

BioLegend®

LEGENDplex™

Multi-Analyte Flow Assay Kit

**Human Proinflammatory Chemokine
Panel 1
Mix and Match Subpanel**

Please read the entire manual before running the assay.

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.

Table of Contents	Page
Chapter 1: KIT DESCRIPTION	3
Introduction.....	3
Principle of the Assay.....	4
Beads Usage.....	4
Storage Information.....	6
Materials Supplied.....	6
Materials to be Provided by the End-User.....	8
Precautions.....	9
Chapter 2: ASSAY PREPARATION	10
Sample Collection and Handling.....	10
Reagent Preparation.....	10
Standard Preparation	11
Sample Dilution.....	12
Chapter 3: ASSAY PROCEDURE	13
Performing the Assay Using a Filter Plate.....	13
Performing the Assay Using a V-bottom Plate	16
Chapter 4: FLOW CYTOMETER SETUP	19
Chapter 5: DATA ACQUISITION AND ANALYSIS	19
Data Acquisition.....	19
Data Analysis.....	20
Chapter 6: ASSAY CHARACTERIZATION	21
Representative Standard Curve.....	21
Assay Sensitivity.....	21
Cross-Reactivity.....	22
Accuracy.....	22
Linearity of Dilution.....	23

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Intra-Assay Precision..... 24

Inter-Assay Precision..... 25

Biological Samples..... 26

TROUBLESHOOTING..... 28

PLATE MAP..... 33

Chapter 1: KIT DESCRIPTION

Introduction

Chemotactic cytokines or chemokines play pivotal roles in various processes such as immune surveillance, organ development, angiogenesis, and immune responses. Expression profiling of chemokines, especially those involved in inflammation and immune disorders, is important in achieving a deeper understanding of disease states.

The Human Proinflammatory Chemokine Panel 1 is a multiplex bead-based assay panel, using fluorescence-encoded beads suitable for use on various flow cytometers. This panel allows simultaneous quantification of 13 human chemokines, including MCP-1 (CCL2), RANTES (CCL5), IP-10 (CXCL10), Eotaxin (CCL11), TARC (CCL17), MIP-1 α (CCL3), MIP-1 β (CCL4), MIG (CXCL9), MIP-3 α (CCL20), ENA-78 (CXCL5), GRO α (CXCL1), I-TAC (CXCL11) and IL-8 (CXCL8). This assay panel provides higher detection sensitivities and broader dynamic ranges than traditional ELISA methods. The panel has been validated by detecting expected changes in biological samples.

The LEGENDplex™ Human Proinflammatory Chemokine Panel 1 (13-plex) is designed to allow flexible customization within the panel. It can also be divided into subpanels. The table below shows the panel configuration and sample dilution requirement.

Cat #	Plex Size	Targets	Sample Type	Dilution Factor
740984, 740985	13-plex	CCL2, CCL5, CXCL10, CCL11, CCL17, CCL3, CCL4, CXCL9, CCL20, CXCL5, CXCL1, CXCL11, CXCL8	Tissue Culture	Varies
741080, 741081	12-plex	CCL2, CXCL10, CCL11, CCL17, CCL3, CCL4, CXCL9, CCL20, CXCL5, CXCL1, CXCL11, CXCL8	Tissue Culture	Varies
			Serum/Plasma	2x
741082, 741083	1-plex	CCL5	Tissue Culture	Varies
			Serum Plasma	50x

Please visit www.biolegend.com/legendplex for more information on how to mix and match within the panel.

Principle of the Assay

BioLegend's LEGENDplex™ assays are bead-based immunoassays using the same basic principle as sandwich immunoassays.

Beads are differentiated by size and internal fluorescence intensities. Each bead set is conjugated with a specific antibody on its surface and serves as the capture beads for that particular analyte. When a selected panel of capture beads is mixed and incubated with a sample containing target analytes specific to the capture antibodies, each analyte will bind to its specific capture beads. After washing, a biotinylated detection antibody cocktail is added, and each detection antibody in the cocktail will bind to its specific analyte bound on the capture beads, thus forming capture bead-analyte-detection antibody sandwiches. Streptavidin-phycoerythrin (SA-PE) is subsequently added, which will bind to the biotinylated detection antibodies, providing fluorescent signal intensities in proportion to the amount of bound analytes.

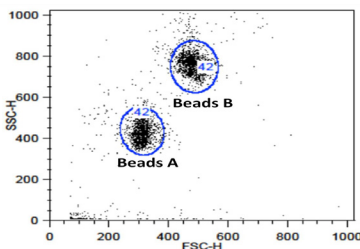
Since the beads are differentiated by size and internal fluorescence intensity on a flow cytometer, analyte-specific populations can be segregated and PE fluorescent signal quantified. The concentration of a particular analyte is determined using a standard curve generated in the same assay.

Beads Usage

The Human Proinflammatory Chemokine Panel uses two sets of beads. Each set has a unique size that can be identified based on their forward scatter (FSC) and side scatter (SSC) profiles (Beads A and Beads B, Figure 1). Each bead set can be further resolved based on their internal fluorescence intensities. The internal dye can be detected using FL3, FL4, or APC channel, depending on the type of flow cytometer used. The smaller Beads A consists of 6 bead populations and the larger Beads B consists of 7 bead populations (Figure 2-3).

Using a total of 13 bead populations distinguished by size and internal fluorescent dye, the Human Proinflammatory Chemokine Panel allows simultaneous detection of 13 chemokines in a single sample. Each analyte is associated with a particular bead set as indicated (Figures 2-3 and Table 1).

Figure 1. Beads Differentiated by Size



Beads A = smaller beads

Beads B = larger beads

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Figure 2. Beads A Classification by FL4

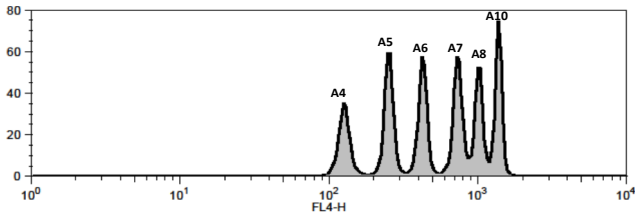
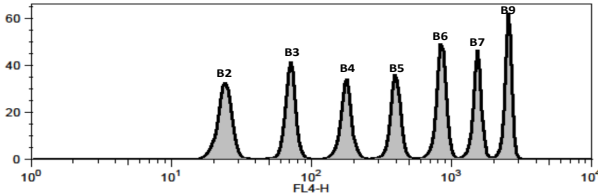


Figure 3. Beads B Classification by FL4



For Beads usage in the panel, please refer to Table 1 below:

Table 1. Beads ID*, Panel Target Selection and Top Standard Concentrations:

Target	Bead ID	(13-Plex)	(12-Plex)	(1-Plex)	Top Standard Concentration
		No.740984, 740985	No.741080, 741081	No.741082, 741083	
IL-8	A4	√	√		Note: The top standard concentrations of analytes in this panel were set at various concentrations, but may be subject to change from lot to lot (please visit biolegend.com/en-us/legendplex to download a lot-specific certificate of analysis).
IP-10	A5	√	√		
Eotaxin	A6	√	√		
TARC	A7	√	√		
MCP-1	A8	√	√		
RANTES	A10	√		√	
MIP-1α	B2	√	√		
MIG	B3	√	√		
ENA-78	B4	√	√		
MIP-3α	B5	√	√		
GROα	B6	√	√		
I-TAC	B7	√	√		
MIP-1β	B9	√	√		

*Bead ID is used to associate a bead population to a particular analyte when using the LEGENDplex™ data analysis software program. For further information regarding the use of the program please visit biolegend.com/en-us/legendplex

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Storage Information

Recommended storage for all original kit components is between 2°C and 8°C. DO NOT FREEZE Beads, Detection Antibodies or SA-PE.

- Once the standards have been reconstituted, immediately transfer contents into polypropylene vials. DO NOT STORE RECONSTITUTED STANDARDS IN GLASS VIALS.
- Upon reconstitution, leftover standard and Matrix B should be stored at $\leq -70^{\circ}\text{C}$ for use within one month. Avoid multiple (>2) freeze-thaw cycles. Discard any leftover diluted standards.

Materials Supplied

The LEGENDplex™ kit contains reagents for 100 tests, listed in the table below. When assayed in duplicate, this is enough for an 8-point standard curve and 40 samples.

For the Mix and Match Subpanels, individual beads are provided at 13X concentration. The Buffer Set contains Setup Beads, all Buffers, Plate Sealers, Matrix, and SA-PE.

Kit Components	Quantity	Volume	Cat #
Capture Beads* (see tables below for more information)	varies	varies	varies
LEGENDplex™ Human Proinflammatory Chemokine Detection Antibodies	1 bottle	3.3 mL	740986
LEGENDplex™ Human Proinflammatory Chemokine Standard	1 vial	lyophilized	740987
LEGENDplex™ Buffer Set A	1		740368
Filter Plate* or V-bottom Plate**	1 Plate		740377* or 740379**

* For kit with filter plate. ** For kit with V-bottom plate.

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Capture beads for Mix and Match Subpanels*:

Bead Name	Quantity	Volume	Cat#
LEGENDplex™ Human CXCL8 (IL-8) Capture Bead A4, 13X	1 vial	270 µL	740988
LEGENDplex™ Human CXCL10 (IP-10) Capture Bead A5, 13X	1 vial	270 µL	740989
LEGENDplex™ Human CCL11 (Eotaxin) Capture Bead A6, 13X	1 vial	270 µL	740990
LEGENDplex™ Human CCL17 (TARC) Capture Bead A7, 13X	1 vial	270 µL	740991
LEGENDplex™ Human CCL2 (MCP-1) Capture Bead A8, 13X	1 vial	270 µL	741241
LEGENDplex™ Human CCL5 (RANTES) Capture Bead A10, 13X*	1 vial	270 µL	740992
LEGENDplex™ Human CCL3 (MIP-1α) Capture Bead B2, 13X	1 vial	270 µL	740993
LEGENDplex™ Human CXCL9 (MIG) Capture Bead B3, 13X	1 vial	270 µL	740994
LEGENDplex™ Human CXCL5 (ENA-78) Capture Bead B4, 13X	1 vial	270 µL	740084
LEGENDplex™ Human CCL20 (MIP-3α) Capture Bead B5, 13X	1 vial	270 µL	740995
LEGENDplex™ Human CXCL1 (GROα) Capture Bead B6, 13X	1 vial	270 µL	740996
LEGENDplex™ Human CXCL11 (I-TAC) Capture Bead B7, 13X	1 vial	270 µL	740997
LEGENDplex™ Human CCL4 (MIP-1β) Capture Bead B9, 13X	1 vial	270 µL	740998

***For serum or plasma samples, mixing and matching of RANTES with other targets is not recommended due to high dilution requirement. A single plex is recommended for measuring RANTES in serum or plasma samples**

LEGENDplex™ Buffer Set A (Cat#: 740368)

Components	Quantity	Volume	Part #
Setup Beads: PE Beads	1 vial	1 mL	77842
Setup Beads: Raw Beads	1 vial	1.8 mL	77844
LEGENDplex™ SA-PE	1 bottle	3.3 mL	77743
LEGENDplex™ Matrix B, Lyophilized	1 vial	lyophilized	77549
LEGENDplex™ Assay Buffer	1 bottle	25 mL	77562
LEGENDplex™ Wash Buffer, 20X	1 bottle	25 mL	77564
Plate Sealers	4 sheets		78101

No plate is included in Buffer Set A. Plate need to be ordered separately. Please order the correct type of plate based on the preferred assay protocol (Cat# 740377 or 740378 for Filter Plate and Cat# 740379 for V-bottom Plate)

Materials to be Provided by the End-User

- A flow cytometer equipped with two lasers (e.g., a 488 nm blue laser or 532 nm green laser and a 633-635 nm red laser) capable of distinguishing 575 nm and 660 nm or a flow cytometer equipped with one laser (e.g., 488 nm blue laser) capable of distinguishing 575 nm and 670 nm.

Partial list of compatible flow cytometers:

Flow Cytometer	Reporter Channel	Channel Emission	Classification Channel	Channel Emission	Compensation needed?
BD FACSCalibur™	FL2	575 nm	FL4	660 nm	No*
BD Accuri™ C6™	FL2	585 nm	FL4	675 nm	No*
BD FACSCanto, BD FACSCanto™II	PE	575 nm	APC	660 nm	No*
BD™ LSR, LSR II BD LSRFortessa™	PE	575 nm	APC	660 nm	No*
Gallios™	PE	575 nm	APC	660 nm	No*
CytoFLEX	PE	585 nm	APC	660 nm	No*
NovoCyte	PE	572 nm	APC	660 nm	No*
Attune™ NxT	PE	574 nm	APC	670 nm	No*

***Compensation is not required for the specified flow cytometers when set up properly.**

For setting up various flow cytometers, please visit: www.biolegend.com/ **labelplex** and click on the **Instrument Setup** tab.

- Multichannel pipettes capable of dispensing 5 µL to 200 µL
- Reagent reservoirs for multichannel pipette
- Polypropylene microfuge tubes (1.5 mL)
- Laboratory vortex mixer
- Sonicator bath (e.g., Branson Ultrasonic Cleaner model #B200, or equivalent)
- Aluminum foil
- Absorbent pads or paper towels
- Plate shaker (e.g., Lab-Line Instruments model #4625, or equivalent)
- Tabletop centrifuges (e.g., Eppendorf centrifuge 5415 C, or equivalent)
- 1.1 mL polypropylene micro FACS tubes, in 96-tube rack (e.g., National Scientific Supply Co, catalog # TN0946-01R, or equivalent).

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

If the assay is performed in a filter plate;

- A vacuum filtration unit (Millipore MultiScreen[®] HTS Vacuum Manifold, cat # MSVMHTS00 or equivalent). Instructions on how to use the vacuum manifold can be found at the supplier's website.
- A vacuum source (mini vacuum pump or line vacuum, e.g., Millipore Vacuum Pump, catalog # WP6111560, or equivalent).
- If needed, additional Filter plate can be ordered from BioLegend (Cat# 740377 or 740378).

If the assay is performed in a V-bottom plate;

- Centrifuge with a swinging bucket adaptor for microtiter plates (e.g., Beckman Coulter Allegra[™] 6R Centrifuge with MICROPLUS CARRIER adaptor for GH3.8 and JS4.3 Rotors).
- If needed, additional V-bottom plate can be ordered from BioLegend (Cat# 740379).

Precautions

- All blood components and biological materials should be handled as potentially hazardous. Follow universal precautions as established by the Center for Disease Control and Prevention and by the Occupational Safety and Health Administration when handling and disposing of infectious agents.
- Sodium azide has been added to some reagents as a preservative. Although the concentrations are low, sodium azide may react with lead and copper plumbing to form highly explosive metal azides. On disposal, flush with a large volume of water to prevent azide build-up.
- Matrix B for LEGENDplex[™] kits contains components of human origin and should be handled as potentially hazardous. The raw material has been screened for infectious diseases and is negative for HIV, HBV and HCV using FDA-approved test methods.
- Do not mix or substitute reagents from different kits or lots. Reagents from different manufacturers should not be used with this kit.
- Do not use this kit beyond its expiration date.
- SA-PE and Beads are light-sensitive. Minimize light exposure.

Chapter 2: ASSAY PREPARATION

Sample Collection and Handling

Preparation of Serum Samples:

- Allow the blood to clot for at least 30 minutes and centrifuge for 10 minutes at 1,000 x *g*.
- Remove serum and assay immediately or aliquot and store samples at $\leq -20^{\circ}\text{C}$. Avoid multiple (>2) freeze/thaw cycles.
- When using frozen samples, it is recommended that samples are thawed completely, mixed and centrifuged to remove particulates prior to use.

Preparation of Plasma Samples:

- Plasma collection using EDTA as an anti-coagulant is recommended. Centrifuge for 10 minutes at 1,000 x *g* within 30 minutes of blood collection.
- Remove plasma and assay immediately, or aliquot and store samples at $\leq -20^{\circ}\text{C}$. Avoid multiple (>2) freeze/thaw cycles.
- When using frozen samples, it is recommended that samples are thawed completely, mixed well and centrifuged to remove particulates.

Preparation of Tissue Culture Supernatant:

- Centrifuge the sample to remove debris and assay immediately. If not possible, aliquot and store samples at $\leq -20^{\circ}\text{C}$. Avoid multiple (>2) freeze/thaw cycles.

Reagent Preparation

Preparation of Antibody-Immobilized Beads

The individual beads (13X) should be mixed with each other and diluted to 1X final concentration with Assay Buffer prior to use. To mix the beads, follow the steps below (a 5-plex subpanel is used as an example):

1. Sonicate each bead vial for 1 minute in a sonicator bath and then vortex for 30 seconds to completely resuspend the beads
2. Calculate the amount of mixed and diluted beads needed for the assay. Prepare extra to compensate for pipetting loss. Each reaction needs 25 μL of mixed and diluted beads. For 50 reactions, prepare 1.5 mL of mixed beads. For 100 reactions, prepare 3 mL of mixed beads.

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

3. To make 1.5 ml of 5-plex 1X diluted beads, transfer 115 μL of each of the 5 individual beads (13X) to a fresh tube (total bead volume = 575 μL) and add 925 μL of Assay Buffer to make the final volume of 1.5 mL.

Preparation of Wash Buffer

- Bring the 20X Wash Buffer to room temperature and mix to bring all salts into solution.
- Dilute 25 mL of 20X Wash Buffer with 475 mL deionized water. Store unused portions between 2°C and 8°C for up to one month.

Preparation of Matrix B (for Serum or Plasma Samples Only)

- Add 5.0 mL LEGENDplex™ Assay Buffer to the bottle containing lyophilized Matrix B. Allow at least 15 minutes for complete reconstitution. Vortex to mix well. Leftover reconstituted Matrix B should be stored at $\leq -70^\circ\text{C}$ for up to one month.

Standard Preparation

1. Prior to use, reconstitute the lyophilized Human Proinflammatory Chemokine Panel 1 Standard Cocktail with 250 μL Assay Buffer.
2. Mix and allow the vial to sit at room temperature for 10 minutes, and then transfer the standard to an appropriately labeled polypropylene microfuge tube. This will be used as the top standard C7.

Note: The top standard concentrations of analytes in this panel were set at various concentrations, but may be subject to change from lot to lot (please visit biolegend.com/en-us/legendplex to download a lot-specific certificate of analysis).

3. Label 6 polypropylene microfuge tubes as C6, C5, C4, C3, C2 and C1, respectively.
4. Add 75 μL of Assay Buffer to each of the six tubes. Prepare 1:4 dilution of the top standard by transferring 25 μL of the top standard C7 to the C6 tube and mix well. This will be the C6 standard.
5. In the same manner, perform serial 1:4 dilutions to obtain C5, C4, C3, C2 and C1 standards (**see the table below using 10ng/mL of top standard as an example**). Assay Buffer will be used as the 0 pg/mL standard (C0).

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Tube/Standard ID	Serial Dilution	Assay Buffer to add (μL)	Standard to add	Final Conc. (pg/mL)
C7	--	--	--	10,000
C6	1:4	75	25 μL of C7	2,500
C5	1:16	75	25 μL of C6	625
C4	1:64	75	25 μL of C5	156.3
C3	1:256	75	25 μL of C4	39.1
C2	1:1024	75	25 μL of C3	9.8
C1	1:4096	75	25 μL of C2	2.4
C0	--	75	--	0

Sample Dilution

- For measuring serum or plasma samples for all targets except RANTES, the samples need to be diluted 2-fold with Assay Buffer before being tested (e.g. dilute 50 μL of sample with 50 μL of Assay Buffer). If further sample dilution is needed, the samples should be diluted with Matrix B provided in the kit.
- For measuring serum or plasma samples using the 1-plex RANTES kit, a 50-fold dilution using Assay Buffer is recommended due to the high concentration of RANTES in samples. If further sample dilution is needed, the samples should be diluted with Assay Buffer provided in the kit.

Adding serum or plasma samples without dilution will result in low assay accuracy and possibly, clogging of the filter plate.

- For cell culture supernatant samples, the levels of analyte can vary greatly from sample to sample. While the sample can be tested without dilutions, a preliminary experiment may be required to determine the appropriate dilution factor for samples.

If sample dilution is desired, dilution should be done with corresponding fresh cell culture medium or Assay Buffer to ensure accurate measurement.

Chapter 3: ASSAY PROCEDURE

The LEGENDplex™ assay can be performed in a filter plate, or in a V-bottom plate.

- The in-filter plate assay procedure requires a vacuum filtration unit for washing (see **Materials to be Provided by the End-User, page 8**).
- If the in-filter plate assay procedure is not possible or if you prefer, the assay can be performed in a V-bottom plate.

Performing the Assay Using a Filter Plate

- Allow all reagents to warm to room temperature (20-25°C) before use.
 - Set the filter plate on an inverted plate cover at all times during assay setup and incubation steps, so that the bottom of the plate does not touch any surface. Touching a surface may cause leakage.
 - Keep the plate upright during the entire assay procedure, including the washing steps, to avoid losing beads.
 - The plate should be placed in the dark or wrapped with aluminum foil for all incubation steps.
 - **Standards and samples should be run in duplicate and arranged on the plate in a vertical configuration convenient for data acquisition and analysis (as shown in attached PLATE MAP, page 33). Be sure to load standards in the first two columns. If an automation device is used for reading, the orientation and reading sequence should be carefully planned.**
1. Pre-wet the plate by adding 100 µL of LEGENDplex™ 1X Wash Buffer to each well and let it sit for 1 minute at room temperature. To remove the excess volume, place the plate on the vacuum manifold and apply vacuum. Do not exceed 10" Hg of vacuum. Vacuum until wells are drained (5-10 seconds). Blot excess Wash Buffer from the bottom of the plate by pressing the plate on a stack of clean paper towels. Place the plate on top of the inverted plate cover.

For measuring cell culture supernatant samples, load the plate as shown in the table below (in the order from left to right):

	Assay Buffer	Matrix B	Standard	Sample*
Standard Wells	25 µL	---	25 µL	---
Sample wells	25 µL	---	---	25 µL

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

For measuring serum/plasma samples for all targets except RANTES, load the plate as shown in the table below (in the order from left to right):

	Assay Buffer	Matrix B	Standard	Sample*
Standard Wells	---	25 μ L	25 μ L	---
Sample wells	25 μ L	---	---	25 μ L

For measuring serum/plasma samples for RANTES, load the plate as shown in the table below (in the order from left to right):

	Assay Buffer	Matrix B	Standard	Sample*
Standard Wells	25 μ L	---	25 μ L	---
Sample wells	25 μ L	---	---	25 μ L

*See **Sample Dilution**

2. Vortex mixed beads bottle for 30 seconds. Add 25 μ L of mixed beads to each well. The volume should be 75 μ L in each well after beads addition. (Note: During addition of the beads, shake mixed beads bottle intermittently to avoid bead settling).
3. Seal the plate with a plate sealer. **To avoid plate leaking, do not apply positive pressure to the sealer when sealing the plate.** Wrap the entire plate, including the inverted plate cover, with aluminum foil. Place the plate on a plate shaker, secure it with a rubber band and shake at approximate 500 rpm for 2 hours at room temperature.
4. **Do not invert the plate!** Place the plate on the vacuum manifold and apply vacuum as before in Step 1. Add 200 μ L of 1X Wash Buffer to each well. Remove Wash Buffer by vacuum filtration. Blot excess Wash Buffer from the bottom of the plate with an absorbent pad or paper towels. Repeat this washing step once more.
5. Add 25 μ L of Detection Antibodies to each well.
6. Seal the plate with a fresh plate sealer. Wrap the entire plate, including the inverted plate cover, with aluminum foil. Place the plate on a plate shaker and shake at approximately 500 rpm for 1 hour at room temperature.
7. **Do not vacuum!** Add 25 μ L of SA-PE to each well directly.
8. Seal the plate with a fresh plate sealer. Wrap the entire plate, including the inverted plate cover, with aluminum foil. Place the plate on a plate shaker and shake at approximate 500 rpm for 30 minutes at room temperature.
9. Repeat step 4 above.
10. Add 150 μ L of 1X Wash Buffer to each well. Resuspend the beads on a plate

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

shaker for 1 minute.

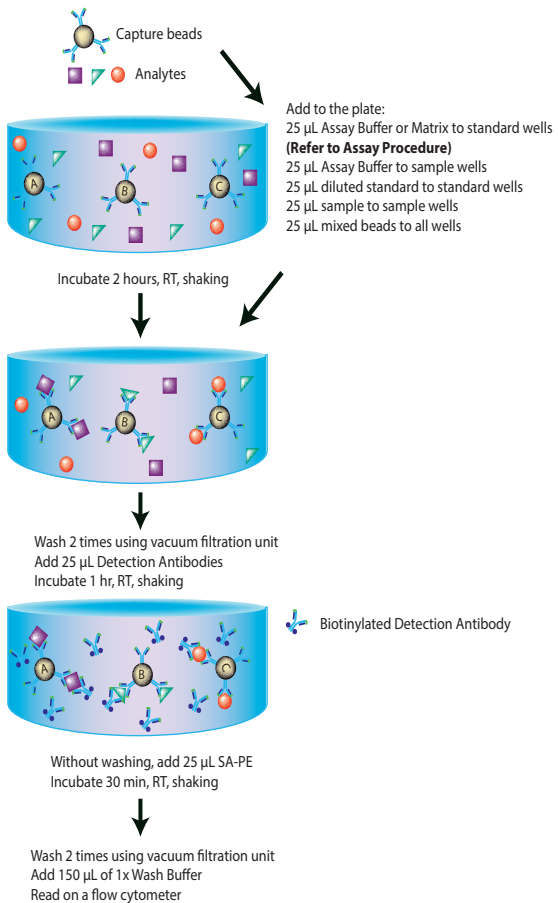
11. Read samples on a flow cytometer, preferably within the same day of the assay (Note: Prolonged sample storage can lead to reduced signal).

If the flow cytometer is equipped with an autosampler, read the plate directly using the autosampler. **Please be sure to program the autosampler to resuspend beads in the well immediately before taking samples. The probe height may need to be adjusted when using an autosampler.**

If an autosampler is not available, the samples can be transferred from the filter plate to micro FACS (or FACS) tubes and read manually.

Assay Procedure Summary for Filter Plate

Add 100 μL 1X Wash Buffer to filter plate wells
Vacuum to remove excess buffer



Performing the Assay Using a V-bottom Plate

- Allow all reagents to warm to room temperature (20-25°C) before use.
 - Keep the plate upright during the entire assay procedure, including the washing steps, to avoid losing beads.
 - The plate should be placed in the dark or wrapped with aluminum foil for all incubation steps.
 - Standards and samples should be run in duplicate and arranged on the plate in a vertical configuration convenient for data acquisition and analysis (as shown in attached PLATE MAP, page 33). Be sure to load standards in the first two columns. If an automation device is used for reading, the orientation and reading sequence should be carefully planned.
1. **For measuring cell culture supernatant samples**, load the plate as shown in the table below (in the order from left to right):

	Assay Buffer	Matrix B	Standard	Sample*
Standard Wells	25 µL	---	25 µL	---
Sample wells	25 µL	---	---	25 µL

For measuring serum/plasma samples for all targets except RANTES, load the plate as shown in the table below (in the order from left to right):

	Assay Buffer	Matrix B	Standard	Sample*
Standard Wells	---	25 µL	25 µL	---
Sample wells	25 µL	---	---	25 µL

For measuring serum/plasma samples for RANTES, load the plate as shown in the table below (in the order from left to right):

	Assay Buffer	Matrix B	Standard	Sample*
Standard Wells	25 µL	---	25 µL	---
Sample wells	25 µL	---	---	25 µL

*See **Sample Dilution**

2. Vortex mixed beads for 30 seconds. Add 25 µL of mixed beads to each well. The total volume should be 75 µL in each well after beads addition. (Note: During beads addition, shake mixed beads bottle intermittently to avoid bead settling).
3. Seal the plate with a plate sealer. Cover the entire plate with aluminum foil to protect the plate from light. Shake at 800 rpm on a plate shaker for 2 hours at room temperature (**Depending on the shaker, the speed may**

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

need to be adjusted. The optimal speed is one that is high enough to keep beads in suspension during incubation, but not too high so it causes spill from the wells).

4. Centrifuge the plate at 1050 rpm (~250 g) for 5 minutes, using a swinging bucket rotor (G.H 3.8) with microplate adaptor (Please refer to **Materials to be Provided by the End-User, page 8**). Do not use excessive centrifugation speed as it may make it harder to resuspend beads in later steps. **Make sure the timer of the centrifuge works properly and standby to make sure the centrifuge reaches preset speed.**
5. Immediately after centrifugation, dump the supernatant into a sink by quickly inverting and flicking the plate **in one continuous and forceful motion**. Do not worry about losing beads even if the pellet is not visible. The beads will stay in the tip of the well nicely. Blot the plate on a stack of clean paper towel and drain the remaining liquid from the well as much as possible. Be careful not to disturb the bead pellet.

Alternatively, removal of the supernatant may be completed using a multichannel pipette set at 75 μ L. Try to remove as much liquid as possible without removing any beads. Be sure to change pipette tips between each row or column.

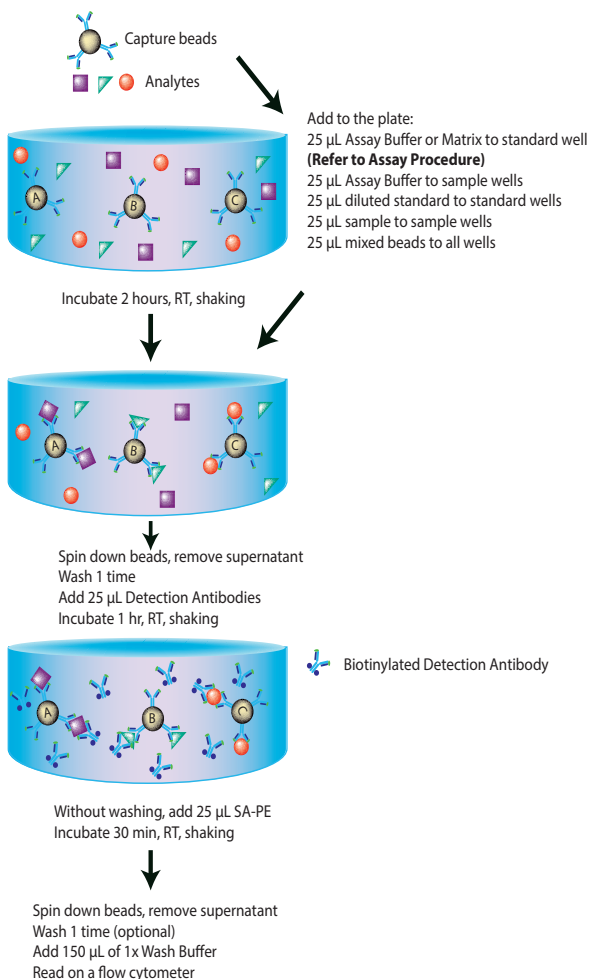
6. Wash the plate by dispensing 200 μ L of 1X Wash Buffer into each well and incubate for one minute. Repeat step 4 and 5 above. A second wash is optional, but may help reduce background.
7. Add 25 μ L of Detection Antibodies to each well.
8. Seal the plate with a new plate sealer. Cover the entire plate with aluminum foil to protect the plate from light. Shake at 800 rpm on a plate shaker for 1 hour at room temperature.
9. **Do not wash the plate!** Add 25 μ L of SA-PE to each well directly.
10. Seal the plate with a new plate sealer. Wrap the entire plate with aluminum foil and shake the plate on a plate shaker at approximate 800 rpm for 30 minutes at room temperature.
11. Repeat step 4, and 5.
12. Wash the plate by dispensing 200 μ L of 1X Wash Buffer into each well and incubate for one minute. Repeat step 4 and 5 above. This washing step is optional but helps to reduce the background.
13. Add 150 μ L of 1X Wash Buffer to each well. Resuspend the beads by pipetting.
14. Read samples on a flow cytometer, preferably within the same day of the assay (Note: Prolonged sample storage can lead to reduced signal).

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

If the flow cytometer is equipped with an autosampler, the samples can be read directly. **Please be sure to program the autosampler to resuspend beads in the well immediately before taking samples. The probe height may need to be adjusted when using an autosampler.**

If an autosampler is not available, the samples can be transferred from the plate to micro FACS (or FACS) tubes and read manually.

Assay Procedure Summary for V-bottom Plate



Chapter 4: FLOW CYTOMETER SETUP

In order to generate reliable data, the flow cytometer must be set up properly before data acquisition.

The setup instructions have been removed from this manual and uploaded onto our website to save paper.

To access the setup instructions, please visit: www.biolegend.com/legendplex and click on the **Instrument Setup** tab.

Chapter 5: DATA ACQUISITION AND ANALYSIS

Data Acquisition

1. Before reading samples, make sure that the flow cytometer is set up properly.
2. Create a new template or open an existing template (for details on how to create a cytometer-specific template, please refer to the Flow Cytometer Setup Guide).
3. Vortex each sample for 5 seconds before analysis.
4. Set the flow rate to low. Set the number of beads to be acquired to about 300 per analyte (e.g., acquire 2,400 beads for a 8-plex assay or 4000 beads for a 13-plex assay). Do not set to acquire total events as samples may contain large amounts of debris. Instead, create a large gate to include both Beads A and Beads B (gate A+B) and set to acquire the number of events in gate A + B. This will exclude majority of the debris.

Note: Do not acquire too few or too many beads. Too few beads acquired may result in high CVs and too many beads acquired may result in slow data analysis later.

5. Read samples.

When reading samples, set the flow cytometer to setup mode first and wait until bead population is stabilized before recording or switching to acquisition mode.

To simplify data analysis using the LEGENDplex™ Data Analysis Software, read samples in the same order as shown on the PLATE MAP attached at the end of the manual. For an in-plate assay, read column by column (A1,

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel B1, C1...A2, B2, C2...).

When naming data files, try to use simple names with a consecutive numbering for easy data analysis (e.g. for standards, C0.001, C0.002, C1.003, C1.004, C2.005, C2.006, C3.007, C3.008, ... C7.015, C7.016; for samples, S1.017, S1.018, S2.019, S2.020, S3.021, S3.022...)

Store all FCS files in the same folder for each assay. If running multiple assays, create a separate folder for each assay.

6. Proceed to data analysis using LEGENDplex™ Data Analysis Software when data acquisition is completed.

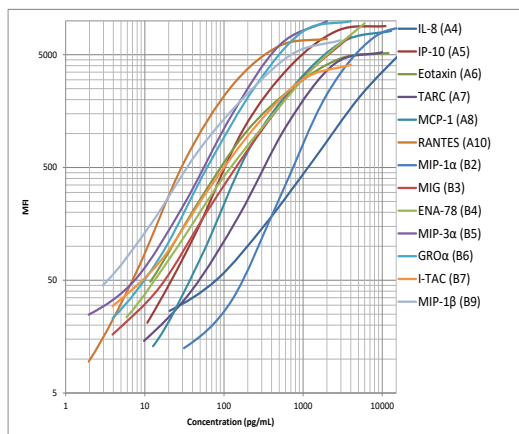
Data Analysis

- The assay FCS files should be analyzed using BioLegend's LEGENDplex™ data analysis software. The program is offered free of charge with the purchase of any LEGENDplex™ assay. For further information regarding access to, and use of the program please visit biolegend.com/en-us/legendplex.

Chapter 6: ASSAY CHARACTERIZATION

Representative Standard Curve

This standard curve was generated using the LEGENDplex™ Human Proinflammatory Chemokine Panel 1 for demonstration purpose only. A standard curve must be run with each assay.



Assay Sensitivity

The assay sensitivity is the theoretical limit of detection calculated using the LEGENDplex™ Data Analysis Software by applying a 5-parameter curve fitting algorithm. Assay Sensitivity presented here is $\leq \text{Mean LOD} + 2x \text{STDEV LOD}$

Analyte	LOD in Assay Buffer (pg/mL)	LOD in Matrix (pg/mL)
Human IL-8	5.77	5.40
Human IP-10	4.10	5.00
Human Eotaxin	2.40	4.20
Human TARC	1.50	1.70
Human MCP-1	2.30	4.40
Human RANTES	1.00	n/a
Human MIP-1α	13.80	10.10
Human MIG	1.18	2.50
Human ENA-78	1.70	2.40

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Human MIP-3 α	1.00	1.00
Human GRO α	1.60	1.30
Human I-TAC	1.20	1.22
Human MIP-1 β	2.00	1.96

Cross-Reactivity

The following human recombinant proteins were tested at 50 ng/mL using the LEGENDplex™ Human Proinflammatory Chemokine Panel 1. CXCL2 and CXCL3 showed a cross of 4% and 5% with CXCL1, respectively. No or negligible cross-reactivity was found between all other analytes.

CCL22	IFN- γ	CCL28	CX3CL1	CCL14	IL-17A
CCL23	CXCL7	IL-10	IL-2	CCL13	IL-15
CCL24	CXCL14	CCL18	IL-1R	CCL8	IL-13
CCL25	CXCL13	CXCL6	IL-1B	CCL15	IL-12
CCL26	CXCL16	CCL1	IL-10	CCL19	
CCL27	CXCL17	CCL7	IL-17F	CXCL4	

Accuracy (Spike Recovery)

For spike recovery in cell culture medium, target proteins with known concentrations were spiked into cell culture medium (RPMI and DMEM with 10% FCS) at three different levels within the assay range. The spiked samples were then assayed, and the measured concentrations were compared with expected values.

For spike recovery in serum, a sample with known high concentrations of target proteins was spiked into unknown serum samples. The spiked samples were then assayed, and the measured concentrations were compared with expected values.

Analyte	% of Recovery in Cell Culture Medium	% of Recovery in Serum
Human IL-8	102.74%	92.29%
Human IP-10	111.97%	92.34%
Human Eotaxin	111.45%	93.98%
Huamn TARC	116.74%	88.70%

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Human MCP-1	113.75%	118.98%
Human RANTES	111.75%	112.80%
Human MIP-1 α	111.22%	97.52%
Human MIG	126.32%	167.83%
Human ENA-78	109.71%	127.79%
Human MIP-3 α	118.13%	93.29%
Human GRO α	111.34%	150.36%
Human I-TAC	114.68%	109.47%
Human MIP-1 β	115.77%	109.23%

Linearity of Dilution

For testing linearity of dilution, serum samples were first diluted two-fold with Assay Buffer, then serially diluted 1:2, 1:4, 1:8 with Matrix B and assayed. The measured concentrations of serially diluted samples were then compared with that of the two-fold diluted samples.

Analyte	Linearity of Dilution	Analyte	Linearity of Dilution
Human IL-8	133.7%	Human MIG	160.0%
Human IP-10	121.3%	Human ENA-78	114.4%
Human Eotaxin	157.2%	Human MIP-3 α	113.9%
Human TARC	123.5%	Human GRO α	98.6%
Human MCP-1	107.8%	Human I-TAC	91.6%
Human RANTES	110.1%	Human MIP-1 β	117.1%
Human MIP-1 α	108.9%		

Intra-Assay Precision

Two samples with different concentrations of target proteins were analyzed in one assay with 16 replicates for each sample. The intra-assay precision was calculated as below.

Analyte	Sample	Mean (pg/mL)	STDEV	%CV
Human IL-8	Sample 1	379.3	15.4	4.1%
	Sample 2	1204.5	62.9	5.2%
Human IP-10	Sample 1	83.3	1.7	2.1%
	Sample 2	264.4	7.6	2.9%
Human Eotaxin	Sample 1	55.9	1.7	3.0%
	Sample 2	217.6	6.6	3.0%
Human TARC	Sample 1	104.2	4.5	4.3%
	Sample 2	323.7	13.1	4.1%
Human MCP-1	Sample 1	89.5	2.3	2.6%
	Sample 2	326.2	8.1	2.5%
Human RANTES	Sample 1	19.8	0.6	3.1%
	Sample 2	65.8	2.0	3.0%
Human MIP-1 α	Sample 1	286.2	7.7	2.7%
	Sample 2	1027.8	20.6	2.0%
Human MIG	Sample 1	51.6	2.7	5.2%
	Sample 2	183.9	14.3	7.8%
Human ENA-78	Sample 1	70.0	3.2	4.6%
	Sample 2	264.4	9.3	3.5%
Human MIP-3 α	Sample 1	27.8	1.1	4.1%
	Sample 2	94.5	3.3	3.5%
Human GRO α	Sample 1	46.9	1.3	2.8%
	Sample 2	135.9	4.7	3.4%
Human I-TAC	Sample 1	27.6	0.8	2.7%
	Sample 2	96.1	3.9	4.1%
Human MIP-1 β	Sample 1	40.5	1.8	4.5%
	Sample 2	110.5	4.7	4.3%

Inter-Assay Precision

Two samples with different concentrations of target proteins were analyzed in five independent assays by five different people. The inter-assay precision was calculated as below.

Analyte	Sample	Mean (pg/mL)	STDEV	%CV
Human IL-8	Sample 1	373.5	64.6	17.3%
	Sample 2	1401.2	195.5	14.0%
Human IP-10	Sample 1	117.3	16.2	13.8%
	Sample 2	438.4	29.2	6.7%
Human Eotaxin	Sample 1	62.3	13.2	21.2%
	Sample 2	247.4	40.3	16.3%
Human TARC	Sample 1	108.3	12.6	11.6%
	Sample 2	396.2	51.9	13.1%
Human MCP-1	Sample 1	92.3	16.2	17.6%
	Sample 2	365.5	50.6	13.9%
Human RANTES	Sample 1	20.6	3.0	14.7%
	Sample 2	73.1	6.9	9.4%
Human MIP-1 α	Sample 1	282.0	37.2	13.2%
	Sample 2	1131.7	138.4	12.2%
Human MIG	Sample 1	106.5	20.7	19.5%
	Sample 2	489.1	90.7	18.5%
Human ENA-78	Sample 1	76.0	14.7	19.3%
	Sample 2	334.2	44.5	13.3%
Human MIP-3 α	Sample 1	28.2	4.9	17.4%
	Sample 2	120.4	14.7	12.2%
Human GRO α	Sample 1	48.8	7.9	16.3%
	Sample 2	170.0	10.6	6.3%
Human I-TAC	Sample 1	38.9	6.8	17.6%
	Sample 2	161.9	17.8	11.0%
Human MIP-1 β	Sample 1	38.3	6.1	15.9%
	Sample 2	128.3	12.0	9.3%

Biological Samples**Serum and Plasma (Samples are not paired.)**

Normal human serum samples (n=20) were tested for endogenous levels of the Chemokines. The concentrations measured are shown below:

Analyte	Range (pg/ml)	No. of Detectable	% of Detectable	Mean (pg/mL)
Human IL-8	ND-458	17	85%	88
Human IP-10	48-996	20	100%	167
Human Eotaxin	ND-524	18	90%	110
Huamn TARC	74-1786	20	100%	423
Human MCP-1	76-538	20	100%	303
Human RANTES	6907-17093	20	100%	8753
Human MIP-1 α	ND-167	7	35%	24
Human MIG	26-223	20	100%	62
Human ENA-78	112-1083	20	100%	362
Human MIP-3 α	ND-33	17	85%	11
Human GRO α	24-628	20	100%	229
Human I-TAC	ND-367	19	95%	47
Human MIP-1 β	7--66	20	100%	23

ND = Non-detectable

Normal human plasma samples (n=60)) were tested for endogenous levels of chemokines. The concentrations measured are shown below:

Analyte	Range (pg/mL)	No. of Detectable	% of Detectable	Mean (pg/mL)
Human IL-8	ND-2704	54	90%	273
Human IP-10	13-1700	60	100%	168
Human Eotaxin	ND-18866	53	88%	513
Huamn TARC	3-253	60	100%	75
Human MCP-1	37-351	60	100%	141
Human RANTES	671-11294	60	100%	3704
Human MIP-1 α	ND-924	32	53%	160
Human MIG	8-491	60	100%	75
Human ENA-78	6-326	60	100%	68

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Human MIP-3 α	ND-193	48	80%	27
Human GRO α	ND-359	52	87%	59
Human I-TAC	ND-1356	58	97%	95
Human MIP-1 β	ND-57	56	93%	6

ND = Non-detectable

Cell Culture Supernatant

Human PBMC (1×10^6 cells/mL) were cultured under various conditions (LPS, 1 μ g/mL; LPS, 1 μ g/mL; IFN- γ , 100 ng/mL; CD3, 1 μ g/mL plate-coated; CD28, 1 μ g/mL soluble;). Supernatants were collected after 48 hours and assayed with the LEGENDplex™ Human Proinflammatory Chemokine Panel 1 kit. The results (all in pg/mL) are summarized below.

Analyte	Control	CD3+CD28	LPS	LPS+IFN- γ
Human IL-8	886	138502	50046	29338
Human IP-10	1747	4218	ND	154
Human Eotaxin	3	119	40	39
Human TARC	13	3818	30	46
Human MCP-1	2859	6253	9045	2297
Human RANTES	225	2626	433	557
Human MIP-1 α	35	35736	4192	4323
Human MIG	692	13299	ND	186
Human ENA-78	118	1295	3089	87
Human MIP-3 α	ND	826	42	21
Human GRO α	70	3105	3159	1152
Human I-TAC	2	ND	ND	ND
Human MIP-1 β	31	9157	971	987

TROUBLESHOOTING

Problem	Possible Cause	Solution
Bead population shifting upward or downward during acquisition	The strong PE signal from high concentration samples or standards may spill over to classification Channel (e.g., FL3/FL4/APC) and mess up the bead separation.	Optimize instrument settings using Kit Setup Beads, and make appropriate compensation between channels.
Filter plate will not vacuum or some wells clogged	Vacuum pressure is insufficient or vacuum manifold does not seal properly.	Increase vacuum pressure such that 0.2 mL buffer can be suctioned in 3-5 seconds. Clean the vacuum manifold and make sure no debris on the manifold. Press down the plate on the manifold to make a good seal.
	Samples have insoluble particles or sample is too viscous (e.g., serum and plasma samples)	<p>Centrifuge samples just prior to assay setup and use supernatant. If high lipid content is present, remove lipid layer after centrifugation. Sample may need dilution if too viscous.</p> <p>If some wells are still clogged during washing, try the following:</p> <ol style="list-style-type: none"> 1). Add buffer to all the wells, pipette up and down the clogged wells and vacuum again. 2). Use a piece of clean wipe, wipe the under side of the clogged wells and vacuum again. 3). Take a thin needle (e.g., insulin needle), while holding the plate upward, poke the little hole under each of the clogged wells and vacuum again. Do not poke too hard or too deep as it may damage the filter and cause leaking.
	Filter plate was used without pre-wet.	Pre-wet plate with wash buffer before running the assay.

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Insufficient bead count or slow reading	Beads inappropriately prepared	Sonicate bead vials and vortex just prior to addition. Agitate mixed beads intermittently in reservoir while pipetting this into the plate.
	Samples cause beads aggregation due to particulate matter or viscosity.	Centrifuge samples just prior to assay setup and use supernatant. If high lipid content is present, remove lipid layer after centrifugation. Sample may need dilution if too viscous.
	Beads were lost during washing for in-tube assay	Make sure beads are spun down by visually check the pellet (beads are in light blue or blue color). Be very careful when removing supernatant during washing.
	Probe might be partially clogged.	Sample probe may need to be cleaned, or if needed, probe should be removed and sonicated.
Plate leaked	Vacuum pressure set too high	Adjust vacuum pressure such that 0.2 mL buffer can be suctioned in 3-5 seconds. Do not exceed 10" Hg of vacuum.
	Plate set directly on table or absorbent towels during incubations or reagent additions	Set plate on plate holder or raised edge so bottom of filter is not touching any surface.
	Liquid present on the under side of the plate after vacuum	After washing, press down plate firmly on a stack of clean paper towels to dry the underside of the plate.
	Pipette touching and damaged plate filter during additions.	Pipette to the side of wells.
High Background	Background wells were contaminated	Avoid cross-well contamination by changing tips between pipetting when performing the assay using a multichannel pipette.
	Insufficient washes	The background may be due to non-specific binding of SA-PE. Increase number of washes.
Debris (FSC/SSC) during sample acquisition	Debris or platelet may exist in sample solution.	Centrifuge samples before analyzing samples. Remove platelet as much as possible.

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Variation between duplicate samples	Beads aggregation	Sonicate and vortex the Beads prior to use.
	Multichannel pipette may not be calibrated or inconsistent pipetting	Calibrate Pipette. Ensure good pipetting practice. Prime pipette before use may help.
	Plate washing was not uniform	Make sure all reagents are vacuumed out completely in all wash steps.
	Samples may contain particulate matters.	Centrifuge samples just prior to assay setup and use supernatant. If high lipid content is present, remove lipid layer after centrifugation. Sample may need dilution if too viscous.
Low or poor standard curve signal	The standard was incorrectly reconstituted, stored or diluted	Follow the protocol to reconstitute, store and dilute standard. Double check your calculation.
	Wrong or short incubation time	Ensure the time of all incubations was appropriate.
Signals too high, standard curves saturated	PMT value for FL2/PE set too high	Make sure the PMT setting for the reporter channel is appropriate
	Plate incubation time was too long	Use shorter incubation time.
Sample readings are out of range	Samples contain no or below detectable levels of analyte	Make sure the experiment to generate the samples worked. Use proper positive controls.
	Samples concentrations higher than highest standard point.	Dilute samples and analyze again.
	Standard curve was saturated at higher end of curve.	Make sure the PMT setting for the reporter channel is appropriate. Use shorter incubation time if incubation time was too long
Missed beads populations during reading, or distribution is unequal	Sample may cause some beads to aggregate.	Centrifuge samples just prior to assay setup and use supernatant. If high lipid content is present, remove lipid layer after centrifugation. Sample may need dilution if too viscous.
	Beads populations are not mixed properly	Make sure all bead populations are mixed. and in similar numbers.

Human Proinflammatory Chemokine Panel 1 Mix and Match Subpanel

Variation between duplicate samples	Beads aggregation	Sonicate and vortex the Beads prior to use.
	Multichannel pipette may not be calibrated or inconsistent pipetting	Calibrate Pipette. Ensure good pipetting practice. Prime pipette before use may help.
	Plate washing was not uniform	Make sure all reagents are vacuumed out completely in all wash steps.
	Samples may contain particulate matters.	Centrifuge samples just prior to assay setup and use supernatant. If high lipid content is present, remove lipid layer after centrifugation. Sample may need dilution if too viscous.
Low or poor standard curve signal	The standard was incorrectly reconstituted, stored or diluted	Follow the protocol to reconstitute, store and dilute standard. Double check your calculation.
	Wrong or short incubation time	Ensure the time of all incubations was appropriate.
Signals too high, standard curves saturated	PMT value for FL2/PE set too high	Make sure the PMT setting for the reporter channel is appropriate
	Plate incubation time was too long	Use shorter incubation time.
Sample readings are out of range	Samples contain no or below detectable levels of analyte	Make sure the experiment to generate the samples worked. Use proper positive controls.
	Samples concentrations higher than highest standard point.	Dilute samples and analyze again.
	Standard curve was saturated at higher end of curve.	Make sure the PMT setting for the reporter channel is appropriate. Use shorter incubation time if incubation time was too long
Missed beads populations during reading, or distribution is unequal	Sample may cause some beads to aggregate.	Centrifuge samples just prior to assay setup and use supernatant. If high lipid content is present, remove lipid layer after centrifugation. Sample may need dilution if too viscous.
	Beads populations are not mixed properly	Make sure all bead populations are mixed. and in similar numbers.

PLATE MAP (for in-plate assay)

	1	2	3	4	5	6	7	8	9	10	11	12
A	C0	C4	Sample1	Sample5	Sample 9	Sample 13	Sample 17	Sample 21	Sample 25	Sample 29	Sample 33	Sample 37
B	C0	C4	Sample1	Sample5	Sample 9	Sample 13	Sample 17	Sample 21	Sample 25	Sample 29	Sample 33	Sample 37
C	C1	C5	Sample2	Sample6	Sample 10	Sample 14	Sample 18	Sample 22	Sample 26	Sample 30	Sample 34	Sample 38
D	C1	C5	Sample2	Sample6	Sample 10	Sample 14	Sample 18	Sample 22	Sample 26	Sample 30	Sample 34	Sample 38
E	C2	C6	Sample3	Sample7	Sample 11	Sample 15	Sample 19	Sample 23	Sample 27	Sample 31	Sample 35	Sample 39
F	C2	C6	Sample3	Sample7	Sample 11	Sample 15	Sample 19	Sample 23	Sample 27	Sample 31	Sample 35	Sample 39
G	C3	C7	Sample4	Sample8	Sample 12	Sample 16	Sample 20	Sample 24	Sample 28	Sample 32	Sample 36	Sample 40
H	C3	C7	Sample4	Sample8	Sample 12	Sample 16	Sample 20	Sample 24	Sample 28	Sample 32	Sample 36	Sample 40



LEGENDplex™ Kits are manufactured by **BioLegend**

8999 BioLegend Way

San Diego, CA 92121

Tel: 1.858.768.5800

Tel: US & Canada Toll-Free: 1.877.Bio-Legend (1.877.246.5343)

Fax: 1.877.455.9587

Email: info@biolegend.com

biolegend.com

For a complete list of world-wide BioLegend offices and distributors,
please visit our website at: biolegend.com