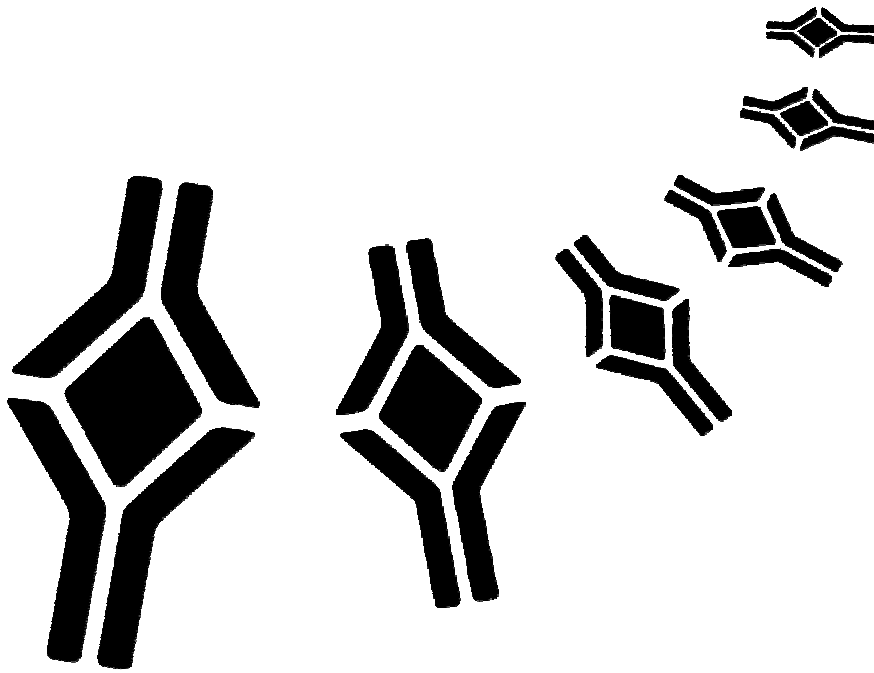


# BioVendor

Research  
and Diagnostic Products



## Human TNF-alpha ELISA

Product Data Sheet

Cat. No.: RBMS223/4R

For Research Use Only

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➤➤ This kit is manufactured by:  
BioVendor – Laboratorní medicína a.s.

➤➤ Use only the current version of Product Data Sheet enclosed with the kit!

## 1. INTENDED USE

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The human TNF $\alpha$  ELISA is an enzyme-linked immunosorbent assay for the quantitative detection of human TNF $\alpha$ . **The human TNF $\alpha$  ELISA is for research use only. Not for diagnostic or therapeutic procedures.**

## 2. SUMMARY

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Tumor Necrosis Factor  $\alpha$  (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 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).

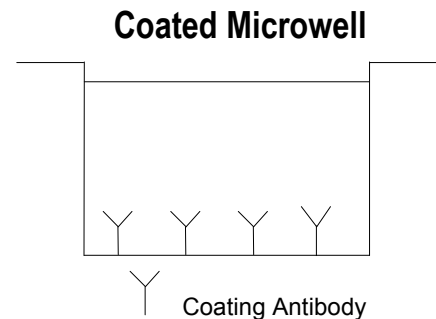
TNF $\alpha$  may play a significant role in the pathogenesis of inflammatory disease of the joints and other tissues. Chin et al. (6) found that TNF $\alpha$ , along with gamma interferon and IL-1 $\beta$  increased cell surface expression of ICAM-1 on synovial fibroblasts. Alvaro-Garcia et al. (3)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

Recently, a growing body of information has pointed to a role for  $\text{TNF}\alpha$  in the pathogenesis of AIDS. Alveolar macrophages (AM) from HIV positive individuals with opportunistic lung infections have been shown to spontaneously produce higher levels of  $\text{TNF}\alpha$  *in vitro* than those HIV positive individuals without infection and HIV negative controls (14, 16). Krishnan et al. (16) report that higher  $\text{TNF}\alpha$  production by AM was associated with lower counts of *pneumocystis carinii* in bronchoalveolar lavage fluid, indicating that  $\text{TNF}\alpha$  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<sup>+</sup>) released significantly higher levels of  $\text{TNF}\alpha$  than p24-alveolar macrophages and controls. Reddy et al. (20) found persistently elevated levels of circulating  $\text{TNF}\alpha$  in HIV seropositive individuals and suggest a possible involvement of this cytokine in the development of AIDS.

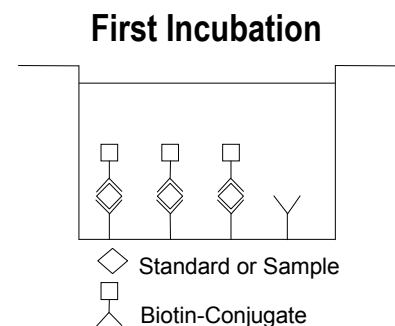
Measurement of  $\text{TNF}\alpha$  levels has also been shown to be useful in transplant research, where Maury et al. (18) and McLaughlin et al. (19). both reported  $\text{TNF}\alpha$  to be markedly elevated in renal allograft rejection episodes. Recent evidence has been presented on increased  $\text{TNF}\alpha$  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  $\text{TNF}\alpha$  levels significantly increase over controls (13).

### 3. PRINCIPLES OF THE TEST

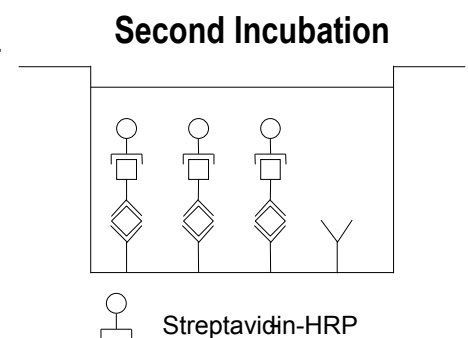
An anti-human TNF $\alpha$  coating antibody is adsorbed onto microwells. Figure 1



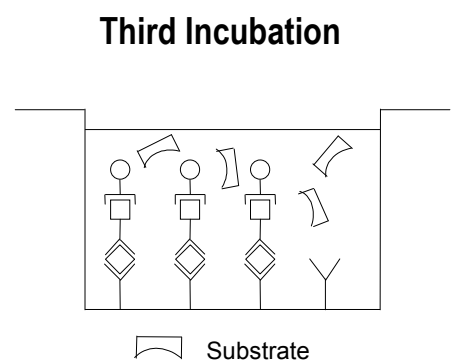
Human TNF $\alpha$  present in the sample or standard binds to antibodies adsorbed to the microwells. A biotin-conjugated anti-human TNF $\alpha$  antibody is added and binds to human TNF $\alpha$  captured by the first antibody. Figure 2



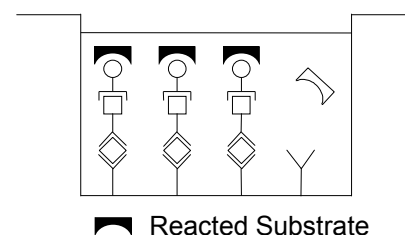
Following incubation unbound biotin-conjugated anti-human TNF $\alpha$  antibody is removed during a wash step. Streptavidin-HRP is added and binds to the biotin-conjugated anti-human TNF $\alpha$  antibody. Figure 3



Following incubation unbound Streptavidin-HRP is removed during a wash step, and substrate solution reactive with HRP is added to the wells. Figure 4



A coloured product is formed in proportion to the amount of human  $\text{TNF}\alpha$  present in the sample or standard. The reaction is terminated by addition of acid and absorbance is measured at 450 nm. A standard curve is prepared from 7 human  $\text{TNF}\alpha$  standard dilutions and human  $\text{TNF}\alpha$  sample concentration determined



#### 4. REAGENTS PROVIDED

- 1 aluminium pouch with a **Microwell Plate** coated with monoclonal antibody to human  $\text{TNF}\alpha$
- 1 vial (100  $\mu\text{l}$ ) **Biotin-Conjugate** anti-human  $\text{TNF}\alpha$  polyclonal antibody
- 1 vial (150  $\mu\text{l}$ ) **Streptavidin-HRP**
- 2 vials human  $\text{TNF}\alpha$  **Standard** lyophilized, 1000 pg/ml upon reconstitution
- 1 vial **Control high**, lyophilized
- 1 vial **Control low**, lyophilized
- 1 vial (12 ml) **Sample Diluent**
- 1 vial (5 ml) **Assay Buffer Concentrate** 20x (PBS with 1% Tween 20 and 10% BSA)
- 1 bottle (50 ml) **Wash Buffer Concentrate** 20x (PBS with 1% Tween 20)
- 1 vial (15 ml) **Substrate Solution** (tetramethyl-benzidine)
- 1 vial (15 ml) **Stop Solution** (1M Phosphoric acid)
- 1 vial (0.4 ml) **Blue-Dye**
- 1 vial (0.4 ml) **Green-Dye**
- 1 vial (0.4 ml) **Red-Dye**
- 4 **Adhesive Films**

#### 5. STORAGE INSTRUCTIONS – ELISA KIT

Store kit reagents between 2° and 8°C except controls. Store lyophilized controls at -20°C. Immediately after use remaining reagents should be returned to cold storage (2° to 8°C), controls to -20°C, respectively. Expiry of the kit and reagents is stated on labels. Expiry of the kit components can only be guaranteed if the components are stored properly, and if, in case of repeated use of one component, this reagent is not contaminated by the first handling.

## 6. SPECIMEN COLLECTION AND STORAGE INSTRUCTIONS

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Cell culture supernatant, serum, plasma (EDTA, citrate, heparinized) and urine were tested with this assay. Other biological samples might be suitable for use in the assay. Remove serum or plasma from the clot or cells as soon as possible after clotting and separation.

Pay attention to a possible “**Hook Effect**” due to high sample concentrations (see chapter 11). Samples containing a visible precipitate must be clarified prior to use in the assay. Do not use grossly hemolyzed or lipemic specimens.

Samples should be aliquoted and must be stored frozen at -20°C to avoid loss of bioactive human TNF $\alpha$ . If samples are to be run within 24 hours, they may be stored at 2° to 8°C (for sample stability refer to 0).

Avoid repeated freeze-thaw cycles. Prior to assay, the frozen sample should be brought to room temperature slowly and mixed gently.

Do not thaw samples in a 37°C water bath. Do not vortex or sharply agitate samples.

## 7. MATERIALS REQUIRED BUT NOT PROVIDED

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- 5 ml and 10 ml graduated pipettes
- 5  $\mu$ l to 1000  $\mu$ l adjustable single channel micropipettes with disposable tips
- 50  $\mu$ l to 300  $\mu$ l adjustable multichannel micropipette with disposable tips
- Multichannel micropipette reservoir
- Beakers, flasks, cylinders necessary for preparation of reagents
- Device for delivery of wash solution (multichannel wash bottle or automatic wash system)
- Microwell strip reader capable of reading at 450 nm (620 nm as optional reference wave length)
- Glass-distilled or deionized water
- Statistical calculator with program to perform regression analysis

## 8. PRECAUTIONS FOR USE

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- All chemicals should be considered as potentially hazardous. We therefore recommend that this product is handled only by those persons who have been trained in laboratory techniques and that it is used in accordance with the principles of good laboratory practice. Wear suitable protective clothing such as laboratory overalls, safety glasses and gloves. Care should be taken to avoid contact with skin or eyes. In the case of contact with skin or eyes wash immediately with water. See material safety data sheet(s) and/or safety statement(s) for specific advice.
- Reagents are intended for research use only and are not for use in diagnostic or therapeutic procedures.
- Do not mix or substitute reagents with those from other lots or other sources.
- Do not use kit reagents beyond expiration date on label.
- Do not expose kit reagents to strong light during storage or incubation.
- Do not pipette by mouth.
- Do not eat or smoke in areas where kit reagents or samples are handled.
- Avoid contact of skin or mucous membranes with kit reagents or specimens.
- Rubber or disposable latex gloves should be worn while handling kit reagents or specimens.
- Avoid contact of substrate solution with oxidizing agents and metal.
- Avoid splashing or generation of aerosols.
- In order to avoid microbial contamination or cross-contamination of reagents or specimens which may invalidate the test use disposable pipette tips and/or pipettes.
- Use clean, dedicated reagent trays for dispensing the conjugate and substrate reagent.
- Exposure to acid inactivates the conjugate.
- Glass-distilled water or deionized water must be used for reagent preparation.
- Substrate solution must be at room temperature prior to use.
- Decontaminate and dispose specimens and all potentially contaminated materials as they could contain infectious agents. The preferred method of decontamination is autoclaving for a minimum of 1 hour at 121.5°C.
- Liquid wastes not containing acid and neutralized waste may be mixed with sodium hypochlorite in volumes such that the final mixture contains 1.0% sodium hypochlorite. Allow 30 minutes for effective decontamination. Liquid waste containing acid must be neutralized prior to the addition of sodium hypochlorite.



## 9. PREPARATION OF REAGENTS

**Buffer Concentrates** should be brought to room temperature and should be diluted before starting the test procedure.

### 9.1 Wash Buffer (1x)

If crystals have formed in the **Wash Buffer Concentrate**, warm it gently until they have completely dissolved.

Pour entire contents (50 ml) of the Wash Buffer Concentrate into a clean 1000 ml graduated cylinder. Bring to final volume of 1000 ml with glass-distilled or deionized water. Mix gently to avoid foaming. The pH of the final solution should adjust to 7.4.

Transfer to a clean wash bottle and store at 2° to 25°C. Please note that Wash Buffer is stable for 30 days.

Wash Buffer may also be prepared as needed according to the following table:

| Number of Strips | Wash Buffer Concentrate (20x) (ml) | Distilled Water (ml) |
|------------------|------------------------------------|----------------------|
| 1 - 6            | 25                                 | 475                  |
| 1 - 12           | 50                                 | 950                  |

### 9.2 Assay Buffer (1x)

Pour the entire contents (5 ml) of the **Assay Buffer Concentrate** (20x) into a clean 100 ml graduated cylinder. Bring to final volume of 100 ml with distilled water. Mix gently to avoid foaming.

Store at 2° to 8°C. Please note that the Assay Buffer (1x) is stable for 30 days.

Assay Buffer (1x) may also be prepared as needed according to the following table:

| Number of Strips | Assay Buffer Concentrate (20x) (ml) | Distilled Water (ml) |
|------------------|-------------------------------------|----------------------|
| 1 - 6            | 2.5                                 | 47.5                 |
| 1 - 12           | 5.0                                 | 95.0                 |

### 9.3 Biotin-Conjugate

**Please note that the Biotin-Conjugate should be used within 30 minutes after dilution.**

Make a 1:100 dilution of the concentrated **Biotin-Conjugate** solution with Assay Buffer (1x) in a clean plastic tube as needed according to the following table:

| Number of Strips | Biotin-Conjugate (ml) | Assay Buffer (1x) (ml) |
|------------------|-----------------------|------------------------|
| 1 - 6            | 0.03                  | 2.97                   |
| 1 - 12           | 0.06                  | 5.94                   |

## 9.4 Streptavidin-HRP

**Please note that the Streptavidin-HRP should be used within 30 minutes after dilution.**

Make a 1:200 dilution of the concentrated **Streptavidin-HRP** solution with Assay Buffer (1x) in a clean plastic tube as needed according to the following table:

| Number of Strips | Streptavidin-HRP (ml) | Assay Buffer (1x) (ml) |
|------------------|-----------------------|------------------------|
| 1 - 6            | 0.03                  | 5.97                   |
| 1 - 12           | 0.06                  | 11.94                  |

## 9.5 Human APRIL Standard

Reconstitute **human TNF $\alpha$  standard** by addition of distilled water.

Reconstitution volume is stated on Quality Control Sheet.

Swirl or mix gently to insure complete and homogeneous solubilisation (concentration of reconstituted standard = 1000 pg/ml).

The standard has to be used immediately after reconstitution and cannot be stored.

**Standard dilutions** can be prepared directly on the microwell plate (see 10.c) or alternatively in tubes (see 0).

### 9.5.1 External Standard Dilution

Label 7 tubes, one for each standard point.

S1, S2, S3, S4, S5, S6, S7

Then prepare 1:2 serial dilutions for the standard curve as follows:

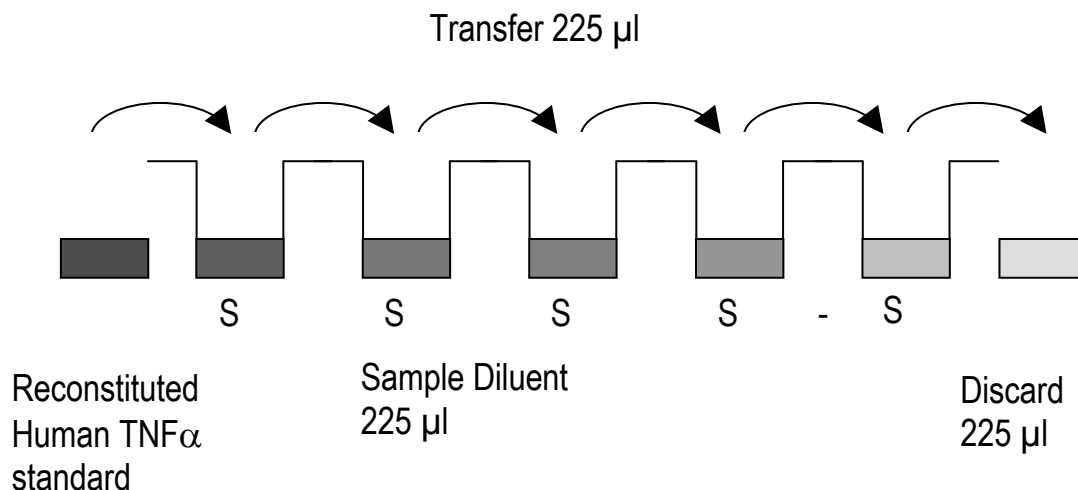
Pipette 225  $\mu$ l of Sample Diluent into each tube.

Pipette 225  $\mu$ l of reconstituted standard (concentration = 1000 pg/ml) into the first tube, labelled S1, and mix (concentration of standard 1 = 500 pg/ml).

Pipette 225  $\mu$ l of this dilution into the second tube, labelled S2, and mix thoroughly before the next transfer.

Repeat serial dilutions 5 more times thus creating the points of the standard curve

Sample Diluent serves as blank.



## 9.6 Controls

Reconstitute by adding 800 µl distilled water to lyophilized controls. Swirl or mix gently to ensure complete and homogeneous solubilisation.

Further treat the controls like your samples in the assay. For control range please refer to certificate of analysis or vial label. Store reconstituted controls aliquoted at -20°C. Avoid repeated freeze and thaw cycles.

## 9.7 Addition of Colour-giving Reagents: Blue-Dye, Green-Dye, Red-Dye

**This procedure is optional**, does not in any way interfere with the test results, and is designed to help the customer with the performance of the test, but can also be omitted, just following the instruction booklet.

Alternatively, the dye solutions from the stocks provided (**Blue-Dye, Green-Dye, Red-Dye**) can be added to the reagents according to the following guidelines:

**1. Diluent:** Before standard and sample dilution add the **Blue-Dye** at a dilution of 1:250 (see table below) to the appropriate diluent (1x) according to the test protocol. After addition of **Blue-Dye**, proceed according to the instruction booklet.

|                      |                        |
|----------------------|------------------------|
| 5 ml Sample Diluent  | 20 µl <b>Blue-Dye</b>  |
| 12 ml Sample Diluent | 48 µl <b>Blue-Dye</b>  |
| 50 ml Sample Diluent | 200 µl <b>Blue-Dye</b> |

**2. Biotin-Conjugate:** Before dilution of the concentrated Biotin-Conjugate, add the **Green-Dye** at a dilution of 1:100 (see table below) to the Assay Buffer (1x) used for the final conjugate dilution. Proceed after addition of **Green-Dye** according to the instruction booklet: Preparation of Biotin-Conjugate.

|                        |                        |
|------------------------|------------------------|
| 3 ml Assay Buffer (1x) | 30 µl <b>Green-Dye</b> |
| 6 ml Assay Buffer (1x) | 60 µl <b>Green-Dye</b> |

**3. Streptavidin-HRP:** Before dilution of the concentrated Streptavidin-HRP, add the **Red-Dye** at a dilution of 1:250 (see table below) to the Assay Buffer (1x) used for the final Streptavidin-HRP dilution. Proceed after addition of **Red-Dye** according to the instruction booklet: Preparation of Streptavidin-HRP.

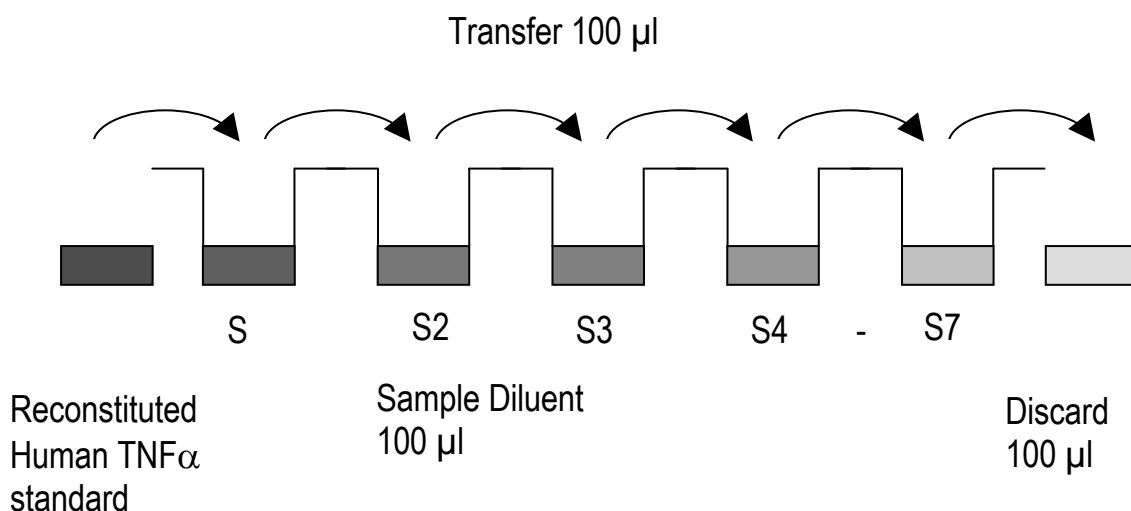
|                         |                      |
|-------------------------|----------------------|
| 6 ml Assay Buffer (1x)  | 24 µl <b>Red-Dye</b> |
| 12 ml Assay Buffer (1x) | 48 µl <b>Red-Dye</b> |

## 10. TEST PROTOCOL

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- a. Determine the number of microwell strips required to test the desired number of samples plus appropriate number of wells needed for running blanks and standards. Each sample, standard, blank and optional control sample should be assayed in duplicate. Remove extra microwell strips from holder and store in foil bag with the desiccant provided at 2°-8°C sealed tightly.
- b. Wash the microwell strips twice with approximately 400 µl **Wash Buffer** per well with thorough aspiration of microwell contents between washes. Allow the Wash Buffer to sit in the wells for about **10 – 15 seconds** before aspiration. Take care not to scratch the surface of the microwells. After the last wash step, empty wells and tap microwell strips on absorbent pad or paper towel to remove excess Wash Buffer. Use the microwell strips immediately after washing. Alternatively microwell strips can be placed upside down on a wet absorbent paper for not longer than 15 minutes. **Do not allow wells to dry.**
- c. **Standard dilution on the microwell plate** (Alternatively the standard dilution can be prepared in tubes – see 9.5.1):  
Add 100 µl of Sample Diluent in duplicate to all **standard wells**. Pipette 100 µl of prepared **standard** (see Preparation of Standard 0, concentration = 1000 pg/ml) in duplicate into well A1 and A2 (see In case of an **external standard dilution** (see 9.5.1), pipette 100 µl of these standard dilutions (S1 - S7) in the standard wells according.
- d.
- e. Table 1). Mix the contents of wells A1 and A2 by repeated aspiration and ejection (concentration of standard 1, S1 = 500 pg/ml), and transfer 100 µl to wells B1 and B2, respectively (see Figure6). Take care not to scratch the inner surface of the microwells. Continue this procedure 5 times, creating two rows of human TNF $\alpha$  standard dilutions ranging from 500.0 to 7.8 pg/ml. Discard 100 µl of the contents from the last microwells (G1, G2) used.

Figure6



In case of an **external standard dilution** (see 9.5.1), pipette 100 µl of these standard dilutions (S1 - S7) in the standard wells according.

Table 1

Table depicting an example of the arrangement of blanks, standards and samples in the microwell strips:

|          | 1                        | 2                        | 3        | 4        |
|----------|--------------------------|--------------------------|----------|----------|
| <b>A</b> | Standard 1 (500.0 ng/ml) | Standard 1 (500.0 ng/ml) | Sample 1 | Sample 1 |
| <b>B</b> | Standard 2 (250.0 ng/ml) | Standard 2 (250.0 ng/ml) | Sample 2 | Sample 2 |
| <b>C</b> | Standard 3 (125.0 ng/ml) | Standard 3 (125.0 ng/ml) | Sample 3 | Sample 3 |
| <b>D</b> | Standard 4 (62.5 ng/ml)  | Standard 4 (62.5 ng/ml)  | Sample 4 | Sample 4 |
| <b>E</b> | Standard 5 (31.3 ng/ml)  | Standard 5 (31.3 ng/ml)  | Sample 5 | Sample 5 |
| <b>F</b> | Standard 6 (15.6 ng/ml)  | Standard 6 (15.6 ng/ml)  | Sample 6 | Sample 6 |
| <b>G</b> | Standard 7 (7.8 ng/ml)   | Standard 7 (7.8 ng/ml)   | Sample 7 | Sample 7 |
| <b>H</b> | Blank                    | Blank                    | Sample 8 | Sample 8 |

- f. Add 100 µl of **Sample Diluent** in duplicate to the **blank wells**.
- g. Add 50 µl of Sample Diluent to the sample wells.
- h. Add 50 µl of each **sample** in duplicate to the **sample wells**.
- i. Prepare **Biotin-Conjugate** (see Preparation of Biotin-Conjugate 0).
- j. Add 50 µl of **Biotin-Conjugate** to all wells.
- k. Cover with an adhesive film and incubate at room temperature (18 to 25°C) for 2 hours, if available on a microplate shaker set at 100 rpm.

- l. Prepare **Streptavidin-HRP** (refer to Preparation of Streptavidin-HRP 0).
- m. Remove adhesive film and empty wells. **Wash** microwell strips 4 times according to point b. of the test protocol. Proceed immediately to the next step.
- n. Add 100 µl of diluted **Streptavidin-HRP** to all wells, including the blank wells.
- o. Cover with an adhesive film and incubate at room temperature (18° to 25°C) for 1 hour, if available on a microplate shaker set at 100 rpm.
- p. Remove adhesive film and empty wells. **Wash** microwell strips 4 times according to point b. of the test protocol. Proceed immediately to the next step.
- q. Pipette 100 µl of **TMB Substrate Solution** to all wells.
- r. Incubate the microwell strips at room temperature (18° to 25°C) for about 10 min. Avoid direct exposure to intense light.

**The colour development on the plate should be monitored and the substrate reaction stopped (see next point of this protocol) before positive wells are no longer properly recordable. Determination of the ideal time period for colour development has to be done individually for each assay.**

It is recommended to add the stop solution when the highest standard has developed a dark blue colour. Alternatively the colour development can be monitored by the ELISA reader at 620 nm. The substrate reaction should be stopped as soon as Standard 1 has reached an OD of 0.6 – 0.65.

- s. Stop the enzyme reaction by quickly pipetting 100 µl of **Stop Solution** into each well. It is important that the Stop Solution is spread quickly and uniformly throughout the microwells to completely inactivate the enzyme. Results must be read immediately after the Stop Solution is added or within one hour if the microwell strips are stored at 2 - 8°C in the dark.
- t. Read absorbance of each microwell on a spectro-photometer using 450 nm as the primary wave length (optionally 620 nm as the reference wave length; 610 nm to 650 nm is acceptable). Blank the plate reader according to the manufacturer's instructions by using the blank wells. Determine the absorbance of both the samples and the standards.

**Note: In case of incubation without shaking the obtained O.D. values may be lower than indicated below. Nevertheless the results are still valid.**

## 11. CALCULATION OF RESULTS

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- Calculate the average absorbance values for each set of duplicate standards and samples. Duplicates should be within 20 per cent of the mean value.
- Create a standard curve by plotting the mean absorbance for each standard concentration on the ordinate against the human TNF $\alpha$  concentration on the abscissa. Draw a best fit curve through the points of the graph (a 5-parameter curve fit is recommended).
- To determine the concentration of circulating human TNF $\alpha$  for each sample, first find the mean absorbance value on the ordinate and extend a horizontal line to the standard curve. At the point of intersection, extend a vertical line to the abscissa and read the corresponding human TNF $\alpha$  concentration.
- To determine the concentration of circulating human TNF $\alpha$  for each sample, first find the mean absorbance value on the ordinate and extend a horizontal line to the standard curve. At the point of intersection, extend a vertical line to the abscissa and read the corresponding human TNF $\alpha$  concentration.
- If instructions in this protocol have been followed samples have been diluted 1:2 (50  $\mu$ l sample + 50  $\mu$ l Sample Diluent), the concentration read from the standard curve must be multiplied by the dilution factor (x 2).
- Calculation of samples with a concentration exceeding standard 1 may result in incorrect, low human TNF $\alpha$  levels (Hook Effect). Such samples require further external predilution according to expected human TNF $\alpha$  values with Sample Diluent in order to precisely quantitate the actual human TNF $\alpha$  level.
- It is suggested that each testing facility establishes a control sample of known human TNF $\alpha$  concentration and runs this additional control with each assay. If the values obtained are not within the expected range of the control, the assay results may be invalid.
- A representative standard curve is shown in Figure 7. This curve cannot be used to derive test results. Each laboratory must prepare a standard curve for each group of microwell strips assayed.

Figure 7

Representative standard curve for human  $\text{TNF}\alpha$  ELISA. Human  $\text{TNF}\alpha$  was diluted in serial 2-fold steps in Sample Diluent. Do not use this standard curve to derive test results. A standard curve must be run for each group of microwell strips assayed.

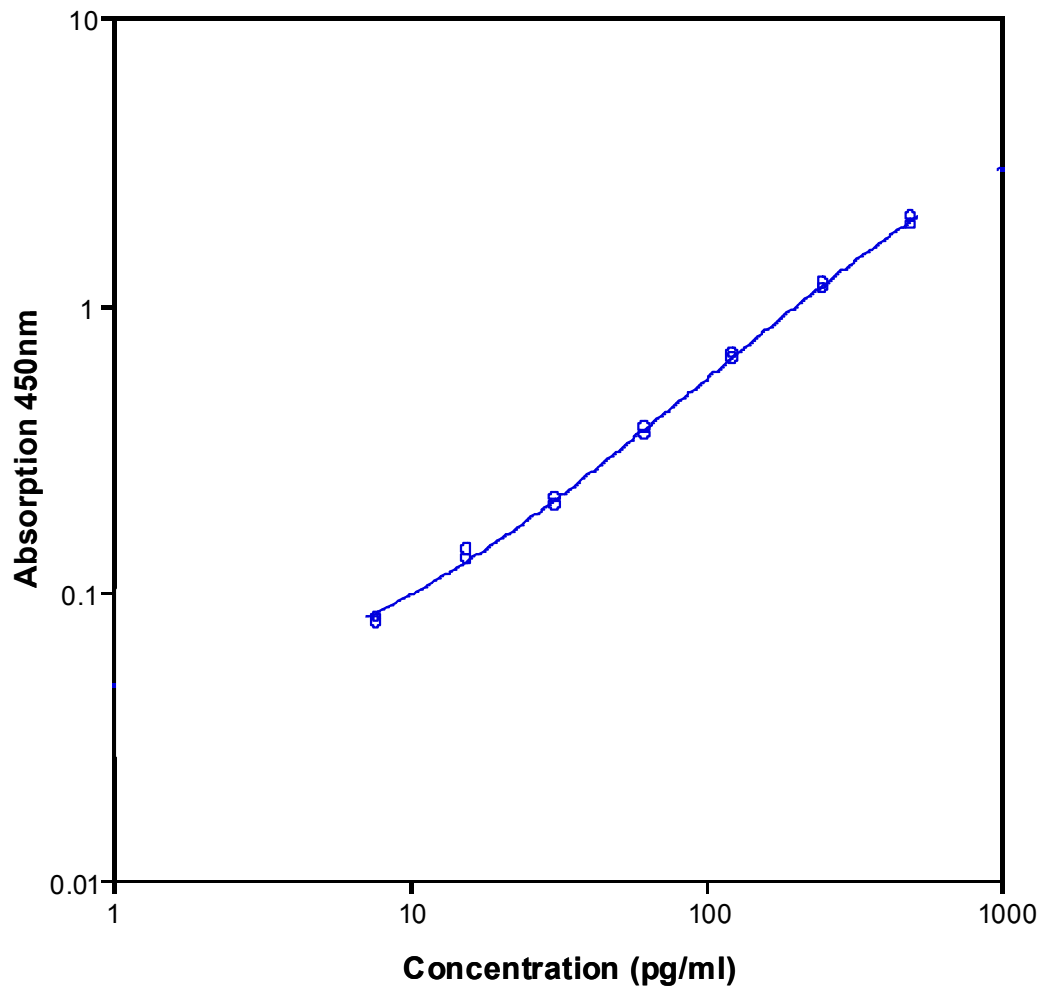




Table 2

Typical data using the human TNF $\alpha$  ELISA

Measuring wavelength: 450 nm

Reference wavelength: 620 nm

| Standard | HumanTNF $\alpha$<br>Concentration (pg/ml) | O.D. at 450 nm | Mean O.D. at 450 nm | C.V. (%) |
|----------|--|----------------|---------------------|----------|
| 1        | 500.0                                      | 1.877          | 1.951               | 5.4      |
|          | 500.0                                      | 2.025          |                     |          |
| 2        | 250.0                                      | 1.133          | 1.163               | 3.6      |
|          | 250.0                                      | 1.192          |                     |          |
| 3        | 125.0                                      | 0.646          | 0.659               | 2.8      |
|          | 125.0                                      | 0.672          |                     |          |
| 4        | 62.5                                       | 0.352          | 0.364               | 4.5      |
|          | 62.5                                       | 0.375          |                     |          |
| 5        | 31.3                                       | 0.200          | 0.208               | 5.1      |
|          | 31.3                                       | 0.215          |                     |          |
| 6        | 15.6                                       | 0.130          | 0.136               | 5.7      |
|          | 15.6                                       | 0.141          |                     |          |
| 7        | 7.8  | 0.082          | 0.080               | 3.5      |
|          | 7.8  | 0.078          |                     |          |
| Blank    | 0  | 0.042          |                     |          |
|          | 0  | 0.034          |                     |          |

The OD values of the standard curve may vary according to the conditions of assay performance (e.g. operator, pipetting technique, washing technique or temperature effects). Furthermore shelf life of the kit may affect enzymatic activity and thus colour intensity. Values measured are still valid.

## 12. LIMITATIONS

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- Since exact conditions may vary from assay to assay, a standard curve must be established for every run.
- Bacterial or fungal contamination of either screen samples or reagents or cross-contamination between reagents may cause erroneous results.
- Disposable pipette tips, flasks or glassware are preferred, reusable glassware must be washed and thoroughly rinsed of all detergents before use.
- Improper or insufficient washing at any stage of the procedure will result in either false positive or false negative results. Empty wells completely before dispensing fresh wash solution, fill with Wash Buffer as indicated for each wash cycle and do not allow wells to sit uncovered or dry for extended periods.
- The use of radioimmunotherapy has significantly increased the number of patients with human anti-mouse IgG antibodies (HAMA). HAMA may interfere with assays utilizing murine monoclonal antibodies leading to both false positive and false negative results. Serum samples containing antibodies to murine immunoglobulins can still be analysed in such assays when murine immunoglobulins (serum, ascitic fluid, or monoclonal antibodies of irrelevant specificity) are added to the sample

## 13. PERFORMANCE CHARACTERISTICS

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### 13.1 Sensitivity

The limit of detection of human  $\text{TNF}\alpha$  defined as the analyte concentration resulting in an absorbance significantly higher than that of the dilution medium (mean plus 2 standard deviations) was determined to be 2.3 pg/ml (mean of 6 independent assays).

### 13.2 Reproducibility

#### 13.2.1 Intra-assay

Reproducibility within the assay was evaluated in 3 independent experiments. Each assay was carried out with 6 replicates of 8 serum samples containing different concentrations of human  $\text{TNF}\alpha$ . 2 standard curves were run on each plate. Data below show the mean human  $\text{TNF}\alpha$  concentration and the coefficient of variation for each sample. The calculated overall intra-assay coefficient of variation was 6.0%.

Table 3

The mean human TNF $\alpha$  concentration and the coefficient of variation for each sample

| Sample | Experiment | Mean Human TNF $\alpha$ |                              |
|--------|------------|-------------------------|------------------------------|
|        |            | Concentration (pg/ml)   | Coefficient of Variation (%) |
| 1      | 1          | 463.7                   | 3.2                          |
|        | 2          | 582.1                   | 5.1                          |
|        | 3          | 583.2                   | 5.4                          |
| 2      | 1          | 364.6                   | 6.4                          |
|        | 2          | 454.0                   | 1.9                          |
|        | 3          | 415.4                   | 7.3                          |
| 3      | 1          | 243.9                   | 3.4                          |
|        | 2          | 282.0                   | 4.7                          |
|        | 3          | 295.1                   | 8.1                          |
| 4      | 1          | 144.3                   | 4.7                          |
|        | 2          | 168.6                   | 6.1                          |
|        | 3          | 178.2                   | 7.8                          |
| 5      | 1          | 60.4                    | 4.4                          |
|        | 2          | 66.7                    | 5.7                          |
|        | 3          | 72.7                    | 4.4                          |
| 6      | 1          | 26.3                    | 8.7                          |
|        | 2          | 23.8                    | 4.9                          |
|        | 3          | 24.2                    | 10.4                         |
| 7      | 1          | 6265.8                  | 4.6                          |
|        | 2          | 6223.9                  | 7.5                          |
|        | 3          | 6857.6                  | 6.1                          |
| 8      | 1          | 4498.1                  | 4.6                          |
|        | 2          | 4752.0                  | 7.2                          |
|        | 3          | 5326.0                  | 5.4                          |

### 13.2.2 Inter-assay

Assay to assay reproducibility within one laboratory was evaluated in 3 independent experiments. Each assay was carried out with 6 replicates of 8 serum samples containing different concentrations of human TNF $\alpha$ . 2 standard curves were run on each plate. Data below show the mean human TNF $\alpha$  concentration and the coefficient of variation calculated on 18 determinations of each sample. The calculated overall inter-assay coefficient of variation was 7.4%.

Table 4

The mean human TNF $\alpha$  concentration and the coefficient of variation of each sample

| Sample | Mean Human TNF $\alpha$ Concentration (pg/ml) | Coefficient of Variation (%) |
|--------|---|------------------------------|
| 1      | 543.0   | 10.3                         |
| 2      | 411.3   | 8.9                          |
| 3      | 273.7   | 7.9                          |
| 4      | 163.7   | 8.7                          |
| 5      | 66.6  | 7.5                          |
| 6      | 24.8  | 4.5                          |
| 7      | 6449.1  | 4.5                          |
| 8      | 4858.7  | 7.1                          |

### 13.3 Spiking Recovery

The spiking recovery was evaluated by spiking 4 levels of human TNF $\alpha$  into serum samples. Recoveries were determined in 3 independent experiments with 6 replicates each.

The amount of endogenous human TNF $\alpha$  in unspiked serum was subtracted from the spike values.

The recovery ranged from 72% to 112% with an overall mean recovery of 93%.

Recoveries were shown to depend on the serum used.

### 13.4 Dilution Linearity

4 serum samples with different levels of human TNF $\alpha$  were analysed at serial 2 fold dilutions with 4 replicates each.

The recovery ranged from 94% to 117% with an overall recovery of 105%.

Table 5

| Sample | Dilution | Expected Human TNF $\alpha$ Concentration (pg/ml) | Observed Human TNF $\alpha$ Concentration (pg/ml) | Recovery of Expected Human TNF $\alpha$ Concentration (%) |
|--------|----------|---|---|---|
| 1      | 1:2      | --  | 2192.7  | --  |
|        | 1:4      | 1096.3  | 1168.3  | 106.6   |
|        | 1:8      | 584.1   | 574.0   | 98.3  |
|        | 1:16     | 287.0   | 287.0   | 100.0   |
| 2      | 1:2      | --  | 984.0   | --  |
|        | 1:4      | 492.0   | 513.1   | 104.3   |
|        | 1:8      | 256.5   | 240.2   | 93.6  |
|        | 1:16     | 120.1   | 138.8   | 115.6   |
| 3      | 1:2      | --  | 1937.3  | --  |
|        | 1:4      | 968.6   | 1056.2  | 109.0   |
|        | 1:8      | 528.1   | 546.0   | 103.4   |
|        | 1:16     | 273.0   | 270.0   | 98.9  |
| 4      | 1:2      | --  | 877.1   | --  |
|        | 1:4      | 438.6   | 504.4   | 115.0   |
|        | 1:8      | 252.2   | 243.0   | 96.3  |
|        | 1:16     | 121.5   | 141.7   | 116.6   |

Recoveries were shown to depend on the serum used.

### 13.5 Sample Stability

#### 13.5.1 Freeze-Thaw Stability

Aliquots of serum samples (spiked or unspiked) were stored at -20°C and thawed 5 times, and the human TNF $\alpha$  levels determined. A significant decrease of human TNF $\alpha$  immunoreactivity was detected. Therefore samples should be stored in aliquots at -20°C and thawed only once.

#### 13.5.2 Storage Stability

Aliquots of serum samples (spiked or unspiked) were stored at -20°C, 2-8°C, room temperature (RT) and at 37°C, and the human TNF $\alpha$  level determined after 25 h. There was no significant loss of human TNF $\alpha$  immunoreactivity detected during storage at -20°C and 2-8°C.

A significant loss of human TNF $\alpha$  immunoreactivity was detected during storage at RT and 37°C after 24 h.

### **13.7 Comparison of Serum and Plasma**

From two individuals, serum and EDTA plasma obtained at the same time point were evaluated. Human TNF $\alpha$  concentrations were not significantly different and therefore these body fluids are suitable for the assay. It is nevertheless highly recommended to assure the uniformity of blood preparations.

### **13.7 Specificity**

The interference of circulating factors of the immune system was evaluated by spiking these proteins at physiologically relevant concentrations into a human TNF $\alpha$  positive serum.

There was no interference detected, namely not with TNF-R (60 kDa and 80 kDa).

### **13.8 Expected Values**

A panel of 8 sera samples from randomly selected apparently healthy donors (males and females) was tested for human TNF $\alpha$ .

There were no detectable human TNF $\alpha$  levels found.

### **13.9. Calibration**

The immunoassay is calibrated with highly purified recombinant human TNF $\alpha$  which has been evaluated against the international Reference Standard NIBSC 87/650 and has been shown to be equivalent. NIBSC 87/650 is quantitated in International Units (IU), 1IU corresponding to 25 pg human TNF $\alpha$ .

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## 15. REAGENT PREPARATION SUMMARY

### 15.1 Wash Buffer (1x)

Add **Wash Buffer Concentrate** 20x (50 ml) to 950 ml distilled water.

| Number of Strips | Wash Buffer Concentrate (ml) | Distilled Water (ml) |
|------------------|------------------------------|----------------------|
| 1 - 6            | 25                           | 475                  |
| 1 - 12           | 50                           | 950                  |

### 15.2 Assay Buffer (1x)

Add **Assay Buffer Concentrate** 20x (5 ml) to 95 ml distilled water.

| Number of Strips | Assay Buffer Concentrate (ml) | Distilled Water (ml) |
|------------------|-------------------------------|----------------------|
| 1 - 6            | 2.5                           | 47.5                 |
| 1 - 12           | 5.0                           | 95.0                 |

### 15.3 Biotin-Conjugate

Make a 1:100 dilution of **Biotin-Conjugate** in Assay Buffer (1x):

| Number of Strips | Biotin-Conjugate (ml) | Assay Buffer (1x) (ml) |
|------------------|-----------------------|------------------------|
| 1 - 6            | 0.03                  | 2.97                   |
| 1 - 12           | 0.06                  | 5.94                   |

### 15.4 Streptavidin-HRP

Make a 1:200 dilution of **Streptavidin-HRP** in Assay Buffer (1x):

| Number of Strips | Streptavidin-HRP (ml) | Assay Buffer (1x) (ml) |
|------------------|-----------------------|------------------------|
| 1 - 6            | 0.03                  | 5.97                   |
| 1 - 12           | 0.06                  | 11.94                  |

### 15.5 Human APRIL Standard

Reconstitute lyophilized **human TNF $\alpha$  standard** with distilled water. (Reconstitution volume is stated in the Quality Control Sheet.)

### 15.6. Controls

Add 800  $\mu$ l distilled water to lyophilized **controls**.

## 16. TEST PROTOCOL SUMMARY

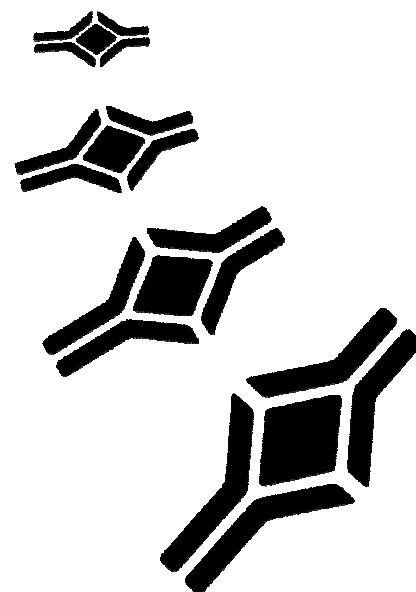
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1. Determine the number of microwell strips required.
2. Wash microwell strips twice with Wash Buffer.
3. Standard dilution on the microwell plate: Add 100 µl Sample Diluent, in duplicate, to all standard wells. Pipette 100 µl prepared standard into the first wells and create standard dilutions by transferring 100 µl from well to well. Discard 100 µl from the last wells. Alternatively external standard dilution in tubes (see 9.5.1): Pipette 100 µl of these standard dilutions in the microwell strips.
4. Add 100 µl Sample Diluent, in duplicate, to the blank wells.
5. Add 50 µl Sample Diluent to sample wells.
6. Add 50 µl sample in duplicate, to designated sample wells.
7. Prepare Biotin-Conjugate.
8. Add 50 µl Biotin-Conjugate to all wells.
9. Cover microwell strips and incubate 2 hours at room temperature (18° to 25°C).
10. Prepare Streptavidin-HRP.
11. Empty and wash microwell strips 4 times with Wash Buffer.
12. Add 100 µl diluted Streptavidin-HRP to all wells.
13. Cover microwell strips and incubate 1 hour at room temperature (18° to 25°C).
14. Empty and wash microwell strips 4 times with Wash Buffer.
15. Add 100 µl of TMB Substrate Solution to all wells.
16. Incubate the microwell strips for about 10 minutes at room temperature (18° to 25°C).
17. Add 100 µl Stop Solution to all wells.
18. Blank microwell reader and measure colour intensity at 450 nm.

**Note:** If instructions in this protocol have been followed samples have been diluted 1:2 (50 µl sample + 50 µl Sample Diluent), the concentration read from the standard curve must be multiplied by the dilution factor (x 2).

**NOTES**





|  |   |   |   |   |
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