

MSD[®] MULTI-ARRAY Assay System

Phospho-Smad1 (Ser463/465) Whole Cell Lysate Kit

1-Plate Kit

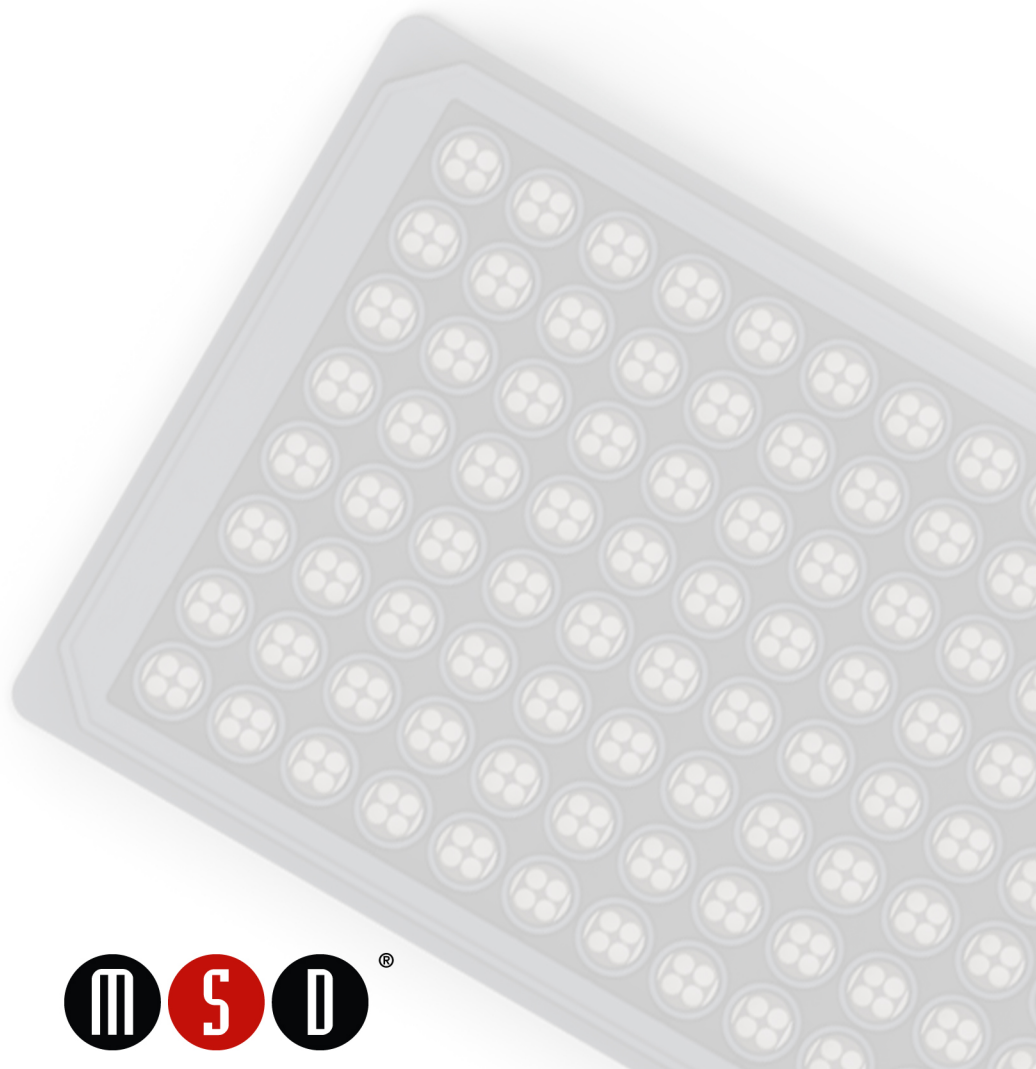
K150LCD-1

5-Plate Kit

K150LCD-2

25-Plate Kit

K150LCD-4



MSD Phosphoprotein Assays

Phospho-Smad1 (Ser463/465) Whole Cell Lysate Kit

This package insert must be read in its entirety before using this product.

FOR RESEARCH USE ONLY.

NOT FOR USE IN DIAGNOSTIC PROCEDURES.

MESO SCALE DISCOVERY®

A division of Meso Scale Diagnostics, LLC.

1601 Research Blvd.

Rockville, MD 20850 USA

www.mesoscale.com

MESO SCALE DISCOVERY, MESO SCALE DIAGNOSTICS, MSD, DISCOVERY WORKBENCH, MULTI-ARRAY, MULTI-SPOT, QUICKPLEX, SECTOR, SECTOR PR, SECTOR HTS, SULFO-TAG, V-PLEX, STREPTAVIDIN GOLD, MESO, www.mesoscale.com, SMALL SPOT (design), 96 WELL 1, 4, 7, & 10-SPOT (designs), 384 WELL 1 & 4-SPOT (designs), MSD (design), V-PLEX (design), and SPOT THE DIFFERENCE are trademarks and/or service marks of Meso Scale Diagnostics, LLC. ©2014 Meso Scale Diagnostics, LLC. All rights reserved.

Table of Contents

Introduction	4
Principle of the Assay	4
Reagents Supplied	5
Required Materials and Equipment (not supplied).....	5
Safety	6
Best Practices and Technical Hints	6
Reagent Preparation	6
Sample Preparation and Storage	8
Assay Protocol.....	9
Typical Data.....	9
Assay Components	10
References.....	10
Appendix: Suggested Cell Lysis Protocols	10
Summary Protocol	13
Plate Diagram	15

Ordering Information

MSD Customer Service (Orders and Sales Support)

Phone: 1-240-314-2795
Fax: 1-301-990-2776
Email: CustomerService@mesoscale.com

MSD Scientific Support

Phone: 1-240-314-2798
Fax: 1-240-632-2219 attn: Scientific Support
Email: ScientificSupport@mesoscale.com

Scan for contact
Information



Introduction

Smad1 (mothers against decapentaplegic homolog 1, MADH1) is a transcriptional modulator and key member of the transforming growth factor- β (TGF- β) signaling superfamily of proteins. Functionally, Smad1 is phosphorylated by the bone morphogenetic protein (BMP) receptor kinases at an evolutionarily conserved c-terminal binding motif, SSXS.¹ Smad1 phosphorylation occurs at serine 463 and serine 465 which activates Smad1 to form a complex with Smad4, translocate to the nucleus, interact with various co-activators and co-repressors, and bind to TGF- β -responsive target gene promoters. Through these actions, Smad1 regulates transcription of genes critical to stem cell renewal, cell proliferation, differentiation, migration, and apoptosis.^{1,2}

Defects in Smad1 signaling have been shown to cause bone-related disorders such as osteoporosis and impact tumorigenesis. The availability of co-proteins varies significantly among different cell types and explains the cell type-dependent diversity of TGF- β -induced gene responses often observed in carcinogenesis.¹⁻³ Smad1 activation may be negatively regulated by extracellular signal-regulated kinase-1 (ERK) phosphorylation in the linker regions of Smad1, which inhibits nuclear translocation. Inhibitory Smads (Smad6 and Smad7) may compete for receptor kinase binding and target the protein for ubiquitination and proteasome-mediated degradation.^{1,2} As TGF- β -Smad signaling is involved in many cellular activities, further study and comprehensive analysis are critical in guiding cancer and other disease research and clinical applications.

Principle of the Assay

MSD phosphoprotein assays provide a rapid and convenient method for measuring biomarkers within a single, small-volume sample. The Phospho-Smad1 (Ser463/465) assay is a sandwich immunoassay (Figure 1). MSD provides a plate pre-coated with capture antibodies. The user adds the sample and a solution containing detection antibodies conjugated with electrochemiluminescent labels (MSD SULFO-TAG™) over the course of one or more incubation periods. Analytes in the sample bind to capture antibodies immobilized on the working electrode surface; recruitment of the detection antibodies by the bound analytes completes the sandwich. The user adds an MSD buffer that provides the appropriate chemical environment for electrochemiluminescence and loads the plate into an MSD instrument where a voltage applied to the plate electrodes causes the captured labels to emit light. The instrument measures intensity of emitted light to provide a quantitative measure of analytes in the sample.

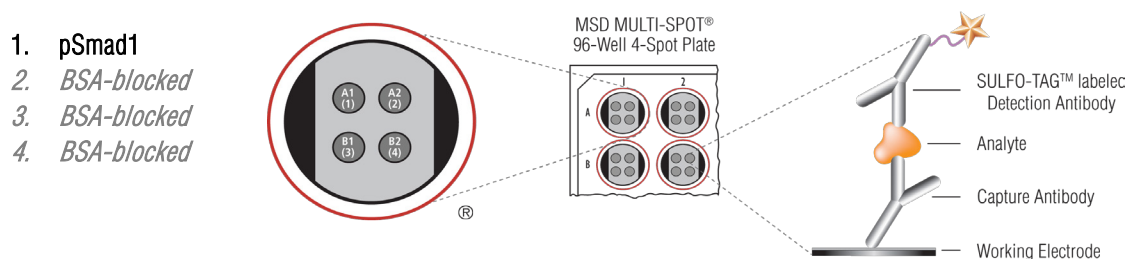


Figure 1. Spot diagram showing placement of analyte capture antibody. The numbering convention for the different spots is maintained in the software visualization tools, on the plate packaging, and in the data files. A unique bar code label on each plate allows complete traceability back to MSD manufacturing records.

Reagents Supplied

Product Description	Storage	Quantity per Kit		
		K150LCD-1	K150LCD-2	K150LCD-4
MULTI-SPOT [®] 96-Well 4-Spot Phospho-Smad1 (Ser463/465) Plate N450LCA-1	2–8°C	1 plate	5 plates	25 plates
SULFO-TAG Anti-Total Smad1 Antibody ¹ (50X)	2–8°C	1 vial (75 µL)	1 vial (375 µL)	5 vials (375 µL ea)
Tris Lysis Buffer (1X) R60TX-3 (50 mL)	2–8°C	1 bottle (50 mL)	1 bottle (50 mL)	5 bottles (50 mL ea)
Tris Wash Buffer (10X) R61TX-2 (200 mL)	2–8°C	1 bottle (200 mL)	1 bottle (200 mL)	5 bottles (200 mL ea)
Phosphatase Inhibitor I (100X)	2–8°C	1 vial (0.1 mL)	1 vial (0.5 mL)	5 vials (0.5 mL ea)
Phosphatase Inhibitor II (100X)	2–8°C	1 vial (0.1 mL)	1 vial (0.5 mL)	5 vials (0.5 mL ea)
Protease Inhibitor Solution (100X)	2–8°C	1 vial (0.1 mL)	1 vial (0.5 mL)	5 vials (0.5 mL ea)
Blocker D-R ² (10%)	≤-10°C	1 vial (0.05 mL)	1 vial (0.2 mL)	5 vials (0.2 mL ea)
Blocker A (dry powder) R93BA-4	RT	1 vial (15 g)	1 vial (15 g)	5 vials (15 g ea)
Read Buffer T (4X) R92TC-3 (50 mL)	RT	1 bottle (50 mL)	1 bottle (50 mL)	5 bottles (50 mL ea)

Required Materials and Equipment (not supplied)

- Deionized water for diluting concentrated buffers
- 500 mL bottle for reagent preparation
- 50 mL tubes for reagent preparation
- 15 mL tubes for reagent preparation
- Microcentrifuge tubes for preparing serial dilutions
- Appropriate liquid handling equipment for desired throughput, capable of dispensing 10 to 150 µL into a 96-well microtiter plate
- Plate washing equipment: automated plate washer or multichannel pipette
- Adhesive plate seals
- Microtiter plate shaker

¹ SULFO-TAG conjugated detection antibodies should be stored in the dark.

² Blocker D-R can tolerate at least 5 freeze–thaw cycles. Alternatively, an aliquot of Blocker D-R can be stored at 2–8°C up to 1 month.

Safety

Use safe laboratory practices and wear gloves, safety glasses, and lab coats when handling kit components. Handle and dispose of all hazardous samples properly in accordance with local, state, and federal guidelines.

Best Practices and Technical Hints

- Do not mix or substitute reagents from different sources or different kit lots.
- Thaw reagents on wet ice and use as directed without delay.
- Avoid prolonged exposure of detection antibody (stock or diluted) to light. During the antibody incubation step, plates do not need to be shielded from light except for direct sunlight.
- Avoid bubbles in wells at all pipetting steps. Bubbles may lead to variable results; bubbles introduced when adding read buffer may interfere with signal detection.
- Use reverse pipetting when necessary to avoid introduction of bubbles, and for empty wells, pipette to the bottom corner.
- Shaking should be vigorous with a rotary motion between 300 and 1000 rpm.
- When using an automated plate washer, rotating the plate 180 degrees between wash steps may improve assay precision.
- Gently tap the plate to remove residual fluid after washing.
- Read buffer should be at room temperature when added to the plate.
- Keep time intervals consistent between adding read buffer and reading the plate to improve inter-plate precision. Unless otherwise directed, read plate as soon as practical after adding read buffer.
- No shaking is necessary after adding read buffer.
- If an incubation step needs to be extended, avoid letting the plate dry out by keeping sample or detection antibody solution in the plate.
- Remove plate seals prior to reading the plate.
- If assay results are above the top of the calibration curve, dilute samples, and repeat the assay.
- When running a partial plate, seal the unused sectors (see sector map in instrument and software manuals) to avoid contaminating unused wells. (Remove all seals before reading.) Partially used plates may be sealed and stored up to 30 days at 2–8°C in the original foil pouch with desiccant. You may adjust volumes proportionally when preparing reagents.

Reagent Preparation

Prepare Tris Wash Buffer

Dilute the 10X stock of Tris Wash Buffer provided to 1X as shown below. Tris Wash Buffer (1X) will be used throughout the assay to make additional reagents and wash plates. Approximately 350 mL per plate is required—more if using an automatic plate washer.

For 1 plate, combine:

- ☐ 35 mL of Tris Wash Buffer (10X)
- ☐ 315 mL deionized water

Excess Tris Wash Buffer may be stored at room temperature in a tightly sealed container.

Prepare Blocking Solution

For 1 plate, combine:

- ☐ 600 mg Blocker A (dry powder)
- ☐ 20 mL 1X Tris Wash Buffer

Prepare Antibody Dilution Buffer

For 1 plate, combine:

- ☐ 30 μ L 10% Blocker D-R
- ☐ 1 mL blocking solution
- ☐ 1.97 mL 1X Tris Wash Buffer

Set aside on ice.

Prepare Complete Lysis Buffer

Prepare complete lysis buffer just prior to use.

For 2–3 plates (1X concentration) of complete lysis buffer, combine:

- ☐ 100 μ L Protease Inhibitor Solution (100X stock)
- ☐ 100 μ L Phosphatase Inhibitor Solution I (100X stock)
- ☐ 100 μ L Phosphatase Inhibitor Solution II (100X stock)
- ☐ 9.7 mL of 1X Tris Lysis Buffer

Immediately place the complete lysis buffer on ice; it should be ice cold before use.

Prepare Detection Antibody Solution

MSD provides detection antibody in a 50X stock solution. The working detection antibody solution is 1X.

For 1 plate, combine:

- ☐ 60 μ L 50X SULFO-TAG Anti-Total Smad1 Antibody
- ☐ 2.94 mL antibody dilution buffer

Prepare Read Buffer

MSD provides Read Buffer T as a 4X stock solution. The working solution is 1X.

For 1 plate, combine:

- ☐ 5 mL Read Buffer T (4X)
- ☐ 15 mL deionized water

You may prepare diluted 1X read buffer in advance and store it room temperature in a tightly sealed container.

Prepare MSD Plate

MSD plates are pre-coated with capture antibodies (see Figure 1) and exposed to a proprietary stabilizing treatment to ensure the integrity and stability of the immobilized antibodies. Plates can be used as delivered; no additional preparation (e.g., pre-wetting) is required.

Sample Preparation and Storage

Most lysis buffers and sample matrices are compatible with MSD plates, although high concentrations of denaturing reagents should be avoided. Keep SDS and other ionic detergents to a concentration of 0.1% or less in the sample applied to the well and avoid reducing agents (DTT >1mM). Please contact MSD Scientific Support if you have any questions about lysate preparation options.

Analysis of proteins in their activated state (i.e. phosphorylated) usually requires stimulation prior to cell lysis. Verify cell stimulation and sample preparation prior to using this kit.

Perform all manipulations on ice; keep PBS wash buffer and complete lysis buffer ice cold. Cell concentrations for lysis can range from $0.5\text{--}5 \times 10^7$ cells per mL of lysis buffer. Protein yields will vary by cell line. To get your desired final protein concentration, you will need to optimize the number of cells used and the amount of complete lysis buffer added. Depending on the stability of the target in the matrix, you may need additional protease and phosphatase inhibitors in the matrix or diluent.

MSD provides suggested cell lysis protocols in the appendix; however, specific cell types or targets may benefit from alternative buffer components or techniques, depending upon the particular research application.

Assay Protocol

Notes

1. Block Plate and Prepare Samples:

- Add 150 μL of blocking solution to each well. Seal the plate with an adhesive plate seal, and incubate for 1 hour with vigorous shaking (300–1000 rpm) at room temperature.
- Prepare complete lysis buffer just prior to sample dilution. See the Sample Preparation and Storage section above for recommended sample handling procedures.
- Prepare positive and negative cell lysates.
 - Thaw cell lysate samples on ice and dilute them immediately before use. Keep on ice during all manipulations and discard all remaining thawed, unused material.
 - Dilute cell lysate in complete lysis buffer to a final concentration of 0.8 $\mu\text{g}/\mu\text{L}$. This will deliver 20 μg of lysate in 25 μL per well. You may prepare a dilution series at this point if desired.

2. Wash and Add Samples:

Wash the plate 3 times with 300 μL /well of Tris Wash Buffer. Add 25 μL of sample per well. Seal the plate with an adhesive plate seal, and incubate for 3 hours with vigorous shaking (300–1000 rpm) at room temperature.

You may prepare detection antibody solution during incubation.

3. Wash and Add Detection Antibody Solution:

Wash the plate 3 times with 300 μL /well of Tris Wash Buffer. Add 25 μL of detection antibody solution to each well of the MSD plate. Seal the plate with an adhesive plate seal, and incubate for 1 hour with vigorous shaking (300–1000 rpm) at room temperature.

You may prepare 1X read buffer during incubation.

4. Wash and Read:

Wash the plate 3 times with 300 μL /well of Tris Wash Buffer. Add 150 μL of 1X Read Buffer T to each well of the MSD plate.

Analyze the plate on the MSD instrument. No incubation in read buffer is required before reading the plate.

Shaking a 96-well MSD MULTI-ARRAY® plate typically accelerates capture at the working electrode.

Solutions containing MSD Blocker A should be stored at 2–8°C and discarded after 14 days.

Complete lysis buffer should be kept ice-cold during all experiment manipulations.

If working with purified protein, only a few nanograms per well will generally provide a strong assay signal. Purified recombinant proteins may exhibit differences in both signal and background as compared to native proteins in cell lysates.

Samples, including cell lysates, may be used neat or diluted.

It is not possible to prepare serial dilutions in the MSD plate. Use microcentrifuge tubes or a separate 96-well polypropylene plate to prepare serial dilutions.

The sensitivity of MSD immunoassays rivals that of ELISAs and Western blots. The amount of sample required for a given assay will depend on the abundance of the analyte in the matrix and the affinities of the antibodies used.

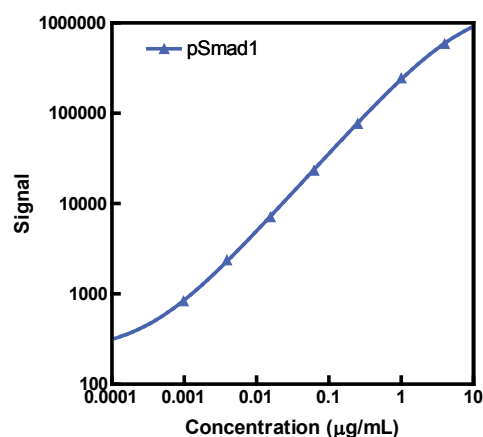
You may keep excess diluted read buffer in a tightly sealed container at room temperature for later use.

Bubbles introduced when adding read buffer will interfere with imaging of the plate and produce unreliable data. Use reverse pipetting technique to avoid creating bubbles.

Due to the varying nature of each research application, you should investigate assay stability before allowing plates to sit with read buffer for extended periods.

Typical Data

The following standard curve illustrates the dynamic range of the assay. Recombinant Smad1 protein (not included in this kit) was used to generate the data. Actual signals will vary. Best quantification of unknown samples will be achieved by generating a standard curve for each plate using a minimum of 2 replicates of standards.



Conc. (µg/mL)	pSmad1	
	Average Signal	%CV
0	151	3.3
0.00098	832	14.7
0.0039	2371	0.5
0.0156	7119	3.3
0.0625	23 327	2.5
0.25	76 846	7.6
1.0	245 640	0.5
4.0	588 487	1.2

Assay Components

The capture and detection antibodies used in this assay are listed below. They cross-react with human and mouse cell lysates.

Analyte	Source Species	
	MSD Capture Antibody	MSD Detection Antibody
Phospho-Smad1 (Ser463/465)	Rabbit Polyclonal	Rabbit Polyclonal

References

1. Kretschmar M, Liu F, Hata A, Doody J, Massague J. The TGF-beta family mediator Smad1 is phosphorylated directly and activated functionally by the BMP receptor kinase. *Genes Dev.* 1997 11:984-95.
2. Lin Y, Martin J, Gruendler C, Farley J, Meng X, Li B-Y, Lechleider R, Huff C, Kim RH, Grasser WA, Paralkar V, Wang T. A novel link between the proteasome pathway and the signal transduction pathway of the bone morphogenetic proteins (BMPs). *BMC Cell Biol.* 2002 3:15.
3. Nagaraj NS, Datta PK. Targeting the transforming growth factor-beta signaling pathway in human cancer. *Expert Opin Investig Drugs.* 2010 Jan;19(1):77-91.

Appendix: Suggested Cell Lysis Protocols

Preparation in Culture Flask or Petri Dish

Suspension Cells. Pellet cells by centrifugation at 500 x g for 3 minutes at 2–8°C. Discard supernatant and wash the pellet once with cold PBS. Pellet cells again, discard supernatant, and resuspend in complete lysis buffer at $1\text{--}5 \times 10^7$ cells per mL. Incubate on ice for 30 minutes. (A shorter incubation time of 15 minutes may be adequate for many targets.) Clear cellular debris from the lysate by centrifuging ($\geq 10\,000 \times g$) for 10 minutes at 2–8°C. Discard the pellet and determine the protein concentration in the lysate using a detergent-compatible protein assay such as a bicinchoninic acid (BCA) assay. Unused lysates should be aliquoted, quickly frozen in a dry ice-ethanol bath, and stored at $\leq -70^\circ\text{C}$.

Adherent Cells. All volumes given are for cells plated on 15 cm dishes. Remove media from the dish and wash cells one time with 5 mL cold PBS. Add 2 mL PBS to each dish, scrape the cells from the surface of the dish, and transfer into 15 mL conical tubes. Pellet the cells by centrifugation at 500 x g for 3 minutes at 2–8°C. Discard supernatant and resuspend cells in 0.5–2 mL of complete lysis buffer per dish. (Alternatively, cells can be lysed by adding 1–2 mL of complete lysis buffer per 15 cm dish after completely removing the PBS wash buffer. Cell lysate can be collected by snapping the dish surface prior to the clarifying spin.) Incubate on ice for 30 minutes. A shorter incubation time of 15 minutes may be adequate for many targets. Clear cellular debris from the lysate by centrifuging ($\geq 10\,000 \times g$) for 10 minutes at 2–8°C. Discard the pellet and determine protein concentration in the lysate using a detergent compatible protein assay such as BCA. Unused lysates should be aliquoted, quickly frozen in a dry ice-ethanol bath, and stored at $\leq -70^\circ\text{C}$.

Preparation in 96-well Culture Plate

Successful adaptation to a 96-well culture format depends on cell type and target. First, determine the number of cells of each cell type to be plated per well. MSD generally recommends plating concentrations ranging from $1 \times 10^4\text{--}10^5$ cells per well; however, the optimal concentrations will vary depending on cell line used.

Suspension Cells. You may lyse many cell types without removing growth medium. For flat bottom plates, design the experiment so that the final suspension cell volume per well is such that a concentrated complete lysis buffer (prepared by the user) can be added to the well to achieve a final 1X lysis buffer concentration in the well. For example, 40 μL of 5X complete lysis buffer added to a well containing 160 μL of cell culture medium would provide a 1X concentration of complete lysis buffer.

For conical microwell plates, perform lysis by pelleting the cells, removing most of the growth medium, and adding a constant amount of 1X complete lysis buffer.

Adherent Cells. Plate cells on coated tissue culture plates to reduce variability due to cells lost as growth medium is removed. Treat cells as desired. Gently aspirate growth medium from the microwell plate to avoid disrupting the cell monolayer. A PBS wash step is not required and can introduce variability as cells may detach during the wash step. Add 100 μL of 1X complete lysis buffer per well. You may modify lysis volume for different cell types or applications.

You will need to determine the optimum cell lysis time. Some targets are immediately available for detection. Other targets may require an incubation step at room temperature or on ice with gentle agitation.

Carefully pipet cell lysate onto prepared plate and proceed with assay protocol. Note: It is important to transfer a constant volume and to avoid introducing air bubbles by pipetting too vigorously.

Summary Protocol
MSD 96-well Phospho-Smad1 (Ser463/465) Kit

*MSD provides this summary protocol for your convenience.
Please read the entire detailed protocol prior to performing the
Phospho-Smad1 (Ser463/465) assay.*

Reagent Preparation

Prepare Tris Wash Buffer.
Prepare blocking solution.
Prepare antibody dilution buffer.
Prepare detection antibody solution by diluting 50X detection antibody 50-fold in antibody dilution buffer.
Prepare 1X Read Buffer T by diluting 4X Read Buffer T 4-fold with deionized water.

Step 1: Block Plate and Prepare Samples

Add 150 μ L/well of blocking solution.
Incubate at room temperature with vigorous shaking (300–1000 rpm) for 1 hour.
Prepare complete lysis buffer just prior to sample dilution.
Prepare positive and negative cell lysates and keep on ice until use.

Step 2: Wash and Add Sample

Wash the plate 3 times with 300 μ L/well of Tris Wash Buffer.
Add 25 μ L/well of sample.
Incubate at room temperature with vigorous shaking (300–1000 rpm) for 3 hours.

Step 3: Wash and Add Detection Antibody Solution

Wash the plate 3 times with 300 μ L/well of Tris Wash Buffer.
Add 25 μ L/well of 1X detection antibody solution.
Incubate at room temperature with vigorous shaking (300–1000 rpm) for 1 hour.

Step 4: Wash and Read Plate

Wash the plate 3 times with 300 μ L/well of Tris Wash Buffer.
Add 150 μ L/well of 1X Read Buffer T.
Analyze plate on the MSD instrument within 5 minutes of adding read buffer.

Plate Diagram

