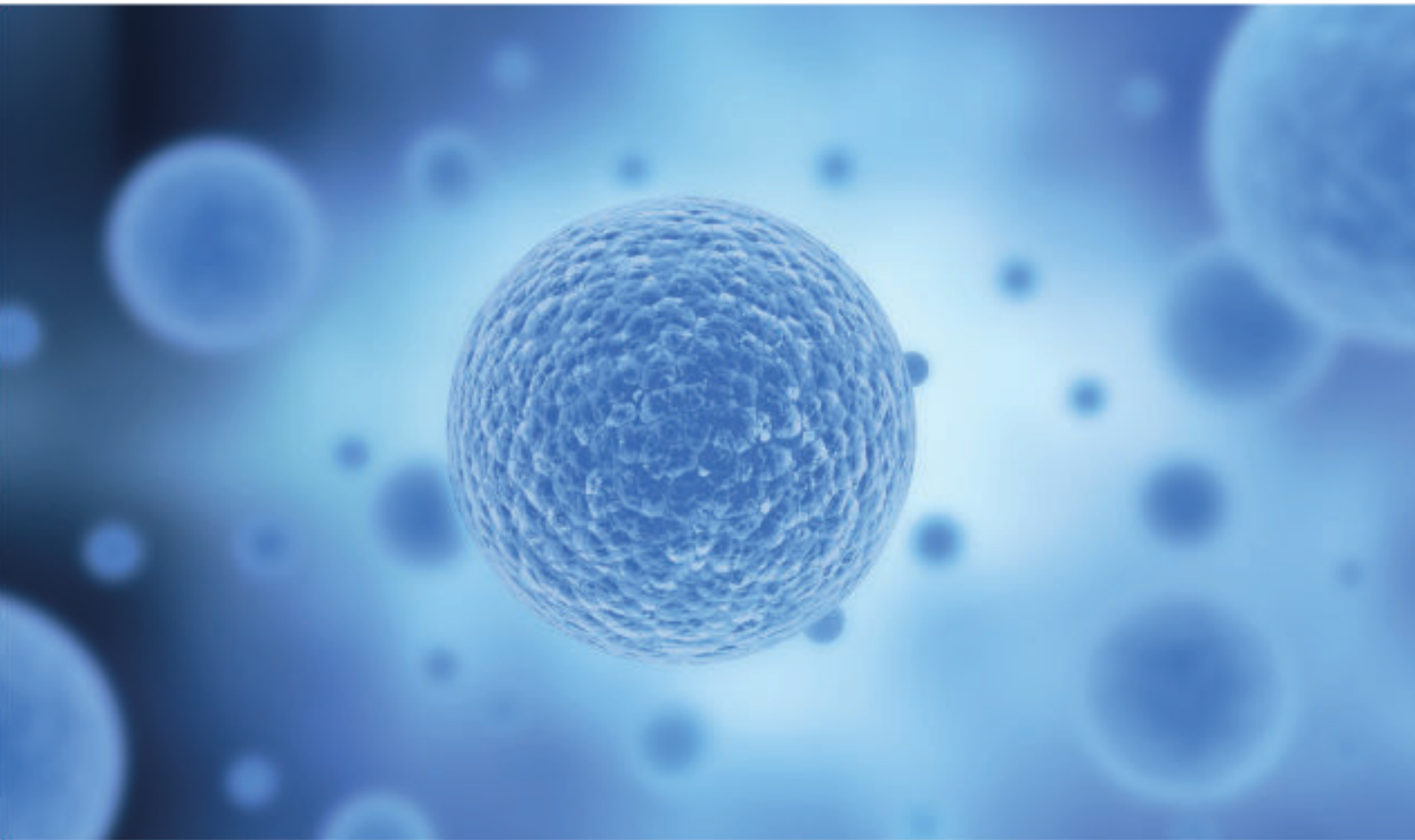


# HUMANKINE ACTIVE CYTOKINES & GROWTH FACTORS





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# FOR HUMANS, BY HUMAN CELLS:

## Why Human Cell Expressed Proteins are Superior.

Breakthroughs in molecular biology to write, edit, and erase DNA in the 20th century created new possibilities for medicine. A successful realization of this potential is the use of a tractable living system to make an active human protein. A notable early example is the use of *E. coli* by Genentech to make recombinant insulin (1). As biology and medicine have changed, so too have the needs of recombinant proteins. For activity, many proteins require glycosylation and processing only available in eukaryotic systems. This need led to the development of insect and Chinese hamster ovary (CHO) cells as recombinant protein producers. As

science and medicine have progressed, these systems are struggling to satisfy the growing number of needs. For example, human stem cell technology and CAR-T cell therapy require culture media whose components must be animal-component and xenobiotic free yet retain high activity and scalability. For human applications and research, a human cell expression system is ideal. All our Humankine products are made using HEK293 cells and are perfect for the new needs of medicine. Here is why Humankine products are a cut above the rest:

- **Animal-component and xenobiotic free** – Products from or by an animal are not used at any point during production.
- **Native folding and maturation** – Though CHO and insect cells are eukaryotic, their ability to process human proteins does not match human cell in many cases. For example, *Figure 1* shows that human cells generate more mature Activin A dimers than CHO cells.
- **Native human glycosylation** – Glycosylation is crucial to stability and activity. CHO and insect cells have vastly different machinery for this process, producing glycosylated species that can be very different from humans. *Figure 2* provides an example where glycosylation differs between expression systems.
- **High stability** – Due to native glycosylation and maturation, human cell expressed proteins can outperform other systems in stability. *Figure 3* shows how Humankine FGF has greater stability in culture than an *E. coli*-derived FGF.
- **High activity** – The above features synergize to create proteins that tend to have higher activity than those produced in other expression systems. *Figure 4* compares activity for multiple cytokines between eukaryotic systems.

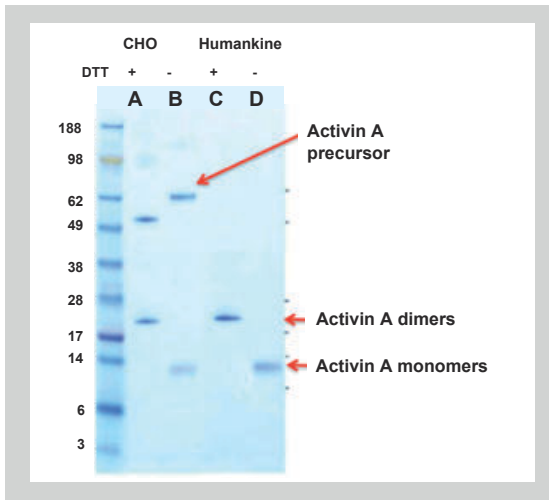


Figure 1 – SDS-PAGE gel with Coomassie blue staining of purified activin A from CHO cell and Humankine systems, demonstrating the formation of mature Activin A dimers.

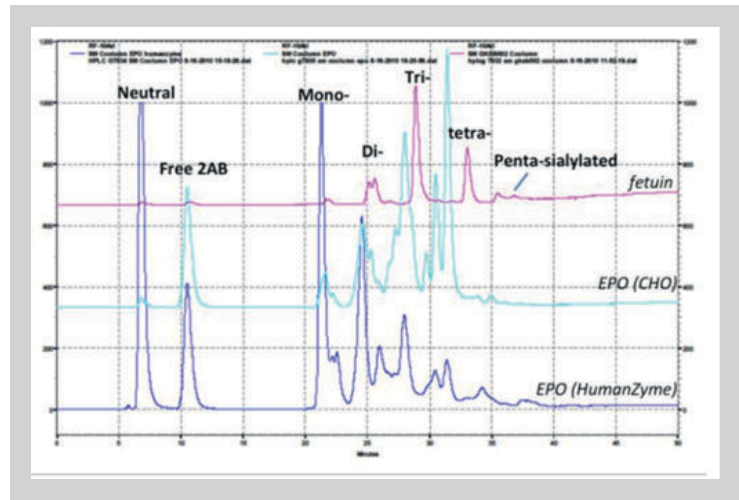


Figure 2 – HPLC comparison of glycosylation of human cell expressed (Humanzyme) and CHO EPO, demonstrating significant differences in glycan composition. Fetuin was used as a positive control.

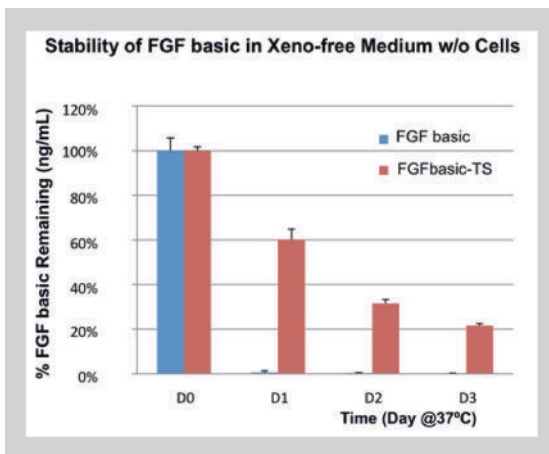


Figure 3 – Comparison of stability of Humankine (FGFbasic-TS, red) and *E. coli*-derived (FGFbasic, blue) FGF incubated in cell culture at 37°C without cells.

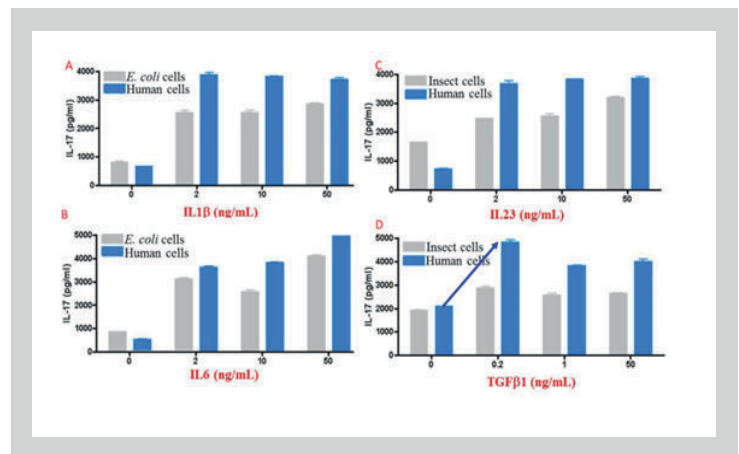


Figure 4 – Comparison of activity of insect, human, and *E. coli* cell expressed cytokines (A, IL1B, B, IL6, C, IL23, D, TGFβ1), determined by Th17 differentiation of human CDE4+ cells.

## References:

1. First Successful Laboratory Production of Human Insulin Announced. - Genentech, 1978.

# HUMANKINE® ACTIVE CYTOKINES AND GROWTH FACTORS 50+ AVAILABLE.

View full range on [ptglab.com](http://ptglab.com)

Humankine® product line  
**HUMANZYME**  
 Now part of Proteintech

## PRODUCT FOCUS

# RECOMBINANT HUMAN PROTEIN ACTIVIN A:

## An Alpha in the TGF Beta Family

Humankine®  
Activin A

Catalog Number:  
**HZ-1138**

Product Name:  
**Activin A**

ED50:  
**≤5 ng/mL**

Purity:  
**>95%**

13 Citations

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

One of the defining characteristics of life is the ability to reproduce. In humans, a major player in setting up and maintaining reproductive machinery is activin A. It is a heterodimeric protein that is a member of the TGF Beta family (Figure 1). Activin A acts in paracrine and autocrine mechanisms, binding to its cognate receptor and exerting downstream to its

cognate receptor and exerting downstream effects through the SMAD pathway (Figure 2). Besides reproduction, activin A has been implicated in the regulation of islets and the immune response. For regenerative medicine, it is used to help maintain stem cell pluripotency and self-renewal *in vitro* (1, 2).

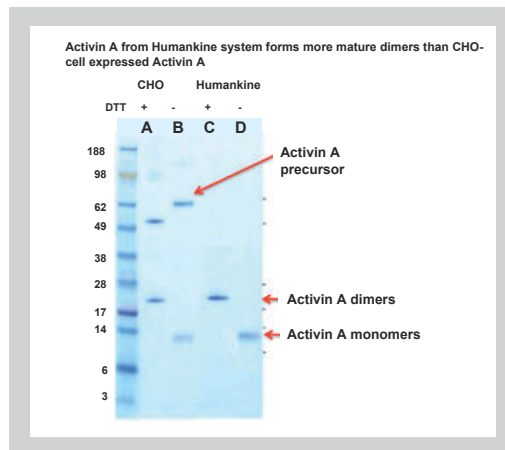


Figure 1. SDS-PAGE gel with Coomassie blue staining of purified activin A from CHO cell and Humankine® systems, demonstrating the formation of mature activin A dimers.

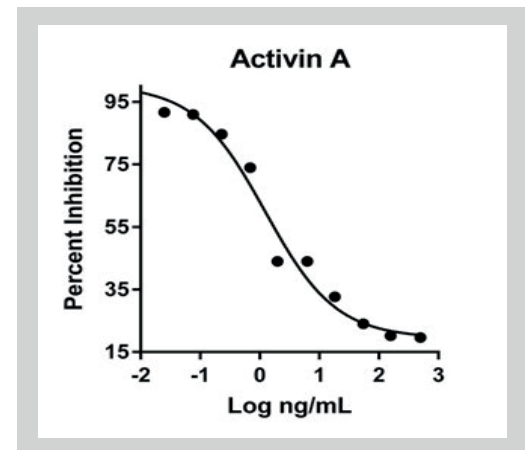


Figure 2. The activity of Humankine® Activin A was determined by the dose-dependent inhibition of the proliferation of the MPC11 cell line (mouse plasmacytoma cell line) using Promega.

## Animal-free recombinant proteins:

Humankine products are created in HEK293 cells using animal-free components. Our human expression system ensures that proteins have native conformation and post-translational modifications to optimize biological activity.

- ✓ Expressed in human cells
- ✓ Carrier Free (CF)
- ✓ Endotoxin free
- ✓ Native confirmation and glycosylation

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

# FROM OUR BENCH TO YOUR BENCH™

Founded by scientists in 2001, Proteintech manufactures and validates everything in-house, allowing it to maintain complete control over the quality of its products.

- ✓ Polyclonal antibodies against 12,000 targets
- ✓ Mouse monoclonal antibodies
- ✓ Tag/control antibodies
- ✓ ELISA kits
- ✓ Fusion proteins
- ✓ Secondary antibodies
- ✓ Animal-free recombinant proteins

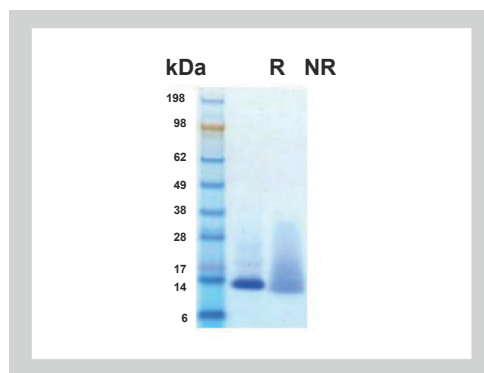
## BETA NGF

Catalog Number:  
**HZ-1222**

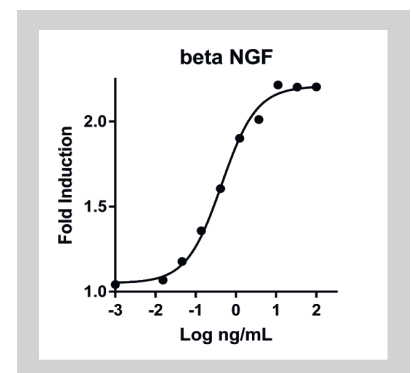
ED50:  
**≤4 ng/mL**

Molecular Weight:  
**13 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose dependent stimulation of the proliferation of human TF-1 cells (human erythroleukemic indicator cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Beta nerve growth factor (NGF) is critical for the survival and maintenance of sympathetic and sensory neurons and may play an important role in the regulation of the immune system (PMID: 16842161). The presence of beta NGF in immune cells, endocrine cells, and the CNS limbic areas suggests that beta NGF may function as an intracellular messenger to regulate the body's response to stress (PMID: 19442684). Xeno-free Recombinant Human beta NGF is expressed in human 293 cells as a non-disulfide bonded homodimeric protein with an apparent molecular mass of 13 kDa. This product is produced in a human cell expression system with serum-free, chemically defined media.

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## BMP-2

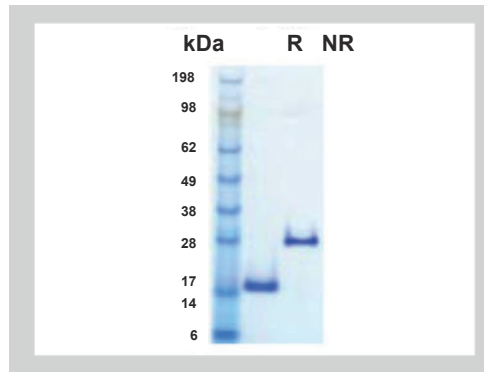
Catalog Number:  
**HZ-1128**

ED50:  
≤60 ng/mL

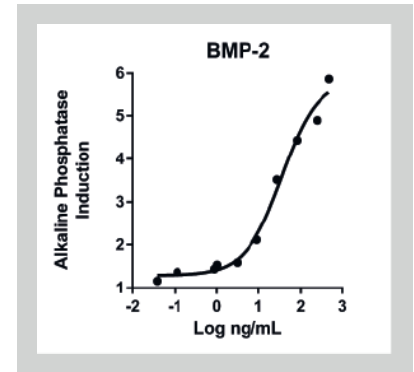
Molecular Weight:  
**28 kDa**

Purity:  
>95%

17 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent induction of alkaline phosphatase production in the ATDC-5 cell line (Mouse chondrogenic cell line) using pNPP as a chromogenic substrate.

### Product Background:

Bone morphogenetic protein-2 (BMP-2) is a member of the transforming growth factor beta (TGFB) superfamily. BMP-2 induces bone formation and regeneration during early embryonic development (PMID 16234975). It is involved in the hedgehog pathway, TGF beta signaling pathway, and cytokine-cytokine receptor interaction (PMID 26620161). Xeno-free Recombinant Human BMP-2 is expressed from human 293 cells as a disulfide-linked homodimeric glycoprotein with an apparent molecular mass of 28 kDa.

## BMP-4

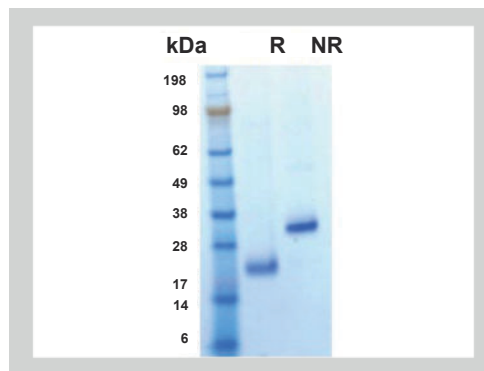
Catalog Number:  
**HZ-1045**

ED50:  
≤20 ng/mL

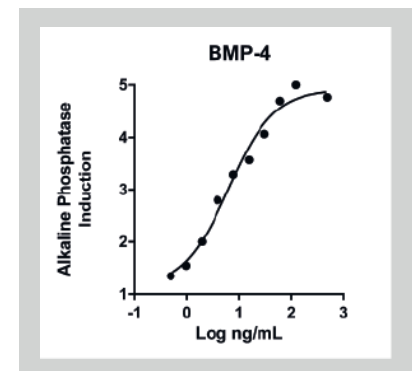
Molecular Weight:  
**34 kDa**

Purity:  
>95%

30 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent induction of alkaline phosphatase production in the ATDC-5 cell line (Mouse chondrogenic cell line) using pNPP as a chromogenic substrate.

### Product Background:

Bone morphogenetic protein-4 (BMP-4), also known as BMP2B and DVR4, belongs to the TGF-beta family. BMPs have been shown to promote astroglial differentiation both in vitro and in vivo. BMP-4 can also induce cartilage and bone formation (PMID 16234975). Xeno-free Recombinant Human BMP-4 is expressed in human 293 cells as a disulfide-linked homodimeric glycoprotein with an apparent molecular mass of 34 kDa.



✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## BMP-7

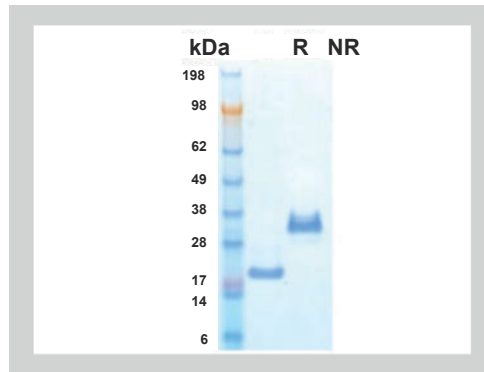
Catalog Number:  
HZ-1229

ED50:  
≤100 ng/mL

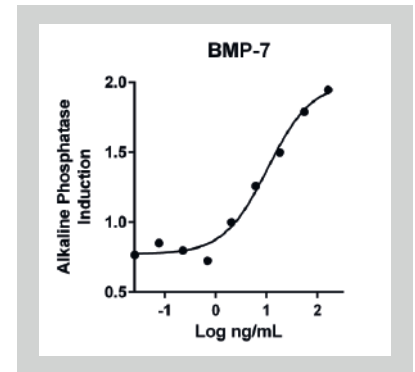
Molecular Weight:  
29 kDa

Purity:  
>95%

6 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent induction of alkaline phosphatase production in the ATDC-5 cell line (Mouse chondrogenic cell line) using pNPP as a chromogenic substrate.

### Product Background:

Bone morphogenetic protein-7 (BMP-7), also known as osteogenic protein-1 or OP-1, plays a key role in the differentiation of mesenchymal cells into bone and cartilage. BMP-7 may be involved in bone homeostasis (PMID: 15621726). It is expressed in the brain, kidneys, and bladder. BMP-7 is also present in several cancers, including breast, prostate, and colon cancers (PMID: 16419056, PMID: 15531927). Overexpression of BMP-7 mRNA in colorectal cancer patients is significantly associated with poor prognosis and low overall survival (PMID: 18259822). Recent studies suggest a high expression level of BMP-7 serves as a biomarker for poor prognosis for HCC (PMID: 23179403).

## CYSTATIN C

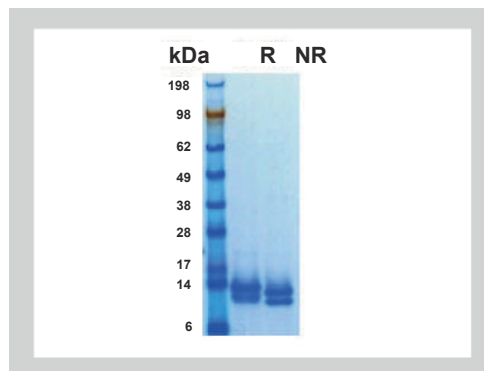
Catalog Number:  
HZ-1211

ED50:  
≤5 μM IC50

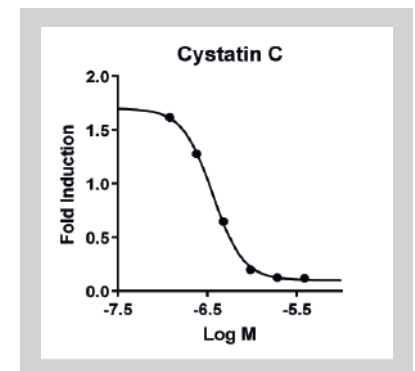
Molecular Weight:  
12 to 13 kDa

Purity:  
>95%

1 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of human TF-1 cells (human erythroleukemic indicator cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Cystatin C is a 13-kDa protein that is expressed globally in the body. In healthy individuals, glomerular filtration in the kidney maintains it at a safe level. When kidney function is impaired, Cystatin C levels rise quickly. This makes it an early and sensitive biomarker of renal dysfunction (PMID: 24848523). A mutation in Cystatin C has been associated with amyloid angiopathy (PMID: 11409420). Expression of this protein in vascular wall smooth muscle cells is severely reduced in both atherosclerotic and aneurysmal aortic lesions, establishing its role in vascular disease. In addition, this protein has been shown to have an antimicrobial function, inhibiting the replication of the herpes simplex virus.

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## EPO

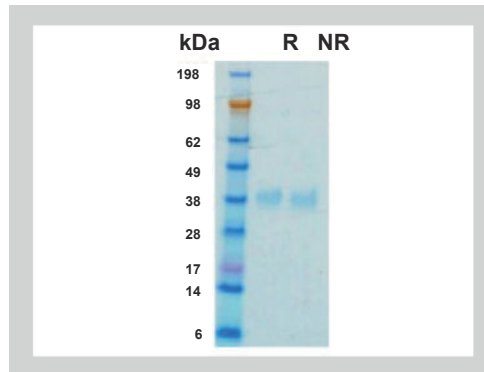
Catalog Number:  
**HZ-1168**

ED50:  
**≤2.5 ng/mL**

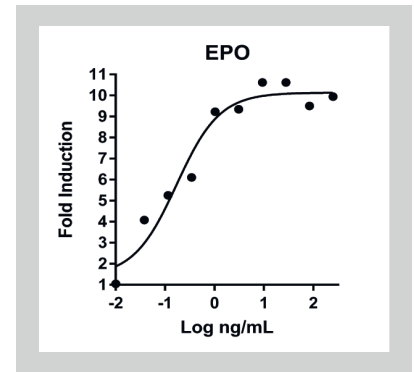
Molecular Weight:  
**36 kDa**

Purity:  
**>95%**

**2 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of human TF-1 cells (human erythroleukemic indicator cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Erythropoietin (Epo) is a member of the EPO/TPO family. It is a secreted, glycosylated cytokine composed of four alpha helical bundles. Epo is found in the plasma and regulates erythrocyte production by promoting erythroid differentiation and initiating hemoglobin synthesis through activation of its cognate receptor (PMID: 29458727). Epo also has neuroprotective activity against a variety of potential brain injuries and anti-apoptotic functions in several tissue types (PMID: 11854521).

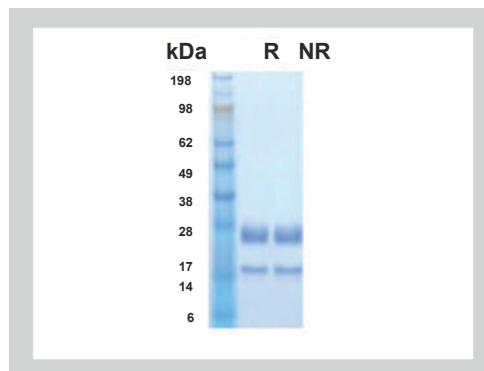
## FGF-4

Catalog Number:  
**HZ-1218**

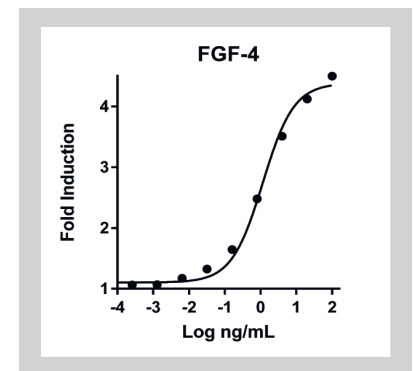
ED50:  
**≤1.25 ng/mL**

Molecular Weight:  
**17 and 27 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of the Balb/3T3 cell line using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Fibroblast growth factor-4 (FGF-4) plays an important physiologically role in the self-renewal of human embryonic stem cells (PMID: 21990129). It also promotes stem cell proliferation and may aid in differentiation. Xeno-free Recombinant Human FGF-4 is expressed in human 293 cells as a monomeric glycoprotein with an apparent molecular mass of 17 and 27 kDa.

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

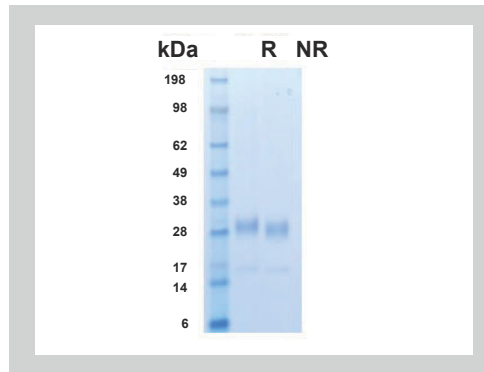
## FGF-7 (KGF)

Catalog Number:  
**HZ-1100**

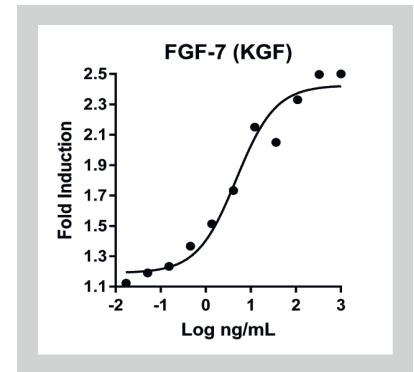
ED50:  
≤7.5 ng/mL

Molecular Weight:  
17 and 30 kDa

Purity:  
>95%



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of 4MBr-5 cells (monkey epithelial cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Fibroblast growth factor 7 (FGF-7), also known as keratinocyte growth factor (KGF), belongs to the FGF family. FGF family members possess broad mitogenic and cell survival activities, and are involved in a variety of biological processes, including embryonic development, cell growth, morphogenesis, tissue repair, tumor growth, and invasion (PMID: 11276432, 15863033). FGF-7 is a potent epithelial cell-specific growth factor, whose mitogenic activity is predominantly exhibited in keratinocytes (PMID: 15327889).

## FGF-8B

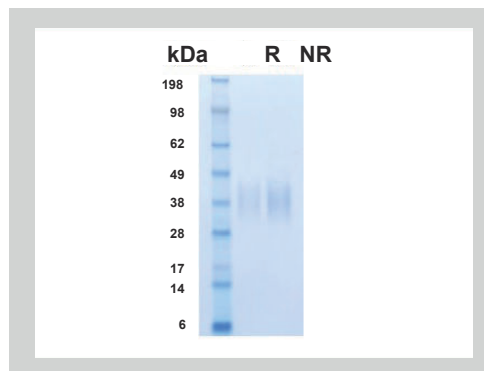
Catalog Number:  
**HZ-1103**

ED50:  
≤60 ng/mL

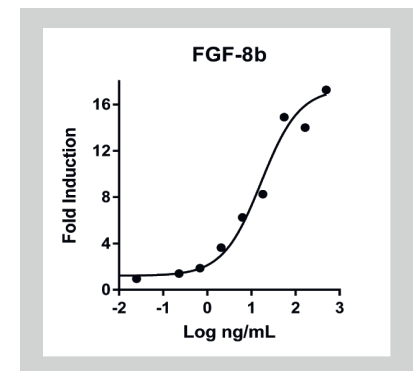
Molecular Weight:  
30 to 45 kDa

Purity:  
>95%

**1 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of the Balb/3T3 cell line using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Fibroblast growth factor 8 (FGF8), also known as AIGF and HBGF-8, belongs to the FGF family. FGF family members possess broad mitogenic and cell survival activities and are involved in a variety of biological processes, including embryonic development, cell growth, morphogenesis, tissue repair, tumor growth, and invasion (PMID: 11276432; 15863033). FGF8 stimulates growth in an autocrine manner in normal individuals but mediates hormonal action during tumorigenesis (PMID: 17512240). Defects in FGF8 cause Kallmann syndrome type 6 (KAL6) and idiopathic hypogonadotropic hypogonadism (IHH) (PMID: 18596921).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## FGF BASIC-TS

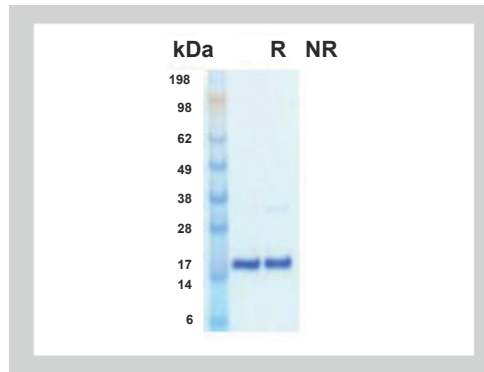
Catalog Number:  
**HZ-1285**

ED50:  
**≤0.5 ng/mL**

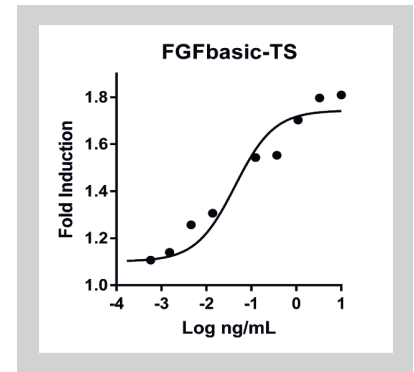
Molecular Weight:  
**17 kDa**

Purity:  
**>95%**

1 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of the Balb/c 3T3 cell line.

### Product Background:

Basic fibroblast growth factor (FGF-basic), also known as bFGF, FGF2, FGF- $\beta$  or HBGF-2, belongs to the FGF family. FGF-basic is involved in a number of biological processes including embryonic development and differentiation, neuron differentiation, survival, and regeneration, and the proliferation of cells of mesodermal origin and many cells of neuroectodermal, ectodermal, and endodermal origin (PMID: 3272178, 3316527). FGF-basic is critical for human embryonic stem cells to remain in an undifferentiated state during cell culture (PMID: 15782187).

## FLT3 LIGAND

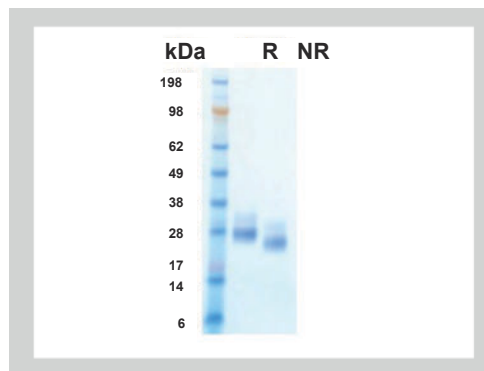
Catalog Number:  
**HZ-1151**

ED50:  
**≤0.8 ng/mL**

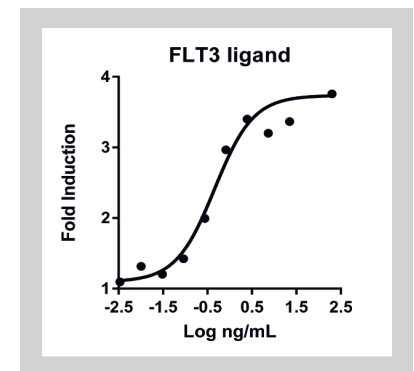
Molecular Weight:  
**24 to 30 kDa**

Purity:  
**>95%**

7 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of the human acute myeloid leukemia cell line OCI-AML5 using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

FMS-related tyrosine kinase 3 ligand (FLT3 Ligand) is a growth factor that regulates proliferation of early hematopoietic cells. FLT3 Ligand binds to cells expressing the tyrosine kinase receptor FLT3. FLT3 Ligand by itself does not stimulate proliferation of early hematopoietic cells, but synergizes with other CSFs and interleukins to induce growth and differentiation (PMID: 8590775; 7544638; 12176867).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## G-CSF

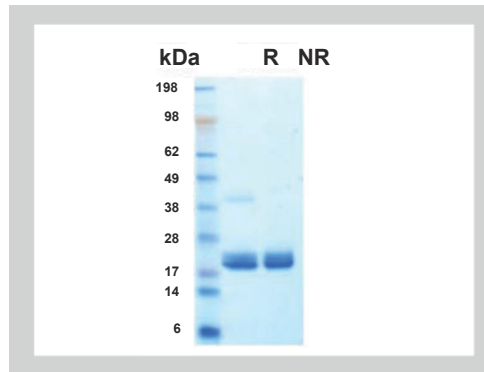
Catalog Number:  
**HZ-1207**

ED50:  
**≤0.1 ng/mL**

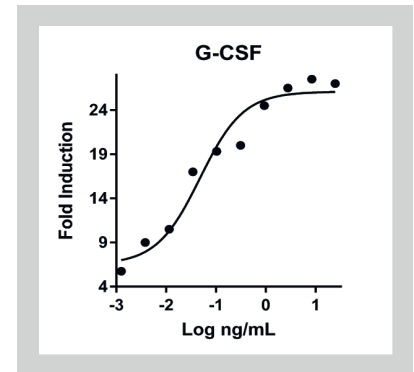
Molecular Weight:  
**21 to 25 kDa**

Purity:  
**>95%**

**4 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of murine M-NFS-60 cells (Mouse Myeloid Leukemia indicator cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Granulocyte colony-stimulating factor (G-CSF), also known as CSF3, is a protective cytokine with anti-inflammatory effects. G-CSF is important in promoting survival of the granulocytic lineage cells and proliferation and migration of neutrophils and trophoblast cells. G-CSF exerts its effects by binding to its receptor G-CSFR, in turn activating the JAK/STAT and Ras/Raf/MAP kinase pathways (PMID: 9015216, 7509213, 9933603). G-CSF potently stimulates the proliferation and release of peripheral blood progenitor cells into the bloodstream and is therefore used to treat neutropenia after chemotherapy (PMID: 7524753, 3264199). Furthermore, G-CSF levels are elevated upon intensive exercise, leading to increased neutrophil counts, which are predominantly due to delayed neutrophil apoptosis (PMID: 18524991).

## GM-CSF

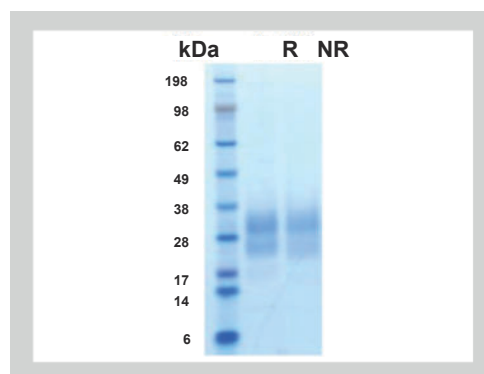
Catalog Number:  
**HZ-1002**

ED50:  
**≤2 ng/mL**

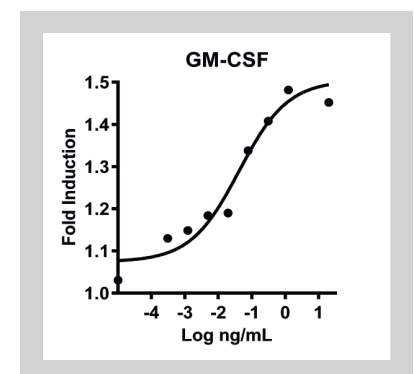
Molecular Weight:  
**15 to 36 kDa**

Purity:  
**>95%**

**8 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of human TF-1 cells (human erythroleukemic indicator cell line) using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Granulocyte-macrophage colony-stimulating factor (GM-CSF), also known as colony-stimulating factor 2 (CSF2), is a monomeric glycoprotein secreted by macrophages, T cells, mast cells, natural killer cells, endothelial cells and fibroblasts. GM-CSF is a hematopoietic growth factor that stimulates the development of early erythroid megakaryocytic and eosinophilic progenitor cells (PMID: 2990035). GM-CSF stimulates stem cells, to produce granulocytes (neutrophils, eosinophils, and basophils) and monocytes (PMID: 3021817, 2984574, 6390681).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## HGF

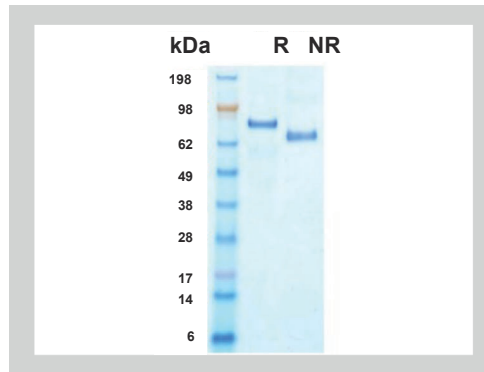
Catalog Number:  
**HZ-1084**

ED50:  
**≤20 ng/mL**

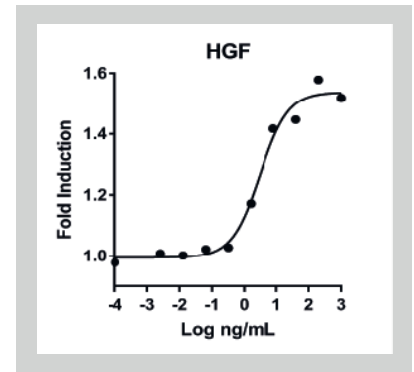
Molecular Weight:  
**70 kDa**

Purity:  
**>95%**

**10 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of the monkey epithelial cell line 4MBr-5 using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Hepatocyte growth factor (HGF) is the most potent mitogen of mature hepatocytes in primary culture. It is secreted by mesenchymal cells and acts as a multifunctional cytokine on cells of mainly epithelial origin (PMID: 1530787, 2531289). HGF exerts a variety of effects on several cells, such as inflammation, tissue repair, morphogenesis, angiogenesis, tumor propagation, immunomodulation of viral infections, and cardio-metabolic activities (PMID: 1846706; 15070743; 1383237; 1827664).

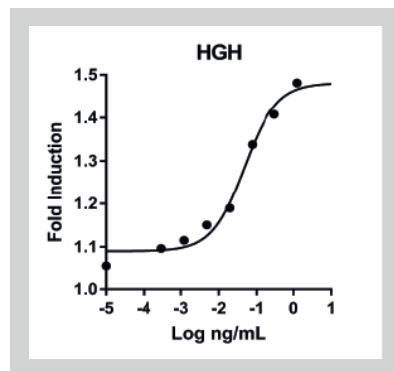
## HGH

Catalog Number:  
**HZ-1007**

ED50:  
**≤2 ng/mL**

Molecular Weight:  
**22 kDa**

Purity:  
**>95%**



The activity was determined by the dose-dependent stimulation of the proliferation of rat lymphoma line Nb2-11 cells (prolactin indicator cell line) using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Human growth hormone (HGH), also known as somatotropin, is an integral mitogen for development. It is synthesized, stored, and secreted by somatotrophic cells within the anterior pituitary gland (PMID: 13975314). HGH stimulates growth, cell reproduction, and cell regeneration in humans and other animals (PMID 7079756). HGH stimulates both the differentiation and proliferation of myoblasts, and also stimulates amino acid uptake and protein synthesis in muscle and other tissues (PMID: 8203982, 16332656).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## HSA

**Catalog Number:**  
**HZ-3001**

**ED50:**  
**N/A**

**Molecular Weight:**  
**60 to 65 kDa**

**Purity:**  
**>95%**

**1 Citations**

### Human serum albumin's importance in Biology and Biotech:

Human serum albumin (HSA) is the most abundant protein in the blood and has many vital biological roles. It is a vehicle for a host of small molecules and proteins, regulates oncotic pressure, performs majority of antioxidation in the body, and more. In medicine, it is used for treatment of hypovolemia, shock, burns, severe blood loss, hemorrhage, and liver disease. In biotech applications, it is used to enhance drug delivery and maintaining cell culture (1).

#### References:

1. Fanali et al. (2008) Human serum albumin: from bench to bedside. *Mol Aspects Med.*
2. Wu et al. (2012) The extremely high level expression of human serum albumin in the milk of transgenic mice. *Transgenic Research.*
3. Moghaddassi et al. (2014) TALEN-Mediated

The demand for HSA exceeds 500 tons (1). At this moment, the majority is collected from humans, but yields are low and there are risks of infectious agent transmission. There have been efforts to create recombinant sources, including mice (2), cows (3), and rice (4). However, international regulations are pushing xenobiotic and animal component free production to ensure safety for human use(1). Besides adhering to these rules, Humankine HSA is scalable for GMP production, making it ideal for industrial applications.

- Modification of the Bovine Genome for Large-Scale Production of Human Serum Albumin. PLoS One.*
4. Zhang et al. (2013) Expression and purification of recombinant human serum albumin from selectively terminable transgenic rice. *J Zhejiang Univ Sci B.*

#### Product Background:

Human serum albumin (HSA) is the most abundant protein in blood plasma and has a vast number of roles including oncotic pressure and detoxification. It has important applications in medicine, including treatment of trauma and blood loss (PMID: 7027277, 2574367).

## IFN ALPHA 2A

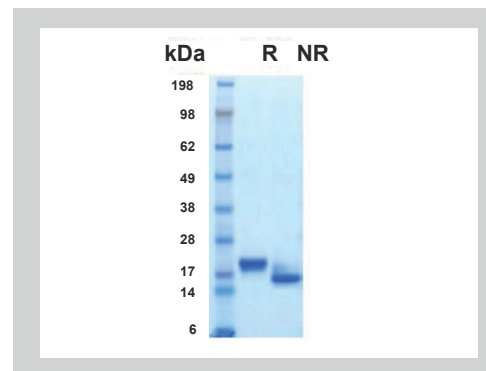
**Catalog Number:**  
**HZ-1066**

**ED50:**  
**≤0.4 ng/mL**

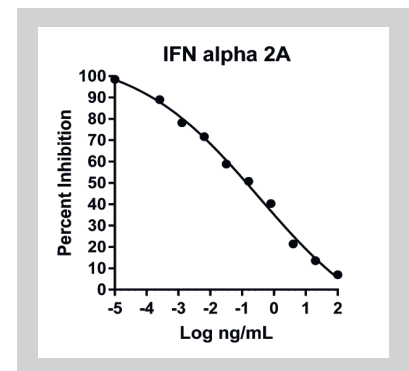
**Molecular Weight:**  
**16 kDa**

**Purity:**  
**>95%**

**3 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent cytotoxicity of the human TF-1 cell line (human erythroleukemic indicator cell line) using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

#### Product Background:

Interferon alpha 2 is a type 1 interferon. Interferon alpha 2 is secreted by virus-infected cells and inhibits other cells from further infection. Recombinant human interferon alpha 2 has been approved for therapeutic application in a range of human oncological and viral diseases. Three Interferon alpha 2 subvariants (2A, 2B, 2C) differ by only one or two amino acids at positions 23 and/or 34 of the mature protein (PMID: 25982860; 10672347; 1694761).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

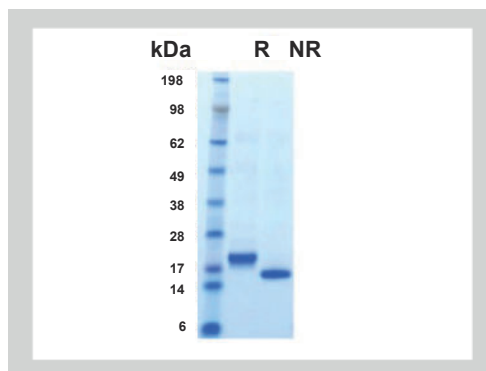
## IFN ALPHA 2B

Catalog Number:  
**HZ-1072**

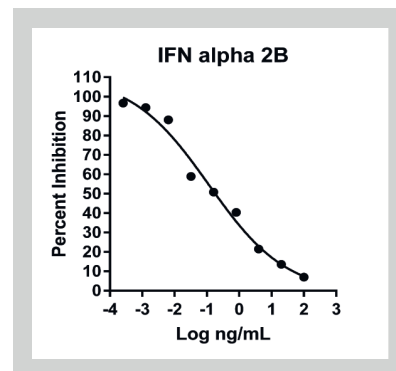
ED50:  
**≤0.12 ng/mL**

Molecular Weight:  
**16 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent cytotoxicity of the human TF-1 cell line (human erythroleukemic indicator cell line) using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Interferon alpha 2 is a type 1 interferon secreted by virus-infected cells to protect surrounding cells from the pathogen. Recombinant human interferon alpha 2 has been approved for therapeutic application in a range of human oncological and viral diseases. Three Interferon alpha 2 subvariants (2A, 2B, 2C) differ by only one or two amino acids at positions 23 and/or 34 of the mature protein (PMID: 25982860; 10672347; 1694761).

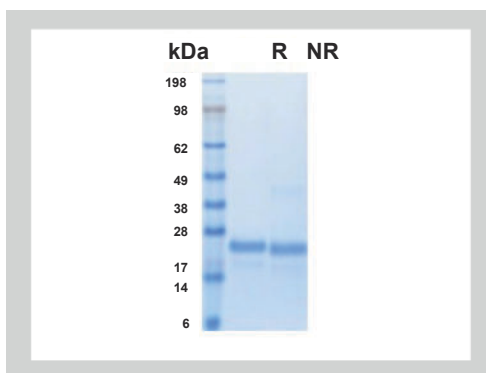
## IFN BETA

Catalog Number:  
**HZ-1298**

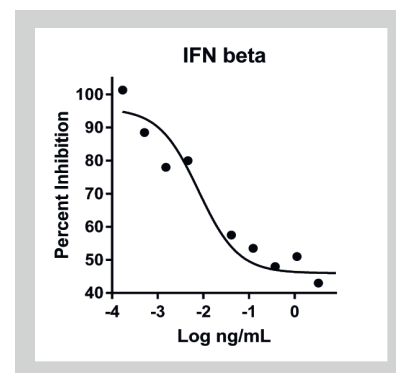
ED50:  
**≤0.1 ng/mL**

Molecular Weight:  
**18 to 22 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent inhibition of the proliferation of TF-1 cells using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

IFN beta is a member of type I family of the interferons. It binds to the IFN $\alpha/\beta$  receptor (IFNAR), activating the JAK/STAT pathway. Activation of this signaling pathway results in upregulating genes that inhibit viral infection and regulate MHC class I antigens. It is primarily produced by fibroblasts and monocytes. In addition to inhibiting viral infection, IFN beta is also involved in regulating and activating immune response against bacteria, parasites, and tumor cells. Multiple sclerosis is characterized by a deficiency of IFN beta 1. An injectable form of IFN beta 1 is used for MS treatment (PMID: 22222875; 29258190; 8602746; 8469318).



✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## IFN GAMMA

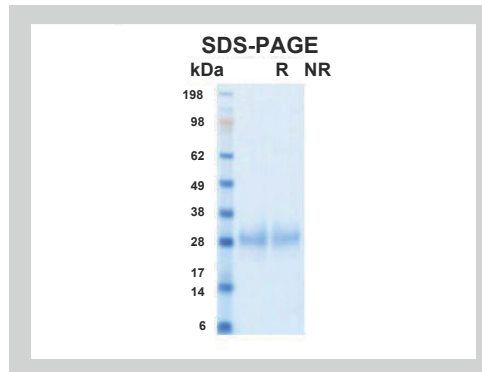
Catalog Number:  
**HZ-1301**

ED50:  
≤0.05 ng/mL

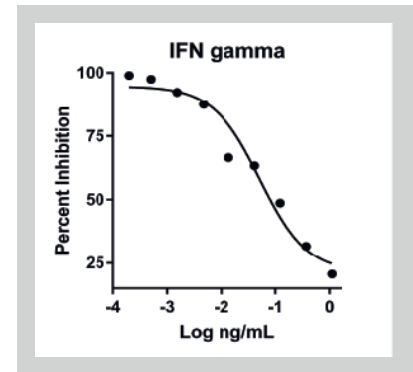
Molecular Weight:  
29-32 kDa

Purity:  
>95%

1 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent inhibition of the proliferation of HT-29 cells using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Interferon gamma (IFN  $\gamma$ ) is a type II interferon that provides immunity against bacterial, viral, and protozoan infections. In its active form, IFN  $\gamma$  is a glycosylated, non-covalently linked homodimer of 29-32 kDa subunits. It is produced by a number of immune cell types including natural killer cells, natural killer T cells, and effector lymphocyte T cells following antigenic and inflammatory triggers. The IFN  $\gamma$  dimer binds to its cognate receptor, which has two subunits: IFN- $\gamma$ R1, which is the ligand-binding chain ( $\alpha$  chain), and IFN- $\gamma$ R2, the signal-transducing chain ( $\beta$  chain). Binding to the receptor activates the JAK/STAT pathway, which in turn activates IFN  $\gamma$  responsive genes. While IFN  $\gamma$  can inhibit viral replication, it also works as an immune modulator and immune stimulator by increasing surface expression of class I MHC proteins (PMID: 19268625; 10688427).

## IL-1 BETA

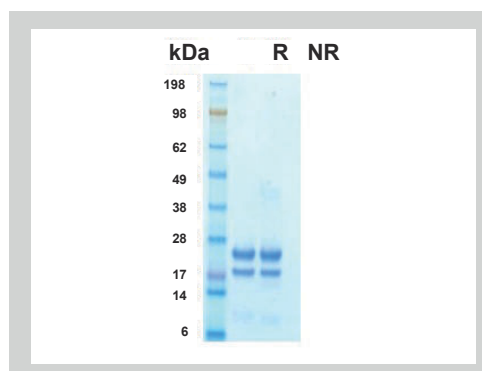
Catalog Number:  
**HZ-1164**

ED50:  
≤0.1 ng/mL

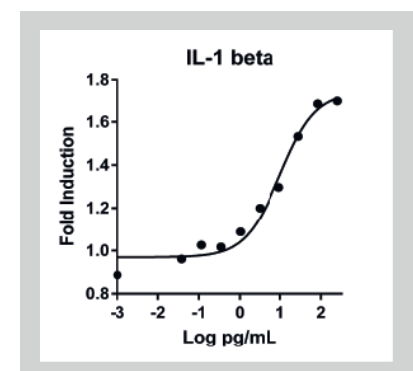
Molecular Weight:  
18 and 25 kDa

Purity:  
>95%

15 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of human TF-1 cells (human erythroleukemic indicator cell line) using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Interleukin-1 is a pro-inflammatory cytokine with multiple biological effects. The IL-1 gene family encodes three proteins: IL-1 $\alpha$ , IL-1 $\beta$ , and their naturally occurring inhibitor IL-1RN. Interleukin 1 $\beta$  (IL-1 $\beta$ ), mainly produced by blood monocytes and tissue macrophages, has been implicated in mediating both acute and chronic inflammation. IL-1 $\beta$  is known to be involved in a variety of cellular activities, including cell proliferation, differentiation, and apoptosis. IL-1 $\beta$  is emerging as a key mediator of carcinogenesis that characterizes host-environment interactions (PMID: 8630372; PMID: 12401481; PMID: 23704929; PMID: 24618930).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## IL-2

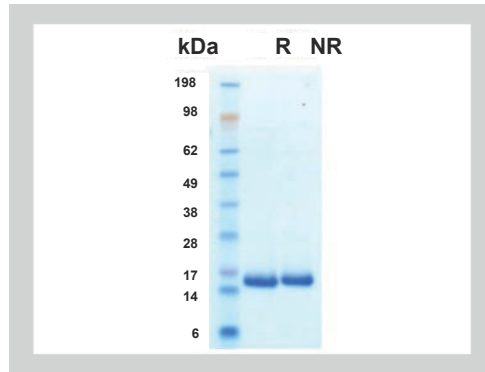
Catalog Number:  
**HZ-1015**

ED50:  
**≤5 ng/mL**

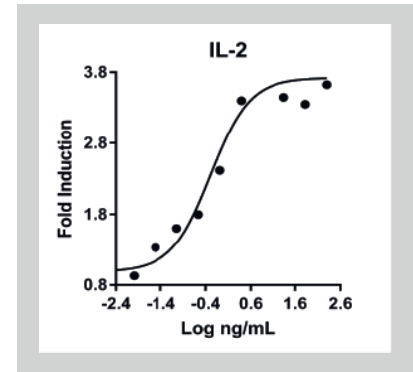
Molecular Weight:  
**15 kDa**

Purity:  
**>95%**

**3 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of mouse CTLL-2 cells (mouse cytotoxic T cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Interleukin-2 (IL-2) is a four-helix bundle, type I cytokine that functions as a growth factor for a wide range of leukocytes. In the immune system, IL-2 is essential for immune homeostasis, normal regulatory T cell function, and self-tolerance. It regulates immune cell homeostasis and has been used to treat a range of disorders including cancer and autoimmune disease. IL-2 signals through heterodimerization of the IL-2R $\beta$  and IL-2R $\gamma$  receptor subunits (PMID: 25992858, 24907378, 15034008, 17981641).

## IL-3

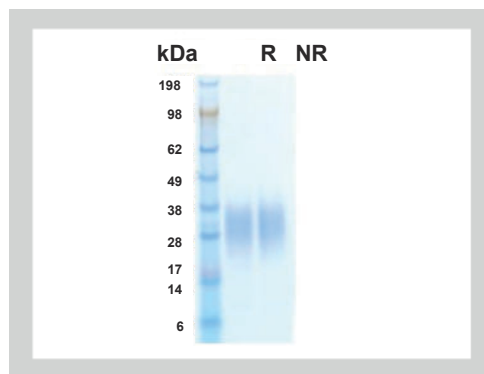
Catalog Number:  
**HZ-1074**

ED50:  
**≤2 ng/mL**

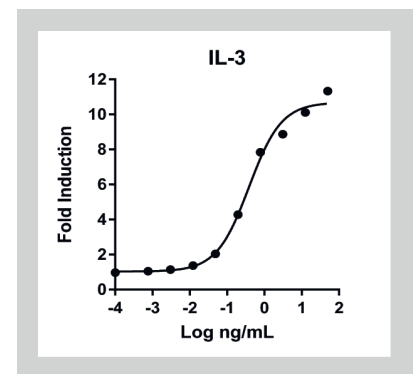
Molecular Weight:  
**17 to 40 kDa**

Purity:  
**>95%**

**7 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of human TF-1 cells (human erythroleukemic indicator cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Interleukin-3 (IL-3) is a multilineage hematopoietic growth factor that promotes the proliferation, differentiation, and survival of early multilineage hematopoietic progenitors. In particular, this cytokine plays a key role in stimulating the proliferation and survival of myeloid precursors. It is involved in a variety of cell activities such as cell growth, differentiation, and apoptosis. This cytokine has been shown to also possess neurotrophic activity, and it may be associated with neurologic disorders (PMID: 24103757; 2698876; 2809196)

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## IL-4

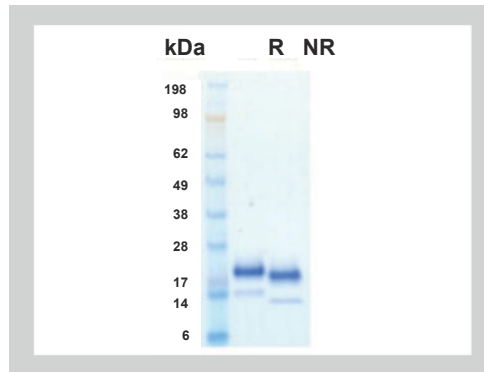
Catalog Number:  
**HZ-1004**

ED50:  
**≤0.6 ng/mL**

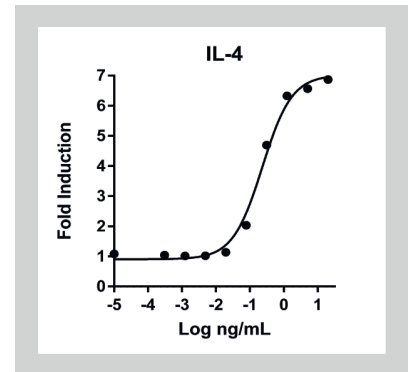
Molecular Weight:  
**14 and 19 kDa**

Purity:  
**>95%**

9 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent protection of the cytopathic effect on A549 cells (human lung adenocarcinoma epithelial cell line) that were challenged with encephalomyocarditis (EMC) virus using crystal violet staining as a read-out.

### Product Background:

Interleukin-4 (IL-4), a member of the  $\alpha$ -helical cytokine family, is produced by activated CD4+ T cells, basophils, and mast cells. It promotes the proliferation and differentiation of antigen-presenting cells. IL-4 also plays a pivotal role in antibody isotype switching and stimulates the production of IgE. This cytokine has been applied in the treatment of autoimmune disorders like multiple myeloma, cancer, psoriasis, and arthritis. IL4 has also been extensively applied to inhibit the detrimental effect of Th1. It may promote the growth of epithelial tumors by mediating increased proliferation and survival (PMID: 24489573; 3049907; 21663408)

## IL-6

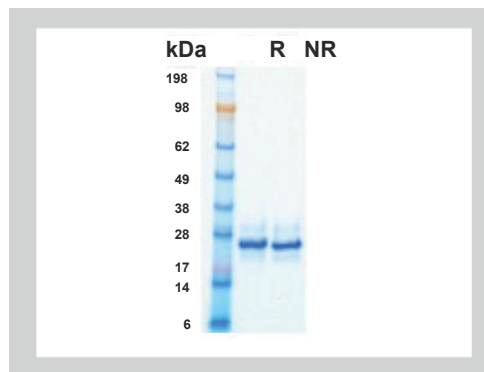
Catalog Number:  
**HZ-1019**

ED50:  
**≤1 ng/mL**

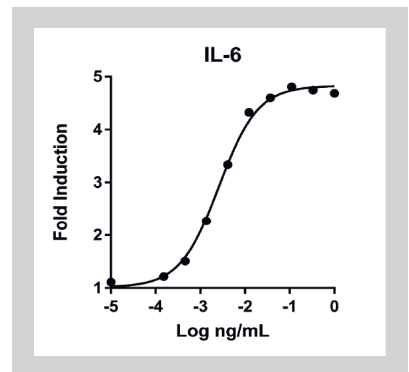
Molecular Weight:  
**21 and 29 kDa**

Purity:  
**>95%**

16 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of 7TD1 cells (mouse hybridoma cell line) using CellTiter 96® AQueous One Solution Cell Proliferation Assay.

### Product Background:

Interleukin-6 (IL-6) is an interleukin that acts as both a pro-inflammatory and anti-inflammatory cytokine. IL-6 protein is secreted by a variety of cell types including T cells and macrophages. IL-6 plays an essential role in the final differentiation of B cells into immunoglobulin-secreting cells. It induces myeloma and plasmacytoma growth and induces nerve cell differentiation acts on B cells, T cells, hepatocytes, hematopoietic progenitor cells and cell of the CNS. IL-6 is also considered a myokine, a cytokine produced from muscle, and is elevated in response to muscle contraction. IL-6 has been shown to interact with interleukin-6 receptor and glycoprotein 130. Additionally, IL-6 is involved in hematopoiesis, bone metabolism, and cancer progression, and has been defined as having an essential role in directing transition from innate to acquired immunity (PMID: 29736207; 29731693).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## IL-7

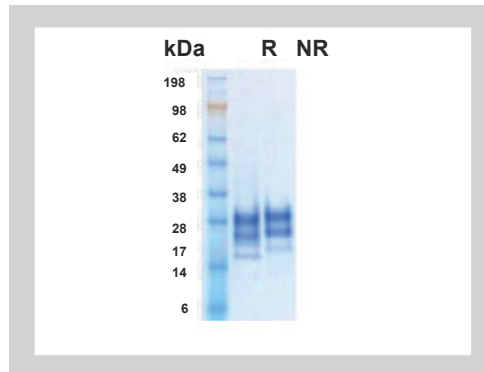
Catalog Number:  
**HZ-1281**

ED50:  
**≤1 ng/mL**

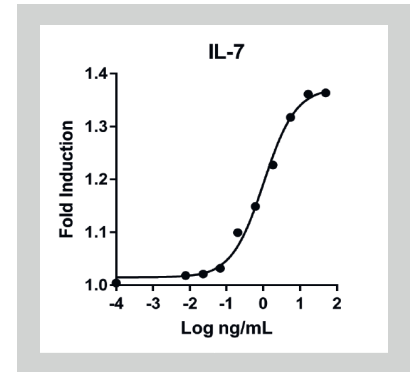
Molecular Weight:  
**19,25, and 30 kDa**

Purity:  
**>95%**

**2 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The specific activity was determined by the dose-dependent stimulation of the proliferation of murine 2E8 cells using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Interleukin-7 (IL-7) is a cytokine involved in B and T cell development. It plays an active role in the development, survival, maintaining, and restoring of the homeostasis of mature T lymphocytes and is a key regulator of the commitment, survival, proliferation, and maturation of B cells during development. Furthermore, IL-7 can improve the antiviral function and expansion of natural killer (NK) cells and regulate the development and differentiation of dendritic cells. IL-7 has also been reported as a regulator of the development of central nervous system and myogenesis and skeletal muscle cell migration (PMID: 29663382; 29655570; 29449560).

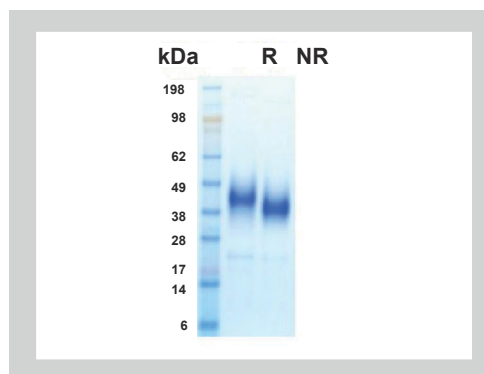
## IL-9

Catalog Number:  
**HZ-1240**

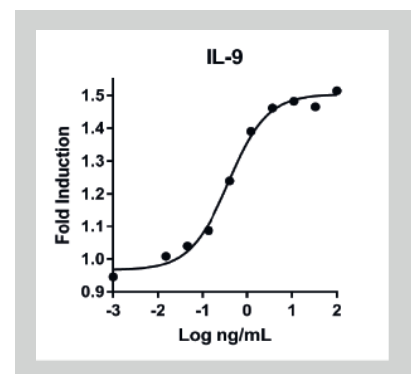
ED50:  
**≤1 ng/mL**

Molecular Weight:  
**38 to 48 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of human MO7e cells (human megakaryoblastic leukemia cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Interleukin 9 (IL-9) is a  $\gamma$ c-family cytokine produced by T helper 9 (Th9) cells. IL-9 promotes the survival and activation of various cellular targets, including mast cells, B cells, T cells, and structural cells. Its expression is considered a hallmark of Th2-lineage cells. Primarily studied in Th2-type immunity, IL-9 has been shown to be involved in asthma, allergy, and host defense against helminth infections. IL-9 also stimulates cell proliferation and prevents apoptosis. It functions through the cognate receptor (IL9R), which activates different signal transducer and activator proteins to execute various biological processes (PMID: 29703631; 29437190; 29392411; 29391143).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

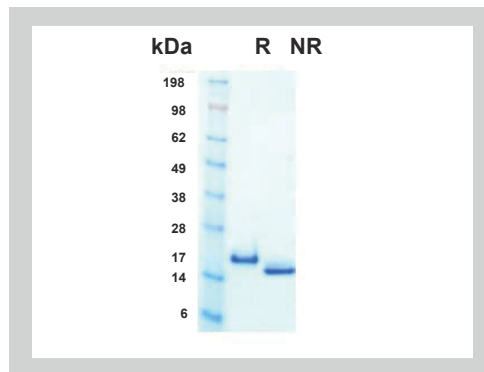
## IL-10

Catalog Number:  
HZ-1145

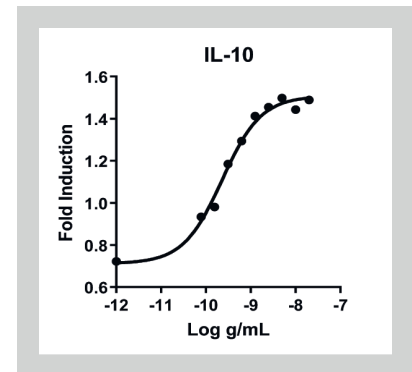
ED50:  
≤1.5ng/mL

Molecular Weight:  
17 kDa

Purity:  
>95%



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of MC/9 cells (mouse mast cell line) in the presence of 200 pg/mL IL-4 using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

IL-10 is a non-covalent homodimeric glycoprotein with an apparent molecular mass of 17 kDa. IL-10 is produced by a variety of mammalian cell types including T cells, B cells, macrophages, and keratinocytes and monocytes. It is an anti-inflammatory cytokine with multiple roles in inflammation and immunoregulation (PMID: 19161426; 9162098).

## IL-12

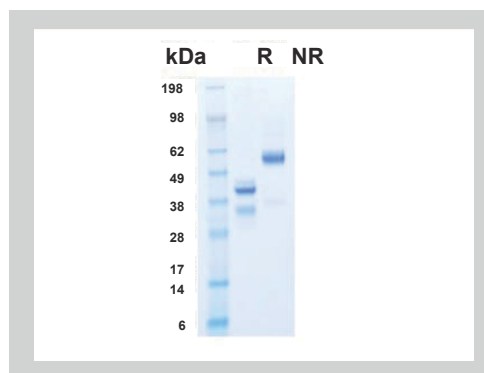
Catalog Number:  
HZ-1256

ED50:  
≤2 ng/mL

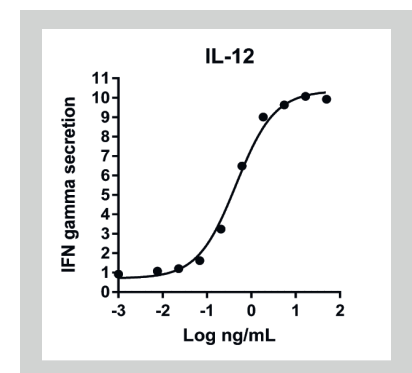
Molecular Weight:  
57 kDa

Purity:  
>95%

3 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent release of IFN-gamma from the human NK92 cell line in the presence of 20 ng/mL rIL-2 using an IFN-gamma ELISA kit.

### Product Background:

IL-12 is a heterodimeric cytokine composed of two glycosylated and disulfide-linked subunits (p40 cysteine-linked to p35). IL-12 is a potent regulator of cell mediated immune responses and it induces IFN-gamma production by NK and T cells. It is produced by activated monocytes/macrophage cells, B lymphocytes, and connective tissue-type mast cells (PMID: 24821971; 7612223).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## IL-17A

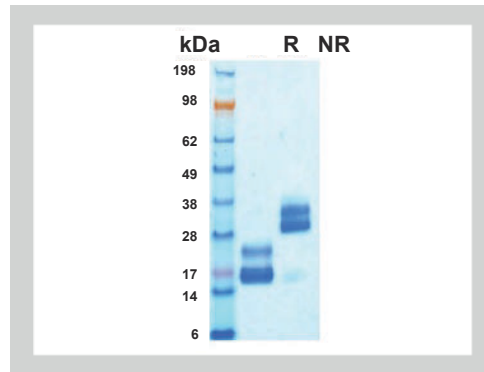
Catalog Number:  
**HZ-1113**

ED50:  
**≤10 ng/mL**

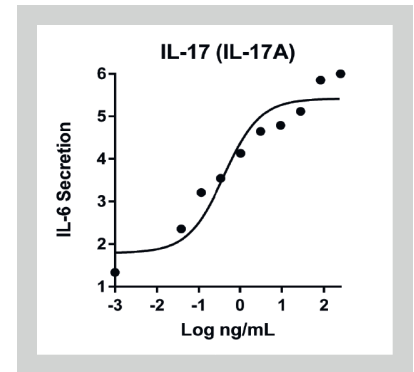
Molecular Weight:  
**30 to 35 kDa**

Purity:  
**>95%**

**3 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent induction of IL-6 secretion from NHDF Adult fibroblasts using an IL6 ELISA kit.

### Product Background:

IL-17 (IL-17A) is a homodimeric glycoprotein with an apparent molecular mass of 30 to 35 kDa. The IL-17 family comprises of at least 6 proinflammatory cytokines that share a conserved cystine-knot structure but diverge at the N-terminus. IL-17 family members are glycoproteins that induce local cytokine production and recruit granulocytes to sites of inflammation (PMID: 15485625; 11574464).

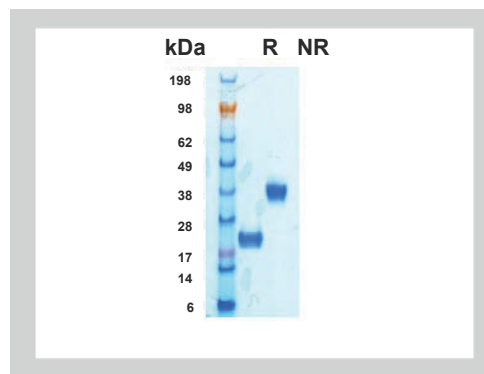
## IL-17F

Catalog Number:  
**HZ-1116**

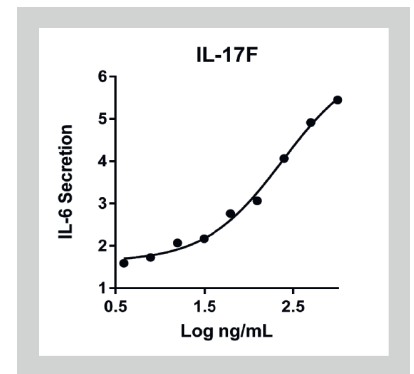
ED50:  
**≤10 ng/mL**

Molecular Weight:  
**38 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent induction of IL-6 secretion from NHDF Adult fibroblasts using an IL6 ELISA kit.

### Product Background:

IL-17F is a homodimeric glycoprotein with an apparent molecular mass of 38 kDa. IL-17 is commonly associated with allergic responses. IL-17 induces the production of many other cytokines such as TNF alpha, chemokines such as IL-8, and prostaglandins. The IL17-induced release of cytokines has many effects, including airway remodeling in asthma (PMID: 24292568).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## IL-23

Catalog Number:

**HZ-1254**

ED50:

**≤30 ng/mL**

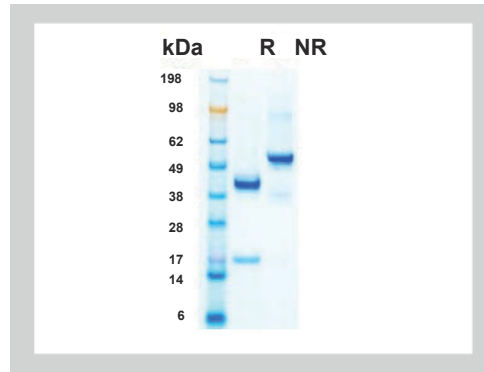
Molecular Weight:

**55 kDa**

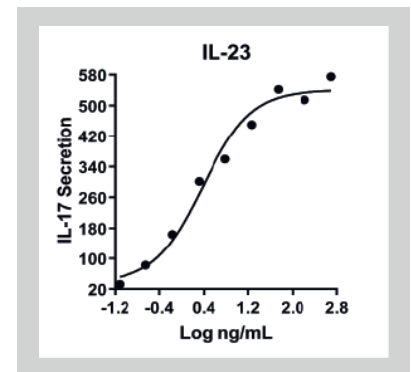
Purity:

**>95%**

**10 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent release of IFN- $\gamma$  from the human NK92 cell line in presence of 20 ng/mL rIL-2 using an IFN- $\gamma$  ELISA kit.

### Product Background:

Interleukin 23 (IL-23) is a member of the IL12 cytokine family and is composed of two subunits, IL12p40 and IL23p19. It is produced by antigen-presenting cells and has been shown to promote the production and survival of a distinct lineage of T cells called TH17 cells. A functional receptor for IL-23 (the IL-23 receptor) has been identified and is composed of IL-12R $\beta$ 1 and IL-23R. IL-23 is expressed chiefly by the macrophages and DCs. The IL-23R is found on memory T cells, NKT cells, macrophages, DCs, and naive T cells upon activation by TGF- $\beta$  and IL-6. The main biological effects of IL-23 identified initially are stimulation of antigen presentation by DCs, T cell differentiation to Th17 cells, and production of interferon- $\gamma$  (IFN- $\gamma$ ). IL-23 also acts as an end-stage effector cytokine through direct action on macrophages (PMID: 16393998; 15657292;12023369; 12610626).

## IL-27

Catalog Number:

**HZ-1275**

ED50:

**≤12 ng/mL**

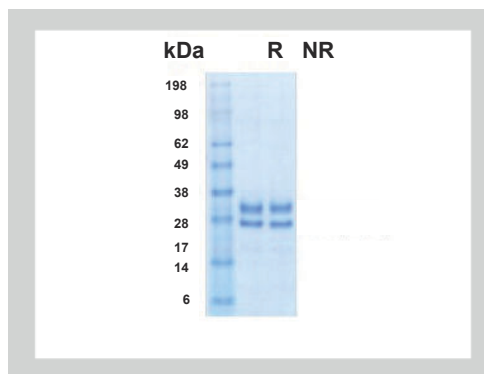
Molecular Weight:

**25 and 30 kDa heterodimer**

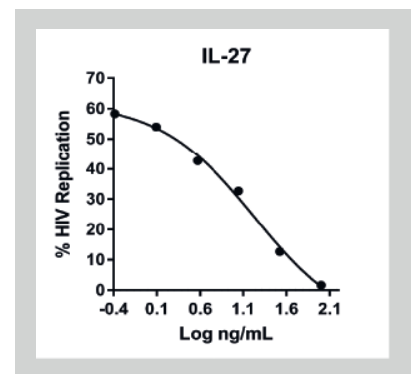
Purity:

**>95%**

**1 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The specific activity was determined by the dose-dependent inhibition of HIV replication in human CD4+ T cells and in human monocyte-derived macrophages as described in Fakruddin, J.M., et al. Blood 109:1841.

### Product Background:

IL-27 is a heterodimeric cytokine composed of two subunits: IL-27a and IL-27b. IL-27 acts on various cell types, including T cells, B cells, macrophages, dendritic cells, natural killer (NK) cells, and non-hematopoietic cells. IL-27 plays a critical role in the early regulation of T-helper type 1 initiation, and enhances proliferation of naive CD4+ T cells and naive B cells. However, it also exerts anti-inflammatory functions by inhibiting the development of Th17 cells and inducing IL-10-producing type 1 regulatory T cells. IL-27 is a potentially promising cytokine for therapeutic approaches in various human diseases (PMID: 22608254; 16081786; 16670296; 16906167).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

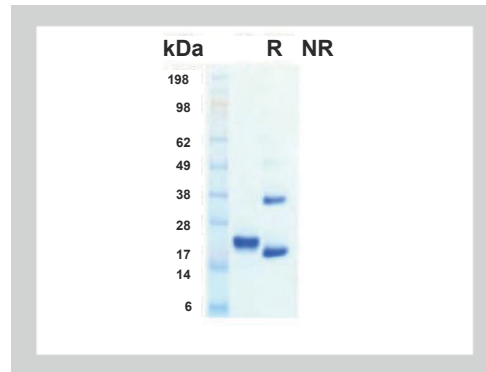
## IL-28A

Catalog Number:  
**HZ-1235**

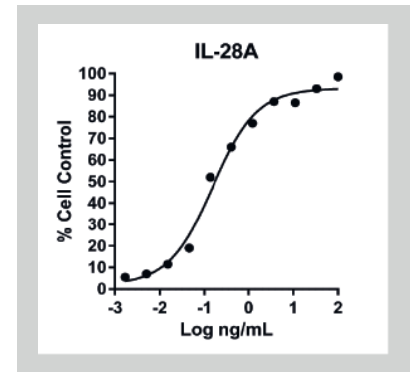
ED50:  
**≤5 ng/mL**

Molecular Weight:  
**24 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent protection of the cytopathic effect on A549 cells (human lung adenocarcinoma epithelial cell line) that were challenged with encephalomyocarditis (EMC) virus using crystal violet staining as a read-out.

### Product Background:

IL-28A is a type III IFN, which shares many of the biological effects of type I IFNs but may have fewer side effects due to a more selective receptor distribution. It interacts with a heterodimeric class II cytokine receptor that consists of interleukin 10 receptor, beta (IL10RB) and interleukin 28 receptor, alpha (IL28RA). IL-28A is believed to play a significant role in the antiviral immune defense in the intestinal epithelium (PMID: 20712453; 12469119; 16539846).

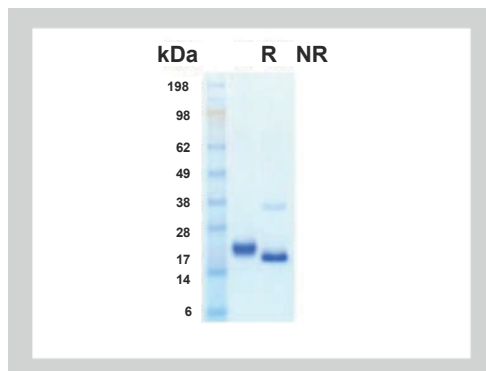
## IL-28B

Catalog Number:  
**HZ-1245**

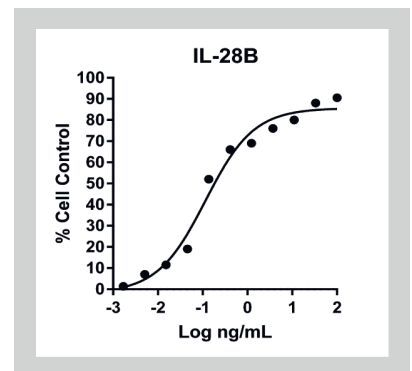
ED50:  
**≤1 ng/mL**

Molecular Weight:  
**24 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent protection of the cytopathic effect on A549 cells (human lung adenocarcinoma epithelial cell line) that were challenged with encephalomyocarditis (EMC) virus using crystal violet staining as a read-out.

### Product Background:

IL-28B is a type III IFN, which shares many of the biological effects of type I IFNs but may have fewer side effects due to a more selective receptor distribution. It interacts with a heterodimeric class II cytokine receptor that consists of interleukin 10 receptor, beta (IL10RB) and interleukin 28 receptor, alpha (IL28RA) (PMID: 20712453; 12469119; 16539846).



✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

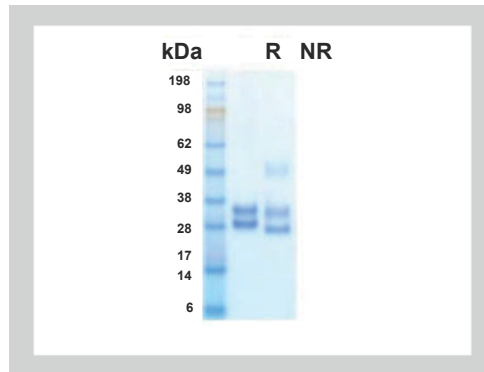
## IL-29

Catalog Number:  
**HZ-1156**

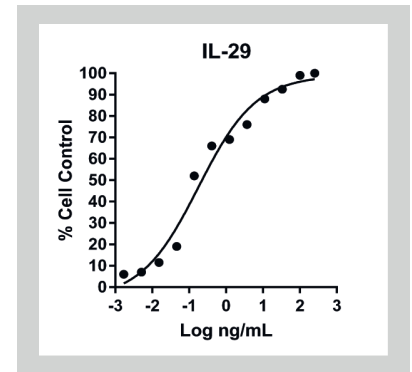
ED50:  
**≤5 ng/mL**

Molecular Weight:  
**29 and 35 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent protection of the cytopathic effect on A549 cells (human lung adenocarcinoma epithelial cell line) that were challenged with encephalomyocarditis (EMC) virus using crystal violet staining as a read-out.

### Product Background:

Interleukin-29 (IL-29, also known as IFN gamma1) is a member of the helical cytokine family and is a type III interferon. IL-29 plays an important role in host defenses against microbes and its gene is highly upregulated in cells infected with viruses (PMID: 18547367; 12469119; 27637354).

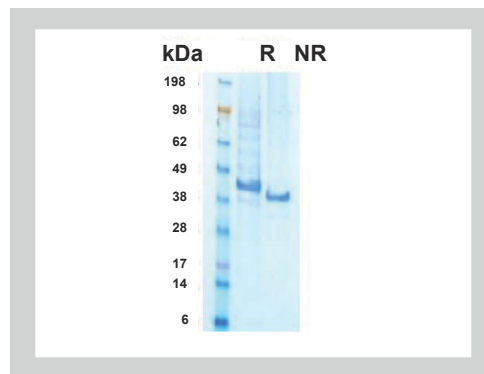
## LEFTY-1

Catalog Number:  
**HZ-1109**

ED50:  
**≤40 ng/mL**

Molecular Weight:  
**38 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.

**1 Citations**

### Product Background:

LEFTY-1 is a member of the TGF-beta family of proteins that plays a role in the left-right asymmetry determination of organ systems during development. LEFTY-1 regulates transforming growth factor, mitogen-activated protein kinase, and other signaling pathways, and is considered to have a potential anti-inflammatory function (PMID: 29286065; 26316705; 10500184; 9708731).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

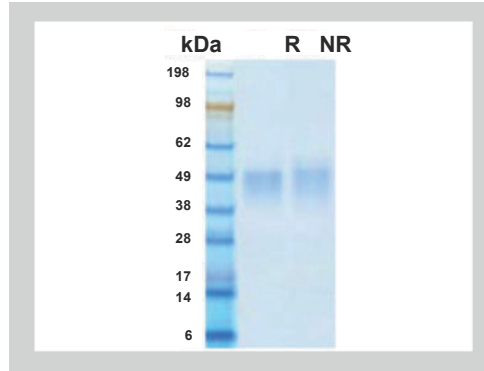
## LIF

Catalog Number:  
**HZ-1292**

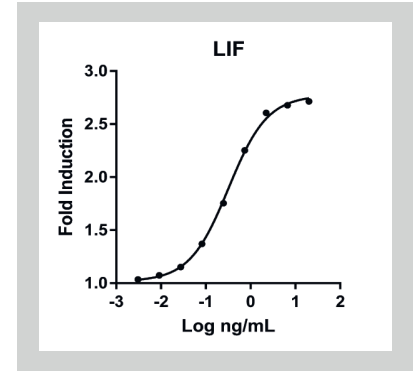
ED50:  
**≤0.2 ng/mL**

Molecular Weight:  
**35-53 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of human TF-1 cells (human erythroleukemic indicator cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

LIF is a pleiotropic cytokine with a variety of roles. It is involved in the induction of hematopoietic differentiation in normal and myeloid leukemia cells, induction of neuronal cell differentiation, regulation of mesenchymal to epithelial conversion during kidney development, and it may also have the role in immune tolerance at the maternal-fetal interface (PMID: 29620145; 29391217; 29271384)

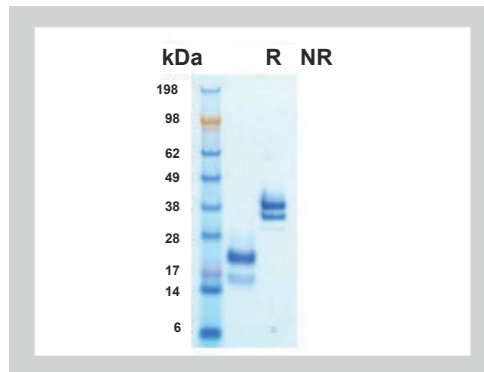
## M-CSF

Catalog Number:  
**HZ-1192**

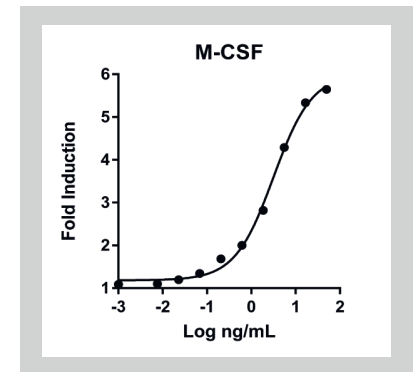
ED50:  
**≤4 ng/mL**

Molecular Weight:  
**35 and 40 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of murine M-NFS-60 cells (Mouse Myeloid Leukemia indicator cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

**3 Citations**

### Product Background:

M-CSF plays an essential role in the regulation of survival, proliferation, and differentiation of hematopoietic precursor cells, especially mononuclear phagocytes. M-CSF promotes the release of proinflammatory chemokines, and thereby plays an important role in innate immunity and in inflammatory processes. It also plays an important role in the regulation of osteoclast proliferation and differentiation, the regulation of bone resorption, and is required for normal bone development. At the cellular level, M-CSF promotes reorganization of the actin cytoskeleton, regulates formation of membrane ruffles, cell adhesion and cell migration, and plays a role in lipoprotein clearance (PMID: 29734839; 29679908; 28202039).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## NOGGIN

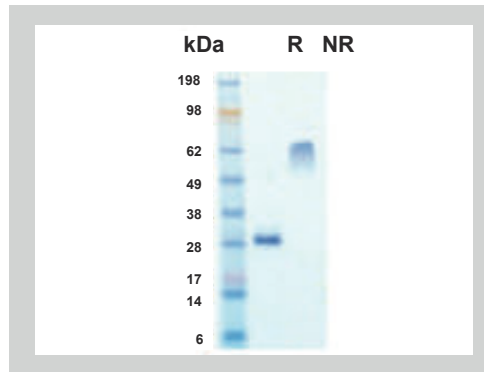
Catalog Number:  
**HZ-1118**

ED50:  
≤25 ng/mL

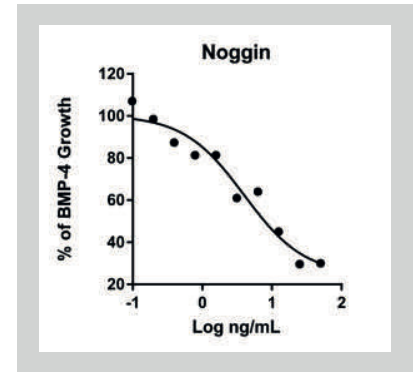
Molecular Weight:  
65 kDa

Purity:  
>95%

3 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent inhibition of rh-BMP-4-induced alkaline phosphatase production by ATDC5 cells using pNPP as a chromogenic substrate.

### Product Background:

Noggin is an inhibitor of bone morphogenetic proteins (BMP) signaling, which is required for growth and patterning of the neural tube and somite. It is essential for cartilage morphogenesis and joint formation. Noggin inhibits chondrocyte differentiation through its interaction with GDF5 and GDF6 (PMID: 29497255; 29167826; 29094227; 28842965).

## OSM

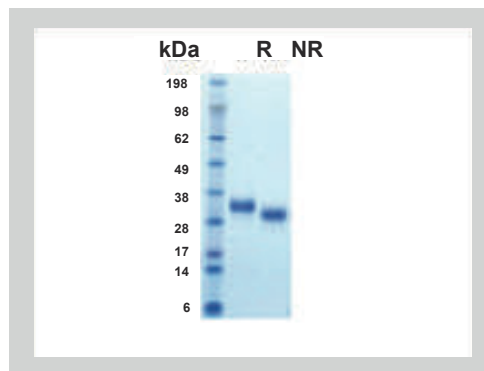
Catalog Number:  
**HZ-1030**

ED50:  
≤10 ng/mL

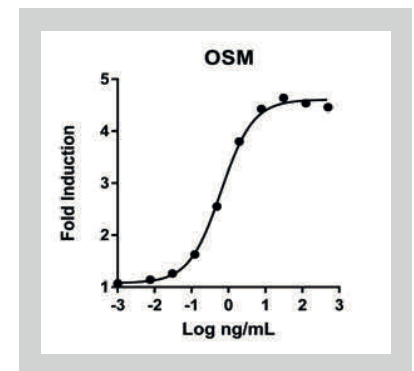
Molecular Weight:  
30 kDa

Purity:  
>95%

2 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of human TF-1 cells (human erythroleukemic indicator cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Oncostatin M (OSM) is a member of a cytokine family that includes a leukemia-inhibitory factor, granulocyte colony-stimulating factor, and interleukin 6. OSM is a growth regulator that inhibits the proliferation of some tumor cell lines. It can stimulate proliferation of AIDS-KS cells. It regulates cytokine production, including IL-6, G-CSF, and GM-CSF from endothelial cells. OSM is involved in the maturation of fetal hepatocytes, thereby promoting liver development and regeneration (PMID: 9133674; 29526757; 29363180; 21887386).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## PDGFaa

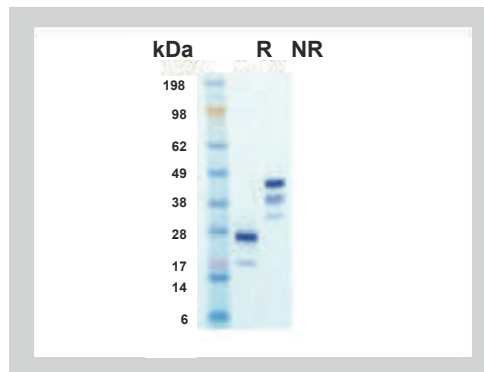
Catalog Number:  
**HZ-1215**

ED50:  
**≤25 ng/mL**

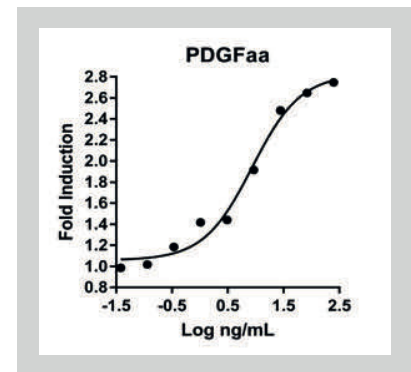
Molecular Weight:  
**35,40 and 45 kDa**

Purity:  
**>95%**

**1 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of 3T3 cells using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

PDGFaa is a member of the platelet-derived growth factor family. Four members of this family are mitogenic factors for cells of mesenchymal origin, and they are characterized by a motif of eight cysteines. PDGFaa plays an essential role in the regulation of embryonic development, cell proliferation, cell migration, and chemotaxis. It is also required for a normal lung alveolar septum formation during embryogenesis, development of the gastrointestinal tract, and spermatogenesis. PDGFaa is also involved in oligodendrocyte development and l myelination process in the spinal cord and cerebellum (PMID: 29408302; 29282077; 27002148).

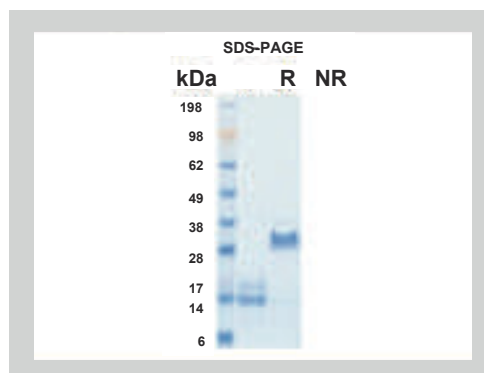
## PDGFbb

Catalog Number:  
**HZ-1308**

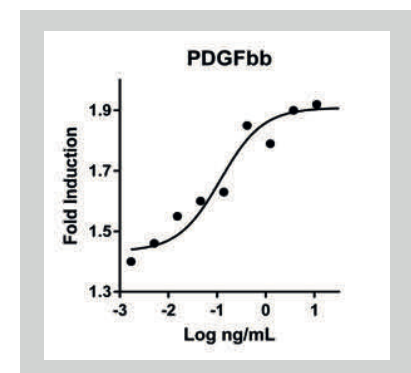
ED50:  
**≤3 ng/mL**

Molecular Weight:  
**29 to 32 kDa**

Purity:  
**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of 3T3 cells using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

PDGFbb is a member of the platelet-derived growth family factor. Four members of this family are mitogenic factors for cells of mesenchymal origin, and they are characterized by a motif of eight cysteines. PDGFbb is required for normal proliferation and recruitment of pericytes and vascular smooth muscle cells in the central nervous system, skin, and placenta, among others. PDGFbb plays a role in blood vessel development. It also implements its role in wound healing (PMID: 29266203; 28851707; 2855636839).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## PLEIOTROPHIN-PTN

Catalog Number:

**HZ-1278**

ED50:

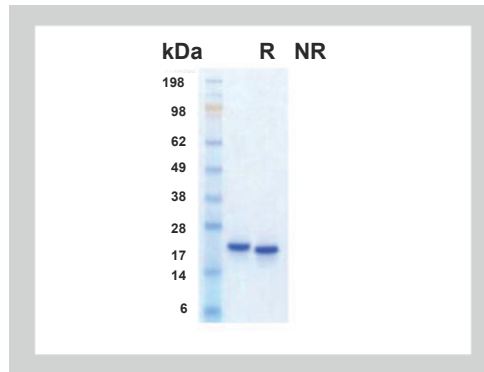
**N/A**

Molecular Weight:

**18 kDa**

Purity:

**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.

### Product Background:

Pleiotrophin is a secreted growth factor that induces neurite outgrowth, being mitogenic for fibroblasts, epithelial, and endothelial cells. It binds anaplastic lymphoma kinase (ALK) to induce MAPK pathway activation, as an important step in the anti-apoptotic signaling of PTN and cell proliferation (PMID:1768439; 1733956; 11278720).

## PRO-IGF-II

Catalog Number:

**HZ-1161**

ED50:

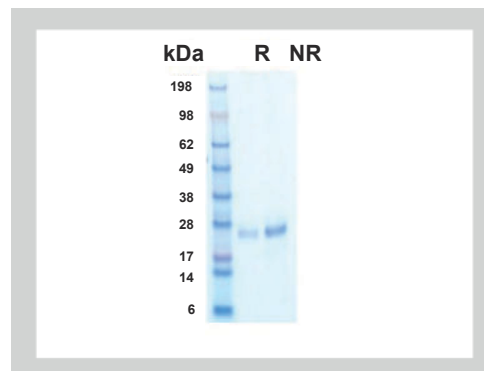
**≤50 ng/mL**

Molecular Weight:

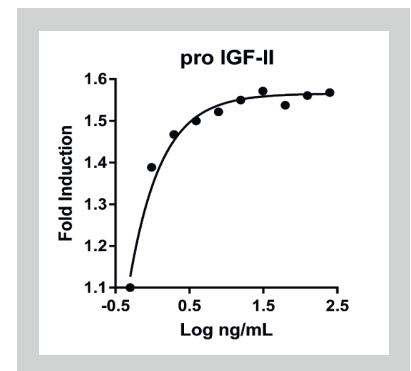
**25 kDa**

Purity:

**>95%**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of MCF-7 cells (human breast cancer cell line) using the Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

IGF2 is a hormone involved in the regulation of cell proliferation, growth, migration, differentiation, and survival. IGF2 is mostly expressed in early embryonic and fetal development. Adult IGF2 expression occurs in the liver and epithelial cells lining the surface of the brain. IGF2 can also be detected in plasma (PMID: 24593700; 23257688).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## SCF

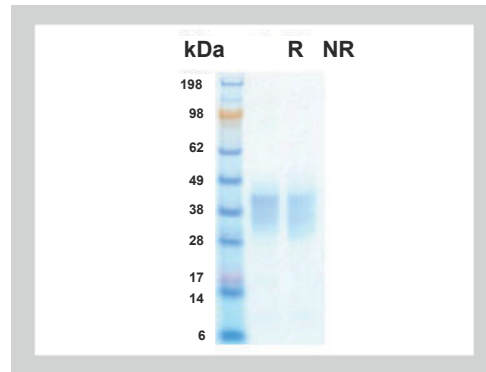
Catalog Number:  
**HZ-1024**

ED50:  
≤25 ng/mL

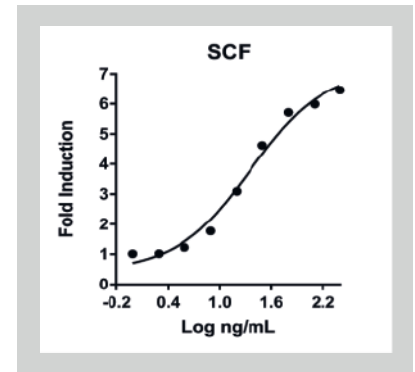
Molecular Weight:  
35 to 45 kDa

Purity:  
>95%

8 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of human TF-1 cells (human erythroleukemic indicator cell line) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

SCF is a hematopoietic growth factor that works by signaling through the c-Kit receptor. SCF and c-Kit are essential for the survival, proliferation, and differentiation of hematopoietic cells (PMID: 12773427).

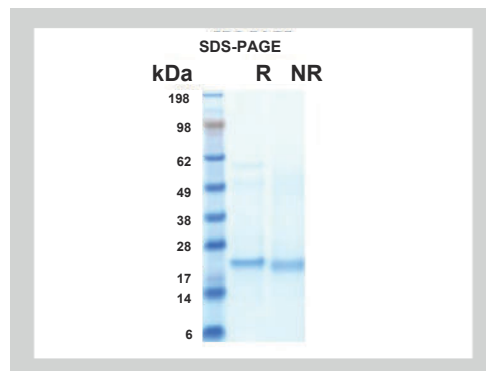
## SONIC HEDGEHOG-SHH

Catalog Number:  
**HZ-1306**

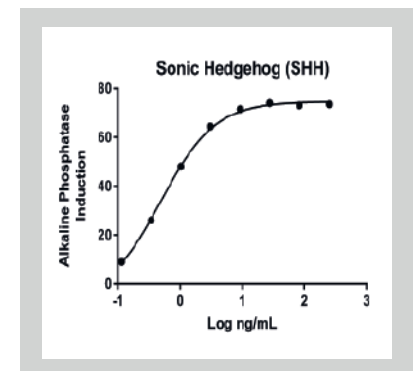
ED50:  
≤350 ng/mL

Molecular Weight:  
20-24 kDa

Purity:  
>95%



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the ability to induce alkaline phosphatase production in C3H10T1/2 mouse embryonic fibroblast cells using pNPP as the chromogenic substrate.

### Product Background:

SHH, also named as HHG-1, belongs to the hedgehog family. SHH binds to the patched receptor (PTC), which in association with smoothened (SMO) activates the transcription of target genes. In the absence of SHH, PTC represses the constitutive signaling activity of SMO. SHH is synthesized as a 45 kDa protein precursor that is autocatalytically cleaved to yield a 20 kDa N-terminal fragment (24-197 in the human gene sequence), known as being responsible for all known hedgehog biological activity, and a 25 kDa C-terminal fragment that contains the auto-processing machinery (PMID: 10753901).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## TGF BETA 1

Catalog Number:

**HZ-1011**

ED50:

≤0.5 ng/mL

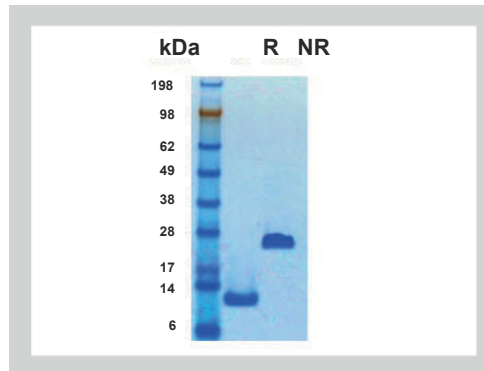
Molecular Weight:

**25 kDa**

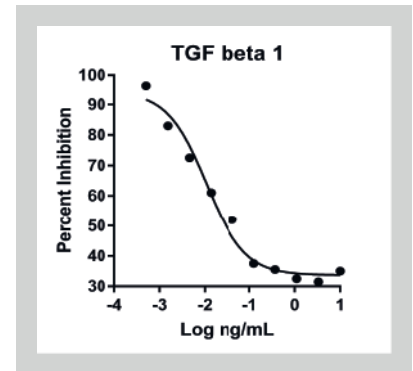
Purity:

>95%

59 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent inhibition of IL-4-induced proliferation of mouse HT-2 cells (BALB/c spleen activated by sheep erythrocytes in the presence of IL-2) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

TGFB, also named as LAP and TGFB1, is a multifunctional peptide that controls proliferation and cell differentiation. TGF acts synergistically with TGFA in inducing the transformation process. It also acts as a negative autocrine growth factor. Dysregulation of TGFB activation and signaling may result in apoptosis. Many cells synthesize TGFB having specific receptors for it. TGFB, positively and negatively regulates many other growth factors. It plays an important role in bone remodeling, being a potent stimulator of an osteoblastic bone formation (PMID: 11586292).

## TGF BETA 2

Catalog Number:

**HZ-1092**

ED50:

≤0.5 ng/mL

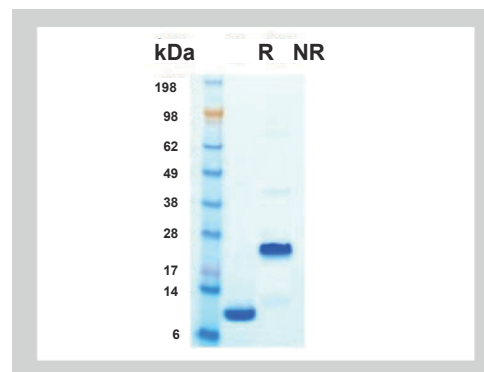
Molecular Weight:

**25 kDa**

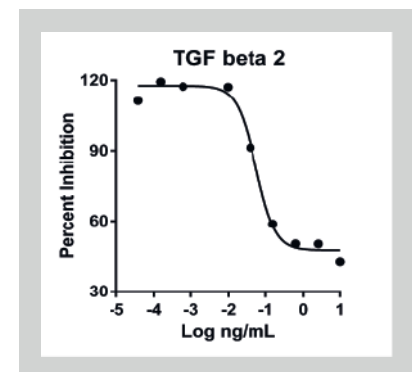
Purity:

>95%

4 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent inhibition of IL-4-induced proliferation of mouse HT-2 cells (BALB/c spleen activated by sheep erythrocytes in the presence of IL-2) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

Transforming growth factor beta-2 (TGFB2) belongs to the TGF-beta family. TGFB2 is a secreted protein known as a cytokine that plays a vital role during embryonic development (PMID 19289080). TGFB2 regulates cell proliferation, differentiation, adhesion, and migration by transducing the signal through transmembrane receptors type I and type II (TGFB1 and TGFB2) and their downstream effectors, the SMAD proteins (PMID 18313409). Disruption of the TGFB/SMAD pathway has been implicated in many types of cancers. TGFB2 has suppressive effects on interleukin-2 dependent T-cell growth (PMID 12064833). The TGFβ2 protein plays a role in the formations of blood vessels, the regulation of muscle tissue, and body fat development. TGFβ-2 is especially abundant in tissues related to the skeleton, where it helps regulate bone growth and form the extracellular matrix in the spaces between cells.

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## TGF BETA 3

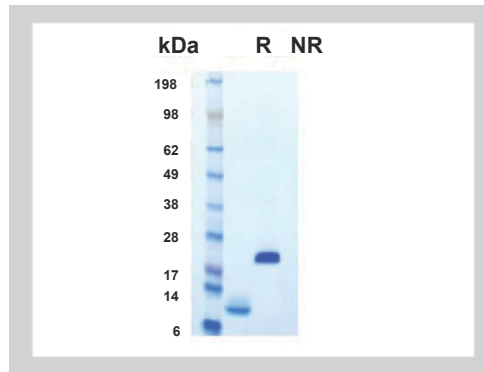
Catalog Number:  
**HZ-1090**

ED50:  
**≤0.5 ng/mL**

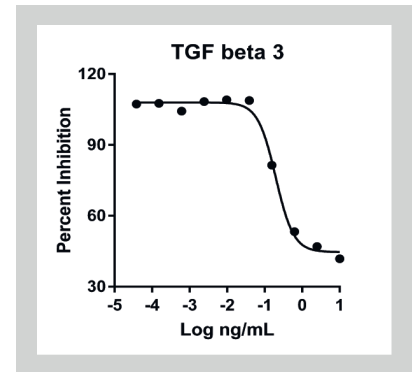
Molecular Weight:  
**25 kDa**

Purity:  
**>95%**

8 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent inhibition of the IL-4-induced proliferation of mouse HT-2 cells (BALB/c spleen activated by sheep erythrocytes in the presence of IL-2) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

The transforming growth factor beta-3 (TGFβ-3) protein is found throughout the body and is required for development before birth and throughout life. TGFβ-3 binds to the receptor proteins on the surface of cells. This binding triggers the transmission of signals within the cell. As part of the TGF-β signalling pathway, the TGFβ-3 protein helps to control the growth and proliferation of cells. The TGFβ-3 protein is especially abundant in skeletal muscles and plays a key role in their development. The protein is also involved in blood vessel formation, regulation of bone growth, and wound healing (PMID: 25835445; 23824657).

## THROMBIN-COAGULATION FACTOR II

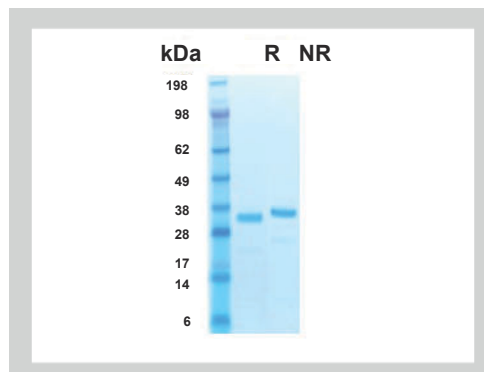
Catalog Number:  
**HZ-3010**

ED50:  
**6800 NIH U/mg**

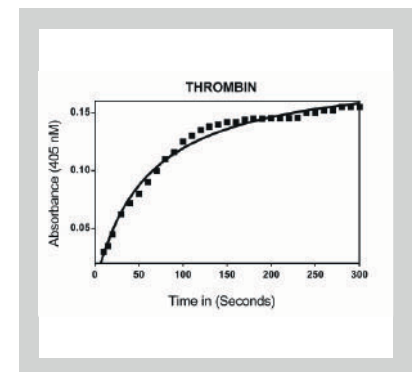
Molecular Weight:  
**36 kDa**

Purity:  
**>95%**

1 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity of Thrombin and standard Thrombin (1nM) was measured by rates of formation of free chromophore monitored absorbance at 405 nm in the presence of 20 uM Spectrozyme PL (Sekisui Diagnostics, 251L) in a buffer of 5 mM Tris-Cl (pH 8.0), 0.1% PEG, and 200 mM NaCl at 25°C.

### Product Background:

Coagulation factors are a group of related proteins that are essential for normal blood clotting (hemostasis). After an injury, clots protect the body by sealing off damaged blood vessels and preventing further blood loss. Prothrombin circulates in the bloodstream in an inactive form until an injury occurs. In response to that, prothrombin is converted to its active form, thrombin. Thrombin next converts a protein called fibrinogen into fibrin. Thrombin is also important for cell growth and division, tissue repair, and the formation of new blood vessels - angiogenesis (PMID: 11154146; 16549895; 15892853; 12421139).



✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## TNF ALPHA

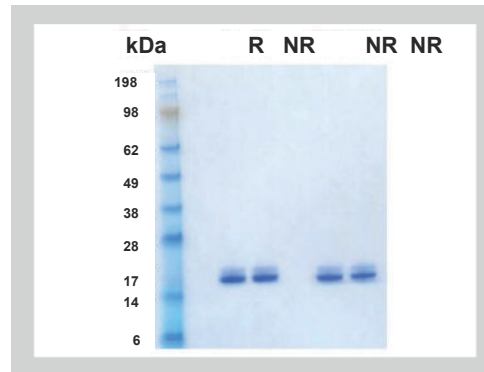
Catalog Number:  
**HZ-1014**

ED50:  
**≤1 ng/mL**

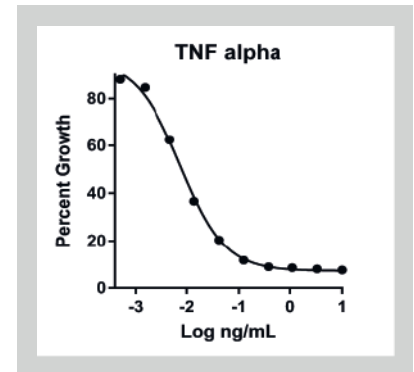
Molecular Weight:  
**17 kDa**

Purity:  
**>95%**

9 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent cytotoxicity of the TNF alpha sensitive cell line L-929 in the presence of Actinomycin D using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

TNF, as also known as TNF alpha, or cachectin, is a multifunctional proinflammatory cytokine that belongs to the tumor necrosis factor (TNF) superfamily. It is expressed as a 26 kDa membrane-bound protein and free soluble 17 kDa monomer, which forms homotrimers in circulation. It is produced mostly by activated macrophages, CD4+ lymphocytes, NK cells, neutrophils, eosinophils, and neurons. This cytokine is involved in the regulation of a wide spectrum of biological processes including cell proliferation, differentiation, apoptosis, lipid metabolism, and coagulation (PMID: 20194223).

## TPO

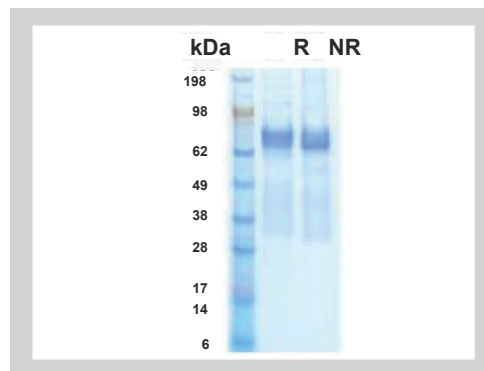
Catalog Number:  
**HZ-1248**

ED50:  
**≤5 ng/mL**

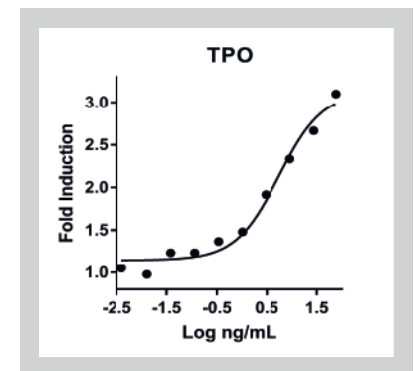
Molecular Weight:  
**80 to 85 kDa**

Purity:  
**>95%**

2 Citations



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of MO7e cells using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

The thyroid peroxidase enzyme plays a central role in the function of the thyroid gland. Thyroid hormones play an important role in regulating brain development and the rate of chemical reactions in the body (metabolism) (PMID: 16687716; 8537317).

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## VEGF121

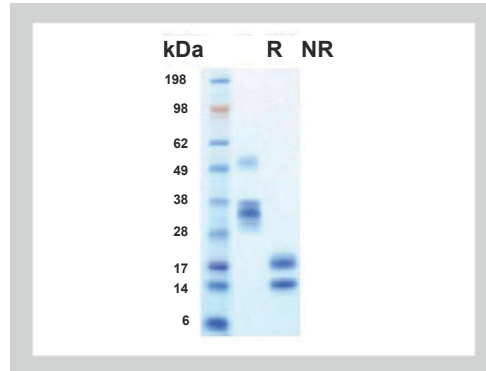
Catalog Number:  
**HZ-1204**

ED50:  
**≤15 ng/mL**

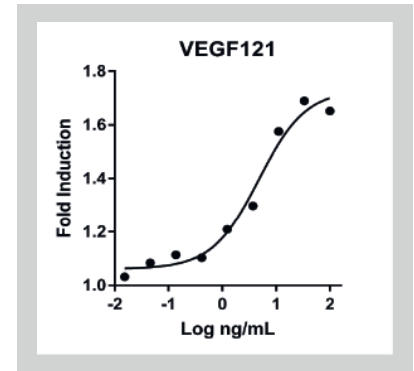
Molecular Weight:  
**37 kDa**

Purity:  
**>95%**

**10 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of HUVEC cells (Human Umbilical Vein Endothelial Cells) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

This gene is a member of the PDGF/VEGF growth factor family. It encodes a heparin-binding protein, which exists as a disulphide-linked homodimer. This growth factor induces the proliferation and migration of vascular endothelial cells and is essential for physiological and pathological angiogenesis. Misregulations of this gene in mice result in abnormal embryonic blood vessel formation (PMID:10838264; 11329058).

## VEGF165

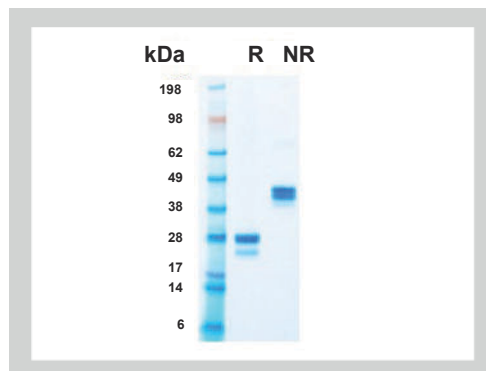
Catalog Number:  
**HZ-1038**

ED50:  
**≤15 ng/mL**

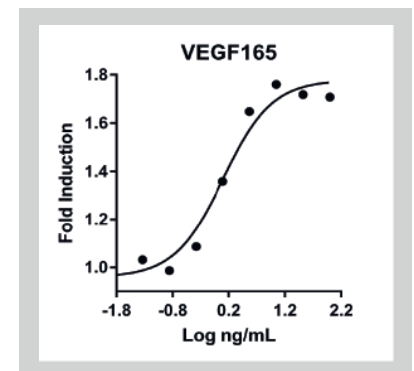
Molecular Weight:  
**45 kDa**

Purity:  
**>95%**

**7 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by the dose-dependent stimulation of the proliferation of HUVEC cells (Human Umbilical Vein Endothelial Cells) using Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

### Product Background:

This gene is a member of the PDGF/VEGF growth factor family. It encodes a heparin-binding protein, which exists as a disulphide-linked homodimer (PMID 10838264; 11329058). This growth factor induces the proliferation and migration of vascular endothelial cells and is essential for physiological and pathological angiogenesis. Misregulations of this gene in mice result in abnormal embryonic blood vessel formation.

✓ HEK293 expressed    ✓ Free of animal components    ✓ Endotoxin-free

## WNT3A

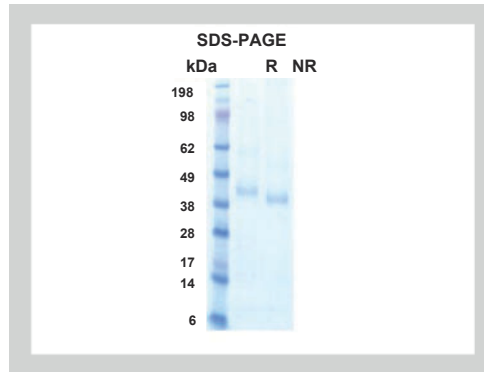
Catalog Number:  
**HZ-1296**

ED50:  
**≤20 ng/mL**

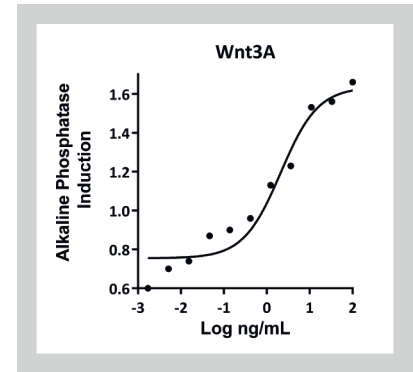
Molecular Weight:  
**38-42 kDa**

Purity:  
**>95%**

**8 Citations**



The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents reducing conditions and NR represents non-reducing condition.



The activity was determined by dose-dependent Alkaline Phosphatase production in MC3T3 E1 mouse preosteoblast cells using pNPP as the chromogenic substrate and stabilization of beta catenin in mouse L929 cells.

### Product Background:

Wnt3A is a member of the Wnt family that consists of structurally linked genes that encode secreted signaling proteins. This protein is associated with oncogenesis and also regulation of cell fate and patterning during embryogenesis. It plays a key role in maintaining the integrity of embryonic and adult tissues. The post-translational glycosylation and acylation of Wnt are essential for their efficient secretion and biological functions (PMID: 8244403; 11834740).

# GM-CSF:

## A modulatory cytokine in autoimmunity & inflammation

Granulocyte-macrophage colony-stimulating factor (GM-CSF) is important in inflammatory, infectious, and autoimmune diseases. It can affect various cell types by promoting the survival, proliferation, activation, or differentiation of various hematopoietic cell lineages, such as macrophages and dendritic cells (1).

GM-CSF is a homodimer extracellular polyprotein, mostly

known as a hematopoietic growth factor and immune modulator. The lungs are the major source of GM-CSF, and the majority of pulmonary cells can synthesize this cytokine in response to various stimuli (2). GM-CSF stimulates the development of early erythroid megakaryocytic and eosinophilic progenitor cells (3). GM-CSF also stimulates stem cells to produce granulocytes and monocytes to cope with infection (4, 5).

## Proteintech's Humankine<sup>®</sup> GM-CSF

Proteintech's Humankine<sup>®</sup> GM-CSF is made from HEK293 human cells, conferring authentic glycosylation and folding in addition to superior stability and activity.

Our human expression system ensures that proteins have native conformation and post-translational modifications to optimize biological activity.

Product name	Catalog number	ED50	Purity	Citations
GM-CSF	HZ-1002	≤2 ng/mL	>95%	8

✓ **Animal-free**

✓ **Expressed in human cells**

✓ **Lyophilized & Carrier Free (CF)**

✓ **Endotoxin-free**

Proteintech's Humankine<sup>®</sup> GM-CSF is produced in a human cell expression system in serum-free, chemically defined media (Figure 1). It has demonstrated a greater stability under cell culture conditions, making it ideal for the efficient generation of human type specific cells such as dendritic cells

from peripheral blood progenitors. Recombinant Proteintech Human GM-CSF is a 15 to 36 kDa protein consisting of 128 amino acids, containing two intramolecular disulfide bonds and two potential N-linked glycosylation sites (Figure 2).

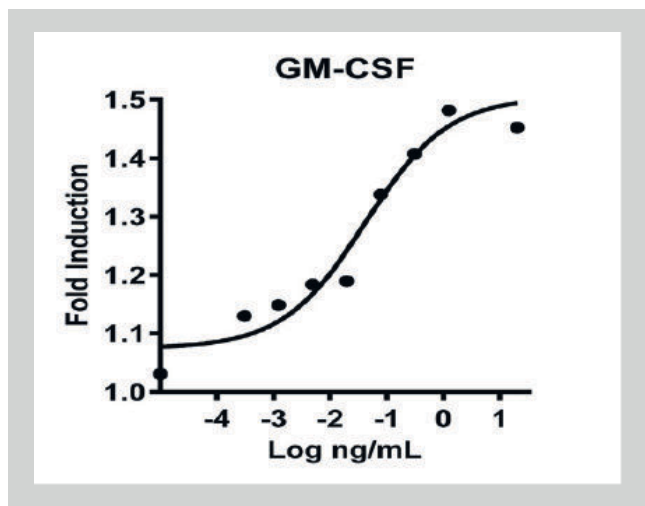


Figure 1. The activity was determined by the dose-dependent stimulation of the proliferation of human TF-1 cells (human erythroleukemic indicator cell line) using a Promega CellTiter96® Aqueous Non-Radioactive Cell Proliferation Assay.

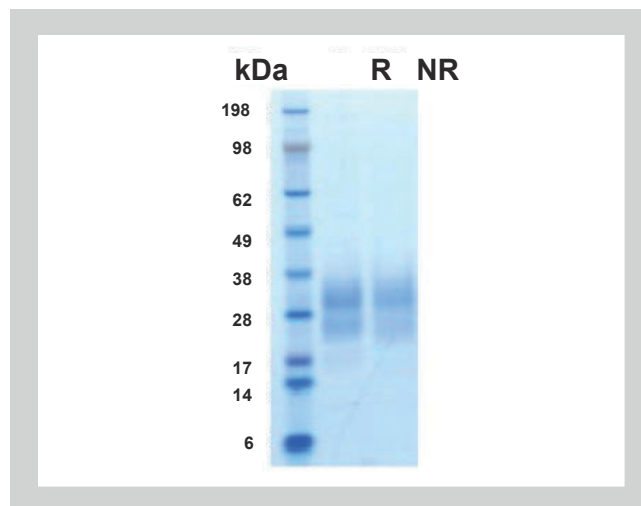


Figure 2. The protein was resolved by SDS-polyacrylamide gel electrophoresis and the gel was stained with Coomassie blue. R represents the reduced condition and NR represents the non-reduced condition.

# The role of GM-CSF role in leukemia and breast cancer - Proteintech's Humankine® GM-CSF.

Proteintech's Humankine® GM-CSF was used in a study showing the potential treatment of juvenile myelomonocytic leukemia with a GM-CSF-neutralizing antibody and JAK2 inhibitors (6). Additionally, it has been cited in a phase 1 study for HER2-expressing breast cancer patients (7)

Little is still known about how GM-CSF production is regulated

in T lymphocytes. Does GM-CSF produced by T cells play a role in regulating the differentiation and function of antigen-presenting cells? Even more importantly, can T cells respond directly to GM-CSF? Working with Proteintech's GM-CSF Humankine might help to answer such questions, in addition to making it possible to better define its further clinical applications.

## References:

1. Granulocyte-macrophage colony-stimulating factor (GM-CSF) and T-cell responses: what we do and don't know.
2. GM-CSF: An Immune Modulatory Cytokine that can Suppress Autoimmunity.
3. The granulocyte-macrophage colony-stimulating factors.
4. Human granulocyte-macrophage colony-stimulating factor is a neutrophil activator.
5. Purified human granulocyte-macrophage colony-stimulating factor: direct action on neutrophils.
6. GM-CSF-dependent pSTAT5 sensitivity is a feature with therapeutic potential in chronic myelomonocytic leukemia.
7. A phase 1 study of a heterologous prime-boost vaccination involving a truncated HER2 sequence in patients with HER2-expressing breast cancer.



# FROM OUR BENCH TO YOUR BENCH™

Founded by scientists in 2001, Proteintech manufactures and validates everything in-house, allowing it to maintain complete control over the quality of its products.

- ✓ **Polyclonal antibodies against 12,000 targets**
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- ✓ **Tag/control antibodies**
- ✓ **ELISA kits**
- ✓ **Fusion proteins**
- ✓ **Secondary antibodies**
- ✓ **Animal-free recombinant proteins**

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# CONTACT US

## Proteintech Group *US Head Office*

<b>PHONE</b>	1 (888) 4PTGLAB (1-888-478-4522) (toll free in USA), or 1(312) 455-8498 (outside USA)
<b>FAX</b>	1 (312) 455-8408
<b>ADDRESS</b>	Proteintech Group, Inc. 5400 Pearl Street, Suite 300, Rosemont, IL 60018, USA
<b>EMAIL</b>	proteintech@ptglab.com

## Proteintech Europe *United Kingdom*

<b>PHONE</b>	+44 (161) 8393007
<b>FAX</b>	+44 (161) 2413103
<b>ADDRESS</b>	Proteintech Europe, Ltd. 4th Floor, 196 Deansgate, Manchester, M3 3WF
<b>EMAIL</b>	europe@ptglab.com

## Proteintech Europe *Germany*

<b>EMAIL</b>	germany@ptglab.com <b>Sales and technical support only.</b>
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## Proteintech *China Office*

<b>PHONE</b>	027-87531629 or 4006-900-926
<b>FAX</b>	027-87531627
<b>ADDRESS</b>	Wuhan Sanying Biotechnologies D3-3, No.666 Gaoxin Avenue, Wuhan East Lake Hi-tech Development Zone Wuhan, Hubei, P.R.C
<b>EMAIL</b>	Proteintech-CN@ptglab.com

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