ARBOR ASSAYS™
Interactive Assay Solutions™

MULTI SPECIES

DetectX®

Glutathione
Colorimetric Detection Kit

4 Plate Kit Catalog Number K006-H1

Species Independent

Sample Types Validated:

Whole Blood, Serum, Plasma, Erythrocytes, Urine, Cell Lysates and Tissue Samples

Please read this insert completely prior to using the product.
For research use only. Not for use in diagnostic procedures.

www.ArborAssays.com

K006-H WEB 230123

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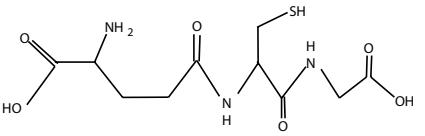
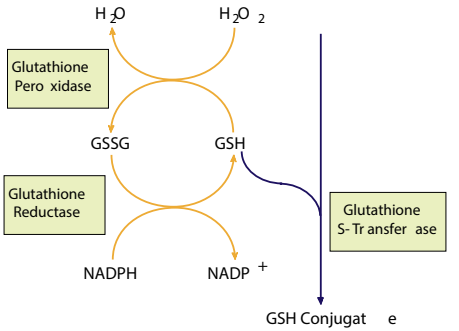
BACKGROUND

Glutathione (L-γ-glutamyl-L-cysteinylglycine; GSH) is the highest concentration non-protein thiol in mammalian cells and is present in concentrations of 0.5 – 10 mM[1]. GSH plays a key role in many biological processes, including the synthesis of proteins and DNA, the transport of amino acids, and the protection of cells against oxidation. Harmful hydrogen peroxide cellular levels are minimized by the enzyme glutathione peroxidase (GP) using GSH as a reductant[2].



The oxidized GSH dimer, GSSG, is formed from GSH and peroxide by the GP reaction (see below). An important role of GSSG in the NF*K*ß activating signal cascade is suggested by the facts that the potent NF*K*ß inducer, tetradecanoyl phorbol acetate, increases intracellular GSSG levels and GSSG/GSH ratios[3].



Glutathione S-transferases (GST) are an important group of enzymes that catalyze the nucleophilic addition of GSH to electrophiles. They are encoded by 5 gene families; 4 encode cytosolic GST and one encodes the microsomal form of GST. They have been implicated in a number of diseases. In asthma arachidonic acid is converted to unstable leukotriene A_4 (LTA_4). LTA_4 is either hydrated to form LTB_4 or it is conjugated to GSH by a GST, leukotriene C_4 synthase, to form leukotriene C_4. LTC_4 and its derivative LTD_4 are important molecules in bronchial asthma. Leukotriene C_4 synthase is therefore an important therapeutic target. It has also been shown that increased expression of GSTs can lead to drug resistance. Three glutathione adducts of the drug melphalan, used to treat ovarian cancer and multiple myeloma, have been isolated from reactions involving human microsomal GSTs.

1. Meister, A. (1988). On the discovery of glutathione. *Trends in Biochemical Science, 13*(5), 185-188.
2. Meister, A. (1994). The glutathione-ascorbic acid antioxidant systems in animals. *Journal of Biological Chemistry, 269*(13), 9397-9400.
3. Dröge W, et al. (1994). Functions of glutathione and glutathione disulfide in immunology and immunopathology. *The FASEB Journal, 8*, 1131-1138.

ASSAY PRINCIPLE

The DetectX® Glutathione kit is designed to quantitatively measure glutathione (GSH), and oxidized glutathione (GSSG) present in a variety of samples. No separation or washing is required. Please read the complete kit insert before performing this assay. A GSSG standard is provided to generate a standard curve for the assay and all samples should be read off the standard curve.

The kit utilizes a colorimetric substrate that reacts with the free thiol group on GSH to yield a highly colored product. Supplied reagents are in solution and require simple dilution for use in the assay. By using 2-Vinylpyridine (not supplied) to block any free GSH in the sample, Oxidized Glutathione (GSSG) can be determined. Any samples that have not been treated with 2-Vinylpyridine will yield Total GSH levels. The Free GSH concentration in the sample is calculated from the difference between the Total GSH determined and the GSH generated from Oxidized Glutathione for the 2-Vinylpyridine treated samples. The concentration of GSH can be determined either as an endpoint read of the color developed at 405 nm or by measuring the rate of color development at 405 nm.

Our Fluorescent Glutathione kits (Catalog Numbers K006-F1 and K006-F5) allow the measurement of both Free and Oxidized Glutathione with higher sensitivity in the same sample in the same well without using 2-Vinylpyridine.

RELATED PRODUCTS

Kits	Catalog No.
Glutathione Fluorescent Detection Kit	K006-F1/F5
Glutathione S-Transferase Fluorescent Activity Kit	K008-F1
Glutathione Reductase Fluorescent Activity Kit	K009-F1

Reagents	Catalog No.
Glutathione Mouse Monoclonal Antibody, 50 µg Mouse IgG2a, Clone L4H raised to glutathione conjugated to KLH Applications: Western blotting, Immunoassay and Immunoprecipitation	A001-50UG
DyLight® 488 Glutathione Mouse Monoclonal Antibody, 50 µg Purified monoclonal labeled with a stable FITC like fluorescent dye Applications: Flow cytometry and direct immunofluorescence	A001F-50UG

SUPPLIED COMPONENTS

Clear Half Area 96 Well Plate

See www.arborassays.com/resources/#general-info for plate dimension data.

4 Plates Catalog Number X018-4EA

Oxidized Glutathione Standard

Oxidized Glutathione at 250 µM in a special stabilizing solution.

350 µL Catalog Number C020-350UL

Detection Reagent Concentrate

Detection substrate in DMSO.

1 mL Catalog Number X041-1ML

Assay Buffer

A phosphate buffer containing chelators and stabilizers.

225 mL Catalog Number X040-225ML

NADPH Concentrate **Must be stored at -20°C.**

Reduced ß-nicotinamide adenine dinucleotide 2'-phosphate (NADPH) as a stable solution.

1 mL Catalog Number X043-1ML

Glutathione Reductase Conc.

Glutathione Reductase (GR) as a stable solution.

1 mL Catalog Number X130-1ML

STORAGE INSTRUCTIONS

The unopened kit must be stored at -20°C.

Once opened the kit can be stored at 4°C up to the expiration date on the kit label**, except for the NADPH Concentrate which must be stored at -20°C.**

OTHER MATERIALS REQUIRED

Distilled or deionized water.

Repeater pipet with disposable tips capable of dispensing 25 µL.

Aqueous 5-sulfo-salicylic acid dihydrate (SSA) solution at 5% weight/volume (1g of SSA per 20 mL of water) for treating samples to remove protein. We recommend Sigma-Aldrich Catalog Number S2130.

2-Vinylpyridine (2VP) is used to block any free GSH or other thiols present in the treated samples. 2VP is prepared by adding 27 µL of 2-vinylpyridine (such as Sigma Catalog Number 132292) to 98 µL of ethanol. Use immediately and discard remaining unused solutions.

A 96 well plate reader capable of reading optical absorption at 405-412 nm.

Software for converting raw optical density readings from the plate reader and carrying out four parameter logistic curve (4PLC) fitting. Contact your plate reader manufacturer for details.

PRECAUTIONS

As with all such products, this kit should only be used by qualified personnel who have had laboratory safety instruction. The complete insert should be read and understood before attempting to use the product.

Sulfosalicylic acid is a strong acid solution and should be treated like any other laboratory acid.

2VP is TOXIC and may cause burns. 2VP solutions should be prepared in a fume hood. Use immediately and discard remaining unused solutions by mixing with copious amounts of water.

Dimethyl sulfoxide is a powerful aprotic organic solvent that has been shown to enhance the rate of skin absorption of skin-permeable substances. Wear protective gloves when using the solvent especially when it contains dissolved chemicals.

SAMPLE TYPES

GSH is identical across species and we expect this kit may measure GSH from sources other than human. The end user should evaluate recoveries of GSH in samples from other species being tested.

If samples need to be stored after collection, we recommend storing them at -70°C or lower, preferably after being frozen in liquid nitrogen. This assay has been validated for human whole blood, serum, EDTA and heparin plasma, urine, and isolated erythrocytes. Most cell lysates and tissue homogenates should also be compatible. Samples containing visible particulate should be centrifuged prior to using.

All samples will be deproteinized with 5% SSA (see page 6 for preparation), please see sample specific information below for details. This treatment removes any protein thiols present in the samples and also slows oxidation of free GSH.

SAMPLE PREPARATION

All samples must be treated with the SSA solution prepared on page 6. All of the SSA treated centrifuged supernatants must have their SSA concentration brought down to 1% SSA by dilution with Assay Buffer. Further dilutions of the sample, using Sample Diluent (see page 9 for preparation), may be necessary to allow the GSH concentration to be measurement in the assay. Detailed instructions follow.

All samples and standards must be in Sample Diluent before starting the assay

To measure Oxidized Glutathione in samples, reduced Glutathione (GSH) in the sample must be blocked by treatment with 2-vinylpyridine, 2VP (see page 6 for preparation). SSA treated samples should be treated with 2VP by addition of 5 µL of 2VP solution for every 250 µL of sample (see page 9). 2VP treated samples must be read off a standard curve made with 2VP-treated standards. **Use all samples within 2 hours of dilution.**

Whole Blood, Serum, EDTA or Heparin Plasma, or Urine

Thoroughly mix sample with an equal volume of cold 5% SSA. Incubate for 10 minutes at 4°C. Centrifuge at 14,000 rpm for 10 minutes at 4°C. Collect the supernatant. If the supernatent contains particulates, re-centrifuge the supernatant for 15 minutes and collect the clarified second supernatant. Samples can be stored in aliquots at ≤ -70°C or analyzed immediately. At this point the SSA concentration will be 2.5%.

The supernatant must be diluted 1:2.5 with Assay Buffer by mixing one part with 1.5 parts of Assay Buffer to bring the SSA concentration to 1%. The sample will have been diluted 1:5 at this point.

All final dilutions are made in Sample Diluent. Treated Whole Blood must be further diluted at least 1:20 for a recommended final dilution of ≥ 1:100. For Treated Plasma and Treated Urine a final dilution of ≥ 1:5 is recommended, but further dilutions in Sample Diluent may be necessary.

Tissue Samples

Fresh tissue is washed with ice cold PBS to remove blood then blotted on filter paper before recording wet weight. **NOTE: Samples that have been frozen will contain lysed cells. The PBS wash may contain substantial amounts of GSH and/or GSSG.**

- For Samples Where a Protein Determination is to be Obtained: Homogenize at 10 mg/250 µL in ice cold 100mM phosphate buffer, pH 7. Centrifuge at 14,000 rpm for 10 minutes at 4°C and remove an aliquot of the supernatant for protein determination. Thoroughly mix a second aliquot of the supernatant with an equal volume of cold 5% SSA. Incubate for 10 minutes at 4°C. Centrifuge at 14,000 rpm for 10 minutes at 4°C to remove precipitated protein. Collect the supernatant. The supernatant must be diluted 1:2.5 with Assay Buffer by mixing one part with 1.5 parts of Assay Buffer. The SSA concentration will be 1%.
- For Samples Not Requiring a Protein Determination: Homogenize at 10 mg/250 µL in ice cold 5% SSA, incubate at 10 minutes at 4°C, then centrifuge at 14,000 rpm for 10 minutes at 4°C to remove precipitated protein. Collect the supernatant. The supernatant must be diluted 1:5 with Assay Buffer by mixing one part with 4 parts of Assay Buffer. The SSA concentration will be 1%.

Further sample dilutions must be determined by the end-user since it will be dependent upon the tissue type and the amount of tissue used. These dilutions must be made in the prepared Sample Diluent.

Erythrocytes, Red Blood Cells (RBC's)

Collect blood with heparin or EDTA. Centrifuge the sample, remove and discard the plasma and white cell layer. Wash the RBC's 2 times by suspending in 3 volumes of isotonic saline (0.9%), centrifuging at 600 x g for 10 minutes and discarding the saline wash.

After the 2 washes, mix 250 µL RBC's with 1mL of cold 5% SSA. Incubate for 10 minutes at 4°C and centrifuge at 14,000 rpm for 10 minutes at 4°C. Collect the supernatant. At this point the SSA concentration will be 4%. The supernatant must be diluted 1:4 with Assay Buffer by mixing one part with 3 parts of Assay Buffer. The SSA concentration will now be 1% and the sample will have been diluted 1:20 at this point. Further dilutions are made in Sample Diluent for a recommended final dilution of ≥ 1:40.

Cell Lysates

Washed cell pellets are resuspended at 1-10x10^6 cells/mL in cold 5% SSA (we used Jurkats at 5x10^6 cells/mL) and are lysed and deproteinized by vigorous vortexing, freeze/thaw cycling or other suitable disruption method. Incubate cells at 4°C for 10 minutes followed by centrifugation for 10 minutes at 14,000 rpm and 4°C. **NOTE: Samples that have been frozen will contain lysed cells. The PBS wash may contain substantial amounts of GSH and/or GSSG.**

The deproteinized supernatants must be diluted 1:5 with Assay Buffer by mixing one part with 4 parts of Assay Buffer. The SSA concentration will be 1%. The sample will have been diluted 1:5 at this point. Further sample dilutions must be done in Sample Diluent and need to be determined by the end-user since it will be dependent upon the cell type and number of cells used. The recommended final dilution is ≥ 1:20.

Use all samples within 2 hours of dilution.

REAGENT PREPARATION

Allow the kit reagents to come to room temperature for 30 minutes. We recommend that all standards and samples be run in duplicate to allow the end user to accurately determine GSH concentrations. Ensure that all samples have reached room temperature and have been diluted as appropriate prior to running them in the kit.

Sample Diluent

Prepare the Sample Diluent by diluting one part 5% SSA 1:5 with four parts Assay Buffer and vortex thoroughly. The pH of the Sample Diluent **must** be > 4. Sample Diluent can be stored at 4°C for one month.

2-Vinylpyridine Treatment

To measure Oxidized Glutathione, free GSH must be blocked by alkylation. To 250 µL of SSA treated samples, standards or Sample Diluent add 5 µL of the ethanolic solution of 2VP (see page 6) and allowed to incubate at room temperature for 1 hour. The 2VP treated samples and standards should then be diluted in Assay Buffer and Sample Diluent according to the dilutions recommended for each sample type on pages 7 and 8 prior to using in the assay. The 2VP treated Sample Diluent is used for the zero standard on page 11. **Samples treated with 2VP should be read off a standard curve generated with 2VP treated standards**.

Colorimetric Detection Reagent

Prepare the Colorimetric Detection Reagent by diluting one part Colorimetric Detection Reagent Concentrate 1:10 with nine parts Assay Buffer. See Colorimetric Detection Reagent Dilution Table for suitable volumes.

Colorimetric Detection Reagent Dilution Table

	1/2 Plate	One Plate	Two Plates	Four Plates
Colorimetric Detection Concentrate	140 µL	260 µL	500 µL	1 mL
Assay Buffer	1.26 mL	2.34 mL	4.5 mL	9 mL
Total Colorimetric Reagent Volume	1.4 mL	2.6 mL	5 mL	10 mL

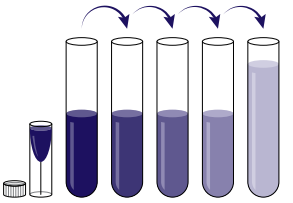
Reaction Mixture

Prepare the Reaction Mixture by diluting one part each NADPH and Glutathione Reductase Concentrates 1:10 into eight parts Assay Buffer. See Reaction Mix Dilution Table for suitable volumes. Store any unused Reaction Mixture at 4°C for no more than 2 days.

Reaction Mix Dilution Table

	1/2 Plate	One Plate	Two Plates	Four Plates
NADPH Concentrate	140 µL	260 µL	500 µL	1 mL
Glutathione Reductase Concentrate	140 µL	260 µL	500 µL	1 mL
Assay Buffer	1.12 mL	2.08 mL	4 mL	8 mL
Total Reaction Mix Volume	1.4 mL	2.6 mL	5 mL	10 mL

Standard Preparation



For the measurement of Oxidized Glutathione (GSSG), a 50 µL aliquot of the 250 µM Oxidized Glutathione Standard should be treated with 1 µL of 2VP as outlined on page 9. 2VP-treated Standards are prepared by labeling test tubes as #1 through #6. Pipet 475 µL of Sample Diluent into tube #1 and 250 µL into tubes #2 to #6. Carefully add 25 µL of the 2VP-treated Standard to tube #1 and vortex completely. Take 250 µL of the solution in tube #1 and add it to tube #2 and vortex completely. Repeat this for tubes #3 through #6. The concentration of Oxidized Glutathione in tubes 1 through 6 will be 12.5, 6.25, 3.125, 1.56, 0.781 and 0.391 µM. The concentration of Total GSH in tubes 1 through 6 will be 25, 12.5, 6.25, 3.125, 1.56, and 0.781 µM after addition of the Reaction Mixture. 2VP treated Sample Diluent **must** be used as a 0 µM standard.

To determine Total GSH, the Standards are prepared by labeling test tubes as #1 through #6. Pipet 475 µL of Sample Diluent into tube #1 and 250 µL into tubes #2 to #6. Carefully add 25 µL of the supplied Standard to tube #1 and vortex completely. Take 250 µL of the solution in tube #1 and add it to tube #2 and vortex completely. Repeat this for tubes #3 through #6. The concentration of Total GSH in tubes 1 through 6 will be 25, 12.5, 6.25, 3.125, 1.56, and 0.781 µM after addition of the Reaction Mixture. Sample Diluent **must** be used as a 0 µM standard.

Use all Standards within 2 hours of preparation.

	Std 1	Std 2	Std 3	Std 4	Std 5	Std 6
Sample Diluent Volume (µL)	**475**	250	250	250	250	250
Addition	Stock	Std 1	Std 2	Std 3	Std 4	Std 5
Volume of Addition (µL)	**25**	250	250	250	250	250
GSSG Conc (µM)	12.5	6.25	3.125	1.56	0.781	0.391
Total GSH Conc (µM)	25	12.5	6.25	3.125	1.56	0.781

ASSAY PROTOCOL - END POINT

For Oxidized Glutathione (GSSG) use the 2VP treated standards, 2VP treated Sample Diluent and 2VP treated samples diluted with Sample Diluent as described previously.

For Total Glutathione use the standards and samples diluted with Sample Diluent as described previously.

1. Use the plate layout sheet on the back page to aid in proper sample and standard identification.
2. Pipet 50 µL of either 2VP treated or untreated samples or standards into duplicate wells in the plate.
3. Pipet 50 µL of either 2VP treated or untreated Sample Diluent into duplicate wells as the Zero standard.
4. Add 25 µL of the Colorimetric Detection Reagent to each well using a repeater pipet.
5. Add 25 µL of the Reaction Mixture to each of the wells using a repeater pipet.
6. Gently tap the sides of the plate to ensure adequate mixing of the reagents.
7. Incubate at room temperature for 20 minutes.
8. Read the optical density at 405 nm. These data will be used to determine either Oxidized Glutathione or Total Glutathione concentration.

ASSAY PROTOCOL - KINETIC

1. Carry out **steps 1-4** above.
2. Gently tap the sides of the plate to ensure adequate mixing of the reagents.
3. Add 25 µL of the Reaction Mixture to each of the wells using a repeater and immediately place plate in reader and read optical density at 405 nm every minute for at least 10 minutes. These data will be used to determine Total or Oxidized Glutathione concentration kinetically.

CALCULATION OF RESULTS

Average the duplicate optical density readings for each standard and sample. Create a standard curve by reducing the data using the 4PLC fitting routine on the plate reader, after subtracting the mean ODs for the zero standard. The concentrations obtained should be multiplied by the dilution factor to obtain sample values.

Or use the online tool from MyAssays to calculate the data:
www.myassays.com/arbor-assays-glutathione-colorimetric-detection-kit.assay

Glutathione concentrations (see below) are calculated from the data using the curve fitting routine supplied with the plate reader.

Oxidized Glutathione concentrations of the samples are determined from the data obtained from 2VP-treated samples read off a 2VP-treated standard curve. The concentration of Oxidized Glutathione (GSSG) in the samples would be half of the GSH concentration read off the curve.

Note: 1 GSSG = 2 GSH

Free glutathione (GSH) concentrations are obtained by subtracting the Oxidized Glutathione (GSSG) levels obtained from the 2VP treated standard and samples from non-treated standards and samples (Total GSH). Concentrations obtained will be in µM of Glutathione.

Total GSH = Free GSH + Oxidized GSH (GSSG)

$$\textbf{Oxidized GSH} = \frac{\textbf{(measured 2VP Treated GSH concentration)}}{\textbf{2}}$$

Free GSH = Total GSH Conc. - Oxidized GSH Conc.

TYPICAL DATA - TOTAL GLUTATHIONE

Sample	Mean OD	Net OD	Total Glutathione Conc. (µM)
Zero	0.086	0	0
Standard 1	1.239	1.153	25
Standard 2	0.673	0.587	12.5
Standard 3	0.368	0.282	6.25
Standard 4	0.224	0.138	3.125
Standard 5	0.155	0.069	1.56
Standard 6	0.123	0.037	0.781
Sample 1	0.360	0.273	6.05
Sample 2	0.246	0.160	3.65

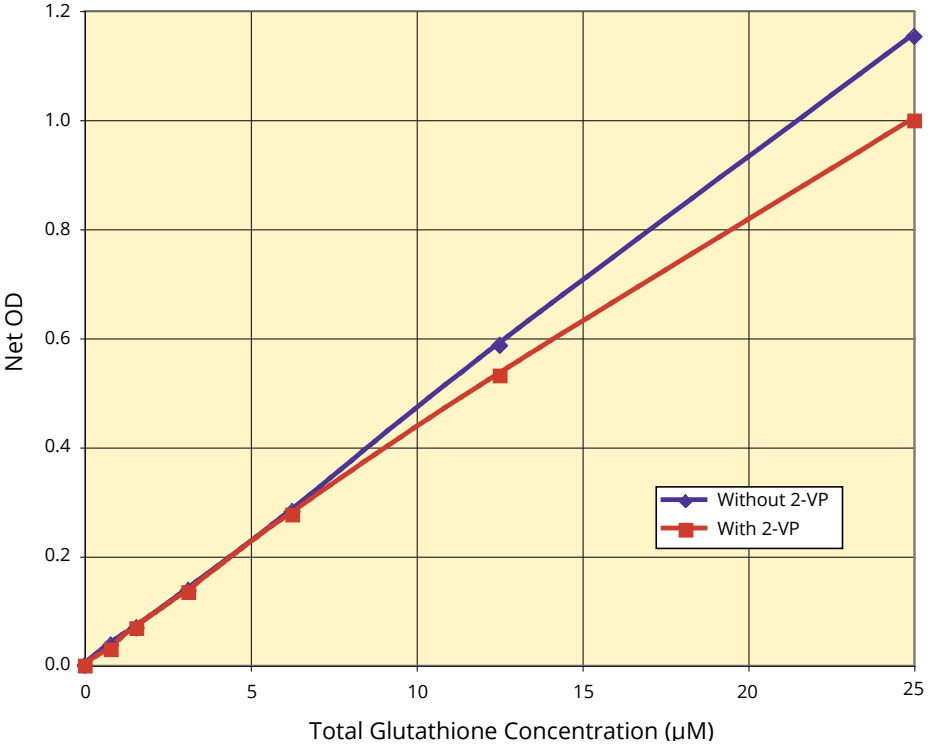
TYPICAL DATA - OXIDIZED GLUTATHIONE

Sample	Mean OD	Net OD	Total Glutathione Conc. (µM)	Oxidized Glutathione Conc. (µM)
Zero	0.087	0	0	0
Standard 1	1.086	0.999	25	12.5
Standard 2	0.619	0.532	12.5	6.25
Standard 3	0.364	0.277	6.25	3.125
Standard 4	0.222	0.135	3.125	1.52
Standard 5	0.156	0.069	1.56	0.781
Standard 6	0.117	0.030	0.781	0.391
Sample 1	0.177	0.089	-	1.02
Sample 2	0.125	0.038	-	0.48

Always run your own standard curve for calculation of results.

Do not use this data.

Typical Standard Curves



Always run your own standard curves for calculation of results. Do not use this data.

VALIDATION DATA

Sensitivity and Limit of Detection

Sensitivity was calculated by comparing the ODs for twenty wells run for each of the zero and standard #6. The detection limit was determined at two (2) standard deviations from the zero along the standard curve.

Sensitivity was determined as 0.634 µM of Glutathione. This is equivalent to 31.7 pM/well.

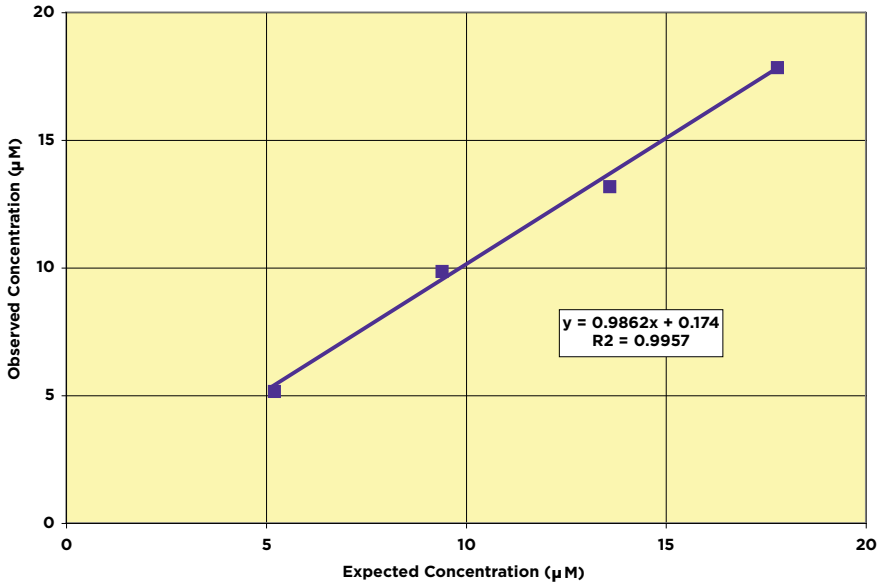
The Limit of Detection was determined in a similar manner by comparing the ODs for twenty wells run for each of the zero and a low concentration human urine sample.

The Limit of Detection was determined as 1.78 µM Glutathione. This is equivalent to 89 pM/well.

Linearity

Linearity was determined by taking Jurkat cell lysates at 25 x 10^6 cells/mL and one at 1.28 x 10^6 cells/mL, diluted 1:5, and mixed in the ratios given below. The measured concentrations were compared to the expected values based on the ratios used.

Low Cell #	High Cell #	Observed GSH Conc. (µM)	Expected GSH Conc. (µM)	% Recovery
80%	20%	5.20	5.16	99.2
60%	40%	9.40	9.86	104.9
40%	60%	13.59	13.18	97.0
20%	80%	17.79	17.84	100.3
			Mean Recovery	**100.3%**



Intra Assay Precision

Two whole blood samples and one human urine sample were SSA treated, diluted in Standard Diluent and run in replicates of 20 in an assay. The mean and precision of the calculated Total Glutathione concentrations were:

Sample	Total Glutathione Conc. (µM)	%CV
1	9.36	2.1
2	5.55	3.1
3	3.30	5.0

Inter Assay Precision

Two whole blood samples and one human urine sample were SSA treated, diluted in Standard Diluent and run in duplicates in twenty assays run over multiple days by four operators. The mean and precision of the calculated Total Glutathione concentrations were:

Sample	Total Glutathione Conc. (µM)	%CV
1	9.43	7.5
2	5.27	8.4
3	3.08	13.3

REPORTED NORMAL RANGES

Reference	Sample	Total GSH	Free GSH	GSSG
Clinical Chemistry (2002) 48/5:742-53	Whole blood	914 – 996 ± 101 µM	756-945 ± 95 µM	5.66-6.6 ± 1.55 µM
Internet Journal of Alternative Medicine (2005) 2/1	EDTA Erythro-cytes		95.2 ± 11.5 µM (n=45)	
Diabetes (1999) 48:1850-55	Erythrocytes		5.7 ± 0.3 µM/g Hgb	
Clinical Chemistry (2002) 48/5:742-53	Erythrocytes			3.27 ± 1.15 µM
J Biol. Chem. (1929) 83/2:-361-65	EDTA Plasma	7.3 ± 1.8 µM	3.4 ± 0.9 µM	
Clinical Chemistry (1987) 33/9:1675-76	Plasma	3.35 ± 1.07 µM		0.35 ± 0.14 µM
J Biol. Chem. (2007) 282/19:14337-4	Jurkat Lysate		40 ng/ mg total Protein	
FASEB J. (2000) 14:1352-61	Jurkat Lysate		15 ng/mg total Protein	

LIMITED WARRANTY

Arbor Assays warrants that at the time of shipment this product is free from defects in materials and workmanship. This warranty is in lieu of any other warranty expressed or implied, including but not limited to, any implied warranty of merchantability or fitness for a particular purpose.

We must be notified of any breach of this warranty within 48 hours of receipt of the product. No claim shall be honored if we are not notified within this time period, or if the product has been stored in any way other than outlined in this publication. The sole and exclusive remedy of the customer for any liability based upon this warranty is limited to the replacement of the product, or refund of the invoice price of the goods.

CONTACT INFORMATION

For details concerning this kit or to order any of our products please contact us:

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OFFICIAL SUPPLIER TO ISWE

Arbor Assays and the International Society of Wildlife Endocrinology (ISWE) signed an exclusive agreement for Arbor Assays to supply ISWE members with EIA kits for wildlife conservation research.

ASSAYS™
FOR SERIOUS SCIENCE

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