



## **Human Total MMP-9 ELISA Kit**

**Catalog #: OKAG00175**

**Detection and Quantification of Human Matrix Metalloproteinase-9 (hMMP-9) Concentrations in Cell Lysates, Sera and Plasma.**

**Please read the provided manual as suggested experimental protocols may have changed.**

**Research Purposes Only. Not Intended for Diagnostic or Clinical Procedures.**

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## INTRODUCTION

Proteins of the matrix metalloproteinase (MMP) family are involved in the breakdown of extracellular matrix in normal physiological processes such as embryonic development, reproduction, and tissue remodeling, as well as in disease processes, such as arthritis and metastasis. Most MMP's are secreted as inactive proproteins which are activated when cleaved by extracellular proteinases. The enzyme encoded by this gene degrades type IV and V collagens. Human total MMP-9 may play an essential role in local proteolysis of the extracellular matrix and in leukocyte migration and could play a role in bone osteoclastic resorption. MMP-9 cleaves KiSS1 at a Gly-I-Leu bond while it cleaves type IV and type V collagen into large C-terminal three quarter fragments and shorter N-terminal one quarter fragments in addition to cleavage of gelatin types I and V and collagen types IV and V. The proteinase degrades fibronectin, but not laminin or Pz-peptide. The enzyme is inhibited by histatin-3 1/24 (histatin-5) and inhibited by ECM1. MMP-9 exists as a monomer or a disulfide-linked homodimer and also as heterodimer with a 25 kDa protein. Macrophages and transformed cell lines produce only the monomeric form. This proteinase interacts with ECM1 and is activated by 4-aminophenylmercuric acetate and phorbol ester. Furthermore, it is up-regulated by ARHGEF4, SPATA13 and APC via the JNK signaling pathway in colorectal tumor cells. Processing of the precursor yields different active forms of 64, 67 and 82 kDa. Sequentially processing by MMP3 yields the 82 kDa matrix metalloproteinase-9. MMP-9 can be N- and O-glycosylated. Defects in MMP9 may be a cause of susceptibility to intervertebral disc disease (IDD); also known as lumbar disk herniation (LDH). IDD is one of the most common musculo-skeletal disorders and the predominant cause of low-back pain and unilateral leg pain. Defects in MMP9 are the cause of metaphyseal anadysplasia type 2 (MANDP2). Metaphyseal anadysplasia consists of an abnormal bone development characterized by severe skeletal changes that, in contrast with the progressive course of most other skeletal dysplasias, resolve spontaneously with age. Clinical characteristics are evident from the first months of life and include slight shortness of stature and a mild varus deformity of the legs. Patients attain a normal stature in adolescence and show improvement or complete resolution of varus deformity of the legs and rhizomelic micromelia.

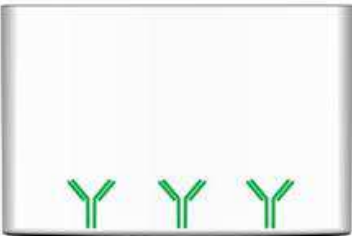
*Source: Entrez Gene; Swiss-Prot*

## ASSAY PRINCIPLES

The Aviva Human Total MMP-9 ELISA Kit contains the components necessary for quantitative determination of natural or recombinant hMMP-9 concentrations within any experimental sample including cell lysates, serum and plasma. This particular immunoassay utilizes the quantitative technique of a “Sandwich” Enzyme-Linked Immunosorbent Assay (ELISA) where the target protein (antigen) is bound in a “sandwich” format by the primary capture antibodies coated to each well-bottom and the secondary detection antibodies added subsequently by the investigator. The capture antibodies coated to the bottom of each well are specific for a particular epitope on the Human MMP-9 cytokine while the user-added detection antibodies bind to epitopes on the captured target protein. Amid each step of the procedure, a series of wash steps must be performed to ensure the elimination of non-specific binding between proteins to other proteins or to the solid phase. After incubation and “sandwiching” of the target antigen, a peroxidase enzyme is conjugated to the constant heavy chain of the secondary antibody (either covalently or via Avidin/Streptavidin-Biotin interactions), allowing for a colorimetric reaction to ensue upon substrate addition. When the substrate TMB (3, 3', 5, 5'-Tetramethylbenzidine) is added, the reaction catalyzed by peroxidase yields a blue color that is representative of the antigen concentration. Upon sufficient color development, the reaction can be terminated through addition of Stop Solution (2 N Sulfuric Acid) where the color of the solution will turn yellow. The absorbance of each well can then be read by a spectrophotometer, allowing for generation of a standard curve and subsequent determination of protein concentration.

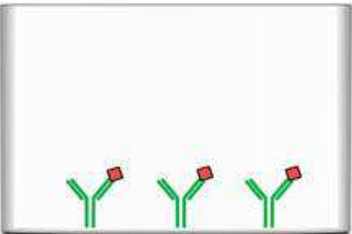
# ASSAY FORMAT

  
Capture Antibody



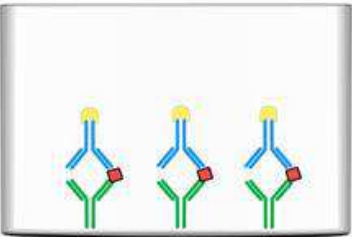
Monoclonal capture antibodies specific for the target are adsorbed to the plate.

  
Target Antigen



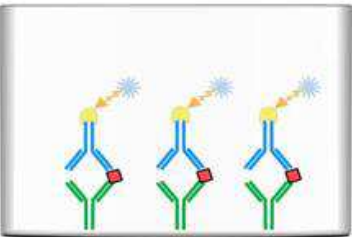
Target antigen present in standard or sample is bound by capture antibodies on the solid-phase.

  
Biotin-Labeled Detection Antibody



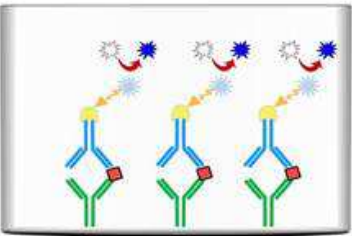
Polyclonal, biotin-labeled detection antibodies specific for the target are added to bind another epitope on the target antigen.

  
Avidin-HRP Enzyme Conjugate



Avidin-HRP attaches to detection antibody via high affinity avidin-biotin interaction.

  
Unreacted TMB



TMB substrate is converted to the blue TMB diimine via the HRP enzyme. Upon addition of acid, the reaction terminates and the wells can be read at 450 nm.

  
Blue TMB Diimine Product

## ASSAY RESTRICTIONS

- This ELISA kit is intended for research purposes only, NOT diagnostic or clinical procedures of any kind.
- Materials included in this kit should NOT be used past the expiration date on the kit label.
- Reagents or substrates included in this kit should NOT be mixed or substituted with reagents or substrates from any other kits.
- Variations in pipetting technique, washing technique, operator laboratory technique, kit age, incubation time or temperature may cause differences in binding affinity of the materials provided.
- The assay is designed to eliminate interference and background by other cellular macromolecules or factors present within any biological samples. However, the possibility of background noise cannot be fully excluded until all factors have been tested using the assay kit.

## MATERIALS INCLUDED

Component	Quantity Per Plate	Container	Reconstitution
96-Well Microplate or Strips Coated w/ Capture Antibody	12 x 8 Strips	-	-
Ready-to-Use Streptavidin-HRP	12 ml	Clear	-
Ready-to-Use Substrate	12 ml	Brown	-
Stop Solution	12 ml	Clear	-
Wash Buffer (15x)	50 ml	Clear	-
Protein Standard Diluent	12 ml	Clear	-
Sample Diluent	12 ml	Clear	-
Detection Antibody Diluent	12 ml	Clear	-
Biotin-Labeled Detection Antibody	Lyophilized	Yellow	67 $\mu$ l H <sub>2</sub> O
Protein Standard	Lyophilized (1.7 ng)	Red	33 $\mu$ l H <sub>2</sub> O
Adhesive Plate Sealers	4 Sheets	-	-
Technical Manual	1 Manual	-	-

## **ADDITIONAL MATERIALS REQUIRED**

The following materials and/or equipment are NOT provided in this kit but are necessary to successfully conduct the experiment:

- Microplate reader able to measure absorbance at 450 nm (with correction wavelength set to 540 nm or 570 nm)
- Micropipettes with capability of measuring volumes ranging from 1 µl to 1 ml
- Deionized or sterile water
- Squirt bottle, manifold dispenser, multichannel pipette reservoir or automated microplate washer
- Graph paper or computer software capable of generating or displaying logarithmic functions
- Absorbent paper or vacuum aspirator
- Test tubes or microfuge tubes capable of storing ≥1 ml
- Bench-top centrifuge (optional)
- Bench-top vortex (optional)
- Orbital shaker (optional)

## **HEALTH AND SAFETY PRECAUTIONS**

- Reagents provided in this kit may be harmful if ingested, inhaled or absorbed through the skin. Please carefully review the MSDS for each reagent before conducting the experiment.
- Stop Solution contains 2 N Sulfuric Acid ( $\text{H}_2\text{SO}_4$ ) and is an extremely corrosive agent. Please wear proper eye, hand and face protection when handling this material. When the experiment is finished, be sure to rinse the plate with copious amounts of running water to dilute the Stop Solution prior to disposing the plate.

## STORAGE INFORMATION

**Note:** If used frequently, reagents may be stored at 4°C.

**Unopened Kits:** Store at 4°C for 6 months.

Component	Storage Time	Storage Information
96-Well Microplate or Strips Coated w/ Capture Antibody	6 Months	4°C
Ready-to-Use Streptavidin-HRP		
Ready-to-Use Substrate		
Stop Solution		
Wash Buffer (15x)		
Protein Standard Diluent		
Sample Diluent		
Detection Antibody Diluent		
Protein Standard	Lyophilized: 6 Months Reconstituted: 1 Month	4°C
Biotin-Labeled Detection Antibody		
Adhesive Plate Sealers	-	-
Technical Manual	-	-



## SAMPLE PREPARATION AND STORAGE

If samples are to be used within 24 hours, aliquot and store at 4°C. If samples are to be used over a long period of time, aliquot and store between -20°C and -80°C, depending on the duration of storage.

**Note:** Samples containing a visible precipitate or pellet must be clarified prior to use in the assay.

**Caution:** Avoid repeated freeze/thaw cycles to prevent loss of biological activity of proteins in experimental samples.

### ***Cell Lysate and Supernatants***

Remove large cell components via centrifugation and perform the assay. Cell lysates and supernatants require a dilution using Sample Diluent. A serial dilution may be performed to determine a suitable dilution factor for the sample. For future use of the sample, follow the sample storage guidelines stated above.

### ***Serum***

Allow samples to clot in a serum separator tube (SST) for 30 minutes. After sufficient clotting, centrifuge at 1000 x g for 15 minutes and remove serum from SST in preparation for the assay. Serum samples require at least a 1:50 dilution using Sample Diluent. For future use of the sample, follow the storage guidelines above.

### ***Plasma***

Use heparin, citrate or EDTA as an anticoagulant to gather plasma from original biological sample. After collection of the plasma, centrifuge for 15 minutes at 1000 x g. This step must be performed within 30 minutes of plasma collection. Plasma samples require at least a 1:50 dilution using Sample Diluent. Afterwards, perform the assay or for future use of the sample, follow the storage guidelines stated above.

## SAMPLE EXPERIMENT LAYOUT

	1	2	3	4	5	6
A	Standard (High Point)	Standard (High Point)	Standard (High Point)	Sample	Sample	Sample
B	Standard (1:2)	Standard (1:2)	Standard (1:2)	Sample	Sample	Sample
C	Standard (1:4)	Standard (1:4)	Standard (1:4)	Sample	Sample	Sample
D	Standard (1:8)	Standard (1:8)	Standard (1:8)	Sample	Sample	Sample
E	Standard (1:16)	Standard (1:16)	Standard (1:16)	Sample	Sample	Sample
F	Standard (1:32)	Standard (1:32)	Standard (1:32)	Sample	Sample	Sample
G	Standard (1:64)	Standard (1:64)	Standard (1:64)	Sample	Sample	Sample
H	Negative Control	Negative Control	Negative Control	Sample	Sample	Sample

# IMMUNOASSAY PROTOCOL

**Note:** If possible, all incubation steps should be performed on an orbital shaker to equilibrate solutions when added to the microplate wells. Also, all provided solutions should be at ambient temperature prior to use.

**Note:** Avoid adding solutions into wells at an angle, always keep pipette tip perpendicular to plate bottom.

## ***Reconstitution of Provided Materials***

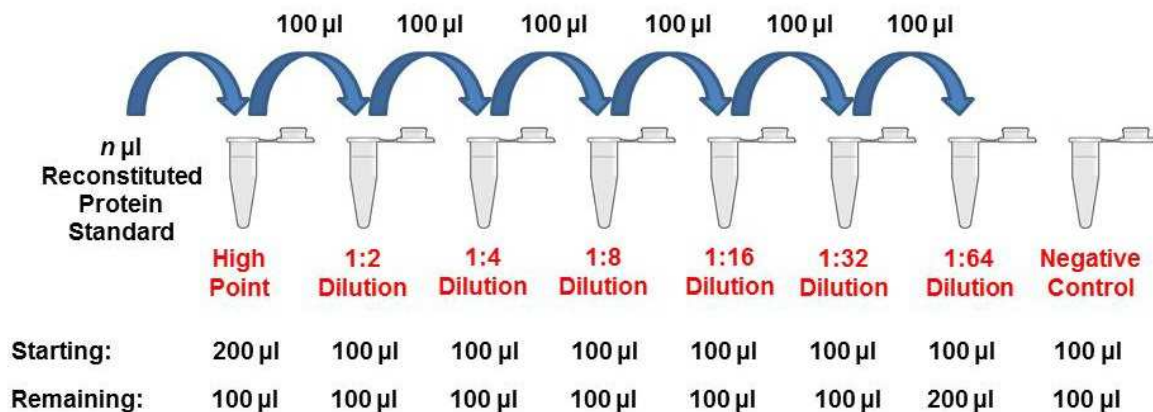
1. Reconstitute the Biotin-Conjugated Detection Antibody in 67  $\mu$ l of ddH<sub>2</sub>O for a concentration of 18  $\mu$ g/ml.
2. Reconstitute the Protein Standard in 33  $\mu$ l of ddH<sub>2</sub>O for a concentration of 50 ng/ml.
3. Dilute the 50 ml of 15X Wash Buffer in 700 ml of ddH<sub>2</sub>O for 750ml of 1X Wash Buffer.

## ***Addition of Known Standard and Unknown Sample to Immunoassay***

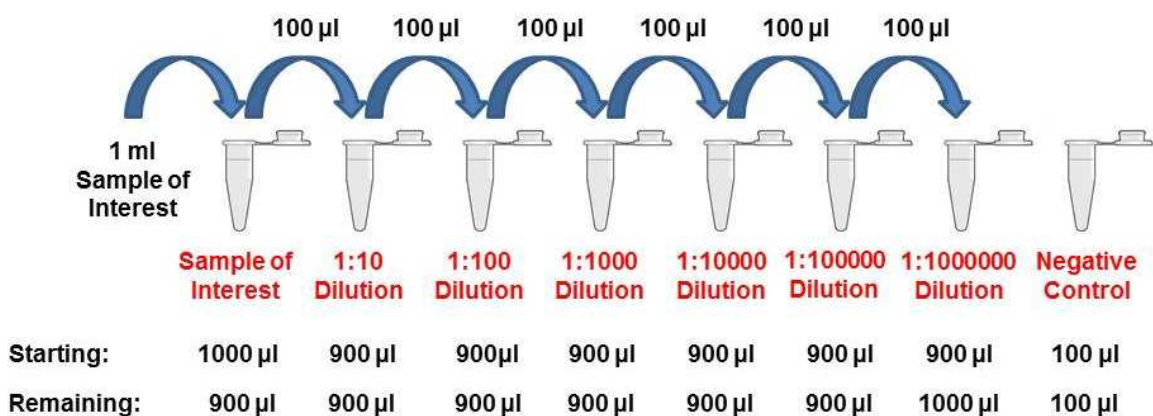
The Human Total MMP-9 ELISA Kit allows for the detection and quantification of endogenous levels of natural and/or recombinant Human Total MMP-9 proteins within the range of 32-2000 pg/ml.

1. Dilute the known standard sample from 2 ng/ml to 0 ng/ml in a series of microfuge tubes. Mix each tube thoroughly by inverting several times or by vortexing lightly to ensure proper equilibration. Add 100  $\mu$ l of each serial dilution step into the wells of a specified row or column of the 96-well microtiter plate in duplicate or triplicate and incubate at room temperature for 2 hours. S Unknown samples of interest can be serial diluted with Sample Diluent to concentrations within the detection range of this assay kit and added to the plate at 100  $\mu$ l per well. Seal the microplate air-tight using one of the microplate adhesive seals provided in this kit or Parafilm if readily available. See Appendix for serial dilution diagram.

To obtain serial dilution high point, dilute reconstituted Protein Standard to the maximum concentration for serial dilution by adding  $n$   $\mu$ l reconstituted Protein Standard to serial dilution high point tube and then raising the volume to 200  $\mu$ l. Shown below is a diagram illustrating a hypothetical 2-fold serial dilution on a given reconstituted Protein Standard.



For samples of unknown protein concentrations, serial dilute the experimental sample using Sample Diluent to determine range of detection and acceptable dilutions. Shown below is a diagram illustrating a 10-fold serial dilution on a given Sample of Interest.



### ***Addition of Detection Antibody to Capture Antibody-Bound Samples***

1. Aspirate the protein standard solution out of the microplate wells. If your lab does not have a vacuum-based aspirator, you may dump the solutions from the microplate into a waste container and blot 3-4 times on a stack of paper towels until most or all of the liquid is removed from the wells. Dilute the 15X wash buffer to 1X using pure H<sub>2</sub>O. Add 300-400 µl of Wash Buffer to each well being used and gently shake for 5-7 minutes on an orbital shaker. Perform this wash step 4 times consecutively.

Aspirate the protein standard solution out of the microplate wells. If your lab does not have a vacuum-based aspirator, you may dump the solutions from the microplate into a waste container and blot 3-4 times on a stack of paper towels until most or all of the liquid is removed from the wells. Dilute the 15X wash buffer to 1X using pure H<sub>2</sub>O. Add 300-400 µl of Wash Buffer to each well being used and gently shake for 5-7 minutes on an orbital

### ***Conjugation of Streptavidin-HRP to Biotin-Labeled Detection Antibody***

1. Remove the detection antibody solution out of the microplate wells by either vacuum-based aspirator or paper towel blotting. Perform 4 consecutive wash steps with gentle shaking between each wash.
2. After the 4<sup>th</sup> wash step, add 100 µl of Ready-to-Use Streptavidin-HRP Conjugate Solution into each well and incubate at room temperature for 30 minutes.

### ***Application of Liquid Substrate for Colorimetric Reaction***

1. Remove the Streptavidin-HRP conjugate solution out of the microplate wells by either vacuum-based aspirator or paper towel blotting. Prepare the ready-to-use substrate solution by bringing it to room temperature without exposure to fluorescent or UV light as these may degrade the substrate. Perform 4 consecutive wash steps with gentle shaking between each wash.
2. After the 4<sup>th</sup> wash step, add 100 µl of ready-to-use substrate solution into each well and incubate at room temperature for color development. The microplate should be kept out of direct light by

either covering with an opaque object or putting it into a dark room. Closely monitor the color development as some wells may turn blue very quickly depending on analyte and/or detection antibody-HRP concentrations. Once the blue color has ceased to develop further, immediately add 100 µl of stop solution to each well being used. The color in the wells should immediately change from blue to yellow.

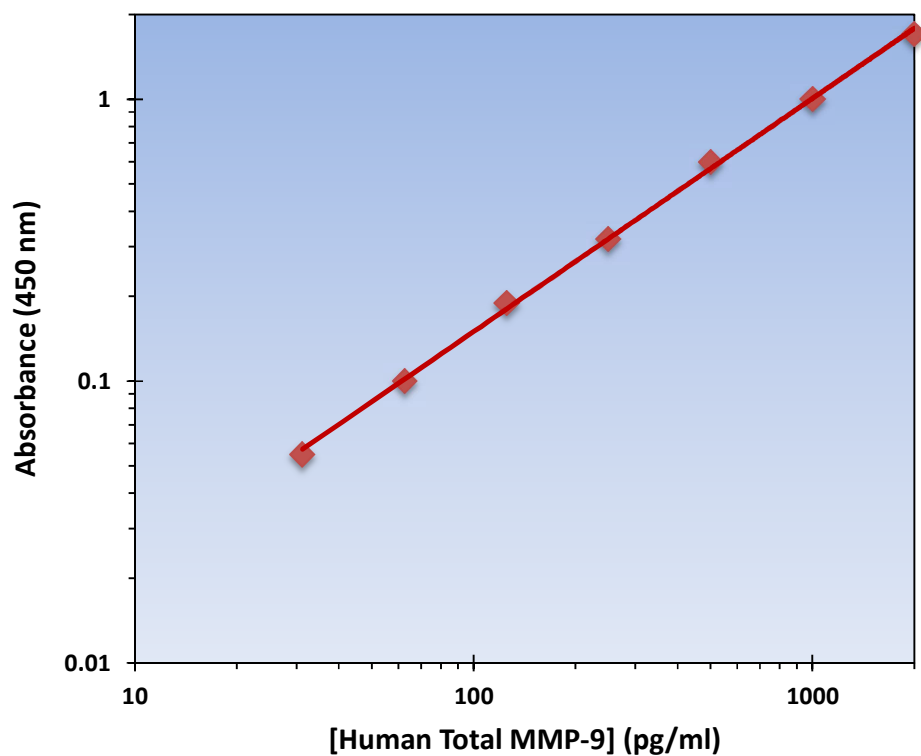
3. The microplate is now ready to be read by a microplate reader. Within 30 minutes of adding the Stop Solution, determine the optical density (absorbance) of each well by reading the plate with the microplate reader set to 450 nm. If wavelength correction is available, set to 540 nm or 570 nm. If wavelength correction is not available, subtract readings at 540 nm or 570 nm from the readings at 450 nm. **Caution:** Readings made directly at 450 nm without correction may be higher and less accurate.

### ***Generation of Standard Curve and Interpretation of Data***

1. Average the duplicate or triplicate readings for each standard, control and sample and subtract the average zero standard optical density.
2. Generate a standard curve by using Microsoft Excel or other computer software capable of establishing a 4-Parameter Logistic (4-PL) curve fit. If using Excel or an alternative graphing tool, plot the average optical density values in absorbance units (y-axis) against the known standard concentrations in pg/ml (x-axis). **Note:** Only use the values in which a noticeable gradient can be established. Afterwards, generate a best fit curve or “trend-line” through the plotted points via regression analysis. **Note:** Shown on the next page is an example of typical data produced by analysis of the standard sample.

The data and subsequent graph was obtained after performing a cytokine ELISA for Human MMP-9. Each known sample concentration was assayed in triplicate.

Human Total MMP-9 Standard Curve	
Concentration (pg/ml)	Average OD 450nm
2000	1.7
1000	1
500	0.6
250	0.32
125	0.19
62.5	0.1
31.25	0.055



## SUMMARIZED PROTOCOL

**Reconstitute Biotin-Conjugated Detection Antibody and Protein Standard and dilute the 10X Wash Buffer as specified.**



**Perform serial dilution of Protein Standard and prepare samples as desired. See sample preparation section for instructions to dilute serum and plasma samples.**



**Add 100 µl of Standard, sample or control to each well and incubate for 2 hours at room temperature.**



**Aspirate Standards, samples or controls out and wash plate 4 times.**



**Dilute Biotin-Conjugated Detection Antibody as specified. Add 100 µl to each well and incubate for 2 hours at room temperature.**



**Aspirate Biotin-Conjugated Detection Antibody out and wash plate 4 times.**



**Add 100 µl of Ready-to-Use Streptavidin-HRP to each well and incubate at room temperature for 30 minutes.**



**Aspirate Ready-to-Use Avidin-HRP out and wash plate 4 times.**



**Add 100 µl of Ready-to-Use Substrate to each well and incubate at room temperature for color development.**



**Add 100 µl of Stop Solution and read plate at 450 nm.**



## **SENSITIVITY**

The Human Total MMP-9 ELISA Kit allows for the detection and quantification of endogenous levels of natural and/or recombinant Human Total MMP-9 proteins within the range of 32-2000 pg/ml.

## **CROSS REACTIVITY AND SPECIFICITY**

The Human MMP-9 ELISA is capable of recognizing both recombinant and naturally produced Human MMP-9 proteins. The antigens listed below were tested at 50 ng/ml and did not exhibit significant cross reactivity or interference.

- **Human:** MMP-1, MMP-2, MMP-3, MMP-7, MMP-8, MMP-10, MMP-12, MMP-13, MMP-14, TIMP-2, TIMP-3, TIMP-4
- **Murine:** MMP-9

## TECHNICAL SUPPORT

For troubleshooting, information or assistance, please go online to [www.avivasysbio.com](http://www.avivasysbio.com) or contact us at:

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United States of America

Email: [info@avivasysbio.com](mailto:info@avivasysbio.com) or [techsupport@avivasysbio.com](mailto:techsupport@avivasysbio.com)

Phone: (858) 552-6979  
Toll-Free Phone: (888) 880-0001  
Fax: (858) 552-6975

ELISA PLATE TEMPLATE

A	B	C	D	E	F	G	H

## NOTES