-095-353
Treg Expansion Kit, mouse	Anti-Biotin MACSiBead Particles, cell culture grade, pre-loaded with CD3 and CD28 antibodies for the *in vitro* expansion of mouse regulatory T cells	2 mL	130-095-925
Treg Suppression Inspector, human	Anti-Biotin MACSiBead Particles, preloaded with biotinylated CD2, CD3, and CD28 antibodies for functional characterization of human $CD4^+CD25^+$ regulatory T cells	2.5 mL	130-092-909

Antigens

Product	Description	Content		Order no.
Recombinant Human ACE2 (HEK)	Recombinant human angiotensin-converting enzyme 2	25 µg		130-127-456
		100 µg		130-127-516
Recombinant Human ACE2 (HEK)-Biotin	Recombinant human angiotensin-converting enzyme 2	10 µg		130-127-442
		50 µg		130-127-465
Recombinant Human ACE2 (insect cells)	Recombinant human angiotensin-converting enzyme 2	25 µg		130-127-444
		100 µg		130-127-466
Recombinant Human ACE2 (insect cells)-Biotin	Recombinant human angiotensin-converting enzyme 2	10 µg		130-127-468
		50 µg		130-127-464
Recombinant SARS-CoV-2 Nucleoprotein	SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg		130-127-462
		100 µg		130-127-517
Recombinant SARS-CoV-2 Nucleoprotein-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg		130-127-454
		50 µg		130-127-467
Recombinant SARS-CoV-2 RBD (HEK)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg		130-127-448
		100 µg		130-127-518
Recombinant SARS-CoV-2 RBD (HEK)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg		130-127-458
		50 µg		130-127-457
Recombinant SARS-CoV-2 RBD (insect cells)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg		130-127-463
		100 µg		130-127-453
Recombinant SARS-CoV-2 RBD (insect cells)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg		130-127-445
		50 µg		130-127-469
Recombinant SARS-CoV-2 RBD B.1.1.7 (HEK)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg	*new*	130-128-478
		100 µg	*new*	130-128-477
Recombinant SARS-CoV-2 RBD B.1.1.7 (HEK)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg	*new*	130-128-481
		50 µg	*new*	130-128-479
Recombinant SARS-CoV-2 RBD B.1.351 (HEK)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg	*new*	130-128-935
		100 µg	*new*	130-128-932
Recombinant SARS-CoV-2 RBD B.1.351 (HEK)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg	*new*	130-128-931
		50 µg	*new*	130-128-930
Recombinant SARS-CoV-2 RBD B.1.617.2 (HEK)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg	*new*	130-129-705
		100 µg	*new*	130-129-556
Recombinant SARS-CoV-2 RBD B.1.617.2 (HEK)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg	*new*	130-129-704
		50 µg	*new*	130-129-703
Recombinant SARS-CoV-2 Spike-Prot (HEK)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg		130-127-681
		50 µg		130-127-680
Recombinant SARS-CoV-2 Spike-Prot (HEK)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg		130-127-682
Recombinant SARS-CoV-2 Spike-Prot B.1.1.7 (HEK)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg	*new*	130-129-572
		50 µg	*new*	130-129-561
Recombinant SARS-CoV-2 Spike-Prot B.1.1.7 (HEK)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg	*new*	130-129-570
Recombinant SARS-CoV-2 Spike-Prot B.1.351 (HEK)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg	*new*	130-129-559
		50 µg	*new*	130-129-560
Recombinant SARS-CoV-2 Spike-Prot B.1.351 (HEK)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg	*new*	130-129-569
Recombinant SARS-CoV-2 Spike-Prot B.1.617.2 (HEK)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg	*new*	130-129-558
		50 µg	*new*	130-129-557
Recombinant SARS-CoV-2 Spike-Prot B.1.617.2 (HEK)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg	*new*	130-129-565

Product	Description	Content		Order no.
Recombinant SARS-CoV-2 Spike-S1 (HEK)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg	*new*	130-127-852
		50 µg	*new*	130-127-854
Recombinant SARS-CoV-2 Spike-S1 (HEK)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg	*new*	130-127-853
Recombinant SARS-CoV-2 Spike-S2 (insect cells)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg		130-127-687
		50 µg		130-127-686
Recombinant SARS-CoV-2 Spike-S2 (insect cells)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg		130-127-688
Recombinant SARS-CoV-2 Spike-Trimer (HEK)	SARS-CoV-2 antigen for investigation of virus-specific immune responses	10 µg		130-127-684
		50 µg		130-127-683
Recombinant SARS-CoV-2 Spike-Trimer (HEK)-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	25 µg		130-127-685
SARS-CoV-2 Envelope C-term	SARS-CoV-2 antigen for investigation of virus-specific immune responses	100 µg		130-127-446
SARS-CoV-2 Envelope C-term-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	100 µg		130-127-451
SARS-CoV-2 Envelope H2	SARS-CoV-2 antigen for investigation of virus-specific immune responses	100 µg		130-127-450
SARS-CoV-2 Envelope H2-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	100 µg		130-127-452
SARS-CoV-2 Envelope N-term	SARS-CoV-2 antigen for investigation of virus-specific immune responses	100 µg		130-127-455
SARS-CoV-2 Envelope N-term-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	100 µg		130-127-461
SARS-CoV-2 Furin Cleavage Site Control FAM-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	100 µg		130-127-692
SARS-CoV-2 Furin Cleavage Site Control-Biotin	SARS-CoV-2 antigen for investigation of virus-specific immune responses	100 µg		130-127-691
SARS-CoV-2 Furin Cleavage Site FAM-Biotin	Biotinylated SARS-CoV-2 antigen for investigation of virus-specific immune responses	100 µg		130-127-690
SARS-CoV-2 Furin Cleavage Site-Biotin	SARS-CoV-2 antigen for investigation of virus-specific immune responses	100 µg		130-127-689

PepTivator® Peptide Pools covering antigens from infectious diseases

Product	Quality grade	Capacity/Content	Order no.
PepTivator® A. fumigatus Catalase B	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-291
PepTivator® A. fumigatus crf1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-775
PepTivator® A. fumigatus f 22	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-776
PepTivator® A. fumigatus Gel1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-289
PepTivator® A. fumigatus pmp20	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-772
PepTivator® A. fumigatus SHMT	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-290
PepTivator® A. fumigatus SOD	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-288
PepTivator® AdV Select	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-124-394

Product	Quality grade	Capacity/Content	Order no.
PepTivator® AdV5 Hexon	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-093-495
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-093-496
PepTivator® AdV5 Hexon (HT)	premium grade	for 96 tests	130-098-237
PepTivator® AdV5 Penton	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-777
PepTivator® Aquaporin-4	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-126-131
PepTivator® B. afzelii bmpA	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-788
PepTivator® B. afzelii bmpB	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-792
PepTivator® B. afzelii ospA	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-778
PepTivator® B. afzelii ospB	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-782
PepTivator® B. afzelii ospC	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-786
PepTivator® BKV LT	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-504
PepTivator® BKV ST	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-503
PepTivator® BKV VP1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-272
PepTivator® BKV VP2	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-273
PepTivator® C. albicans MP65	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-776
PepTivator® CEF MHC Class I Plus	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-098-426
PepTivator® CMV IE-1	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-093-493
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-093-494
PepTivator® CMV pp65	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-093-438
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-093-435
PepTivator® CMV pp65 (HT)	premium grade	for 96 tests	130-097-727
PepTivator® Dengue Virus Type 2 Capsid Protein C	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-123-131
PepTivator® Dengue Virus Type 2 Envelope Protein E1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-123-128
PepTivator® Dengue Virus Type 2 Envelope Protein E2	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-123-127
PepTivator® Dengue Virus Type 2 Glycoprotein M	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-123-129
PepTivator® Dengue Virus Type 2 Protein NS1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-123-145
PepTivator® Dengue Virus Type 2 Protein NS2a	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-123-130

Product	Quality grade	Capacity/Content	Order no.
PepTivator® Dengue Virus Type 4 Protein NS2a	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-123-126
PepTivator® EBV BMLF1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-283
PepTivator® EBV BRLF1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-284
PepTivator® EBV BZLF1	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-093-611
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-093-612
PepTivator® EBV BZLF1 (HT)	premium grade	for 96 tests	130-098-239
PepTivator® EBV Consensus	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-764
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-103-462
PepTivator® EBV Consensus (HT)	premium grade	for 96 tests	130-119-472
PepTivator® EBV EBNA-1	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-093-613
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-093-614
PepTivator® EBV EBNA-1 (HT)	premium grade	for 96 tests	130-098-236
PepTivator® EBV LMP1	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-095-930
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-095-931
PepTivator® EBV LMP2A	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-093-615
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-093-616
PepTivator® EBV LMP2A (HT)	premium grade	for 96 tests	130-098-238
PepTivator® HCV1a Core	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-773
PepTivator® HCV1a NS3	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-780
PepTivator® HCV1a NS4	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-282
PepTivator® HCV1a NS5	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-281
PepTivator® HCV1b Core	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-782
PepTivator® HCV1b NS3	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-783
PepTivator® HCV1b NS4	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-280
PepTivator® HCV1b NS5	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-279
PepTivator® HHV1 Envelope Glycoprotein D	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-114-929

Product	Quality grade	Capacity/Content	Order no.
PepTivator® HPV16 E6	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-095-997
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-095-998
PepTivator® HPV16 E7	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-095-999
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-096-000
PepTivator® HPV18 E6	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-005
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-096-006
PepTivator® HPV18 E7	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-095-996
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-096-007
PepTivator® Influenza A (H1N1) HA	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-803
PepTivator® Influenza A (H1N1) MP1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-285
PepTivator® Influenza A (H1N1) MP2	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-812
PepTivator® Influenza A (H1N1) NA	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-806
PepTivator® Influenza A (H1N1) NP	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-278
PepTivator® JCV LT	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-768
PepTivator® JCV ST	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-766
PepTivator® JCV VP1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-502
PepTivator® JCV VP2	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-764
PepTivator® JCV VP3	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-762
PepTivator® RSV Nucleoprotein	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-104-803
PepTivator® SARS-CoV-2 Prot_M	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-126-702
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-126-703
PepTivator® SARS-CoV-2 Prot_N	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-126-698
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-126-699
PepTivator® SARS-CoV-2 Prot_N B.1.1.7 Mutation Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-127-843
PepTivator® SARS-CoV-2 Prot_N B.1.1.7 WT Reference Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-127-842

Product	Quality grade	Capacity/Content	Order no.
PepTivator® SARS-CoV-2 Prot_S	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-126-700
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-126-701
PepTivator® SARS-CoV-2 Prot_S AY.1 Mutation Pool	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-129-568
PepTivator® SARS-CoV-2 Prot_S AY.1 WT Reference Pool	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-129-564
PepTivator® SARS-CoV-2 Prot_S B.1.1.7 Mutation Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-127-844
PepTivator® SARS-CoV-2 Prot_S B.1.1.7 WT Reference Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-127-841
PepTivator® SARS-CoV-2 Prot_S B.1.351 Mutation Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-127-958
PepTivator® SARS-CoV-2 Prot_S B.1.351 WT Reference Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-127-952
PepTivator® SARS-CoV-2 Prot_S B.1.427/B.1.429 Mutation Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-128-482
PepTivator® SARS-CoV-2 Prot_S B.1.427/B.1.429 WT Reference Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-128-487
PepTivator® SARS-CoV-2 Prot_S B.1.525 Mutation Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-128-483
PepTivator® SARS-CoV-2 Prot_S B.1.525 WT Reference Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-128-484
PepTivator® SARS-CoV-2 Prot_S B.1.617.1 Mutation Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-128-762
PepTivator® SARS-CoV-2 Prot_S B.1.617.1 WT Reference Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-128-764
PepTivator® SARS-CoV-2 Prot_S B.1.617.2 Mutation Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-128-763
PepTivator® SARS-CoV-2 Prot_S B.1.617.2 WT Reference Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-128-761
PepTivator® SARS-CoV-2 Prot_S Complete	premium grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-129-712
	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-127-951
		for stimulation of 1×10^9 cells ***new*** 60 nmol/peptide	130-127-953
PepTivator® SARS-CoV-2 Prot_S P.1 Mutation Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-128-485
PepTivator® SARS-CoV-2 Prot_S P.1 WT Reference Pool	research grade	for stimulation of 1×10^8 cells ***new*** 6 nmol/peptide	130-128-486
PepTivator® SARS-CoV-2 Prot_S+	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-127-311
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-127-312
PepTivator® SARS-CoV-2 Prot_S1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-127-041
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-127-048
PepTivator® SARS-CoV-2 Select	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-127-309

Product	Quality grade	Capacity/Content	Order no.
PepTivator® Zika Capsid Protein C	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-114-926
PepTivator® Zika Envelope Protein E1-2	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-114-927
PepTivator® Zika Envelope Protein E3	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-114-925
PepTivator® Zika Glycoprotein M	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-114-923
PepTivator® Zika NS1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-114-922

PepTivator Peptide Pools covering tumor-associated antigens

Product	Quality grade	Capacity/Content	Order no.
PepTivator® gp100/Pmel 17	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-094-449
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-094-450
PepTivator® MAGE-A1	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-095-382
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-095-383
PepTivator® MAGE-A3	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-095-384
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-095-385
PepTivator® MAGE-A4	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-095-386
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-095-387
PepTivator® Melan-A/MART-1	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-094-597
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-094-477
PepTivator® NY-ESO-1	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-095-380
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-095-381
PepTivator® PAP	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-767
PepTivator® PRAME	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-286
PepTivator® Prostein	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-801
PepTivator® PSA	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-800
PepTivator® PSCA	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-798
PepTivator® PSMA	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-795
PepTivator® ROR1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-767

Product	Quality grade	Capacity/Content	Order no.
PepTivator® STEAP1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-100-784
PepTivator® Survivin 1	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-094-444
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-094-443
PepTivator® TERT	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-277
PepTivator® Tyrosinase	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-094-445
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-094-446
PepTivator® WT1	premium grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-095-916
		for stimulation of 1×10^9 cells 60 nmol/peptide	130-095-918

PepTivator Peptide Pools covering other antigens

Product	Quality grade	Capacity/Content	Order no.
PepTivator® CHI3L2	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-276
PepTivator® Desmoglein	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-766
PepTivator® GAD65	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-769
PepTivator® IA-2	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-275
PepTivator® Insulin	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-771
PepTivator® MBP Isoform 1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-763
PepTivator® MBP Isoform 5	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-287
PepTivator® MOG	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-096-770
PepTivator® Mucin-1	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-774
PepTivator® Ovalbumin	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-099-771
PepTivator® PLP	research grade	for stimulation of 1×10^8 cells 6 nmol/peptide	130-097-274

TLR3 agonists

Product	Description	Content	Order no.
Poly (I:C)	Polyinosinic-polycytidylic acid	50 mg	130-112-563
		5×50 mg	130-112-562

TLR7/8 agonists

Product	Description	Content/Components	Order no.
ORN R-0002	TLR8 agonist for stimulation of human immune cells	200 µg 200 µg lyophilized ORN 1 mL RNase-free Water 400 µL DOTAP-Cl [1 mg/mL]	130-104-427
		1 mg 1 mg lyophilized ORN 1 mL RNase-free Water 5×400 µL DOTAP-Cl [1 mg/mL]	130-104-438
ORN R-0006	TLR7/8 agonist, for stimulation of human and mouse immune cells	200 µg 200 µg lyophilized ORN 1 mL RNase-free Water 400 µL DOTAP-Cl [1 mg/mL]	130-104-440
		1 mg 1 mg lyophilized ORN 1 mL RNase-free Water 5×400 µL DOTAP-Cl [1 mg/mL]	130-104-439
ORN R-1263	Control ORN for sequence and backbone control for ORN R-0002 and ORN R-0006	200 µg 200 µg lyophilized ORN 1 mL RNase-free Water 400 µL DOTAP-Cl [1 mg/mL]	130-104-433
		1 mg 1 mg lyophilized ORN 1 mL RNase-free Water 5×400 µL DOTAP-Cl [1 mg/mL]	130-104-435
ORN R-2176-dT	TLR7/8 agonist for stimulation of human and mouse immune cells. Can be used without formulation with DOTAP-Cl	200 µg 200 µg lyophilized ORN 1 mL RNase-free Water 400 µL DOTAP-Cl [1 mg/mL]	130-104-436
		1 mg 1 mg lyophilized ORN 1 mL RNase-free Water 5×400 µL DOTAP-Cl [1 mg/mL]	130-104-437
ORN R-2176-dT Control	Control ORN for sequence and backbone control for ORN R-2176-dT. Can be used without formulation with DOTAP-Cl	200 µg 200 µg lyophilized ORN 1 mL RNase-free Water 400 µL DOTAP-Cl [1 mg/mL]	130-104-442
		1 mg 1 mg lyophilized ORN 1 mL RNase-free Water 5×400 µL DOTAP-Cl [1 mg/mL]	130-104-441
ORN R-2336	TLR7 agonist for stimulation of human and mouse immune cells	200 µg 200 µg lyophilized ORN 1 mL RNase-free Water 400 µL DOTAP-Cl [1 mg/mL]	130-104-431
		1 mg 1 mg lyophilized ORN 1 mL RNase-free Water 5×400 µL DOTAP-Cl [1 mg/mL]	130-104-432

Product	Description	Content/Components	Order no.
ORN R-2336 Control	Control ORN for sequence and backbone control for ORN R-2336	200 µg 200 µg lyophilized ORN 1 mL RNase-free Water 400 µL DOTAP-Cl [1 mg/mL]	130-104-385
		1 mg 1 mg lyophilized ORN 1 mL RNase-free Water 5×400 µL DOTAP-Cl [1 mg/mL]	130-104-387
ORN RNA 40	TLR7/8 agonist, for stimulation of human and mouse immune cells	200 µg 200 µg lyophilized ORN 1 mL RNase-free Water 400 µL DOTAP-Cl [1 mg/mL]	130-104-428
		1 mg 1 mg lyophilized ORN 1 mL RNase-free Water 5×400 µL DOTAP-Cl [1 mg/mL]	130-104-429
ORN RNA 41	Control ORN for sequence and backbone control for ORN RNA 40	200 µg 200 µg lyophilized ORN 1 mL RNase-free Water 400 µL DOTAP-Cl [1 mg/mL]	130-104-430
		1 mg 1 mg lyophilized ORN 1 mL RNase-free Water 5×400 µL DOTAP-Cl [1 mg/mL]	130-104-448
R848 (Resiquimod)	TLR7/8 agonist, for stimulation of human and mouse immune cells	1 mg	130-109-376
TLR7/8 Explorer	Kit of three different ORNs for stimulation of TLR7, TLR8, and TLR7/8, and their respective control ORNs	5×100 µg 5×100 µg lyophilized ORN 1 mL RNase-free Water 3×400 µL DOTAP-Cl [1 mg/mL]	130-104-388

TLR9 agonists

Product	Description	Content/Components	Order no.
ODN 1826	B-class CpG oligodeoxyribonucleotide (murine)	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-274
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-103
ODN 1826 Control (ODN 2138)	B-class CpG control oligodeoxyribonucleotide (murine)	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-275
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-276
ODN 1826 Ready-to-use	B-class CpG oligodeoxyribonucleotide (murine)	5×100 µg in 50 µL	130-109-374
		20×100 µg in 50 µL	130-109-373
ODN 1982	B-class CpG control oligodeoxyribonucleotide	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-104
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-277

Product	Description	Content/Components	Order no.
ODN 2006	B-class CpG oligodeoxyribonucleotide	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-106
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-105
ODN 2006 Control (ODN 2137)	B-class CpG control oligodeoxyribonucleotide	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-107
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-278
ODN 21798	P-class CpG oligodeoxyribonucleotide	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-281
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-280
ODN 21798 Control (ODN 23098)	P-class control CpG oligodeoxyribonucleotide	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-285
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-284
ODN 2216	A-class CpG oligodeoxyribonucleotide	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-243
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-244
ODN 2216 Control (ODN 2243)	A-class CpG control oligodeoxyribonucleotide	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-241
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-108
ODN 2395	C-class CpG oligodeoxyribonucleotide	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-282
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-283
ODN 2395 Control (ODN 5328)	C-class control CpG oligodeoxyribonucleotide	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-279
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-100-109
TLR9 Explorer	Kit of four different CpG ODNs for stimulation of the TLR9 receptor. The kit comprises agonists of the A-class, B-class, C-class and P-class as well as the respective control ODNs.	8×100 µg 8×100 µg lyophilized ODN 1 mL 1x TE Buffer	130-100-589

TLR7/8/9 antagonists

Product	Description	Content/Components	Order no.
ODN 2088	TLR antagonist inhibiting TLR7, 8, and 9 signalling.	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-105-815
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-105-816
ODN 2088 Control (ODN 2087)	Sequence control for ODN 2088. Inhibits TLR7 and TLR8 mediated signalling but not TLR9 mediated signalling.	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-105-819
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-105-940
ODN 2088 Control (ODN 20958)	Sequence control for ODN 2088 and ODN 20959. Inhibits TLR7 mediated signalling but not TLR9 or TLR8 mediated signalling.	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-105-821
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-105-820
ODN 2088 Control (ODN 20959)	Sequence control for ODN 2088. Inhibits TLR7 and TLR8 mediated signalling but not TLR9 mediated signalling.	200 µg 200 µg lyophilized ODN 1 mL 1x TE Buffer	130-105-818
		1 mg 1 mg lyophilized ODN 1 mL 1x TE Buffer	130-105-814

StemMACS™ Small Molecules

Product	Description	Content	Order no.
StemMACS™ A83-01	A potent inhibitor of the TGF-β, Activin and Nodal signaling pathway	2 mg	130-105-333
		5×2 mg	130-106-274
StemMACS™ CHIR99021	The most selective inhibitor of glycogen synthase kinase 3β (GSK3β)	2 mg	130-103-926
		5×2 mg	130-104-172
StemMACS™ CHIR99021 in Solution	The most selective inhibitor of glycogen synthase kinase 3β (GSK3β)	2 mg	130-106-539
StemMACS™ DAPT	A selective, cell-permeable gamma-secretase inhibitor which blocks Notch activation	5 mg	130-110-489
StemMACS™ Dorsomorphin	A potent inhibitor of BMP and AMPK signaling	2 mg	130-104-466
StemMACS™ Forskolin	An activator of adenylate cyclase that increases cAMP levels	10 mg	130-117-341
StemMACS™ IWP-2	An antagonist of the Wnt/β-catenin pathway	2 mg	130-105-335
StemMACS™ IWP-4	An antagonist of the Wnt/β-catenin pathway	2 mg	130-110-488
StemMACS™ IWR-1-endo	An antagonist of the Wnt/β-catenin pathway	5 mg	130-110-491
StemMACS™ LDN-193189	A cell-permeable, small molecule inhibitor of BMP type I receptors ALK2 and ALK3	2 mg	130-103-925
		5×2 mg	130-104-171
StemMACS™ LDN-193189 in Solution	A cell-permeable, small molecule inhibitor of BMP type I receptors ALK2 and ALK3	2 mg	130-106-540
StemMACS™ LY411575	A selective, cell-permeable gamma-secretase inhibitor which blocks Notch activation	5 mg	130-103-924
StemMACS™ PD0325901	A selective inhibitor of MAPK/ERK kinase (MEK)	2 mg	130-103-923
		5×2 mg	130-104-170
StemMACS™ PD0325901 in Solution	A selective inhibitor of MAPK/ERK kinase (MEK)	2 mg	130-106-541
StemMACS™ Purmorphamine	An agonist of Smoothened that activates the hedgehog signaling pathway	5 mg	130-104-465
StemMACS™ RepSox	A potent inhibitor of the TGF-β type I receptor, activin receptor-like kinase (ALK5)	10 mg	130-117-340
StemMACS™ Retinoic Acid	A small molecule agonist for the heterodimeric retinoid receptor RAR/RXR	50 mg	130-117-339
StemMACS™ RG108	A non-nucleoside inhibitor of DNA methyltransferase (DNMT)	10 mg	130-104-464
StemMACS™ SB431542	A potent inhibitor of the TGF-β, Activin and Nodal signaling pathway	5 mg	130-105-336
		2×5 mg	130-106-275
StemMACS™ SB431542 in Solution	A potent inhibitor of the TGF-β, Activin and Nodal signaling pathway	5 mg	130-106-543
StemMACS™ Thiazovivin	A Rho-associated kinase ROCK inhibitor that enhances survival and cloning efficiency of human embryonic stem cells	1 mg	130-104-461
StemMACS™ Thiazovivin in Solution	A Rho-associated kinase ROCK inhibitor that enhances survival and cloning efficiency of human embryonic stem cells	0.5 mg	130-106-542
StemMACS™ TPPB	A high affinity activator of Protein Kinase C	1 mg	130-117-338
StemMACS™ Y27632	A Rho-associated kinase ROCK inhibitor that enhances survival and cloning efficiency of human embryonic stem cells	2 mg	130-103-922
		5×2 mg	130-104-169
StemMACS™ Y27632 in Solution	A Rho-associated kinase ROCK inhibitor that enhances survival and cloning efficiency of human embryonic stem cells	2 mg	130-106-538

MACS® GMP Cell Culture Media

Product	Description	Content/Components	Order no.
HSC-Brew GMP Medium *see page 74*	GMP Medium for expansion of isolated hematopoietic stem and progenitor cells	500 mL 500 mL HSC-Brew GMP Basal Medium 5 mL HSC-Brew GMP Supplement	170-076-310
iPS-Brew GMP Basal Medium *see page 74*	GMP Medium for the maintenance and expansion of human pluripotent stem cells	500 mL	170-076-317
iPS-Brew GMP Supplement R *see page 74*	Supplement for completion of iPS-Brew GMP Basal Medium	10 mL	170-076-318
MACS® GMP Rapamycin	GMP Cell Culture supplement for expansion of human Treg cells	200 nmol	170-076-308
MSC-Brew GMP Medium *see page 75*	GMP Medium for the generationand expansion of mesenchymal stem cells	500 mL 500 mL MSC-Brew Basal Medium MSC-Brew GMP Supplement I MSC-Brew GMP Supplement II	170-076-326
		2000 mL 2000 mL MSC-Brew Basal Medium MSC-Brew GMP Supplement I MSC-Brew GMP Supplement II	170-076-325
NK MACS® GMP Medium (Phenol Red) *see page 75*	GMP Medium for expansion of NK cells	2000 mL 2000 mL NK MACS® GMP Basal Medium 5 mL NK MACS® GMP Supplement	170-076-356
TexMACS™ GMP Medium (Phenol Red) *see page 76*	GMP Medium for cultivation and expansion of T cells supplied in a bottle	1000 mL	170-076-309
TexMACS™ GMP Medium *see page 76*	GMP Medium for cultivation and expansion of T cells supplied in a bottle	1000 mL	170-076-307
	GMP Medium for cultivation and expansion of T cells supplied in a bag	2000 mL	170-076-306

HSC-Brew GMP Medium

Overview

HSC-Brew GMP Medium is an optimized and standardized medium for the expansion of isolated hematopoietic stem and progenitor cells (e.g. $CD34^+$). It is manufactured without animal-derived components. HSC-Brew GMP Medium is filled in flexible bags, making handling in GMP confirming processes easy.

Background information

HSC-Brew GMP Medium is serum- and xeno-component free.

- Optimized formulation containing glucose and stable glutamine (L-alanyl-L-glutamine)
- QC functionality test on every batch
- Flexible bags (500 mL) – without phenol red
- Recombinant growth factors and human serum albumin have to be added to the medium

Applications

HSC-Brew GMP Medium has been developed for the expansion of isolated hematopoietic stem and progenitor cells (e.g. $CD34^+$ cells).

Product	Content/ Components	Order no.
HSC-Brew GMP Medium Availability: worldwide[1)]	500 mL 500 mL HSC-Brew GMP Basal Medium 5 mL HSC-Brew GMP Supplement	170-076-310

[1)] For availability in your country please contact your local representative.

iPS-Brew GMP Medium

Overview

iPS-Brew GMP Medium is a xeno-and serum-free medium formulation that has been developed for the maintenance of undifferentiated pluripotent stem cells under feeder-free conditions. The complete medium is composed of the specifically formulated "iPS-Brew GMP Basal Medium" as well as the optimized "iPS-Brew GMP Supplement R" that when used together support long-term growth and maintenance of undifferentiated cells.

Recombinant human TGF-β1 has to be added to the complete medium for the maintenance and expansion of human pluripotent stem cells.

Background information

iPS-Brew GMP Medium is based on the formulation of StemMACS iPS-Brew XF (#130-104-368) thus enabling seamless translation from research to clinical applications.

- Serum-free and xeno-free formulation
- Manufactured under strictly controlled conditions
- Consistent lot-to-lot performance
- Quality control: functionality test on every batch
- 500 mL bottles – without phenol red
- Recombinant human TGF- ß1 has to be added to the medium

Applications

iPS-Brew GMP Medium has been developed for the maintenance and expansion of human pluripotent stem cells on standard cell attachment matrices, e.g. Laminin 521.

Product	Content	Order no.
iPS-Brew GMP Basal Medium Availability: worldwide[1)]	500 mL	170-076-317
iPS-Brew GMP Supplement R Availability: worldwide[1)]	10 mL	170-076-318

[1)] For availability in your country please contact your local representative.

MSC-Brew GMP Medium

Overview

MSC-Brew GMP Medium is an optimized and standardized medium for the generation and expansion of mesenchymal stem cells (MSCs) from human bone marrow (BM) or other tissue sources. The formulation of MSC-Brew GMP Medium is designed to efficiently support the expansion of MSCs *in vitro* while maintaining their differentiation potential. The medium is xeno- and serum-free and is manufactured under strictly controlled conditions using ingredients of the highest quality. MSC-Brew GMP Medium offers consistent lot-to-lot performance and optimal conditions for the cultivation of MSCs.

Background information

MSC-Brew GMP Medium is based on the formulation of StemMACS MSC Expansion Media Kit XF (#130-104-182) thus enabling seamless translation from research to clinical applications.

- Serum-free and xeno-free formulation
- Manufactured under strictly controlled conditions
- Consistent lot-to-lot performance
- Quality control: functionality test on every batch
- 500 mL or 2000 mL bags – without phenol red

Applications

The MSC-Brew GMP Medium is an optimized and standardized xeno- and serum-free medium for the reproducible and reliable isolation and expansion of MSCs from human bone marrow and other human tissues, such as adipose tissue and umbilical cord.

Product	Content/ Components	Order no.
MSC-Brew GMP Medium Availability: worldwide[1)]	500 mL 500 mL MSC-Brew Basal Medium MSC-Brew GMP Supplement I MSC-Brew GMP Supplement II	170-076-326
MSC-Brew GMP Medium Availability: worldwide[1)]	2000 mL 2000 mL MSC-Brew Basal Medium MSC-Brew GMP Supplement I MSC-Brew GMP Supplement II	170-076-325

[1)] For availability in your country please contact your local representative.

NK MACS® GMP Medium (Phenol Red)

Overview

NK MACS GMP Medium (Phenol Red) has been optimized for the cultivation, activation, and expansion of isolated human NK cells or NK cells from peripheral blood mononuclear cells (PBMCs). It is manufactured without animal-derived components. NK MACS GMP Medium (Phenol Red) is filled in flexible bags, making handling in GMP confirming processes easy.

Background information

NK MACS GMP Medium is serum- and xeno-component free.

- Flexible bags (2000 mL)
- Manufactured under strictly controlled conditions
- Consistent lot-to-lot performance
- Quality control: functionality test on every batch

Applications

NK MACS GMP Medium has beed developed for the cultivation and expansion of human NK cells from PBMCs or isolated human NK cells.

Product	Content/ Components	Order no.
NK MACS® GMP Medium (Phenol Red) Availability: worldwide[1)]	2000 mL 2000 mL NK MACS® GMP Basal Medium 5 mL NK MACS® GMP Supplement	170-076-356

[1)] For availability in your country please contact your local representative.

TexMACS™ GMP Medium

Overview

TexMACS GMP Medium is specialized for optimal cultivation of human T cells and Treg cells. It is manufactured without animal-derived components. TexMACS GMP Medium is either filled in bottles or flexible bags, making handling in GMP confirming processes easy.

Background information

TexMACS GMP Medium is serum- and xeno-component free.

- Pharmaceutical grade human serum albumine
- Optimized formulation containing glucose and stable glutamine (L-alanyl-L-glutamine)
- QC functionality test on every batch
- Flexible bags (2000 mL) – without phenol red
- Bottles (1000 mL) – with and without phenol red

Applications

TexMACS GMP Medium has been developed for the cultivation and expansion of human T cells and Treg cells, and optimized for the use in combination with the CliniMACS Cytokine Capture System (IFN-gamma).

Product	Content	Order no.
TexMACS™ GMP Medium Availability: worldwide[1)]	1000 mL	170-076-307
TexMACS™ GMP Medium Availability: worldwide[1)]	2000 mL	170-076-306
TexMACS™ GMP Medium (Phenol Red) Availability: worldwide[1)]	1000 mL	170-076-309

[1)] For availability in your country please contact your local representative.

MACS® GMP Cytokines and Growth Factors

Product	Description	Source	Content	Order no.
MACS® GMP Recombinant Human Activin A *see page 78*	Recombinant human activin A	CHO cells	5 µg	170-076-179
		CHO cells	25 µg	170-076-180
MACS® GMP Recombinant Human EGF *see page 78*	Recombinant human epidermal growth factor	*E. coli*	100 µg	170-076-406
		E. coli	500 µg	170-076-407
MACS® GMP Recombinant Human FGF-2 *see page 79*	Recombinant human fibroblast growth factor 2	*E. coli*	25 µg	170-076-107
		E. coli	500 µg	170-076-125
MACS® GMP Recombinant Human Flt3-Ligand *see page 79*	Recombinant human Flt3-ligand	*E. coli*	100 µg	170-076-132
MACS® GMP Recombinant Human GM-CSF *see page 80*	Recombinant human granulocyte colony-stimulating factor	*E. coli*	25 µg	170-076-112
		E. coli	250 µg	170-076-136
MACS® GMP Recombinant Human IL-1β *see page 80*	Recombinant human interleukin 1β	*E. coli*	25 µg	170-076-102
MACS® GMP Recombinant Human IL-2 *see page 81*	Recombinant human interleukin 2	*E. coli*	25 µg	170-076-148
		E. coli	100 µg	170-076-146
		E. coli	500 µg	170-076-147
MACS® GMP Recombinant Human IL-3 *see page 81*	Recombinant human interleukin 3	*E. coli*	25 µg	170-076-110
MACS® GMP Recombinant Human IL-4 *see page 82*	Recombinant human interleukin 4	*E. coli*	25 µg	170-076-101
		E. coli	250 µg	170-076-135
MACS® GMP Recombinant Human IL-6 *see page 82*	Recombinant human interleukin 6	*E. coli*	10 µg	170-076-160
		E. coli	50 µg	170-076-161
MACS® GMP Recombinant Human IL-7 *see page 83*	Recombinant human interleukin 7	*E. coli*	25 µg	170-076-111
MACS® GMP Recombinant Human IL-12 *see page 84*	Recombinant human interleukin 12	CHO cells	5 µg	170-076-173
		CHO cells	25 µg	170-076-174
		CHO cells	100 µg	170-076-175
MACS® GMP Recombinant Human IL-15 *see page 85*	Recombinant human interleukin 15	*E. coli*	25 µg	170-076-114
MACS® GMP Recombinant Human IL-21 *see page 86*	Recombinant human interleukin 21	*E. coli*	25 µg	170-076-115
MACS® GMP Recombinant Human M-CSF *see page 86*	Recombinant human macrophage colony-stimulating factor	*E. coli*	10 µg	170-076-170
		E. coli	50 µg	170-076-171
		E. coli	250 µg	170-076-172
MACS® GMP Recombinant Human SCF *see page 87*	Recombinant human stem cell factor	*E. coli*	10 µg	170-076-149
		E. coli	100 µg	170-076-133
MACS® GMP Recombinant Human TGF-β1 *see page 87*	Recombinant human transforming growth factor β1	CHO cells	5 µg	170-076-166
		CHO cells	25 µg	170-076-167
		CHO cells	100 µg	170-076-168
MACS® GMP Recombinant Human TNF-α *see page 88*	Recombinant human tumor necrosis factor α	*E. coli*	25 µg	170-076-103
		E. coli	100 µg	170-076-178
MACS® GMP Recombinant Human TPO *see page 88*	Recombinant human thrombopoietin	*E. coli*	50 µg	170-076-134

MACS® GMP Recombinant Human Activin A

Overview
Human Activin A is a recombinant protein optimized for use in cell culture, differentiation studies, and functional assays.

MACS GMP Recombinant Human Activin A is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information
Activin A is a member of the TGF-β superfamily and is involved in a wide range of biological processes like growth and differentiation of several tissues. It has been described to affect embryogenesis and hematopoiesis and is necessary for the maintenance of self-renewal and pluripotency of human embryonic stem cells (hESCs).

It supports long-term feeder and serum-free growth of hESCs.

Activin A induces the expression of Oct4, Nanog, Nodal, Wnt3, FGF-2, and FGF-8 and suppresses the BMP signal. It also controls the expression and secretion of hormones like follicle stimulating hormone (FSH), prolactin, and ACTH (corticotropin).

The amino acid sequence of human, mouse, and rat activin A shares 100% identity.

Applications
Human Activin A can be used for a variety of applications, including:
- Maintenance of pluripotency of embryonic stem cells under feeder- and serum-free conditions.
- Differentiation of embryonic stem cells and iPS cells.
- Stimulation and differentiation of mesenchymal cells.

Biological activity
The specific activity is determined by inhibition assay using murine MPC-11 cells according to Phillips et al.[1] The inhibition assay was calibrated with the reference reagent for human Activin A (NIBSC code 91/626) provided by the WHO/National Institute for Biological Standards and Control.
Specific activity: ≥ 1×10^3 U/mg

Product	Content	Order no.
MACS® GMP Recombinant Human Activin A Availability: worldwide[1)]	5 µg	170-076-179
MACS® GMP Recombinant Human Activin A Availability: worldwide[1)]	25 µg	170-076-180

[1)] For availability in your country please contact your local representative.

Selected references
1. Phillips, D. J. *et al.* (1999) J. Endocrinol. 162 (1): 111–116.

MACS® GMP Recombinant Human EGF

Overview
Epidermal growth factor (EGF) is a small mitogenic polypeptide that stimulates the proliferation and differentiation of a wide variety of cells of ectodermal and mesodermal origin, including fibroblasts, epithelial cells, and endothelial cells.

MACS GMP Recombinant Human EGF is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information
EGF is the prototype of the large family of EGF-like proteins with a common structural motif comprising three intramolecular disulfide bonds. EGF is produced by various cell types like mammary gland cells, gut epithelial cells, and cells in the nervous system and the kidney. Production of EGF is induced by testosterone and inhibited by estrogens. *In vitro*, EGF stimulates the proliferation and differentiation of mesenchymal cells, acts as a mitogen for fibroblasts, neural precursors, epithelial and endothelial cells, and promotes colony formation of epidermal cells.

Applications
MACS GMP Recombinant Human EGF can be used as an ingredient for many cell culture applications. EGF can support the maintenance of ectodermal and mesodermal progenitor cells, and stimulates the proliferation and differentiation of a wide variety of cell types deriving both from ectoderm and mesoderm.

Biological activity
The specific activity is determined by proliferation assay according to Robinson and Gaines-Das[1] using 3T3 cells. The proliferation assay was calibrated with the international standard for human EGF (NIBSC code 91/530) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 5×10^5 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human EGF Availability: worldwide[1)]	100 µg	170-076-406
MACS® GMP Recombinant Human EGF Availability: worldwide[1)]	500 µg	170-076-407

[1)] For availability in your country please contact your local representative.

Selected references
1. Robinson, C. J. and Gaines-Das, R. (1996) Growth Factors 13: 163–170.

MACS® GMP Recombinant Human FGF-2

Overview

Fibroblast growth factor 2 (FGF-2), also termed basic FGF, belongs to the family of heparin-binding growth factors. FGF-2 functions as a wide-spectrum mitogenic, angiogenic, and neurotrophic factor and stimulates the proliferation of a wide variety of cells including mesenchymal, neuroectodermal, and endothelial cells.

MACS GMP Recombinant Human FGF-2 is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Applications

MACS GMP Recombinant Human FGF-2 can be used for a variety of applications, including the culture of undifferentiated human embryonic stem cells[2,3] or the expansion of mesenchymal stromal cells[4,5].

Biological activity

The specific activity is determined by proliferation assay according to Robinson and Gaines-Das[1] using 3T3 cells. The proliferation assay was calibrated with the international standard for human FGF-2 (NIBSC code 90/712) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 4×10^5 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human FGF-2 Availability: worldwide[1)]	25 µg	170-076-107
MACS® GMP Recombinant Human FGF-2 Availability: worldwide[1)]	500 µg	170-076-125

[1)] For availability in your country please contact your local representative.

Selected references
1. Robinson, C. J. and Gaines-Das, R. (1994) Growth Factors 11: 9–16.
2. Levenstein, M. E. *et al.* (2006) Stem Cells 24: 568–574.
3. Xu, C. *et al.* (2005) Stem Cells 23: 315–323.
4. Ito *et al.* (2008) Cytotechnology 56: 1–7.
5. Solchaga, L. A. *et al.* (2005) J. Cell. Physiol. 203: 398–409.

MACS® GMP Recombinant Human Flt3-Ligand

Overview

Fms-related tyrosine kinase 3 ligand (Flt3-Ligand) is a growth factor that exerts pleiotropic and potent effects on the development of hematopoietic stem cells (HSCs) and the immune system. In synergy with other growth factors Flt3-Ligand promotes proliferation and development of HSCs, myeloid and lymphoid progenitor cells, dendritic cells, and natural killer cells.

MACS GMP Recombinant Human Flt3-Ligand is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information

Flt3-Ligand belongs to a small family of α-helical cytokines and is expressed by T lymphocytes and bone marrow stromal fibroblasts as a membrane-bound and a soluble isoform. Both isoforms signal through the tyrosine kinase receptor Flt3/Flk-2, which is restricted to cells of hematopoietic origin.

Applications

MACS GMP Recombinant Human Flt3-Ligand can be used for a variety of applications, including the expansion[2,3] and the viral transduction[4,5] of hematopoietic stem and progenitor cells derived from bone marrow, peripheral blood cells, and cord blood.

Biological activity

The specific activity is determined by proliferation assay according to Meyer and Drexler[1] using OCI-AML5 cells. The proliferation assay was calibrated with the reference standard for human Flt3-Ligand (NIBSC 96/532) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 4×10^5 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human Flt3-Ligand Availability: worldwide[1)]	100 µg	170-076-132

[1)] For availability in your country please contact your local representative.

Selected references
1. Meyer, C. and Drexler, H.G. (1999) Leuk. Lymphoma 32: 577–581.
2. Gilliland, D. G. and Griffin, J. D. (2002) Blood 100 (5): 1532–1542.
3. Petzer, A. L. *et al.* (1996) J. Exp. Med. 183 (6): 2551–2558.
4. Kiem, H. P. *et al.* (1998) Blood 92 (6): 1878–1886.
5. Uchida, N. *et al.* (2011) Gene Ther. 18 (11): 1078–1086.

MACS® GMP Recombinant Human GM-CSF

Overview

Granulocyte-macrophage colony–stimulating factor (GM-CSF) is a hematopoietic growth factor, which is essential for proliferation and development of granulocyte and monocyte/macrophage progenitors.

MACS GMP Recombinant Human GM-CSF is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information

Beside its role as growth factor for granulocyte and monocyte precursors, GM-CSF also functions as a growth factor for erythroid and megakaryocytic precursor cells in conjunction with erythropoietin. GM-CSF is secreted by various cell types including T cells, macrophages, endothelial cells, and fibroblasts in response to inflammatory stimuli and cytokines. In addition, GM-CSF is a potent chemoattractant for neutrophils and eosinophils and enhances the effector functions of neutrophils and macrophages.

Applications

MACS GMP Recombinant Human GM-CSF can be used for a variety of applications, including the *ex vivo* generation of human dendritic cells from enriched $CD14^+$ monocytes.[2–4]

Biological activity

The specific activity is determined by proliferation assay according to Kitamura *et al.*[1] using TF-1 cells provided by the German Resource Centre for Biological Material (DSMZ). The proliferation assay was calibrated with the international standard for human GM-CSF (NIBSC code 88/646) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 5×10^6 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human GM-CSF Availability: worldwide[1)]	25 µg	170-076-112
MACS® GMP Recombinant Human GM-CSF Availability: worldwide[1)]	250 µg	170-076-136

[1)] For availability in your country please contact your local representative.

Selected references
1. Kitamura, T. *et al.* (1989) J. Cell. Physiol. 140: 323–334.
2. Bender, A. *et al.* (1996) J. Immunol. Methods 196: 121–135.
3. Romani, N. *et al.* (1996) J. Immunol. Methods 196: 137–151.
4. Jonuleit *et al.* (1997) Eur. J. Immunol. 27: 3135–3142.

MACS® GMP Recombinant Human IL-1β

Overview

Interleukin-1β (IL-1β) is a pro-inflammatory cytokine that mediates inflammatory responses and displays a wide variety of biological activities on many different cell types, including T cells, B cells, and monocytes.

MACS GMP Recombinant Human IL-1β is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information

IL-1β is mainly secreted by monocytes and macrophages. IL-1β secretion has also been reported for a variety of other cells, including B cells, NK cells, dendritic cells, astrocytes, and microglial cells. IL-1β acts also on nonimmune system cells such as fibroblasts, vascular endothelial cells, and hepatocytes.

Applications

MACS GMP Recombinant Human IL-1β can be used for a variety of applications, including the *ex vivo* generation of human dendritic cells from enriched $CD14^+$ monocyte populations.[2–4]

Biological activity

The specific activity is determined by proliferation assay according to Poole and Gaines-Das[1] using D10.G4.1 cells provided by the German Resource Centre for Biological Material (DSMZ). The proliferation assay was calibrated with the first international reference standard for human IL-1β (NIBSC code 86/680) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 2×10^7 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human IL-1β Availability: worldwide[1)]	25 µg	170-076-102

[1)] For availability in your country please contact your local representative.

Selected references
1. Poole, S. and Gaines-Das, R. E. (1991) J. Immunol. Methods 142: 1–13.
2. Bender, A. *et al.* (1996) J. Immunol. Methods 196: 121–135.
3. Romani, N. *et al.* (1996) J. Immunol. Methods 196: 137–151.
4. Jonuleit *et al.* (1997) Eur. J. Immunol. 27: 3135–3142.

MACS® GMP Recombinant Human IL-2

Overview
Interleukin 2 (IL-2), a potent lymphoid cell growth factor, plays an important role in both the activation and maintenance of immune responses and in lymphocyte development. IL-2 promotes, for instance, proliferation and differentiation of T cells, NK cells, and B cells.

MACS GMP Recombinant Human IL-2 is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information
IL-2 is a typical four α-helix bundle cytokine and is produced by activated T cells, especially the $CD4^+$ T helper cell population. IL-2 signals through a receptor complex consisting of IL-2 receptor α-chain (CD25), β-chain, and common γ-chain.

Applications
MACS GMP Recombinant Human IL-2 can be used for a variety of applications, including the *ex vivo* activation and expansion of T cells, e.g., antigen-specific cytotoxic T lymphocytes[2,3] or regulatory T cells[4] or the *ex vivo* stimulation of NK cells[5,6].

Biological activity
The specific activity is determined by proliferation assay according to Gearing and Bird[1] using CTLL-2 cells. The proliferation assay was calibrated with the 2nd international standard for human IL-2 (NIBSC code 86/500) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 1×10^6 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human IL-2 Availability: worldwide[1)]	25 µg	170-076-148
MACS® GMP Recombinant Human IL-2 Availability: worldwide[1)]	100 µg	170-076-146
MACS® GMP Recombinant Human IL-2 Availability: worldwide[1)]	500 µg	170-076-147

[1)] For availability in your country please contact your local representative.

Selected references
1. Gearing, A. J. H. and Bird, C. B. (1987) Oxford: IRL Press: 295.
2. Zhang, H. *et al.* (2007) J. Immunol. 179: 4910–4918.
3. Hinrichs *et al.* (2008) Blood 111: 5326–5333.
4. Peters, J. H. *et al.* (2008) PLoS One 3 (5): e2233.
5. Berg *et al.* (2009) Cytotherapy 11: 341–355.
6. McKenna, D. H. Jr. *et al.* (2007) Transfusion 47 (3): 520–528.

MACS® GMP Recombinant Human IL-3

Overview
Interleukin 3 (IL-3) is a hematopoietic growth factor with a broad spectrum of biologic activities. These include the stimulation of the proliferation and differentiation of immature pluripotent hematopoietic stem cells and various lineage-committed progenitor cells, leading to the production of most of the major blood cell types.

MACS GMP Recombinant Human IL-3 is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information
IL-3 is mainly produced by activated T cells, but is also secreted by other cell types, including mast cells, eosinophils, and keratinocytes. Beside its role as hematopoietic growth factor, IL-3 also affects the functional activity of mature mast cells, basophils, eosinophils, and macrophages.

Applications
MACS GMP Recombinant Human IL-3 can be used for a variety of applications, including the *ex vivo* cultivation of human plasmacytoid dendritic cells from enriched CD304 (BDCA-4)$^+$ cells.[2-4]

Biological activity
The specific activity is determined by proliferation assay according to Kitamura *et al.*[1] using TF-1 cells provided by the German Resource Centre for Biological Material (DSMZ). The proliferation assay was calibrated with the international standard for human IL-3 (NIBSC code 91/510) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 1×10^6 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human IL-3 Availability: worldwide[1)]	25 µg	170-076-110

[1)] For availability in your country please contact your local representative.

Selected references
1. Kitamura, T. *et al.* (1989) J. Cell. Physiol. 140: 323–334.
2. Grouard, G. *et al.* (1997) J. Exp. Med. 185: 1101–1111.
3. Colonna, M. *et al.* (2004) Nat. Immunol. 5: 1219–1226.
4. Cella, M. *et al.* (2000) Nat. Immunol. 1: 305–310.

MACS® GMP Recombinant Human IL-4

Overview
Interleukin 4 (IL-4) is an anti-inflammatory cytokine and is a key regulator in humoral and adaptive immunity. It has complex biological roles and promotes growth and differentiation of B cells and T cells, and cells of the monocytic lineage.

MACS GMP Recombinant Human IL-4 is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information
IL-4 is predominantly secreted by activated $CD4^+$ memory and effector T_H2 cells, basophils, and mast cells. It promotes the proliferation and differentiation of B cells, as well as immunoglobulin isotype switching, and MHC class II antigen and low-affinity IgE receptor expression. Furthermore, IL-4 induces the differentiation of naive $CD4^+$ T cells into helper T_H2 cells, while suppressing T_H1 development, and promotes chemotaxis of mast cells and basophils.

Applications
MACS GMP Recombinant Human IL-4 can be used for a variety of applications, including the *ex vivo* generation of human dendritic cells from enriched $CD14^+$ monocyte populations.[2–4]

Biological activity
The specific activity is determined by proliferation assay according to Kitamura *et al.*[1] using TF-1 cells provided by the German Resource Centre for Biological Material (DSMZ). The proliferation assay was calibrated with the international standard for human IL-4 (NIBSC code 88/656) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 2×10^6 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human IL-4 Availability: worldwide[1)]	25 µg	170-076-101
MACS® GMP Recombinant Human IL-4 Availability: worldwide[1)]	250 µg	170-076-135

[1)] For availability in your country please contact your local representative.

Selected references
1. Kitamura, T. *et al.* (1991) Int. Immunol. 3: 571–577.
2. Bender, A. *et al.* (1996) J. Immunol. Methods 196: 121–135.
3. Romani, N. *et al.* (1996) J. Immunol. Methods 196: 137–151.
4. Jonuleit *et al.* (1997) Eur. J. Immunol. 27: 3135–3142.

MACS® GMP Recombinant Human IL-6

Overview
Interleukin 6 (IL-6) is a multifunctional cytokine, which regulates immune responses, hematopoiesis, acute phase responses, and inflammatory reactions.

MACS GMP Recombinant Human IL-6 is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information
IL-6 is mainly produced by monocytes and macrophages, but as well by fibroblasts or endothelial cells. IL-6 is one of the most important mediators of fever and of the acute phase response. IL-6 induces the terminal maturation of activated B cells into plasma cells, and in combination with other factors like IL-2 and IFN-γ it also affects cytotoxic T lymphocytes.

Applications
MACS GMP Recombinant Human IL-6 can be used for a variety of applications, including the *ex vivo* generation of human dendritic cells from enriched $CD14^+$ monocytes.[2–4]

Biological activity
The specific activity is determined by proliferation assay according to Gaines-Das and Poole[1] using B9 hybridoma cells provided by the German Resource Centre for Biological Material (DSMZ). The proliferation assay was calibrated with the international standard for human IL-6 (NIBSC code 89/548) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 8×10^7 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human IL-6 Availability: worldwide[1)]	10 µg	170-076-160
MACS® GMP Recombinant Human IL-6 Availability: worldwide[1)]	50 µg	170-076-161

[1)] For availability in your country please contact your local representative.

Selected references
1. Gaines-Das, R.E. and Poole, S. (1993) J. Immunol. Methods 160: 147–153.
2. Bender, A. *et al.* (1996) J. Immunol. Methods 196: 121–135.
3. Romani, N. *et al.* (1996) J. Immunol. Methods 196: 137–151.
4. Jonuleit *et al.* (1997) Eur. J. Immunol. 27: 3135–3142.

MACS® GMP Recombinant Human IL-7

Overview

Interleukin 7 (IL-7) is a pleiotropic cytokine with central roles in modulating T cell development and peripheral T cell homeostasis. IL-7 can act both as a T cell growth factor as well as a critical anti-apoptotic survival factor for naive and memory T cells.

MACS GMP Recombinant Human IL-7 is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information

The primary sources of IL-7 are non-hematopoietic stromal cells in bone marrow, thymus, and lymphoid organs and tissues. IL-7 is a member of the type I cytokine family. It is related to IL-2 and signals through a heterodimeric receptor composed of the common cytokine signaling γ-chain and IL-7 receptor α-chain.

Applications

MACS GMP Recombinant Human IL-7 can be used for a variety of applications, including the *ex vivo* generation of antigen-specific cytotoxic T lymphocytes.[2,3]

Biological activity

The specific activity is determined by proliferation assay according to Ishihara *et al.*[1] using mouse 2E8 cells. The proliferation assay was calibrated with the reference standard for human IL-7 (NIBSC code 90/530) provided by the National Institute for Biological Standards and Control.

Specific activity: ≥ 5×10^7 U/mg

Product	Content	Order no.
MACS® GMP Recombinant Human IL-7 Availability: worldwide[1)]	25 µg	170-076-111

[1)] For availability in your country please contact your local representative.

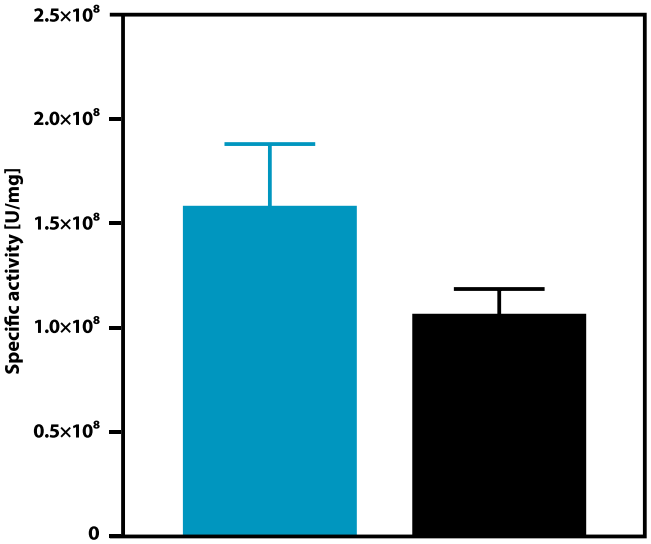


Figure 1: Human IL-7 biological activity. Activity of Human IL-7, GMP grade (blue bar) was compared to another commercially available product (black bar).

Selected references
1. Ishihara, K. *et al.* (1991) Dev. Immunol. 1: 149–161.
2. Zhang, H. *et al.* (2007) J. Immunol. 179: 4910–4918.
3. Kaneko *et al.* (2009) Blood 113: 1006–1015.

MACS® GMP Recombinant Human IL-12

Overview

IL-12 stands for interleukin 12. Human IL-12 is a recombinant protein optimized for use in cell culture, differentiation studies, and functional assays.

MACS GMP Recombinant Human IL-12 is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information

Interleukin 12 (IL-12) is a heterodimeric proinflammatory cytokine and a modulator of cell-mediated immunity, which is mainly produced by macrophages, dendritic cells, and B cells.

IL-12 stimulates the production and secretion of several cytokines, in particular IFN-γ, by NK cells and T cells, induces proliferation, and enhances the cytotoxic activity within these cell populations.

Another important activity of IL-12, acting together with IFN-γ and IL-2, is to drive T helper cell responses toward the T_H1 rather than the T_H2 phenotype. Moreover, IL-12 is also important in resistance to viral disease and has significant antitumor activity.

It has been shown that single chain fusion proteins of naturally occurring heterodimeric cytokines such as IL-12 or IL-23 are bioactive *in vitro* and in *vivo*.[2–4]

Applications

Human IL-12 can be used for a variety of applications, including:

- *In vitro* differentiation of naive $CD4^+$ T cells towards T_H1 cells.
- *In vitro* proliferation and stimulation of cytotoxic activity of NK cells and T cells

Biological activity

The specific activity is determined by induction of IFN-γ secretion by PHA-activated T cells.[1] The proliferation assay was calibrated with the reference reagent for human IL-12 (NIBSC code 95/544) provided by the WHO/National Institute for Biological Standards and Control.

Specific activity: ≥ 3×10^6 U/mg

Product	Content	Order no.
MACS® GMP Recombinant Human IL-12 Availability: worldwide[1)]	5 µg	170-076-173
MACS® GMP Recombinant Human IL-12 Availability: worldwide[1)]	25 µg	170-076-174

[1)] For availability in your country please contact your local representative.

Product	Content	Order no.
MACS® GMP Recombinant Human IL-12 Availability: worldwide[1)]	100 µg	170-076-175

[1)] For availability in your country please contact your local representative.

Selected references

1. Wulff, H. *et al.* (2007) BMC Biotechnol. 7: 35.
2. Lieschke, G.J. *et al.* (1997) Nat. Biotechnol. 15: 35–40.
3. Miller, J.M. *et al.* (2010) Int. J. Infereron Cytokine Mediator Res. 2010: 63–72.
4. Juelke, K. *et al.* (2010) Blood 116 (8): 1299–1307.

MACS® GMP Recombinant Human IL-15

Overview

Interleukin 15 (IL-15) is a potent lymphoid cell growth factor and stimulates the proliferation of activated T cells and the generation of cytotoxic T lymphocytes (CTLs). IL-15 also induces the generation, activation, and proliferation of NK cells.

MACS GMP Recombinant Human IL-15 is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information

IL-15 is a member of the four α-helix bundle cytokine family. It is produced by different cell types, including epithelial cells, monocytes, muscle and placenta cells. In addition to its ability to activate T cells and NK cells, IL-15 is also important for B cell growth and immunoglobulin production as well as for the maintenance of $CD8^+$ memory T cells. For binding and signaling IL-15 uses the unique IL-15 receptor α-chain, but shares the β- and γ-chain of the IL-2 receptor.

Applications

MACS GMP Recombinant Human IL-15 can be used for a variety of applications, including the *ex vivo* generation of cytotoxic T lymphocytes[2,3] or the *ex vivo* stimulation of NK cells[4,5].

Biological activity

The specific activity is determined by proliferation assay according to Soman *et al.*[1] using CTLL-2 cells. The proliferation assay was calibrated with the reference standard for human IL-15 (NIBSC code 95/554) provided by the National Institute for Biological Standards and Control.

Specific activity: ≥ 7×10^6 U/mg

Product	Content	Order no.
MACS® GMP Recombinant Human IL-15 Availability: worldwide[1)]	25 µg	170-076-114

[1)] For availability in your country please contact your local representative.

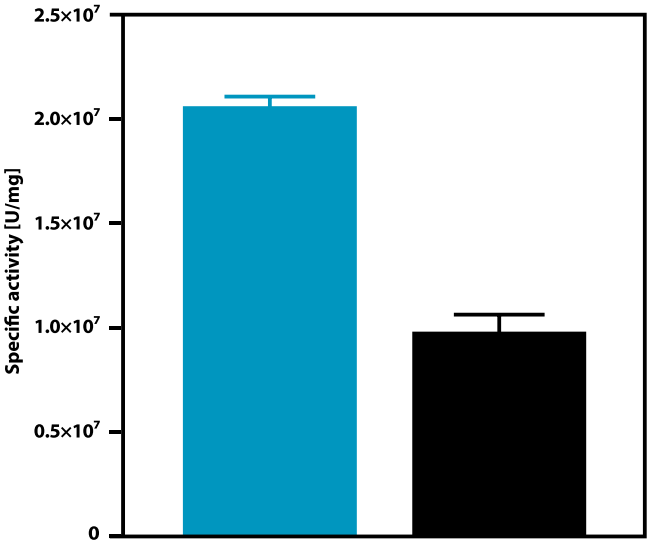


Figure 1: MACS GMP Recombinant Human IL-15 biological activity. Activity of Human IL-15, GMP grade, (blue bar) was compared to another commercially available product (black bar).

Selected references
1. Soman, G. *et al.* (2009) J. Immunol. Methods 348: 83–94.
2. Alves *et al.* (2003) Blood 102: 2541–2546.
3. Kaneko *et al.* (2009) Blood 113: 1006–1015.
4. Cho, D. and Campana, D. (2009) Korean J. Lab. Med. 29: 89–96.
5. Siegler, U. *et al.* (2010) Cytotherapy 12 (6): 750–763.

MACS® GMP Recombinant Human IL-21

Overview

Interleukin 21 (IL-21) has pleiotropic effects on both cellular and humoral immune responses, such as stimulation of lymphocyte proliferation, promotion of $CD8^+$ T cell and NK cell cytotoxicity, and differentiation of B cells into plasma cells.

MACS GMP Recombinant Human IL-21 is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for manufacture of this product. The product is lyophilized without carrier protein or preservatives.

Background information

IL-21 is a four α-helix bundle cytokine and closely related to IL-2, IL-7, and IL-15. IL-21 expression is restricted to activated $CD4^+$ T helper cells and NKT cells. The functional receptor for IL-21, composed of the IL-21 receptor- and the common γ-chain, is expressed on various hematopoietic cells including T, B, NK and dendritic cells.

Applications

MACS GMP Recombinant Human IL-21 can be used for a variety of applications, including the *ex vivo* generation of antigen-specific cytotoxic T cells[1,2] or the *ex vivo* stimulation of NK cells[3].

Biological activity

The specific activity is determined by proliferation assay using mouse B9 hybridoma cells provided by the German Resource Centre for Biological Material (DSMZ).
Specific activity: ≥ 1×10^4 U/mg

Product	Content	Order no.
MACS® GMP Recombinant Human IL-21 Availability: worldwide[1)]	25 µg	170-076-115

[1)] For availability in your country please contact your local representative.

Selected references
1. Li and Yee (2008) Blood 111: 229–235.
2. Hinrichs *et al.* (2008) Blood 111: 5326–5333.
3. de Rham, C. *et al.* (2007) Arthritis Res. Ther. 9: R125.

MACS® GMP Recombinant Human M-CSF

Overview

M-CSF stands for macrophage colony-stimulating factor. Human M-CSF is a recombinant protein optimized for use in cell culture, differentiation studies, and functional assays.

MACS GMP Recombinant Human M-CSF is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information

Macrophage colony-stimulating factor (M-CSF), a four α-helical bundle cytokine, is a potent hematopoietic regulator. It is primarily produced by monocytes, granulocytes, endothelial cells, and fibroblasts. The main function of M-CSF is the regulation of proliferation, differentiation, and survival of monocytes, macrophages, and their hematopoietic progenitors. Furthermore, M-CSF has been shown to play an important role in immunological defense, bone metabolism, fertility, and pregnancy.[2–5]

Applications

Human M-CSF can be used for a variety of applications, including:
- Survival studies and apoptosis assays, for example, using peripheral blood monocytes.
- Differentiation of macrophages from peripheral blood monocytes.
- Differentiation of osteoclasts from $CD14^+$ monocytes.

Biological activity

The specific activity is determined by proliferation assay using mouse M-NFS-60 cells according to Mire-Sluis, A. R. *et al.*[1] The proliferation assay was calibrated with the international standard for human M-CSF (NIBSC code 89/512) provided by the WHO/ National Institute for Biological Standards and Control.
Specific activity: ≥ 4×10^7 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human M-CSF Availability: worldwide[1)]	10 µg	170-076-170
MACS® GMP Recombinant Human M-CSF Availability: worldwide[1)]	50 µg	170-076-171
MACS® GMP Recombinant Human M-CSF Availability: worldwide[1)]	250 µg	170-076-172

[1)] For availability in your country please contact your local representative.

Selected references
1. Mire-Sluis, A.R. *et al.* (1995) J. Immunol. Methods 179: 141–151.
2. Guery L. *et al.* (2014) Blood 118: 4694–4704.
3. Meissner, F. *et al.* (2010) Blood 116 (9): 1570–1573.
4. Stanley, E.R. *et al.* (1997) Mol. Reprod. Dev. 46 (1): 4–10.
5. Fixe, P. *et al.* (1997) Eur. Cytokine Netw. 8 (2): 125–136.

MACS® GMP Recombinant Human SCF

Overview

Stem cell factor (SCF), also termed c-kit ligand, mast cell growth factor (MGF), or steel factor (SLF) is a hematopoietic growth factor important for the survival, proliferation, and differentiation of hematopoietic stem cells and progenitor cells. Besides its pivotal role in mast cell development, SCF acts as a potent mast cell chemoattractant and upregulates mast cell adhesion and migration.

MACS GMP Recombinant Human SCF is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information

SCF signals through the c-kit receptor (CD117) and exists in two forms; cell surface bound SCF and soluble SCF. The secreted soluble form of SCF is produced by the proteolytic processing of the cell surface anchored precursor molecule. SCF is constitutively produced by endothelial cells and by stromal fibroblasts.

Applications

MACS GMP Recombinant Human SCF can be used for a variety of applications, including the expansion[2,3] and the viral transduction[4,5] of hematopoietic stem and progenitor cells derived from bone marrow, peripheral blood cells, and cord blood, or the *in vitro* differentiation of megakaryocytes[6].

Biological activity

The specific activity is determined by proliferation assay according to Kitamura *et al.*[1] using TF-1 cells provided by the German Resource Centre for Biological Material (DSMZ). The proliferation assay was calibrated with the international standard for human SCF (NIBSC code 91/682) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 5×10^5 U/mg

Product	Content	Order no.
MACS® GMP Recombinant Human SCF Availability: worldwide[1)]	10 µg	170-076-149
MACS® GMP Recombinant Human SCF Availability: worldwide[1)]	100 µg	170-076-133

[1)] For availability in your country please contact your local representative.

Selected references
1. Kitamura, T. *et al.* (1989) J. Cell. Physiol. 140: 323–334.
2. Broudy, V. C. (1997) Blood 90 (4): 1345–1364.
3. Petzer, A. L. *et al.* (1996) J. Exp. Med. 183 (6): 2551–2558.
4. Kiem, H. P. *et al.* (1998) Blood 92 (6): 1878–1886.
5. Uchida, N. *et al.* (2011) Gene Ther. 18 (11): 1078–1086.
6. Bruno, S. *et al.* (2003) Haematologica 88 (4): 379–387.

MACS® GMP Recombinant Human TGF-β1

Overview

Transforming growth factor β1 (TGF-β1) belongs to a family of homologous, disulfide-linked, homodimeric proteins. These highly pleiotropic cytokines inhibit proliferation of most cells, but can promote the growth of mesenchymal cells and enhance extracellular matrix formation. The pivotal function of TGF-β1 in the immune system is to mediate immunosuppression and maintain tolerance by regulating lymphocyte proliferation, differentiation, and survival.

Background information

TGF-β1 controls inflammatory responses through chemotactic attraction and activation of inflammatory cells and fibroblasts. All three TGF-β members are synthesized as an homodimeric precursor of 390 residues, which is intracellularly processed by proteolysis into a 112-amino acid form. The resulting N-terminal latency-associated peptide (LAP) remains non-covalently associated with the TGF-β dimer, and the complex binds to another protein called Latent TGF-β-Binding Protein (LTBP), forming a larger complex called Large Latent Complex (LLC). The LLC is secreted into the extracellular matrix and prevents the binding of TGF-β to its specific cell surface receptor. Several extracellular factors, such as matrix metalloproteases, low pH, reactive oxygen species, and thrombospondin-1 can induce release of the active mature TGF-β dimer from the inactive complex. This sophisticated mechanism of activation is important for a fine-tuning of TGF-β signaling.

Applications

MACS GMP Recombinant Human TGF-β1 can be used for a variety of applications, including the culture of undifferentiated human embryonic stem cells or the expansion of mesenchymal stromal cells.

Biological activity

The specific activity is determined by inhibition assay using IL-5 induced TF-1 cells according to Randall *et al.*[1]. The proliferation assay was calibrated with the standard for human TGF-β1 (NIBSC code 89/514) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 2×10^6 U/mg

Product	Content	Order no.
MACS® GMP Recombinant Human TGF-β1 Availability: worldwide[1)]	5 µg	170-076-166
MACS® GMP Recombinant Human TGF-β1 Availability: worldwide[1)]	25 µg	170-076-167
MACS® GMP Recombinant Human TGF-β1 Availability: worldwide[1)]	100 µg	170-076-168

[1)] For availability in your country please contact your local representative.

Selected references
1. Randall, L. A. *et al.* (1993) J. Immunol. Methods 164: 61–67.

MACS® GMP Recombinant Human TNF-α

Overview
Tumor necrosis factor alpha (TNF-α) has a broad spectrum of biological activities. In addition to its central role in inflammation TNF-α is involved in regulating apoptotic cell death, cellular proliferation, and differentiation.

MACS GMP Recombinant Human TNF-α is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product, unless otherwise stated in the respective Certificate of Origin. The product is lyophilized without carrier protein or preservatives.

Background information
TNF-α is mainly produced by activated monocytes and macrophages, but also by a broad variety of other cell types including lymphoid cells, mast cells, endothelial cells, fibroblasts, and astrocytes. Beside its primary role in immune regulation, TNF-α promotes angiogenesis, bone resorption, and thrombotic processes.

Applications
MACS GMP Recombinant Human TNF-α can be used for a variety of applications, including the *ex vivo* generation of human dendritic cells from enriched $CD14^+$ monocyte populations.[2-4]

Biological activity
The specific activity is determined by cytotoxicity assay using L929 cells provided by the German Collection of Microorganisms and Cell Cultures (DSMZ) in the presence of 1 µg/mL actinomycin D according to Baarsch *et al.*[1] The cytotoxicity assay was calibrated with the international standard for human TNF-α (NIBSC code 88/786) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 2×10^7 IU/mg

Product	Content	Order no.
MACS® GMP Recombinant Human TNF-α Availability: worldwide[1)]	25 µg	170-076-103
MACS® GMP Recombinant Human TNF-α Availability: worldwide[1)]	100 µg	170-076-178

[1)] For availability in your country please contact your local representative.

Selected references
1. Baarsch, M. J. *et al.* (1991) J. Immunol. Methods 140: 15–22.
2. Bender, A. *et al.* (1996) J. Immunol. Methods 196: 121–135.
3. Romani, N. *et al.* (1996) J. Immunol. Methods 196: 137–151.
4. Jonuleit *et al.* (1997) Eur. J. Immunol. 27: 3135–3142.

MACS® GMP Recombinant Human TPO

Overview
Thrombopoietin (TPO), also termed megakaryocyte growth and development factor (MGDF), is a glycoprotein hormone and the major stimulator of megakaryopoiesis and platelet production. It promotes the proliferation of hematopoietic stem cells, primitive progenitors, megakaryocytes, and platelets.

MACS GMP Recombinant Human TPO is designed for *ex vivo* cell culture processing. No animal- or human-derived materials were used for the manufacture of this product. The product is lyophilized without carrier protein or preservatives.

Background information
TPO is expressed in liver, kidney, spleen, lung, bone marrow, and brain. The TPO receptor is a product of the proto-oncogene *c-mpl* and displays homology with type I cytokine receptor superfamily members. The receptor is present mainly on hematopoietic stem cells, megakaryocytic progenitors, megakaryocytes, and platelets.

Applications
MACS GMP Recombinant Human TPO can be used for a variety of applications, including the expansion[2,3] and the viral transduction[4,5] of hematopoietic stem and progenitor cells derived from bone marrow, peripheral blood cells, and cord blood, or the *in vitro* differentiation of megakaryocytes[6].

Biological activity
The specific activity is determined by proliferation assay according to Page *et al.*[1] using M07e cells. The proliferation assay was calibrated with the Non WHO Reference Material for human TPO (NIBSC code 03/124) provided by the National Institute for Biological Standards and Control.
Specific activity: ≥ 1×10^7 U/mg

Product	Content	Order no.
MACS® GMP Recombinant Human TPO Availability: worldwide[1)]	50 µg	170-076-134

[1)] For availability in your country please contact your local representative.

Selected references
1. Page, L. A. *et al.* (1996) Cytokine 8 (1): 66–69.
2. Kaushansky, K. and Drachman, J. G. (2002) Oncogene 21 (21): 3359–3367.
3. Petzer, A. L. *et al.* (1996) J. Exp. Med. 183 (6): 2551–2558.
4. Kiem, H. P. *et al.* (1998) Blood 92 (6): 1878–1886.
5. Uchida, N. *et al.* (2011) Gene Ther. 18 (11): 1078–1086.
6. Bruno, S. *et al.* (2003) Haematologica 88 (4): 379–387.

MACS® GMP Activation and Expansion Tools

Product	Description	Content	Order no.
MACS® GMP CD3 pure	GMP-grade antibody for *ex vivo* T cell activation and expansion	0.2 mg in 1 mL	170-076-124[1]
		1 mg in 1 mL	170-076-116[1]
MACS® GMP CD28 pure	GMP-grade antibody for *ex vivo* T cell activation and expansion	0.5 mg in 1 mL	170-076-117[1]
MACS® GMP CpG-P	MACS GMP CpG-P is intended for *in vitro* stimulation of human B cells or plasmacytoid dendritic cells (pDCs)	75 nmol	170-079-000[1]
MACS® GMP ExpAct™ Treg Kit	Kit for the efficient expansion of human Treg cells for clinical research	2×5 mL	170-076-119[1,2]
MACS® GMP ExpAct™ Treg Kit for Research Use	Kit for the efficient expansion of human Treg cells for clinical research	2×5 mL	130-020-007[3]
MACS® GMP ExpAct™ Treg Kit, CRR-US	Kit for the efficient expansion of human Treg cells for clinical research	2×5 mL	200-070-412[3,4]
MACS® GMP T Cell TransAct™	MACS GMP T Cell TransAct is intended for the *in vitro* stimulation and expansion of human T cells from PBMCs or enriched T cells	4 mL	170-076-156[1]
MACS® GMP T Cell TransAct™ Large Scale	MACS GMP T Cell TransAct is intended for the *in vitro* stimulation and expansion of human T cells from PBMCs or enriched T cells	4 mL	170-076-177[1]
MACS® GMP T Cell TransAct™ Large Scale, CRR	MACS GMP T Cell TransAct is intended for the *in vitro* stimulation and expansion of human T cells from PBMCs or enriched T cells	4 mL	200-076-204[3,4]
MACS® GMP T Cell TransAct™, CRR	MACS GMP T Cell TransAct is intended for the *in vitro* stimulation and expansion of human T cells from PBMCs or enriched T cells	4 mL	200-076-202[3,4]
MACS® GMP Vectofusin®-1	Synthetic peptide for enhanced viral transduction efficiency	1 mg	170-076-165[1]

[1] For availability in your country please contact your local representative.
[2] Not available for use in the USA.
[3] This product is available in the USA only.
[4] In the USA, this product is available for use only under an approved Investigational New Drug (IND) application or Investigation Device Exemption (IDE).

MACS® GMP Antigens and Peptide Pools

Product	Capacity/Content	Order no.
MACS® GMP PepTivator® AdV select	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-169
MACS® GMP PepTivator® AdV5 Hexon	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-106
MACS® GMP PepTivator® BKV LT	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-139
MACS® GMP PepTivator® BKV VP1	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-138
MACS® GMP PepTivator® EBV EBNA-1	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-129
MACS® GMP PepTivator® EBV Select	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-143
MACS® GMP PepTivator® HCMV pp65	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-109
MACS® GMP PepTivator® HPV16-E6	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-158
MACS® GMP PepTivator® HPV16-E7	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-159
MACS® GMP PepTivator® MAGE-A3	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-153
MACS® GMP PepTivator® Melanoma Select	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-164
MACS® GMP PepTivator® Mucin-1	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-151
MACS® GMP PepTivator® NY-ESO-1	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-137
MACS® GMP PepTivator® PRAME	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-157
MACS® GMP PepTivator® SARS-CoV-2 Select	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-017
MACS® GMP PepTivator® Survivin 1	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-152
MACS® GMP PepTivator® WT1	for stimulation of 1×10^9 cells 60 nmol/peptide	170-076-123



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