Version 2 Last updated 18 November 2021

ab226904 Human U-Plasminogen Activator SimpleStep ELISA® Kit

For the quantitative measurement of U-Plasminogen Activator in human serum, plasma, cell culture supernatant, urine, and cell extract.

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

Table of Contents

1. Overview

U-Plasminogen Activator *in vitro* SimpleStep ELISA® (Enzyme-Linked Immunosorbent Assay) kit is designed for the quantitative measurement of U-Plasminogen Activator protein in human serum, plasma, cell culture supernatant, urine, and cell extract.

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 Development Solution 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.

U-Plasminogen Activator (also known as Urokinase-type plasminogen activator) is a secreted serine protease which activates plasminogen to plasmin. Mature U-Plasminogen Activator is a disulfide linked dimer of A and B chains. The antibodies in this kit were generated to the A chain and recognize both the A chain and the A-B dimer.

2. Protocol Summary

Prepare all reagents, samples, and standards as instructed

Add 50 µL standard or sample to appropriate wells

Add 50 µL Antibody Cocktail to all wells

Incubate at room temperature for 1 hour

Aspirate and wash each well three times with 350 µL 1X Wash Buffer PT

Add 100 µL TMB Development Solution to each well and incubate for 10 minutes.

Add 100 µL Stop Solution and read OD at 450 nm

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.
- We understand that, occasionally, experimental protocols might need to be modified to meet unique experimental circumstances. However, we cannot guarantee the performance of the product outside the conditions detailed in this protocol booklet.
- Reagents should be treated as possible mutagens and should be handled with care and disposed of properly. Please review the Safety Datasheet (SDS) provided with the product for information on the specific components.
- Observe good laboratory practices. Gloves, lab coat, and protective eyewear should always be worn. Never pipet by mouth. Do not eat, drink or smoke in the laboratory areas.
- All biological materials should be treated as potentially hazardous and handled as such. They should be disposed of in accordance with established safety procedures.

4. Storage and Stability

Store kit at +4°C immediately upon receipt. Kit has a storage time of 1 year from receipt, providing components have not been reconstituted.

Refer to list of materials supplied for storage conditions of individual components.

5. 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.

6. Materials Supplied

Item	Quantity	Storage Condition
Human U-Plasminogen Activator Capture Antibody 10X	600 µL	+4°C
Human U-Plasminogen Activator Detector Antibody 10X	600 µL	+4°C
Human U-Plasminogen Activator Lyophilized Recombinant Protein	2 Vials	+4°C
Antibody Diluent 4BI	6 mL	+4°C
Wash Buffer PT 10X	20 mL	+4°C
Cell Extraction Buffer PTR 5X	10 mL	+4°C
Cell Extraction Enhancer Solution 50X	1 mL	+4°C
TMB Development Solution	12 mL	+4°C
Stop Solution	12 mL	+4°C
Sample Diluent NS	50 mL	+4°C
Anti-tag coated microplate (12 x 8 well strips)	96 Wells	+4°C
Plate Seal	1	+4°C

7. Materials Required, Not Supplied

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

- Microplate reader capable of measuring absorbance at 450 or 600 nm.
- Method for determining protein concentration (BCA assay recommended).
- Deionized water.
- Multi- and single-channel pipettes.
- Tubes for standard dilution.
- Plate shaker for all incubation steps.
- Optional: Phenylmethylsulfonyl Fluoride (PMSF) (or other protease inhibitors).

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.
- 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.

- The provided Cell Extraction Enhancer Solution 50X may precipitate when stored at + 4°C. To dissolve, warm briefly at + 37°C and mix gently. The Cell Extraction Enhancer Solution 50X can be stored at room temperature to avoid precipitation.
- 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 Cell Extraction Buffer PTR (For cell extracts only):

Prepare 1X Cell Extraction Buffer PTR by diluting Cell Extraction Buffer PTR 5X and 50X Cell Extraction Enhancer Solution to 1X with deionized water. To make 10 mL 1X Cell Extraction Buffer PTR combine 7.8 mL deionized water, 2 mL Cell Extraction Buffer PTR 5X and 200 µL Cell Extraction Enhancer Solution 50X. Mix thoroughly and gently. If required protease inhibitors can be added.

Alternative – Enhancer may be added to 1X Cell Extraction Buffer PTR after extraction of cells or tissue. Refer to note in the Troubleshooting section.

9.2 1X Wash Buffer PT:

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

9.3 Antibody Cocktail:

Prepare Antibody Cocktail by diluting the capture and detector antibodies in Antibody Diluent 4BI. To make 3 mL of the Antibody Cocktail combine 300 µL 10X Capture Antibody and 300 µL 10X Detector Antibody with 2.4 mL Antibody Diluent 4BI. Mix thoroughly and gently.

10. Standard Preparation

- Always prepare a fresh set of standards for every use.
- Discard working standard dilutions after use as they do not store well.
- 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 U-Plasminogen Activator by adding that volume of Diluent indicated on the label. Alternatively, if the vial has a mass identified, reconstitute the U-Plasminogen Activator standard by adding 500 µL Diluent. Hold at room temperature for 10 minutes and mix gently. This is the 8,000 pg/mL **Stock Standard** Solution.

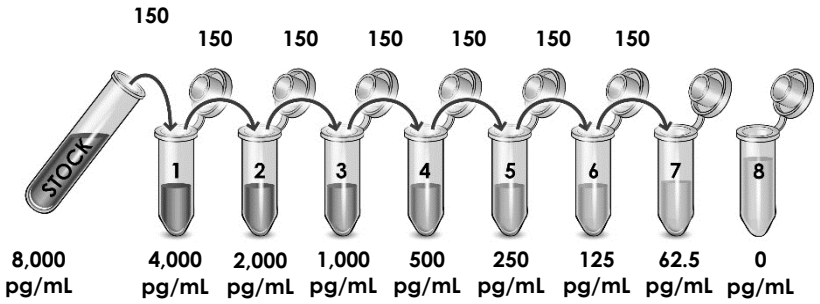
For serum, plasma, cell culture supernatant and urine sample measurements, reconstitute the U-Plasminogen Activator protein standard by adding Sample Diluent NS.

For **cell and tissue extract sample measurements**, reconstitute the U-Plasminogen Activator protein standard by adding 1X Cell Extraction Buffer PTR.

10.2 Label eight tubes, Standards 1– 8.

10.3 Add 150 µL of appropriate diluent (see step 10.1) into tube number 1-8.

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
Serum	1.6-25%
Plasma	3.1-50%
Urine	0.2-5%
HepG2 Supernatant	0.8-25%
PC-3 Cell Supernatant	1:8,000 – 1:250
PC-3 Cell Extract	2-31.3 µg/ml

11.1 Plasma:

Collect plasma using citrate, EDTA or heparin. Centrifuge samples at 2,000 x g for 10 minutes. Dilute samples at least two-fold into Sample Diluent NS 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 at least four-fold into Sample Diluent NS 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. Or dilute samples as needed into Sample Diluent NS and assay. Store un-diluted samples at -20°C or below. Avoid repeated freeze-thaw cycles.

11.4 Urine:

Centrifuge urine at 2,000 x g for 10 minutes to remove debris. Collect supernatants, dilute at least 20-fold in Sample Diluent NS and assay. Store un-diluted samples at -20°C or below. Avoid repeated freeze-thaw cycles.

11.5 Preparation of extracts from cell pellets:

11.5.1 Collect non-adherent cells by centrifugation or scrape to collect adherent cells from the culture flask. Typical centrifugation conditions for cells are 500 x g for 5 minutes at 4°C.

11.5.2 Rinse cells twice with PBS.

11.5.3 Solubilize pellet at $2x10^7$ cell/mL in chilled 1X Cell Extraction Buffer PTR.

11.5.4 Incubate on ice for 20 minutes.

11.5.5 Centrifuge at 18,000 x g for 20 minutes at 4°C.

11.5.6 Transfer the supernatants into clean tubes and discard the pellets.

11.5.7 Assay samples immediately or aliquot and store at -80°C. The sample protein concentration in the extract may be quantified using a protein assay.

11.5.8 Dilute samples to desired concentration in 1X Cell Extraction Buffer PTR.

11.6 Preparation of extracts from adherent cells by direct lysis (alternative protocol):

11.6.1 Remove growth media and rinse adherent cells 2 times in PBS.

11.6.2 Solubilize the cells by addition of chilled 1X Cell Extraction Buffer PTR directly to the plate (use 750 µL - 1.5 mL 1X Cell Extraction Buffer PTR per confluent 15 cm diameter plate).

11.6.3 Scrape the cells into a microfuge tube and incubate the lysate on ice for 15 minutes.

11.6.4 Centrifuge at 18,000 x g for 20 minutes at 4°C.

11.6.5 Transfer the supernatants into clean tubes and discard the pellets.

11.6.6 Assay samples immediately or aliquot and store at -80°C. The sample protein concentration in the extract may be quantified using a protein assay.

11.6.7 Dilute samples to desired concentration in 1X Cell Extraction Buffer PTR.

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.
- We recommend that you 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. Wash Buffer PT should remain in wells for at least 10 seconds. Complete removal of liquid at each step is essential for good performance. After the last wash invert the plate and tap gently against clean paper towels to remove excess liquid.

13.7 Add 100 µL of TMB Development Solution to each well and incubate for 10 minutes in the dark on a plate shaker set to 400 rpm.

Given variability in laboratory environmental conditions, optimal incubation time may vary between 5 and 20 minutes. Note: The addition of Stop Solution will change the color from blue to yellow and enhance the signal intensity about 3X. To avoid signal saturation, proceed to the next step before the high concentration of the standard reaches a blue color of O.D.600 equal to 1.0.

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.

13.9 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:

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

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

13.10 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.

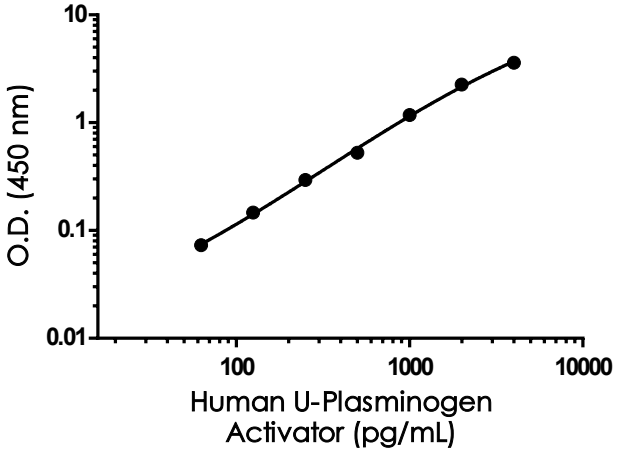
Δ **Note:** Most microplate reader software or graphing software will plot these values and fit a curve to the data. A four parameter curve fit (4PL) is often the best choice; however, other algorithms (e.g. linear, semi-log, log/log, 4 parameter logistic) can also be tested to determine if it provides 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.

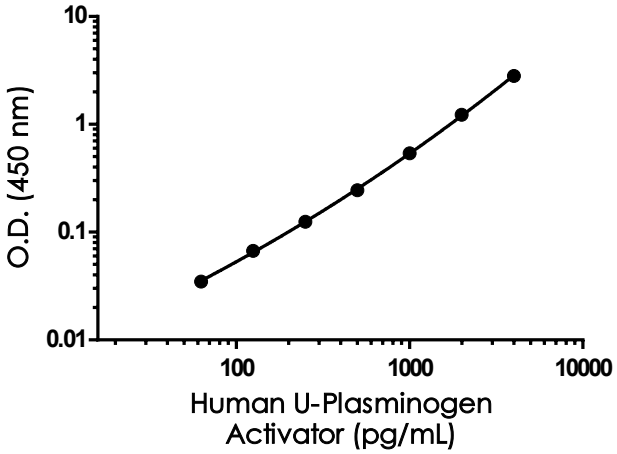
15. Typical Data

Typical standard curve – data provided **for demonstration purposes only**. A new standard curve must be generated for each assay performed.



Standard Curve Measurements			
Concentration (pg/mL)	O.D 450 nm		Mean O.D
	1	2	
0	0.063	0.065	0.063
62.5	0.140	0.132	0.136
125	0.210	0.209	0.209
250	0.358	0.356	0.357
500	0.579	0.598	0.589
1000	1.220	1.260	1.240
2000	2.279	2.364	2.321
4000	3.645	3.674	3.660

Figure 1. Example of human U-Plasminogen Activator standard curve in Sample Diluent NS. The U-Plasminogen Activator standard curve was prepared as described in Section 10. Raw data values are shown in the table. Background-subtracted data values (mean +/- SD) are graphed.



Standard Curve Measurements			
Concentration (pg/mL)	O.D 450 nm		Mean O.D
	1	2	
0	0.067	0.058	0.062
62.5	0.095	0.099	0.097
125	0.127	0.132	0.29
250	0.188	0.187	0.187
500	0.312	0.301	0.307
1000	0.611	0.590	0.600
2000	1.303	1.269	1.286
4000	2.888	2.870	2.879

Figure 2. Example of human U-Plasminogen Activator standard curve in 1X Cell Extraction Buffer PTR. The U-Plasminogen Activator standard curve was prepared as described in Section 10. 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 44 pg/mL in Sample Diluent NS. The calculated minimal detectable dose (MDD) is 4 pg/mL in 1X Cell Extraction Buffer PTR. The MDD was determined by calculating the mean of zero standard replicates (n=25) and adding 2 standard deviations then extrapolating the corresponding concentration.

RECOVERY –

Three concentrations of purified U-Plasminogen Activator were spiked in duplicate to the indicated biological matrices to evaluate signal recovery in the working range of the assay.

Sample Type	Average % Recovery	Range (%)
Serum (25%)	87	85-90
Plasma – Citrate (25%)	89	89-90
Plasma – Heparin (25%)	87	86-88
Plasma – EDTA (25%)	91	88-93
Urine (1.3%)	106	97-115
HepG2 Supernatant (6.3%)	106	98-113
PC-3 Supernatant (0.1%)	108	96-113
PC-3 Cell Extract	84	83-86

Linearity of Dilution

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.

Recombinant U-Plasminogen Activator was spiked into the following biological samples and diluted in a 2-fold dilution series in Sample Diluent NS.

Dilution Factor	Interpolated value	25% Human Serum	50% Human Plasma (Citrate)	50% Human Plasma (Heparin)	50% Human Plasma (EDTA)
Undiluted	pg/mL	3439	3220	3206	3239
	% Expected value	100	100	100	100
2	pg/mL	3508	3482	3354	3362
	% Expected value	102	108	105	104
4	pg/mL	3563	3488	3350	3139
	% Expected value	104	108	105	97
8	pg/mL	3758	3648	3685	3640
	% Expected value	109	113	115	112
16	pg/mL	3868	3961	3967	3683
	% Expected value	112	123	124	114

Native U-Plasminogen Activator was measured in the following biological samples in a 2-fold dilution series. Urine and HepG2 and PC-3 supernatant sample dilutions are made in Sample Diluent NS. PC-3 Cell Extract sample dilutions are made in 1X Cell Extraction Buffer PTR.

Dilution Factor	Interpolated value	5% Human Urine	25% HEPG2 Cell Culture Supernatant	1:250 PC-3 Cell Culture Supernatant	31.25 µg/ml PC-3 Cell Extract
Undiluted	pg/mL	3614	2543	3498	4163
	% Expected value	100	100	100	100
2	pg/mL	3535	2260	3344	4408
	% Expected value	98	89	96	106
4	pg/mL	3495	2304	3261	4900
	% Expected value	97	91	93	118
8	pg/mL	3495	2471	3411	4876
	% Expected value	97	97	97	117
16	pg/mL	4077	2559	3502	5099
	% Expected value	113	101	100	122

PRECISION –

Mean coefficient of variations of interpolated values from three concentrations of human urine within the working range of the assay.

	Intra-Assay	Inter-Assay
n =	5	3
CV(%)	1.7	2.6

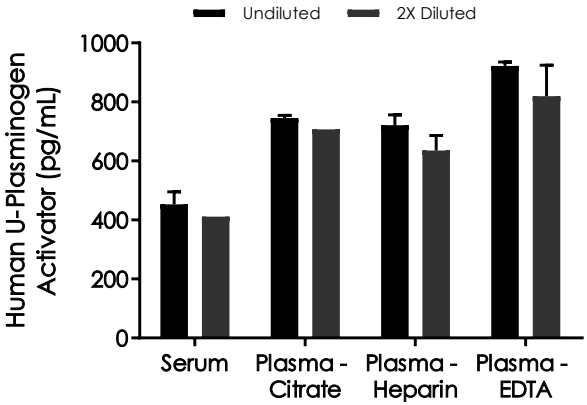


Figure 3. Interpolated concentrations of **native** U-Plasminogen Activator in human serum and plasma samples. The concentrations of U-Plasminogen Activator were measured in duplicates, interpolated from the U-Plasminogen Activator standard curves and corrected for sample dilution. Undiluted samples are as follows: serum 25%, plasma (citrate) 25%, plasma (heparin) 25%, and plasma (EDTA) 25%. The interpolated dilution factor corrected values are plotted (mean +/- SD, n=2). The mean U-Plasminogen Activator concentration was determined to be 439 pg/mL in serum, 732 pg/mL in plasma (citrate), 678 pg/mL in plasma (heparin), and 871 pg/ml in plasma (EDTA).

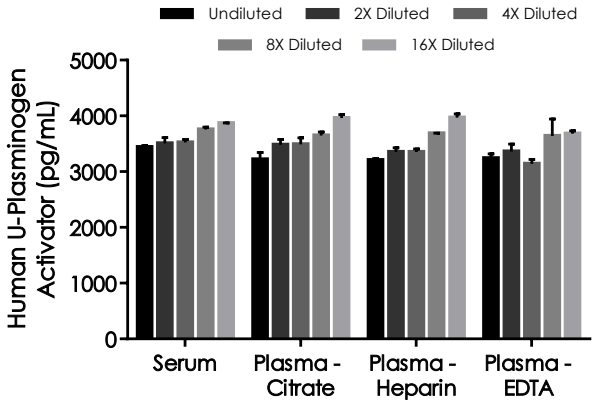


Figure 4. Interpolated concentrations of **spiked** U-Plasminogen Activator in human serum and plasma samples. The concentrations of U-Plasminogen Activator were measured in duplicates, interpolated from the U-Plasminogen Activator standard curves and corrected for sample dilution. Undiluted samples are as follows: serum 25%, plasma (citrate) 50%, plasma (heparin) 50%, and plasma (EDTA) 50%. The interpolated dilution factor corrected values are plotted (mean +/- SD, n=2).

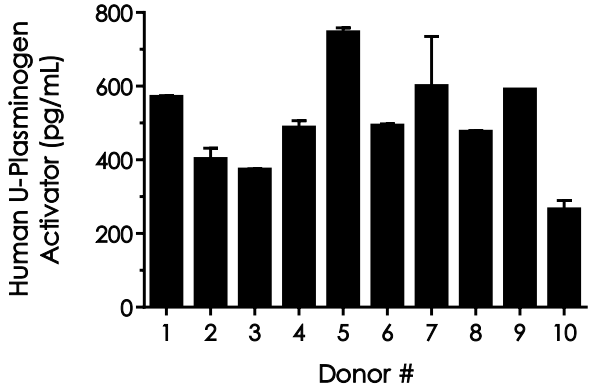


Figure 5. Serum from ten individual healthy human male donors was measured in duplicate. Interpolated dilution factor corrected values are plotted (mean +/- SD, n=2). The mean U-Plasminogen Activator concentration was determined to be 500 pg/mL with a range of 265 – 745 pg/mL.

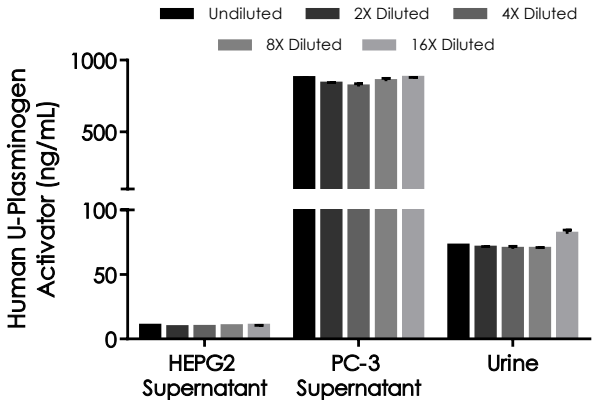


Figure 6. Interpolated concentrations of native U-Plasminogen Activator in human HEPG2 and PC-3 cell culture supernatant and Urine samples. The concentrations of U-Plasminogen Activator were measured in duplicates, interpolated from the U-Plasminogen Activator standard curves and corrected for sample dilution. Undiluted samples are as follows: HepG2 supernatant 25%, PC-3 supernatant 1:250, and Urine 5%. The interpolated dilution factor corrected values are plotted (mean +/- SD, n=2). The mean U-Plasminogen Activator concentration was determined to be 10 ng/mL in HepG2 supernatant, 865 ng/mL in PC-3 supernatant, and 73 ng/mL in Urine.

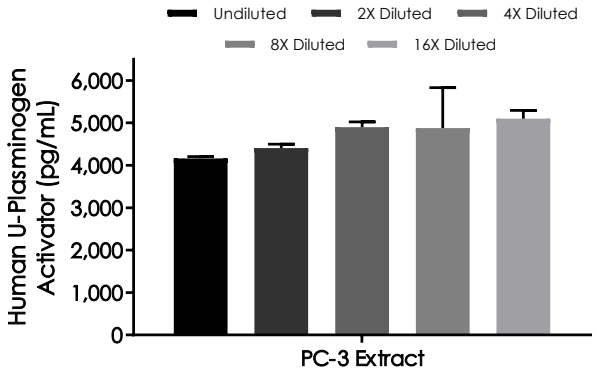


Figure 7. Interpolated concentrations of native U-Plasminogen Activator in human PC-3 Cell Extract based on a 31.3 µg/mL extract load. The concentrations of U-Plasminogen Activator were measured in duplicate and interpolated from the U-Plasminogen Activator standard curve and corrected for sample dilution. The interpolated dilution factor corrected values are plotted (mean +/- SD, n=2). The mean U-Plasminogen Activator concentration was determined to be 4689 pg/mL in PC-3 Cell Extract.

17. Assay Specificity

This kit recognizes both native and recombinant human U-Plasminogen Activator protein in serum, plasma, urine, cell culture supernatant, and cell extract samples only.

Tissue supernatant and tissue extract samples have not been tested with this kit.

CROSS REACTIVITY

Recombinant Human PAI-1 and Human Plasminogen were prepared at 4000 pg/mL and assayed for cross reactivity. No cross-reactivity was observed.

INTERFERENCE

Recombinant Human PAI-1 and Human Plasminogen were prepared at 2000 pg/mL and tested for interference. No interference with Huma U-Plasminogen activator was observed.

18. Species Reactivity

This kit recognizes human U-Plasminogen Activator protein.

Other species reactivity was determined by measuring four-fold-diluted serum samples and 20-fold-diluted urine samples of various species. No cross-reactivity was observed in mouse, rat, and bovine serum or mouse urine.

Please contact our Technical Support team for more information.

19. Troubleshooting

Problem	Reason	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 Development Solution protected from light.
Precipitate in Diluent	Precipitation and/or coagulation of components within the Diluent.	Precipitate can be removed by gently warming the Diluent to 37°C.

Technical Support

For all technical or commercial enquiries please go to:

www.abcam.com/contactus
www.abcam.cn/contactus (China)
www.abcam.co.jp/contactus (Japan)