



Miltenyi Biotec

# MACS® Cytokines

Catalog and product list

January 1, 2012

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GMP grade

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Premium grade

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Research grade

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► [miltenyibiotec.com/cytokines](http://miltenyibiotec.com/cytokines)

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**MACS GMP Cytokines are for research use and *ex vivo* cell culture processing only, and are not intended for human *in vivo* applications. The products are manufactured and tested under a certified ISO 9001 quality system and in compliance with relevant GMP guidelines. They are designed following the recommendations of USP chapter <1043> on ancillary materials.**

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## Table of contents

4	<b>Product overview</b>
6	<b>About MACS® Cytokines</b>
8	Quality description
9	Technical information
10	<b>MACS® GMP Cytokines</b>
15	Product list: MACS® GMP Cytokines
16	<b>MACS® Premium- and Research-Grade Cytokines</b>
16	Selected highlights
29	Product list: Human cytokines & growth factors
36	Product list: Mouse cytokines & growth factors
38	Product list: Rat cytokines & growth factors

## MACS® GMP Cytokines

### Product overview

Page	Product	Regulatory status	Availability
10	MACS GMP Recombinant Human FGF-2	*)	Worldwide <sup>1)</sup>
10	MACS GMP Recombinant Human GM-CSF	*)	Worldwide <sup>1)</sup>
11	MACS GMP Recombinant Human Interleukin 1β	*)	Worldwide <sup>1)</sup>
11	MACS GMP Recombinant Human IL-2	*)	Worldwide <sup>1)</sup>
12	MACS GMP Recombinant Human IL-3	*)	Worldwide <sup>1)</sup>
12	MACS GMP Recombinant Human IL-4	*)	Worldwide <sup>1)</sup>
13	MACS GMP Recombinant Human IL-6	*)	Worldwide <sup>1)</sup>
13	MACS GMP Recombinant Human IL-7	*)	Worldwide <sup>1)</sup>
14	MACS GMP Recombinant Human IL-15	*)	Worldwide <sup>1)</sup> <i>coming soon</i>
14	MACS GMP Recombinant Human IL-21	*)	Worldwide <sup>1)</sup> <i>new</i>
14	MACS GMP Recombinant Human TNF-α	*)	Worldwide <sup>1)</sup>

### Product list

Page	Complete product list
15	MACS GMP Cytokines

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

\*) 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® Premium- and Research-Grade Cytokines

### Selected highlights

Page	Product	Description	
16	Human FGF-1	Recombinant human fibroblast growth factor 1	
16	Human FGF-2	Recombinant human fibroblast growth factor 2	
17	Human FGF-8b	Recombinant human fibroblast growth factor 8b	
17	Human Flt3-Ligand	Recombinant human Fms-related tyrosin kinase 3 ligand	<i>new</i>
18	Human G-CSF	Recombinant human granulocyte colony stimulating factor	<i>new</i>
18	Human GM-CSF	Recombinant human granulocyte macrophage-colony stimulating factor	
19	Human IFN- $\gamma$ 1b	Recombinant human interferon $\gamma$ 1b	<i>new</i>
19	Human IL-1 $\beta$	Recombinant human interleukin-1 $\beta$	
20	Human IL-3	Recombinant human interleukin 3	
20	Human IL-4	Recombinant human interleukin 4	
21	Human IL-6	Recombinant human interleukin 6	
21	Human IL-7	Recombinant human interleukin 7	
22	Human IL-12	Recombinant human interleukin 12	<i>new</i>
22	Human IL-15	Recombinant human interleukin 15	
23	Human IL-23	Recombinant human interleukin 23	<i>new</i>
23	Human M-CSF	Recombinant human macrophage-colony stimulating factor	<i>new</i>
24	Human SCF	Recombinant human Stem Cell Factor	<i>new</i>
24	Human IL-23	Recombinant human interleukin 23	
25	Human SHH (C24II)	Recombinant human sonic hedgehog (C24II)	
25	Human TGF- $\beta$ 1	Recombinant human transforming growth factor $\beta$ 1	
26	Human TNF- $\alpha$	Recombinant human tumor necrosis factor $\alpha$	
26	Mouse IL-12	Recombinant mouse interleukin 12	<i>new</i>
27	Mouse IL-23	Recombinant mouse interleukin 23	<i>new</i>
26	Mouse GM-CSF	Recombinant mouse granulocyte macrophage-colony stimulating factor	
27	Mouse IFN- $\alpha$	Recombinant mouse interferon $\alpha$	
28	Mouse LIF	Recombinant mouse leukemia inhibitory factor	

### Product lists

Page	Complete product list
29	Human cytokines & growth factors
36	Mouse cytokines & growth factors
38	Rat cytokines & growth factors

## About MACS® Cytokines

### **MACS® Cytokines: not only products, but solutions**

The quality of cell culture ingredients dramatically influences cell biology. Consistent, high-quality products are essential for reliable and functionally relevant cell culture results. The field of cell-based therapy in particular requires that all starting materials, including media and cytokines, comply with highly demanding GMP specifications.

### **Highest standards: crucial in advancing towards clinical applications**

MACS GMP Cytokines are made in Germany in a GMP facility in Teterow, equipped with state-of-the-art development and production areas from class A to D. All products are manufactured in compliance with relevant GMP guidelines and designed following the recommendations of United States Pharmacopeia, chapter <1043> on ancillary materials for cell, gene, and tissue-engineered products. Consequently, they are free of human and animal-derived components and lyophilized without carrier protein or preservatives. Product specifications are confirmed by batch-specific certificates of analysis to ensure consistency of quality.



Miltenyi Biotec GMP facility in Teterow, Germany.

### **Consistent product quality: ensured by stringent manufacturing processes and comprehensive quality control**

MACS GMP Cytokines are manufactured and tested under an ISO 9001 quality system. Standardized and strictly controlled industrial manufacturing processes are followed, including automated aseptic filling, lyophilization, and finishing. All steps, from master cell banks to final filled products, are carried out on qualified equipment and skilled employees.

Stringent quality control (QC) tests are performed using comprehensive and accurate analytical methods. Lot-specific certificates of analysis specify and confirm specific biological activity, sterility, purity, identity, protein content, endotoxin content, host cell DNA content, and host cell protein content. Every processing step, from development to production and QC testing is extensively documented.



Automated and aseptic filling, lyophilization, and finishing ensures product consistency and sterility.

**Support and experience:  
to suit customers' requirements and applications**

Miltenyi Biotec is an experienced provider of products for translational medicine and tools for cell therapy applications. The production of high-quality cytokines for the expansion and differentiation of target cells follows from our research focus on stem cell-based tissue regeneration as well as immunotherapy, including adoptive T cell transfer, NK cell-based therapies, and dendritic cell vaccination. Consequently, Miltenyi Biotec caters to our customers' needs and all technical and regulatory support.

**Flexibility on demand**

As a producer, Miltenyi Biotec offers a variety of vial sizes, besides the off-the-shelf products featured in this catalog, as well as bulk quantities, and customized formulations and fillings to meet your demands. For individual cases and important orders lot reservations and standing orders are possible. Custom cytokines may be produced in bacterial or eukaryotic expression systems. MACS Cytokines are available at different quality formats: GMP grade, premium grade, and research grade.



Broad knowledge and skills among employees, ranging from technical to regulatory expertise.



Bioreactor for production of high-quality recombinant proteins.

## Quality description

### MACS® GMP Cytokines

To support the intricate process of cell-based therapies in pre-clinical and clinical research.

- MACS GMP Cytokines are for research use and *ex vivo* cell culture processing only, and are not intended for human *in vivo* applications.
- MACS GMP Cytokines are manufactured and tested under a certified ISO 9001 quality system and in compliance with relevant GMP guidelines.
- They are designed following the recommendations of USP <1043> on ancillary material.
- No animal-, or human-derived materials were used for manufacture of these products.
- They are lyophilized without carrier proteins or preservatives.
- Lot-specific certificates of analysis specify:  
biological activity (standardized International Units), sterility (Ph. Eur.), purity (chip electrophoresis), identity (isoelectric focusing or mass spectrometry), endotoxin content (LAL assay according to Ph. Eur.), protein content, host cell DNA content, and host cell protein content.



MACS Cytokines, available at different quality grades, up to GMP grade, to meet all your demands.

### MACS Premium-Grade Cytokines

These high-activity, low-endotoxin products are intended for applications where the exact knowledge of the biological activity plays a crucial role.

- The specific biological activity is determined for each lot after lyophilization, assuring a particular high and well-defined activity.
- The bioassays to determine the specific activity are calibrated with international standards (NIBSC) for reproducible results.
- Carrier protein-free product-specific formulations containing mannitol and trehalose are optimized for fast and reliable reconstitution and increased stability.
- In most cases the purity is above 97%.
- The endotoxin level is usually below 0.1 EU/µg (corresponding to 0.01 ng/µg cytokine).
- Lot-specific certificates of analysis are available on request.

### MACS Research-Grade Cytokines

These products are suitable for a wide variety in cell culture applications, differentiation studies, and functional assays.

- Biological activity determined by appropriate bioassays and a minimum activity is usually assured.
- Purity generally higher than 95%.
- Endotoxin levels below 1 EU/µg (corresponding to 0.1 ng/µg cytokine).

## Technical information

### Biological activity

Biological activities of cytokines are determined by appropriate bioassays employing factor-dependent cell lines (or primary cells). The most common read-out of bioassays is cell proliferation (stimulation or inhibition). Bioassays are used to determine ED50 values, the concentration of cytokine required to induce half maximal activity (e.g., in ng/mL).

By definition, one unit of activity is the amount of cytokine per mL that has 50% of the maximal effect. The specific activity is therefore generally deduced from the ED50 value by the following equation:  
Specific activity (units/mg):

$$A \text{ (U/mg)} = 1/\text{ED50 (ng/mL)} \times 10^6$$

For GMP- and premium-grade cytokines the bioassay is calibrated with international standards provided by the National Institute for Biological Standards and Control (NIBSC). Whenever an international standard is available, we measure the activity of a given cytokine in relation to the international standard for that cytokine, and specific biological activities are given in International Units/mg (IU/mg).

The standardized determination of the specific activity allows the comparability between different lots and to balance lot variations by always using the same amounts of units (instead of ng). Exact unit dosing makes lot reservations and revalidation needless.

Please note that biological activities of different samples can only be compared if the cellular assays are normalized with a defined standard (from the NIBSC) or if the samples are measured in parallel using the same assay, the same batch of cells, and the same set of conditions.

The determined biological activity is only an indication for the sensitivity of the respective assay. It does not mean that this specific activity translates 1:1 into any particular application. Therefore, it is recommended to determine the optimal concentration for a specific application by a dose-response experiment.

### Storage and shipping

For long-term storage, lyophilized and reconstituted products should be stored at  $-20^{\circ}\text{C}$ . Upon reconstitution we recommend to store working aliquots and to avoid repeated freeze-thaw cycles. Shipment or short-term storage of the lyophilized products at room temperature will not alter the performance.

As we constantly develop and release new products, not every product can be listed in this catalog. Therefore please visit our website at [www.miltenyibiotec.com/cytokines](http://www.miltenyibiotec.com/cytokines) for new products or contact our technical support, if you are not able to find the specific product you need.

## MACS® GMP Recombinant Human FGF-2

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human FGF-2	25 µg	*)	Worldwide <sup>1)</sup>	170-076-107
MACS GMP Recombinant Human FGF-2	500 µg	*)	Worldwide <sup>1)</sup> <b>new</b>	170-076-125

\*) 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.

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

### Description

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 lyophilized without carrier protein or preservatives. A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, endotoxin content, host-cell DNA content, and host-cell protein content.

### Biological activity

≥ 4×10<sup>5</sup> IU/mg;  
proliferation of 3T3 cells (NIBSC 90/712)

### Applications

MACS GMP Recombinant Human FGF-2 can be used for a variety of applications, including the culture of undifferentiated human embryonic stem cells<sup>1,2</sup> or the expansion of mesenchymal stromal cells<sup>3,4</sup>.

### References

1. Levenstein *et al.* (2006) *Stem Cells* 24: 568–574.
2. Xu *et al.* (2005) *Stem Cells* 23: 315–323.
3. Ito *et al.* (2008) *Cytotechnology* 56: 1–7.
4. Solchaga *et al.* (2005) *J. Cell. Physiol.* 203: 398–409.

## MACS® GMP Recombinant Human GM-CSF

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human GM-CSF	25 µg	*)	Worldwide <sup>1)</sup>	170-076-112

\*) 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.

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

### Description

Human 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. 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.

MACS GMP Recombinant Human GM-CSF is lyophilized without carrier protein or preservatives.

A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, endotoxin content, host-cell DNA content, and host-cell protein content.

### Biological activity

≥ 5×10<sup>6</sup> IU/mg;  
proliferation of TF-1 cells (NIBSC 88/646)

### 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<sup>+</sup> monocytes.<sup>1-3</sup>

### References

1. Bender *et al.* (1996) *J. Immunol. Methods* 196: 121–135.
2. Romani *et al.* (1996) *J. Immunol. Methods* 196: 137–151.
3. Jonuleit *et al.* (1997) *Eur. J. Immunol.* 27: 3135–3142.

### Related products

MACS® GMP Recombinant Human IL-4

## MACS® GMP Recombinant Human Interleukin 1β

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human IL-1β	25 µg	*)	Worldwide <sup>1)</sup>	170-076-102

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

### Description

Interleukin-1β (IL-1β) is a pro-inflammatory cytokine that is secreted mainly 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. It mediates inflammatory responses in B cells, T cells, and NK cells by inducing the production of cytokines, such as IL-2, IL-3, IL-6, as well as interferons.

MACS GMP Recombinant Human Interleukin 1β is lyophilized without carrier protein or preservatives.

A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, endotoxin content, and host-cell DNA content.

### Biological activity

≥ 2×10<sup>7</sup> IU/mg;  
proliferation of D10.G4.1 cells (NIBSC 86/680)

### Applications

MACS GMP Recombinant Human Interleukin 1β can be used for a variety of applications, including the *ex vivo* generation of human dendritic cells from enriched CD14<sup>+</sup> monocyte populations.<sup>1-3</sup>

### References

- Bender *et al.* (1996) *J. Immunol. Methods* 196: 121–135.
- Romani *et al.* (1996) *J. Immunol. Methods* 196: 137–151.
- Jonuleit *et al.* (1997) *Eur. J. Immunol.* 27: 3135–3142.

## MACS® GMP Recombinant Human IL-2

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human IL-2	20 µg	*)	Worldwide <sup>1)</sup>	170-076-113

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

### Description

Interleukin 2 (IL-2), a potent lymphoid cell growth factor, is a typical four α-helix bundle cytokine. IL-2 is produced by activated T cells, especially the CD4<sup>+</sup> 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, for instance, proliferation and differentiation of T cells, NK cells, and B cells. IL-2 signals through a receptor complex consisting of IL-2 receptor α-chain (CD25), β-chain, and common γ-chain.

MACS GMP Recombinant Human IL-2 is lyophilized without carrier protein or preservatives.

A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, and endotoxin content.

### Biological activity

≥ 1×10<sup>6</sup> IU/mg;  
proliferation of CTLL-2 cells (NIBSC 86/504)

### 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<sup>1,2</sup> or regulatory T cells<sup>3</sup> or the *ex vivo* stimulation of NK cells<sup>4,5</sup>.

### References

- Zhang *et al.* (2007) *J. Immunol.* 179: 4910–4918.
- Hinrichs *et al.* (2008) *Blood* 111: 5326–5333
- Peters *et al.* (2008) *PLoS ONE* 3 (5): e2233.
- Berg *et al.* (2009) *Cytotherapy* 11: 341–355.
- McKenna *et al.* (2007) *Transfusion* 47: 520–528.

## MACS® GMP Recombinant Human IL-3

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human IL-3	25 µg	*)	Worldwide <sup>1)</sup>	170-076-110

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

### Description

Interleukin 3 (IL-3) is a hematopoietic growth factor which is produced mainly by activated T cells, but is also secreted by other cell types, including mast cells, eosinophils, and keratinocytes. The broad spectrum of biologic activities of IL-3 includes the stimulation of the proliferation and differentiation of immature pluripotent hematopoietic stem cells and various lineage-committed progenitor cells.

MACS GMP Recombinant Human IL-3 is lyophilized without carrier protein or preservatives. A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, endotoxin content, host-cell DNA content, and host-cell protein content.

### Biological activity

≥ 1×10<sup>6</sup> IU/mg;  
proliferation of TF-1 cells (NIBSC 91/510)

### 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)<sup>+</sup> cells.<sup>1-3</sup>

### References

- Grouard *et al.* (1997) *J. Exp. Med.* 185: 1101–1111.
- Colonna *et al.* (2004) *Nat. Immunol.* 5: 1219–1226.
- Cella *et al.* (2000) *Nat. Immunol.* 1: 305–310.

## MACS® GMP Recombinant Human IL-4

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human IL-4	25 µg	*)	Worldwide <sup>1)</sup>	170-076-101
MACS GMP Recombinant Human IL-4	250 µg	*)	Worldwide <sup>1)</sup> <b>new</b>	170-076-135

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

### Description

Interleukin 4 (IL-4) is an anti-inflammatory cytokine and is a key regulator in humoral and adaptive immunity. It has complex biological roles including the stimulation of activated B cell and T cell proliferation, and the differentiation of CD4<sup>+</sup> T cells into Th2 cells.

MACS GMP Recombinant Human IL-4 is lyophilized without carrier protein or preservatives.

A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, endotoxin content, host-cell DNA content, and host-cell protein content.

### 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<sup>+</sup> monocyte populations.<sup>1-3</sup>

### Biological activity

≥ 2×10<sup>6</sup> IU/mg;  
proliferation of TF-1 cells (NIBSC 88/656)

### References

- Bender *et al.* (1996) *J. Immunol. Methods* 196: 121–135.
- Romani *et al.* (1996) *J. Immunol. Methods* 196: 137–151.
- Jonuleit *et al.* (1997) *Eur. J. Immunol.* 27: 3135–3142.

### Related products

MACS® GMP Recombinant Human GM-CSF

## MACS® GMP Recombinant Human IL-6

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human IL-6	10 µg	*)	Worldwide <sup>1)</sup>	170-076-104

\*) 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.

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

### Description

Interleukin 6 (IL-6) is a cytokine showing growth-inducing, growth-inhibitory, and differentiation-inducing effects in a cell type-specific manner. IL-6 acts as both a pro-inflammatory and anti-inflammatory cytokine. It is mainly produced by monocytes and macrophages, but as well by epithelial or endothelial cells. IL-6 is one of the most important mediators of fever and of the acute phase response affecting B lymphocytes, T lymphocytes, and hybridoma cells.

In combination with other factors like human interleukin 2 and interferon  $\gamma$  it also affects cytotoxic T lymphocytes.

MACS GMP Recombinant Human IL-6 is lyophilized without carrier protein or preservatives.

A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, endotoxin content, and host-cell DNA content.

### Biological activity

$\geq 4 \times 10^7$  IU/mg;  
proliferation of B9 cells (NIBSC 89/548)

### 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<sup>+</sup> monocytes.<sup>1-3</sup>

### References

- Bender *et al.* (1996) *J. Immunol. Methods* 196: 121–135.
- Romani *et al.* (1996) *J. Immunol. Methods* 196: 137–151.
- Jonuleit *et al.* (1997) *Eur. J. Immunol.* 27: 3135–3142.

## MACS® GMP Recombinant Human IL-7

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human IL-7	25 µg	*)	Worldwide <sup>1)</sup>	170-076-111

\*) 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.

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

### Description

Interleukin 7 (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  $\gamma$ -chain and IL-7 receptor  $\alpha$ -chain.

MACS GMP Recombinant Human IL-7 is lyophilized without carrier protein or preservatives.

A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, endotoxin content, and host-cell DNA content.

### Biological activity

$\geq 5 \times 10^7$  U/mg;  
proliferation of 2E8 cells (NIBSC 90/530)

### 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.<sup>1,2</sup>

### References

- Zhang *et al.* (2007) *J. Immunol.* 179: 4910–4918.
- Kaneko *et al.* (2009) *Blood* 113: 1006–1015.

## MACS® GMP Recombinant Human IL-15

coming soon

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human IL-15	25 µg	*)	Worldwide <sup>1)</sup>	170-076-114

\*) 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.

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

**Description**

Interleukin 15 (IL-15) is a member of the four  $\alpha$ -helix bundle cytokine family. It is produced by different cell types, including epithelial cells, monocytes, muscle and placenta cells. IL-15 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<sup>+</sup> memory T cells.

A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, endotoxin content, host-cell DNA content, and host-cell protein content.

**Biological activity**

$\geq 7 \times 10^6$  U/mg;  
proliferation of CTLL-2 cells (NIBSC 95/554)

**Applications**

MACS GMP Recombinant Human IL-15 can be used for a variety of applications, including the *ex vivo* generation of cytotoxic T lymphocytes<sup>1,2</sup> or the *ex vivo* stimulation of NK cells<sup>3,4</sup>.

**References**

- Alves *et al.* (2003) *Blood* 102: 2541–2546.
- Kaneko *et al.* (2009) *Blood* 113: 1006–1015.
- Cho and Campana (2009) *Korean J. Lab. Med.* 29: 89–96.
- Siegler *et al.* (2010) *Cytotherapy early online*: 1–14.

## MACS® GMP Recombinant Human IL-21

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human IL-21	25 µg	*)	Worldwide <sup>1)</sup> <b>new</b>	170-076-115

\*) 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.

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

**Description**

Interleukin 21 (IL-21) is a four  $\alpha$ -helix bundle cytokine and closely related to IL-2, IL-7, and IL-15. IL-21 expression is restricted to activated CD4<sup>+</sup> T helper cells and NKT cells. IL-21 exerts pleiotropic effects on both cellular and humoral immune responses, such as stimulation of lymphocyte proliferation, promotion of CD8<sup>+</sup> T cell and NK cell cytotoxicity, and differentiation of B cells into plasma cells.

MACS GMP Recombinant Human IL-21 is lyophilized without carrier protein or preservatives. A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, endotoxin content, host-cell DNA content, and host-cell protein content.

**Biological activity**

$\geq 1 \times 10^4$  U/mg;  
proliferation of B9 hybridoma 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<sup>1,2</sup> or the *ex vivo* stimulation of NK cells<sup>3</sup>.

**References**

- Li and Yee (2008) *Blood* 111: 229–235.
- Hinrichs *et al.* (2008) *Blood* 111: 5326–5333.
- de Rham *et al.* (2007) *Arthritis Res. Ther.* 9: R125

MACS® GMP Recombinant Human TNF- $\alpha$ 

Product	Content	Regulatory status	Availability	Order no.
MACS GMP Recombinant Human TNF- $\alpha$	25 µg	*)	Worldwide <sup>1)</sup>	170-076-103

\*) 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.

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

**Description**

Tumor necrosis factor alpha (TNF- $\alpha$ ) has its primary role in the regulation of immune cells. It is mainly produced by macrophages, but also by a broad variety of other cell types including lymphoid cells, mast cells, endothelial cells, cardiac myocytes, adipose tissue, fibroblasts, and neuronal tissue. This cytokine is involved in systemic inflammation. TNF- $\alpha$  is involved in regulating

apoptotic cell death, cellular proliferation, differentiation, and inflammation.

A lot-specific certificate confirms identity, molecular mass, specific activity, sterility, purity, endotoxin content, and host-cell DNA content.

**Biological activity**

$\geq 2 \times 10^7$  IU/mg;  
inhibition of L-929 cells (NIBSC 88/786)

**Applications**

MACS GMP Recombinant Human TNF- $\alpha$  can be used for a variety of applications, including the *ex vivo* generation of human dendritic cells from enriched CD14<sup>+</sup> monocyte populations.<sup>1–3</sup>

**References**

- Bender *et al.* (1996) *J. Immunol. Methods* 196: 121–135.
- Romani *et al.* (1996) *J. Immunol. Methods* 196: 137–151.
- Jonuleit *et al.* (1997) *Eur. J. Immunol.* 27: 3135–3142.

**Product list: MACS® GMP Cytokines**

Product	Description	Source	Content	Order no.
MACS GMP Recombinant Human FGF-2	Recombinant human fibroblast growth factor 2	<i>E. coli</i>	25 µg	170-076-107
			500 µg	170-076-125
MACS GMP Recombinant Human GM-CSF	Recombinant human granulocyte colony-stimulating factor	<i>E. coli</i>	25 µg	170-076-112
MACS GMP Recombinant Human IL-1β	Recombinant human interleukin 1β	<i>E. coli</i>	25 µg	170-076-102
MACS GMP Recombinant Human IL-2	Recombinant human interleukin 2	<i>E. coli</i>	20 µg	170-076-113
MACS GMP Recombinant Human IL-3	Recombinant human interleukin 3	<i>E. coli</i>	25 µg	170-076-110
MACS GMP Recombinant Human IL-4	Recombinant human interleukin 4	<i>E. coli</i>	25 µg	170-076-101
			250 µg <i>new</i>	170-076-135
MACS GMP Recombinant Human IL-6	Recombinant human interleukin 6	<i>E. coli</i>	10 µg	170-076-104
MACS GMP Recombinant Human IL-7	Recombinant human interleukin 7	<i>E. coli</i>	25 µg	170-076-111
MACS GMP Recombinant Human IL-21	Recombinant human interleukin 21	<i>E. coli</i>	25 µg <i>new</i>	170-076-115
MACS GMP Recombinant Human TNF-α	Recombinant human tumor necrosis factor α	<i>E. coli</i>	25 µg	170-076-103

## Human FGF-1

### Description

Fibroblast growth factor 1 (FGF-1), also termed acidic fibroblast growth factor (aFGF), belongs to the family of heparin-binding proteins. It acts as mitogen for a broad range of cells, including most cells of mesodermal and ectodermal origin. As a potent neurotrophic factor, FGF-1 affects survival and differentiation of neuronal cells both *in vitro* and *in vivo*. In addition, FGF-1 has angiogenic activity and promotes endothelial cell proliferation *in vitro* and blood vessel growth and vascular repair *in vivo*. The involvement in angiogenesis is also of critical importance in tumor growth and progression.

### Applications

Human FGF-1 can be used for a variety of applications, including:

- Differentiation of embryonic and adult stem cells, e.g. into hepatocyte-like cells or pulmonary progenitors
- *In vitro* proliferation of different cell types, including endothelial cells, cardiomyocytes, and skeletal muscle satellite cells

Product	Packing unit	Source	Order no.
Human FGF-1, research grade	10 µg	<i>E. coli</i>	130-093-835
Human FGF-1, research grade	25 µg	<i>E. coli</i>	130-095-789
Human FGF-1, premium grade	10 µg	<i>E. coli</i>	130-095-790
Human FGF-1, premium grade	25 µg	<i>E. coli</i>	130-095-763
Human FGF-1, premium grade	100 µg	<i>E. coli</i>	130-095-761
Human FGF-1, premium grade	1000 µg	<i>E. coli</i>	130-095-756

- Differentiation or transdifferentiation of mesenchymal stromal cells
- Investigation of FGF-1 mediated signaling pathways, e.g. regulation of apoE-HDL production in astrocytes

### Alternative names

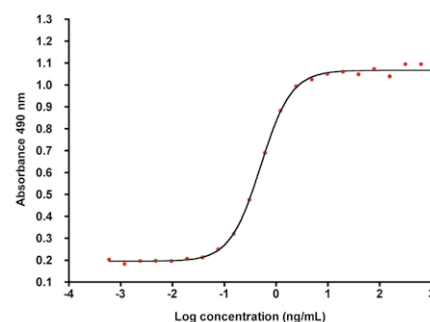
acidic FGF, aFGF, HBGF-1

### Biological activity

Proliferation of 3T3 cells in the presence of sodium heparin

**Research grade:**  $\geq 5 \times 10^5$  U/mg

**Premium grade:**  $\geq 1 \times 10^6$  U/mg



**Figure 1:** Human FGF-1 activity assay. The biological activity of Human FGF-1, premium grade is determined by proliferation assay using 3T3 cells in the presence of sodium heparin.

## Human FGF-2

### Description

Fibroblast growth factor 2 (FGF-2 or FGF2), also termed fibroblast growth factor basic (FGF-b) or basic FGF, belongs to the family of heparin-binding growth factors. 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.

### Applications

Human FGF-2 can be used as a cell culture supplement to optimize the culture conditions for a broad variety of cell types, such as mesenchymal stromal cells (MSCs), neural cells, and endothelial cells. Human FGF-2 also promotes long-term maintenance and propagation of undifferentiated embryonic and induced pluripotent stem cells.

Product	Packing unit	Source	Order no.
Human FGF-2, research grade	10 µg	<i>E. coli</i>	130-093-837
Human FGF-2, research grade	50 µg	<i>E. coli</i>	130-093-838
Human FGF-2, premium grade	10 µg	<i>E. coli</i>	130-093-839
Human FGF-2, premium grade	50 µg	<i>E. coli</i>	130-093-840
Human FGF-2, premium grade	100 µg	<i>E. coli</i>	130-093-564
Human FGF-2, premium grade	200 µg	<i>E. coli</i>	130-093-841
Human FGF-2, premium grade	1000 µg	<i>E. coli</i>	130-093-842
Human FGF-2, premium grade	2000 µg	<i>E. coli</i>	130-093-843

### Alternative names

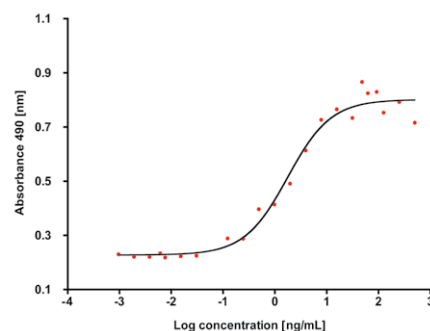
basic FGF, HBGF-2

### Biological activity

Proliferation of 3T3 cells (NIBSC 90/712)

**Research grade:**  $\geq 5 \times 10^5$  IU/mg

**Premium grade:**  $\geq 8 \times 10^5$  IU/mg



**Figure 1:** Human FGF-2 activity assay. The biological activity of Human FGF-2, premium grade is determined by proliferation assay using 3T3 cells.

## Human FGF-8b

### Description

Fibroblast growth factor 8 (FGF-8), originally identified as androgen-induced growth factor, is a heparin-binding protein, which has mitogenic and transforming activity. Out of the four known isoforms in humans, isoform b (FGF-8b) has been shown to have the most important oncogenic transforming capacity. FGF-8 exerts a pivotal role in embryogenesis. It is expressed during gastrulation and influences brain, limb, heart and facial development in the mouse embryo. In addition, FGF-8 was shown to stimulate osteoblast proliferation. The amino acid sequence of human FGF8-b shares 100% identity with mouse FGF-8b.

### Biological activity

Proliferation of 3T3 cells

**Research grade:**  $\geq 1 \times 10^4$  U/mg

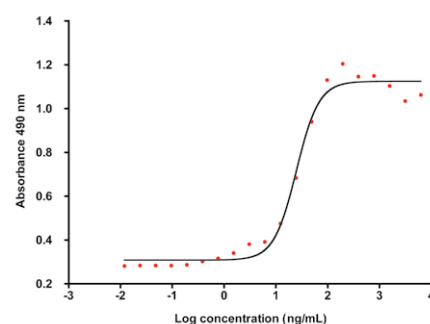
**Premium grade:**  $\geq 2 \times 10^4$  U/mg

Product	Packing unit	Source	Order no.
Human FGF-8b, research grade	10 µg	<i>E. coli</i>	130-095-731
Human FGF-8b, research grade	25 µg	<i>E. coli</i>	130-095-733
Human FGF-8b, premium grade	10 µg	<i>E. coli</i>	130-095-737
Human FGF-8b, premium grade	25 µg	<i>E. coli</i>	130-095-738
Human FGF-8b, premium grade	100 µg	<i>E. coli</i>	130-095-740
Human FGF-8b, premium grade	1000 µg	<i>E. coli</i>	130-095-741

### Applications

Human FGF-8b can be used for a variety of applications, including:

- *In vitro* differentiation of embryonic stem cells into neural progenitor cells
- Survival of neural precursor cells and differentiation into astroglial cells
- Stimulation of osteoblast proliferation
- Proliferation of endothelial cells
- Proliferation of myogenic cells
- Tumor growth studies of prostate and breast cancer



**Figure 1:** Human FGF-8b activity assay. The biological activity of Human FGF-8b is determined by proliferation assay in the presence of sodium heparin using 3T3 cells.

## Human Flt3-Ligand

### Description

Fms-related tyrosin kinase 3 ligand (Flt3-Ligand) is a growth factor that regulates early hematopoiesis. Flt3-ligand belongs to a small family of  $\alpha$ -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.

### Biological activity

Proliferation of OCI-AML5 cells (NIBSC 96/532)

**Research grade:**  $\geq 2 \times 10^5$  IU/mg

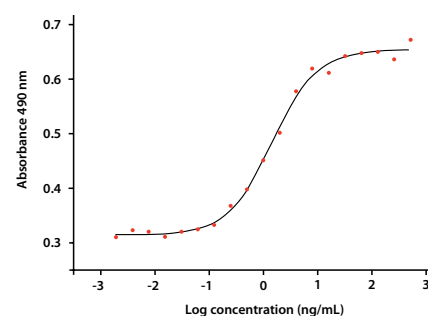
**Premium grade:**  $\geq 5 \times 10^5$  IU/mg

Product	Packing unit	Source	Order no.
Human Flt3-Ligand, research grade	10 µg	<i>E. coli</i>	130-093-854
Human Flt3-Ligand, research grade	25 µg	<i>E. coli</i>	<b>new</b> 130-096-474
Human Flt3-Ligand, premium grade	10 µg	<i>E. coli</i>	<b>new</b> 130-096-476
Human Flt3-Ligand, premium grade	25 µg	<i>E. coli</i>	<b>new</b> 130-096-477
Human Flt3-Ligand, premium grade	100 µg	<i>E. coli</i>	<b>new</b> 130-096-479
Human Flt3-Ligand, premium grade	1000 µg	<i>E. coli</i>	<b>new</b> 130-096-480

### Applications

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

- *In vitro* expansion of CD34<sup>+</sup> hematopoietic progenitor cells
- Differentiation of ES-derived cells towards the hematopoietic lineage
- *In vitro* generation of Langerhans cells, dendritic cells, or eosinophils from CD34<sup>+</sup> cells



**Figure 1:** Human Flt3-Ligand activity assay. The biological activity of Human Flt3-Ligand is determined by proliferation assay using OCI-AML5 cells.

## Human G-CSF

### Description

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- $\alpha$  and IFN- $\gamma$ . 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.

### Biological activity

Proliferation of NFS-60 cells (NIBSC 88/502)

**Research grade:**  $\geq 2 \times 10^7$  IU/mg

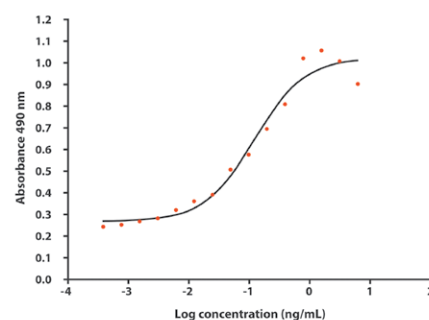
**Premium grade:**  $\geq 4 \times 10^7$  IU/mg

Product	Packing unit	Source		Order no.
Human G-CSF, research grade	10 $\mu$ g	<i>E. coli</i>	<b>new</b>	130-096-345
Human G-CSF, research grade	25 $\mu$ g	<i>E. coli</i>	<b>new</b>	130-096-346
Human G-CSF, premium grade	10 $\mu$ g	<i>E. coli</i>		130-093-860
Human G-CSF, premium grade	25 $\mu$ g	<i>E. coli</i>	<b>new</b>	130-096-347
Human G-CSF, premium grade	100 $\mu$ g	<i>E. coli</i>		130-093-861
Human G-CSF, premium grade	1000 $\mu$ g	<i>E. coli</i>		130-094-265

### Applications

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

- Growth promotion and differentiation of cell of the neutrophil lineage
- Induction of colony formation of normal and leukemic bone marrow cells in soft agar cultures



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

## Human GM-CSF

### Description

Human 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. 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.

### Biological activity

Proliferation of TF-1 cells (NIBSC 88/646)

**Research grade:**  $\geq 2 \times 10^6$  IU/mg

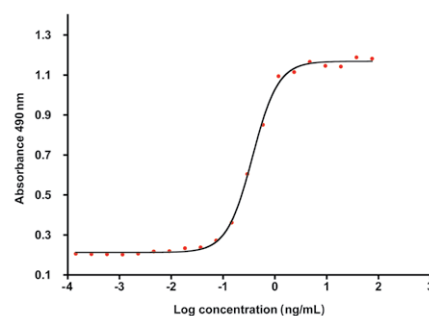
**Premium grade:**  $\geq 5 \times 10^6$  IU/mg

Product	Packing unit	Source		Order no.
Human GM-CSF, research grade	10 $\mu$ g	<i>E. coli</i>		130-093-862
Human GM-CSF, research grade	50 $\mu$ g	<i>E. coli</i>		130-095-372
Human GM-CSF, premium grade	10 $\mu$ g	<i>E. coli</i>		130-093-864
Human GM-CSF, premium grade	50 $\mu$ g	<i>E. coli</i>		130-093-865
Human GM-CSF, premium grade	100 $\mu$ g	<i>E. coli</i>		130-093-866
Human GM-CSF, premium grade	500 $\mu$ g	<i>E. coli</i>		130-093-867
Human GM-CSF, premium grade	1000 $\mu$ g	<i>E. coli</i>		130-093-868

### 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 (e.g. together with IL-4)
- *In vitro* differentiation of CD34<sup>+</sup> cells towards eosinophils
- Migration assays for eosinophils



**Figure 1:** Human GM-CSF activity assay. The biological activity of Human GM-CSF, premium grade is determined by proliferation assay using TF-1 cells.

## Human IFN-γ1b

### Description

Interferon γ (IFN-γ), the only type II interferon, possesses potent anti-viral activity and immunoregulatory properties. It is structurally unrelated to the type I interferons and binds to a different receptor expressed by most immune cells. IFN-γ is produced predominantly by NK cells and T cells. IFN-γ enhances NK cell and macrophage activity and regulates B cell functions, like immunoglobulin production and class switching. In addition, IFN-γ orchestrates leukocyte attraction and directs growth, maturation, and differentiation of many cell types. The activity of human IFN-γ is species-specific.

### Biological activity

Proliferation of HT-29 cells (NIAID Gxg01-902-535)

**Research grade:** ≥ 2×10<sup>7</sup> IU/mg

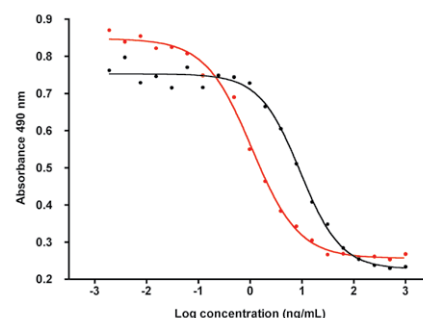
**Premium grade:** ≥ 5×10<sup>7</sup> IU/mg

Product	Packing unit	Source		Order no.
Human IFN-γ1b, research grade	10 µg	<i>E. coli</i>	<b>new</b>	130-096-872
Human IFN-γ1b, research grade	25 µg	<i>E. coli</i>	<b>new</b>	130-096-873
Human IFN-γ1b, premium grade	10 µg	<i>E. coli</i>	<b>new</b>	130-096-481
Human IFN-γ1b, premium grade	25 µg	<i>E. coli</i>	<b>new</b>	130-096-482
Human IFN-γ1b, premium grade	100 µg	<i>E. coli</i>	<b>new</b>	130-096-484
Human IFN-γ1b, premium grade	1000 µg	<i>E. coli</i>	<b>new</b>	130-096-486

### Applications

Human IFN-γ1b may be used for a variety of applications, including:

- Stimulation of monocytes, macrophages, and microglia
- *In vitro* maturation of Mo-DCs
- Apoptosis and cell growth inhibition assays
- Adhesion and migration assays



**Figure 1:** Human IFN-γ1b activity assay. The biological activity of Human IFN-γ1b is determined by inhibition assay using HT-29 cells. Activity of Human IFN-γ1b, premium grade (red line) was compared to another commercially available IFNγ (black line).

## Human IL-1β

### Description

Interleukin-1 beta (IL-1β) is a proinflammatory cytokine that is secreted mainly 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. It mediates inflammatory responses in B cells, T cells, and NK cells by inducing the production of cytokines, such as IL-2, IL-3, IL-6, as well as interferons. Upon exposure to IL-1β, endothelial cells and smooth muscle cells synthesize prostaglandins and other derivatives of arachidonic acid. In addition, IL-1β is found in synovial fluid of arthritis patients, causing degranulation of basophils and eosinophils as well as activation of osteoclasts. IL-1β is mitogenic for mesangial cells, glial cells, and keratinocytes.

### Biological activity

Proliferation of D10.G4.1 cells (NIBSC 86/680)

**Research grade:** ≥ 1×10<sup>7</sup> IU/mg

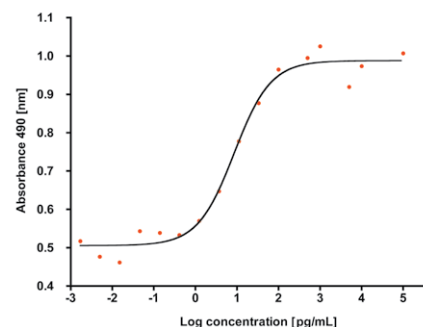
**Premium grade:** ≥ 3×10<sup>7</sup> IU/mg

Product	Packing unit	Source		Order no.
Human IL-1β, research grade	10 µg	<i>E. coli</i>		130-093-895
Human IL-1β, research grade	25 µg	<i>E. coli</i>		130-095-374
Human IL-1β, premium grade	10 µg	<i>E. coli</i>		130-093-897
Human IL-1β, premium grade	25 µg	<i>E. coli</i>		130-093-563
Human IL-1β, premium grade	100 µg	<i>E. coli</i>		130-093-898
Human IL-1β, premium grade	1000 µg	<i>E. coli</i>		130-093-899

### Applications

Human IL-1β can be used for a variety of applications including:

- Induction of Mo-DC maturation
- Chemotaxis assays
- Investigation of IL-1 receptor signaling



**Figure 1:** Human IL-1β activity assay. The biological activity of Human IL-1β, premium grade is determined by proliferation assay using D10.G4.1 cells.

## Human IL-3

### Description

Interleukin 3 (IL-3) is a hematopoietic growth factor, which is produced mainly by activated T cells, but is also secreted by other cell types, including mast cells, eosinophils, and keratinocytes. The broad spectrum of biological activities of IL-3 includes the stimulation of the proliferation and differentiation of immature pluripotent hematopoietic stem cells (HSCs) and various lineage-committed progenitor cells, leading to the production of most of the major blood cell types. In addition, IL-3 also affects the functional activity of mature mast cells, basophils, eosinophils, and macrophages.

### Applications

Human IL-3 can be used for a variety of applications, including:

- Induction of colony formation from hematopoietic progenitor cells in semi-solid medium *in vitro*.
- *In vitro* differentiation studies.

Product	Packing unit	Source	Order no.
Human IL-3, research grade	10 µg	<i>E. coli</i>	130-093-908
Human IL-3, research grade	25 µg	<i>E. coli</i>	130-093-909
Human IL-3, premium grade	10 µg	<i>E. coli</i>	130-095-071
Human IL-3, premium grade	25 µg	<i>E. coli</i>	130-095-070
Human IL-3, premium grade	100 µg	<i>E. coli</i>	130-095-069
Human IL-3, premium grade	1000 µg	<i>E. coli</i>	130-095-068

- Cultivation of plasmacytoid dendritic cells<sup>1</sup>
- *In vitro* expansion of HSCs<sup>2</sup>
- Analysis of mast cell or basophil function
- Investigation of IL-3-mediated signaling

### References

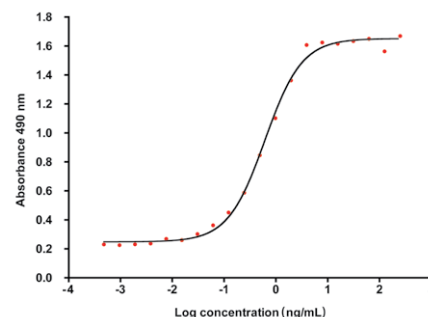
1. Groot *et al.* (2006) *Blood* 108: 1957–1964.
2. Jing *et al.* (2010) *Bone Marrow Transplant*: 1–8

### Biological activity

Proliferation of TF-1 cells (NIBSC 91/510)

**Research grade:**  $\geq 1 \times 10^6$  IU/mg

**Premium grade:**  $\geq 2 \times 10^6$  IU/mg



**Figure 1:** Human IL-3 activity assay. The biological activity of Human IL-3, premium grade is determined by proliferation assay using TF-1 cells.

## Human IL-4

### Description

Human interleukin 4 (IL-4) is a pleiotropic cytokine, which plays a central role in humoral and adaptive immune responses. IL-4 is predominantly secreted by activated CD4<sup>+</sup> memory and effector Th2 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<sup>+</sup> T cells into helper Th2 cells, while suppressing Th1 development, and promotes chemotaxis of mast cells and basophils. Excessive IL-4 production and mechanisms involving Th2 types have been associated with immunological disorders, such as IgE-mediated allergy.

Product	Packing unit	Source	Order no.
Human IL-4, research grade	5 µg	<i>E. coli</i>	130-093-915
Human IL-4, research grade	10 µg	<i>E. coli</i>	130-095-373
Human IL-4, research grade	25 µg	<i>E. coli</i>	130-093-917
Human IL-4, research grade	100 µg	<i>E. coli</i>	130-094-117
Human IL-4, cell culture grade	~5 µg	<i>E. coli</i>	130-093-918
Human IL-4, premium grade	5 µg	<i>E. coli</i>	130-093-919
Human IL-4, premium grade	10 µg	<i>E. coli</i>	130-093-920
Human IL-4, premium grade	25 µg	<i>E. coli</i>	130-093-921
Human IL-4, premium grade	100 µg	<i>E. coli</i>	130-093-922
Human IL-4, premium grade	1000 µg	<i>E. coli</i>	130-093-924

### Applications

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

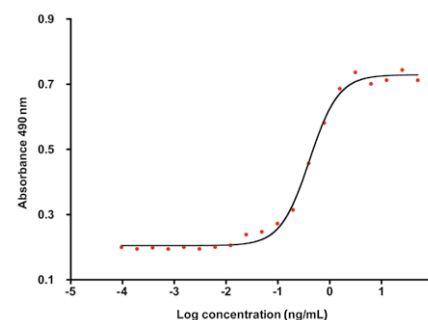
- *In vitro* generation of Mo-DCs (e.g. together with GM-CSF).
- *In vitro* differentiation of naive CD4<sup>+</sup> T cells towards Th2 cells.

### Biological activity

Proliferation of TF-1 cells (NIBSC 88/656)

**Research grade:**  $\geq 2 \times 10^6$  IU/mg

**Premium grade:**  $\geq 5 \times 10^6$  IU/mg



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

## Human IL-6

### Description

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, fibroblasts, endothelial cells, T cells, etc. Disturbed IL-6 production has been associated with pathological processes including inflammatory autoimmune diseases, such as rheumatoid arthritis, and cancer.

### Applications

Human 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 and human hybridomas
- *In vitro* differentiation of Th17 cells

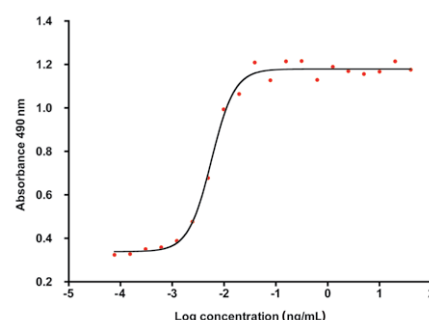
### Biological activity

Proliferation of B9 hybridoma cells (NIBSC 89/548)

**Research grade:**  $\geq 2 \times 10^7$  IU/mg

**Premium grade:**  $\geq 5 \times 10^7$  IU/mg

Product	Packing unit	Source	Order no.
Human IL-6, research grade	10 µg	<i>E. coli</i>	130-095-365
Human IL-6, research grade	25 µg	<i>E. coli</i>	130-093-929
Human IL-6, research grade	100 µg	<i>E. coli</i>	130-095-366
Human IL-6, premium grade	10 µg	<i>E. coli</i>	130-095-352
Human IL-6, premium grade	25 µg	<i>E. coli</i>	130-093-931
Human IL-6, premium grade	100 µg	<i>E. coli</i>	130-093-932
Human IL-6, premium grade	500 µg	<i>E. coli</i>	130-093-933
Human IL-6, premium grade	1000 µg	<i>E. coli</i>	130-093-934



**Figure 1:** Human IL-6 activity assay. The biological activity of Human IL-6, premium grade is determined by proliferation assay using B9 hybridoma cells.

## Human IL-7

### Description

Interleukin 7 (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  $\gamma$ -chain and IL-7 receptor  $\alpha$ -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, for example, of iNKT cells
- Investigation of IL-7 mediated signaling pathways

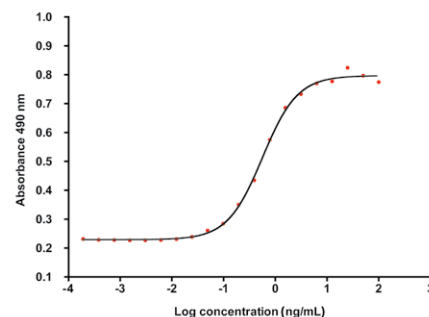
### Biological activity

Proliferation of 2E8 cells (NIBSC 90/530)

**Research grade:**  $\geq 2 \times 10^7$  U/mg

**Premium grade:**  $\geq 5 \times 10^7$  U/mg

Product	Packing unit	Source	Order no.
Human IL-7, research grade	10 µg	<i>E. coli</i>	130-093-937
Human IL-7, research grade	25 µg	<i>E. coli</i>	130-095-367
Human IL-7, premium grade	10 µg	<i>E. coli</i>	130-095-361
Human IL-7, premium grade	25 µg	<i>E. coli</i>	130-095-362
Human IL-7, premium grade	100 µg	<i>E. coli</i>	130-095-363
Human IL-7, premium grade	1000 µg	<i>E. coli</i>	130-095-364



**Figure 1:** Human IL-7 activity assay. The biological activity of Human IL-7, premium grade is determined by proliferation assay using mouse 2E8 cells.

## Human IL-12

### Description

Interleukin 12 (IL-12) is a heterodimeric pro-inflammatory 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- $\gamma$ , 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- $\gamma$  and IL-2, is to drive T helper cell responses toward the T<sub>H</sub>1 rather than the T<sub>H</sub>2 phenotype. Moreover, IL-12 is also important in resistance to viral disease and has significant antitumor activity.

Product	Packing unit	Source		Order no.
Human IL-12, premium grade	5 $\mu$ g	HEK293 cells	<b>new</b>	130-096-704
Human IL-12, premium grade	25 $\mu$ g	HEK293 cells	<b>new</b>	130-096-705
Human IL-12, premium grade	100 $\mu$ g	HEK293 cells	<b>new</b>	130-096-798

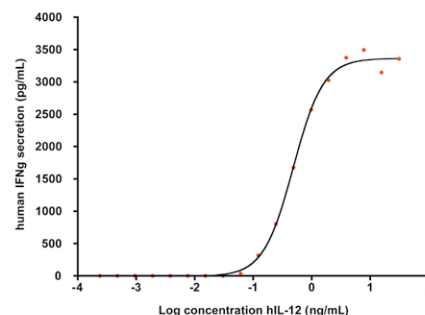
### Biological activity

Induction of IFN- $\gamma$  secretion by human T cells  
**Premium grade:**  $\geq 3 \times 10^6$  U/mg

### Applications

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

- *In vitro* activation and proliferation of NK and T cells
- *In vitro* differentiation of naive CD4<sup>+</sup> T cells towards T<sub>H</sub>1 cells



**Figure 1:** Human IL-12 activity assay. The biological activity of Human IL-12 is determined by induction of IFN- $\gamma$  secretion by PHA-activated T cells.

## Human IL-15

### Description

Interleukin 15 (IL-15) is a member of the four  $\alpha$ -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<sup>+</sup> memory T cells.

### Biological activity

Proliferation of CTLL-2 cells (NIBSC 95/554)

**Research grade:**  $\geq 2 \times 10^6$  U/mg

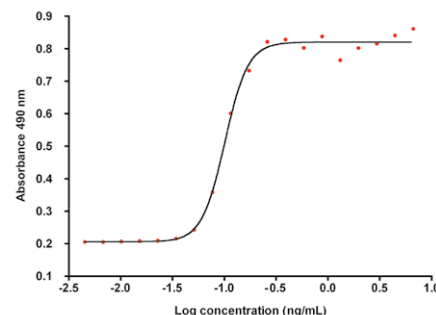
**Premium grade:**  $\geq 5 \times 10^6$  U/mg

Product	Packing unit	Source		Order no.
Human IL-15 research grade	10 $\mu$ g	<i>E. coli</i>		130-093-955
Human IL-15 research grade	25 $\mu$ g	<i>E. coli</i>		130-095-760
Human IL-15, premium grade	10 $\mu$ g	<i>E. coli</i>		130-095-762
Human IL-15, premium grade	25 $\mu$ g	<i>E. coli</i>		130-095-764
Human IL-15, premium grade	100 $\mu$ g	<i>E. coli</i>		130-095-765
Human IL-15, premium grade	1000 $\mu$ g	<i>E. coli</i>		130-095-766

### 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, for example, from purified CD34<sup>+</sup> cells
- *In vitro* T cell expansion, e.g., of naive CD8<sup>+</sup> T cells, and T cell activation, for example, of CTLs



**Figure 1:** Human IL-15 activity assay. The biological activity of Human IL-15 is determined by proliferation assay using CTLL-2 cells.

## Human IL-23

### Description

Interleukin 23 (IL-23) is a covalently linked heterodimeric cytokine, which is closely related to IL-12. IL-23 is produced mainly by activated macrophages, dendritic cells, and keratinocytes. As a key cytokine in the survival and proliferation of TH17 cells, IL-23 has central roles in autoimmune diseases and promotes chronic inflammation.

Human IL-23 is a glycosylated single-chain polypeptide of 504 amino acids comprising subunits p40 and p19 fused by a flexible linker region. It has been shown that single-chain fusion proteins of naturally heterodimeric cytokines are bioactive *in vitro* and *in vivo*.

Product	Packing unit	Source	Order no.
Human IL-23, research grade	5 µg	HEK293 cells	130-095-757
Human IL-23, research grade	25 µg	HEK293 cells	130-095-758
Human IL-23, research grade	100 µg	HEK293 cells	130-095-759

### Applications

Human IL-23 may be used for a variety of applications, including:

- *In vitro* differentiation of CD4<sup>+</sup> T cells towards TH17 cells and proliferation of TH17 cells
- Exploration of the role of IL-23 in autoimmune diseases or inflammatory bowel diseases
- Investigation of IL-23-mediated molecular signaling pathways

## Human M-CSF

### Description

Human macrophage-colony stimulating factor (M-CSF), a four  $\alpha$ -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.

### Biological activity

Proliferation of NFS-60 cells (NIBSC 89/512)

**Research grade:**  $\geq 1 \times 10^7$  IU/mg

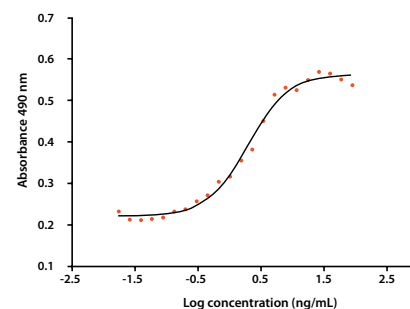
**Premium grade:**  $\geq 2 \times 10^7$  IU/mg

Product	Packing unit	Source	Order no.
Human M-CSF, research grade	10 µg	<i>E. coli</i>	130-093-963
Human M-CSF, research grade	25 µg	<i>E. coli</i> <b>new</b>	130-096-491
Human M-CSF, premium grade	10 µg	<i>E. coli</i> <b>new</b>	130-096-485
Human M-CSF, premium grade	25 µg	<i>E. coli</i> <b>new</b>	130-096-489
Human M-CSF, premium grade	100 µg	<i>E. coli</i> <b>new</b>	130-096-492
Human M-CSF, premium grade	1000 µg	<i>E. coli</i> <b>new</b>	130-096-493

### 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<sup>+</sup> monocytes



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

## Human SCF

### Description

Stem cell factor (SCF), also known as 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. 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.

### Biological activity

Proliferation of TF-1 cells (NIBSC 91/682)

**Research grade:**  $\geq 2 \times 10^5$  U/mg

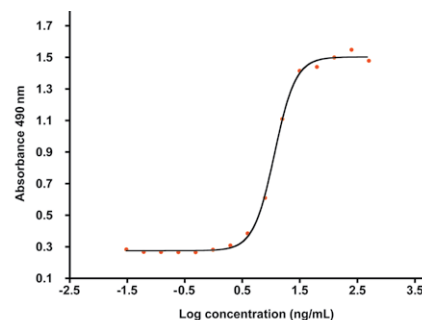
**Premium grade:**  $\geq 4 \times 10^5$  U/mg

Product	Packing unit	Source	Order no.
Human SCF, research grade	10 µg	<i>E. coli</i>	130-093-991
Human SCF, research grade	25 µg	<i>E. coli</i> <b>new</b>	130-096-692
Human SCF, premium grade	10 µg	<i>E. coli</i> <b>new</b>	130-096-693
Human SCF, premium grade	25 µg	<i>E. coli</i> <b>new</b>	130-096-694
Human SCF, premium grade	100 µg	<i>E. coli</i> <b>new</b>	130-096-695
Human SCF, premium grade	1000 µg	<i>E. coli</i> <b>new</b>	130-096-696

### 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<sup>+</sup> hematopoietic progenitor cells
- Differentiation of ES-derived cells towards the hematopoietic lineage
- Mast cell differentiation and maintenance
- Mast cell chemotaxis assays



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

## Human SHH (C24II)

### Description

Sonic hedgehog (SHH) is involved in a wide variety of embryonic developmental events, including neurogenesis, limb development, hematopoiesis, and gut formation. Besides their role as morphogens, hedgehog family members have also been shown to act as mitogens, cell survival factors, and axon guidance factors and to influence tissue regeneration within the adult.

SHH is synthesized as a precursor, which is autocatalytically cleaved into a 19 kDa N-terminal signaling domain (SHH-N) and a 25 kDa C-terminal domain (SHH-C). SHH-C acts as a cholesterol transferase and covalently attaches a cholesterol molecule to SHH-N. The lipid-modified SHH-N displays enhanced activity. Human SHH (C24II) corresponds to the mature SHH-N domain and carries a Cys to Ile-Ile substitution resulting in a lipophilic moiety.

Product	Packing unit	Source	Order no.
Human SHH (C24II), research grade	10 µg	<i>E. coli</i>	130-095-717
Human SHH (C24II), research grade	25 µg	<i>E. coli</i>	130-095-718
Human SHH (C24II), premium grade	10 µg	<i>E. coli</i>	130-095-721
Human SHH (C24II), premium grade	25 µg	<i>E. coli</i>	130-095-723
Human SHH (C24II), premium grade	100 µg	<i>E. coli</i>	130-095-727
Human SHH (C24II), premium grade	1000 µg	<i>E. coli</i>	130-095-730

### Applications

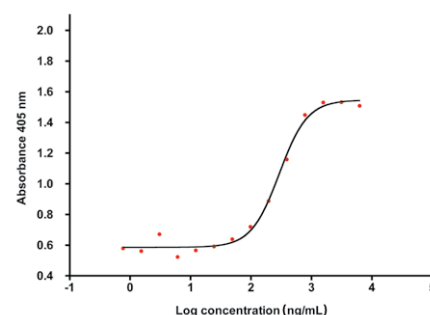
Human SHH (C24II) can be used for the expansion or differentiation of various cell types, predominantly of human and mouse embryonic stem cells, but also of adult stem cells and mesenchymal cells and others.

### Biological activity

Alkaline phosphatase production of C3H10T1/2 fibroblasts

**Research grade:**  $\geq 1 \times 10^3$  U/mg

**Premium grade:**  $\geq 2 \times 10^3$  U/mg



**Figure 1:** Human SHH (C24II) activity assay. The biological activity of Human SHH (C24II) was determined by alkaline phosphatase assay using mouse C3H10T1/2 fibroblasts.

## Human TGF-β1

### Description

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. In addition, TGF-β1 controls inflammatory responses through chemotactic attraction and activation of inflammatory cells and fibroblasts. TGF-β1 is produced by many cell types, but is reported to be most abundant in mammalian platelets and bone. It is secreted predominantly as an inactive latent complex. After proteolytical processing of the TGF-β1 precursor, the resulting N-terminal latency-associated peptide (LAP) remains non-covalently associated with the TGF-β1 dimer.

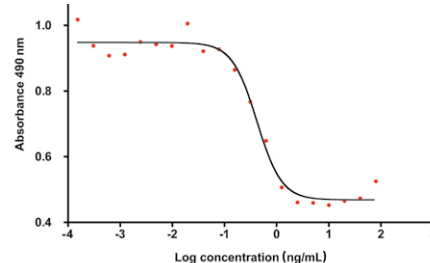
Product	Packing unit	Source	Order no.
Human TGF-β1, premium grade	5 µg	HEK293 cells	130-095-067

Mature and biologically active TGF-β1 can be released from the complex by action of proteases and/or conformational changes. The amino acid sequence of Human TGF-β1 shares 99% identity with TGF-β1 from mouse and rat.

### Applications

Human TGF-β1 can be used for a variety of applications, including:

- *In vitro* differentiation of naive CD4<sup>+</sup> T cells towards TH17 cells
- *In vitro* generation of FoxP3<sup>+</sup> inducible regulatory T cells (iTregs)
- Embryonic stem cell differentiation models, for example, for vasculogenesis and angiogenesis
- *In vitro* chondrogenesis of mesenchymal progenitor cells and redifferentiation of expanded chondrocytes



**Figure 1:** Human TGF-β1 activity assay. The biological activity of Human TGF-β1, premium grade is determined by inhibition assay using IL-5-induced TF-1 cells.

### Biological activity

Inhibition of IL-5-induced TF-1 cells (NIBSC 89/514)

**Premium grade:** ≥ 5×10<sup>6</sup> U/mg

## Human TNF-α

### Description

Human tumor necrosis factor α (TNF-α), also called TNFSF2 (TNF ligand superfamily member 2), is a proinflammatory cytokine that is mainly produced by activated monocytes and macrophages in response to infection, injury, and tumor burden. TNF-α production has also been reported for a variety of other cell types involved in inflammatory responses, including T cells, NK cells, and neutrophils as well as a number of non-immune cells, such as keratinocytes and astrocytes. TNF-α has a broad spectrum of biological activities. In addition to its central role in inflammation, TNF-α is noted for its cytotoxic and tumoricidal abilities either by necrosis or induction of apoptosis. Further functions include antiviral activity, growth modulation, and induction of cellular differentiation.

### Applications

TNF-α can be used for a variety of applications including:

Product	Packing unit	Source	Order no.
Human TNF-α, premium grade	10 µg	<i>E. coli</i>	130-094-014
Human TNF-α, research grade	10 µg	Yeast	130-094-015
Human TNF-α, research grade	50 µg	Yeast	130-094-017
Human TNF-α, research grade	100 µg	Yeast	130-094-018
Human TNF-α, research grade	750 µg	Yeast	130-094-019
Human TNF-α, research grade	1000 µg	Yeast	130-094-020
Human TNF-α, premium grade	10 µg	Yeast	130-094-022
Human TNF-α, premium grade	50 µg	Yeast	130-094-023
Human TNF-α, premium grade	100 µg	Yeast	130-094-024
Human TNF-α, premium grade	1000 µg	Yeast	130-094-562

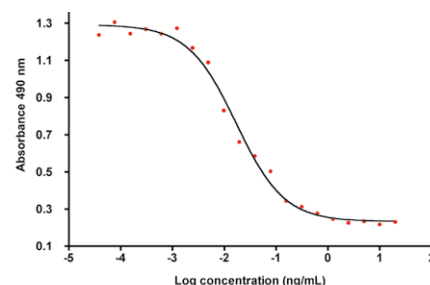
- Induction of Mo-DC maturation
- Cytotoxicity and cell proliferation assays
- Assessment of apoptosis and viral protection
- Investigation of TNF-α-induced signaling pathways

### Biological activity

Inhibition of L-929 cells (NIBSC 88/786)

**Research grade:** ≥ 2×10<sup>7</sup> IU/mg

**Premium grade:** ≥ 4×10<sup>7</sup> IU/mg



**Figure 1:** Human TNF-α activity assay. The biological activity of Human TNF-α, premium grade is determined by inhibition assay using L-929 cells.

## Mouse GM-CSF

### Description

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. 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.

Product	Packing unit	Source	Order no.
Mouse GM-CSF, research grade	10 µg	<i>E. coli</i>	130-094-043
Mouse GM-CSF, research grade	25 µg	<i>E. coli</i>	130-095-746
Mouse GM-CSF, premium grade	10 µg	<i>E. coli</i>	130-095-742
Mouse GM-CSF, premium grade	25 µg	<i>E. coli</i>	130-095-793
Mouse GM-CSF, premium grade	100 µg	<i>E. coli</i>	130-095-739
Mouse GM-CSF, premium grade	1000 µg	<i>E. coli</i>	130-095-735

### Applications

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

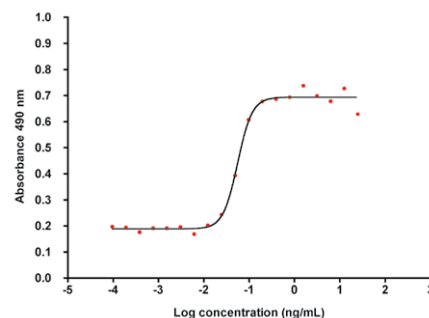
- Induction of colony formation of granulocyte/macrophage progenitors in semi-solid medium
- *In vitro* generation of DCs from bone marrow or the maturation of CD11c<sup>+</sup> splenocytes
- Generation of antigen-presenting (DC-like) cells in primary brain cell culture

### Biological activity

Proliferation of FDC-P1 cells (NIBSC 91/658)

Research grade:  $\geq 1 \times 10^7$  U/mg

Premium grade:  $\geq 5 \times 10^7$  U/mg



**Figure 1:** Mouse GM-CSF activity assay. The biological activity of Mouse GM-CSF is determined by proliferation assay using mouse FDC-P1 cells.

## Mouse IFN-α

### Description

Type I interferons (IFNs), including IFN-α, are a family of cytokines that exert multiple functions in the immune system<sup>1,2</sup>.

The most prominent effect of IFN-α is its antiviral activity. Upon viral infections, host cells release IFN-α which can act in an autocrine or paracrine manner to activate intracellular antiviral defense mechanisms and restrict viral replication.

Furthermore, IFN-α affects the generation and function of various dendritic cell populations. Immunomodulatory activity and antitumor effects have been described both *in vivo* and *in vitro*.

The recombinant Mouse IFN-α was expressed in HEK293 cells and has been purified and analyzed for its activity ( $10^7$  U/mL).

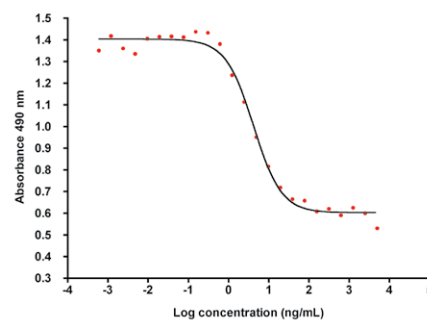
Product	Packing unit	Source	Order no.
Mouse IFN-α, research grade	200 µL	HEK293 cells	130-093-131
Mouse IFN-α, research grade	1 mL	HEK293 cells	130-093-130

### Applications

Mouse IFN-α can be used for studies of *in vitro* and *in vivo* effects of IFN-α in mouse models, e.g., for the *in vitro* investigation of antitumor effects (antiproliferative capacities) of IFN-α on tumor cell lines or for stimulation of IFN-α-dependent cell lines. *In vivo*, Mouse IFN-α can be utilized in studies using transgenic mice harboring the Cre-recombinase transgene driven by the interferon-inducible Mx promoter (Mx-Cre mice)<sup>3</sup>.

### References

1. Pestka *et al.* (2004) *Immunol. Rev.* 202: 8–32.
2. Takaoka *et al.* (2006) *Cell. Microbiol.* 8: 907–922.
3. Kühn *et al.* (1995) *Science* 269: 1427–1429.



**Figure 1:** Mouse IFN-α activity assay. The biological activity of Mouse IFN-α is determined by inhibition assay using a T lymphoma cell line (BW cells).

### Biological activity

$1 \times 10^7$  U/mL; inhibition of BW cells

## Mouse IL-12

### Description

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- $\gamma$ , 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- $\gamma$  and IL-2, is to drive T helper cell responses toward the T<sub>H</sub>1 rather than the T<sub>H</sub>2 phenotype. Moreover, IL-12 is also important in resistance to viral disease and has significant antitumor activity.

Product	Packing unit	Source	Order no.
Mouse IL-12, research grade	5 $\mu$ g	HEK293 cells	<b>new</b> 130-096-707
Mouse IL-12, research grade	25 $\mu$ g	HEK293 cells	<b>new</b> 130-096-708
Mouse IL-12, research grade	100 $\mu$ g	HEK293 cells	<b>new</b> 130-096-795

### Biological activity

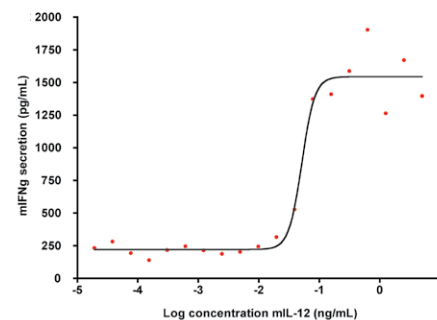
Induction of IFN- $\gamma$  secretion by mouse splenocytes

**Research grade:**  $\geq 6 \times 10^6$  U/mg

### Applications

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

- *In vitro* activation and proliferation of NK and T cells
- *In vitro* differentiation of naive CD4<sup>+</sup> T cells towards T<sub>H</sub>1 cells



**Figure 1:** Human IL-12 activity assay. The biological activity of Human IL-12 is determined by assessment of IFN- $\lambda$  secretion by human T cells activated with 10 ng/mL PHA.

## Mouse IL-23

### Description

Interleukin 23 (IL-23) is a covalently linked heterodimeric cytokine, which is closely related to IL-12. Macrophages and dendritic cells are the major sources of both IL-12 and IL-23, which act on receptors primarily expressed by T cells, NK cells, and NKT cells. IL-23 consists of the p40 subunit shared with IL-12 and the 19 kDa protein p19 that is unique to IL-23. Its effects are mediated by a receptor composed of IL-12 receptor subunit  $\beta$ 1 and an IL-23 specific subunit. IL-12 and IL-23 show different functions although both contain the p40 subunit. While IL-12 drives the development of T<sub>H</sub>1 cells, IL-23 mediates the full differentiation and maintenance of T<sub>H</sub>17 cells. IL-23 stimulates CD4<sup>+</sup> T cells and promotes the production of pro-inflammatory cytokines. As a key cytokine in the survival and proliferation of T<sub>H</sub>17 cells, IL-23 has central roles in autoimmune diseases and promotes chronic inflammation. It has been shown that single chain fusion proteins of naturally heterodimeric cytokines such as IL-12 or IL-23 are bioactive *in vitro* and *in vivo*.

Product	Packing unit	Source	Order no.
Mouse IL-23, research grade	5 $\mu$ g	HEK293 cells	<b>new</b> 130-096-676
Mouse IL-23, research grade	25 $\mu$ g	HEK293 cells	<b>new</b> 130-096-677

### Biological activity

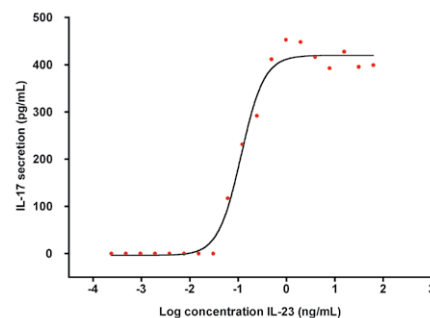
Induction of IL-17 secretion by mouse splenocytes

**Research grade:**  $\geq 4 \times 10^6$  U/mg

### Applications

Mouse IL-23 may be used for a variety of applications, including:

- *In vitro* differentiation of CD4<sup>+</sup> T cells towards T<sub>H</sub>17 cells and proliferation of T<sub>H</sub>17 cells
- Exploration of the role of IL-23 in autoimmune diseases or inflammatory bowel diseases
- Investigation of IL-23-mediated molecular signaling pathways



**Figure 1:** Mouse IL-23 activity assay. The biological activity of Mouse IL-23 is determined by assessment of IL-17 secretion by mouse splenocytes activated with 10 ng/mL PMA.

## Mouse LIF

### Description

Leukemia inhibitory factor (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.

### Application

Mouse LIF is essential for the maintenance of self-renewal and pluripotency in conventional mouse ESC cultures.

Product	Packing unit	Source	Order no.
Mouse LIF, research grade	10 µg	<i>E. coli</i>	130-095-772
Mouse LIF, research grade	25 µg	<i>E. coli</i>	130-095-775
Mouse LIF, premium grade	10 µg	<i>E. coli</i>	130-095-777
Mouse LIF, premium grade	25 µg	<i>E. coli</i>	130-095-778
Mouse LIF, premium grade	100 µg	<i>E. coli</i>	130-095-779

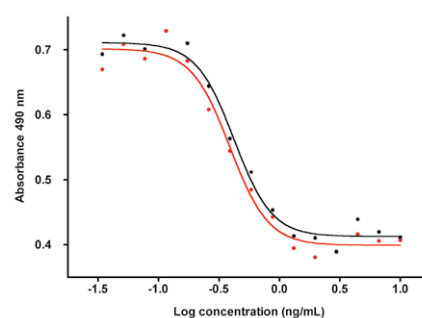
A minimal concentration of 10 ng/mL or 20 units/mL are required to support mouse ESC in an undifferentiated state.

### Biological activity

Inhibition of M1 cells

**Research grade:**  $\geq 1 \times 10^6$  U/mg

**Premium grade:**  $\geq 2 \times 10^6$  U/mg



**Figure 1:** Mouse LIF activity assay. The biological activity of Mouse LIF is 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.

## Product list: Human cytokines & growth factors

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	<i>E. coli</i>	5 µg	130-093-806
				<i>E. coli</i>	20 µg	130-093-807
Human BDNF	research grade		Recombinant human brain-derived neurotrophic factor	<i>E. coli</i>	2 µg	<b>new</b> 130-096-285
				<i>E. coli</i>	10 µg	130-093-811
				<i>E. coli</i>	100 µg	<b>new</b> 130-096-286
Human BD-2	research grade		Recombinant human beta defensin-2	<i>E. coli</i>	20 µg	130-093-809
Human BD-3	research grade		Recombinant human beta defensin-3	<i>E. coli</i>	5 µg	130-093-810
				<i>E. coli</i>	20 µg	130-094-615
Human BMP-2	research grade		Recombinant human bone morphogenetic protein 2	<i>E. coli</i>	2 µg	130-093-814
				<i>E. coli</i>	10 µg	130-093-812
				<i>E. coli</i>	100 µg	130-094-616
Human BMP-7	research grade		Recombinant human bone morphogenetic protein 7	CHO cells	10 µg	130-093-818
Human Cardiotrophin-1	research grade	CT-1	Recombinant human cardiotrophin 1	<i>E. coli</i>	10 µg	130-093-820
Human CD22 – soluble	research grade	BL-CAM, SIGLEC-2	Recombinant soluble human CD22	CHO cells	20 µg	130-093-821
Human CD40-Ligand – soluble	research grade	TRAP, CD154, TNFSF5	Recombinant soluble human CD40 ligand	<i>E. coli</i>	10 µg	130-093-822
				<i>E. coli</i>	50 µg	130-093-823
				<i>E. coli</i>	1000 µg	130-094-617
Human CNTF	research grade		Recombinant human ciliary neurotrophic factor	<i>E. coli</i>	5 µg	<b>new</b> 130-096-337
				<i>E. coli</i>	20 µg	<b>new</b> 130-096-336
Human CXCL16	research grade	SRPSOX	Recombinant human chemokine ligand CXCL16	<i>E. coli</i>	25 µg	130-093-824
Human EG-VEGF	research grade	Prokineticin 1	Recombinant human endocrine gland-derived vascular endothelial growth factor	<i>E. coli</i>	20 µg	130-093-829
Human EGF	research grade		Recombinant human epidermal growth factor	<i>E. coli</i>	100 µg	130-093-825
				<i>E. coli</i>	500 µg	130-093-826
				<i>E. coli</i>	1000 µg	130-093-827
Human Exodus-2	research grade	CCL21, SLC	Recombinant human exodus 2	<i>E. coli</i>	5 µg	130-093-833
				<i>E. coli</i>	20 µg	130-094-618
Human FGF-1	premium grade	acidic FGF, aFGF, HBGF-1	Recombinant human fibroblast growth factor 1	<i>E. coli</i>	10 µg	130-095-790
				<i>E. coli</i>	25 µg	130-095-763
	research grade	acidic FGF, aFGF, HBGF-1	Recombinant human fibroblast growth factor 1	<i>E. coli</i>	100 µg	130-095-761
				<i>E. coli</i>	1000 µg	130-095-756
Human FGF-2	premium grade	basic FGF, HBGF-2	Recombinant human fibroblast growth factor 2	<i>E. coli</i>	10 µg	130-093-839
				<i>E. coli</i>	50 µg	130-093-840
				<i>E. coli</i>	100 µg	130-093-564
				<i>E. coli</i>	200 µg	130-093-841
				<i>E. coli</i>	1000 µg	130-093-842
	<i>E. coli</i>	2000 µg	130-093-843			
research grade	basic FGF, HBGF-2	Recombinant human fibroblast growth factor 2	<i>E. coli</i>	10 µg	130-093-837	
<i>E. coli</i>	50 µg	130-093-838				

Product list: Human cytokines & growth factors

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human FGF-4	research grade	HBGF-4	Recombinant human fibroblast growth factor 4	<i>E. coli</i>	25 µg	130-093-845
Human FGF-5	research grade	HBGF-5	Recombinant human fibroblast growth factor 5	<i>E. coli</i>	50 µg	130-093-846
Human FGF-6	research grade	HBGF-6	Recombinant human fibroblast growth factor 6	<i>E. coli</i>	25 µg	130-093-847
Human FGF-7	research grade	KGF-2, HBGF-7	Recombinant human fibroblast growth factor 7	<i>E. coli</i>	2 µg	130-093-848
				<i>E. coli</i>	10 µg	130-093-849
Human FGF-8b	premium grade		Recombinant human fibroblast growth factor 8b	<i>E. coli</i>	10 µg	130-095-737
				<i>E. coli</i>	25 µg	130-095-738
				<i>E. coli</i>	100 µg	130-095-740
				<i>E. coli</i>	1000 µg	130-095-741
	research grade			<i>E. coli</i>	10 µg	130-095-731
				<i>E. coli</i>	25 µg	130-095-733
Human FGF-10	research grade	KGF-2	Recombinant human fibroblast growth factor 10	<i>E. coli</i>	25 µg	130-093-850
Human Flt3-Ligand	premium grade		Recombinant human Flt3-ligand	<i>E. coli</i>	10 µg	<b>new</b> 130-096-476
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-477
				<i>E. coli</i>	100 µg	<b>new</b> 130-096-479
				<i>E. coli</i>	1000 µg	<b>new</b> 130-096-480
	research grade			<i>E. coli</i>	10 µg	130-093-854
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-474
Human G-CSF	premium grade		Recombinant human granulocyte colony-stimulating factor	<i>E. coli</i>	10 µg	130-093-860
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-347
				<i>E. coli</i>	100 µg	130-093-861
				<i>E. coli</i>	1000 µg	130-094-265
	research grade			<i>E. coli</i>	10 µg	<b>new</b> 130-096-345
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-346
Human Galectin-1	research grade	LGALS1	Recombinant human galectin 1	<i>E. coli</i>	50 µg	130-093-857
Human Galectin-3	research grade	LGALS3	Recombinant human galectin 3	<i>E. coli</i>	50 µg	130-093-858
Human GDNF	research grade		Recombinant human glial cell line-derived neurotrophic factor	<i>E. coli</i>	2 µg	<b>new</b> 130-096-290
				<i>E. coli</i>	10 µg	<b>new</b> 130-096-291
Human GM-CSF	premium grade		Recombinant human granulocyte macrophage colony-stimulating factor	<i>E. coli</i>	10 µg	130-093-864
				<i>E. coli</i>	50 µg	130-093-865
				<i>E. coli</i>	100 µg	130-093-866
				<i>E. coli</i>	500 µg	130-093-867
	research grade			<i>E. coli</i>	1000 µg	130-093-868
				<i>E. coli</i>	10 µg	130-093-862
Human GRO-α	research grade	CXCL1, MGSAα	Recombinant human growth regulated oncogene α	<i>E. coli</i>	5 µg	130-094-620
				<i>E. coli</i>	25 µg	130-093-869
Human GRO-β	research grade	CXCL2, MGSAβ, MIP-2α	Recombinant human growth regulated oncogene β	<i>E. coli</i>	2 µg	130-093-870
				<i>E. coli</i>	10 µg	130-094-621
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
Human IFN-α2a	research grade		Recombinant human interferon α2a	<i>E. coli</i>	20 µg	130-093-873
				<i>E. coli</i>	100 µg	130-093-874

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human IFN- $\alpha$ 2b	research grade		Recombinant human interferon $\alpha$ 2b	<i>E. coli</i>	20 $\mu$ g	130-093-875
				<i>E. coli</i>	100 $\mu$ g	130-093-876
Human IFN- $\beta$ (natural)	research grade		Human interferon $\beta$	Human fibroblasts	15 $\mu$ g	130-093-879
Human IFN- $\beta$ 1a	research grade		Recombinant human interferon $\beta$ 1a	CHO cells	2 $\mu$ g	130-094-116
				CHO cells	10 $\mu$ g	130-093-877
Human IFN- $\beta$ 1b	research grade		Recombinant human interferon $\beta$ 1b	<i>E. coli</i>	2 $\mu$ g	130-093-878
				<i>E. coli</i>	10 $\mu$ g	130-094-619
Human IFN- $\gamma$ 1b	premium grade	IFN- $\gamma$	Recombinant human interferon $\gamma$ 1b	<i>E. coli</i>	10 $\mu$ g	<b>new</b> 130-096-481
				<i>E. coli</i>	25 $\mu$ g	<b>new</b> 130-096-482
				<i>E. coli</i>	100 $\mu$ g	<b>new</b> 130-096-484
				<i>E. coli</i>	1000 $\mu$ g	<b>new</b> 130-096-486
	research grade	IFN- $\gamma$	Recombinant human interferon $\gamma$ 1b	<i>E. coli</i>	10 $\mu$ g	<b>new</b> 130-096-872
				<i>E. coli</i>	25 $\mu$ g	<b>new</b> 130-096-873
Human IGF-BP3	research grade	IBP-3	Recombinant human IGF-binding protein 3	<i>E. coli</i>	25 $\mu$ g	130-093-891
Human IGF-BP5	research grade	IBP-5	Recombinant human IGF-binding protein 5	<i>E. coli</i>	25 $\mu$ g	130-093-892
Human IGF-1	research grade	IGF-I	Recombinant human insulin-like growth factor 1	<i>E. coli</i>	50 $\mu$ g	130-093-885
				<i>E. coli</i>	100 $\mu$ g	130-093-886
				<i>E. coli</i>	1000 $\mu$ g	130-093-887
Human IGF-2	research grade	IGF-II	Recombinant human insulin-like growth factor 2	<i>E. coli</i>	10 $\mu$ g	130-093-888
				<i>E. coli</i>	50 $\mu$ g	130-093-889
				<i>E. coli</i>	1000 $\mu$ g	130-093-890
Human IL-1 $\alpha$	research grade		Recombinant human interleukin 1 $\alpha$	<i>E. coli</i>	2 $\mu$ g	130-093-893
				<i>E. coli</i>	10 $\mu$ g	130-093-894
Human IL-1 $\beta$	premium grade		Recombinant human interleukin 1 $\beta$	<i>E. coli</i>	10 $\mu$ g	130-093-897
				<i>E. coli</i>	25 $\mu$ g	130-093-563
				<i>E. coli</i>	100 $\mu$ g	130-093-898
				<i>E. coli</i>	1000 $\mu$ g	130-093-899
	research grade		Recombinant human interleukin 1 $\beta$	<i>E. coli</i>	10 $\mu$ g	130-093-895
				<i>E. coli</i>	25 $\mu$ g	130-095-374
Human IL-1ra	research grade		Recombinant human interleukin 1 receptor antagonist	<i>E. coli</i>	20 $\mu$ g	<b>new</b> 130-096-142
Human IL-2	research grade		Recombinant human interleukin 2	<i>E. coli</i>	5 $\mu$ g	130-093-901
				<i>E. coli</i>	50 $\mu$ g	130-093-903
Human IL-2 (v126)	research grade	aldesleukin	Recombinant human interleukin 2 (variant in position 126)	<i>E. coli</i>	5 $\mu$ g	130-093-906
				<i>E. coli</i>	50 $\mu$ g	130-093-907
				<i>E. coli</i>	1000 $\mu$ g	130-094-622
Human IL-3	premium grade		Recombinant human interleukin 3	<i>E. coli</i>	10 $\mu$ g	130-095-071
				<i>E. coli</i>	25 $\mu$ g	130-095-070
				<i>E. coli</i>	100 $\mu$ g	130-095-069
				<i>E. coli</i>	1000 $\mu$ g	130-095-068
	research grade		Recombinant human interleukin 3	<i>E. coli</i>	10 $\mu$ g	130-093-908
				<i>E. coli</i>	25 $\mu$ g	130-093-909
				<i>E. coli</i>	4x25 $\mu$ g	130-094-193

Product list: Human cytokines & growth factors

Product	Quality grade	Alternative name	Description	Source	Content	Order no.					
Human IL-4	cell culture grade		Recombinant human interleukin 4	<i>E. coli</i>	~ 5 µg	130-093-918					
					5 µg	130-093-919					
					10 µg	130-093-920					
					25 µg	130-093-921					
					100 µg	130-093-922					
	premium grade				1000 µg	130-093-924					
						research grade	5 µg	130-093-915			
							10 µg	130-095-373			
							25 µg	130-093-917			
							100 µg	130-094-117			
Human IL-6	premium grade	Recombinant human interleukin 6	<i>E. coli</i>	10 µg	130-095-352						
				25 µg	130-093-931						
				100 µg	130-093-932						
				500 µg	130-093-933						
				1000 µg	130-093-934						
	research grade			10 µg	130-095-365						
					25 µg	130-093-929					
					100 µg	130-095-366					
					Human IL-7	premium grade	Recombinant human interleukin 7	<i>E. coli</i>	10 µg	130-095-361	
									25 µg	130-095-362	
100 µg	130-095-363										
1000 µg	<b>new</b> 130-095-364										
research grade	10 µg	130-093-937									
		25 µg	130-095-367								
		100 µg	130-093-939								
		Human IL-8 (72 aa)	research grade	CXCL8		Recombinant human interleukin 8 (72 aa)			<i>E. coli</i>	5 µg	130-093-942
										25 µg	130-093-943
research grade	CXCL8		Recombinant human interleukin 8 (77 aa)							<i>E. coli</i>	25 µg
Human IL-9	research grade				Recombinant human interleukin 9		<i>E. coli</i>	2 µg		130-093-945	
								10 µg		130-093-946	
Human IL-10	research grade				Recombinant human interleukin 10		<i>E. coli</i>	2 µg		130-093-947	
								10 µg		130-093-948	
Human IL-11	research grade				Recombinant human interleukin 11		<i>E. coli</i>	2 µg		130-094-623	
								10 µg		130-093-950	
Human IL-12	premium grade				Recombinant human interleukin 12		HEK293 cells	5 µg		<b>new</b> 130-096-704	
		HEK293 cells		25 µg		<b>new</b> 130-096-705					
		HEK293 cells		100 µg		<b>new</b> 130-096-798					
Human IL-13	research grade		Recombinant human interleukin 13	<i>E. coli</i>	2 µg	130-093-953					
					10 µg	130-093-954					
Human IL-15	premium grade		Recombinant human interleukin 15	<i>E. coli</i>	10 µg	130-095-762					
					25 µg	130-095-764					
					100 µg	130-095-765					
					1000 µg	130-095-766					
	research grade				10 µg	130-093-955					
						25 µg	130-095-760				

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human IL-17	research grade	IL-17A	Recombinant human interleukin 17	<i>E. coli</i>	5 µg	130-093-958
				<i>E. coli</i>	25 µg	130-093-959
				<i>E. coli</i>	100 µg	130-094-625
Human IL-19	research grade		Recombinant human interleukin 19	<i>E. coli</i>	2 µg	130-094-626
				<i>E. coli</i>	10 µg	130-093-960
Human IL-21	premium grade		Recombinant human interleukin 21	<i>E. coli</i>	10 µg	<b>new</b> 130-095-768
				<i>E. coli</i>	25 µg	<b>new</b> 130-095-769
				<i>E. coli</i>	100 µg	<b>new</b> 130-095-784
	research grade		Recombinant human interleukin 21	<i>E. coli</i>	10 µg	130-094-563
				<i>E. coli</i>	25 µg	<b>new</b> 130-095-767
Human IL-22	research grade		Recombinant human interleukin 22	<i>E. coli</i>	2 µg	<b>new</b> 130-096-294
				<i>E. coli</i>	10 µg	<b>new</b> 130-096-295
				<i>E. coli</i>	100 µg	<b>new</b> 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 M-CSF	premium grade		Recombinant human macrophage-colony stimulating factor	<i>E. coli</i>	10 µg	<b>new</b> 130-096-485
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-489
				<i>E. coli</i>	100 µg	<b>new</b> 130-096-492
				<i>E. coli</i>	1000 µg	<b>new</b> 130-096-493
	research grade		Recombinant human macrophage-colony stimulating factor	<i>E. coli</i>	10 µg	130-093-963
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-491
Human MCP-1	research grade	CCL2, MCAF	Recombinant human monocyte chemotactic protein 1	<i>E. coli</i>	5 µg	130-093-961
				<i>E. coli</i>	20 µg	130-093-962
Human MIP-3α	research grade	CCL20, Exodus 1	Recombinant human macrophage inflammatory protein 3α	<i>E. coli</i>	20 µg	130-093-966
Human MIP-3β	research grade	CCL19, ELC, Exodus 3	Recombinant human macrophage inflammatory protein 3β	<i>E. coli</i>	5 µg	130-093-967
				<i>E. coli</i>	20 µg	130-093-968
				<i>E. coli</i>	100 µg	130-093-969
Human NGF-β	research grade	β-NGF	Recombinant human nerve growth factor β	CHO cells	5 µg	130-093-971
				CHO cells	20 µg	130-093-972
Human NT-3	research grade	NTF-3, HDNF	Recombinant human neurotrophin 3	<i>E. coli</i>	2 µg	<b>new</b> 130-096-287
				<i>E. coli</i>	10 µg	130-093-973
				<i>E. coli</i>	100 µg	<b>new</b> 130-096-288
Human NT-4	research grade	NTF-4	Recombinant human neurotrophin 4	<i>E. coli</i>	2 µg	<b>new</b> 130-096-289
				<i>E. coli</i>	10 µg	130-093-974
Human Oncostatin M	research grade	OSM	Recombinant human oncostatin M	<i>E. coli</i>	2 µg	130-093-975
				<i>E. coli</i>	10 µg	130-093-976
Human OPG	research grade	TNFRSF11B, TR1	Recombinant soluble human osteoprotegerin	Yeast	50 µg	130-094-119
Human PDGF-AA	research grade		Recombinant human platelet-derived growth factor AA	<i>E. coli</i>	2 µg	130-093-977
				<i>E. coli</i>	10 µg	130-093-978
Human PDGF-AB	research grade		Recombinant human platelet-derived growth factor AB	<i>E. coli</i>	2 µg	130-094-629
				<i>E. coli</i>	10 µg	130-093-979

Product list: Human cytokines & growth factors

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human PDGF-BB	research grade		Recombinant human platelet-derived growth factor BB	<i>E. coli</i>	2 µg	130-093-980
				<i>E. coli</i>	10 µg	130-093-982
				<i>E. coli</i>	100 µg	130-094-630
				Yeast	2 µg	130-093-981
				Yeast	10 µg	130-093-983
				Yeast	50 µg	130-093-984
Human Prolactin	research grade	Mammotropin	Recombinant human prolactin	<i>E. coli</i>	50 µg	130-093-985
Human RANK-Ligand – soluble	research grade	TNFSF11, TRANCE, ODF	Recombinant soluble human receptor activator of NF-κB ligand	<i>E. coli</i>	2 µg	130-093-987
				<i>E. coli</i>	10 µg	130-093-988
				<i>E. coli</i>	100 µg	130-094-631
Human RANTES	research grade	CCL5	Recombinant human RANTES	<i>E. coli</i>	5 µg	130-093-989
				<i>E. coli</i>	20 µg	130-094-632
Human SCF	premium grade	c-kit ligand, steel factor, MGF	Recombinant human stem cell factor	<i>E. coli</i>	10 µg	<b>new</b> 130-096-693
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-694
				<i>E. coli</i>	100 µg	<b>new</b> 130-096-695
				<i>E. coli</i>	1000 µg	<b>new</b> 130-096-696
	research grade	c-kit ligand, steel factor, MGF	Recombinant human stem cell factor	<i>E. coli</i>	10 µg	130-093-991
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-692
Human SCGF-α	research grade		Recombinant human stem cell growth factor α	<i>E. coli</i>	10 µg	130-093-994
Human SCGF-β	research grade		Recombinant human stem cell growth factor β	<i>E. coli</i>	10 µg	130-093-995
Human SDF-1α	research grade	CXCL12	Recombinant human stromal cell-derived factor 1α	<i>E. coli</i>	10 µg	130-093-996
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-137
				<i>E. coli</i>	100 µg	130-093-997
				<i>E. coli</i>	1000 µg	130-093-998
Human SHH (C24II)	premium grade		Recombinant human sonic hedgehog (C24II)	<i>E. coli</i>	10 µg	130-095-721
				<i>E. coli</i>	25 µg	130-095-723
				<i>E. coli</i>	100 µg	130-095-727
				<i>E. coli</i>	1000 µg	130-095-730
	research grade		Recombinant human sonic hedgehog (C24II)	<i>E. coli</i>	10 µg	130-095-717
				<i>E. coli</i>	25 µg	130-095-718
Human TARC	research grade	CCL17	Recombinant human thymus and activation-regulated chemokine	<i>E. coli</i>	20 µg	130-093-999
Human TGF-α	research grade		Recombinant human transforming growth factor α	<i>E. coli</i>	100 µg	130-094-000
Human TGF-β1	premium grade		Recombinant human transforming growth factor β1	HEK293 cells	5 µg	130-095-067
Human TGF-β2	research grade		Recombinant human transforming growth factor β2	Insect cells	1 µg	130-094-004
				Insect cells	5 µg	130-094-005
Human TGF-β3	research grade		Recombinant human transforming growth factor β3	<i>E. coli</i>	1 µg (liquid)	130-094-006
				<i>E. coli</i>	5 µg (liquid)	130-094-007
				<i>E. coli</i>	20 µg (liquid)	130-094-008

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Human TNF- $\alpha$	premium grade	TNFSF2	Recombinant human tumor necrosis factor $\alpha$	<i>E. coli</i>	10 $\mu$ g	130-094-014
				Yeast	10 $\mu$ g	130-094-022
				Yeast	50 $\mu$ g	130-094-023
				Yeast	100 $\mu$ g	130-094-024
				Yeast	1000 $\mu$ g	130-094-562
	research grade	TNFSF2	Recombinant human tumor necrosis factor $\alpha$	Yeast	10 $\mu$ g	130-094-015
				Yeast	50 $\mu$ g	130-094-017
				Yeast	100 $\mu$ g	130-094-018
				Yeast	750 $\mu$ g	130-094-019
				Yeast	1000 $\mu$ g	130-094-020
Human TPO	research grade	MDGF	Recombinant human thrombopoietin	<i>E. coli</i>	2 $\mu$ g	130-094-010
				<i>E. coli</i>	10 $\mu$ g	130-094-011
				<i>E. coli</i>	100 $\mu$ g	130-094-013
				CHO cells	10 $\mu$ g	130-094-012
				CHO cells	100 $\mu$ g	<b>new</b> 130-097-258
Human TRAIL	research grade	Apo2L, TNFSF10	Recombinant human TNF-related apoptosis inducing ligand	<i>E. coli</i>	10 $\mu$ g	130-094-025
				<i>E. coli</i>	50 $\mu$ g	130-094-026
Human TRAIL Receptor-1 – soluble	research grade	DR4, TNFRSF10A	Recombinant soluble human TNF-related apoptosis inducing ligand receptor 1	<i>E. coli</i>	50 $\mu$ g	130-094-352
Human TRAIL Receptor-2 – soluble	research grade	DR5, TNFRSF10B	Recombinant soluble human TNF-related apoptosis inducing ligand receptor 2	<i>E. coli</i>	50 $\mu$ g	130-094-353
Human TSLP	research grade		Recombinant human thymic stromal lymphopoietin	<i>E. coli</i>	5 $\mu$ g	<b>new</b> 130-096-292
				<i>E. coli</i>	20 $\mu$ g	<b>new</b> 130-096-293
Human VEGF (121 aa)	research grade		Recombinant human vascular endothelial growth factor (121 aa)	Insect cells	5 $\mu$ g	130-094-029
				Insect cells	100 $\mu$ g	130-094-030
Human VEGF (165 aa)	research grade		Recombinant human vascular endothelial growth factor (165 aa)	Insect cells	5 $\mu$ g	130-094-031
				Insect cells	20 $\mu$ g	130-094-033
				Insect cells	100 $\mu$ g	130-094-034
				Insect cells	500 $\mu$ g	130-094-035
Stemfactor Activin A (Human Recombinant)	research grade	FRP	Recombinant human activin A		5 $\mu$ g	130-095-547
Stemfactor BMP-4 (Human Recombinant)	research grade		Recombinant human bone morphogenetic protein 4		10 $\mu$ g	130-095-549
Stemfactor Noggin (Human Recombinant)	research grade		Recombinant human noggin		10 $\mu$ g	130-095-548
Stemfactor Recombinant Human LIF	research grade		Recombinant human leukemia inhibitory factor		10 $\mu$ g	<b>new</b> 130-096-994
					100 $\mu$ g	<b>new</b> 130-096-993

**Product list: Mouse cytokines & growth factors**

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Mouse EGF	research grade		Recombinant mouse epidermal growth factor	<i>E. coli</i>	100 µg	130-094-036
				<i>E. coli</i>	500 µg	130-094-037
Mouse FGF-8b	premium grade		Recombinant mouse fibroblast growth factor 8b	<i>E. coli</i>	10 µg	130-096-102
				<i>E. coli</i>	25 µg	130-096-103
				<i>E. coli</i>	100 µg	130-096-104
				<i>E. coli</i>	1000 µg	130-096-105
	research grade			<i>E. coli</i>	10 µg	130-096-100
				<i>E. coli</i>	25 µg	130-096-101
Mouse Flt3-Ligand	research grade		Recombinant mouse Flt3 ligand	<i>E. coli</i>	10 µg	130-094-038
Mouse G-CSF	research grade		Recombinant mouse granulocyte colony-stimulating factor	<i>E. coli</i>	2 µg	130-094-039
				<i>E. coli</i>	10 µg	130-094-040
				<i>E. coli</i>	100 µg	130-094-041
Mouse GM-CSF	premium grade		Recombinant mouse granulocyte macrophage colony-stimulating factor	<i>E. coli</i>	10 µg	130-095-742
				<i>E. coli</i>	25 µg	130-095-793
				<i>E. coli</i>	100 µg	130-095-739
				<i>E. coli</i>	1000 µg	130-095-735
	research grade			<i>E. coli</i>	10 µg	130-094-043
				<i>E. coli</i>	25 µg	130-095-746
Mouse Gro-α/KC	research grade	CXCL1	Recombinant mouse growth regulated oncogene α/keratinocyte chemoattractant	<i>E. coli</i>	5 µg	130-094-045
				<i>E. coli</i>	20 µg	130-094-046
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	<i>E. coli</i>	20 µg	130-094-047
				<i>E. coli</i>	100 µg	130-094-048
				<i>E. coli</i>	1000 µg	130-094-049
Mouse IL-1α	research grade		Recombinant mouse interleukin 1α	<i>E. coli</i>	2 µg	130-094-050
				<i>E. coli</i>	10 µg	130-094-051
Mouse IL-1β	research grade		Recombinant mouse interleukin 1β	<i>E. coli</i>	2 µg	130-094-052
				<i>E. coli</i>	10 µg	130-094-053
Mouse IL-2	research grade		Recombinant mouse interleukin 2	<i>E. coli</i>	5 µg	130-094-054
				<i>E. coli</i>	20 µg	130-094-055
Mouse IL-3	research grade		Recombinant mouse interleukin 3	<i>E. coli</i>	2 µg	130-094-056
				<i>E. coli</i>	10 µg	130-094-057
				<i>E. coli</i>	100 µg	130-094-633
				<i>E. coli</i>	1000 µg	130-094-661
Mouse IL-4	research grade		Recombinant mouse interleukin 4	<i>E. coli</i>	2 µg	130-094-060
				<i>E. coli</i>	10 µg	130-094-061
				<i>E. coli</i>	100 µg	130-094-063
				<i>E. coli</i>	1000 µg	130-094-064
Mouse IL-6	premium grade		Recombinant mouse interleukin 6	<i>E. coli</i>	10 µg	<b>new</b> 130-096-682
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-684
				<i>E. coli</i>	100 µg	<b>new</b> 130-096-685
				<i>E. coli</i>	1000 µg	<b>new</b> 130-096-686
	research grade			<i>E. coli</i>	10 µg	130-094-065
				<i>E. coli</i>	25 µg	<b>new</b> 130-096-683

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Mouse IL-7	research grade		Recombinant mouse interleukin 7	<i>E. coli</i>	2 µg	130-094-636
				<i>E. coli</i>	10 µg	130-094-066
Mouse IL-10	research grade		Recombinant mouse interleukin 10	<i>E. coli</i>	2 µg	130-094-067
				<i>E. coli</i>	10 µg	130-094-068
Mouse IL-12	research grade		Recombinant mouse interleukin 12	HEK293 cells	5 µg	<b>new</b> 130-096-707
				HEK293 cells	25 µg	<b>new</b> 130-096-708
				HEK293 cells	100 µg	<b>new</b> 130-096-795
Mouse IL-13	research grade		Recombinant mouse interleukin 13	<i>E. coli</i>	2 µg	130-094-639
				<i>E. coli</i>	10 µg	130-094-070
Mouse IL-15	research grade		Recombinant mouse interleukin 15	<i>E. coli</i>	2 µg	130-094-071
				<i>E. coli</i>	10 µg	130-094-072
				<i>E. coli</i>	100 µg	130-094-640
Mouse IL-22	research grade		Recombinant mouse interleukin 22	<i>E. coli</i>	2 µg	<b>new</b> 130-096-298
				<i>E. coli</i>	10 µg	<b>new</b> 130-096-283
Mouse IL-23	research grade		Recombinant mouse interleukin 23	HEK293 cells	5 µg	<b>new</b> 130-096-676
				HEK293 cells	25 µg	<b>new</b> 130-096-677
Mouse IP-10	research grade	CXCL10	Recombinant mouse interferon-inducible protein 10	<i>E. coli</i>	5 µg	130-094-073
				<i>E. coli</i>	25 µg	130-094-641
Mouse LIF	premium grade		Recombinant mouse leukemia inhibitory factor	<i>E. coli</i>	10 µg	130-095-777
				<i>E. coli</i>	25 µg	130-095-778
				<i>E. coli</i>	100 µg	130-095-779
	research grade		Recombinant mouse leukemia inhibitory factor	<i>E. coli</i>	10 µg	130-095-772
				<i>E. coli</i>	25 µg	130-095-775
Mouse M-CSF	research grade		Recombinant mouse macrophage colony-stimulating factor	<i>E. coli</i>	2 µg	130-094-642
				<i>E. coli</i>	10 µg	130-094-129
				<i>E. coli</i>	100 µg	130-094-643
				<i>E. coli</i>	1000 µg	130-094-810
Mouse MIG	research grade	CXCL9	Recombinant mouse monokine induced by interferon γ	<i>E. coli</i>	5 µg	130-094-644
				<i>E. coli</i>	20 µg	130-094-128
Mouse MIP-3β	research grade	CCL19, ELC, Exodus 3	Recombinant mouse macrophage inflammatory protein 3β	<i>E. coli</i>	5 µg	130-094-120
				<i>E. coli</i>	20 µg	130-094-074
				<i>E. coli</i>	100 µg	130-094-075
Mouse RANK-Ligand – soluble	research grade	TNFSF11	Recombinant soluble mouse receptor activator of NF-κB ligand	<i>E. coli</i>	2 µg	130-094-645
				<i>E. coli</i>	10 µg	130-094-076
				<i>E. coli</i>	100 µg	130-094-646
Mouse RANTES	research grade	CCL5	Recombinant mouse RANTES	<i>E. coli</i>	20 µg	130-094-077
Mouse SCF	research grade	c-kit ligand, steel factor, MGF	Recombinant mouse stem cell factor	<i>E. coli</i>	2 µg	130-094-078
				<i>E. coli</i>	10 µg	130-094-079
				<i>E. coli</i>	100 µg	130-094-080
				<i>E. coli</i>	1000 µg	130-094-902
Mouse SDF-1α	research grade	CXCL12	Recombinant mouse stromal cell–derived factor 1α	<i>E. coli</i>	2 µg	130-094-081
				<i>E. coli</i>	10 µg	130-094-647
Mouse TNF-α	research grade	TNFSF2	Recombinant mouse tumor necrosis factor α	Streptomyces	5 µg	130-094-084
				Streptomyces	20 µg	130-094-085

## Product list: Mouse cytokines & growth factors

Product	Quality grade	Alternative name	Description	Source	Content	Order no.
Mouse TPO	research grade	MDGF	Recombinant mouse thrombopoietin	<i>E. coli</i>	2 µg	130-094-082
				<i>E. coli</i>	10 µg	130-094-083
				<i>E. coli</i>	100 µg <b>new</b>	130-096-301
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	<i>E. coli</i>	100 µg	130-094-089
Rat IL-2	research grade	Recombinant rat interleukin 2	<i>E. coli</i>	5 µg	130-094-121
				20 µg	130-094-090
Rat IL-4	research grade	Recombinant rat interleukin 4	<i>E. coli</i>	2 µg	130-094-091
				10 µg	130-094-122
Rat VEGF-C	research grade	Recombinant rat vascular endothelial growth factor	Insect cells	10 µg	130-094-092
Rat VEGF-C (C152S)	research grade	Recombinant rat vascular endothelial growth factor (Cys152Ser substitution)	Insect cells	5 µg	130-094-093





Miltenyi Biotec

**Germany/Austria/  
Switzerland**

Miltenyi Biotec GmbH  
Friedrich-Ebert-Straße 68  
51429 Bergisch Gladbach  
Germany  
Phone +49 2204 8306-0  
Fax +49 2204 85197  
macs@miltenyibiotec.de

**USA/Canada**

Miltenyi Biotec Inc.  
2303 Lindbergh Street  
Auburn, CA 95602, USA  
Phone 800 FOR MACS  
Phone +1 530 888 8871  
Fax +1 530 888 8925  
macs@miltenyibiotec.com

[www.miltenyibiotec.com](http://www.miltenyibiotec.com)

**Australia**

Miltenyi Biotec  
Australia Pty. Ltd.  
Unit 16A, 2 Eden Park Drive  
North Ryde, NSW 2113  
Australia  
Phone +61 2 8877 7400  
Fax +61 2 9889 5044  
macs@miltenyibiotec.com.au

**Benelux**

Miltenyi Biotec B.V.  
Schipholweg 68 H, 2316 Leiden  
The Netherlands  
macs@miltenyibiotec.nl

Customer Service Netherlands:  
Phone 0800 4020120  
Fax 0800 4020100

Customer Service Belgium:  
Phone 0800 94016  
Fax 0800 99626

Customer Service Luxembourg:  
Phone 800 24971  
Fax 800 24984

**China**

Miltenyi Biotec GmbH  
Shanghai Office  
Rm. 2309,  
No. 319 Xianxia Rd.  
Shanghai 200051, P.R. China  
Phone +86 21 62351005  
Fax +86 21 62350953  
macs@miltenyibiotec.com.cn

**France**

Miltenyi Biotec SAS  
10 rue Mercœur  
75011 Paris, France  
Phone +33 1 56 98 16 16  
Fax +33 1 56 98 16 17  
macs@miltenyibiotec.fr

**Italy**

Miltenyi Biotec S.r.l.  
Via Persicetana, 2/D  
40012 Calderara di Reno (BO)  
Italy  
Phone +39 051 6 460 411  
Fax +39 051 6 460 499  
macs@miltenyibiotec.it

**Japan**

Miltenyi Biotec K.K.  
Nittsu-Eitai Building 5F  
16-10 Fuyuki, Koto-ku,  
Tokyo 135-0041, Japan  
Phone +81 3 5646 8910  
Fax +81 3 5646 8911  
macs@miltenyibiotec.jp

**Singapore**

Miltenyi Biotec  
Asia Pacific Pte Ltd.  
100 Beach Road  
#28-06 to 28-08 Shaw Tower  
Singapore 189702  
Phone +65 6238 8183  
Fax +65 6238 0302  
macs@miltenyibiotec.com.sg

**Spain**

Miltenyi Biotec S.L.  
C/Luis Buñuel 2  
Ciudad de la Imagen  
28223 Pozuelo de Alarcón  
(Madrid), Spain  
Phone +34 91 512 12 90  
Fax +34 91 512 12 91  
macs@miltenyibiotec.es

**United Kingdom**

Miltenyi Biotec Ltd.  
Almac House, Church Lane  
Bisley, Surrey GU24 9DR,  
UK  
Phone +44 1483 799 800  
Fax +44 1483 799 811  
macs@miltenyibiotec.co.uk

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