



# Cytokines for Stem Cell Culture





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# Stem Cells Overview

Stem cells are multipotent cells with the ability to self-renew, self-replicate, and differentiate into multiple cell lines, including mesenchymal stem cells (MSCs), hematopoietic stem cells (HSCs), neural stem cells (NSCs), embryonic stem cells (ESCs), and induced pluripotent stem cells (iPSCs). Remarkable progress has been made in isolating and culturing various stem cells for disease treatment. Studies have demonstrated that stem cells have potential applications in treating a range of diseases, including cancer and heart disease.

Cytokines play an indispensable role in stem cell research:



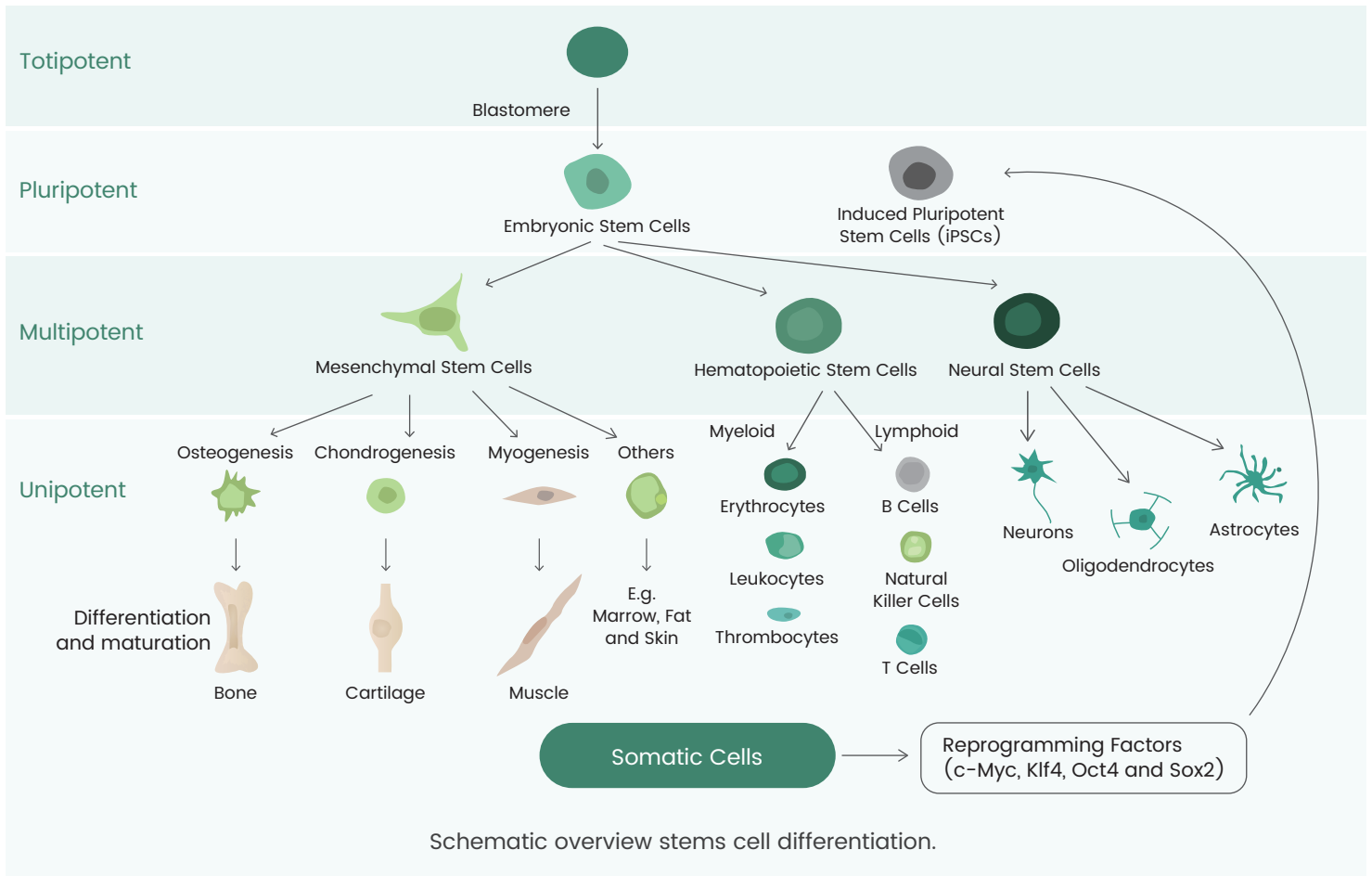
Cytokines can control the proliferation and differentiation of stem cells. For instance, Activin A promotes the differentiation of iPSCs into endodermal cells.



Cytokines have a targeted regulatory effect on the migration and localization of stem cells. For example, TNF- $\alpha$  and BMP-4, secreted by immune cells at injury or inflammation sites, can promote the localization and migration of MSCs to the site, thus aiding in the repair of damaged tissues and cells.



There are many other roles as well. For example, EGF has been shown to enhance the survival of neural stem cells from the embryonic brain, LIF can regulate stem cell pluripotency, and FGF2 is a key regulator of various stem cell types.



# Stem Cell Culture Cytokine Products

As a global leader in recombinant technology, Sino Biological has developed a series of high-quality recombinant cytokines for stem cell culture. These include EGF, PDGF-BB, TGF beta 1, SCF, IGF1, and basic FGF/FGF2, characterized by their high purity, high bioactivity, low endotoxin, and high batch-to-batch consistency. Available in both research-grade and GMP-grade to meet diverse research needs. In addition, we provide a comprehensive range of stem cell marker antibodies to support stem cell research.

## Products Highlights

- High purity: Purity >95% by SDS-PAGE & HPLC
- High bioactivity: Validated by ELISA, cell-based assays
- Low endotoxin: 5-10 EU/mg
- High lot-to-lot consistency
- Vast selection: Covers both research grade and GMP grade cytokines
- Quality control: ISO 9001/ISO 13485/GMP quality systems

## Certificates

Growth factor Supplier to Watch in 2024



GMP



ISO 9001:2015



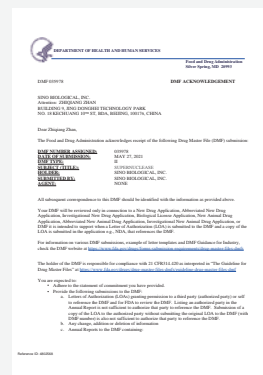
ISO 17025:2017



ISO 13485:2016



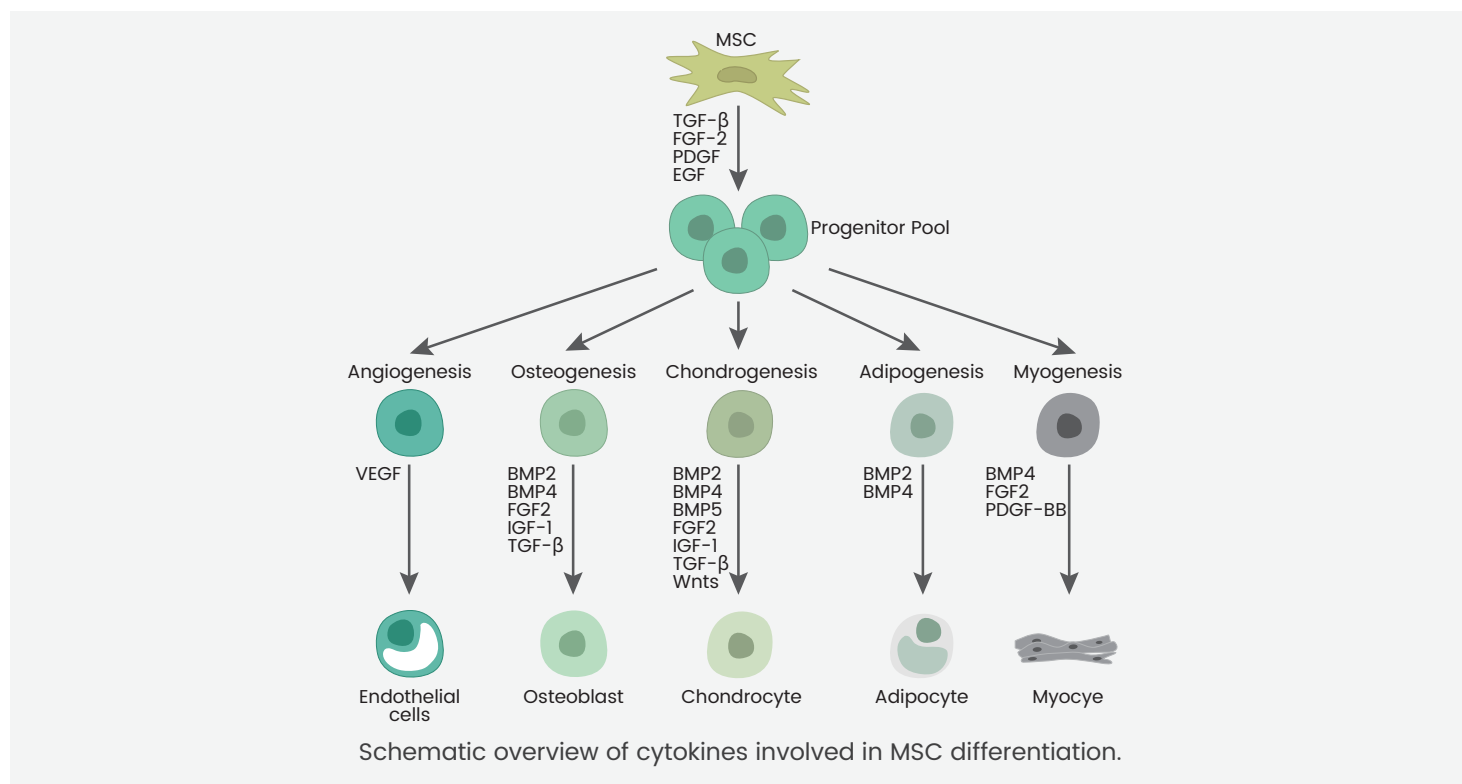
FDA DMF



# MSC Culture

Mesenchymal stem cells (MSCs) are adult stem cells found in various tissues such as umbilical cord, bone marrow, and adipose tissue. They have the remarkable ability to self-renew and differentiate. MSCs are known for their immunomodulatory and anti-inflammatory effects, which they exert by modulating lymphocytes within both innate and adaptive immune systems. This makes them a promising target for the treatment of several diseases, including autoimmune, cardiovascular, inflammatory, and neurodegenerative diseases. The therapeutic potential of MSCs is further supported by their easy accessibility, genetic stability, low immunogenicity, and their capacity for tissue repair and immunomodulation.

## Role of Different Cytokines on MSC



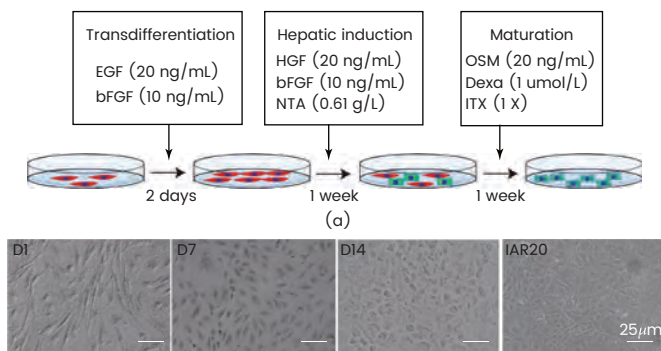
Cytokines	Function	Featured Products
basic FGF/FGF2	<ul style="list-style-type: none"> <li>Enhance MSC proliferation</li> <li>Support chondrocyte proliferation and differentiation</li> </ul>	GMP-10014-HNAE
EGF	<ul style="list-style-type: none"> <li>Stimulate MSC proliferation without altering MSC differentiation potential</li> <li>Enhance paracrine and autocrine functions of MSCs</li> </ul>	GMP-10605-HNAE
PDGF-BB	<ul style="list-style-type: none"> <li>Promote MSC proliferation and survival</li> <li>Promote myoblast proliferation</li> </ul>	10572-HNAE
TGF beta 1	<ul style="list-style-type: none"> <li>Enhance MSC proliferation</li> <li>Promote MSC differentiation into chondrocytes</li> </ul>	10804-HNAC
IGF-1	<ul style="list-style-type: none"> <li>Enhance MSC proliferation</li> <li>Promote MSC differentiation into chondrocytes</li> </ul>	10598-HNAE
SCF	<ul style="list-style-type: none"> <li>Enhance MSC proliferation</li> </ul>	10451-HNAE
VEGF-A	<ul style="list-style-type: none"> <li>Promote MSC proliferation and survival</li> <li>Involved in the formation, proliferation and survival of vascular endothelial cells</li> </ul>	10008-HNAH

GMP-Grade Available

# Cytokine Applications in MSC Cultures

## MSCs differentiation into hepatoid cells

Products used:  
EGF, bFGF, HGF

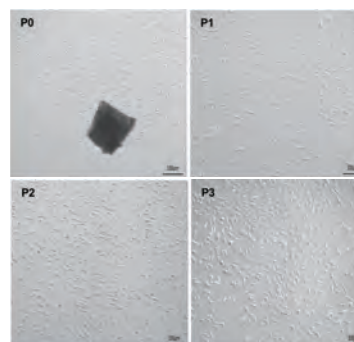


(a) Flowchart illustrating the induction process of MSCs differentiating into hepatoid cells in vitro. (b) Morphological representation of MSCs during their differentiation into hepatoid cells.

DOI: 10.1155/2023/6890299

## Expansion of bone marrow MSCs





Products used:  
EGF (Cat#: 50482-MNCH), FGF-18 (Cat#: 50177-M08H)



P0 denotes the primary cell, while P1, P2, and P3 correspond to the first, second, and third generation cells, respectively.

DOI: 10.1186/s12974-022-02393-2

## Featured Cytokines for MSC Culture

Cytokines	Cat#	Species	Expression Host	Purity	Endotoxin
basic FGF/FGF2	10014-HNAE	Human	<i>E. coli</i>	≥ 95% SDS-PAGE	< 10 EU/mg
	GMP-10014-HNAE 	Human	<i>E. coli</i>	≥ 95% SDS-PAGE	< 10 EU/mg
EGF	10605-HNAE	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 5 EU/mg
	GMP-10605-HNAE 	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 5 EU/mg
PDGF-BB	10572-HNAE	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 50 EU/mg
TGF beta 1	10804-HNAC	Human, Rhesus, Cynomolgus, Canine	CHO Stable Cells	> 95% SDS-PAGE	< 1 EU/µg
	10804-H08H	Human	HEK293 Cells	> 95% SDS-PAGE	< 1 EU/µg
SCF	10451-HNAE	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 10 EU/mg
	GMP-10451-HNAE1-L-AF  	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 10 EU/mg
VEGF-A	10008-HNAH	Human	HEK293 Cells	> 95% SDS-PAGE > 95% SEC-HPLC	< 1 EU/µg
BMP-2	10426-HNAE1	Human, Mouse, Rat, Rhesus, Canine	<i>E. coli</i>	≥ 95% SDS-PAGE	< 10 EU/mg
BMP4	10609-HNAE2	Human	<i>E. coli</i>	≥ 95% SDS-PAGE	< 1 EU/µg

 GMP-Grade Available

 Animal-Free

## Antibodies for MSC Surface Profiling

There are three primary methods for identifying MSC: observing morphological characteristics to determine cell adherence, assessing the potential for multidirectional differentiation, and detecting specific MSC surface markers. In 2006, the International Society for Cell Therapy established a set of criteria for human MSC identification based on cell surface markers.

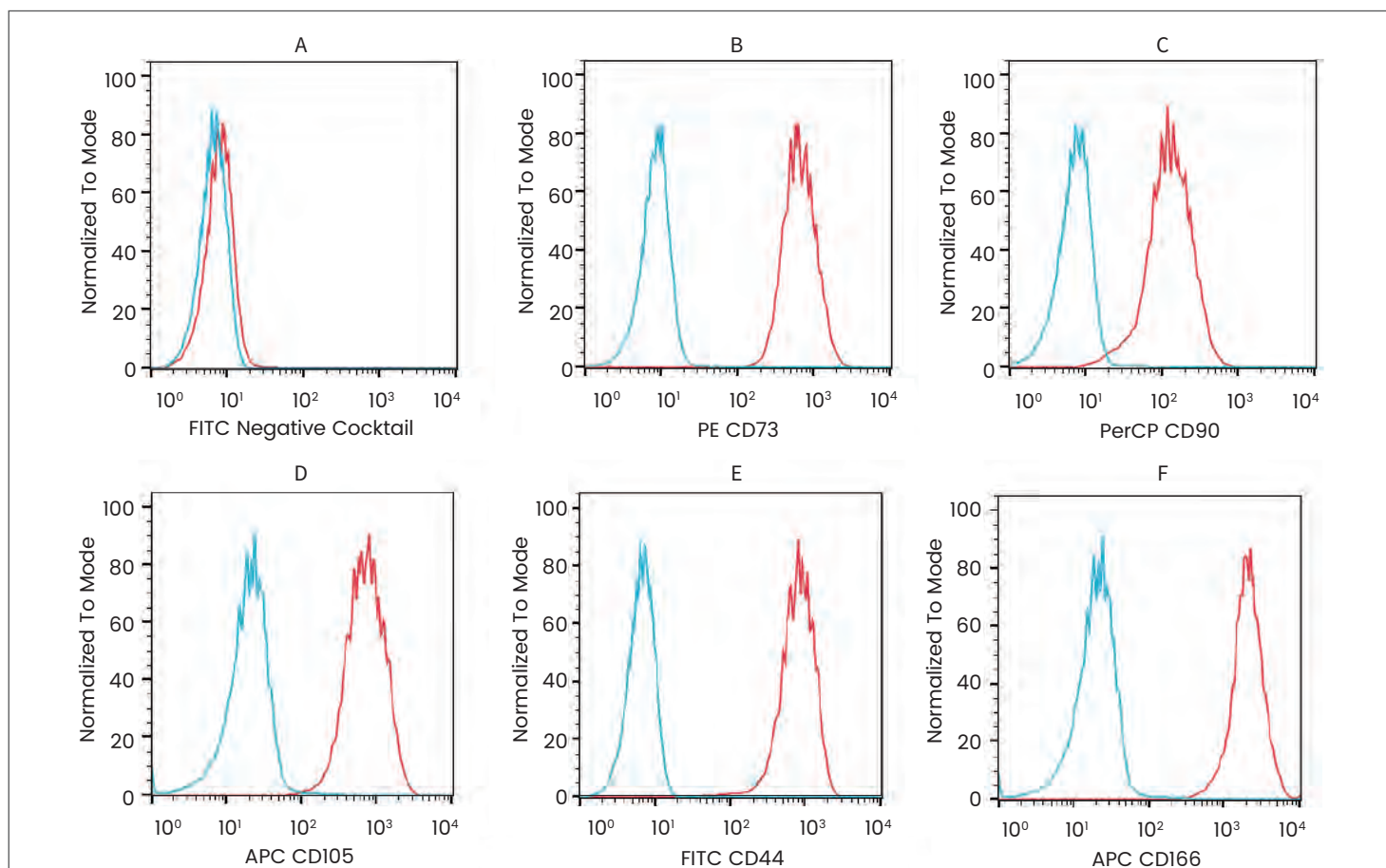
To be classified as MSCs, cells should test positive for CD73, CD90, and CD105, while being negative for CD34, CD45, CD11b or CD14, CD19 or CD79 $\alpha$ , and HLA-DR.

Sino Biological offers a range of high-quality antibodies for MSC surface markers, aiding in the characterization of MSC differentiation and the assessment of cell quality and function. These tools provide comprehensive support for both the identification and research of MSCs.

## Flow Cytometry Antibody Panel for MSC Identification

Target	Type	Cat#	Target	Type	Cat#
CD73	PE	10904-MM07-P	CD45	FITC	10086-MM05-F
CD90	PerCP	16897-MM10-C	CD34	FITC	68035-XM01-F
CD105	APC	10149-MM13-A	CD14	FITC	10073-MM06-F
CD44	FITC	12211-MM02-F	CD19	FITC	11880-MM17-F
CD166	APC	10045-MM03-A	HLA-DR	FITC	68038-XM01-F

## hMSC Surface Marker Profiling via Flow Cytometry



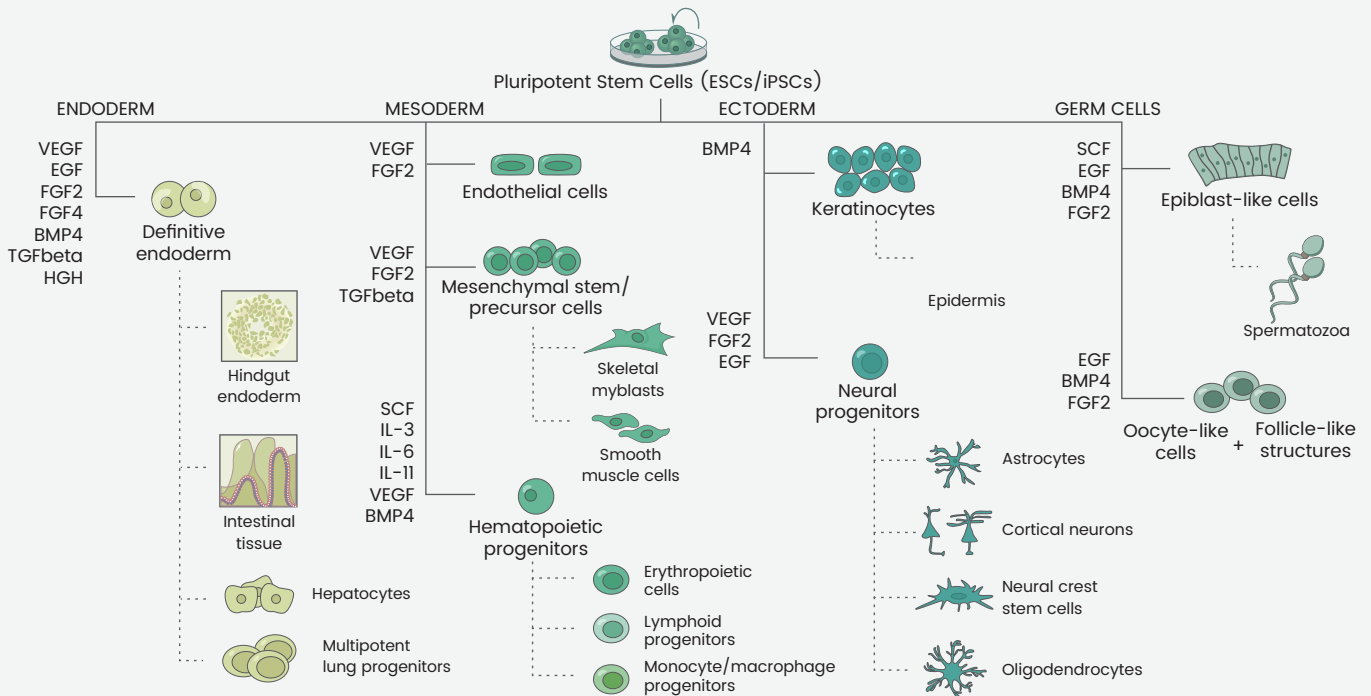
Flow cytometry analysis of hMSCs cultured from an umbilical cord demonstrates the cells' negative expression of CD45, CD34, CD14, CD19, and HLA-DR (figure A), as well as positive expression of CD73 (Figure B), CD90 (Figure C), CD105 (Figure D), CD44 (Figure E), CD166 (Figure F). The blue lines represent cells stained with isotype control antibodies, while red lines indicate cells stained with antibodies specific to each marker. These results confirm the identity of the tested cells as hMSCs.



# ESC/iPSC Culture




Both embryonic stem cells (ESCs) and induced pluripotent stem cells (iPSCs) are pluripotent stem cells with unlimited self-renewal capacity and the potential to differentiate into any cell type.

- ESCs are the most widely recognized type of pluripotent stem cells. However, their derivation from human embryos presents potential ethical issues, limiting their widespread application.
- iPSCs created by reprogramming mature somatic cells, share many properties with ESCs. Their extensive self-renewal and differentiation capabilities make them highly promising for regenerative medicine, disease modeling, drug testing, and innovative cell/gene therapies. Essential for the differentiation of human iPSCs into diverse cell lines are cytokines and growth factors, such as GM-CSF, Activin A, DLL4, NOG, TNF- $\alpha$ , IL-2, VEGF, FGF, IL1 $\beta$ , and EGF.



Schematic overview of cytokines involved in ESC/iPSC differentiation.

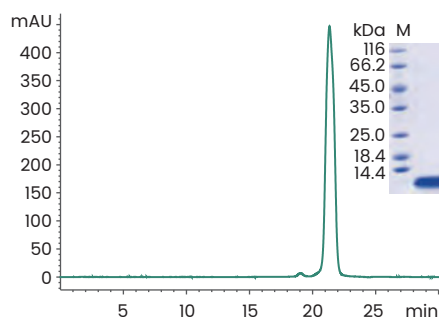
## Featured Cytokines for ESC/iPSC Culture

Cytokines	Cat#	Species	Expression Host	Purity	Endotoxin
Activin A	10429-HNAH	Human, Mouse, Rat, Cynomolgus, Rhesus	HEK293 Cells	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 10 EU/mg
	GMP-10429-HNAH 	Human, Mouse, Rat, Rhesus, Canine	HEK293 Cells	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 10 EU/mg
BMP4	10609-HNAE2	Human	<i>E. coli</i>	≥ 95% SDS-PAGE	< 1 EU/μg
EGF	10605-HNAE	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 5 EU/mg
	GMP-10605-HNAE 	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 5 EU/mg
Noggin	10267-HNAH	Human	HEK293 Cells	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 10 EU/mg
basic FGF/ FGF2	10014-HNAE	Human	<i>E. coli</i>	≥ 95% SDS-PAGE	< 10 EU/mg
	GMP-10014-HNAE 	Human	<i>E. coli</i>	≥ 95% SDS-PAGE	< 10 EU/mg
HGF	10463-HNAS	Human	CHO Stable Cells	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 0.01 EU/μg

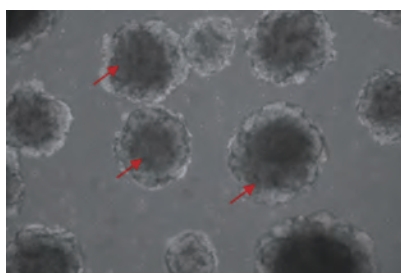
 GMP-Grade Available

## Product Validation Results

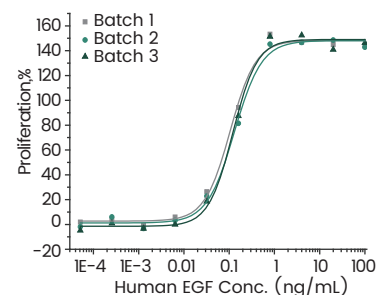
### Human EGF Protein (Cat#: 10605-HNAE)



High-purity: ≥ 95% as determined by SDS-PAGE & SEC-HPLC.

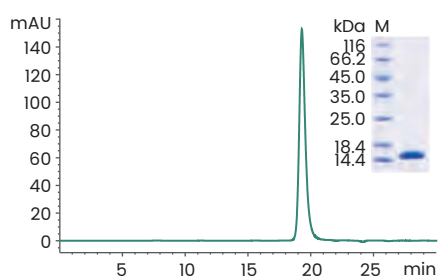


Human vascular organoids derived from iPSCs were cultured using FGF2, VEGFA, and EGF. The vascular organoids are indicated by red arrows.

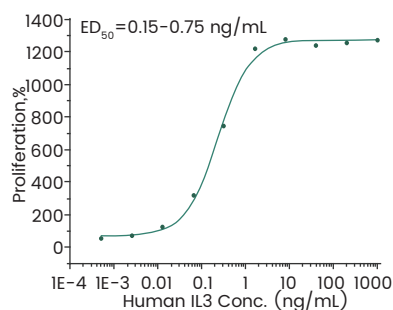


High batch-to-batch consistency: Cell proliferation assay using Balb/C 3T3 mouse embryonic fibroblasts.

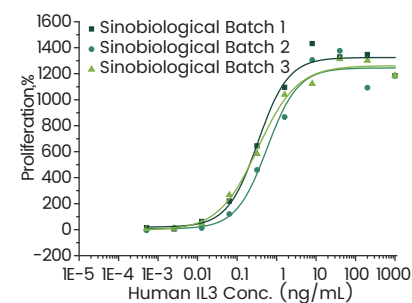
### Human IL3 Protein (Cat#: GMP-11858-HNAE)



High-purity: ≥ 95% as determined by SDS-PAGE & SEC-HPLC.



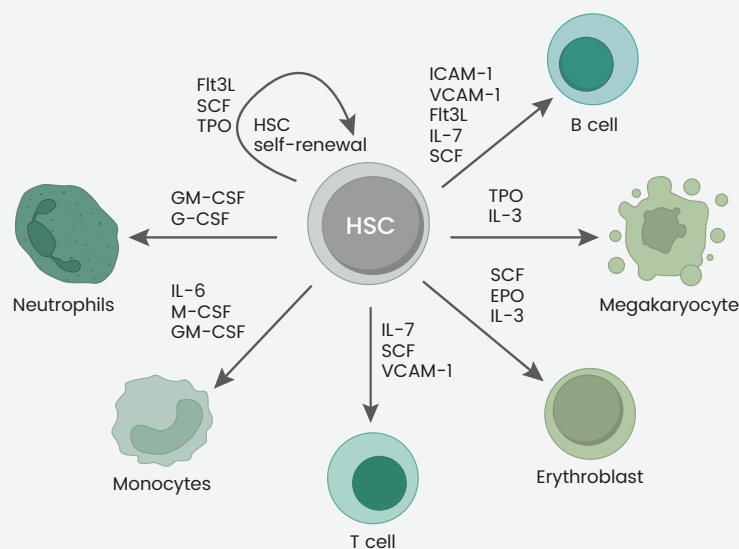
Activity-validated: Cell proliferation assay using TF-1 human erythroleukemic cells



High batch-to-batch consistency: Cell proliferation assay using TF-1 human erythroleukemic cells.

# HSC Culture








HSCs are multipotent stem cells that can self-renew and differentiate multidirectionally into various types of blood cells, including both myeloid and lymphoid lineages. This differentiation is crucial for maintaining the dynamic balance of the hematopoietic system. HSCs are found in various organs, such as peripheral blood, bone marrow, and umbilical cord blood. HSCs can replace abnormal hematopoietic and immune tissues, offering significant potential for the treatment of diseases such as hematological malignancies and certain liver disorders.



Schematic overview of cytokines involved in HSC differentiation.

## Featured Cytokines for HSC Culture

Sino Biological offers cytokines for HSC culture, including GMP-grade options, to comprehensively support HSC research.

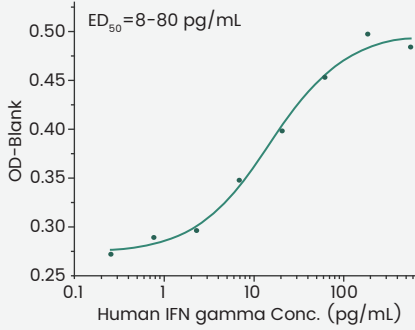
Cytokines	Cat#	Species	Expression Host	Purity	Endotoxin
Flt3 Ligand/FLT3LG	10315-HNAE	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 10 EU/mg
	GMP-10315-HNAE1-L-AF  	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 10 EU/mg
GM-CSF/CSF2	10015-HNAH	Human	HEK293 Cells	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 10 EU/mg
	GMP-10015-HNAH 	Human	HEK293 Cells	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 5 EU/mg
IL-6	10395-HNAE	Human	<i>E. coli</i>	≥ 95% SDS-PAGE	< 10 EU/mg
	GMP-10395-HNAE 	Human	<i>E. coli</i>	≥ 95% SDS-PAGE	< 5 EU/mg
IL-21	10584-HNAE	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 5 EU/mg
	GMP-10584-HNAE 	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 5 EU/mg
	GMP-10584-HNAE1-L-AF  	Human	<i>E. coli</i>	≥ 95% SDS-PAGE ≥ 95% SEC-HPLC	< 10 EU/mg

 GMP-Grade Available

 Animal-Free

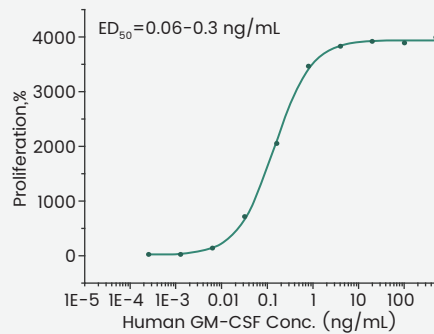
# Product Validation Results

GMP-grade Human IFN gamma  
(Cat#: GMP-11725-HNAE) ★



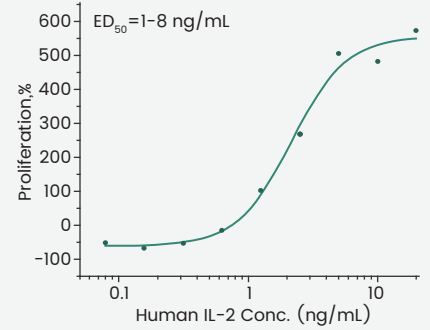
Measured in anti-viral assays using WISH cells infected with vesicular stomatitis virus (VSV).

GMP-grade Human GM-CSF/CSF2  
(Cat#: GMP-10015-HNAH) ★



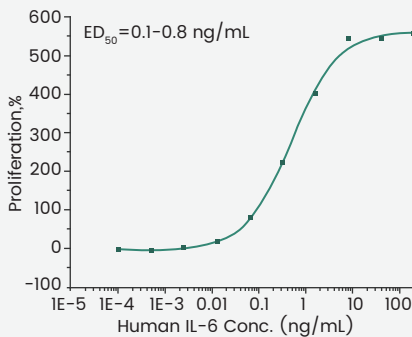
Measured in a cell proliferation assay using TF-1 human erythroleukemic cells.

GMP-grade Human IL-2  
(Cat#: GMP-11848-HNAE) ★

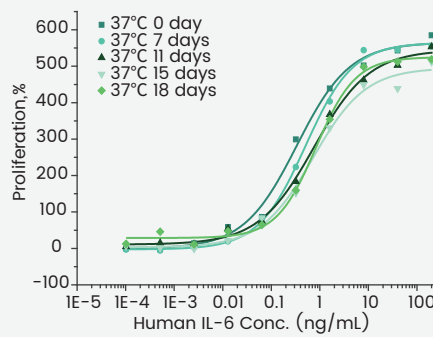


Measured in a cell proliferation assay using CTLL2.

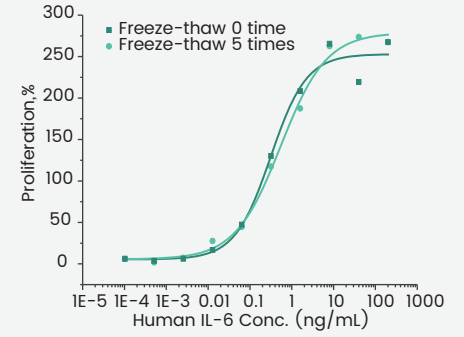
GMP-grade Human IL-6  
(Cat#: GMP-10395-HNAE) ★



Measured in a cell proliferation assay using TF-1 human erythroleukemic cells.

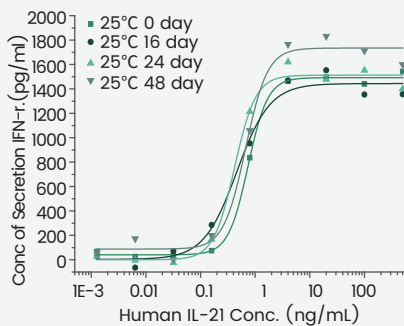


Five tests were conducted at different times to verify GMP-grade human IL-6 stability.

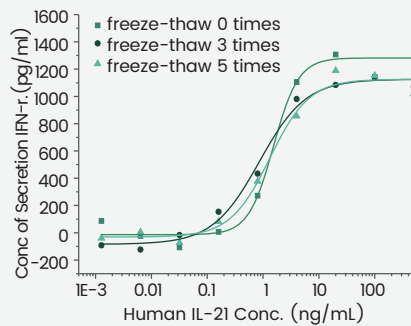


Five cycles of freeze-thaw tests were conducted to verify GMP-grade human IL-6 stability.

GMP-grade Human IL-21  
(Cat#: GMP-10584-HNAE) ★

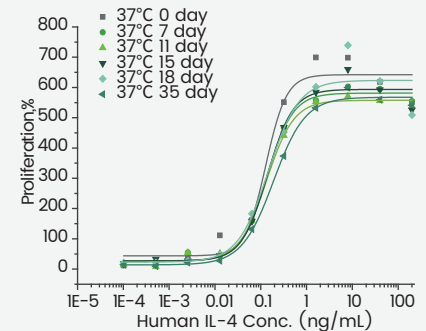


Four tests were conducted at different times to verify GMP-grade human IL-21 stability.



Three and five cycles of freeze-thaw tests were conducted to verify GMP-grade human IL-21 stability.

GMP-grade Human IL-4  
(Cat#: GMP-11846-HNAE) ★

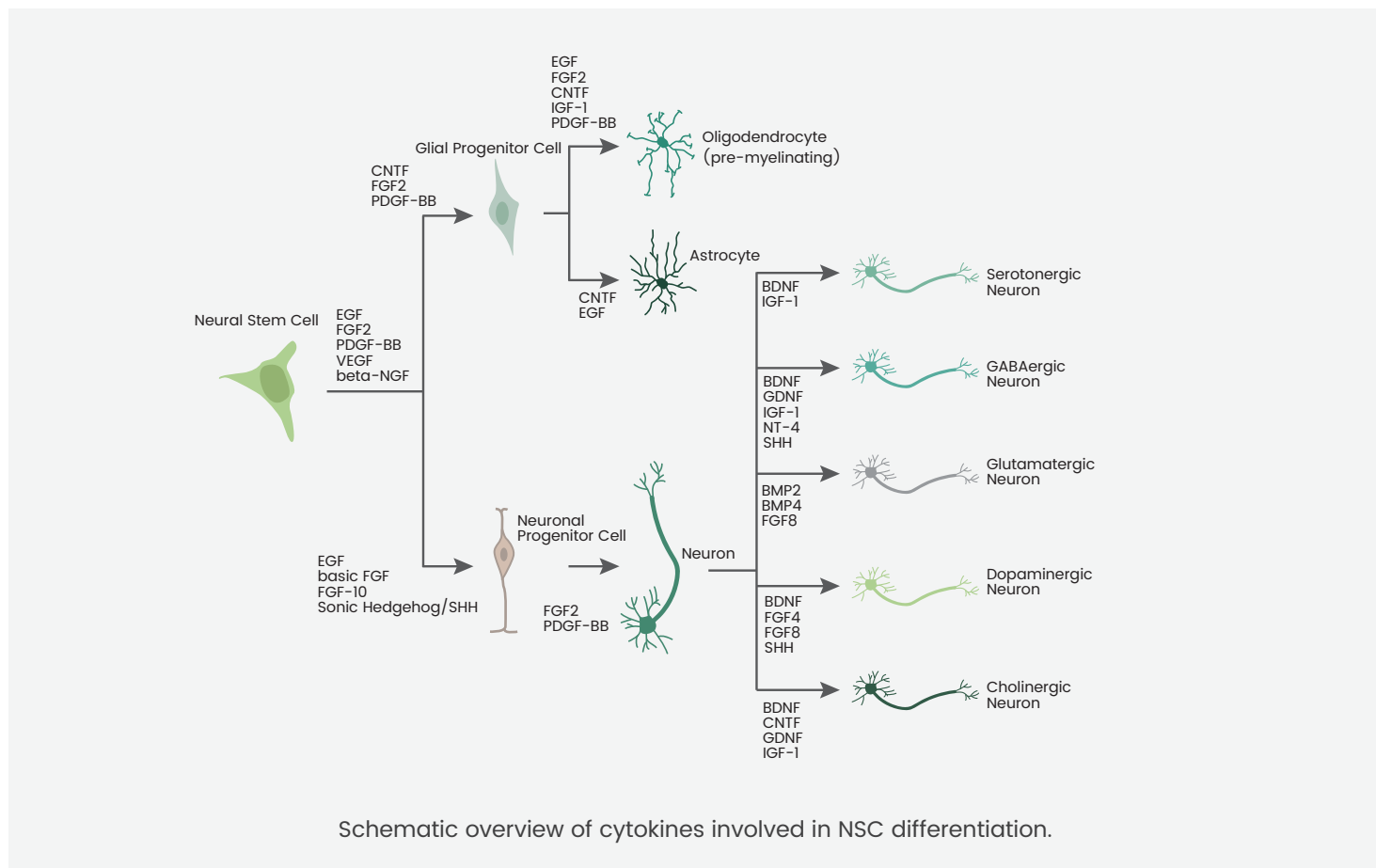


Six tests were conducted at different times to verify GMP-grade human IL-4 stability.



★ GMP-Grade Available

# NSC Culture

Neural stem cells (NSCs) reside within the nervous system and are capable of self-renewal and differentiation into neurons, astrocytes, and oligodendrocytes. Under specific conditions, NSCs differentiate into these functional cells, replenishing lost cells and restoring function. This ability is crucial for neural development and the repair of damaged neural tissues.



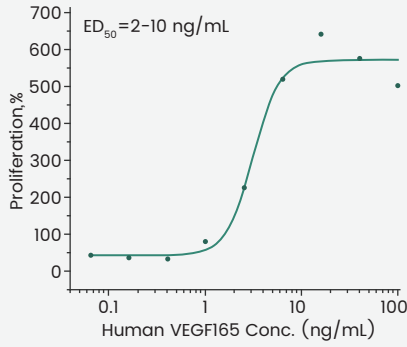
## Featured Cytokines for NSC Culture

Cytokines	Cat#	Species	Expression Host	Purity	Endotoxin
BDNF	50240-M08H	Mouse	HEK293 Cells	> 95% SDS-PAGE	< 1 EU/ $\mu$ g
BMP-2	10426-HNAE1	Human, Mouse, Rat, Rhesus, Canine	<i>E. coli</i>	$\geq$ 95% SDS-PAGE	< 10 EU/mg
EGF	10605-HNAE	Human	<i>E. coli</i>	$\geq$ 95% SDS-PAGE $\geq$ 95% SEC-HPLC	< 5 EU/mg
	GMP-10605-HNAE 	Human	<i>E. coli</i>	$\geq$ 95% SDS-PAGE $\geq$ 95% SEC-HPLC	< 5 EU/mg
basic FGF/FGF2	10014-HNAE	Human	<i>E. coli</i>	$\geq$ 95% SDS-PAGE	< 10 EU/mg
	GMP-10014-HNAE 	Human	<i>E. coli</i>	$\geq$ 95% SDS-PAGE	< 10 EU/mg
Sonic Hedgehog/SHH	10372-H08HI	Human	HEK293 Cells	> 95% SDS-PAGE	< 1 EU/ $\mu$ g

 GMP-Grade Available

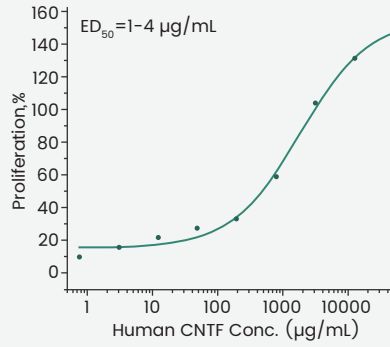
# Product Validation Results

**Human VEGF165 Protein**  
(Cat#: 11066-HNAH)



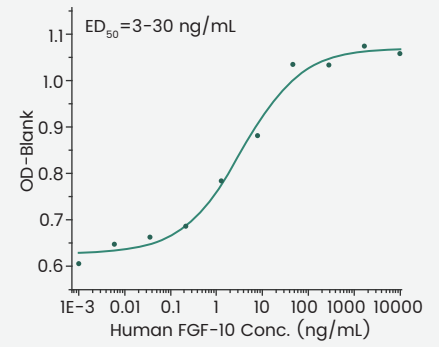
Measured in a cell proliferation assay using human umbilical vein endothelial cells (HUVEC).

**Human CNTF Protein**  
(Cat#: 11841-H07E)



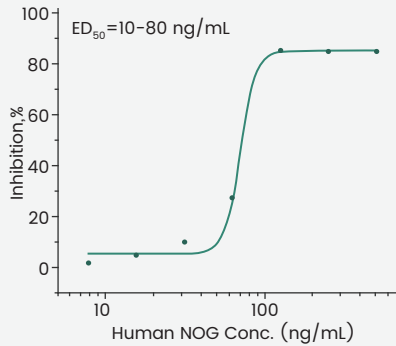
Measured in a cell proliferation assay using TF-1 human erythroleukemic cells.

**Human FGF-10 Protein**  
(Cat#: 10573-HNAE)



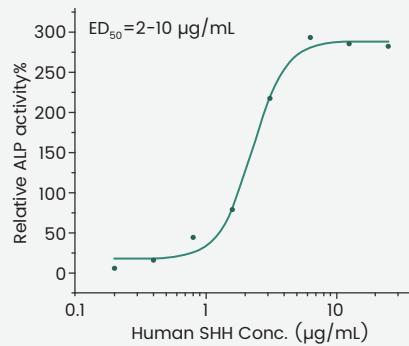
Measured in a cell proliferation assay using BaF3 mouse pro-B cells transfected with human FGFR2b.

**Human Noggin/NOG Protein**  
(Cat#: 10267-HNAH)



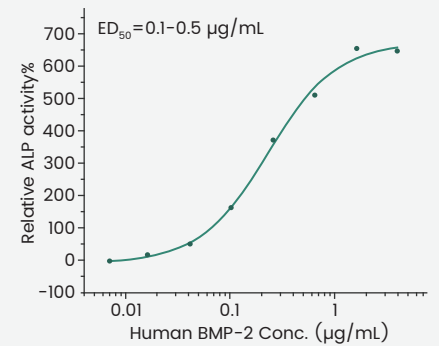
Measured by its ability to inhibit BMP4-induced alkaline phosphatase production by MC3T3E1 mouse preosteoblast cells.

**Human Sonic Hedgehog/SHH Protein**  
(Cat#: 10372-H08HI)



Measured by its ability to induce alkaline phosphatase production by C3H10T1/2 mouse embryonic fibroblast cells.

**Human, Mouse, Rat, Rhesus, Canine BMP-2 Protein**  
(Cat#: 10426-HNAE1)



Measured by its ability to induce alkaline phosphatase production by MC3T3-E1 mouse osteoblastic cells.





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