

Human IL-6 ELISpot Kit – Pre-coated

Instructions for use

Catalogue Numbers:

	Pre-coated
1x96 tests	856.021.001PC
5x96 tests	856.021.005PC

For research use only

Fast Track Your Research.....

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1. Intended use

Diaclone **ELISpot** is a highly specific immunoassay for the analysis of cytokine and other soluble molecule production and secretion from T-cells at a single cell level in conditions closely comparable to the *in-vivo* environment with minimal cell manipulation. This technique is designed to determine the frequency of cytokine producing cells under a given stimulation and the comparison of such frequency against a specific treatment or pathological state. The ELISpot assay constitutes an ideal tool in the investigation of Th1 / Th2 responses, vaccine development, viral infection monitoring and treatment, cancerology, infectious disease, autoimmune diseases and transplantation.

Utilising sandwich immuno-enzyme technology, Diaclone ELISpot assays can detect both secreted cytokines and single cells that simultaneously produce multiple cytokines. Cell secreted cytokines or soluble molecules are captured by coated antibodies avoiding diffusion in supernatant, protease degradation or binding on soluble membrane receptors. After cell removal, the captured cytokines are revealed by tracer antibodies and appropriate conjugates.

This kit has been configured for research use only and is not to be used in diagnostic procedures.

2. Introduction

2.1. Summary

Interleukin-6 (IL-6) is a multi-functional cytokine that regulates immune responses, acute phase reactions and hematopoiesis and may play a central role in host defense mechanisms (13, 31). The gene for human IL-6 has been localized to chromosome 7p21 (1). The genomic sequence has been determined (36). IL-6 is usually not produced constitutively by normal cells, but its expression is readily induced by a variety of cytokines (28), lipopolysaccharide (25) or viral infections (3). The IL-6 gene product is a single chain protein with a molecular mass ranging from 21 to 28 kDa, depending on the cellular source. Extensive posttranslational modifications like N- and O-linked glycosylation (20) as well as phosphorylation (21) seem to account for this heterogeneity. The cDNA for IL-6 predicts a precursor protein of 212 amino acids (10). IL-6 is a pleiotropic cytokine produced by a variety of cells. It acts on a wide range of tissues, exerting growth-induction, growth-inhibition, and differentiation respectively, depending on the nature of the target cells.

IL-6 is involved in

- the induction of B-cell differentiation,
- the induction of acute phase proteins in liver cells,
- growth promotion of myeloma/plasmacytoma/hybridoma cells,
- induction of IL-2 and IL-2 receptor expression,
- proliferation and differentiation of T cells,
- inhibition of cell growth of certain myeloid leukemic cell lines and induction of their differentiation to macrophages,
- enhancement of IL-3-induced multipotential colony cell formation in hematopoietic stem cells and induction of maturation of megakaryocytes as a thrombopoietic factor,
- induction of mesangial cell growth,
- induction of neural differentiation of PC 12 cells and
- induction of keratinocyte growth (14).

The abnormal production of IL-6 was first suggested to be related to polyclonal B-cell activation with autoantibody production in patients with cardiac myxoma (9). Since then, IL-6 has been suggested to be

involved in the pathogenesis of a variety of diseases. Measurement of IL-6 levels in serum and other body fluids thus provides more detailed insights into various pathological situations. For Example:

Infections:

Body fluids of patients with acute local bacterial or viral infections and serum of patients with gram-negative or positive bacteremia contain elevated levels of biologically active IL-6 (7, 16).

Obstetric Infections:

IL-6 has emerged as a reporter cytokine for intraamniotic infection (29).

Diseases associated with an altered immune system (polyclonal B-cell abnormalities or autoimmune diseases):

Elevated levels of circulating IL-6 have been detected in patients with cardiac myxoma (11), Castleman's disease (18), rheumatoid arthritis (12), IgM gammopathy and in those with acquired immunodeficiency syndrome (19, 23) as well as alcoholic liver cirrhosis (2, 32).

Proliferative diseases:

Elevated plasma levels of IL-6 are observed in patients with psoriasis (4, 5) and mesangial proliferative glomerulonephritis (15).

Neoplastic Diseases:

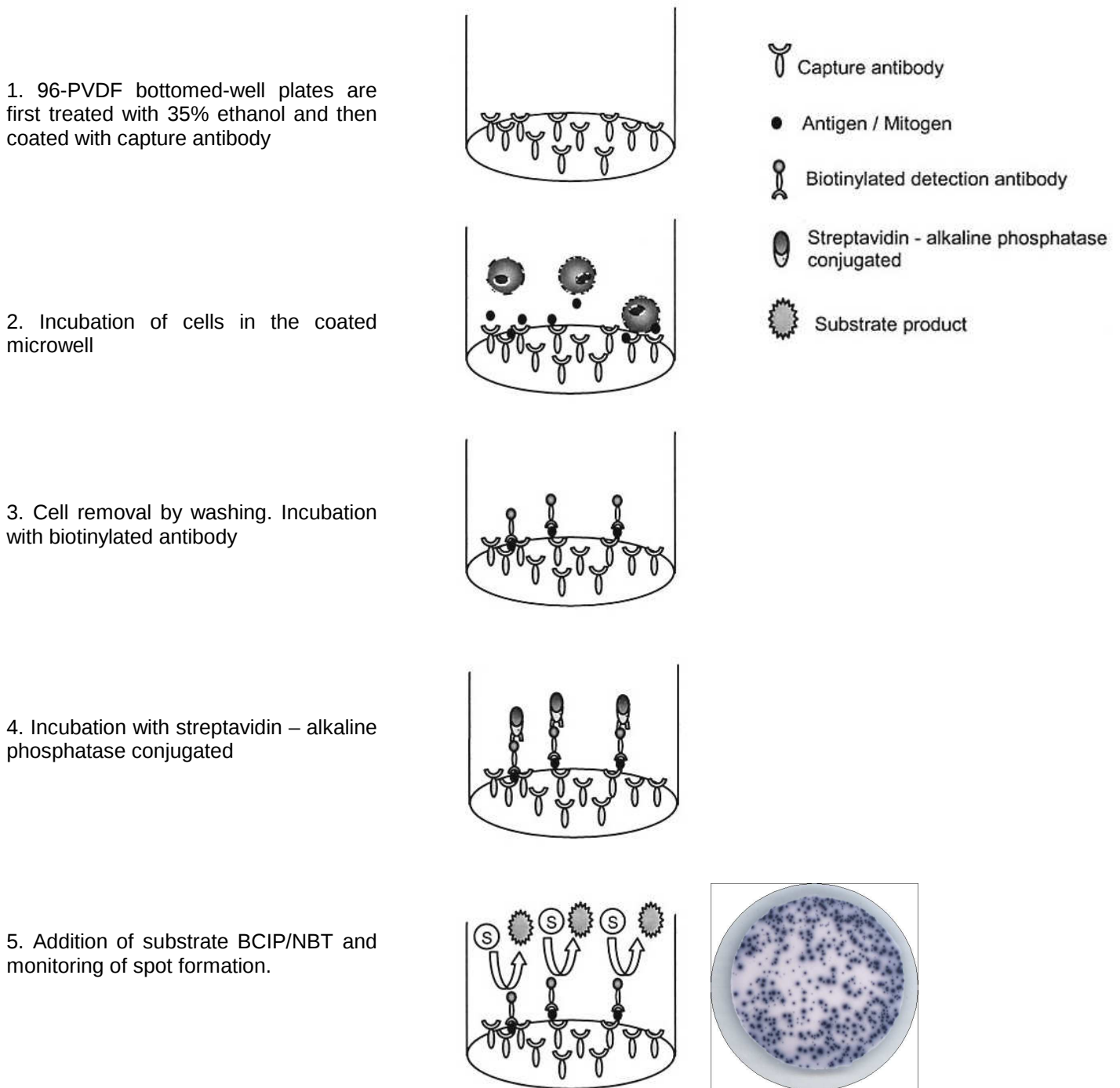
Increased systemic levels of IL-6 have been detected in patients with multiple myeloma (22), other B-cell dyscrasias (27), Lennert's T lymphoma, Castleman's disease, renal cell carcinoma (33) and various other solid tumors (17, 30).

Inflammatory responses:

IL-6 is involved in the induction of acute phase proteins and induction of fever (8). Elevated serum levels of IL-6 are also found in patients with severe burns (24, 34), in serum and plasma as a marker for predicting postoperative complications (26), in serum and urine of recipients of kidney transplants before rejection (35), in the serum of septic shock patients (6) and in patients with inflammatory arthritis and traumatic arthritis.

2.2. Principle of the method

A capture antibody highly specific for the analyte of interest is coated to the wells of a PVDF bottomed 96 well microtitre plate either during kit manufacture or in the laboratory. The plate is then blocked to minimise any non-antibody dependent unspecific binding and washed. Cell suspension and stimulant are added and the plate incubated allowing the specific antibodies to bind any analytes produced. Cells are then removed by washing prior to the addition of Biotinylated detection antibodies which bind to the previously captured analyte. Enzyme conjugated streptavidin is then added binding to the detection antibodies. Following incubation and washing substrate is then applied to the wells resulting in coloured spots which can be quantified using appropriate analysis software or manually using a microscope.



3. Reagents provided (Contents shown for 5x96 test format)

- Pre-coated 96 well PVDF bottomed plates (5)
- Biotinylated detection antibody (lyophilised, resuspend in 0.55ml)
- Streptavidin-Alkaline Phosphatase conjugate (50µl)
- Bovine Serum Albumin (BSA)
- Ready to use BCIP/NBT substrate buffer (50ml)

Please note for 1x96 demo kits, Biotinylated detection antibody is provided in liquid form.

4. Materials/Reagents required but not provided

- Miscellaneous laboratory plastic and/or glass, if possible sterile
- Cell culture reagents (e.g. RPMI-1640, L-glutamine, FCS)
- Cell stimulation reagents (e.g. PMA, Ionomycin)
- CO₂ incubator
- Tween 20
- Phosphate Buffered Saline (PBS)

5. Storage Instructions

Store kit reagents between 2 and 8°C. Immediately after use remaining reagents should be returned to cold storage (2 to 8°C). Expiry of the kit and reagents is stated on box front labels. The expiry of the kit components can only be guaranteed if the components are stored properly, and if in the case of repeated use of one component, the reagent is not contaminated by the first handling.

6. Safety & Precautions for use

- For **research use only** not to be used as a diagnostic test
- Handling of reagents, serum or plasma specimens should be in accordance with local safety procedures , e.g.CDC/NIH Health manual : " Biosafety in Microbiological and Biomedical Laboratories" 1984
- Do not eat, drink, smoke or apply cosmetics where kit reagents are used
- Do not pipette by mouth
- When not in use, kit components should be stored refrigerated or frozen as indicated on vials or bottles labels
- All reagents should be warmed to room temperature before use.
- Cover or cap all reagents when not in use
- Do not mix or interchange reagents between different lots
- Do not use reagents beyond the expiration date of the kit
- Use a clean disposable plastic pipette tip for each reagent, standard, or specimen addition in order to avoid cross contamination
- Use a clean plastic container to prepare the washing solution
- Thoroughly mix the reagents and samples before use by agitation or swirling
- All residual washing liquid must be drained from the wells by efficient aspiration or by decantation followed by tapping the plate forcefully on absorbent paper. Never insert absorbent paper directly into the wells
- When pipetting reagents, maintain a consistent order of addition from well-to-well. This will ensure equal incubation times for all wells
- **BCIP/NBT buffer** is potentially carcinogenic and should be disposed of appropriately, caution should be taken when handling this reagent, always wear gloves
- Follow incubation times described in the assay procedure

7. Reagent Preparation

7.1. 1X Phosphate Buffered Saline (PBS)

For 1 litre of 10X PBS weigh-out: 80g NaCl
 2g KH₂PO₄
 14.4g Na₂HPO₄ · 2H₂O.

Add distilled water to 1 litre. Adjust the pH of the solution to 7.4 +/- 0.1 were required.

Dilute the solution to 1X before use.

7.2. 1% BSA PBS Solution (Dilution Buffer)

For one plate dissolve 0.2 g of BSA in 20 ml of 1X PBS.

7.3. 0.05% PBS-T Solution (Wash Buffer)

For one plate dissolve 50µl of Tween 20 in 100 ml of 1X PBS.

7.4. Detection Antibody

Reconstitute the lyophilised antibody with 0.55mL of distilled water. Gently mix the solution and wait until all the lyophilised material is back into solution.

If not used within a short period of time, reconstituted Detection Antibody should be aliquoted and stored at -20°C. In these conditions the reagent is stable for at least one year. For optimal performance prepare the reconstituted antibody dilution immediately prior to use.

Dilute 100µl of antibody into 10ml Dilution Buffer and mix well.

Please note for 1x96 demo kits, Biotinylated detection antibody is provided in liquid form

7.5. Streptavidin – AP conjugate

For optimal performance prepare the Streptavidin-AP dilution immediately prior to use

For 1 plate dilute 10µl of Streptavidin-HRP conjugate into 10 mL Dilution Buffer and mix well.

Do not keep this solution for further experiments.

8. Sample and Control Preparation

8.1. Cell Stimulation

Cells can either be stimulated directly in the antibody coated wells (Direct) or, first stimulated in 24 well plates or flask, harvested, and then plated into the coated wells (Indirect).

The method used is dependent on 1) the type of cell assayed 2) the expected cell frequency. When a low number of cytokine producing cells are expected it is also advised to test them with the direct method, however, when this number is particularly high it is better to use the indirect ELISpot method.

All the method steps following stimulation of the cells are the same whatever the method (direct/indirect) chosen.

8.2. Positive Assay Control, IL-6 production

We recommend using the following polyclonal activation as a positive control in your assay.

Dilute PBMC in culture media (e.g. RPMI 1640 supplemented with 2mM L-glutamine and 10% heat inactivated fetal calf serum) containing 1µg/ml LPS (Sigma, Saint Louis, MO). Distribute 1×10^4 to 2.5×10^4 cells per 100µl in required wells of an antibody coated 96-well PVDF plates and incubate for 15-20 hours in an incubator.

For antigen specific stimulation, the optimal concentration of the antigen and the optimal concentration of number of cells have to be determined experimentally, as it is depending on the frequency of cytokine producing cells

8.3. Negative Assay Control

Dilute PBMC in culture media to give an appropriate cell number (same number of unstimulated cells as stimulated sample cells) per 100µl with no stimulation.

8.4. Sample

Dilute PBMC in culture medium and stimulator of interest (i.e. Sample, Vaccine, Peptide pool or infected cells) to give an appropriate cell number per 100µl.

Optimal assay performances are observed between 1×10^4 to 2.5×10^4 cells per 100µl.

Stimulators and incubation times can be varied depending on the frequency of cytokine producing cells and therefore should be optimised by the testing laboratory.

9. Method

Prepare all reagents as shown in section 7 and 8.

Note: For optimal performance prepare the Streptavidin-AP dilution immediately prior to use

Assay Step		Details
1.	Addition	Add 100µl of 1X PBS to every well
2.	Incubation	Incubate plate at room temperature (RT) for 10 min
3.	Wash	Empty the wells by flicking the plate over a sink & gently tapping on absorbent paper.
4.	Addition	Add 100µl of sample, positive and negative controls cell suspension to appropriate wells providing the required concentration of cells and stimulant (cells may have been previously stimulated see section 8.)
5.	Incubation	Cover the plate and incubate at 37°C in a CO ₂ incubator for an appropriate length of time (10-15 hours) Note: do not agitate or move the plate during this incubation
6.	Addition	Empty the wells and remove excess solution then add 100µl of PBS-T to every well
7.	Incubation	Incubate the plate at 4°C for 10 min
8.	Wash	Empty the wells as previous and wash the plate 3x with 100µl of PBS-T
9.	Addition	Add 100µl of diluted detection antibody to every well
10.	Incubation	Cover the plate and incubate at RT for 1 hour 30 min
11.	wash	Empty the wells as previous and wash the plate 3x with 100µl of PBS-T
12.	Addition	Add 100µl of diluted Streptavidin-AP conjugate to every well
13.	Incubation	Cover the plate and incubate at RT for 1 hour
14.	Wash	Empty the wells and wash the plate 3x with 100µl of PBS-T
15.	Wash	Peel of the plate bottom and wash both sides of the membrane 3x under running distilled water, once washing complete remove any excess solution by repeated tapping on absorbent paper.
16.	Addition	Add 100µl of ready-to-use BCIP/NBT buffer to every well
17.	Development	Incubate the plate for 5-15 min monitoring spot formation visually throughout the incubation period to assess sufficient colour development
18.	Wash	Empty the wells and rinse both sides of the membrane 3x under running distilled water. Completely remove any excess solution by gentle repeated tapping on absorbent paper
Read Spots: allow the wells to dry and then read results. The frequency of the resulting coloured spots corresponding to the cytokine producing cells can be determined using an appropriate ELISpot reader and analysis software or manually using a microscope. <i>Note: spots may become sharper after overnight incubation at 4°C</i>		

Plate should be stored at RT away from direct light, but please note colour may fade over prolonged periods so read results within 24 hours.

10. Performance Characteristics

10.1. Specificity

The assay recognizes natural human IL-6.

To define specificity, several proteins were tested for cross reactivity. There was no cross reactivity observed for any protein tested (IL-1 α , IL-1 β , IL-10, IL-12, IFN γ , IL-4, TNF α , IL-8 and IL-13). This testing was performed using the equivalent human IL-6 antibody pair in an ELISA assay.

10.2. Reproducibility and Linearity

Intra-assay reproducibility and linearity were evaluated by measuring the spot development following the stimulation (LPS) of 5 different PBMC cell concentrations, 12 repetitions in 1 batch. The data shows the mean spot number, range and CV for the five cell concentrations.

Cells / well	n	Mean number of spots per well	Min	Max	CV%
10000 recommended	12	467	439	533	5.9%
5000	12	340	327	370	3.9%
2500	12	207	190	225	4.7%
1560	12	118	108	129	6.3%
625	12	64	54	76	10.4%

11. Bibliography

1. Bowcock A. M., J. R. Kidd, M. Lathrop, L. Danshvar, L. May, A. Ray, P. B. Sehgal, K. K. Kidd, and L. L. Cavallisforza. (1988). The human "beta-2 interferon/hepatocyte stimulating factor interleukin-6" gene: DNA polymorphism studies and localization to chromosome 7p21. *Genomics* 3. 8-16.
2. Byl B., I. Roucloux, A. Crusiaux, E. Dupont, and J. Deviere. (1993). Tumor Necrosis Factor-alpha and Interleukin-6 plasma levels in infected cirrhotic patients. *Gastroenterology* 104. 1492-1497.
3. Cayphas S., J. Van Damme, A. Vink, R. J. Simpson, A. Billiau, and J. Van Snick. (1987). Identification of an interleukin HPI - like plasmacytoma growth factor produced by L cells in response to viral infection. *J. Immunol.* 139. 2965-2969.
4. Elder J. T., C. I. Sartor, D. K. Boman, S. Benrazavi, G. J. Fisher, and M. R. Pittelkow. (1992). Interleukin-6 in psoriasis-expression and mitogenicity studies. *Arch. Derm. Res.* 284. 324-332.
5. Grossman R. M., J. Krueger, D. Yourish, A. Granelli-Piperno, D. P., Murphy, L. T. May, T. S. Kupper, P. B. Sehgal, and A. B. Gottlieb. (1989). Interleukin 6 is expressed in high levels in psoriatic skin and stimulates proliferation of cultured human keratinocytes. *Proc. Nati. Acad. Sci. USA* 86. 6367.
6. Hack C. E., E. R. De Groot, R. J. F. Felt-Bersma, J. H. Nuijens, R. J. M. Strack van Schijndel, A. J. M. Eerenberg-Belmer, L. G. Thijss, and L. A. Aarden. (1989). Increased plasma levels of interleukin 6 in sepsis. *Blood* 74. 1704.
7. Helfgott D. C., S. B. Tatter, U. Santhanam, R. H. Clarick, N. Bhardwaj, L. T. May, and P. B. Sehgal. (1989). Multiple forms of IFN- β_2 /IL-6 in serum and body fluids during acute bacterial infection. *J. Immunol.* 142. 948.
8. Helle M., J. P. J. Brakenhoff, E. R. De Groot, and L. A. Aarden. (1988). Interleukin 6 is involved in interleukin-1-induced activities. *Eur. J. Immunol.* 18. 957ff.
9. Hirano T., T. Taga, N. Nakano, K. Yasukawa, S. Kashiwamura, K. Shimizu, K. Nakajima, K. H. Pyun, and T. Kishimoto. (1985). Purification to homogeneity and characterization of human B-cell differentiation factor (BCDF or BSFp-2). *PNAS* 82. 5490-5494.
10. Hirano T., K. Yasukawa, H. Harada, T. Taga, Y. Watanabe, T. Matsuda, S.I. Kashiwamura, K. Nakajima, K. Koyama, A. Iwamatsu, S. Tsunasawa, F. Sakiyama, H. Matsui, Y. Takahara, T. Taniguchi, and T. Kishimoto. (1986). Complementary DNA for a novel human interleukin (BSF-2) that induces B lymphocytes to produce immunoglobulin. *Nature* 324. 73-76.
11. Hirano T., T. Taga, K. Yasukawa, K. Nakajima, N. Nakano, F. Takatsuki, M. Shimizu, A. Murashima, S. Tsunasawa, F. Sakiyama, and T. Kishimoto. (1987). Human B-cell differentiation factor defined by an anti-peptide antibody and its possible role in autoantibody production. *PNAS* 84. 228-231.
12. Hirano T., T. Matsuda, M. Turner, N. Miyasaka, G. Buchan, B. Tang, K. Sato, M. Shimizu, R. Maini, M. Feldmann, and T. Kishimoto. (1988). Excessive production of interleukin 6/B cell stimulatory factor-2 in rheumatoid arthritis. *Eur. J. Immunol.* 18. 1797-1801.
13. Hirano T., and T. Kishimoto. (1990). Interleukin-6. In: *Handbook of Experimental Pharmacology. Peptide Growth Factors and Their Receptors*, edited by M. B. Sporn, A. B. Roberts. Berlin. Springer-Verlag. pp 633-665.
14. Hirano T., A. Shizuo, T. Taga, and T. Kishimoto. (1990). Biological and clinical aspects of interleukin 6. *Immunology Today* 11. 443-449.
15. Horii Y., M. Iwano, E. Hirata, H. Shiiki, Y. Fujii, K. Dohi, and H. Ishikawa. (1993). Role of interleukin-6 in the progression of mesangial proliferative glomerulonephritis. *Kidney Intern.* 43. 71-75.
16. Houssiau F. A., K. Bukasa, C. J. M. Sindic, J. Van Damme, and J. Van Snick. (1988). Elevated levels of the 26k human hybridoma growth factor (interleukin 6) in cerebrospinal fluid of patients with acute infection of the central nervous system. *Clin. Exp. Immunol.* 71. 320ff.
17. Kishimoto T. (1989). The biology of interleukin-6. *Blood* 74. 1-10.
18. Kishimoto T., and T. Hirano. (1988). Molecular regulation of B lymphocyte response. *Ann. Rev. Immunol.* 6. 485-512.
19. O. Martinezmaza. (1992). IL-6 and AIDS. *Res. Immunol.* 143. 764-769.
20. May L. T., J. Grayeb, U. Santhanam, S. B. Tatter, Z. Stoege, D. C. Helfgott, N. Chiorazzi, G. Griener, and P. B. Sehgal. (1988). Synthesis and secretion of multiple forms of b2-interferon/B-cell differentiation factor 2 hepatocyte-stimulating factor by human fibroblasts and monocytes. *J. Biol. Chem.* 263. 7760-7766.
21. May L. T., U. Santhana, S. B. Tatter, D. C. Helfgott, A. Ray, J. Grayeb, and P. B. Sehgal. (1988). Phosphorylation of secreted forms of human b2-interferon/hepatocyte-stimulating factor interleukin-6. *Biochem. Biophys. Res. Comm.* 152. 1144-1150.

22. Merico F., L. Bergui, M. G. Gregoret, P. Ghia, G. Aimò, I. J. D. Lindley, and F. Caligaris-cappio. (1993). Cytokines involved in the progression of multiple myeloma. *Clin. Exp. Immunol.* 92. 27-31.
23. Nakajima K., O. Martinez-Maza, T. Hirano, E. C. Breen, P. G. Nishanian, J. F. Salazar-Gonzalez, J. L. Fahey, and T. Kishimoto. (1989). Induction of IL-6 (B cell stimulatory factor-2/IFN- γ) production by HIV. *J. Immunol.* 142. 531ff.
24. Nijsten M. W. N., E. R. De Groot, H. J. Ten Duis, H. J. Klasen, C. E. Hack, and L. A. Aarden (1987). Serum levels of interleukin-6 and acute phase responses. *Lancet* II. 921ff.
25. Nordan R., and M. Potter. (1986). A macrophage-derived factor required by plasmacytomas for survival and proliferation in vitro. *Science* 233. 566-569.
26. Oka Y., A. Murata, J. Nishijima, T. Yasuda, N. Hiraoka, Y. Ohmachi, K. Kitagawa, T. Yasuda, H. Toda, N. Tanaka, and T. Mori. (1992). Circulating interleukin 6 as a useful marker for predicting postoperative complications. *Cytokine* 4. 298-304.
27. Pettersson T., K. Metsärinne, A. M. Teppo, and F. Fyhrquist. (1992). Immunoreactive interleukin-6 in serum of patients with B-lymphoproliferative diseases. *J. Int. Med.* 232. 439-442.
28. Ray A., S. B. Tatter, U. Santhanam, D. C. Helfgott, L. T. May, and P. B. Sehgal. (1989). Regulation of expression of interleukin-6: Molecular and clinical studies. *Ann. NY Acad. Sci.* 557. 353-362.
29. Santhanam U., C. Avila, R. Romero, H. Viguier, N. Ida, S. Sakurai, and P. B. Sehgal. (1991). Cytokines in normal and abnormal parturition: Elevated amniotic fluid interleukin-6 levels in women with premature rupture of membranes associated with intrauterine infection. *Cytokine* 3. 155-163.
30. Seguchi T., K. Yokokawa, H. Sugao, E. Nakano, T. Sonoda, and A. Okuyama. (1992). Interleukin-6 activity in urine and serum in patients with bladder carcinoma. *J. Urol.* 148. 791-794.
31. Sehgal P. B., G. Greininger, and G. Tosato. (1989). Regulation of the acute phase and immune responses: Interleukin-6. *Ann. NY Acad. Sci.* 557. 1-583.
32. Sherron N., G. Bird, J. Goka, G. Alexander, and R. Williams. (1991). Elevated plasma interleukin-6 and increased severity and mortality in alcoholic hepatitis. *Clin. Exp. Immunol.* 84. 449-453.
33. Tsukamoto T., Y. Kumamoto, N. Miyao, N. Masumori, A. Takahashi, and M. Yanase. (1992). Interleukin-6 in renal cell carcinoma. *J. Urol.* 148. 1778-1781.
34. Ueyama M., I. Maruyama, M. Osame, and Y. Sawada. (1992). Marked increase in plasma interleukin-6 in burn patients. *J. Lab. Clin. Med.* 120. 693-698.

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Diaclone SAS
1 Boulevard A.Fleming
25020 Besancon Cedex
France
Tel +33 381413838
Fax +33 381413636
Email: info@diacclone.com