BioLegend®

Enabling Legendary Discovery™

LEGEND MAX™

ELISA Kit with Pre-coated Plates

Mouse MIF

Cat. No. 444107 1 Plate

444108 5 Plates

ELISA Kit for Accurate Quantitation of Mouse MIF from Serum, Plasma, Cell Culture Supernatant, Cell Lysate

BioLegend, Inc.
biolegend.com

It is highly recommended that this manual be read in its entirety before using this product. Do not use this kit beyond the expiration date.

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LEGEND MAX™ Mouse MIF ELISA Kit

Introduction:

Macrophage migration inhibitory factor (MIF), also known as glycosylation inhibiting factor (GIF), is a pituitary hormone and a macrophage- and T cell-derived cytokine that plays an important role in the endocrine and immune systems. MIF consists of 115 amino acids and has a molecular weight of 12.5 kD. Mouse MIF shares most of its identity with human (90%), rat (99%), and cattle (88%) MIFs, and a moderate percentage of its identity with MIFs from a wide variety of other species. It exists in monomeric, dimeric, and trimeric forms of identical protomers.

MIF is active as a pro-inflammatory regulator and upregulates multiple cytokines that are vital to combating infections *in vivo*, including tumor-necrosis factor (TNF), interferon-γ (IFN-γ), and interleukin-12 (IL-12). It is known to maintain cell survival and promote pro-inflammatory immune responses. MIF also activates the ERK1/ERK2 signaling pathway, which inhibits the immunosuppressive effects of glucocorticoids. MIF also plays a critical role in superantigen-induced toxic shock. It upregulates several factors that enhance the growth and invasiveness of gram-negative bacteria. MIF can enhance many inflammatory diseases, such as acute respiratory distress syndrome, arthritis, atopic dermatitis, allograft rejection, glomerulonephritis, inflammatory bowel diseases, asthma, and atherosclerosis. Known receptors for MIF include CXCR2, CXCR4, CD44, and CD74.

The LEGEND MAX™ Mouse MIF ELISA kit is a ready-to-use Sandwich Enzyme-Linked Immunosorbent Assay (ELISA) with a 96-well strip plate that is pre-coated with a rat monoclonal anti-mouse MIF antibody. The Detection Antibody is a biotinylated goat polyclonal anti-mouse MIF antibody. This assay is specifically designed to quantify mouse MIF from serum, plasma, cell culture supernatant, and cell lysate. This kit is analytically validated with prepared reagents.

Materials Provided:

Description	Quantity (1 plate)	Quantity (5 plates)	Volume (per bottle)	Part #
Anti-Mouse MIF Pre-coated 96 well Strip Microplate	1 plate	5 plates		76625
Mouse MIF Detection Antibody	1 bottle	5 bottles	12 mL	76626
Mouse MIF Standard	1 vial	5 vials	lyophilized	76628
Avidin-HRP	1 bottle	5 bottles	12 mL	77897
Assay Buffer B	1 bottle	5 bottles	25 mL	79128
Wash Buffer (20X)	1 bottle	5 bottles	50 mL	78233
Substrate Solution F	1 bottle	5 bottles	12 mL	79132
Stop Solution	1 bottle	5 bottles	12 mL	79133
Plate Sealers	4 sheets	20 sheets		78101

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Materials to be Provided by the End-User:

- Microplate reader able to measure absorbance at 450 nm
- Adjustable pipettes to measure volumes ranging from 1 µL to 1,000 µL
- Deionized water
- Wash bottle or automated microplate washer
- Log-Log graph paper or software for data analysis
- Tubes to prepare standard dilutions
- Timer
- Plate shaker
- Polypropylene vials

Storage Information:

Store unopened kit components between 2°C and 8°C. Do not use this kit beyond its expiration date.

<table>
<tr><th colspan="2">Opened or Reconstituted Components</th></tr>
<tr><td>Microplate wells</td><td>If not all microplate strips are used, remove the excess strips by pressing up from underneath each strip. Place excess strips back in the foil pouch with the included desiccant pack and reseal. Store between 2°C and 8°C for up to one month.</td></tr>
<tr><td>Standard</td><td>The remaining reconstituted standard stock solution can be aliquoted into polypropylene vials and stored at -70°C for up to one month. Avoid repeated freeze-thaw cycles.</td></tr>
<tr><td>Detection Antibody</td><td rowspan="6">Store opened reagents between 2°C and 8°C and use within one month.</td></tr>
<tr><td>Avidin-HRP</td></tr>
<tr><td>Assay Buffer B</td></tr>
<tr><td>Wash Buffer (20X)</td></tr>
<tr><td>Substrate Solution F</td></tr>
<tr><td>Stop Solution</td></tr>
</table>

Health Hazard Warnings:

1. Reagents that contain preservatives may be harmful if ingested, inhaled or absorbed through the skin. Refer to the MSDS online at BioLegend's website for details (www.biolegend.com/msds).
2. Substrate Solution F is harmful if inhaled or ingested. Avoid skin, eye and clothing contact.
3. To reduce the likelihood of blood-borne transmission of infectious agents, handle all serum, plasma and other biological fluids in accordance with NCCLS regulations.

4. Stop Solution contains strong acid and is corrosive. *Wear eye, hand, and face protection when handling, and follow state and county regulations for disposal.*
5. Before disposing of the plate, rinse it with an excess amount of tap water.

Specimen Collection and Handling:

Specimens should be clear and non-hemolyzed. If possible, unknown samples should be run at a number of dilutions to determine the optimal dilution factor that will ensure accurate quantitation.

Serum: Use a serum separator tube and allow clotting for at least 30 minutes, then centrifuge for 10 minutes at 1,000 x *g*. Remove serum layer. *Assay immediately or store serum samples at < -70°C. Avoid repeated freeze-thaw cycles.*

Plasma: Collect blood samples in heparin, citrate or EDTA-containing tubes. Centrifuge for 10 minutes at 1,000 x *g* within 30 minutes of collection. *Assay immediately or store plasma samples at < -70°C. Avoid repeated freeze-thaw cycles*.

Cell Culture Supernatant: If necessary, centrifuge all samples to remove debris prior to analysis. *It is recommended that samples be stored at < -70°C. Avoid repeated freeze-thaw cycles.*

Cell Lysate: Cells were washed twice with cold 1XPBS (rinsed for adherent cells or centrifuged for cells growing in suspension) and lysed with RIPA cell lysis buffer (0.75% NP-40, 0.25% Na deoxycholate acid, 0.05% SDS) containing protease inhibitors. After a round of freeze-thaw cycle, centrifuge cell lysate, collect supernatant, and store at < -70°C. *Once sample is ready for assay, avoid repeated freeze-thaw cycles*.

Reagent and Sample Preparation:

Note: All reagents should be diluted immediately prior to use.

1. Dilute the 20X Wash Buffer to 1X with deionized water. For example, make 1 liter of 1X Wash Buffer by adding 50 mL of 20X Wash Buffer to 950 mL of deionized water. If crystals have formed in the 20X Wash Buffer, bring to room temperature and mix until dissolved.

2. Reconstitute the lyophilized Mouse MIF Standard by adding the volume of Assay Buffer B to make 100 ng/mL standard stock solution (refer to LEGEND MAX™ Kit Lot-Specific Certificate of Analysis/LEGEND MAX™ Kit Protocol). Allow the reconstituted standard to sit at room temperature for 15 minutes, then briefly vortex to mix completely.

3. For cell culture supernatant samples, the end user may need to determine the dilution factor needed in a preliminary experiment. If dilutions are necessary, samples should be diluted in the corresponding cell culture medium.

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4. MIF levels in serum and plasma samples vary. It is recommended to run several dilutions to determine the optimal dilution factor for each sample. A 40-fold dilution and a 10-fold dilution are suggested for serum and plasma, respectively. All dilutions should be prepared in Assay Buffer B. For example, 10 µL of serum sample should be added to 390 µL of Assay Buffer B to make a 1:40 dilution.

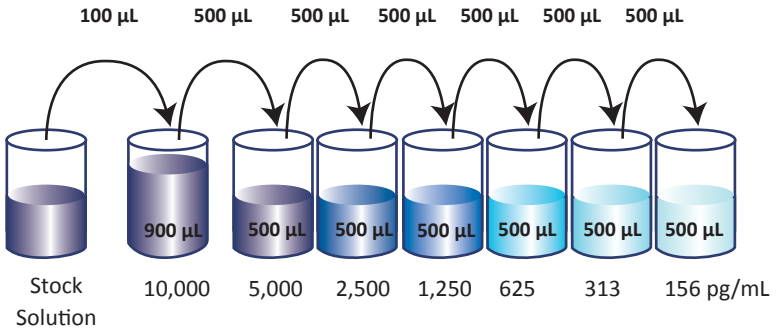
Assay Procedure:

Note: Do not mix reagents from different kits or lots. Reagents and/or antibodies from different manufacturers should not be used with this kit.

1. Bring all reagents to room temperature prior to use. It is strongly recommended that all standards and samples be run in duplicate. A standard curve is required for each assay.

2. If not all microplate strips will be used, remove the excess strips by pressing up from underneath each strip. Place excess strips back in the foil pouch with the included desiccant pack and reseal.

3. Prepare 1,000 µL of the 10,000 pg/mL top standard by diluting 100 µL of the standard stock solution in 900 µL of Assay Buffer B. Perform six two-fold serial dilutions of the 10,000 pg/mL top standard in separate tubes using Assay Buffer B as the diluent. Thus, the mouse MIF standard concentrations in the tubes are 10,000 pg/mL, 5,000 pg/mL, 2,500 pg/mL, 1,250 pg/mL, 625 pg/mL, 313 pg/mL and 156 pg/mL, respectively. Assay Buffer B serves as the zero standard (0 pg/mL).



4. Add 50 µL of Assay Buffer B to each well that will contain either standards or samples.

5. Add 50 µL of standard dilutions or properly diluted samples to the appropriate wells.

6. Seal the plate with a Plate Sealer included in the kit and incubate the plate at room temperature for 2 hours while shaking at 200 rpm.

7. Discard the contents of the plate into a sink, then wash the plate 4 times

with 1X Wash Buffer. Wash the plate with at least 300 µL of 1X Wash Buffer per well and blot any residual buffer by firmly tapping plate upside down on absorbent paper. All subsequent washes should be performed similarly.

8. Add 100 µL of Mouse MIF Detection Antibody solution to each well, seal the plate and incubate at room temperature for 1 hour while shaking.

9. Discard the contents of the plate into a sink, then wash the plate 4 times with 1X Wash Buffer as in step 7.

10. Add 100 µL of Avidin-HRP solution to each well, seal the plate and incubate at room temperature for 30 minutes while shaking.

11. Discard the contents of the plate into a sink, then wash the plate 5 times with 1X Wash Buffer as in step 7. For this final wash, soak wells in 1X Wash Buffer for 30 seconds to 1 minute for each wash. This will help minimize background.

12. Add 100 µL of Substrate Solution F to each well and incubate for 15 minutes in the dark. Wells containing mouse MIF should turn blue in color with intensity proportional to concentration. It is not necessary to seal the plate during this step.

13. Stop the reaction by adding 100 µL of Stop Solution to each well. The well color should change from blue to yellow.

14. Read absorbance at 450 nm within 20 minutes. If the reader is capable of reading at 570 nm, the absorbance at 570 nm can be subtracted from the absorbance at 450 nm.

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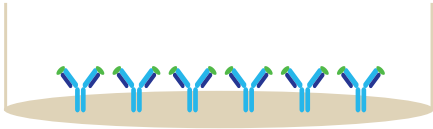
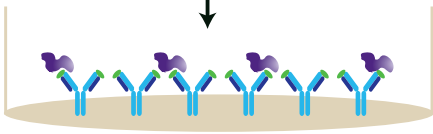
Assay Procedure Summary

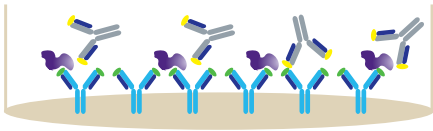
1. Add 50 µL Assay Buffer B



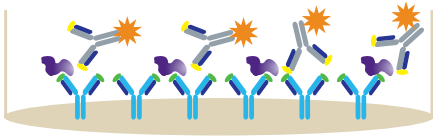
2. Add 50 µL prepared standards or samples.
   Incubate 2 hrs, RT, shaking



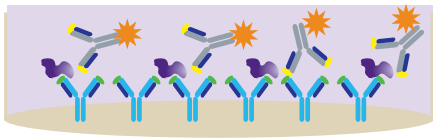
3. Wash 4 times
   Add 100 µL Detection Antibody solution
   Incubate 1hr, RT, shaking



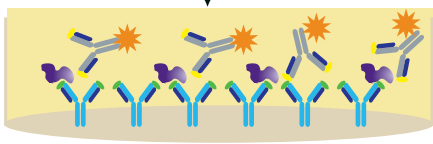
4. Wash 4 times
   Add 100 µL Avidin-HRP solution
   Incubate 30 mins, RT, shaking



5. Wash 5 times
   Add 100 µL Substrate Solution F
   Incubate 15 mins, RT, in the dark



6. Add 100 µL Stop Solution



7. Read absorbance at 450 nm and 570 nm

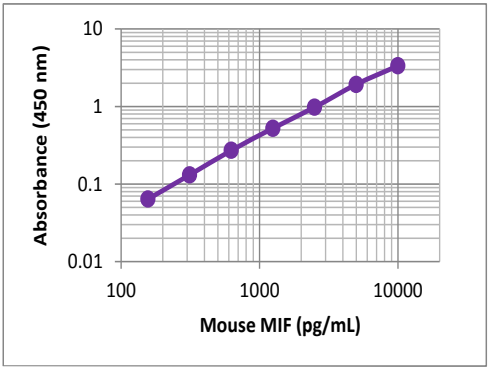
Calculation of Results:

The data can be best calculated with computer-based curve-fitting software using a 5- or 4-parameter logistics curve-fitting algorithm. If appropriate software is not available, use log-log graph paper to determine sample concentrations. Determine the mean absorbance for each set of duplicate or triplicate standards, controls, and samples. Plot the standard curve on log-log graph paper with antigen concentration on the X-axis and absorbance on the Y-axis. Draw a best fit line through the standard points. To determine the unknown antigen concentrations, find the mean absorbance value of the unknown concentration on the Y-axis and draw a horizontal line to the standard curve. At the point of intersection, draw a vertical line to the X-axis and read the sample concentration.

If samples were diluted, multiply the concentration by the appropriate dilution factor. If a test sample's absorbance value falls outside the linear portion of the standard curve, the test sample needs to be re-analyzed at a higher (or lower) dilution as appropriate.

Typical Data:

This standard curve was generated at BioLegend for demonstration purposes only. A standard curve must be run with each assay.



Performance Characteristics:

Specificity: No cross-reactivity was observed when this kit was used to analyze the following recombinant proteins, each at 50 ng/mL.

Human	MIF
Mouse	CD74, CD44, CXCL12, IGF-I, IGF-II, TNF-a, IL-6, IL-2, IFNγ, ICAM-1, CCL1, CCL2, CCL7, CCL8, IL-17A, IL-17F, IL-1a, IL-1b, MMP-9

This kit cross-reacts with rat MIF at ~1% signal strength relative to mouse MIF.

There was no interference observed by CD74 and CD44 receptors up to concentrations of 2.4 and 6.4 ug/mL, respectively, in solution with 10 ng/mL of mouse MIF.

Sensitivity: The average minimum detectable concentration of mouse MIF is 25.28 ± 1.68 pg/mL.

Linearity: Pre-diluted mouse serum, plasma, and cell culture media were further diluted two, four, and eight fold with Assay Buffer B to produce sample concentrations within the dynamic range of the assay.

Recovery: Three levels of recombinant Mouse MIF (5,000 pg/mL, 1,250 pg/mL and 313 pg/mL) were spiked into pre-diluted mouse serum, plasma, and cell culture supernatant samples and analyzed with this kit.

Sample Type	N	Average Linearity	Average Spike Recovery
Serum	4	98%	115%
Plasma	12	98%	108%
Cell culture supernatant	6	88%	92%

Intra-Assay Precision: Two samples with different concentrations of mouse MIF were tested with 16 replicates in one assay.

	Sample 1	Sample 2
Number of Replicates	16	16
Mean Concentration (pg/mL)	4,517	236
Standard Deviation	65	8
% CV	1.4	3.5

Inter-Assay Precision: Two samples with different concentrations of mouse MIF were assayed in four independent assays by four operators.

	Sample 1	Sample 2
Number of Assays	4	4
Mean Concentration (pg/mL)	4,495	223
Standard Deviation	210	11
% CV	4.7	4.7

Biological Samples:

Serum and plasma

Serum and plasma (Heparin, EDTA, and Citrate) samples of the following strains were pooled from a minimum of ten mice each. All samples were tested for endogenous MIF. The concentrations measured are shown below:

Strain	Serum (ng/mL)	Heparin Plasma (ng/mL)	EDTA Plasma (ng/mL)	Citrate Plasma (ng/mL)
C57BL/6	75.9	54.5	53.6	36.7
BALB/c	203.3	68.2	12.3	23.1
Swiss Webster	157.3	36.6	28.4	19.1
CD-1	104.0	41.2	36.4	24.9

Cell culture supernatant and cell lysate

NIH3T3 cells were established in DMEM/10% FBS culture media at a concentration of $1x10^6$/mL, and stimulated with combinations of TNFα (1 µg/mL), IL-4 (50 µg/mL), and IL-13 (50 µg/mL) as indicated. A culture of unstimulated cells was used as a control. 2PK3 and F9 cells were cultured normally without treatment. Supernatants from each culture were collected on day 3. To prepare cell lysate, F9 cells were lysed with RIPA cell lysis buffer as indicated in the section "Specimen Collection and Handling." The protein concentration of cell lysate was determined by Bradford Protein Assay. The concentrations of MIF in supernatant and lysate measured are shown in the table below.

Sample Type	Treatment	Time	Concentration (ng/mL)
NIH3T3 cell supernatant	Unstimulated	Day 3	41.2
	TNFα +IL-4	Day 3	45.8
	TNFα +IL-13	Day 3	48.2
	TNFα +IL-4 + IL-13	Day 3	49.7
2PK3 cell supernatant	Unstimulated	Day 3	26.3
F9 cell supernatant	Unstimulated	Day 3	47.5

Sample Type	Treatment	Time	Concentration (ng/mL)	Total Protein Concentration (mg/mL)	Mouse MIF Concentration (ng/mg)
F9 cell lysate	Unstimulated	Day 3	1,427.3	1.324	1,078

Troubleshooting Guide:

Problem	Probable Cause	Solution
High Background	Background wells were contaminated	Avoid cross-well contamination by using the provided plate sealers. Use multichannel pipettes and change tips between pipetting samples and reagents.
	Insufficient washes	Increase number of washes. Increase soaking time between washes prior to addition of substrate solution.
	TMB Substrate Solution was contaminated	TMB Substrate Solution should be clear and colorless prior to addition to wells. Use a clean container prior to pipetting substrate solution into wells.
No or poor signal	Detection Antibody, Avidin-HRP or Substrate solution were NOT added	Rerun the assay and follow the protocol.
	Wrong reagent or reagents were added in wrong sequential order	
	Insufficient plate agitation	The plate should be agitated during all incubation steps using a plate shaker at a speed where solutions in wells are within constant motion without splashing.
	The wash buffer contains Sodium Azide (NaN3)	Avoid Sodium Azide contamination in the wash buffer as it inhibits HRP activity.
	Incubations were done at an inappropriate temperature, timing or without agitation	Rerun the assay and follow the protocol.
Low or poor standard curve signal	The standard was incorrectly reconstituted or diluted	Adjust the calculations and follow the protocol.
	Standard was inappropriately stored	Store the reconstituted standard stock solution in polypropylene vials at -70°C. Avoid repeated freeze-thaw cycles.
	Reagents added to wells with incorrect concentrations	Check for pipetting errors and the correct reagent volume.

Problem	Probable Cause	Solution
Signal is high, standard curves have saturated signal	Standard reconstituted with less volume than required	Reconstitute new lyophilized standard with the correct volume of solution recommended in the protocol.
	Standards/samples, detection antibody, Avidin-HRP or substrate solution were incubated for too long	Rerun the assay and follow the protocol.
Sample readings are out of range	Samples contain no or below detectable levels of the analyte	If samples are below detectable levels, it may be possible to use a larger sample volume. Contact technical support for appropriate protocol modifications.
	Samples contain analyte concentrations greater than highest standard point	Samples may require dilution and analysis.
High variation in samples and/or standards	Multichannel pipette errors	Confirm that pipette calibrations are accurate.
	Plate washing was not adequate or uniform	Ensure pipette tips are tightly secured. Ensure uniformity in all wash steps.
	Non-homogenous samples	Thoroughly mix samples before assaying.
	Samples may have high particulate matter	Remove particulate matter by centrifugation.
	Cross-well contamination	Do not reuse plate sealers. Always change tips for reagent additions. Ensure that pipette tips do not touch the reagents on the plate.

ELISA Plate Template

	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
C												
D												
E												
F												
G												
H												

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