



*Immunoassay Kits Beyond The Ordinary*

## **GM-CSF (Mouse) EIA**

For the quantitative determination of Ms GM-CSF in mouse serum, plasma, buffered solution, or cell culture medium.

For Research Use Only. Not For Use In Diagnostic Procedures.

***Critical Changes: Please read carefully. e.g. Assay Method***

Catalog Number:	45-GMCMS-E01
Size:	96 Wells
Catalog Number:	45-GMCMS-E02
Size:	2 x 96 Wells
Version:	Rev. A2 05/22/07 – ALPCO 10/2/07

### **ALPCO Diagnostics**

**26 Keewaydin Drive Unit G • Salem, NH 03079**

**Phone: (800) 592-5726 • Fax: (603) 898-6854**

**[www.alpco.com](http://www.alpco.com) • Email: [web@alpco.com](mailto:web@alpco.com)**

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## INTRODUCTION

Granulocyte Macrophage-Colony Stimulating Factor (GM-CSF; CSF-2; CSF- $\alpha$ ) is produced by a large variety of cells including macrophages, endothelial cells and activated T cells. GM-CSF recruits different progenitors depending on its concentration; at its lowest, inducing macrophage colonies, increasing concentrations inducing granulocyte, eosinophil and finally megakaryocyte colonies. In addition to its growth promoting activity, GM-CSF also induces granulocyte and macrophage differentiation. Recombinant GM-CSF is used to accelerate haematopoietic recovery following chemo/radiotherapy and bone marrow transplantation and for the culture of dendritic cells.

Mature mouse GM-CSF is a 124 amino acid protein that is processed from a 141 amino acid precursor. Mouse GM-CSF has two potential N-linked glycosylation sites and two intramolecular disulphide bonds. There is 56% homology between human and mouse GM-CSF and no cross species reactivity in functional assays.

## INTENDED USE

The Mouse Granulocyte Macrophage-Colony Stimulating Factor (Ms GM-CSF) ELISA is to be used for the quantitative determination of Ms GM-CSF in mouse serum, plasma, buffered solution, or cell culture medium. The assay will recognize both natural and recombinant Ms GM-CSF.

**This kit has been configured for research use only and is not to be used in diagnostic procedures.**

**Read entire protocol before use.**

## PRINCIPLE OF THE METHOD

The Ms GM-CSF kit is a solid phase sandwich Enzyme Linked-Immuno-Sorbent Assay (ELISA). A monoclonal antibody specific for Ms GM-CSF has been coated onto the wells of the microtiter strips provided. Samples, including standards of known Ms GM-CSF content, control specimens, and unknowns, are pipetted into these wells. During the first incubation, the Ms GM-CSF antigen binds to the immobilized (capture) antibody on one site. After washing, a biotinylated monoclonal antibody specific for Ms GM-CSF is added. During the second incubation, this antibody binds to the immobilized Ms GM-CSF captured during the first incubation. After removal of excess second antibody, Streptavidin-Peroxidase (enzyme) is added. This binds to the biotinylated antibody to complete the four-member sandwich. After a third incubation and washing to remove all the unbound enzyme, a substrate solution is added, which is acted upon by the bound enzyme to produce color. The intensity of this colored product is directly proportional to the concentration of Ms GM-CSF present in the original specimen.

## REAGENTS PROVIDED

**Note:** Store all reagents at 2 - 8°C.

<i>Reagent</i>	<i>96 Test Kit</i>	<i>192 Test Kit</i>
<i>Ms GM-CSF Standard</i> , recombinant Ms GM-CSF lyophilized. Refer to vial label for quantity and reconstitution volume.	2 vials	4 vials
<i>Standard Diluent Buffer</i> . Contains 15 mM sodium azide; 25 mL per bottle.	1 bottle	2 bottles
<i>Ms GM-CSF High and Low Control</i> , recombinant Ms GM-CSF, lyophilized. Refer to vial label for quantity and reconstitution volume. Once reconstituted, aliquot and store at -20°C or below. Avoid repeated freeze-thaw cycles.	2 vials	2 vials
<i>Ms GM-CSF Antibody-Coated Wells</i> , 96 wells per plate.	1 plate	2 plates
<i>Ms GM-CSF Biotin Conjugate</i> (Biotin-labeled anti-GM-CSF). Contains 15 mM sodium azide; 11 mL per bottle.	1 bottle	2 bottles
<i>Streptavidin-Peroxidase (HRP)</i> , (100x) concentrate. Contains 3.3 mM thymol; 0.125 mL per vial.	1 vial	2 vials
<i>Streptavidin-Peroxidase (HRP) Diluent</i> . Contains 3.3 mM thymol; 25 mL per bottle.	1 bottle	1 bottle
<i>Wash Buffer Concentrate (25x)</i> ; 100 mL per bottle.	1 bottle	1 bottle
<i>Stabilized Chromogen</i> , Tetramethylbenzidine (TMB); 25 mL per bottle.	1 bottle	1 bottle
<i>Stop Solution</i> ; 25 mL per bottle.	1 bottle	1 bottle
<i>Plate Covers</i> , adhesive strips.	4	

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**Disposal Note:** This kit contains materials with small quantities of sodium azide. Sodium azide reacts with lead and copper plumbing to form explosive metal azides. Upon disposal, flush drains with a large volume of water to prevent azide accumulation. Avoid ingestion and contact with eyes, skin and mucous membranes. In case of contact, rinse affected area with plenty of water. Observe all federal, state and local regulations for disposal.

#### SUPPLIES REQUIRED BUT NOT PROVIDED

1. Microtiter plate reader capable of measurement at or near 450 nm.
2. Calibrated adjustable precision pipettes, preferably with disposable plastic tips. (A manifold multi-channel pipette is desirable for large assays.)
3. Distilled or deionized water.
4. Plate washer: automated or manual (squirt bottle, manifold dispenser, etc.).
5. Data analysis and graphing software. Graph paper: linear (Cartesian), log-log, or semi-log, as desired.
6. Glass or plastic tubes for diluting and aliquoting standard.
7. Absorbent paper towels.
8. Calibrated beakers and graduated cylinders in various sizes.

#### PROCEDURAL NOTES/LAB QUALITY CONTROL

1. When not in use, kit components should be refrigerated. All reagents should be warmed to room temperature before use.
2. **Microtiter plates should be allowed to come to room temperature before opening the foil bags.** Once the desired number of strips has been removed, immediately reseal the bag and store at 2 - 8°C to maintain plate integrity.
3. Samples should be collected in pyrogen/endotoxin-free tubes.
4. Samples should be frozen if not analyzed shortly after collection. Avoid multiple freeze-thaw cycles of frozen samples. Thaw completely and mix well prior to analysis.
5. When possible, avoid use of badly hemolyzed or lipemic sera. If large amounts of particulate matter are present, centrifuge or filter prior to analysis.
6. It is recommended that all standards, controls and samples be run in duplicate.
7. Samples that are >500 pg/mL should be diluted with *Standard Diluent Buffer*.
8. When pipetting reagents, maintain a consistent order of addition from well-to-well. This ensures equal incubation times for all wells.
9. Cover or cap all reagents when not in use.
10. **Do not mix or interchange different reagent lots from various kit lots.**
11. Do not use reagents after the kit expiration date.
12. Read absorbances within 30 minutes of assay completion.
13. The provided controls should be run with every assay. If control values fall outside pre-established ranges, the accuracy of the assay is suspect.
14. All residual wash liquid must be drained from the wells by efficient aspiration or by decantation followed by tapping the plate forcefully on absorbent paper. *Never* insert absorbent paper directly into the wells.
15. Because *Stabilized Chromogen* is light sensitive, avoid prolonged exposure to light. Also avoid contact between *Stabilized Chromogen* and metal, or color may develop.

#### SAFETY

All blood components and biological materials should be handled as potentially hazardous. Follow universal precautions as established by the Centers for Disease Control and Prevention and by the Occupational Safety and Health Administration when handling and disposing of infectious agents.

#### DIRECTIONS FOR WASHING

**Incomplete washing will adversely affect the test outcome.** All washing must be performed with *Wash Buffer* provided.

Washing can be performed manually as follows: completely aspirate the liquid from all wells by gently lowering an aspiration tip (aspiration device) into the bottom of each well. Take care not to scratch the inside of the well.

After aspiration, fill the wells with at least 0.4 mL of diluted wash solution. Let soak for 15 to 30 seconds, then aspirate the liquid. Repeat as directed under **ASSAY METHOD**. After the washing procedure, the plate is inverted and tapped dry on absorbent tissue.

Alternatively, the wash solution may be put into a squirt bottle. If a squirt bottle is used, flood the plate with wash buffer, completely filling all wells. After the washing procedure, the plate is inverted and tapped dry on absorbent tissue.

If using an automated washer, the operating instructions for washing equipment should be carefully followed.

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## REAGENT PREPARATION AND STORAGE

### Reconstitution and Dilution of Ms GM-CSF Standard

This assay has been calibrated against the reference preparation 91/658 (NIBSC, Hertfordshire, UK, ENG. 3QG). One microgram equals 100,000 units.

**Note:** Either glass or plastic tubes may be used for standard dilutions.

1. Reconstitute standard to 10,000 pg/mL with *Standard Diluent Buffer*. Refer to standard vial label for instructions. Swirl or mix gently and allow to sit for 10 minutes to ensure complete reconstitution. It is recommended that the standard be used within 1 hour of reconstitution.
2. Add 0.050 mL of the reconstituted standard to a tube containing 0.950 mL *Standard Diluent Buffer*. Label as 500 pg/mL GM-CSF. Mix.
3. Add 0.300 mL of *Standard Diluent Buffer* to each of 6 tubes labeled 250, 125, 62.5, 31.2, 15.6, and 7.8 pg/mL Ms GM-CSF.
4. Make serial dilutions of the standard as described in the following dilution table. Mix thoroughly between steps.

### Dilution of Ms GM-CSF Standard

Standard:	Add:	Into:
500 pg/mL	Prepare as described in Step 2.	
250 pg/mL	0.300 mL of the 500 pg/mL std.	0.300 mL of the Diluent Buffer
125 pg/mL	0.300 mL of the 250 pg/mL std.	0.300 mL of the Diluent Buffer
62.5 pg/mL	0.300 mL of the 125 pg/mL std.	0.300 mL of the Diluent Buffer
31.2 pg/mL	0.300 mL of the 62.5 pg/mL std.	0.300 mL of the Diluent Buffer
15.6 pg/mL	0.300 mL of the 31.2 pg/mL std.	0.300 mL of the Diluent Buffer
7.8 pg/mL	0.300 mL of the 15.6 pg/mL std.	0.300 mL of the Diluent Buffer
0 pg/mL	0.300 mL of the Diluent Buffer	An empty tube

Discard all remaining reconstituted and diluted standards after completing assay. Return the *Standard Diluent Buffer* to the refrigerator.

### Storage and Final Dilution of Streptavidin-HRP

**Please Note:** The *Streptavidin-HRP* 100x concentrate is in 50% glycerol. This solution is viscous. To ensure accurate dilution, allow *Streptavidin-HRP* concentrate to reach room temperature. Gently mix. Pipette *Streptavidin-HRP* concentrate slowly. Remove excess concentrate solution from pipette tip by gently wiping with clean absorbent paper.

1. Within 15 minutes of use, dilute 10 µL of this 100x concentrated solution with 1 mL of *Streptavidin-HRP Diluent* for each 8-well strip used in the assay. Label as Streptavidin-HRP Working Solution.

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For Example:

# of 8-Well Strips	Volume of Streptavidin-HRP Concentrate	Volume of Diluent
2	20 $\mu$ L solution	2 mL
4	40 $\mu$ L solution	4 mL
6	60 $\mu$ L solution	6 mL
8	80 $\mu$ L solution	8 mL
10	100 $\mu$ L solution	10 mL
12	120 $\mu$ L solution	12 mL

2. Return the unused *Streptavidin-HRP* concentrate to the refrigerator.

#### Dilution of Wash Buffer

Allow the 25x concentrate to reach room temperature and mix to ensure that any precipitated salts have redissolved. Dilute 1 volume of the 25x wash buffer concentrate with 24 volumes of deionized water (e.g., 50 mL may be diluted up to 1.25 liters, 100 mL may be diluted up to 2.5 liters). Label as Working Wash Buffer.

Store both the concentrate and the Working Wash Buffer in the refrigerator. The diluted buffer should be used within 14 days.

#### ASSAY METHOD: PROCEDURE AND CALCULATIONS

**Be sure to read the *Procedural Notes/Lab Quality Control* section before carrying out the assay.**

Allow all reagents to reach room temperature before use. Gently mix all liquid reagents prior to use.

**Note:** A standard curve must be run with each assay.

1. Determine the number of 8-well strips needed for the assay. Insert these in the frame(s) for current use. (Re-bag extra strips and frame. Store these in the refrigerator for future use.)
2. Add 100  $\mu$ L of the *Standard Diluent Buffer* to zero wells. Well(s) reserved for chromogen blank should be left empty.
3. Add 100  $\mu$ L of standards to the appropriate microtiter wells. For all samples (serum, plasma, buffered solution and cell culture medium and controls), add 50  $\mu$ L of *Standard Diluent Buffer* to each well followed by 50  $\mu$ L of sample. Tap gently on the side of the plate to mix. (See **REAGENT PREPARATION AND STORAGE**, Section B.)
4. Cover plate with *plate cover* and incubate for **2 hours at room temperature**.
5. Thoroughly aspirate or decant solution from wells and discard the liquid. Wash wells 4 times. See **DIRECTIONS FOR WASHING**.
6. Pipette 100  $\mu$ L of biotinylated anti-GM-CSF (*Biotin Conjugate*) solution into each well except the chromogen blank(s). Tap gently on the side of the plate to mix.
7. Cover plate with *plate cover* and incubate for **1 hour at room temperature**.
8. Thoroughly aspirate or decant solution from wells and discard the liquid. Wash wells 4 times. See **DIRECTIONS FOR WASHING**.
9. Add 100  $\mu$ L Streptavidin-HRP Working Solution to each well except the chromogen blank(s). (Prepare the working dilution as described in **REAGENT PREPARATION AND STORAGE**, Section C.)
10. Cover plate with the *plate cover* and incubate for **30 minutes at room temperature**.
11. Thoroughly aspirate or decant solution from wells and discard the liquid. Wash wells 5 times. See **DIRECTIONS FOR WASHING**.
12. Add 100  $\mu$ L of *Stabilized Chromogen* to each well. The liquid in the wells will begin to turn blue.
13. Incubate for **30 minutes at room temperature and in the dark**. **Please Note: Do not cover the plate with aluminum foil or metalized mylar.** The incubation time for chromogen substrate is often determined by the microtiter plate reader used. Many plate readers have the capacity to record a maximum optical density (O.D.) of 2.0. The O.D. values should be monitored and the substrate reaction stopped before the O.D. of the positive wells exceed the limits of the instrument. The O.D. values at 450 nm can only be read after the *Stop Solution* has been added to each well. If using a reader that records only to 2.0 O.D., stopping the assay after 20 to 25 minutes is suggested.
14. Add 100  $\mu$ L of *Stop Solution* to each well. Tap side of plate gently to mix. The solution in the wells should change from blue to yellow.
15. Read the absorbance of each well at 450 nm having blanked the plate reader against a chromogen blank composed of 100  $\mu$ L each of *Stabilized Chromogen* and *Stop Solution*. Read the plate within 30 minutes after adding the *Stop Solution*.
16. Plot on graph paper the absorbance of the standards against the standard concentration. (Optimally, the background absorbance may be subtracted from *all* data points, including standards, unknowns, and controls prior to plotting.)

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- Draw the best smooth curve through these points to construct the standard curve. If using curve fitting software, the four parameter algorithm provides the best curve fit.
17. Read the Ms GM-CSF concentrations for unknown samples and controls from the standard curve plotted in step 16. **Multiply value(s) obtained for sample(s) by 2 to correct for the 1:2 dilution in step 3.** (Samples producing signals greater than that of the highest standard (500 pg/mL) should be further diluted in *Standard Diluent Buffer* and reanalyzed, multiplying the concentration found by the appropriate dilution factor.)

#### TYPICAL DATA

The following data were obtained for the various standards over the range of 0 to 500 pg/mL Ms GM-CSF.

Standard Ms GM-CSF (pg/mL)	Optical Density (450 nm)
0	0.141
	0.132
7.8	0.185
	0.206
15.6	0.272
	0.266
31.2	0.421
	0.373
62.5	0.649
	0.621
125	1.155
	1.113
250	2.110
	2.116
500	3.395
	3.423

#### LIMITATIONS OF THE PROCEDURE

Do not extrapolate the standard curve beyond the 500 pg/mL standard point; the dose-response is non-linear in this region and accuracy is difficult to obtain. Dilute samples >500 pg/mL with *Standard Diluent Buffer*; reanalyze these and multiply results by the appropriate dilution factor.

The influence of various drugs, aberrant sera (hemolyzed, hyperlipidemic, jaundiced, etc.) and the use of biological fluids in place of serum samples have not been thoroughly investigated. The rate of degradation of native Ms GM-CSF in various matrices has not been investigated. The immunoassay literature contains frequent references to aberrant signals seen with some sera, attributed to heterophilic antibodies. Though such samples have not been seen to date, the possibility of this occurrence cannot be excluded.

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#### PERFORMANCE CHARACTERISTICS

##### SENSITIVITY

The minimum detectable dose of Ms GM-CSF is <4 pg/mL. This was determined by adding two standard deviations to the mean O.D. obtained when the zero standard was assayed 30 times.

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## PRECISION

### 1. Intra-Assay Precision

Samples of known Ms GM-CSF concentration were assayed in replicates of 16 to determine precision within an assay.

	Sample 1	Sample 2	Sample 3
Mean (pg/mL)	57.16	127.57	242.28
SD	3.74	10.30	11.28
%CV	6.54	8.07	4.65

SD = Standard Deviation  
CV = Coefficient of Variation

### Inter-Assay Precision

Samples were assayed 48 times in multiple assays to determine precision between assays.

	Sample 1	Sample 2	Sample 3
Mean (pg/mL)	60.00	134.99	235.96
SD	4.66	10.89	12.83
%CV	7.77	8.07	5.44

SD = Standard Deviation  
CV = Coefficient of Variation

## LINEARITY OF DILUTION

Mouse serum, citrate plasma, heparinized plasma and tissue culture medium containing 1% and 10% fetal calf serum were spiked with Ms GM-CSF and serially diluted in *Standard Diluent Buffer* over the range of the assay. Linear regression analysis of samples versus expected concentration yielded a correlation coefficient of 0.99 in all cases.

## RECOVERY

The recovery of Ms GM-CSF added to mouse serum averaged 100.7%. The recovery of Ms GM-CSF added to mouse plasma (citrate) averaged 97.3%. The recovery of Ms GM-CSF added to mouse plasma (heparin) averaged 95.4%. The recovery of Ms GM-CSF added to tissue culture medium containing 1% fetal calf serum averaged 95.8%, while the recovery of Ms GM-CSF added to tissue culture medium containing 10% fetal calf serum averaged 112.3%.

## PARALLELISM

Random mouse serum and plasma samples spiked with natural MS GM-CSF, and tissue culture supernatant, were serially diluted in the *Standard Diluent Buffer*. The standard accurately reflects the Ms GM-CSF content in natural samples.

## SPECIFICITY

Buffered solutions of a panel of substances ranging in concentrations from 500 to 20,000 pg/mL were assayed with the Ms GM-CSF kit. The following substances were tested and found to have no cross-reactivity: mouse IL-2, IL-4, IL-5, IL-10, IL-12, IFN- $\gamma$ , VEGF, FGFbasic, G-CSF, PDGF-BB, EGF, KC, MCP-1, MIG, IP-10, MIP-1 $\alpha$ , MIP-1 $\beta$ , MIP-2; human GM-CSF; rat GM-CSF, IL-1 $\beta$ , MIP-2, TNF- $\alpha$  and IL-6.

Random, normal serum samples from various species were also evaluated with the Ms GM-CSF kit. No cross-reactivity was observed with bovine, goat, hamster, human, monkey, rabbit or rat serum samples. There was low cross-reactivity with swine serum samples.

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## EXPECTED VALUES

Twenty-three sera, twenty plasma (citrate), and eight plasma (heparin) samples were evaluated in this assay. All samples measured <7.8 pg/mL (the lowest Ms GM-CSF standard).

Mouse splenocytes were cultured under the following conditions and the culture supernatants were assayed for Ms GM-CSF released.

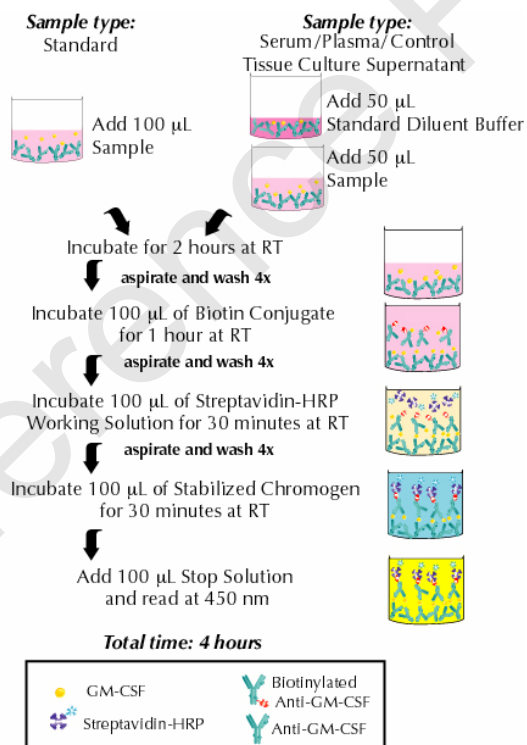
1. Con-A (5 µg/mL) 6 hr: 5 pg/mL
2. PMA (50 ng/mL), Ionophore (250 ng/mL) 6 hr: 105 pg/mL
3. PMA (50 ng/mL), Ionophore (250 ng/mL) 12 hr: 46 pg/mL
4. PMA (50 ng/mL), Ionophore (250 ng/mL) 24 hr: 502 pg/mL
5. LPS (1 µg/mL) 24 hr: 4430 pg/mL

## REFERENCES

1. Garland, J. M. (1991) *The Cytokine Handbook* 269-300.
2. Costello, T.T. (1993) *Acta Oncol.* 32:403.
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4. Moore, M.A. (1991) *Annu. Rev. Immunol.* 9:159.
5. Dedhar, S. et al. (1988) *Proc. Nat'l. Acad. Sci. USA* 85:9253.
6. Callard, R. et al. eds. (1994) *The Cytokine Facts Book* 139-143.

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## Mouse GM-CSF Assay Summary



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