

# **Magnetic Luminex<sup>®</sup> Performance Assay**

## **Human Discovery Cytokine Fixed Panel**

Catalog Number LKTM011

For the simultaneous quantitative determination of multiple human cytokine concentrations in cell culture supernates, serum, and plasma.

This package insert must be read in its entirety before using this product.  
For research use only. Not for use in diagnostic procedures.

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## INTRODUCTION

Cytokines are intercellular signaling proteins released from a wide variety of cells and tissues. They play an integral role in regulating growth and cellular proliferation as well as modulating host response to infection, injury, and inflammation. Cytokines also influence reproduction and bone remodeling. A large number of cytokines are pleiotropic and share similar functions. In addition, many cytokines influence the production of other cytokines. Analysis and quantification of cytokines in biological fluids has thus become increasingly important.

Assessing the levels of multiple cytokines may be more revealing than analyzing a single protein. Quantifying multiple cytokines on an individual level using enzyme-linked immunosorbent assays (ELISA) for example, can be time consuming and expensive. Multiplex assays allow measurement of multiple cytokines simultaneously and conserve precious samples by using a small sample volume. For ease of use, the microparticles are premixed.

The Cytokine Discovery Performance Assay is a multiplex Luminex® bead-based assay that allows for rapid, sensitive, and economical profiling of fourteen well known cytokines. Luminex® High Performance Assays from R&D Systems® are rigorously validated to maximize assay accuracy, precision, and reproducibility. For ease of use, the microparticles are premixed.

Analyte	Microparticle Region	Performance Data Online
IFN- $\alpha$	39	LKTM011data.pdf
IFN- $\gamma$	43	
IL-1 $\alpha$	78	
IL-1 $\beta$	53	
IL-1ra	54	
IL-2	55	
IL-3	56	
IL-4	61	
IL-6	63	
IL-7	64	
IL-10	44	
IL-15	47	
IL-33	57	
VEGF	76	

## PRINCIPLE OF THE ASSAY

Magnetic Luminex® Performance Assay multiplex kits are designed for use with the Luminex® MAGPIX® CCD Imager. Alternatively, kits can be used with the Luminex® 100/200™, Luminex® FLEXMAP 3D®, or Bio-Rad® Bio-Plex®, dual laser, flow-based sorting and detection platforms.

Analyte-specific antibodies are pre-coated onto magnetic microparticles embedded with fluorophores at set ratios for each unique microparticle region. Microparticles, standards and samples are pipetted into wells and the immobilized antibodies bind the analytes of interest. After washing away any unbound substances, a biotinylated antibody cocktail specific to the analytes of interest is added to each well. Following a wash to remove any unbound biotinylated antibody, streptavidin-phycoerythrin conjugate (Streptavidin-PE), which binds to the biotinylated antibody, is added to each well. Final washes remove unbound Streptavidin-PE, the microparticles are resuspended in buffer and read using the Luminex® MAGPIX® Analyzer. A magnet in the analyzer captures and holds the superparamagnetic microparticles in a monolayer. Two spectrally distinct Light Emitting Diodes (LEDs) illuminate the microparticles. One LED excites the dyes inside each microparticle to identify the region and the second LED excites the PE to measure the amount of analyte bound to the microparticle. A sample from each well is imaged with a CCD camera with a set of filters to differentiate excitation levels.

Analysis with the Luminex® 100/200™, Luminex® FLEXMAP 3D®, or Bio-Rad Bio-Plex uses one laser to excite the dyes inside each microparticle to identify the microparticle region and the second laser to excite the PE to measure the amount of analyte bound to the microparticle. All excitation emitted as each microparticle passes through the flow cell is then analyzed to differentiate excitation levels using a Photomultiplier Tube (PMT) and an Avalanche Photodiode.

## LIMITATIONS OF THE PROCEDURE

- FOR RESEARCH USE ONLY. NOT FOR USE IN DIAGNOSTIC PROCEDURES.
- The kit should not be used beyond the expiration date on the kit label.
- Do not mix or substitute reagents with those from other lots or sources.
- If samples fall outside the dynamic range of the assay, further dilute the samples with the appropriate calibrator diluent and repeat the assay.
- Any variation in diluent, operator, pipetting technique, washing technique, incubation time or temperature, and kit age can cause variation in binding.
- Variations in sample collection, processing, and storage may cause sample value differences.
- This assay is designed to eliminate interference by other factors present in biological samples. Until these factors have been tested in the Magnetic Luminex® Performance Assay, the possibility of interference cannot be excluded.
- Magnetic Luminex® Performance Assays afford the user the benefit of multi-analyte analysis of biomarkers in a single complex sample. For each sample type, a single multipurpose diluent is used to optimize recovery, linearity, and reproducibility. Such a multipurpose diluent may not optimize any single analyte to the same degree that a unique diluent selected for analysis of that analyte can optimize conditions, therefore, some performance characteristics may be more variable than those for assays designed specifically for single analyte analysis.
- **Only the analytes listed on the Standard Value Card can be measured with this kit.**

## MATERIALS PROVIDED & STORAGE CONDITIONS

Store the unopened kit at 2-8 °C. Do not use past the kit expiration date.

PART	PART #	DESCRIPTION	STORAGE OF OPENED, DILUTED, OR RECONSTITUTED MATERIAL
Human Discovery Panel Standard Cocktail	898855	2 vials of recombinant human cytokines in a buffered protein base with preservatives; 2 lysospheres.	Discard after use. Use a fresh standard and control for each assay.
Human Discovery Panel Low Control	898889	2 vials of recombinant human cytokines in a buffered protein base with preservatives; lyophilized.	
Human Discovery Panel High Control	898888	2 vials of recombinant human cytokines in a buffered protein base with preservatives; lyophilized.	
Human Discovery Cytokine Microparticle Cocktail	898971	0.600 mL of a concentrated microparticle cocktail with preservative.	May be stored for up to 1 month at 2-8 °C.* <i>Once diluted, 1X solutions must be discarded. Use fresh diluents for each assay.</i>
Human Discovery Panel Biotin-Antibody Cocktail	898854	1 vial of a concentrated biotinylated antibody cocktail; lyophilized.	
Streptavidin-PE	893535	0.250 mL of a concentrated streptavidin-phycoerythrin conjugate with preservatives.	
Microparticle Diluent	895529	6 mL of a buffered protein base with preservative.	May be stored for up to 1 month at 2-8 °C.*
Biotin Antibody Diluent 2	895832	2 vials (5.5 mL/vial) of a buffered protein base with preservative.	
Calibrator Diluent RD6-65	895098	21 mL of a buffered protein base with preservatives. <i>Use diluted 1:2 for cell culture supernate samples. Use undiluted for serum/plasma samples.</i>	
Wash Buffer Concentrate	895003	21 mL of a 25-fold concentrated solution of buffered surfactant with preservative. <i>May turn yellow over time.</i>	
Microplate	641385	1 flat-bottomed 96-well microplate used as a vessel for the assay.	
Mixing Bottles	895505	2 empty 8 mL bottles used for mixing microparticles with Microparticle Diluent.	
Plate Sealers	640445	4 adhesive foil strips.	
Standard Value Card	700138	1 card listing the standard reconstitution volume and working standard concentrations for this lot of base kit.	
Control Mean Value Card	700139	1 card listing the low and high mean control values.	

\*Provided this is within the expiration date of the kit.

## OTHER SUPPLIES REQUIRED

- **Luminex® Performance Assay analyte-specific kit(s) (see page 1).**
- Luminex® MAGPIX®, Luminex® 100/200™, Luminex® FLEXMAP 3D®, or Bio-Rad Bio-Plex analyzer with X-Y platform.
- Hand-held microplate magnet or platewasher with a magnetic platform.
- Pipettes and pipette tips.
- Deionized or distilled water.
- Multi-channel pipette, manifold dispenser, or automated dispensing unit.
- 50 mL and 500 mL graduated cylinders.
- Horizontal orbital microplate shaker (0.12" orbit) capable of maintaining a speed of  $800 \pm 50$  rpm.
- Microcentrifuge.
- **Polypropylene** test tubes for dilution of standards and samples.

## PRECAUTIONS

Some components in this kit contain a preservative which may cause an allergic skin reaction. Avoid breathing mist.

Wear protective gloves, clothing, eye, and face protection. Wash hands thoroughly after handling. Refer to the SDS on our website prior to use.

## TECHNICAL HINTS

- When mixing or reconstituting protein solutions, always avoid foaming.
- To avoid cross-contamination, change pipette tips between additions of each standard level, between sample additions, and between reagent additions. Also, use separate reservoirs for each reagent.
- To ensure accurate results, proper adhesion of plate sealers during incubation steps is necessary.
- Protect microparticles and Streptavidin-PE from light at all times to prevent photobleaching.

## SAMPLE COLLECTION AND STORAGE

**The sample collection and storage conditions listed below are intended as general guidelines. Sample stability has not been evaluated.**

**Cell Culture Supernates** - Remove particulates by centrifugation and assay immediately or aliquot and store samples at  $\leq -20$  °C. Avoid repeated freeze-thaw cycles.

**Serum** - Use a serum separator tube (SST) and allow samples to clot for 30 minutes at room temperature before centrifuging for 15 minutes at 1000 x g. Remove serum and assay immediately or aliquot and store samples at  $\leq -20$  °C. Avoid repeated freeze-thaw cycles.

**Plasma** - Collect plasma using EDTA or heparin as an anticoagulant. Centrifuge for 15 minutes at 1000 x g within 30 minutes of collection. Assay immediately or aliquot and store samples at  $\leq -20$  °C. Avoid repeated freeze-thaw cycles.

**Note:** *Citrate plasma is not validated for use in this assay.*

*Hemolyzed, icteric, and lipemic samples are not suitable for use in this assay.*

## SAMPLE PREPARATION

**Use polypropylene tubes.**

**Note:** *On the day of the assay, ALL fresh and previously frozen serum and plasma samples require centrifugation at 16,000 x g for 4 minutes immediately prior to use or dilution.*

Cell culture supernate samples require a 2-fold dilution. A suggested 2-fold dilution is 75  $\mu$ L of sample + 75  $\mu$ L of Calibrator Diluent RD6-65 (diluted 1:2)\*. Mix thoroughly.

Serum, plasma, and platelet-poor plasma samples require a 2-fold dilution. A suggested 2-fold dilution is 75  $\mu$ L of sample + 75  $\mu$ L of Calibrator Diluent RD6-65. Mix thoroughly.

\*See Reagent Preparation section.

## REAGENT PREPARATION

**Bring all reagents to room temperature before use.**

**Wash Buffer** - If crystals have formed in the concentrate, warm to room temperature and mix gently until the crystals have completely dissolved. Add 20 mL of Wash Buffer Concentrate to 480 mL of deionized or distilled water to prepare 500 mL of Wash Buffer.

**Calibrator Diluent RD6-65 (diluted 1:2) - For cell culture supernate samples only.** Add 10 mL of Calibrator Diluent RD6-65 to 10 mL of deionized or distilled water to prepare 20 mL of Calibrator Diluent RD6-65 (diluted 1:2).

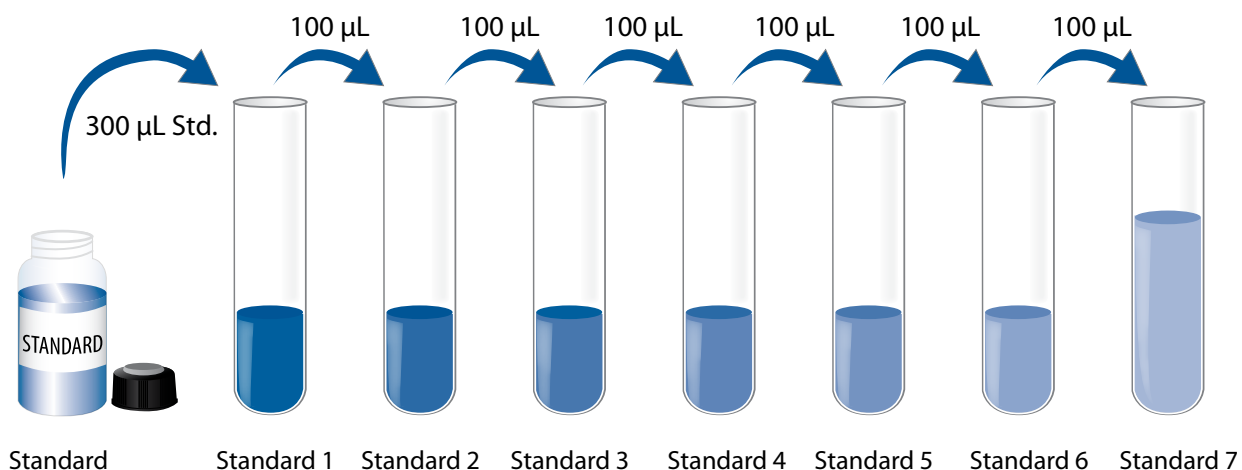
**Low and High Kit Controls - Refer to the vial label for reconstitution volume.** Reconstitute the low and high controls with Calibrator Diluent RD6-65 (diluted 1:2) (*for cell culture supernate samples*) or Calibrator RD6-65 (*for serum and plasma samples*). Allow the controls to sit for a minimum of 15 minutes with gentle agitation prior to plating.

**Biotin-Antibody Cocktail - Refer to the vial label for reconstitution volume.** Reconstitute the Human Discovery Panel Biotin-Antibody Cocktail with Biotin Antibody Diluent 2. Allow the antibody cocktail to sit for a minimum of 20 minutes or a minimum of 5 minutes on a nutator.

**Standard - Refer to the Standard Value Card for the reconstitution volume and assigned values.** Reconstitute the Standard lysospheres with Calibrator Diluent RD6-65 (diluted 1:2) (*for cell culture supernate samples*) or Calibrator RD6-65 (*for serum and plasma samples*). Allow the standard to sit for a minimum of 20 minutes prior to making dilutions.

**Note:** Do NOT vortex standard cocktail. Gentle agitation should be initiated only after the 20-minute reconstitution step is complete. Standard may have a slightly blue appearance once fully reconstituted.

**Use polypropylene tubes.** Pipette 300  $\mu$ L of the reconstituted standard into the Standard 1 tube. Pipette 200  $\mu$ L of Calibrator Diluent RD6-65 (diluted 1:2) (*for cell culture supernate samples*) or Calibrator RD6-65 (*for serum and plasma samples*) into the remaining tubes. Use Standard 1 to produce a 3-fold dilution series (below). Refer to the analyte specific datasheets for details. Mix each tube thoroughly before the next transfer. Standard 1 serves as the high standard. The appropriate calibrator diluent serves as the blank.





## DILUTED MICROPARTICLE COCKTAIL PREPARATION

1. Dilute the Microparticle Cocktail in the mixing bottle provided.

Number of Wells Used	Microparticle Cocktail	+	Microparticle Diluent
96	0.500 mL	+	5.00 mL
72	0.375 mL	+	3.75 mL
48	0.250 mL	+	2.50 mL
24	0.125 mL	+	1.25 mL

**Note:** Protect microparticles from light during handling. Diluted microparticles cannot be stored. Prepare microparticles within 30 minutes of use.

## DILUTED BIOTIN-ANTIBODY COCKTAIL PREPARATION

1. Dilute the reconstituted Discovery Panel Biotin-Antibody Cocktail in Biotin Antibody Diluent 2. Mix gently.

Number of Wells Used	Biotin-Antibody Cocktail	+	Biotin Antibody Diluent 2
96	0.500 mL	+	5.00 mL
72	0.375 mL	+	3.75 mL
48	0.250 mL	+	2.50 mL
24	0.125 mL	+	1.25 mL

## STREPTAVIDIN-PE PREPARATION

**Use a polypropylene amber bottle or a polypropylene tube wrapped with aluminum foil. Protect Streptavidin-PE from light during handling and storage.**

1. Centrifuge the Streptavidin-PE vial for 30 seconds at 1000 x g prior to removing the cap.
2. Gently vortex the vial, taking precautions not to invert the vial.
3. Dilute the Streptavidin-PE concentrate in Wash Buffer.

Number of Wells Used	Streptavidin-PE Concentrate	+	Wash Buffer
96	220 $\mu$ L	+	5.35 mL
72	165 $\mu$ L	+	4.00 mL
48	110 $\mu$ L	+	2.65 mL
24	55 $\mu$ L	+	1.35 mL

## INSTRUMENT SETTINGS

**Note:** *Adjust the probe height setting on the analyzer to avoid puncturing the plate. Calibrate the analyzer using the proper reagents for superparamagnetic microparticles (refer to instrument manual).*

### **Luminex® MAGPIX® analyzer:**

- a) Sample volume: 50 µL
- b) Assign the microparticle region for each analyte being measured (see page 1)
- c) 50 count/region
- d) Collect Median Fluorescence Intensity (MFI)

### **Luminex® 100/200™, Luminex® FLEXMAP 3D® and Bio-Rad Bio-Plex analyzers:**

**Note:** *Ensure that the instrument flow rate is set to the default of 60 µL/minute (fast) for all flow based analyzers.*

- a) Sample volume: 50 µL
- b) Bead Type:
  - i. Luminex® 100/200™ and FLEXMAP 3D® select MagPlex
  - ii. Bio-Rad Bio-Plex Manager use Bio-Plex MagPlex Beads (Magnetic)
- c) Doublet Discriminator gates:
  - i. Luminex® 100/200™ and FLEXMAP 3D® set at 8000 and 16,500
  - ii. Bio-Rad Bio-Plex Manager set at 8000 and 23,000
- d) Reporter Gain Setting:
  - i. Luminex® 100/200™ use Default setting
  - ii. Luminex® FLEXMAP 3D® use Standard PMT setting
  - iii. Bio-Rad Bio-Plex Manager use the low RP1 target value for the CAL2 setting
- e) Assign the microparticle region for each analyte being measured (see page 1)
- f) 50 count/region
- g) Collect MFI

## ASSAY PROCEDURE

**Bring all reagents and samples to room temperature before use. It is recommended that all standards, controls, and samples be assayed in duplicate.**

**Note:** *Protect microparticles and Streptavidin-PE from light at all times.*

1. Prepare all reagents, working standards, and samples as directed in the previous sections.
2. Add 50  $\mu\text{L}$  of standard, control, or sample\* per well. A plate layout is provided to record standards and samples assayed.
3. Resuspend the diluted Microparticle Cocktail by inversion or vortexing. Add 50  $\mu\text{L}$  of the microparticle cocktail to each well of the microplate. Securely cover with a foil plate sealer. Incubate for 2 hours at room temperature on a horizontal orbital microplate shaker (0.12" orbit) set at  $800 \pm 50$  rpm.
4. Using a magnetic device designed to accommodate a microplate, wash by applying the magnet to the bottom of the microplate, allow 1 minute before removing the liquid, filling each well with Wash Buffer (100  $\mu\text{L}$ ) and allow 1 minute before removing the liquid again. Complete removal of liquid is essential for good performance. **Note:** *Do NOT blot; this may cause a loss of microparticles.* Perform the wash procedure three times.

**Note:** *Refer to the magnetic device user manual for proper wash technique using a round bottom microplate.*

5. Add 50  $\mu\text{L}$  of diluted Biotin-Antibody Cocktail to all wells. Securely cover with a foil plate sealer and incubate for 1 hour at room temperature on the shaker set at  $800 \pm 50$  rpm.
6. Repeat the wash as in step 4.
7. Add 50  $\mu\text{L}$  of diluted Streptavidin-PE to all wells. Securely cover with a foil plate sealer and incubate for 30 minutes at room temperature on the shaker set at  $800 \pm 50$  rpm.
8. Repeat the wash as in step 4.
9. Resuspend the microparticles by adding 100  $\mu\text{L}$  of Wash Buffer to each well. Incubate for 2 minutes on the shaker set at  $800 \pm 50$  rpm.
10. Read within 90 minutes using the Luminex® or Bio-Rad analyzer.  
**Note:** *Resuspend microparticles immediately prior to reading by shaking the plate for 2 minutes on the plate shaker set at  $800 \pm 50$  rpm.*

\*Samples require dilution. See Sample Preparation section.

## ASSAY PROCEDURE SUMMARY

**Note:** Protect microparticles and Streptavidin-PE from light at all times.

- 1 Prepare all reagents as instructed.
- 2 Add 50  $\mu$ L of standard, control, or sample\* to each well.
- 3 Add 50  $\mu$ L of diluted Microparticle Cocktail to each well.  
Incubate for 2 hours at RT on a shaker at 800 rpm.
- 4 Wash by removing the liquid from each well, filling with 100  $\mu$ L Wash Buffer, and removing the liquid again.  
Perform the wash 3 times.
- 5 Add 50  $\mu$ L of diluted Biotin-Antibody Cocktail to each well.  
Cover and incubate for 1 hour at RT on the shaker at 800 rpm.
- 6 Repeat the wash as in step 4.
- 7 Add 50  $\mu$ L of diluted Streptavidin-PE to each well.  
Incubate for 30 minutes at RT on the shaker at 800 rpm.
- 8 Repeat the wash as in step 4.
- 9 Add 100  $\mu$ L of Wash Buffer to each well.  
Incubate for 2 minutes at RT on the shaker at 800 rpm.
- 10 Read within 90 minutes using a Luminex<sup>®</sup> or Bio-Rad analyzer  
**Note:** Resuspend microparticles immediately prior to reading.

\*Samples require dilution. See Sample Preparation section.

## **CALCULATION OF RESULTS**

Use the Standard concentrations on the Standard Value Card and calculate 3-fold dilutions for the remaining levels. Average the duplicate readings for each standard and sample and subtract the average blank Median Fluorescence Intensity (MFI).

Create a standard curve for each analyte by reducing the data using computer software capable of generating a five parameter logistic (5-PL) curve-fit.

Since samples have been diluted, the concentration read from the standard curve must be multiplied by the dilution factor.

## **CALIBRATION**

This assay is calibrated against highly purified recombinant human cytokines produced at R&D Systems®.

## SPECIFICITY

The assay was tested for cross-reactivity and interference with the following factors. Less than 0.5% cross-reactivity and interference was observed unless otherwise noted on the analyte specific datasheet.

### Recombinant human:

4-1BB Ligand	EGFR	IL-1 RII
6Ckine	ErbB2	IL-2 Ra
$\alpha_2$ -Macroglobulin	ErbB3	IL-3 Ra
Amphiregulin	ErbB4	IL-4 R
Angiogenin	Fas Ligand	IL-5
APRIL	FGF basic	IL-5 Ra
B7-1	FGF R1 $\alpha$ (IIIb)	IL-6 Ra
B7-2	FGF R1 $\alpha$ (IIIc)	IL-6 Ra/gp130
B7-H2	FGF R $\beta$ (IIIb)	IL-8/CXCL8
B7-H3	FGF R1 $\beta$ (IIIc)	IL-9
B7-H4	FGF acidic	IL-11
B7-H6	FGF-4	IL-12 p70
B7-H7	FGF-5	IL-12 R $\beta$ 1
BAFF/BLyS	FGF-6	IL-12 R $\beta$ 2
BLC/BCA-1	FGF-7/KGF	IL-12p40
Cathepsin C	FGF-16	IL-13
Cathepsin H	Fibrinogen	IL-13 Ra1
CCL2/MCP-1	Flt-3 Ligand	IL-13 Ra2
CCL3/MIP-1 $\alpha$	G-CSF	IL-15 Ra
CCL4/MIP-1 $\beta$	G-CSF R	IL-15/IL-15 Ra Complex
CCL5/RANTES	GITR Ligand	IL-17A
CCL7/MCP-3	GM-CSF	IL-17A/F
CCL11/Eotaxin	GM-CSF Ra	IL-17B
CCL19/MIP-3 $\beta$	GM-CSF R $\beta$	IL-17B R
CCL20/MIP-3 $\alpha$	gp130	IL-17C
CCL22/MDC	Granzyme B	IL-17D
CD27 Ligand/CD70	GRO $\gamma$	IL-17E/IL-25
CD30 Ligand	HB-EGF	IL-17F
CD40 Ligand/TNFSF5	HCC-4	IL-17 R
CNTF	HGF	IL-17 RC
Cripto-1	I-309	IL-17 RD
CX3CL1/Fractalkine	IFN- $\alpha$ / $\beta$ R1	IL-18
CXCL1/GRO $\alpha$	IFN- $\alpha$ / $\beta$ R2	IL-18 Ra
CXCL2/GRO $\beta$	IFN- $\beta$	IL-18 R $\beta$
CXCL5/ENA-78	IFN- $\gamma$ R1	IL-23p40-p19 het
CXCL6/GCP-2/LIX	IGF-I	IL-27
CXCL7/NAP-2	IGF-II	IL-36Ra/FIL-1 $\delta$
CXCL10/IP-10	IL-1 RAcP/IL-1 R3	IL-36 $\alpha$
EGF	IL-1 RI	IL-36 $\beta$

## SPECIFICITY *CONTINUED*

IL-36 $\gamma$   
IL-37/FIL-1 $\zeta$ /IL-1F7  
IL-38/IL-1F10  
Integrin  $\alpha 5\beta 3$   
I-TAC  
LAP (TGF- $\beta 1$ )  
LIF  
LIF R  
LIGHT  
LT- $\alpha$ /TNF- $\beta$   
LT  $\alpha 1/\beta 2$   
LT  $\alpha 2/\beta 1$   
MCP-2  
MCP-4  
M-CSF  
MFG-E8  
MIG  
OPG  
OSM  
OX40 Ligand  
PARC/MIP-4  
PD-1  
PDGF-AA  
PDGF-AB/BB  
PD-L1/B7-H1

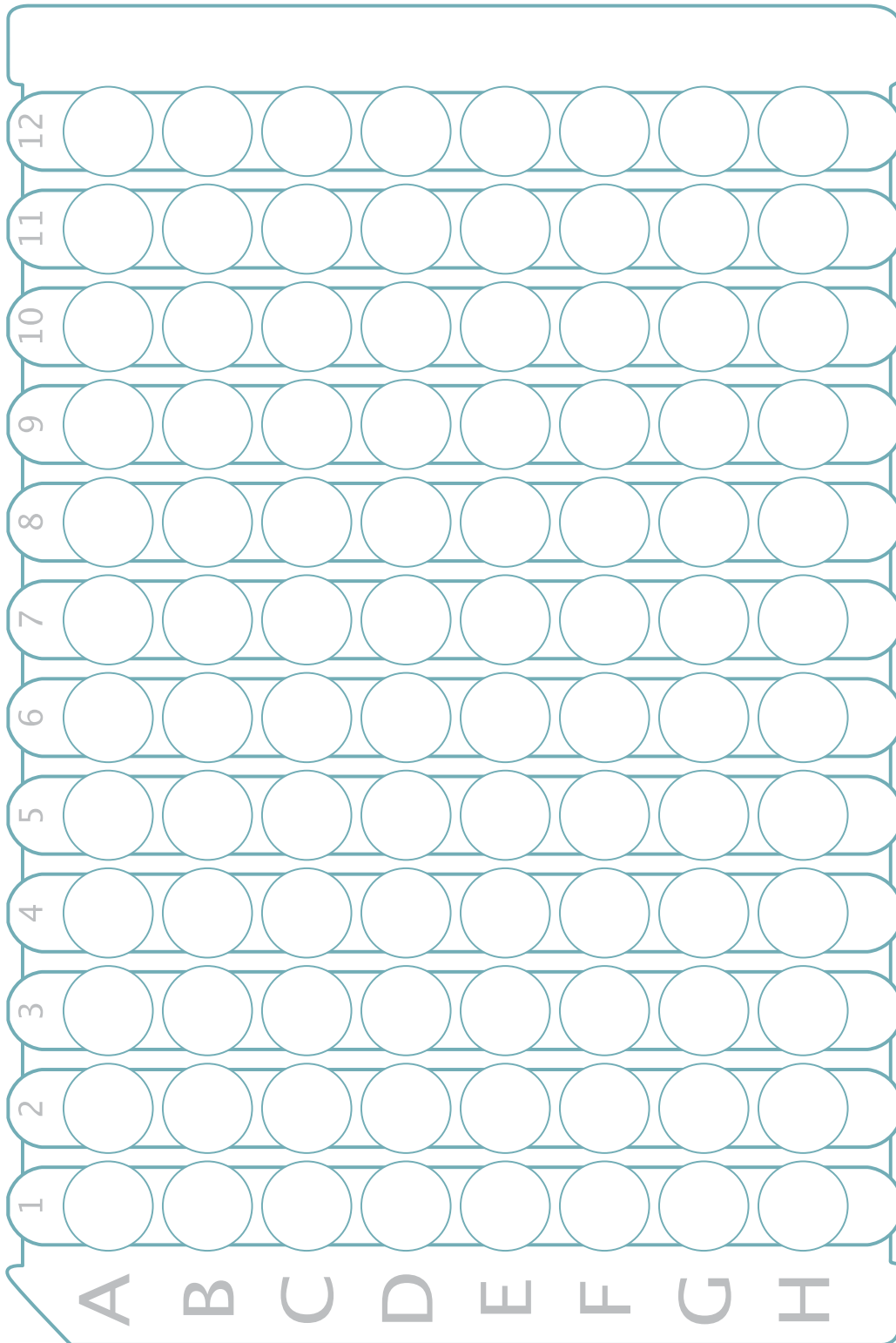
PD-L2  
PF-4  
Pleiotrophin/PTN  
PIGF  
SDF-1 $\alpha$   
SDF-1 $\beta$   
Serpin B9/PI-9  
ST2  
Syndecan-2  
TGF- $\alpha$   
THBS  
TNF- $\alpha$   
TNF RI  
TNF RII  
TRAIL/TNFSF10  
TRAIL R3  
TRAIL R4  
TRANCE  
TSG-6  
TGS-14/Pentraxin-3  
TWEAK  
VEGF R1/Flt-1  
VEGF R2/Flk-1/KDR  
VEGF/PIGF

## Recombinant human multiplex partners:

IFN- $\alpha$   
IFN- $\gamma$   
IL-1 $\alpha$ /IL-1F1  
IL-1 $\beta$ /IL-1F2  
IL-1ra/IL-1F3  
IL-2  
IL-3  
IL-4  
IL-6  
IL-7  
IL-10  
IL-15  
IL-33  
VEGF

## PLATE LAYOUT

Use this plate layout to record standards and samples assayed.



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