

# Human TNF $\alpha$ ELISpot Pair

Instructions for use

Catalogue Number : 10x96 tests: 869.050.010

## For research use only

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## Table of Contents

1.	Intended use.....	2
2.	Introduction.....	2
2.1.	Summary.....	2
2.2.	Principle of the method.....	4
3.	Reagents provided (Contents shown for 10x96 tests format).....	5
4.	Materials/Reagents required but not provided.....	5
5.	Storage Instructions.....	5
6.	Safety & Precautions for use.....	5
7.	Reagent Preparation.....	6
7.1.	1X Phosphate Buffered Saline (PBS) (Coating & Wash Buffer).....	6
7.2.	Cell culture medium + 10% Serum (Blocking Buffer).....	6
7.3.	1% BSA PBS Solution (Dilution Buffer).....	6
7.4.	35% Ethanol (PVDF Membrane Activation Buffer).....	6
7.5.	Capture Antibody.....	6
7.6.	Detection Antibody.....	6
7.7.	Streptavidin conjugate.....	6
7.8.	Substrate buffer.....	6
8.	Sample and Control Preparation.....	7
8.1.	Cell Stimulation.....	7
8.2.	Positive Assay Control, TNF $\alpha$ production.....	7
8.3.	Negative Assay Control.....	7
8.4.	Sample.....	7
9.	Method.....	8
10.	Performance Characteristics.....	9
10.1.	Specificity.....	9
10.2.	Reproducibility and Linearity.....	9
11.	Bibliography.....	10
12.	Diaclone TNF $\alpha$ ELISpot References.....	10

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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

Tumor Necrosis Factor (TNF $\alpha$ ), also known as cachectin, is a polypeptide cytokine produced by monocytes and macrophages. It functions as a multipotent modulator of immune response and further acts as a potent pyrogen (4, 17). TNF $\alpha$  circulates throughout the body responding to stimuli (infectious agents or tissue injury), activating neutrophils, altering the properties of vascular endothelial cells, regulating metabolic activities of other tissues, as well as exhibiting tumoricidal activity by inducing localized blood clotting. TNF $\alpha$  also inhibits lipoprotein lipase activity resulting in cachexia, a physical wasting condition (4, 17). Activation of B-cells by the Epstein Barr virus can be inhibited by TNF $\alpha$  (15). Due to its varied actions throughout the immune system, TNF $\alpha$  may play a role in the pathogenesis of many disease states.

TNF $\alpha$  production is mediated by the action of lymphokines and endotoxins on the macrophage. Purified monocytes produce TNF $\alpha$  within four hours of stimulation by recombinant IL-2 (9) and there is some *in vitro* evidence to suggest that TNF $\alpha$  is expressed at high levels and with prolonged kinetics in T cells stimulated by both CD2 and CD28 (5). Secretion of TNF $\alpha$  is enhanced by gamma interferon. TNF $\alpha$  then induces or enhances the specific production of Class I MHC antigen, GM-CSF, and IL-1. Recent evidence has suggested an intracellular role for this peptide (23).

TNF $\alpha$  may play a significant role in the pathogenesis of inflammatory disease of the joints and other tissues. Chin et al. (6) found that TNF $\alpha$ , along with IFN $\gamma$  and IL-1 increased cell surface expression of ICAM-1 on synovial fibroblasts. Alvaro-Garcia et al. (3) reported that TNF $\alpha$  stimulates synovial proliferation.

Waage et al. (25) found that increased levels of TNF $\alpha$  in patients with septicemia and meningococcal disease correlated with fatal outcome. Scuderi et al. (22) suggest that increased levels of this cytokine may play a role in the host defense mechanism against parasitic infections. Girardin et al. (12) reported that increased serum TNF $\alpha$  levels correlated with the number of risk factors involved in children with gram-negative sepsis and purpura fulminans. Elevated levels of TNF $\alpha$  were also found in individuals suffering from myocarditis (11).

Role for TNF $\alpha$  in the pathogenesis of AIDS has also been pointed out. Alveolar macrophages (AM) from HIV positive individuals with opportunistic lung infections have been shown to spontaneously produce higher levels of TNF $\alpha$  *in vitro* than those HIV positive individuals without infection and HIV negative controls (14, 16). Krishnan et al. (16) report that higher TNF $\alpha$  production by AM was associated with lower counts of

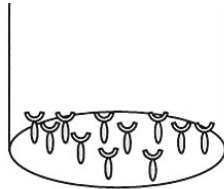
pneumocystis carinii in bronchoalveolar lavage fluid, indicating that TNF $\alpha$  may play a role in the control of this infection in AIDS. Israel-Biet et al. (14) also reported in *in vitro* studies, that AM that express HIV (p24+) released significantly higher levels of TNF $\alpha$  than p24- alveolar macrophages and controls. Reddy et al. (20) found persistently elevated levels of circulating TNF $\alpha$  in HIV seropositive individuals and suggest a possible involvement of this cytokine in the development of AIDS.

Measurement of TNF $\alpha$  levels has also been shown to be useful in transplant research, where Maury et al. (18) and McLaughlin et al. (19). Both reported TNF $\alpha$  to be markedly elevated in renal allograft rejection episodes. Recent evidence has been presented on increased TNF $\alpha$  levels in Bone Marrow Transplant (BMT) (13, 21). BMT patients with major transplant related complications such as interstitial pneumonitis and severe acute graft-versus - host disease had TNF $\alpha$  levels significantly increase over controls (13).

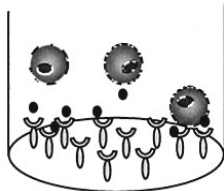
## 2.2. Principle of the method

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.

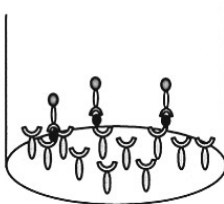
1. 96-PVDF bottomed-well plates are first treated with 35% ethanol and then coated with capture antibody.



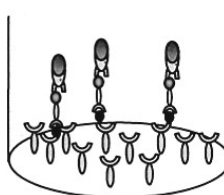
2. Cells are incubated in the presence of the stimulating agent. Upon stimulation they release cytokines which bind to the capture antibodies.



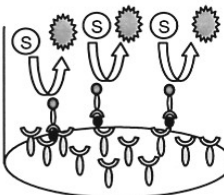
3. Cell removal by washing. Incubation with biotinylated detection antibody.



4. Any excess unbound detection antibodies is removed by washing. Incubation with streptavidin – enzyme conjugate.

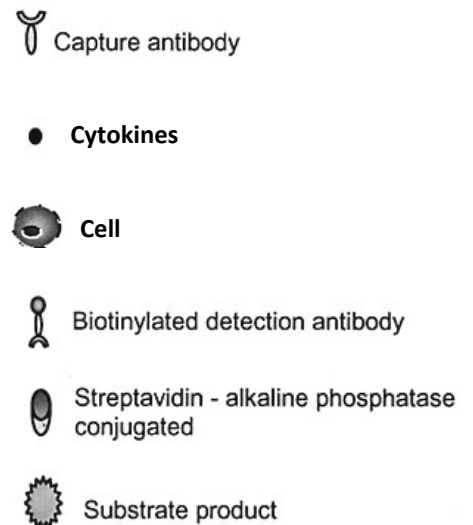


5. Any excess unbound Streptavidin-enzyme conjugate is removed by washing. Incubation with Substrate.



Finally Substrate reduction by enzyme give a precipitated product which give colored spots.

One spot correspond to one single producing cell.



### 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)
- CO<sub>2</sub> incubator
- 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 & Wash Buffer)

For 1 litre of 10X PBS weigh-out: 80g NaCl  
2g KH<sub>2</sub>PO<sub>4</sub>  
14.4g Na<sub>2</sub>HPO<sub>4</sub> ; 2H<sub>2</sub>O.

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. 35% Ethanol (PVDF Membrane Activation Buffer)

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

### 7.5. 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.

### 7.6. 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.

### 7.7. Streptavidin conjugate

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

### 7.8. 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, TNF $\alpha$ 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  $\mu$ g/ml LPS (Sigma, Saint Louis, MO). Distribute  $2 \times 10^3$  to  $6 \times 10^3$  cells per 100  $\mu$ l 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  $\mu$ l 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  $\mu$ l.

Optimal assay performances are observed between  $1 \times 10^5$  and  $2.5 \times 10^5$  cells per 100  $\mu$ 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 µl 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 200 µl of PBS 1X per well
4.	Addition	Add 100 µl of diluted <b>capture antibody</b> 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 200 µl of PBS 1X per well
7.	Addition	Add 100 µl of <b>blocking buffer</b> 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 200 µl of PBS 1X per well
10.	Addition	Add 100 µl of <b>sample, positive and negative controls</b> 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 <sub>2</sub> incubator for an appropriate length of time (15-20 hours). <b>Note: do not agitate or move the plate during this incubation</b>
12.	Addition	Empty the wells and remove excess solution then add 200 µl of PBS 1X 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 200 µl of PBS 1X
15.	Addition	Add 100 µl of diluted <b>detection antibody</b> 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 200 µl of PBS 1X
18.	Addition	Add 100 µl of diluted <b>Streptavidin-conjugate</b> 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 200 µl of PBS 1X
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 <b>substrate buffer</b> to every well
23.	Development	Following the supplier's instructions, incubate the plate for <b>5-15 min</b> 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
<p><b>Read Spots:</b> 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.</p> <p><i>Note: spots may become sharper after overnight incubation at 4°C in the dark</i></p>		

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 TNF $\alpha$ .

To define specificity of this TNF $\alpha$  antibody pair, several proteins were tested for cross reactivity. There was no cross reactivity observed for any protein tested (IL-1 $\beta$ , IL-2, IL-4, IL-6, IL-10, IL-12, IFN $\gamma$ , IL-8 and IL-13). This testing was performed using the equivalent human TNF $\alpha$  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, 6 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%
12500	6	971	856	1028	6.3%
6250	6	649	565	689	7.0%
3125 recommended	6	369	316	405	8.4%
1560 recommended	6	213	192	236	9.4%
725	6	112	100	150	16.9%

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**Products Manufactured and Distributed by:**

**Diaclone SAS**  
6 Rue Dr Jean-François-Xavier Girod  
25000 Besançon  
France  
Tel +33 (0)3 81 41 38 38  
Email: [techsupport@medixbiochemica.com](mailto:techsupport@medixbiochemica.com)