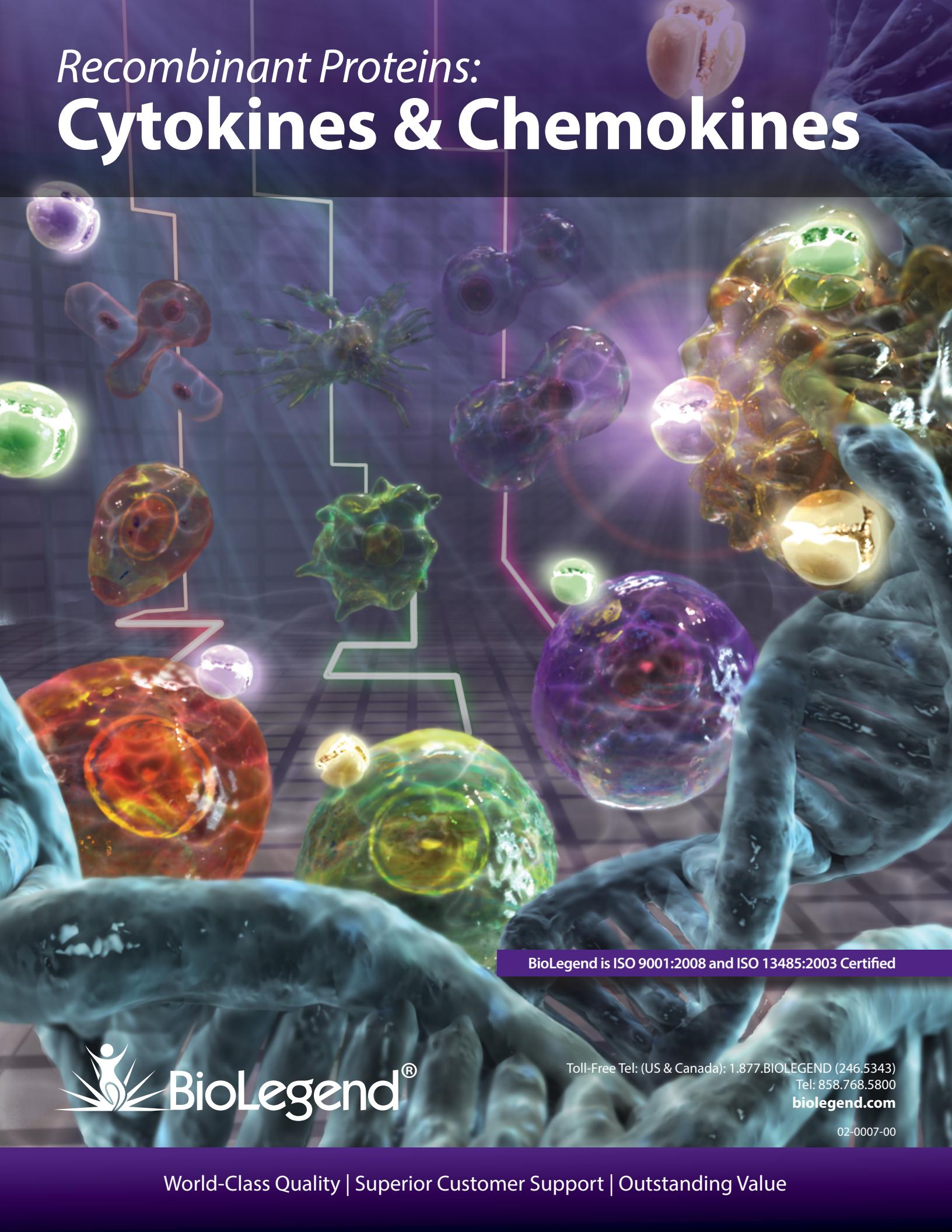


Recombinant Proteins: Cytokines & Chemokines



BioLegend is ISO 9001:2008 and ISO 13485:2003 Certified



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BioLegend Recombinant Proteins

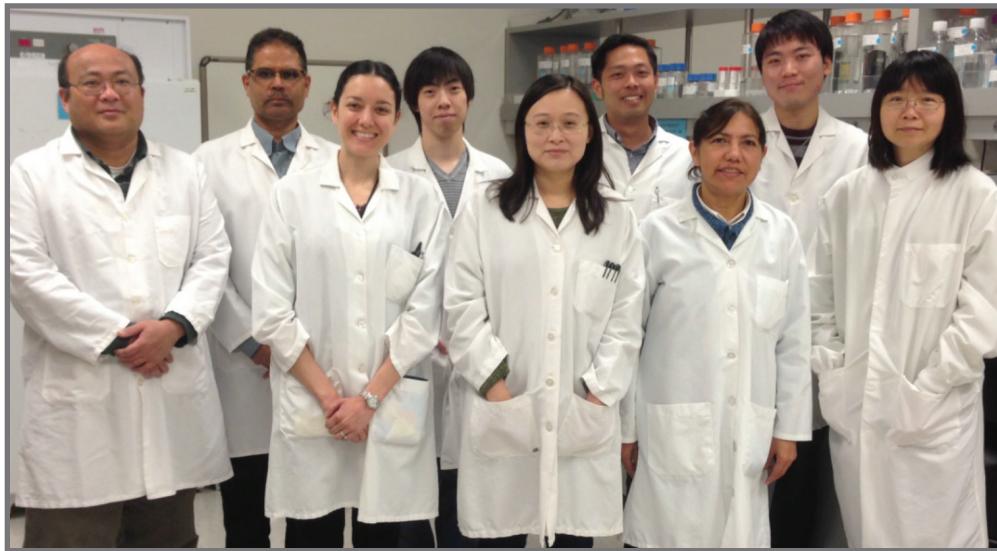
Recombinant proteins are an important tool for scientists in studying biological mechanisms and discovering cell function. BioLegend is proud to present a diverse range of mouse and human recombinant proteins. BioLegend's growing portfolio of recombinants includes chemokines, interleukins, the TNF family members, and growth factors.

Why choose BioLegend?

BioLegend offers a wide variety of recombinant proteins for your bioassay needs.

Our recombinant proteins are:

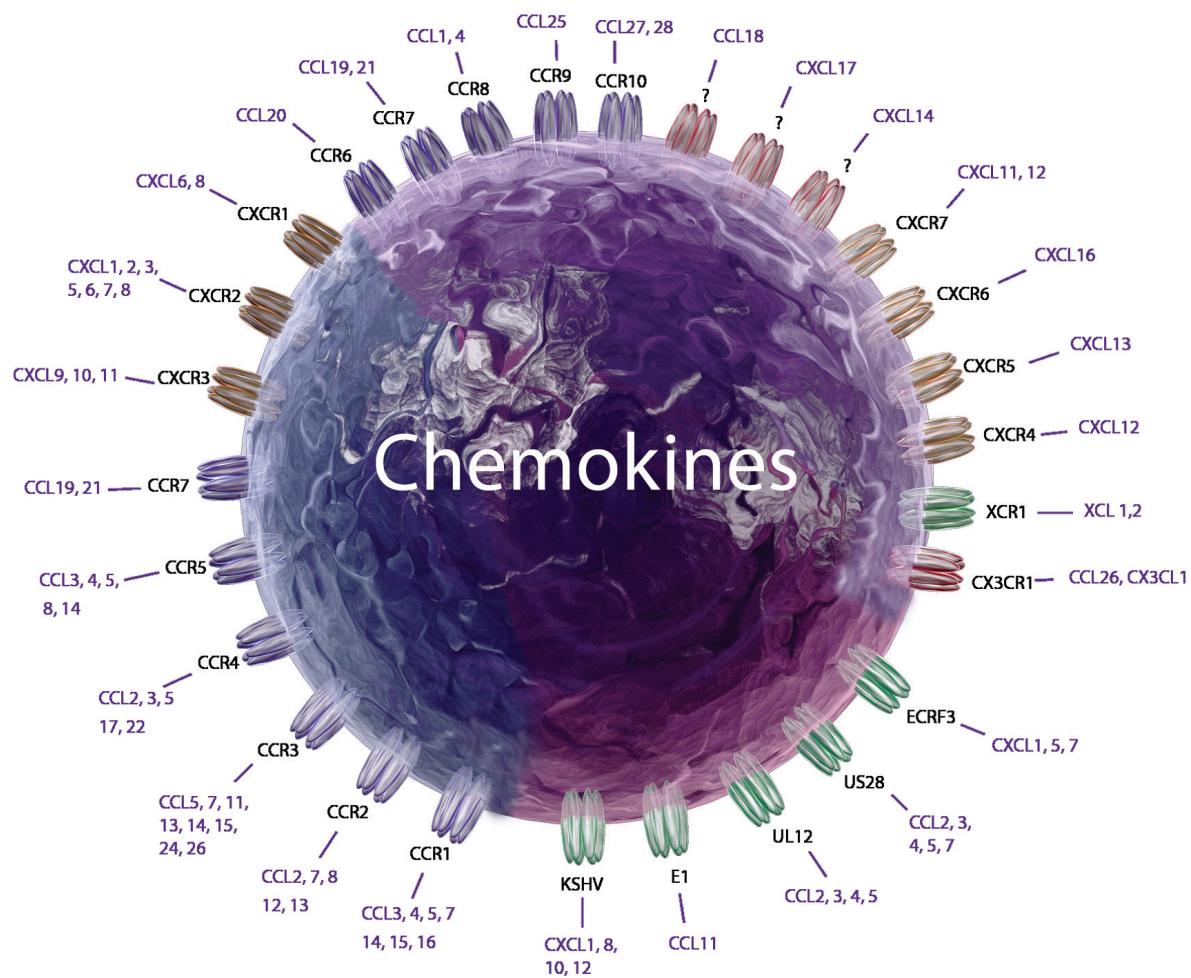
- >95% pure.
- Validated in-house through bioassays to ensure reproducibility and activity.
- Biologically active and compare favorably with the competition's products.
- Endotoxin tested to ensure compatibility with biological systems.
- Stability tested.
- Competitively priced.
- Discounted for bulk orders.



Our Molecular Immunology group produces the highest quality recombinant proteins.

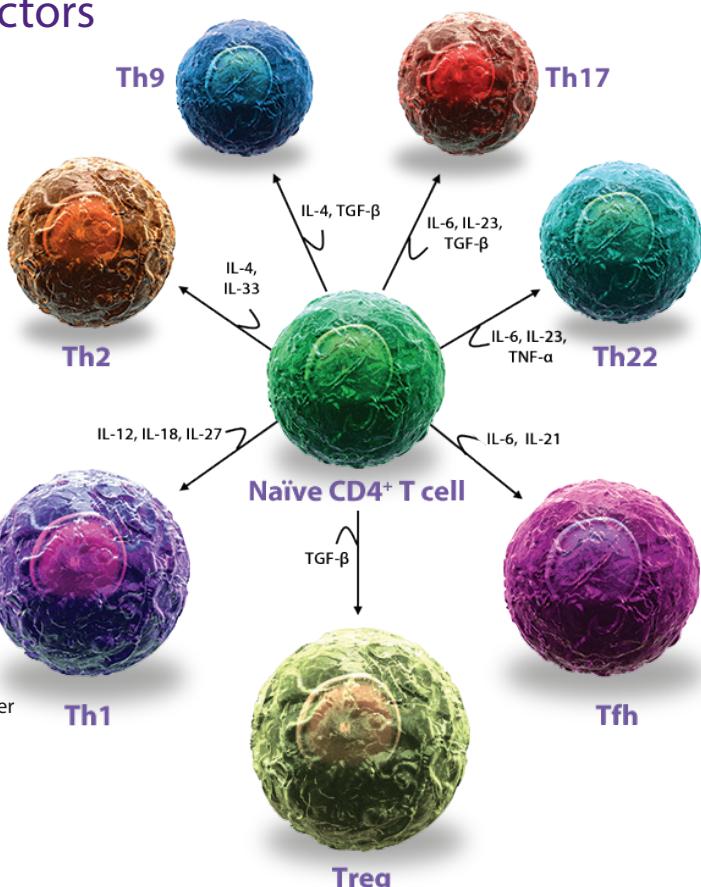
Elevate Your Research with BioLegend Recombinant Proteins

While you may be familiar with many of BioLegend's flow cytometry reagents, you may not be as acquainted with the diverse set of recombinant proteins we develop and manufacture. In order to meet your needs, BioLegend is making a major push to provide researchers with recombinant proteins for *in vitro* bioassay and *in vivo* use. Our expanding catalog now contains over 140 mouse, rat, and human recombinant proteins. We offer exceptional recombinant proteins for use in chemotaxis, cell polarization, and differentiation. In order to guarantee these functions, each and every lot of protein is quality tested against internal (previous lots) and external controls (competitor's products) to ensure full bioactivity and reproducible results. BioLegend is continually improving and listening to customer feedback in order to provide optimal reagents and recombinants for your research.

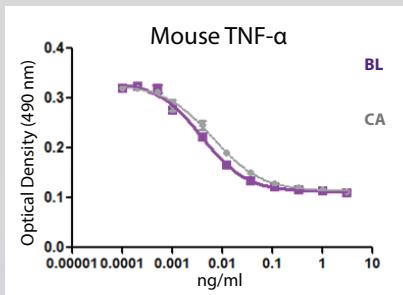


Interleukins, Interferons, and Growth Factors

Cytokines, like interleukins, interferons, and growth factors, allow cells to communicate with one another, inducing a wide range of activities. These factors can incite or prevent inflammation, promote cell growth, or bias cells to differentiate to a particular phenotype. Cytokines mediate their function by binding to their respective receptors, initiating signaling cascades for gene transcription. Growth factors include a diverse group of proteins and molecules. Similar to certain cytokines, they can also enhance cell proliferation, growth, and differentiation. Growth factors are known to aid in wound repair and regulate tissue homeostasis. Due to their capacity to induce cell proliferation, several growth factors have been known to lead to tumor formation and cancer.

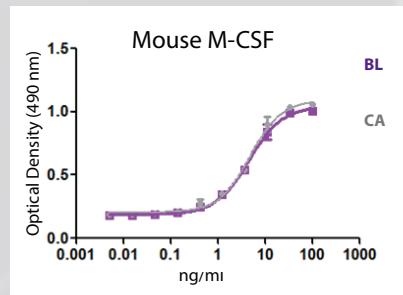


BL = BioLegend CA = Competitor A

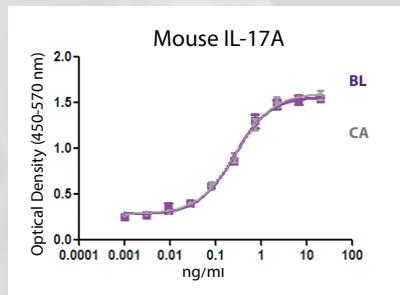


Cytotoxic effect on L929 mouse cells induced by mouse TNF-α.

Comparative Analysis

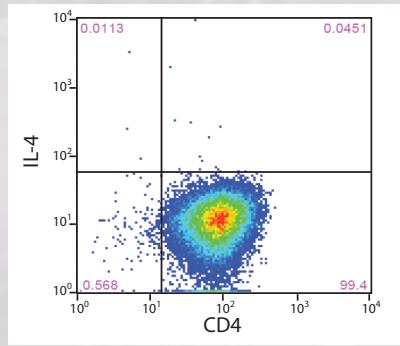
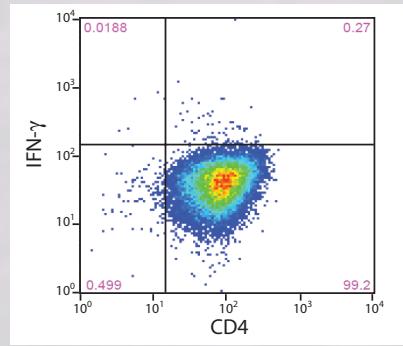
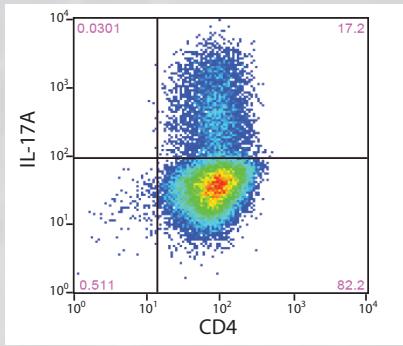


M-NFS60 cell proliferation induced by mouse M-CSF.



Mouse IL-6 induced by mouse IL-17A in fetal mouse skin fibroblasts.

Th17 Polarization with BioLegend Recombinant Proteins

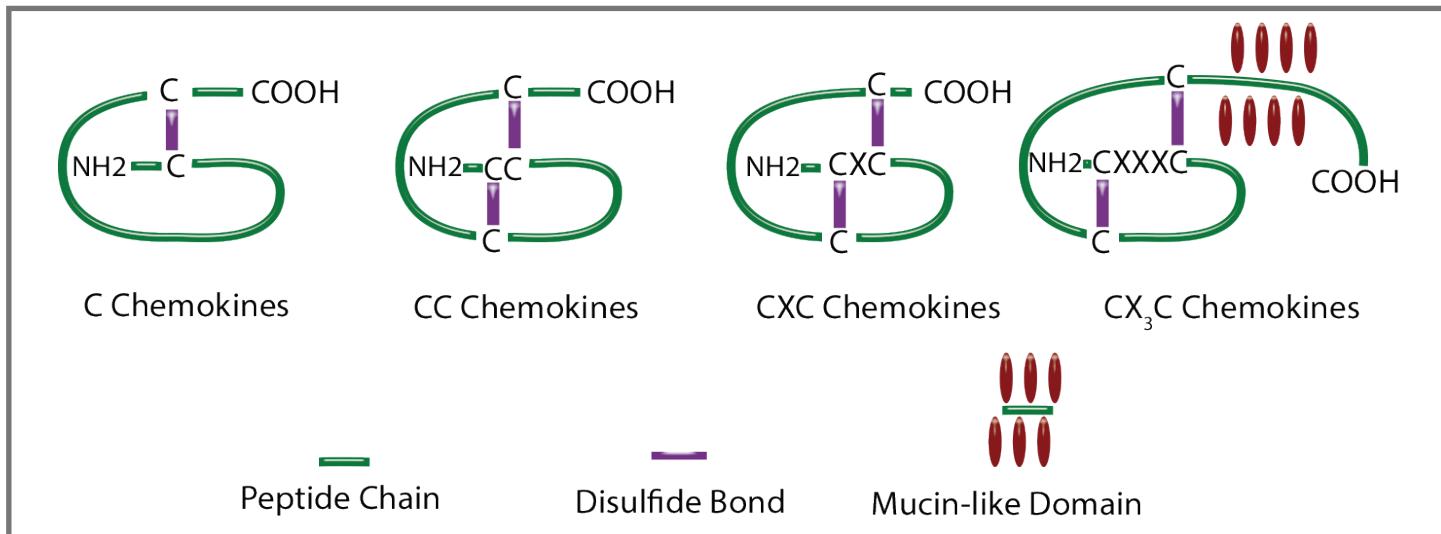


4 Mouse CD4⁺ T cells were polarized with plate-bound anti-mouse CD3, soluble anti-mouse CD28, recombinant mouse IL-6, IL-23, and TGF-β, anti-mouse IL-4, and anti-mouse IFN-γ for 4 days. After re-stimulation with PMA/ionomycin in the presence of BFA or Monensin, the cells were harvested and surface stained with CD4-FITC, and intracellularly stained with IFN-γ-APC, IL-4-APC, or IL-17-PE.

Chemokines

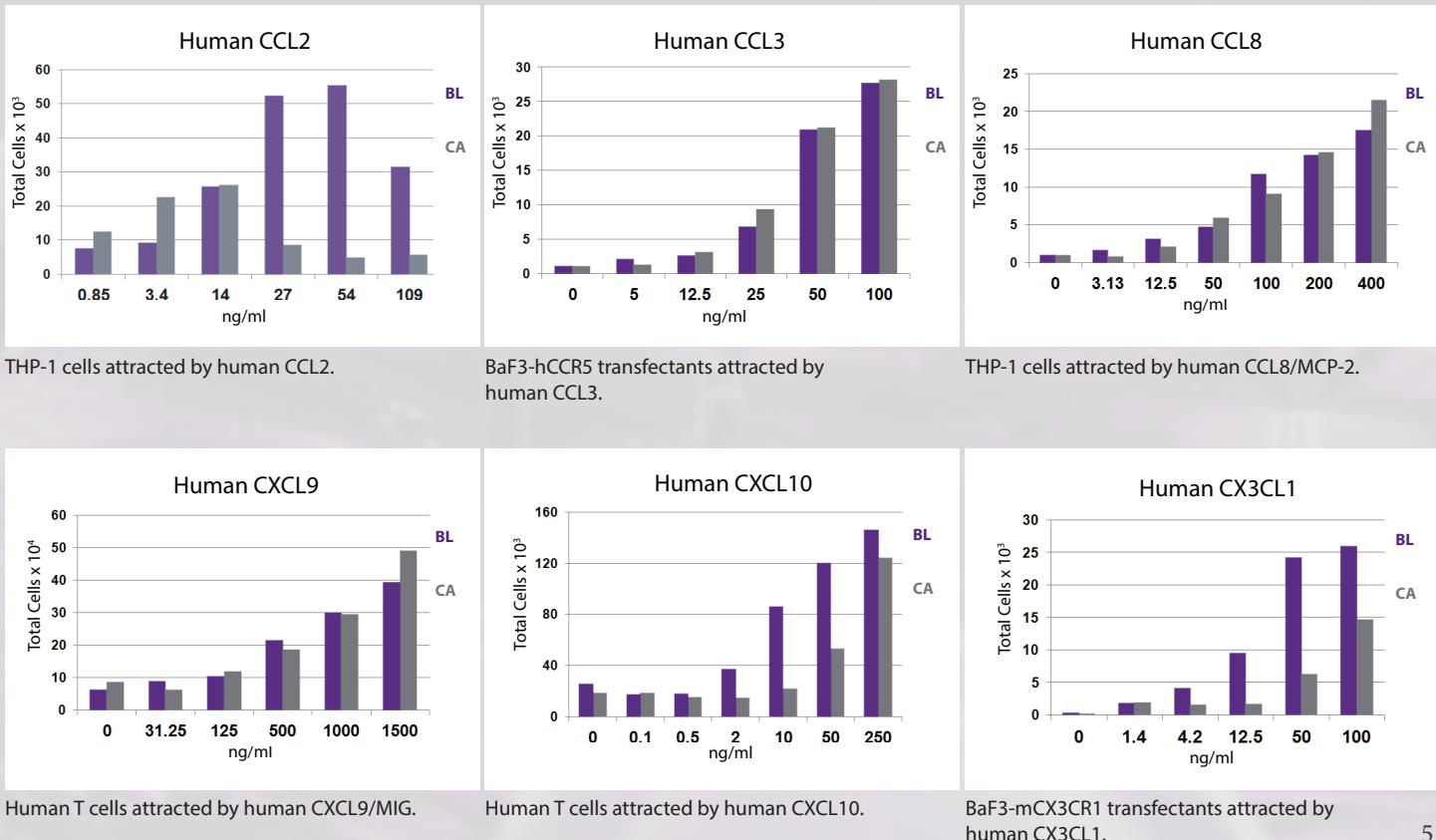
Chemokines are relatively small cytokines focused on inducing cell movement, or chemotaxis. Chemokines contain several (usually four) cysteines in conserved positions within the protein. These cysteines (marked C in the figure below) provide tertiary structure for the chemokine through disulfide bonds.

The spacing and intervening amino acid residues (denoted X) between the first two cysteines determine the type of chemokine. Chemokine receptors consist of seven transmembrane-spanning regions and are often promiscuous, binding to multiple ligands.



BL = BioLegend CA = Competitor A

Comparative Analysis

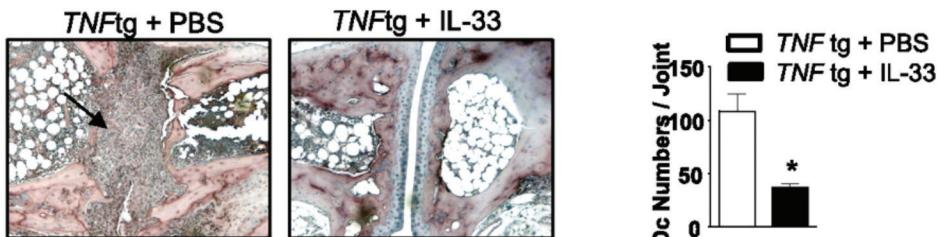


Researcher Spotlight

Dr. George Schett



Photo: Dr. H.E. Langer



Dr. Schett's group injected mice with BioLegend recombinant mouse IL-33 and found that this treatment prevented differentiation of cells into inflammatory osteoclasts (Oc) and bone loss.
Zaiss, M.M. et al. 2011. *J. Immunol.* 186:6097.

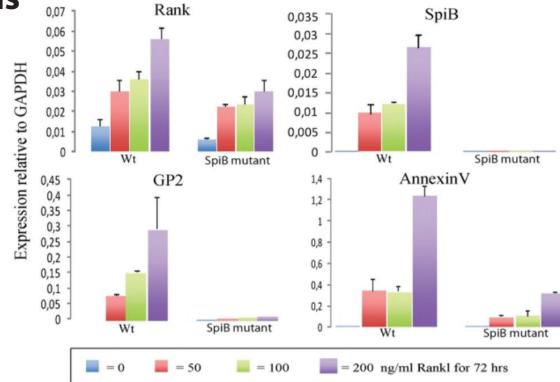
"I am currently the Professor of Internal Medicine and Chairman of the Department of Internal Medicine 3 at the University Erlangen-Nuremberg. My research focuses on basic, translational, and clinical forms of research of several autoimmune diseases. BioLegend's recombinant mouse IL-33 allowed us to analyze its effects on prevention of bone destruction."

-Dr. George Schett, University Erlangen-Nuremberg

Dr. Edward Nieuwenhuis



The Lab of Dr. Edward Nieuwenhuis
(third from the right)



Dr. Nieuwenhuis's group utilized BioLegend recombinant mouse RANKL to stimulate wild-type or SpiB mutant minigut organoid cultures to detect gene expression of RANK, SpiB, GP2, and Annexin V.
de Lau, W., et al. 2012. *Mol. Cell. Biol.* 32:3639.

"Our lab of pediatric gastroenterology focuses on the immune system of the gut and different enteropathies. By using BioLegend's recombinant mouse RANKL, we successfully established a culture system for large amounts of M-cells, a rare cell type in the small intestine which plays an important role in immune homeostasis of the gut. This culture system gives us the unique opportunity to further study the differentiation and function of M-cells in health and disease."

-Dr. Edward Nieuwenhuis, University Medical Centre Utrecht

Dr. Steven Dow

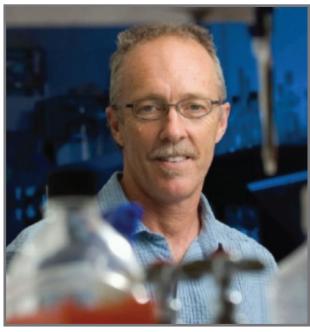
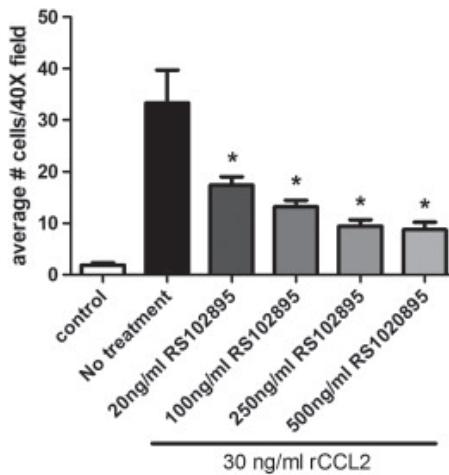


Photo: College of Veterinary Medicine & Biomedical Sciences



Dr. Dow's group measured the ability of an antagonistic drug (RS102895) to prevent chemotaxis induced by BioLegend recombinant mouse CCL2.
Mitchell, L.M. et al. 2013. *Intl Immupharmacl.* 15:357.

"Our lab uses BioLegend mouse rCCL2 in monocyte migration assays. These studies are done with Boyden chambers and are used to identify novel compounds or repurposed drugs that can be applied *in vivo* for vaccine enhancement and cancer therapeutics."

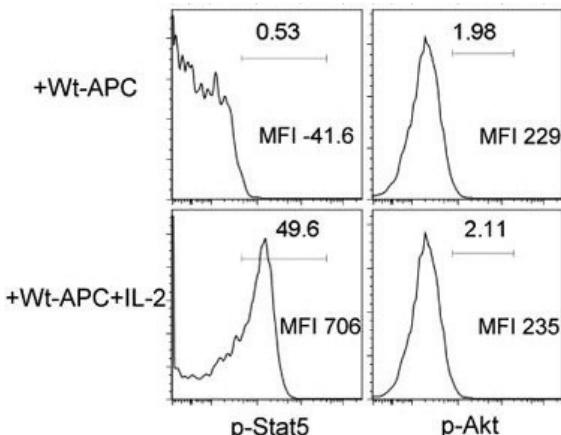
-Dr. Steven Dow, Colorado State University

Researcher Spotlight

Dr. Xian C. Li



Dr. Xian C. Li (Left).

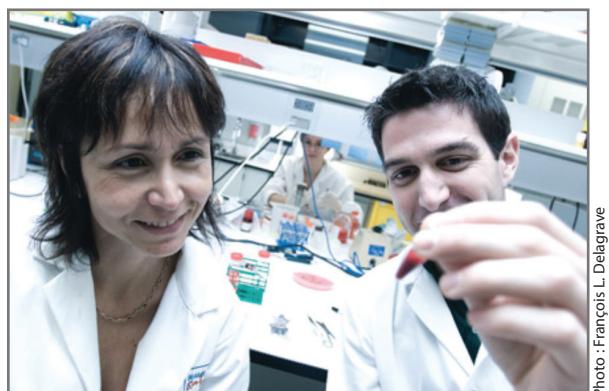


Dr. Li's group stimulated mouse Tregs with BioLegend recombinant mouse IL-2 and measured Stat5 and Akt phosphorylation through flow cytometry. Xiao, X. et al. 2012. *J. Immunol.* 188: 892.

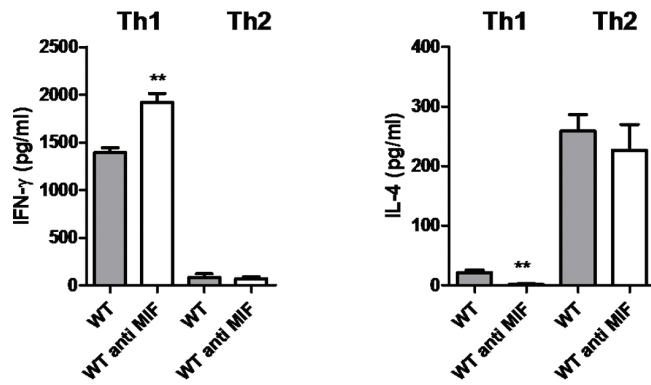
"We are interested in IL-2 and IL-15 and how such cytokines regulate different facets of T cells, particularly Tregs and memory T cells. The proteins from BioLegend are instrumental in our endeavor in this area."

-Dr. Xian C. Li, Harvard Medical School

Dr. Tatiana Scorza



Dr. Tatiana Scorza (Left)



Dr. Scorza's group tested the effect of neutralization of migration inhibitory factor on production of hallmark Th1 and Th2 cytokines by cells polarized with BioLegend recombinant proteins and antibodies. Malu, D.T. et al. 2011. *J. Immunol.* 186:6271.

"Our lab is focused on studying the interaction between malaria parasites and the immune system, particularly the induction of immunosuppressive factors in macrophages following contact with Plasmodium or with damaged red blood cells. BioLegend has provided numerous recombinant proteins which have allowed us to explore the mechanism of the host response to malarial infection."

-Dr. Tatiana Scorza, Université du Québec à Montréal

BioLegend Recombinant Proteins

Interleukins, Interferons, and Growth Factors

Protein	Human	Mouse	Rat
IL-1 α	570002/570004/570006/570008	575002/575004/575006/575008	-
IL-1 β	579402/579404/579406/579408	575102/575104/575106/575108	-
IL-2	589102/589104/589106/589108	575402/575404/575406/575408	579502/579504/579506/579508
IL-3	578002/578004/578006/578008	575502/575504/575506/575508	-
IL-4	574002/574004/574006/574008	574302/574304/574306/574308	-
IL-5	560701	581502/581504/581506/581508	-
IL-6	570802/570804/570806/570808	575702/575704/575706/575708	-
IL-7	581902/581904/581906/581908	577802/577804	-
IL-10	571002/571004/571006/571008	575802/575804/575806/575808	-
IL-10 (Mammalian Expressed)	573202/573204/573206	-	-
IL-11	585902/585904/585906/585908	586002	-
IL-12 (p40)	-	573102/573104/573106/573108	-
IL-12 (p70)	573002/573004/573006/573008	577002/577004/577006/577008	-
IL-13	571102/571104/571106	575902/575904/575906/575908	-
IL-15	570302/570304/570306/570308	566301/566302/566304	-
IL-17A	570502/570504/570506/570508	576002/576004/576006/576008	-
IL-17F	570606	576106/576108	-
IL-17A/F	580602/580604/580606/580608	580802/580804/580806/580808	-
IL-17E (IL-25)	-	587302/587304/587306	-
IL-21	571202/571204/571206/571208	574502/574504/574506	-
IL-22	571302/571304/571306/571308	576202/576204/576206/576208	-
IL-23	574102	589002/589004/589006/589008	-
IL-27	589202/589204	577402/577404/577406/577408	-
IL-33	581802/581804/581806/581808	580502/580504/580506/580508	-
IL-34	577902/577904/577906	577602/577604/577606/577608	-
EGF	585506/585508	585606/585608	-
EPO	587102/587104/587106/587108	-	-
FGF-basic	-	579602/579604/579606/579608	-
FGF-basic/145aa	571502/571504/571506/571508	-	-
G-CSF	578602/578604/578606	574602/574604/574606/574608	-
GM-CSF	572902/572903/572904/572905	576302/576304/576306/576308	-
IFN- β 1	-	581302/581304/581306	-
IFN- γ	570202/570204/570206/570208	575302/575304/575306/575308	-
Isthmin-1	-	577502	-
M-CSF	574802/574804/574806/574808	576402/576404/576406/576408	-
PDGF-BB	577302/577304/577306/577308	-	-
SCF	573902/573904/573906/573908	579702/579704/579706/579708	-
TACI-Fc Chimera	-	577702/577704/577706/577708	-
TGF- β 1*	580702/580704/580706	-	-
TGF- β 2*	583301	-	-
TGF- β 3*	585802	-	-
TNF- α	570102/570104/570106/570108	575202/575204/575206/575208	580102/580104/580106/580108
TNF- β (LT- α)	562603	-	-
TRANCE (RANKL)	-	577102	-
TWEAK (CD255)	566402	-	-
TSLP	582402/582404/582406/582408	-	-
VEGF-120	-	580902/580904/580906/580908	-
VEGF-121	583202/583204/583206/583208	-	-
VEGF-164	-	583102/583104/583106/583108	-
VEGF-165	583702/583704/583706/583708	-	-

*Also cross-reactive against mouse

BioLegend Recombinant Proteins

Chemokines

Protein	Human	Mouse
CCL1 (I-309)	582702/582704/582706/582708	584802
CCL2 (MCP-1)	571402/571404/571406/571408	578402/578404/578406
CCL3 (MIP-1 α)	582802/582804/582806	-
CCL5 (RANTES)	580202/580204/580206/580208	-
CCL7 (MCP-3)	585702/585704/585706	586102/586104/586106/586108
CCL8 (MCP-2)	581602/581604/581606/581608	581702/581704/581706/581708
CCL9 (MIP-1 γ)	-	586202/586204/586206/586208
CCL11 (Eotaxin)	583002/583004/583006/583008	582902/582904/582906/582908
CCL14 (HCC-1)	587202/587204/587206/587208	-
CCL17 (TARC)	573802/573804/573806/573808	581402/581404/581406/581408
CCL19 (MIP-3 β)	582102/582104/582106/582108	-
CCL20 (MIP-3 α)	583802/583804	582302/582304/582306/582308
CCL21 (6CKine)	582202/582204/582206/582208	586402/586404/586406/586408
CCL22 (MDC)	584902/584904	582602/582604
CCL23 (MPIF-1) (Arg22-Ans120)	586902/586904/586906/586908	-
CCL23 (MPIF-1) (Arg46-Ans120)	587002/587004/587006/587008	-
CCL24 (Eotaxin-2)	585002/585004/585006/585008	585102/585104/585106/585108
CCL25 (TECK)	586802/586804/586806/586808	589302/589304/589306/589308
CCL26 (Eotaxin-3)	585202/585204/585206/585208	-
CCL27 (CTACK)	583602/583604/583606	-
CCL28 (MEC)	584602/584604/584606/584608	584702/584704/584706/584708
CXCL1 (GRO- α)	574402/574404/574406/574408	573702/573704/573706/573708
CXCL2 (GRO- β)	582002/582004/582006/582008	582502/582504/582506/582508
CXCL3 (GRO- γ)	586302/586304/586306/586308	-
CXCL5 (ENA-78)	573402/573404/573406/573408	-
CXCL6 (GCP2)	586502/586504/586506	573302/573304/573306/573308†
CXCL7 (NAP-2)	586602/586604	586702/586704
CXCL8 (IL-8)	574202/574204/574206/574208	-
CXCL9 (MIG)	578102/578104/578106/578108	578202/578204/578206/578208
CXCL10 (IP-10)	573502/573504/573506/573508	573602/573604
CXCL11 (ITAC)	574902/574904/574906/574908	578302/578304/578306/578308
CXCL12 (SDF-1 α)	581202/581204/581206/581208	578702/578704/578706/578708
CXCL13 (BLC)	574702/574704/574706/574708	583902/583904/583906/583908
CXCL17 (VCC-1)	585302/585304/585306/585308	585402/585404/585406/585408
CX3CL1 (Fractalkine)	583402/583404/583406/583408	583502/583504/583506/583508

†Mouse Cxcl5 is the ortholog of human CXCL6

Recombinant proteins for use as ELISA standards can be found at:
biolegend.com/recombinant_elisa

Upcoming Recombinant Proteins

BioLegend is always expanding its portfolio of recombinant proteins!
Be on the lookout for our new proteins: biolegend.com/new_products

Want to suggest a recombinant protein we don't have yet?
Contact us here: biolegend.com/suggest_a_product

Learn More: biolegend.com/recombinant_proteins

Chemokines Webpage: biolegend.com/chemokine_receptors

- Learn about chemokine structure and their classifications.
- Full table on chemokines and each respective receptor.
- Gain insight on the role of chemokines in inflammation and homeostasis.

Interleukin Receptors Webpage: biolegend.com/interleukin_receptors

- Visual structures for each receptor.
- Ligands assigned for every receptor.
- Useful information on function and distribution.

Frequently Asked Questions

How does the activity of your recombinant proteins compare to competitors?

We quality control each and every lot of recombinant protein. Not only do we check its bioactivity, but we also compare it against other commercially available recombinant proteins. We make sure each recombinant protein's activity is at least as good as or better than the competition's. In order to provide you with the best possible product, we ensure that our testing process is rigorous and thorough. If you're curious and eager to make the switch to BioLegend recombinants, contact sales@biolegend.com today!

What is the difference between the carrier-free and the non carrier-free recombinant proteins?

Carrier-free recombinant proteins do not have any additional protein, while non carrier-free recombinant proteins do. The carrier-free format provides flexibility for the customer. When the presence of carrier is not desirable (i.e., *in vivo* applications), carrier-free proteins can be used directly. When carrier proteins do not affect the outcome in a study, the customer can decide what type of carrier protein they would like to use and whether it is necessary to add it to their stock.

How are BioLegend's carrier-free recombinant proteins shipped?

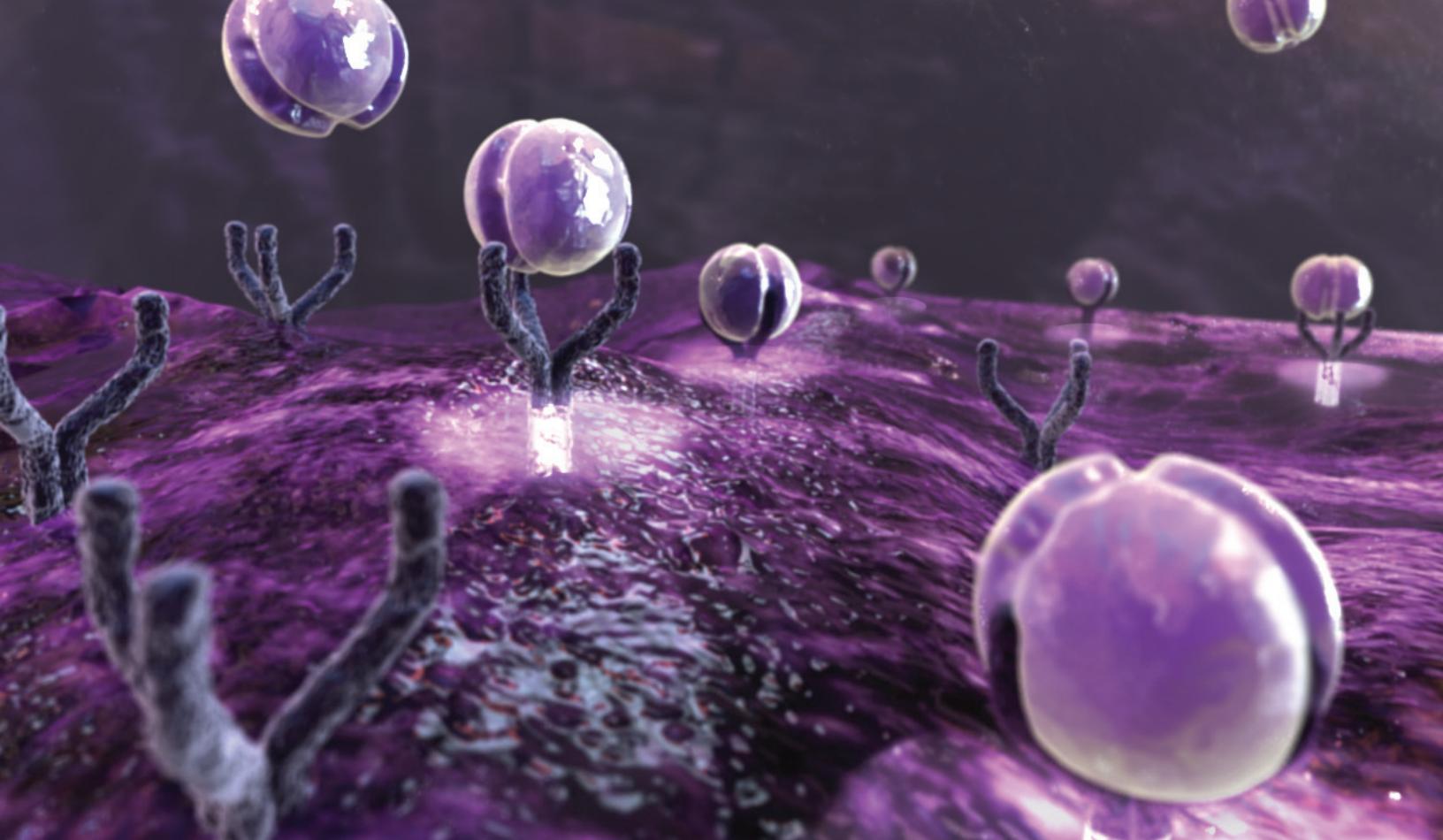
Our carrier-free recombinant proteins are shipped on blue ice. These products have been validated to maintain activity after shipping using blue ice.

What is the specific activity or ED50 of my recombinant protein?

This information is typically lot-dependent. Contact techserv@biolegend.com today to find out. Please have the lot number ready (it is written on the vial label and starts with B).

What should I reconstitute the protein with? What do you recommend for its long-term storage?

Our recombinant proteins are shipped in liquid form, so there is no need for reconstitution. If you need to make dilutions, refer to the formulation on the product datasheet. Stock solutions should be prepared at no less than 10 µg/mL in buffer containing carrier protein such as 1% BSA or HSA or 10% FBS (for chemokines, use either BSA or HSA). For long-term storage, aliquot into polypropylene vials and store in a manual defrost freezer. Avoid repeated freeze/thaw cycles.



TNF- α binding to its receptor, TNFR.

Additional References Using BioLegend Recombinant Proteins

Human IFN- γ

1. Meissner, T.B., et al. 2010. *PNAS*. 107:13794.
2. Meissner, T.B., et al. 2012. *J. Immunol.* 188:4951.

Human IL-2

1. Wang, N., et al. 2010. *J. Immunol.* 185:5683.
2. Wingender, G., et al. 2011. *J. Exp. Med.* 208:1151.

Human IL-22

1. Dhiman, R., et al. 2009. *J. Immunol.* 183:6639.

Human PDGF-BB

1. Banerjee, P., et al. 2011. *J. Biol. Chem.* 286:33580.

Human TGF- β

1. Alcaide, P., et al. 2012. *J. Immunol.* 188:1421.

Human TWEAK (CD255)

1. Novoyatleva, T., et al. 2010. *Cardiovasc. Res.* 85:681.

Mouse CCL2

1. Mitchell, L.A., et al. 2013. *Int. Immunopharmacol.* 15:357.

Mouse GM-CSF

1. Ahn, J., et al. 2012. *PNAS*. 109:19386.
2. Verhagen, J., et al. 2012. *PNAS*. 110:221.

Mouse IFN- γ

1. Dey, S., et al. 2010. *Mol. Cell. Biol.* 30:2181.
2. Sun, T., et al. 2012. *PNAS*. 109:2117.

Mouse IL-1 α

1. Lee, P.Y., et al. 2011. *J. Immunol.* 186:1747.

Mouse IL-1 β

1. O'Sullivan, B.J., et al. 2006. *J. Immunol.* 176:7278.

Mouse IL-2

1. Alcaide, P., et al. 2012. *J. Immunol.* 188:1421.
2. Detanico, T., et al. 2011. *J. Immunol.* 187:82.
3. Malu, D.T., et al. 2011. *J. Immunol.* 186:6271.

Mouse IL-4

1. Malu, D.T., et al. 2011. *J. Immunol.* 186:6271.
2. Ong, Y.C., et al. 2010. *J. Biol. Chem.* 285:28731.

Mouse IL-6

1. Alcaide, P., et al. 2012. *J. Immunol.* 188:1421.
2. Hilberath, J.N., et al. 2011. *FASEB J.* 25:1827.
3. Suzuki, T., et al. 2011. *J. Biol. Chem.* 286:31263.
4. Wang, Q., et al. 2010. *J. Immunol.* 185:834.

Mouse IL-10

1. Nguyen, H.H., et al. 2012. *J. Immunol.* 189:3112.
2. Schaefer, J.S., et al. 2011. *J. Immunol.* 187:5834.

Mouse IL-12p40 Homodimer

1. Yabu, M., et al. 2010. *Int. Immunol.* 23:29.

Mouse IL-17A

1. Bian, Z., et al. 2012. *J. Immunol.* 188:844.
2. Cho, K.A., et al. 2012. *Int. Immunol.* 24:147.
3. Saha, A., et al. 2012. *Hum. Mol. Genet.* 21:2233.
4. Xu, S., et al. 2010. *J. Immunol.* 185:5879.

Mouse IL-33

1. Barlow, J.L., et al. 2012. *J. Allergy. Clin. Immunol.* 129:151.
2. Miller, A.M., et al. 2010. *Circ. Res.* 107:650.
3. Rosen, M.J., et al. 2013. *J. Immunol.* 190:1849.
4. Zaiss, M.M., et al. 2011. *J. Immunol.* 186:6097.

Mouse TNF- α

1. Alcaide, P., et al. 2012. *J. Immunol.* 188:1421.
2. Azcutia, V., et al. 2012. *J. Immunol.* 189:2553.
3. Theiss, A.L., et al. 2009. *Mol. Biol. Cell.* 20:4412.

Mouse TRANCE (RANKL)

1. de Lau, W., et al. 2012. *Mol. Cell. Biol.* 32:3639.

Rat IL-2

1. Xiao, X., et al. 2012. *J. Immunol.* 188:892.

Contact BioLegend

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International: 1.858.768.5800

Fax: 1.877.455.9587

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International: 1.858.768.5801

email: techserv@biologend.com

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