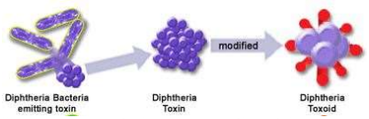
INTENDED USE

The Mouse Anti-Diphtheria IgM ELISA Kit detects and quantifies diphtheria toxin (DTOX) or toxoid-specific IgM in mouse serum or plasma of vaccinated, immunized and/or Diphtheria exposed individuals. This immunoassay is suitable for:

- Determining **immune status** relative to non-immune controls;
- Assessing efficacy of **vaccines**, including dosage, adjuvantcy, route of immunization and timing;
- Qualifying and standardizing vaccine batches & protocols.

This kit is for research use only (RUO), not for diagnostic or therapeutic use.

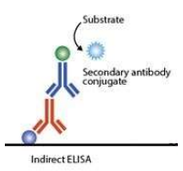
GENERAL INFORMATION



Diphtheria is a contagious disease of the upper respiratory tract. The illness is characterized by sore throat, low fever, and an adherent membrane (a pseudo membrane) on the tonsils, pharynx, and/or nasal cavity. Diphtheria also causes the progressive deterioration of myelin sheaths in the central and peripheral nervous system leading to degenerating motor control and loss of sensation. Common diphtheria has largely been eradicated in industrialized nations through widespread vaccination, e.g., the DPT (Diphtheria–Pertussis–Tetanus) vaccines are recommended for all school aged. These contain a toxoid of the disease-causing diphtheria toxin.

Monitoring the efficacy of vaccines by determining the anti-toxin levels in patients, including for clinical trials using new formulation of vaccines, is often required. The ADI Anti- Diphtheria ELISAs will quantify antibodies produced by vaccines, or from exposure to the toxin-producing organisms.

PRINCIPLE OF THE TEST



The Mouse Anti- Diphtheria IgM ELISA kit is based on the binding of mouse anti-DTOX IgM in samples to diphtheria toxin immobilized on the microwells, and anti- diphtheria toxin IgM antibody is detected by anti-Mouse IgM-specific antibody conjugated to HRP (horseradish peroxidase) enzyme. After a washing step, chromogenic substrate (TMB) is added and color is developed by the enzymatic reaction of HRP on the substrate, which is directly proportional to the amount of anti-DTOX toxin IgM present in the sample. Stopping Solution is added to terminate the reaction, and absorbance at 450nm is then measured using an ELISA microwell reader. The activity of mouse antibody in samples is determined relative to mouse anti-diphtheria toxin calibrators.

PRODUCT SPECIFICATIONS

Specificity

Purified diphtheria toxin CRM197 is used to coat the microwells; stabilizing postcoat contains BSA; thus, no other antibody specificity is detectable in the assay. The anti-Mouse IgM HRP conjugate specifically detects IgM, and will not react with IgG, IgA or IgE class antibodies (see also page 7).

KIT CONTENTS

The microtiter well plate and all other reagents, if unopened, are stable at 2-8°C until the expiration date printed on the box label. Stabilities of the working solutions are indicated under Reagent Preparation.

To Be Reconstituted: Store as indicated.

Component	Preparation Instructions
Wash Solution Concentrate (100x) Cat. No. WB-100, 10ml	Dilute the entire volume 10ml + 990ml with distilled or deionized water into a clean stock bottle. Label as **Working Wash Solution** and store at ambient temperature until kit is used entirely.
Sample Diluent Concentrate (20x) Cat. No. SD-20T, 10ml	Dilute the entire volume, 10ml + 190ml with distilled or deionized water into a clean stock bottle. Label as **Working Sample/Conjugate Diluent (WSD)** and store at 2-8°C until the kit lot expires or is used up.
Anti-Mouse IgM - HRP Conjugate Concentrate (100x) Part No. H-MsM.211, 0.15ml	Peroxidase conjugated anti- mouse IgM in buffer with protein, detergents and antimicrobial as stabilizers. Dilute fresh as needed; 10ul of concentrate to 1ml of **HRP Conjugate Diluent** is sufficient for 1 8-well strip. Use within the working day and discard. Return 100X to 2-8°C storage.

Ready For Use: Store as indicated on labels.

Component	Part	Amt	Contents
Diphtheria Toxoid Microwell Strip Plate	940-131	8-well strips (12)	Coated with diphtheria CRM197 toxoid, and post-coated with stabilizers.
Anti-Diphtheria Calibrators			
10 U/ml 25 U/ml 50 U/ml 100 U/ml	940-132B 940-132C 940-132D 940-132E	0.65 ml 0.65 ml 0.65 ml 0.65 ml	Four (4) vials, each containing anti-diphtheria toxoid levels in arbitrary activity Units; diluted in buffer with protein, detergents and antimicrobial as stabilizers.
Low NSB Sample Diluent	TBTm	30 ml	Buffer with protein, detergents and antimicrobial as stabilizers. Use as is for sample dilution
TMB Substrate	80091	12 ml	Chromogenic substrate for HRP containing TMB and peroxide.
Stop Solution	80101	12 ml	1% sulfuric acid.

Materials Required But Not Provided:

- Pipettors and pipettes that deliver 100ul and 1-10ml. A multi-channel pipettor is recommended.
- Disposable glass or plastic 5-15ml tubes for diluting samples and Anti- mouse IgM HRP Concentrate.
- Graduated cylinder to dilute Wash Concentrate; 0.2 - 1L.
- Stock bottle to store diluted Wash Solution; 200ml to 1L.
- Distilled or deionized water to dilute reagent concentrates.
- Microwell plate reader at 450 nm wavelength.

PRECAUTIONS AND SAFETY INSTRUCTIONS

Calibrators, Sample Diluent, and Antibody HRP contain bromonitrodioxane (BND: 0.05%, w/v). Stop Solution contains dilute sulfuric acid. Follow good laboratory practices, and avoid ingestion or contact of any reagent with skin, eyes or mucous membranes. All reagents may be disposed of down a drain with copious amounts of water. MSDS for TMB, sulfuric acid and BND can be requested or obtained from the ADI website: http://4adi.com/commerce/info/showpage.jsp?page_id=1060&category_id=2430&visit=10

ASSAY DESIGN AND SET-UP

Sample Collection and Handling

Culture medium, serum and other biological fluids may be used as samples with proper dilution to avoid solution matrix interference. For **serum**, collect blood by venipuncture, allow clotting, and separate the serum by centrifugation at room temperature. For other samples, including **tissue culture media**, clarify the sample by centrifugation and/or filtration prior to dilution in Sample Diluent.

Sample Dilution & Stability

Initial dilution of serum into **Working Sample Diluent** (WSD) is recommended to stabilize antibody activity. This enhances reproducible sampling, and stabilizes the antibody activity for years, stored refrigerated or frozen. Further dilution into **Low NSB Sample Diluent** (LNSD), which provides the lowest assay background, should be at least 5 times the initial dilution and performed the same day as the assay.

Example: Initial (1/5): **10**ul serum + **40**ul WSD [or 0.1ml + 0.4ml]
Further (1/25): **10**ul initial (1/5) + **40**ul LNSD (1/25)

Assay Design

Review Calculation of Results (p5-7) and Limits of the Assay (above) before proceeding:

- Select the proper sample dilutions. Account for expected potency of positives and minimize non-specific binding (NSB) and other matrix effects; for example, non-immune samples should give net signal <0.5 OD. This is usually 1:25 or greater dilution for mouse sera with normal levels of IgG and IgM. Dilute samples in **Working Sample Diluent (WSD)** or in **Low NSB Sample Diluent (TBTm)** (see above). Note: **all samples** must be diluted in the same diluent for proper comparison – either TBTm **or** 1xSD20T.
- Run a Sample Diluent **Blank**. This signal is an indicator of proper assay performance, especially of washing efficacy, and is used for net OD calculations, if required. Blank OD should be <0.3. **See Method A**.
- Run a set of Calibrators. Calibrators validate that the assay was performed to specifications, and can be used to normalize between-assay variation for enhanced precision. Reading values off a Calibrator curve, **Method B**, has limitations. See Limits of the Assay above.
- Run a range of sample dilutions for expected higher positives that allows calculation of antibody **Titer** (when specific titer is at least 4-fold higher than non-immune)**. See Method C.**
- Run samples in duplicate if used for quantitation; non-immunes that are significantly lower than immunes may be run in singlicate. The Calibrators that are used for quantitation, e.g., for between-assay normalization, should be run in duplicate. When determining titer from a dilution curve, singlicates can be run if more than two dilution points are used for titer calculations.

Plate Set-up

Bring all reagents to room temperature (18-30° C) equilibration (at least 30 minutes).

- Determine the number of wells for the assay run. Duplicates are recommended, including 8 Calibrator wells and 2 wells for each sample and control to be assayed.
- Remove the appropriate number of microwell strips from the pouch and return unused strips to the pouch. Reseal the pouch and store refrigerated.
- Add 200-300ul Working Wash Solution to each well and let stand for about 5 minutes. Aspirate or dump the liquid and pat dry on a paper towel before sample addition.

Assay Procedure

ALL STEPS ARE PERFORMED AT ROOM TEMPERATURE. After each reagent addition, gently tap the plate to mix the well contents prior to beginning incubation.

1. 1st Incubation [100ul – 60 min; 4 washes]

- Add 100ul of calibrators, samples and controls each to pre-determined wells.
- Tap the plate gently to mix reagents and incubate for 60 minutes.
- Wash wells 4 times and pat dry on fresh paper towels. As an alternative, an automatic plate washer may be used. Improper washes may lead to falsely elevated signals and poor reproducibility.

2. 2nd Incubation [100ul – 30 min; 5 washes]

- Add 100ul of diluted Anti-Mouse IgM HRP to each well.
- Incubate for 30 minutes.
- Wash wells 5 times as in step 2.

3. Substrate Incubation [100ul – 15 min]

- Add 100ul TMB Substrate to each well. The liquid in the wells will begin to turn blue.
- Incubate for 15 minutes in the dark, e.g., place in a drawer or closet.

Note: If your microplate reader does not register optical density (OD) above 2.0, incubate for less time, or read OD at 405-410 nm (results are valid).

4. Stop Step [Stop: 100ul]

- Add 100ul of Stop Solution to each well.
- Tap gently to mix. The enzyme reaction will stop; liquid in the wells will turn yellow.

5. Absorbance Reading

- Use any commercially available microplate reader capable of reading at 450nm wavelength. Use a program suitable for obtaining OD readings, and data calculations if available.
- Read absorbance of the entire plate at 450nm using a single wavelength within 30 minutes after Stop Solution addition. If available, program to subtract OD at 630nm to normalize well background.

CALCULATION OF RESULTS

Calculation of Results

Consider several data reduction methods to best represent the relationships among experimental and control groups, to determine **Positive Immune** and **Negative Non-immune**, and to **Quantitate** positive antibody levels.

Method A. Antibody Activity **[ELISA Signal & Sample Dilution]**

Represent data as net OD units (A450 signal; blank subtracted) ÷ dilution = **Total Activity Units**.

A Calibrator value in the mid-OD range (e.g., 25 U/ml) can be used to normalize inter-assay values.

Method B. Positive Index

Experimental sample values may be expressed relative to the values of Control or Non-immune samples, by calculation of a **Positive Index**. One typical method is as follows:

1. Calculate the net OD mean + 2 SD of the Control/Non-immune samples = **Positive Index**.
2. Divide each sample net OD by the Positive Index. Values above 1.0 are a measure of **Positive** Antibody Activity; below 1.0 are **Negative** for antibody.

A sample value would be **Positive** if significantly above the value of the pre-immune serum sample or a suitably determined non-immune panel or pool of samples, tested at the same sample dilution. This calculation **quantifies** the positive Antibody Activity level.

Example:

	Assay Net OD		Calculated Antibody Activity	
Sample	Control	Exptl	Control	Exptl
1	0.243	2.358	0.49	**4.79**
2	0.351	0.597	0.71	**1.21**
3	0.286	1.421	0.58	**2.89**
4	0.357	1.268	0.73	**2.58**
5	0.512	0.857	**1.04**	**1.74**
6	0.342	1.296	0.70	**2.63**
7	0.298	0.608	0.61	**1.24**
8	0.285	0.369	0.58	0.75
9	0.157	0.864	0.32	**1.76**
10	0.187	0.543	0.38	**1.10**
Mean	0.302			
SD	0.095			
Mean +2 SD	**0.492**	= **Positive Index**		

Assay Sensitivity
The diphtheria toxin-coated plate and the anti-Mouse IgM HRP concentration are optimized to differentiate anti-diphtheria IgM from background (non-antibody) signal with mouse serum samples diluted 1:25 or higher.

CALCULATION OF RESULTS (continued)

Method B. Use of a Calibrator Curve

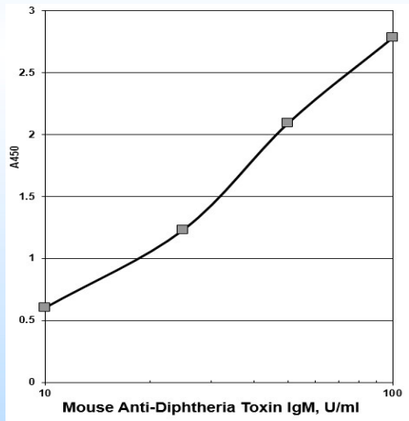
When the dilution curves of samples are parallel to the Calibrator curve (see Limits of the Assay), the anti-diphtheria toxoid activity units may be determined by interpolation from the Calibrator curve, as follows:

1. The results may be calculated using any immunoassay software package. If software is not available, anti-diphtheria toxoid activity concentrations may be determined as follows:
2. Calculate the mean OD of duplicate samples.
3. On graph paper plot the mean OD of the calibrators (y-axis) against the concentration (U/ml) of anti-diphtheria toxoid (x-axis). Draw the best fit curve through these points to construct the calibrator curve. A point-to-point construction is most common and reliable.
4. The anti-diphtheria toxoid activity concentrations in unknown samples and controls can be determined by interpolation from the calibrator curve.
5. Multiply the values obtained for the samples by the dilution factor of each sample.
6. Samples producing signals higher than the 100 U/ml calibrator should be further diluted and re-assayed.

Typical Results:

Wells	Calibrators & Samples		A450 nm	U/ml
A1, A2	**Negative Diluent Control**		0.04	0
B1, B2	10 U/ml	**Calibrator**	0.60	10
C1, C2	25 U/ml	**Calibrator**	1.23	25
D1, D2	50 U/ml	**Calibrator**	2.09	50
E1, E2	100 U/ml	**Calibrator**	2.78	100
F1, F2	**Sample** (1:25 dilution)		1.46	29

Calculated: 25-fold dilution x 29 U/ml = **725** U/ml in serum



CALCULATION OF RESULTS (continued)

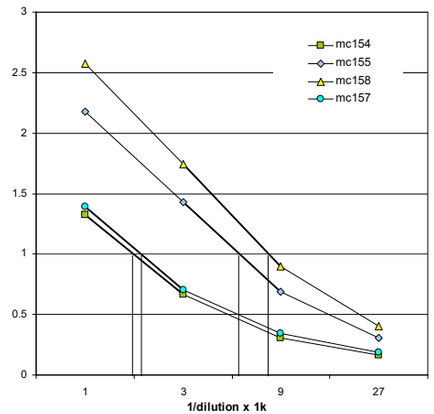
1. Prepare serial dilutions of each sample to provide a series that will produce signals higher and lower than the selected index. With accurate diluting, duplicates may not be required if at least 4 dilutions are run per sample.
2. A 5-fold dilution scheme is useful to efficiently cover a wide range which produces ODs both above and below 1.0 OD. The dilution scheme can be tightened to 3-fold or 2-fold for more precise comparative data.
3. A Calibrator value in the mid-OD range (e.g., 50 U/ml) can be used to normalize inter-assay values.

Calculations

1. On a log scale of inverse of Sample Dilution as the x-axis, plot the OD values of the two dilutions of each positive sample having ODs above and below the OD value of the Index (arbitrary or selected Calibrator).
2. From a point-to-point line drawn between the two sample ODs, read the dilution value (x-axis) corresponding to the OD of the selected Index
   = **Total IgM Antibody Activity Units**

Example:

II. A **1.0 OD** Index was used to determine titer of 4 antibodies.



Titer Values
mc154 = 1.72 kU **mc155 = 5.70 kU**
mc157 = 1.85 kU **mc158 = 7.90 kU**

Specificity and Reactivity of Diphtheria Toxoid and CRM197

Mutant forms of diphtheria toxin (DT), cross-reactive material 197 (**CRM197**) is a non-toxic DT mutant containing a lesion in the A chain blocking ADP-ribosylation. CRM results from a single base change in the structural gene resulting in the substitution of glutamic acid for glycine. While CRM shows no enzymatic activity, it is immunologically indistinguishable from diphtheria toxin. In its applications, CRM 197 is similar to diphtheria toxoid. This kit can be used to detect anti-DT/DTOX or anti-CRM197.

Instruction Manual No. M-940-225-DMM

Mouse Anti-Diphtheria Toxin/Toxoid/CRM197 IgM ELISA Kit

Cat. # 940-225-DMM

For Quantitation of Anti-Diphtheria Toxin/Toxoid/CRM197 IgM in Serum or Plasma

For research use only (RUO), not for diagnostic or therapeutic use

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ELISA Kit Components	Amount	Part
Diphtheria Toxin Coated Microwell Strip Plate	8-well strips (12)	940-131
Anti-Diphtheria Calibrator 10 U/ml	0.65 ml	940-132C
Anti-Diphtheria Calibrator 25 U/ml	0.65 ml	940-132D
Anti-Diphtheria Calibrator 50 U/ml	0.65 ml	940-132E
Anti-Diphtheria Calibrator 100 U/ml	0.65 ml	940-132F
Anti-Mouse IgM HRP Conjugate (100X)	0.15 ml	H-MsM.211
Sample Diluent (20X)	10 ml	SD20T
Low NSB Sample Diluent	30 ml	TBTm
Wash Solution Concentrate (100X)	10 ml	WB-100
TMB Substrate	12 ml	80091
Stop Solution	12 ml	80101
Product Manual	1 ea	M-940-225