

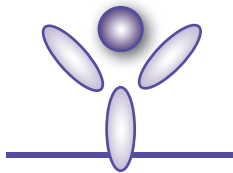


**BioLegend®**

The path to legendary discovery™

# **LEGEND MAX™**

ELISA Kit with Pre-coated Plate



## **Human GM-CSF**

Cat. No. 432007

ELISA Kit for Accurate Quantitation of Human GM-CSF  
from Cell Culture Supernatant, Serum, Plasma and Other  
Biological Fluids

BioLegend, Inc.  
[biolegend.com](http://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.***

*For Research Purposes Only. Not for use in diagnostic or therapeutic procedures. Purchase does not include or carry the right to resell or transfer this product either as a stand-alone product or as a component of another product. Any use of this product other than the permitted use without the express written authorization of BioLegend is strictly prohibited.*



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# LEGEND MAX™ Human GM-CSF ELISA Kit

## Introduction:

Granulocyte/Macrophage - Colony Stimulating Factor (GM-CSF) is a hematopoietic factor that is produced by activated T cells, B cells, mast cells, macrophages, fibroblasts and endothelial cells. In addition to supporting colony formation of granulocyte/macrophage progenitors, GM-CSF is a growth factor for erythroid, megakaryocyte and eosinophil progenitors.

The BioLegend LEGEND MAX™ Human GM-CSF ELISA Kit is a Sandwich Enzyme-Linked Immunosorbent Assay (ELISA) with a 96-well strip plate that is pre-coated with a monoclonal rat anti-human GM-CSF capture antibody. The detection antibody is a biotinylated monoclonal rat anti-human GM-CSF antibody. This kit is specifically designed for the accurate quantitation of human GM-CSF from cell culture supernatant, serum, plasma, and other biological fluids. It is analytically validated with ready-to-use reagents.

## Materials Provided:

| Description   | Quantity | Volume (per bottle) | Part # |
|---|----------|---------------------|--------|
| Anti-human GM-CSF Pre-coated 96-well Strip Microplate | 1 plate  |                     | 78244  |
| Human GM-CSF Detection Antibody                       | 1 bottle | 12 mL               | 78245  |
| Human GM-CSF Standard                                 | 1 vial   | lyophilized         | 78398  |
| Matrix A  | 1 bottle | lyophilized         | 78303  |
| Avidin-HRP A  | 1 bottle | 12 mL               | 79131  |
| Assay Buffer A  | 1 bottle | 25 mL               | 78232  |
| Wash Buffer (20X)                                     | 1 bottle | 50 mL               | 78233  |
| Substrate Solution F                                  | 1 bottle | 12 mL               | 79132  |
| Stop Solution   | 1 bottle | 12 mL               | 79133  |
| Plate Sealers   | 4 sheets |                     | 78101  |

**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.

| <b>Opened or Reconstituted Components</b> |   |
|---|---|
| Microplate wells                          | 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. |
| Standard                                  | 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.   |
| Matrix A                                  |   |
| Detection Antibody                        | Store opened reagents between 2°C and 8°C and use within one month.   |
| Avidin-HRP A                              |   |
| Assay Buffer A                            |   |
| Wash Buffer (20X)                         |   |
| Substrate Solution F                      |   |
| Stop Solution                             |   |

**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](http://www.biolegend.com/msds)).
2. Substrate Solution F is harmful if inhaled or ingested. Avoid skin, eye and clothing contact.

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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. *Wear eye, hand, and face protection.*
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.

Cell Culture Supernatant: If necessary, centrifuge all samples to remove debris prior to analysis. It is recommended that samples be stored at  $< -70^{\circ}\text{C}$ . Avoid repeated freeze-thaw cycles.

Serum: Use a serum separator tube and allow clotting for at least 30 minutes, then centrifuge for 10 minutes at  $1,000 \times g$ . Remove serum layer and assay immediately or store serum samples at  $< -70^{\circ}\text{C}$ . Avoid repeated freeze-thaw cycles.

Plasma: Collect blood samples in citrate, heparin or EDTA containing tubes. Centrifuge for 10 minutes at  $1,000 \times g$  within 30 minutes of collection. Assay immediately or store plasma samples at  $< -70^{\circ}\text{C}$ . Avoid repeated freeze-thaw cycles.

### Reagent and Sample Preparation:

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

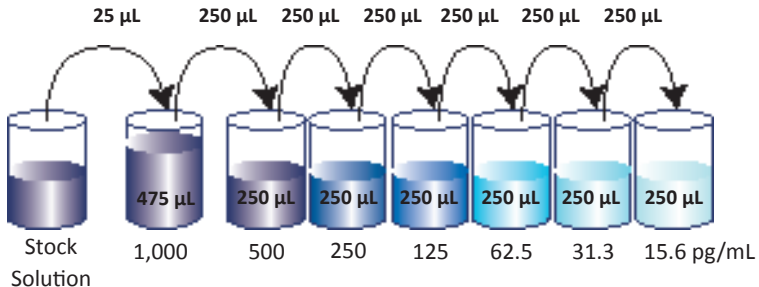
1. Dilute the 20X Wash Buffer to 1X with deionized water. For example, make 1 liter of 1X Wash Buffer by adding 50 mL of 20X Wash Buffer to 950 mL of deionized water. If crystals have formed in the 20X Wash Buffer, bring to room temperature and vortex until dissolved.
2. If serum or plasma samples will be assayed, reconstitute the lyophilized Matrix A by dispensing 2 mL of deionized water into the vial and allow the reconstituted Matrix A to sit at room temperature for 15 minutes, then vortex to mix completely.
3. Reconstitute the lyophilized Human GM-CSF Standard by adding the volume of Assay Buffer A to make the 20 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 15-20 minutes, then briefly vortex to mix completely.

- In general, samples are analyzed without dilutions. However, if dilutions are required, use Assay Buffer A for diluting cell culture supernatant samples and Matrix A for diluting plasma and serum samples.

### 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.

- Bring all reagents to room temperature prior to use. It is strongly recommended that all standards and samples be run in duplicate or triplicate. A standard curve is required for each assay.
- 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.
- Prepare 500  $\mu\text{L}$  of the 1,000  $\text{pg}/\text{mL}$  top standard by diluting 25  $\mu\text{L}$  of the standard stock solution in 475  $\mu\text{L}$  of Assay Buffer A. Perform six two-fold serial dilutions of the 1,000  $\text{pg}/\text{mL}$  top standard in separate tubes using Assay Buffer A as the diluent. Thus, the human GM-CSF standard concentrations in the tubes are 1,000  $\text{pg}/\text{mL}$ , 500  $\text{pg}/\text{mL}$ , 250  $\text{pg}/\text{mL}$ , 125  $\text{pg}/\text{mL}$ , 62.5  $\text{pg}/\text{mL}$ , 31.3  $\text{pg}/\text{mL}$  and 15.6  $\text{pg}/\text{mL}$ , respectively. Assay Buffer A serves as the zero standard (0  $\text{pg}/\text{mL}$ ).



- Wash the plate 4 times with at least 300  $\mu\text{L}$  of 1X Wash Buffer per well and blot any residual buffer by firmly tapping the plate upside down on absorbent paper. All subsequent washes should be performed similarly.
- For measuring samples of cell culture supernatant:**
  - Add 50  $\mu\text{L}$  of Assay Buffer A to each well that will contain either standard dilutions or samples.
  - Add 50  $\mu\text{L}$  of standard dilutions or samples to the appropriate wells.

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### **For measuring serum or plasma samples:**

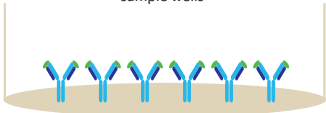
- a) Add 50  $\mu\text{L}$  of Matrix A to each well that will contain the standard dilutions. Add 50  $\mu\text{L}$  of Assay Buffer A to each well that will contain samples.
  - b) Add 50  $\mu\text{L}$  of standard dilutions to the wells containing Matrix A. Add 50  $\mu\text{L}$  of diluted serum or plasma samples to the wells containing Assay Buffer A.
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 as in step 4.
  8. Add 100  $\mu\text{L}$  of Human GM-CSF 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 4.
  10. Add 100  $\mu\text{L}$  of Avidin-HRP A 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 4. 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  $\mu\text{L}$  of Substrate Solution F to each well and incubate for 15 minutes in the dark. Wells containing human GM-CSF should turn blue in color with an intensity proportional to its concentration. It is not necessary to seal the plate during this step.
  13. Stop the reaction by adding 100  $\mu\text{L}$  of Stop Solution to each well. The solution color should change from blue to yellow.
  14. Read absorbance at 450 nm within 30 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.



## Assay Procedure Summary

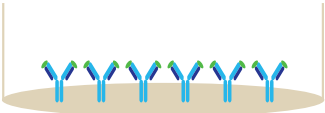
- For measuring cell culture supernatant:**

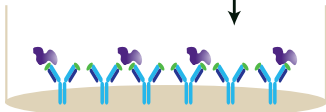
Wash 4 times  
Add 50  $\mu$ L Assay Buffer A to standard and sample wells



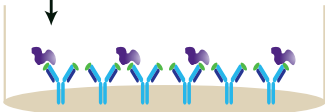
**For measuring serum or plasma:**

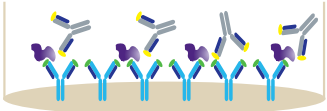
Wash 4 times  
Add 50  $\mu$ L Matrix A to standard wells  
Add 50  $\mu$ L Assay Buffer A to sample wells

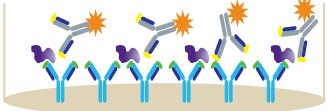

- Add 50  $\mu$ L diluted standards to standard wells  
Add 50  $\mu$ L samples to sample wells  
Incubate 2 hr, RT, shaking

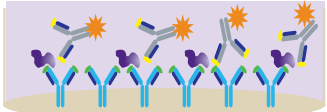


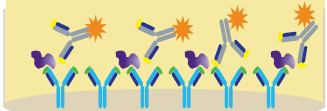
Add 50  $\mu$ L diluted standards to standard wells  
Add 50  $\mu$ L of samples to sample wells  
Incubate 2 hr, RT, shaking


- Wash 4 times  
Add 100  $\mu$ L Detection Antibody solution  
Incubate 1 hr, RT, shaking


- Wash 4 times  
Add 100  $\mu$ L Avidin-HRP A solution  
Incubate 30 min, RT, shaking


- Wash 5 times  
Add 100  $\mu$ L Substrate Solution F  
Incubate 15 min, RT, in the dark


- Add 100  $\mu$ L Stop Solution


- Read absorbance at 450 nm and 570 nm

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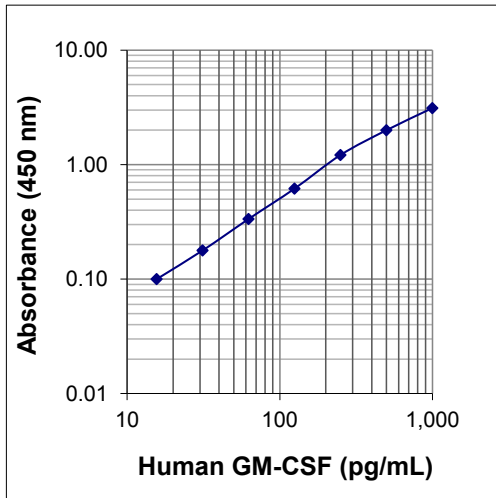
## Calculation of Results:

The data can be best calculated with computer-based curve-fitting software using a 5- or 4-parameter logistics curve-fitting algorithm. If an 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 cytokine concentration on the X-axis and absorbance on the Y-axis. Draw a best fit line through the standard points. To determine the unknown cytokine 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 cytokine 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 14 human recombinant cytokines and murine GM-CSF at a concentration of 50 ng/mL.

***Sensitivity:*** The minimum detectable concentration of GM-CSF is 3.5 pg/mL.

***Recovery:*** Recombinant GM-CSF was spiked into four human serum samples at concentrations of 500 and 250 pg/mL then analyzed with the LEGEND MAX™ Human GM-CSF ELISA kit. On average, 99.9% of the cytokine was recovered from the serum samples.

***Linearity:*** Four human serum samples spiked with high concentrations of GM-CSF were diluted with the appropriate matrix to produce samples with concentrations within the dynamic range and then assayed. On average, 98.7% of the expected cytokine concentrations were detected in the serum samples.

***Intra-Assay Precision:*** Two samples containing different GM-CSF concentrations were tested with sixteen replicates in one assay.

| Concentration              | Sample 1 | Sample 2 |
|----------------------------|----------|----------|
| Number of Replicates       | 16       | 16       |
| Mean Concentration (pg/mL) | 230.4    | 61       |
| Standard Deviation         | 13.1     | 2.0      |
| % CV                       | 5.7      | 3.3      |

***Inter-Assay Precision:*** Two samples containing different concentrations of GM-CSF were tested in four independent assays.

| Concentration              | Sample 1 | Sample 2 |
|----------------------------|----------|----------|
| Number of Assays           | 4        | 4        |
| Mean Concentration (pg/mL) | 227.8    | 59.8     |
| Standard Deviation         | 15.6     | 3.6      |
| % CV                       | 6.8      | 6.0      |

***Biological Samples:***

Freshly isolated human peripheral blood mononuclear cells at a concentration of  $1 \times 10^6$  cells/mL were stimulated with 50 ng/mL PMA and 1 µg/mL ionomycin at 37°C overnight. Cell culture supernatants were collected and assayed for concentrations of natural human GM-CSF. The resulting human GM-CSF concentration averaged 1,803 pg/mL in the PMA and ionomycin-stimulated samples and was undetectable in unstimulated samples.

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## Troubleshooting Guide:

| Problem                           | Probable Cause   | Solution  |
|-----------------------------------|--|---|
| High Background                   | Background wells were contaminated   | Avoid cross-well contamination by using the provided plate sealers.<br>Use multichannel pipettes and change tips between pipetting samples and reagents.        |
|                                   | Insufficient washes  | Increase number of washes.<br>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.<br>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 (NaN <sub>3</sub> )                          | 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.<br>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.<br>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.<br><br>Always change tips for reagent additions. Ensure that pipette tips do not touch the reagents on the plate.               |

| <b>ELISA Plate Template</b> |   |   |   |   |   |   |   |   |   |    |    |    |
|-----------------------------|---|---|---|---|---|---|---|---|---|----|----|----|
|                             | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| A                           |   |   |   |   |   |   |   |   |   |    |    |    |
| B                           |   |   |   |   |   |   |   |   |   |    |    |    |
| C                           |   |   |   |   |   |   |   |   |   |    |    |    |
| D                           |   |   |   |   |   |   |   |   |   |    |    |    |
| E                           |   |   |   |   |   |   |   |   |   |    |    |    |
| F                           |   |   |   |   |   |   |   |   |   |    |    |    |
| G                           |   |   |   |   |   |   |   |   |   |    |    |    |
| H                           |   |   |   |   |   |   |   |   |   |    |    |    |





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