



# ab189580 – Osteoprotegerin Human SimpleStep ELISA<sup>®</sup> Kit

Instructions for Use

For the quantitative measurement of Osteoprotegerin in human serum, plasma and cell culture supernatants.

This product is for research use only and is not intended for diagnostic use.

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## 1. BACKGROUND

Osteoprotegerin *in vitro* SimpleStep ELISA® (Enzyme-Linked Immunosorbent Assay) kit is designed for the quantitative measurement of Osteoprotegerin protein in human serum, plasma and cell culture supernatants.

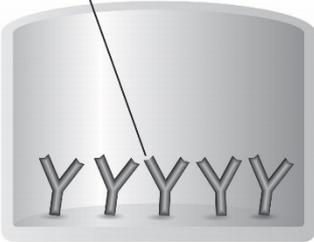
The SimpleStep ELISA® employs an affinity tag labeled capture antibody and a reporter conjugated detector antibody which immunocapture the sample analyte in solution. This entire complex (capture antibody/analyte/detector antibody) is in turn immobilized via immunoaffinity of an anti-tag antibody coating the well. To perform the assay, samples or standards are added to the wells, followed by the antibody mix. After incubation, the wells are washed to remove unbound material. TMB substrate is added and during incubation is catalyzed by HRP, generating blue coloration. This reaction is then stopped by addition of Stop Solution completing any color change from blue to yellow. Signal is generated proportionally to the amount of bound analyte and the intensity is measured at 450 nm. Optionally, instead of the endpoint reading, development of TMB can be recorded kinetically at 600 nm.

Human Osteoprotegerin (OPG), also known as Tumor necrosis factor receptor superfamily member 11B (TNFRSF11B), is a 46kDa glycoprotein member of the tumor necrosis factor receptor superfamily. This cytokines is a homodimer expressed and secreted by multiple adult tissues such as the lung, liver, spleen, prostate, ovary, adrenal gland and bone marrow. It plays a critical function in bone homeostasis by acting as a decoy receptor for TNFSF11/RANKL and for the receptor activator of nuclear factor-kappa-B ligand. OPG therefore decreases bone resorption by inhibiting osteoclast differentiation and activation of osteoclast and by stimulating osteoclast apoptosis.

OPG deficiency has been found in Juvenile Paget disease, a rare autosomal recessive osteopathy that presents in infancy and early childhood characterized by rapidly remodeling woven bone, osteopenia, debilitating fractures and deformities due to accelerated bone remodeling. OPG may also play a role in arterial calcification and high levels of OPG have been found to be an independent risk factor for cardiovascular disease and vascular mortality.

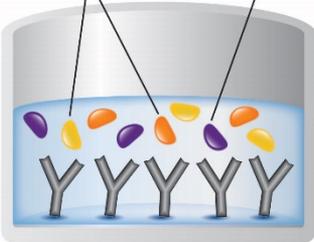
## 2. ASSAY SUMMARY

Immobilization Antibody



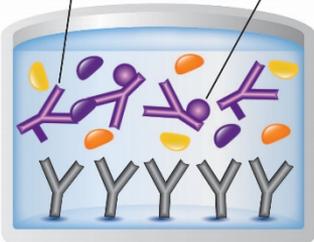
Remove appropriate number of antibody coated well strips. Equilibrate all reagents to room temperature. Prepare all reagents, samples, and standards as instructed.

Matrix Proteins Target Analyte



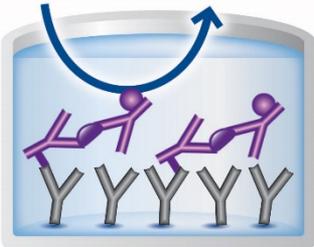
Add standard or sample to appropriate wells.

Capture Antibody Detector Antibody



Add Antibody Cocktail to all wells. Incubate at room temperature.

Substrate Color Development



Aspirate and wash each well. Add TMB Substrate to each well and incubate. Add Stop Solution at a defined endpoint. Alternatively, record color development kinetically after TMB substrate addition.

### 3. PRECAUTIONS

**Please read these instructions carefully prior to beginning the assay.**

All kit components have been formulated and quality control tested to function successfully as a kit. Modifications to the kit components or procedures may result in loss of performance.

### 4. STORAGE AND STABILITY

**Store kit at 2-8°C immediately upon receipt.**

Refer to list of materials supplied for storage conditions of individual components. Observe the storage conditions for individual prepared components in sections 9 & 10.

### 5. MATERIALS SUPPLIED

Item	Amount	Storage Condition (Before Preparation)
10X Osteoprotegerin Capture Antibody	600 µL	+2-8°C
10X Osteoprotegerin Detector Antibody	600 µL	+2-8°C
Osteoprotegerin Human Lyophilized Recombinant Protein	2 Vials	+2-8°C
Antibody Diluent CPI2*	6 mL	+2-8°C
10X Wash Buffer PT	20 mL	+2-8°C
TMB Substrate	12 mL	+2-8°C
Stop Solution	12 mL	+2-8°C
Sample Diluent NS	50 mL	+2-8°C
Sample Diluent 25BS	20 mL	+2-8°C
Pre-Coated 96 Well Microplate (12 x 8 well strips)	96 Wells	+2-8°C
Plate Seal	1	+2-8°C

\*Note: Antibody Diluent CPI2- This buffer has been reformulated to enhance stability after freeze-thaw cycles while producing data equivalent to the original formulation of antibody diluent CPI previously used in this kit.

While we run stock down, you may receive kits containing antibody diluent CPI. This does not affect the way you should use the kit.

If you have any questions please contact Abcam Scientific Support.

### **6. MATERIALS REQUIRED, NOT SUPPLIED**

These materials are not included in the kit, but will be required to successfully utilize this assay:

- Microplate reader capable of measuring absorbance at 450 or 600 nm
- Method for determining protein concentration (BCA assay recommended)
- Deionized water
- PBS (1.4 mM KH<sub>2</sub>PO<sub>4</sub>, 8 mM Na<sub>2</sub>HPO<sub>4</sub>, 140 mM NaCl, 2.7 mM KCl, pH 7.4)
- Multi- and single-channel pipettes
- Tubes for standard dilution
- Plate shaker for all incubation steps
- Phenylmethylsulfonyl Fluoride (PMSF) (or other protease inhibitors)

### **7. LIMITATIONS**

- Assay kit intended for research use only. Not for use in diagnostic procedures
- Do not mix or substitute reagents or materials from other kit lots or vendors. Kits are QC tested as a set of components and performance cannot be guaranteed if utilized separately or substituted

### **8. TECHNICAL HINTS**

- Samples generating values higher than the highest standard should be further diluted in the appropriate sample dilution buffers
- Avoid foaming or bubbles when mixing or reconstituting components

## GENERAL INFORMATION

- Avoid cross contamination of samples or reagents by changing tips between sample, standard and reagent additions
- Ensure plates are properly sealed or covered during incubation steps
- Complete removal of all solutions and buffers during wash steps is necessary to minimize background
- As a guide, typical ranges of sample concentration for commonly used sample types are shown below in Sample Preparation (section 11)
- All samples should be mixed thoroughly and gently
- Avoid multiple freeze/thaw of samples
- Incubate ELISA plates on a plate shaker during all incubation steps
- When generating positive control samples, it is advisable to change pipette tips after each step
- **To avoid high background always add samples or standards to the well before the addition of the antibody cocktail**
- **This kit is sold based on number of tests. A 'test' simply refers to a single assay well. The number of wells that contain sample, control or standard will vary by product. Review the protocol completely to confirm this kit meets your requirements. Please contact our Technical Support staff with any questions**

## 9. REAGENT PREPARATION

- Equilibrate all reagents to room temperature (18-25°C) prior to use. The kit contains enough reagents for 96 wells. **The sample volumes below are sufficient for 48 wells (6 x 8-well strips); adjust volumes as needed for the number of strips in your experiment.**
- Prepare only as much reagent as is needed on the day of the experiment. Capture and Detector Antibodies have only been tested for stability in the provided 10X formulations.

### 9.1 **1X Wash Buffer PT**

Prepare 1X Wash Buffer PT by diluting 10X Wash Buffer PT with deionized water. To make 50 mL 1X Wash Buffer PT combine 5 mL 10X Wash Buffer PT with 45 mL deionized water. Mix thoroughly and gently.

### 9.2 **Antibody Cocktail**

Prepare Antibody Cocktail by diluting the capture and detector antibodies in Antibody Diluent CPI2. To make 3 mL of the Antibody Cocktail combine 300  $\mu$ L 10X Capture Antibody and 300  $\mu$ L 10X Detector Antibody with 2.4 mL Antibody Diluent CPI2. Mix thoroughly and gently.

## 10. STANDARD PREPARATION

Prepare serially diluted standards immediately prior to use. Always prepare a fresh set of positive controls for every use.

The following section describes the preparation of a standard curve for duplicate measurements (recommended).

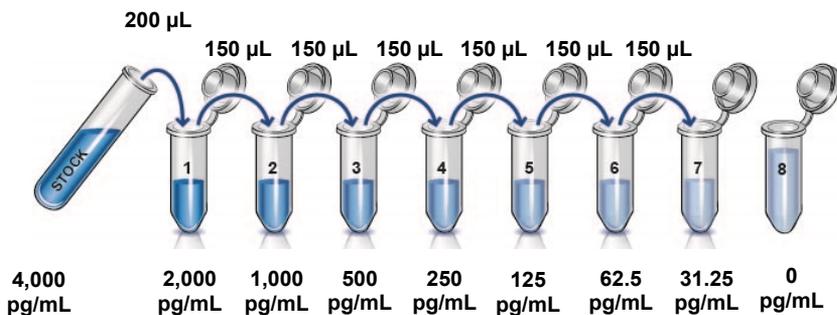
10.1 **IMPORTANT:** If the protein standard vial has a volume identified on the label, reconstitute the Osteoprotegerin standard by adding that volume of Diluent indicated on the label. Alternatively, if the vial has a mass identified, reconstitute the Osteoprotegerin standard by adding 500  $\mu\text{L}$  of Diluent. Hold at room temperature for 10 minutes and mix gently. This is the 4,000  $\text{pg/mL}$  **Stock Standard Solution**.

10.2 Label eight tubes, Standards 1–8.

10.3 For **cell culture supernatant samples** reconstitute the standard by adding Sample Diluent NS. Add 200  $\mu\text{L}$  Sample Diluent NS into tube number 1 and 150  $\mu\text{L}$  Sample Diluent NS into numbers 2-8.

For **serum and plasma samples** reconstitute the standard by adding Sample Diluent 25BS. Add 200  $\mu\text{L}$  Sample Diluent 25BS into tube number 1 and 150  $\mu\text{L}$  Sample Diluent 25BS into numbers 2-8.

10.4 Use the Stock Standard to prepare the following dilution series. Standard #8 contains no protein and is the Blank control:



## 11. SAMPLE PREPARATION

TYPICAL SAMPLE DYNAMIC RANGE	
Sample Type	Range (%)
Human Serum	6 – 50
Human Plasma - Citrate	6 – 50
Human Plasma - Heparin	6 – 50
Human Plasma - EDTA	3 – 25
Cell Culture Supernatant	6 – 50

### 11.1 Plasma

Collect plasma using citrate, EDTA or heparin. Centrifuge samples at 2,000 x g for 10 minutes. Dilute samples into Sample Diluent 25BS and assay. Store un-diluted plasma samples at -20°C or below for up to 3 months. Avoid repeated freeze-thaw cycles.

### 11.2 Serum

Samples should be collected into a serum separator tube. After clot formation, centrifuge samples at 2,000 x g for 10 minutes and collect serum. Dilute samples into Sample Diluent 25BS and assay. Store un-diluted serum at -20°C or below. Avoid repeated freeze-thaw cycles.

### 11.3 Cell Culture Supernatants

Centrifuge cell culture media at 2,000 x g for 10 minutes to remove debris. Collect supernatants and assay. If required, dilute in sample diluent NS. Store samples at -20°C or below. Avoid repeated freeze-thaw cycles.

## 12. PLATE PREPARATION

- The 96 well plate strips included with this kit are supplied ready to use. It is not necessary to rinse the plate prior to adding reagents
- Unused plate strips should be immediately returned to the foil pouch containing the desiccant pack, resealed and stored at 4°C
- For each assay performed, a minimum of two wells must be used as the zero control
- For statistical reasons, we recommend each sample should be assayed with a minimum of two replicates (duplicates)
- Differences in well absorbance or “edge effects” have not been observed with this assay

## **13. ASSAY PROCEDURE**

- **Equilibrate all materials and prepared reagents to room temperature prior to use.**
- **It is recommended to assay all standards, controls and samples in duplicate.**
  - 13.1 Prepare all reagents, working standards, and samples as directed in the previous sections.
  - 13.2 Remove excess microplate strips from the plate frame, return them to the foil pouch containing the desiccant pack, reseal and return to 4°C storage.
  - 13.3 Add 50 µL of all sample or standard to appropriate wells.
  - 13.4 Add 50 µL of the Antibody Cocktail to each well.
  - 13.5 Seal the plate and incubate for 1 hour at room temperature on a plate shaker set to 400 rpm.
  - 13.6 Wash each well with 3 x 350 µL 1X Wash Buffer PT. Wash by aspirating or decanting from wells then dispensing 350 µL 1X Wash Buffer PT into each well. Complete removal of liquid at each step is essential for good performance. After the last wash invert the plate and blot it against clean paper towels to remove excess liquid.
  - 13.7 Add 100 µL of TMB Substrate to each well and incubate for 10 minutes in the dark on a plate shaker set to 400 rpm.
  - 13.8 Add 100 µL of Stop Solution to each well. Shake plate on a plate shaker for 1 minute to mix. Record the OD at 450 nm. This is an endpoint reading.

*Alternative to 13.7 – 13.8: Instead of the endpoint reading at 450 nm, record the development of TMB Substrate kinetically. Immediately after addition of TMB Development Solution begin recording the blue color development with elapsed time in the microplate reader prepared with the following settings:*

## ASSAY PROCEDURE

Mode:	Kinetic
Wavelength:	600 nm
Time:	up to 20 min
Interval:	20 sec - 1 min
Shaking:	Shake between readings

*Note that an endpoint reading can also be recorded at the completion of the kinetic read by adding 100  $\mu$ L Stop Solution to each well and recording the OD at 450 nm.*

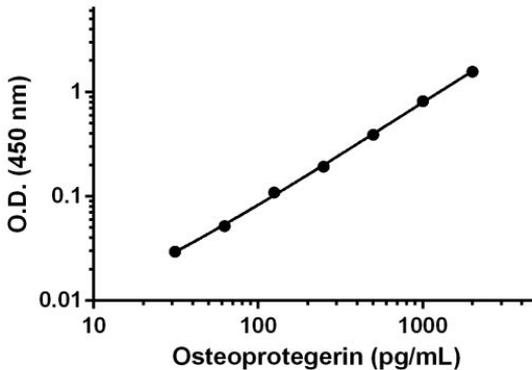
13.9 Analyze the data as described below.

## 14. CALCULATIONS

- 14.1 Calculate the average absorbance value for the blank control (zero) standards. Subtract the average blank control standard absorbance value from all other absorbance values.
- 14.2 **Create a standard curve** by plotting the average blank control subtracted absorbance value for each standard concentration (y-axis) against the target protein concentration (x-axis) of the standard. Use graphing software to draw the best smooth curve through these points to construct the standard curve.  
  
*Note:* Most microplate reader software or graphing software will plot these values and fit a curve to the data. A four parameter curve fit (4PL) is often the best choice; however, other algorithms (e.g. linear, semi-log, log/log, 4 parameter logistic) can also be tested to determine if it provides a better curve fit to the standard values.
- 14.3 Determine the concentration of the target protein in the sample by interpolating the blank control subtracted **absorbance values against the standard curve**. Multiply the resulting value by the appropriate sample dilution factor, if used, to obtain the concentration of target protein in the sample.
- 14.4 Samples generating absorbance values greater than that of the highest standard should be further diluted and reanalyzed. Similarly, samples which measure at an absorbance values less than that of the lowest standard should be retested in a less dilute form.

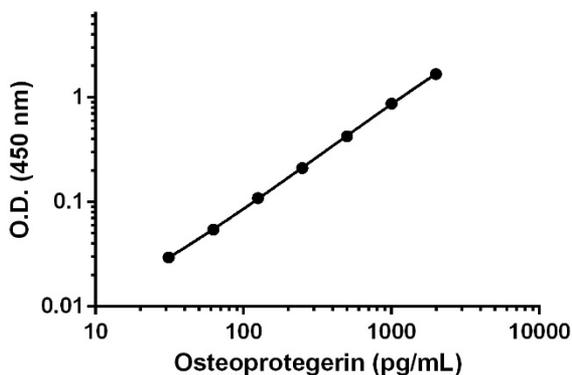
## 15. TYPICAL DATA

**TYPICAL STANDARD CURVE** – Data provided for **demonstration purposes only**. A new standard curve must be generated for each assay performed.



Standard Curve Measurements			
Conc. (pg/mL)	O.D. 450 nm		Mean O.D.
	1	2	
0	0.062	0.060	0.061
31.25	0.092	0.089	0.090
62.50	0.114	0.112	0.113
125	0.175	0.165	0.170
250	0.252	0.256	0.254
500	0.451	0.451	0.451
1,000	0.889	0.870	0.879
2,000	1.602	1.650	1.626

**Figure 1.** Example of Osteoprotegerin standard curve. The Osteoprotegerin standard curve was prepared as described in Section 10 in Sample Diluent 25BS. Raw data values are shown in the table. Background-subtracted data values (mean +/- SD) are graphed.



<b>Standard Curve Measurements</b>			
<b>Conc. (pg/mL)</b>	<b>O.D. 450 nm</b>		<b>Mean O.D.</b>
	<b>1</b>	<b>2</b>	
0	0.062	0.064	0.063
31.25	0.091	0.094	0.092
62.50	0.115	0.120	0.117
125	0.168	0.176	0.172
250	0.268	0.281	0.274
500	0.473	0.501	0.487
1,000	0.929	0.944	0.937
2,000	1.684	1.779	1.731

**Figure 2.** Example of Osteoprotegerin standard curve. The Osteoprotegerin standard curve was prepared as described in Section 10 in Sample Diluent NS. Raw data values are shown in the table. Background-subtracted data values (mean +/- SD) are graphed.

## 16. TYPICAL SAMPLE VALUES

### SENSITIVITY –

The calculated minimal detectable dose (MDD) is determined by calculating the mean of zero standard replicates and adding 2 standard deviations then extrapolating the corresponding concentrations:

Sample Diluent Buffer	n=	Minimal Detectable Dose
Sample Diluent NS	24	13 pg/mL
Sample Diluent 25BS	24	11 pg/mL

### RECOVERY –

Three concentrations of Serum were spiked in duplicate to the indicated biological matrix to evaluate signal recovery in the working range of the assay.

Sample Type	Average % Recovery	Range (%)
50% Human Serum	101	100 - 103
50% Human Plasma - Citrate	88	86 - 90
25% Human Plasma - EDTA	98	86 - 104
50% Human Plasma - Heparin	89	84 - 92
50% Media	88	81 - 96

## LINEARITY OF DILUTION –

Recombinant Osteoprotegerin was spiked into the following biological samples and diluted in a 2-fold dilution series in Sample Diluent 25BS.

Linearity of dilution is determined based on interpolated values from the standard curve. Linearity of dilution defines a sample concentration interval in which interpolated target concentrations are directly proportional to sample dilution.

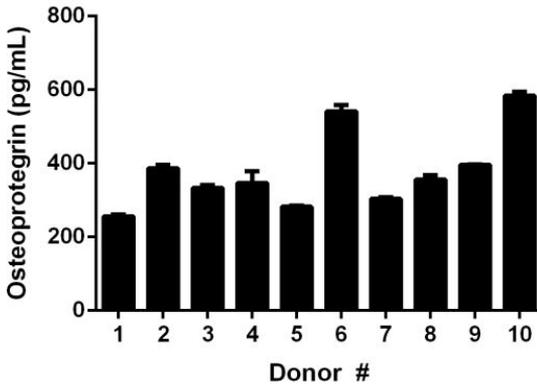
Dilution Factor	Interpolated value	50% Human Serum	50% Human Plasma (Citrate)	25% Human Plasma (EDTA)	50% Human Plasma (Heparin)	50% Media
Undiluted	pg/mL	1138.02	922.28	858.66	1136.13	960.14
	<b>% Expected value</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
2	pg/mL	609.94	505.94	423.21	558.28	481.55
	<b>% Expected value</b>	<b>107</b>	<b>110</b>	<b>99</b>	<b>98</b>	<b>100</b>
4	pg/mL	292.01	246.17	198.28	259.56	227.81
	<b>% Expected value</b>	<b>103</b>	<b>107</b>	<b>92</b>	<b>91</b>	<b>95</b>
8	pg/mL	148.92	121.29	95.54	120.00	109.32
	<b>% Expected value</b>	<b>105</b>	<b>105</b>	<b>89</b>	<b>84</b>	<b>91</b>
16	pg/mL	73.66	60.82	51.85	54.41	56.52
	<b>% Expected value</b>	<b>104</b>	<b>106</b>	<b>97</b>	<b>77</b>	<b>94</b>

## PRECISION –

Mean coefficient of variations of interpolated values from 3 concentrations of Serum within the working range of the assay.

	Intra-Assay	Inter-Assay
n=	8	3
CV (%)	6	9

## SAMPLE DATA –



**Figure 3.** Ten individual healthy donors were evaluated for the presence of Osteoprotegerin in serum using this assay. Results were interpolated from the standard curve in Sample Diluent 25BS and corrected by sample dilution (1:2). The mean level of Osteoprotegerin is 378.8 pg/mL with a range of 256.5 – 584.5 pg/mL and a standard deviation of 106.7 pg/mL.

## 17. SPECIES REACTIVITY

This kit recognizes human Osteoprotegerin protein.

Other species reactivity was determined by measuring 1:2 dilution serum samples of various species, interpolating the protein concentrations from the human standard curve, and expressing the interpolated concentrations as a percentage of the protein concentration in human serum assayed at the same dilution.

Reactivity < 3% was determined for the following species:

Rat

Hamster

Guinea Pig

Rabbit

Dog

Goat

Cow

Chicken

Serum showing cross-reactivity:

<b>Species</b>	<b>% Cross-reactivity</b>
Mouse	44.5
Pig	100

Please contact our Technical Support team for more information.

## 18. TROUBLESHOOTING

Problem	Cause	Solution
Difficulty pipetting lysate; viscous lysate.	Genomic DNA solubilized	Prepare 1X Cell Extraction Buffer PTR (without enhancer). Add enhancer to lysate after extraction.
Poor standard curve	Inaccurate Pipetting	Check pipettes
	Improper standard dilution	Prior to opening, briefly spin the stock standard tube and dissolve the powder thoroughly by gentle mixing
Low Signal	Incubation times too brief	Ensure sufficient incubation times; increase to 2 or 3 hour standard/sample incubation
	Inadequate reagent volumes or improper dilution	Check pipettes and ensure correct preparation
	Incubation times with TMB too brief	Ensure sufficient incubation time until blue color develops prior addition of Stop solution
Large CV	Plate is insufficiently washed	Review manual for proper wash technique. If using a plate washer, check all ports for obstructions.
	Contaminated wash buffer	Prepare fresh wash buffer
Low sensitivity	Improper storage of the ELISA kit	Store your reconstituted standards at -80°C, all other assay components 4°C. Keep TMB substrate solution protected from light.

19. NOTES

## Technical Support

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