



Human IL-6 ELISpot Pair

SKU: HUDC0174

Instructions for use

10x96 tests

For research use only

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1. Intended use

Assay Genie **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, Assay Genie 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), lipopolysaccharides (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).

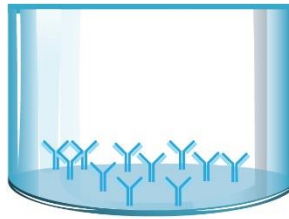
Inflammatory responses:

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.

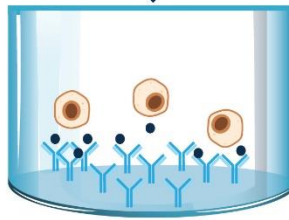
2.2. Principle of the method

A capture antibody highly specific for the analyte of interest is coated to the wells of a PVDF bottomed 96 well microtiter 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.

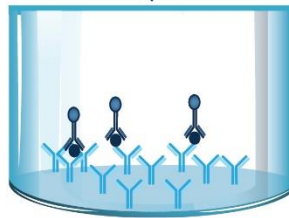
1. 96-PVDF bottomed-well plates are first treated with 35% ethanol and then coated with capture antibody.



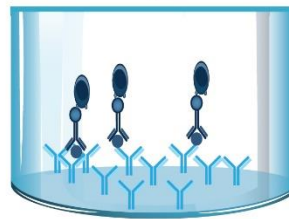
2. Cells are incubated in the presence of the stimulating agent. Upon stimulation they release cytokines which bind to the capture antibodies.



3. Cells are removed by washing. Detection antibody is added.



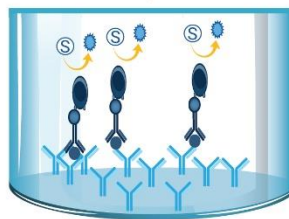
4. Any excess unbound detection antibodies are removed by washing. Streptavidin-alkaline phosphatase is added.









5. Any excess unbound Strep-AP is removed by washing. BCIP/NBT is added.

BCIP/NBT is reduced by alkaline phosphatase to produce a precipitate observed as blue/purple spots.

One spot corresponds to one single producing cell.



-  Capture antibody
-  Cytokines
-  Cell
-  Biotinylated detection antibody
-  Streptavidin-alkaline phosphatase conjugated
-  Substrate product

3. Reagents provided (Contents shown for 10x96 tests format)

- Capture Antibody (2 vials of 0.5 ml). The antibody is supplied sterile and does not contain preservative. We strongly advise sterile pipetting.
- Biotinylated detection antibody (2 vials, lyophilised)

4. Materials/Reagents required but not provided

- Miscellaneous laboratory plastic and/or glass, if possible sterile
- Streptavidin-conjugated (e.g. Streptavidin-alkaline phosphatase)
- Bovine Serum Albumin (BSA)
- Substrate solution (e.g. BCIP/NBT)
- Ethanol
- Cell culture reagents (e.g. RPMI-1640, L-glutamine, FCS)
- Cell stimulation reagents (PMA, Ionomycin)
- CO₂ incubator
- Tween 20
- Phosphate Buffered Saline (PBS)
- 96 well PVDF bottomed plates (we recommended Millipore plates catalogue # MSIPN4510, MSIPS4510 and M8IPS4510)

5. Storage Instructions

Store reagents between 2 and 8°C. Immediately after use remaining reagents should be returned to cold storage (2 to 8°C). Expiry of the components is stated on box front label and 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, blood specimens, PBMC, human cell lines 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.
- **Substrate buffer** is potentially carcinogenic and should be disposed of appropriately, caution should be taken when handling this reagent, always wear gloves. Follow the supplier's instructions.
- Follow incubation times described in the assay procedure.

7. Reagent Preparation

7.1. 1X Phosphate Buffered Saline (PBS) (Coating Buffer)

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

Add distilled water to 1 litre.

Dilute the solution to 1X before use.

Check the pH of the 1X solution and adjust to required pH : 7.4 +/- 0.1.

7.2. Cell culture medium + 10% Serum (Blocking Buffer)

For one plate, add 1 ml Serum (e.g. FCS) to 9 ml of culture medium.

Use same cell culture medium as used to derive the cell suspension.

7.3. 1% BSA PBS Solution (Dilution Buffer)

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

7.4. 0.05% Tween PBS Solution (Wash Buffer)

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

7.5. 35% Ethanol (PVDF Membrane Activation Buffer)

For one plate, mix 3.5 ml of ethanol with 6.5 ml of distilled water.

7.6. Capture Antibody

This reagent is supplied sterile, once opened keep the vial sterile or aliquot and store at -20°C. For optimal performance prepare the Capture Antibody dilution immediately before use.

For one plate, dilute 100 µl of capture antibody in 10 ml of PBS 1X and mix well.

7.7. Detection Antibody

Reconstitute the lyophilised antibody with 0.55 ml 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.

For one plate, dilute 100 µl of antibody into 10 ml of Dilution Buffer and mix well.

7.8. Streptavidin conjugate

Dilute in Dilution buffer according to the instructions of the supplier.

7.9. Substrate buffer

Use according to the instructions of the supplier.

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

For other stimulators incubation times may vary, depending on the frequency of cytokine producing cells, and should be optimised in each situation.

8.3. Negative Assay Control

Dilute PBMC in culture medium to give an appropriate cell number (same number of unstimulated cells as stimulated sample cells) per 100 µl 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 100 μ l.

Optimal assay performances are observed between 1×10^4 and 2.5×10^4 cells per 100 μ l.

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	For PVDF membrane activation, add 25 μ l of 35% ethanol to every well
2.	Incubation	Incubate plate at room temperature (RT) for 30 seconds
3.	Wash	Empty the wells by flicking the plate over a sink & gently tapping on absorbent paper. Thoroughly wash the plate 3x with 100 μ l of PBS 1X per well
4.	Addition	Add 100 μ l of diluted capture antibody to every well
5.	Incubation	Cover the plate and incubate at 4°C overnight
6.	Wash	Empty the wells as previous and wash the plate once with 100 μ l of PBS 1X per well
7.	Addition	Add 100 μ l of blocking buffer to every well
8.	Incubation	Cover the plate and incubate at RT for 2 hours
9.	Wash	Empty the wells as previous and thoroughly wash once with 100 μ l of PBS 1X per well
10.	Addition	Add 100 μ l 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.)
11.	Incubation	Cover the plate and incubate at 37°C in a CO ₂ incubator for an appropriate length of time (15-20 hours). Note: do not agitate or move the plate during this incubation
12.	Addition	Empty the wells and remove excess solution then add 100 μ l of Wash Buffer to every well
13.	Incubation	Incubate the plate at 4°C for 10 min
14.	Wash	Empty the wells as previous and wash the plate 3x with 100 μ l of Wash Buffer
15.	Addition	Add 100 μ l of diluted detection antibody to every well

16.	Incubation	Cover the plate and incubate at RT for 1 hour 30 min
17.	Wash	Empty the wells as previous and wash the plate 3x with 100 µl of Wash Buffer
18.	Addition	Add 100 µl of diluted Streptavidin-conjugate to every well
19.	Incubation	Cover the plate and incubate at RT following the supplier's instructions
20.	Wash	Empty the wells and wash the plate 3x with 100 µl of Wash Buffer
21.	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.
22.	Addition	Add 100 µl of ready-to-use substrate buffer to every well
23.	Development	Following the supplier's instructions, incubate the plate for 5-15 min monitoring spot formation visually throughout the incubation period to assess sufficient colour development
24.	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.

Note: spots may become sharper after overnight incubation at 4°C in the dark

Plate should be stored at RT away from direct light, but please note that 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 of this IL-6 antibody pair, 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 IL13). 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. The data show 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%
1250	12	118	108	129	6.3%
625	12	64	54	76	10.4%

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