

# Human TNF alpha (Total) ELISA Kit

Enzyme-linked Immunosorbent Assay for quantitative detection of human TNF  $\alpha$  total

**Catalog Numbers** BMS2034 or BMS2034TEN

**Pub. No.** MAN0016494 **Rev.** A.0 (30)

**WARNING!** Read the Safety Data Sheets (SDSs) and follow the handling instructions. Wear appropriate protective eyewear, clothing, and gloves. Safety Data Sheets (SDSs) are available from [thermofisher.com/support](http://thermofisher.com/support).

## Product description

The Human TNF alpha (Total) ELISA Kit is an enzyme-linked immunosorbent assay for the quantitative detection of human TNF  $\alpha$ .

## Summary

TNF  $\alpha$  is a multifunctional cytokine involved in many different pathways, in homeostasis and pathophysiology of mammals. It can show opposing biological effects suggesting complex regulatory mechanisms.

TNF  $\alpha$ , also known as cachectin, was first detected as a cytotoxic factor inducing lysis of certain tumor cells. The TNF  $\alpha$  gene is member 2 of the TNF-superfamily (consisting of at least 20 distinct members).

TNF  $\alpha$  release is mainly triggered by viral infections and endotoxins, lipopolysaccharides or other bacterial components, by tissue injury, DNA-damage and by IL-1, PDGF and TNF  $\alpha$  itself. It is primarily expressed in macrophages, but also in monocytes, neutrophils, NK-cells, mast-cells, endothelial cells and activated lymphocytes. TNF  $\alpha$  expression in endothelial cells and fibroblasts can be induced by IL-17. The expression of other cytokines, chemokines, reactive oxygen intermediates, nitric oxide and prostaglandins is stimulated by TNF  $\alpha$ .

The initially membrane bound TNF  $\alpha$  is enzymatically cleaved by TACE (= ADAM17). The soluble monomers aggregate to homotrimers and are secreted into blood and other biological fluids. The membrane bound and the soluble form are biologically active and bind to the TNF- receptors TNFR1 (= TNFRSF1A, p55-60) and TNFR2 (= TNFRSF1B, TNFBR2, p75-80).

Upon ligand binding, receptors form trimers leading to conformational changes, protein dissociation (SODD = silencer of death domains, BAG4, Bcl2-associated athanogene 4) and association (TRADD = TNF-R1 associated death domain protein) and yielding the following biological activities:

- Transcription of anti-apoptotic factors and proteins involved in cell proliferation and inflammation via binding of TRAF2 (TNF-R associated factor 2) and RIPK1 (TNF-R interacting serine-threonine kinase 1) and activation of the transcription factor NF  $\kappa$  B.
- Cell proliferation, differentiation but also apoptosis via TRAF2 binding, kinases activation, activation of c-Jun and ATF2 (JNK-MAPK-pathway).
- Apoptosis via the binding of FADD (Fas associating protein with death domain) to TRADD and activation of caspases (including caspase 8 = FLICE).
- Necrosis, a caspase independent cell death, mediated by NADPH oxidases, which form a complex with TRADD and RIPK1, leading to the generation of oxygen species.

TNF-R2 contains no DD (death domain), but exhibits its function via direct TRAF binding.

Thus the multiple biological functions of TNF  $\alpha$  comprise cellular proliferation and differentiation, tumorigenesis, apoptotic or necrotic

cell death (including certain tumor cell lines), immunoregulatory activities, lipid metabolism, coagulation and endothelial function. It promotes local or systemic inflammation (TNF  $\alpha$  is a potent pyrogen) and stimulates the acute phase response. Very high expressions of TNF  $\alpha$  after infection can lead to septic shock (TNF  $\alpha$  is highly cytotoxic.), whereas sustained low levels induce cachexia and inflammation.

For literature update refer to our website.

## Principles of the test

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

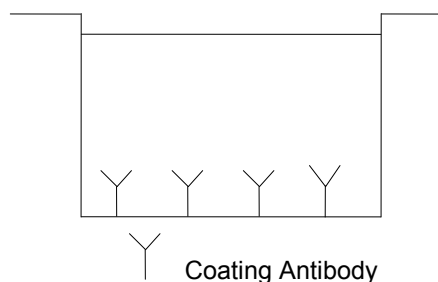


Fig. 1 Coated microwell

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.

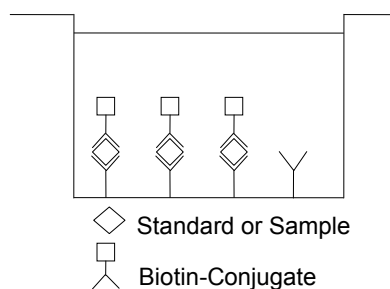


Fig. 2 First incubation

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.

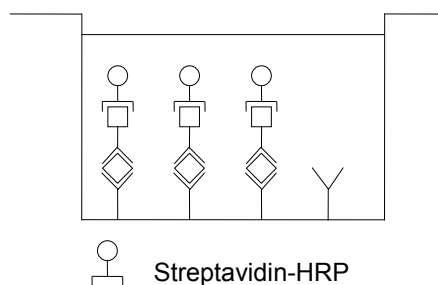


Fig. 3 Second incubation

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

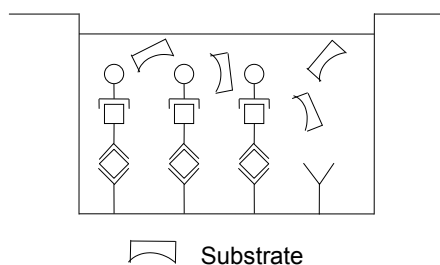


Fig. 4 Third incubation

A colored product is formed in proportion to the amount of human 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 TNF  $\alpha$  standard dilutions and human TNF  $\alpha$  sample concentration determined.

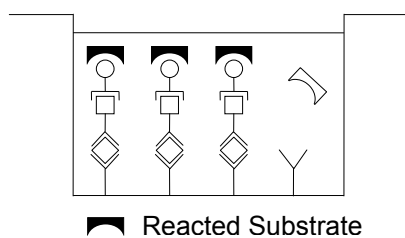


Fig. 5 Stop reaction

## Reagents provided

### Reagents for human TNF $\alpha$ total ELISA BMS2034 (96 tests)

- 1 aluminum pouch with a Microwell Plate (12 strips of 8 wells each) coated with monoclonal antibody to human TNF  $\alpha$
- 1 vial (70  $\mu$ L) Biotin-Conjugate anti-human TNF  $\alpha$  polyclonal antibody
- 1 vial (150  $\mu$ L) Streptavidin-HRP
- 2 vials human TNF  $\alpha$  Standard lyophilized, 3000 pg/mL upon reconstitution
- 1 vial (12 mL) Sample Diluent
- 1 vial (5 mL) Assay Buffer Concentrate 20x (PBS with 1% Tween™ 20, 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)
- 4 Adhesive Films

### Reagents for human TNF $\alpha$ total ELISA BMS2034TEN (10x96 tests)

- 10 aluminum pouches with a Microwell Plate (12 strips of 8 wells each) coated with monoclonal antibody to human TNF  $\alpha$
- 10 vials (70  $\mu$ L) Biotin-Conjugate anti-human TNF  $\alpha$  polyclonal antibody
- 10 vials (150  $\mu$ L) Streptavidin-HRP
- 10 vials human TNF  $\alpha$  Standard lyophilized, 3000 pg/mL upon reconstitution
- 7 vials (12 mL) Sample Diluent
- 2 vials (5 mL) Assay Buffer Concentrate 20x (PBS with 1% Tween™ 20, 10% BSA)
- 6 bottles (50 mL) Wash Buffer Concentrate 20x (PBS with 1% Tween™ 20)
- 10 vials (15 mL) Substrate Solution (tetramethyl-benzidine)
- 1 vial (100 mL) Stop Solution (1M Phosphoric acid)
- 20 Adhesive Films

## Storage instructions – ELISA kit

Store kit reagents between 2°C and 8°C. Immediately after use remaining reagents should be returned to cold storage (2°C to 8°C). 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.

## Sample collection and storage instructions

Cell culture supernatant, serum, and plasma (EDTA, citrate, heparin) 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.

Samples containing a visible precipitate must be clarified prior to use in the assay. Do not use grossly hemolyzed or lipemic samples.

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°C to 8°C (for sample stability refer to “Sample stability” on page 6).

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.

## Materials required but not provided

- 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

## Precautions for use

- 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 pipet 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 samples.
- Rubber or disposable latex gloves should be worn while handling kit reagents or samples.
- Avoid contact of substrate solution with oxidizing agents and metal.
- Avoid splashing or generation of aerosols.

- To avoid microbial contamination or cross-contamination of reagents or samples that 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 samples and all potentially contaminated materials as if 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.

## Preparation of reagents

- Buffer concentrates should be brought to room temperature and should be diluted before starting the test procedure.
- If crystals have formed in the Buffer Concentrates, warm them gently until they have completely dissolved.

## Wash buffer (1x)

- Pour entire contents (50 mL) of the Wash Buffer Concentrate (20x) 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.
- Transfer to a clean wash bottle and store at 2°C to 25°C. Please note that Wash Buffer (1x) is stable for 30 days.
- Wash Buffer (1x) 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

## 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°C 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

## Biotin-Conjugate

**Note:** 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

## Streptavidin-HRP

**Note:** The Streptavidin-HRP should be used within 30 minutes after dilution.

Make a 1:100 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	0.06	5.94
1 - 12	0.12	11.88

## Human TNF $\alpha$ total Standard

- Reconstitute human TNF  $\alpha$  total standard by addition of distilled water.
- Reconstitution volume is stated on the label of the standard vial. Swirl or mix gently to insure complete and homogeneous solubilization (concentration of reconstituted standard = 3000 pg/mL).
- Allow the standard to reconstitute for 10-30 minutes. Mix well prior to making dilutions.

The standard must be used immediately after reconstitution and cannot be stored.

## External standard dilution

- Label 7 tubes, one for each standard point: S1, S2, S3, S4, S5, S6, S7.
- 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 = 3000 pg/mL) into the first tube, labeled S1, and mix (concentration of standard 1 = 1500 pg/mL).
- Pipette 225  $\mu$ L of this dilution into the second tube, labeled S2, and mix thoroughly before the next transfer.
- Repeat serial dilutions 5 more times thus creating the points of the standard curve (see Figure 6).

Sample Diluent serves as blank.

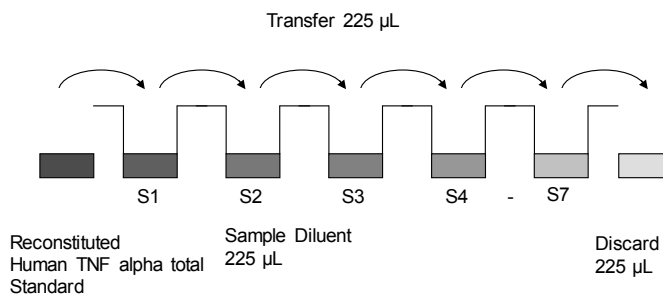


Fig. 6 Dilute standards - tubes

## Test protocol

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

1. 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°C to 8°C sealed tightly.
2. 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.

3. Standard dilution on the microwell plate (alternatively, the standard dilution can be prepared in tubes, see “External standard dilution” on page 3):

Add 100 µL of Sample Diluent in duplicate to all standard wells. Pipette 100 µL of prepared standard (see “Human TNF α total Standard” on page 3, concentration = 3000 pg/mL) in duplicate into well A1 and A2 (see Table 1). Mix the contents of wells A1 and A2 by repeated aspiration and ejection (concentration of standard 1, S1 = 1500 pg/mL), and transfer 100 µL to wells B1 and B2, respectively (see Figure 7). Take care not to scratch the inner surface of the microwells. Continue this procedure 5 times, creating two rows of human TNF α standard dilutions ranging from 1500–23 pg/mL. Discard 100 µL of the contents from the last microwells (G1, G2) used.

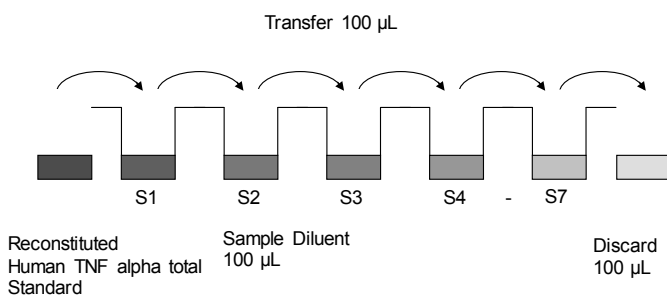


Fig. 7 Dilute standards - microwell plate.

In case of an external standard dilution (see “External standard dilution” on page 3), pipette 100 µL of these standard dilutions (S1–S7) in the standard wells according to Table 1.

**Table 1** Example of the arrangement of blanks, standards, and samples in the microwell strips.

	1	2	3	4
A	Standard 1 1500 pg/mL	Standard 1 1500 pg/mL	Sample 1	Sample 1
B	Standard 2 750 pg/mL	Standard 2 750 pg/mL	Sample 2	Sample 2
C	Standard 3 375 pg/mL	Standard 3 375 pg/mL	Sample 3	Sample 3
D	Standard 4 188 pg/mL	Standard 4 188 pg/mL	Sample 4	Sample 4
E	Standard 5 94 pg/mL	Standard 5 94 pg/mL	Sample 5	Sample 5
F	Standard 6 47 pg/mL	Standard 6 (47 pg/mL)	Sample 6	Sample 6
G	Standard 7 23 pg/mL	Standard 7 23 pg/mL	Sample 7	Sample 7
H	Blank	Blank	Sample 8	Sample 8

4. Add 100 µL of Sample Diluent in duplicate to the blank wells.
5. Add 50 µL of Sample Diluent to the sample wells.
6. Add 50 µL of each sample in duplicate to the sample wells.
7. Prepare Biotin-Conjugate (see “Biotin-Conjugate” on page 3).
8. Add 50 µL of Biotin-Conjugate to all wells.
9. Cover with an adhesive film and incubate at room temperature (18°C to 25°C) for 2 hours on a microplate shaker.
10. Prepare Streptavidin-HRP (see “Streptavidin-HRP” on page 3).
11. Remove adhesive film and empty wells. Wash microwell strips 6 times according to point 2 of the test protocol. Proceed immediately to the next step.
12. Add 100 µL of diluted Streptavidin-HRP to all wells, including the blank wells.
13. Cover with an adhesive film and incubate at room temperature (18°C to 25°C) for 1 hour on a microplate shaker.
14. Remove adhesive film and empty wells. Wash microwell strips 6 times according to point 2 of the test protocol. Proceed immediately to the next step.
15. Pipette 100 µL of TMB Substrate Solution to all wells.
16. Incubate the microwell strips at room temperature (18°C to 25°C) for about 10 minutes. Avoid direct exposure to intense light.

The color 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 color 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 color. Alternatively the color 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 0.9–0.95.

17. 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°C to 8°C in the dark.
18. 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.

## Calculation of results

1. Calculate the average absorbance values for each set of duplicate standards and samples. Duplicates should be within 20% of the mean value.
2. Create a standard curve by plotting the mean absorbance for each standard concentration on the ordinate against the human TNF α concentration on the abscissa. Draw a best fit curve through the points of the graph (a 5-parameter curve fit is recommended).
3. To determine the concentration of circulating human TNF α 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 α concentration.
4. If instructions in this protocol have been followed, samples have been diluted 1:2 (50 µL sample + 50 µL Sample Diluent) and the concentration read from the standard curve must be multiplied by the dilution factor (x 2).
5. Calculation of samples with a concentration exceeding standard 1 may result in incorrect, low human TNF α levels. Such samples require further external predilution according to expected human TNF α values with Sample Diluent in order to precisely quantitate the actual human TNF α level.

6. 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.
7. A representative standard curve is shown in Figure 8.

**Note:** Do not use this standard curve to derive test results. Each laboratory must prepare a standard curve for each group of microwell strips assayed.

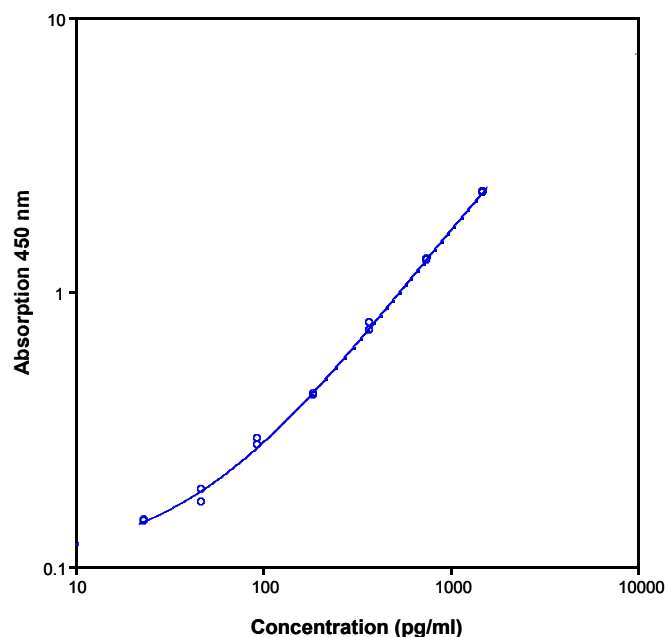


Fig. 8 Representative standard curve for human TNF  $\alpha$  total ELISA. Human TNF  $\alpha$  was diluted in serial 2-fold steps in Sample Diluent.

**Table 2** Typical data using the human TNF  $\alpha$  ELISA.

Measuring wavelength: 450 nm

Reference wavelength: 620 nm

Standard	Human TNF $\alpha$ Concentration (pg/mL)	O.D. at 450 nm	Mean O.D. at 450 nm	C.V. (%)
1	1500	2.312 2.278	2.295	0.7
2	750	1.304 1.314	1.309	0.4
3	375	0.768 0.720	0.744	3.3
4	188	0.424 0.417	0.420	0.8
5	94	0.291 0.276	0.284	2.7
6	47	0.190 0.170	0.180	5.5
7	23	0.147 0.145	0.146	1.0
Blank	0	0.090 0.092	0.091	1.4

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 color intensity. Values measured are still valid.

## Limitations

- 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 radioimmunoassay 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 analyzed in such assays when murine immunoglobulins (serum, ascitic fluid, or monoclonal antibodies of irrelevant specificity) are added to the sample.

## Performance characteristics

### Sensitivity

The limit of detection of human 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 5.0 pg/mL (mean of 6 independent assays).

### Reproducibility

#### 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 TNF  $\alpha$ . Two standard curves were run on each plate. Data below show the mean human TNF  $\alpha$  concentration and the coefficient of variation for each sample (see Table 3). The calculated overall intra-assay coefficient of variation was 7.7%.

**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	5328	6.6
	2	4990	9.4
	3	5474	3.4
2	1	4818	6.4
	2	4149	9.9
	3	4558	11.3
3	1	3523	12.2
	2	2967	5.3
	3	3478	5.7
4	1	2236	5.1
	2	2207	2.8
	3	2381	5.9
5	1	1528	6.7
	2	1379	11.6
	3	1310	8.4
6	1	889	2.0
	2	805	9.0
	3	827	7.4
7	1	607	14.9
	2	492	8.2
	3	507	7.3
8	1	216	6.3
	2	286	10.7
	3	267	8.0

## 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  $\alpha$ . Two 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 (see Table 4). The calculated overall inter-assay coefficient of variation was 8.1%.

**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	5264	4.7
2	4508	7.5
3	3323	9.3
4	2275	4.1
5	1405	7.9
6	840	5.2
7	535	11.7
8	256	14.0

## Spike recovery

The spike 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 unspiked serum was used as blank in these experiments. The recovery ranged from 76–115% with an overall mean recovery of 90%. Recoveries were shown to depend on the serum used.

## Dilution parallelism

Four serum samples with different levels of human TNF  $\alpha$  were analyzed at serial two-fold dilutions with four replicates each. The recovery ranged from 97.1–128.6% with an overall recovery of 112.7%. Recoveries were shown to depend on the serum used.

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	–	4937	–
	1:4	2469	2996	121.4
	1:8	1498	1781	118.9
	1:16	890	975	109.5
2	1:2	–	4590	–
	1:4	2295	2925	127.5
	1:8	1463	1582	108.2
	1:16	791	1017	128.6
3	1:2	–	5,986	–
	1:4	2993	3442	115.0
	1:8	1721	1751	101.8
	1:16	876	969	110.6
4	1:2	–	5550	–
	1:4	2775	3119	112.4
	1:8	1560	1514	97.1
	1:16	757	766	101.2

## Sample stability

### Freeze-Thaw stability

Aliquots of serum samples (spiked or unspiked) were stored at  $-20^{\circ}\text{C}$  and thawed five 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  $-20^{\circ}\text{C}$  and thawed only once.

## Storage stability

Aliquots of serum samples (spiked or unspiked) were stored at  $-20^{\circ}\text{C}$ ,  $2^{\circ}\text{C}$  to  $8^{\circ}\text{C}$ , room temperature, and at  $37^{\circ}\text{C}$ , and the human TNF  $\alpha$  level determined after 25 hours. There was no significant loss of human TNF  $\alpha$  immunoreactivity detected during storage at  $-20^{\circ}\text{C}$  and  $2^{\circ}\text{C}$  to  $8^{\circ}\text{C}$ . A significant loss of human TNF  $\alpha$  immunoreactivity was detected during storage at room temperature and  $37^{\circ}\text{C}$  after 24 hours.

## Specificity

The assay detects both natural and recombinant Product. 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. No interference was detected, namely not with TNF-R (60 kDa and 80 kDa).

## Expected values

A panel of 40 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. Elevated product levels depend on the type of immunological disorder.

## Reagent preparation summary

### 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

### 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

## 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

## Streptavidin-HRP

Make a 1:100 dilution of Streptavidin-HRP in Assay Buffer (1x):

Number of Strips	Streptavidin-HRP (mL)	Assay Buffer (1x) (mL)
1 - 6	0.06	5.94
1 - 12	0.12	11.88

## Human TNF $\alpha$ standard

Reconstitute lyophilized human TNF  $\alpha$  standard with distilled water. (Reconstitution volume is stated on the label of the standard vial.)

## Test protocol summary

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  $\mu\text{L}$  Sample Diluent, in duplicate, to all standard wells. Pipette 100  $\mu\text{L}$  prepared standard into the first wells and create standard dilutions by transferring 100  $\mu\text{L}$  from well to well. Discard 100  $\mu\text{L}$  from the last wells.  
Alternatively, external standard dilution in tubes (see "External standard dilution" on page 3): Pipette 100  $\mu\text{L}$  of these standard dilutions in the microwell strips.
4. Add 100  $\mu\text{L}$  Sample Diluent, in duplicate, to the blank wells.

5. Add 50  $\mu$ L Sample Diluent to sample wells.
6. Add 50  $\mu$ L sample in duplicate, to designated sample wells.
7. Prepare Biotin-Conjugate.
8. Add 50  $\mu$ L Biotin-Conjugate to all wells.
9. Cover microwell strips and incubate 2 hours at room temperature (18°C to 25°C).
10. Prepare Streptavidin-HRP.
11. Empty and wash microwell strips 6 times with Wash Buffer.
12. Add 100  $\mu$ L diluted Streptavidin-HRP to all wells.
13. Cover microwell strips and incubate 1 hour at room temperature (18°C to 25°C).
14. Empty and wash microwell strips 6 times with Wash Buffer.
15. Add 100  $\mu$ L of TMB Substrate Solution to all wells.
16. Incubate the microwell strips for about 10 minutes at room temperature (18°C to 25°C).
17. Add 100  $\mu$ L Stop Solution to all wells.
18. Blank microwell reader and measure color intensity at 450 nm.

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

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