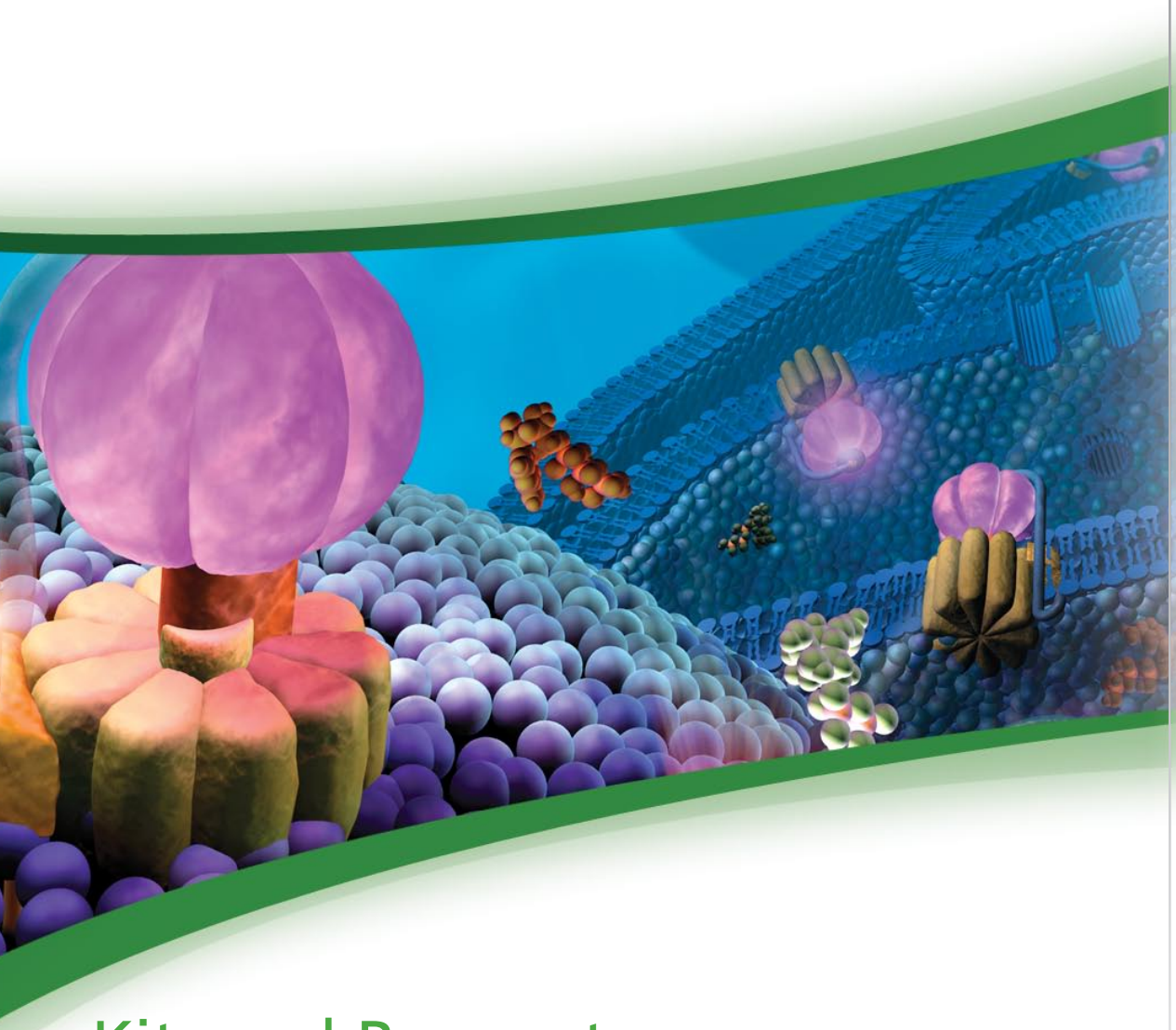
BioFiles

FOR LIFE SCIENCE RESEARCH

Issue 1, 2006

SIGMA



Kits for Quantitation of:

Albumin
Ammonia
ATP
Glucose, Fructose, and Sucrose
Glycerol & Triglyceride
Nitrate/Nitrite
Starch and Dietary Fiber

New Products

High Purity Cytochrome c
Dihydrofolate Reductase

Metabolite Libraries

Amino Acid Metabolites
Carbohydrate Metabolites

Stable Isotope Metabolites

Kits and Reagents for Metabolomic and Dietary Research

sigma-aldrich.com

SIGMA-ALDRICH

The Enzyme Explorer

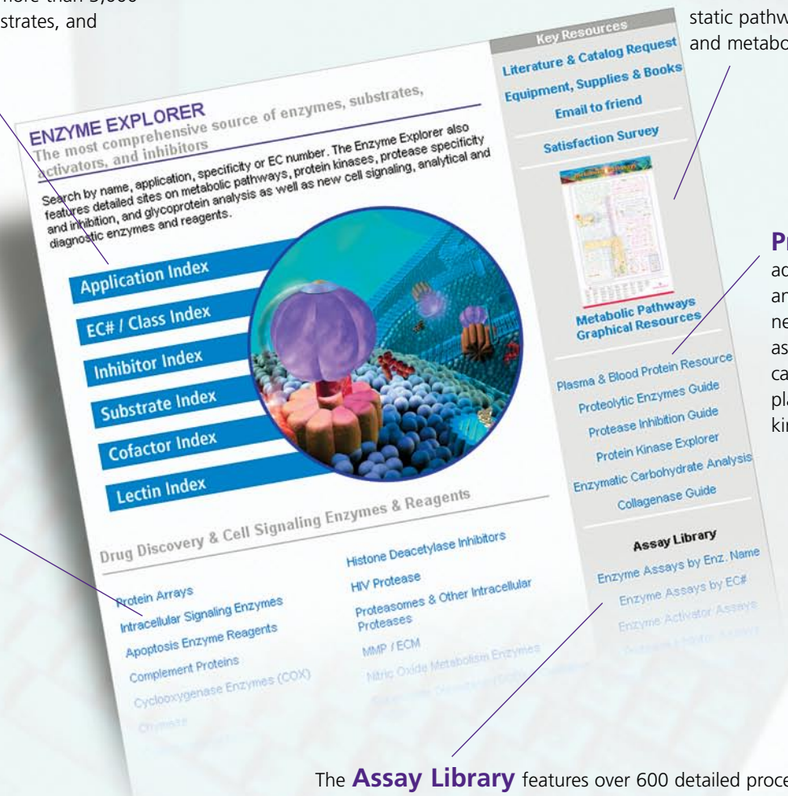
Expanded Online Resources and New Products

The **Enzyme Explorer Indices** provide paths to find more than 3,000 enzymes/proteins, substrates, and inhibitors.

The **Metabolic Pathways Resource** contains animated and static pathways with links to products and metabolite libraries.

Product Guides address the procedures and product ideas you need for applications such as protease inhibition, carbohydrate analysis, plasma chemistry, and kinase biology.

Product Highlights address specific new tools for your research.



The **Assay Library** features over 600 detailed procedures for measuring enzyme activities and related metabolites. The Library is the result of over ten years of in-house process development by Sigma.

Access the original Enzyme Explorer and discover a new dimension in online resources.
sigma-aldrich.com/enzymeexplorer

Nutrition and Metabolomics Resources

Metabolomics involves the study of all metabolites in a cell, tissue, or organism. The importance of metabolomic data has been increasingly recognized in many research areas. A detailed understanding of cellular functions and responses not only requires knowledge on the DNA, RNA, and protein level, it also requires the measurement of the products of enzymatic activities. Low-molecular weight metabolites constitute a complex network with enormous potential for practical applications. The analysis of how metabolic pathways are connected or not connected, both within a cell and between cell and environment, requires experimental methods at hand and metabolites in the bottle to quantify relationships. The involvement of key metabolites in different metabolic networks like amino acid, carbohydrate, nucleotide, and energy metabolism, utilization of cofactors and vitamins, biosynthesis, degradation of secondary metabolites, and biodegradation of xenobiotic compounds is a characteristic feature of a living cell, illustrating the complex network of biochemical reactions that are tightly connected. **(sigma-aldrich.com/metpath)**

Although there are many structural classes of metabolites, several analytical developments point towards analysis of as many metabolites as possible by a single method. Whether by a single or by multiple analytical methods, the quantitative analysis of well-defined metabolites requires the availability of these compounds in order to proceed and define data standards for comparing different experiments. Our ability to provide both natural and stable-isotope-labeled (non-radioactive) metabolites is a unique contribution towards the rapid development of this exciting research area.

Kits for Nutrient & Metabolite Quantitation

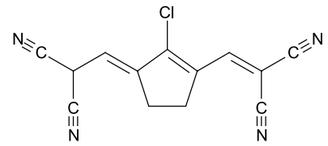
Enzymatic Kits and Reagents for the Quantitation and Characterization of Nutrients and Metabolites

Sigma manufactures several unique enzymatic-based kits for the quantitation of important nutrients and metabolites. These kits utilize spectrophotometric, fluorescent, bioluminescent, and gravimetric detection making them easy-to-use, yielding high sensitivity, and consistent results.

Albumin Fluorescence Assay Kit, Cat. No. 09753

The specific and sensitive determination of albumin in biological fluids is required in many areas of biomedical sciences. Assays suitable for the determination of low concentrations (<100 mg/L) of albumin in natural matrices are either nonspecific for albumin and determine total protein content (dye binding methods) or use complicated and costly procedures (e.g., immunoassays).

Albumin blue 580 (AB 580) is a fluorescent probe that is highly specific for albumin, with minimal binding to other proteins.[1] The Albumin Fluorescence Assay kit provides a robust, sensitive, and specific assay for albumin, and includes both human and bovine albumin references. The lower limit of detection is 0.4 mg/L albumin, with a recommended range of 1-200 mg/L. Sufficient for up to ~200 assays using 0.5 ml samples.



Albumin Blue 580

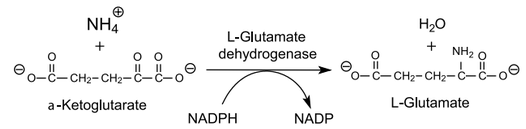
Reference

[1]Kessler M.A., et al., Albumin blue 580 fluorescence assay for albumin. *Anal. Biochem.*, **248**, 180-182 (2000)

Ammonia Assay Kit, Cat. No. AA0100-1KT

sufficient for 100 assays

For the quantitative, enzymatic determination of ammonia in food and biological samples. Ammonia reacts with α-ketoglutaric acid and NADPH in the presence of L-glutamate dehydrogenase to form L-glutamate and NADP. The decrease in absorbance at 340 nm, due to the oxidation of NADPH, is proportional to the ammonia concentration. L-Glutamate dehydrogenase reacts specifically with ammonia. The Ammonia Assay Kit is recommended for the determination of ammonia concentrations in the range of 0.02-15 µg/ml.



For hazards and other information, please refer to the Sigma Biochemicals & Reagents for Life Science Research Catalog or www.sigma-aldrich.com

Kits for Nutrient & Metabolite Quantitation

ATP Bioluminescent Assay Kit, Cat. No. FL-AA

For ATP determination in aqueous solutions

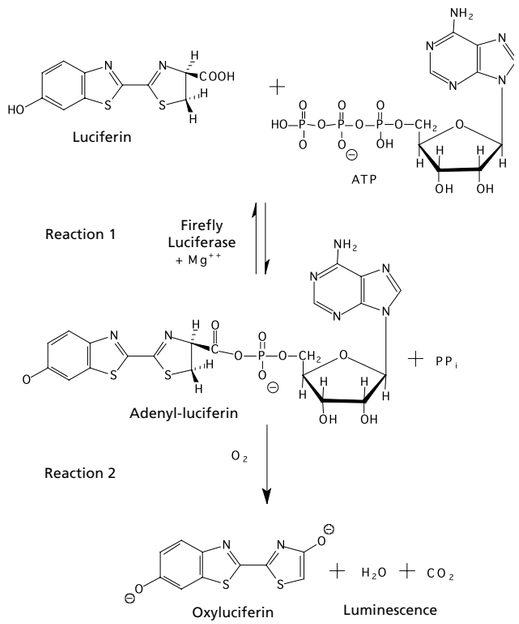
ATP Bioluminescent Somatic Cell Assay Kit, Cat. No. FL-ASC

For ATP determination in whole cells

Sigma Luciferase ATP Determination kits are effective for determining the ATP concentrations in samples ranging from 2 x 10^{-12} to 8 x 10^{-9} moles/liter for the FL-AA kit. The number of samples will vary depending on the sensitivity required. The ATP Somatic Cell Assay Kit can measure the ATP released by fewer than 10, or as many as 2 x 10^5 viable somatic cells (or a sample containing from 400 to 8 x 10^6 cells per ml). The number of samples will vary depending on the sensitivity required. Typically, a minimum of 40 samples (0.1ml) can be analyzed with each kit.

ATP is hydrolyzed and light is emitted when firefly luciferase catalyzes the oxidation of D-luciferin. Results are typically recorded using a luminometer.

Reaction (1) is reversible and the equilibrium preferentially forms adenyl-luciferin. Reaction (2) is essentially irreversible. When ATP is the limiting reagent, the light emitted is proportional to the ATP present.



Total Dietary Fiber Assay Kit, Cat. No. TDF100A-1KT

sufficient for ~100 assays

For the determination of total dietary fiber. Uses a combination of enzymatic and gravimetric methods to analyze samples of dried, defatted foods to determine soluble fiber, protein, and ash content. This procedure is based on the method published by AOAC.[1]

Reference:

[1]Official Methods of Analysis, 16th ed., AOAC, Arlington, VA, Vol. II, Sec. 45.4.07, Method 985.29, 1105 (1997).

Total Dietary Fiber Assay Procedure

Heat stable α-Amylase, incubation at pH 6.0, 15 min., 95 °C

↓

Protease incubation at pH 7.5, 30 min., 60 °C

↓

Amyloglucosidase incubation at pH 4.5, 30 min., 60 °C

↓

Ethanol precipitation of Soluble Dietary Fiber

↓

Alcohol and acetone washes

↓

Drying

↙ ↘

Kjeldahl Protein Determination → Ash Determination 5 hours, 525 °C

↘ ↙

Calculation of Total Dietary Fiber

Dietary Fiber, Total, Assay Control Kit, Cat. No. TDFC10-1KT

sufficient for ~10 assays

Set of 6 standards for use as internal controls in conjunction with the Total Dietary Fiber Assay Kit (TDF100A)

Visit the Nutrition Research & the Bioactive Nutrient Explorer at: sigma-aldrich.com/nutrition

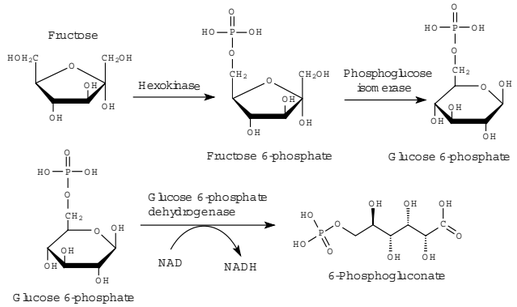
Nutrient analysis, chemoprevention, bioavailability and nutrient interactions are emerging as pathways to understanding relationships between diet and health, disease and metabolism. The Bioactive Nutrient Explorer is designed to help you identify structurally related chemicals and locate compounds found in specific plant species.

Kits for Nutrient & Metabolite Quantitation

Fructose Assay Kit, Cat. No. FA20-1KT

sufficient for 20 assays

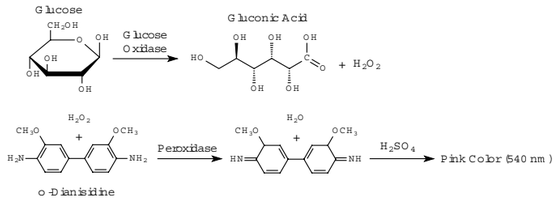
For the quantitative, enzymatic determination of fructose in food and other materials. Fructose is phosphorylated by ATP using hexokinase. Fructose 6-phosphate is then converted to glucose 6-phosphate by phosphoglucose isomerase. Glucose 6-phosphate is then oxidized to 6-phosphogluconate in the presence of NAD by glucose 6-phosphate dehydrogenase. During this oxidation, an equimolar amount of NAD is reduced to NADH. The consequent increase in absorbance at 340 nm is directly proportional to fructose concentration.



Glucose (GO) Assay Kit, Cat. No. GAGO20-1KT

sufficient for 20 assays

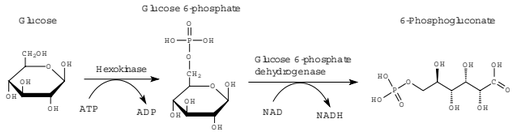
For the quantitative, enzymatic determination of glucose in food and other materials. Glucose is oxidized to gluconic acid and hydrogen peroxide by glucose oxidase. Hydrogen peroxide reacts with *o*-dianisidine in the presence of peroxidase to form a colored product. Oxidized *o*-dianisidine reacts with sulfuric acid to form a more stable colored product. The intensity of the pink color measured at 540 nm is proportional to the original glucose concentration.



Glucose (HK) Assay Kit, Cat. No. GAHK20-1KT

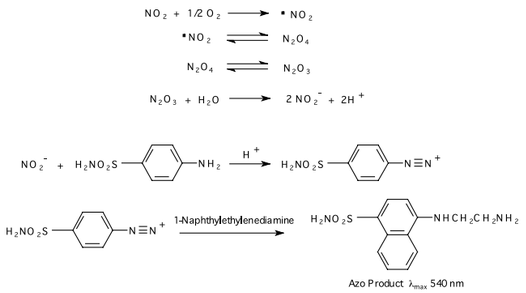
sufficient for 20 assays

For the quantitative, enzymatic determination of glucose in food and other materials. Glucose is phosphorylated by hexokinase to form glucose 6-phosphate. Glucose 6-phosphate is then oxidized to 6-phospho gluconate in the presence of NAD by glucose 6-phosphate dehydrogenase. During this oxidation, an equimolar amount of NAD is reduced to NADH. The consequent increase in absorbance at 340 nm is directly proportional to glucose concentration.



Nitrate/Nitrite Colorometric Assay Kit, Cat. No. 23479-1KT-F

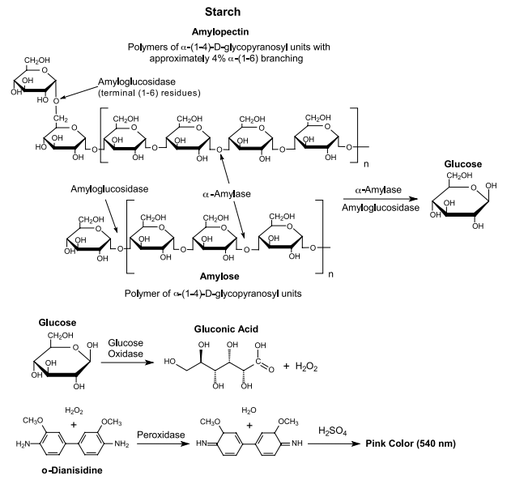
Based on the Griess assay, total NO, NO_2, and NO_3 metabolites are easily detectable using this kit. The NO_2/NO_3 Assay Kit contains indicator dyes, nitrate reductase, co-factor, buffer, and NO_2 and NO_3 standards. The NO_2 detection range is from 10 to 100 µM.



Starch (GO/P) Assay Kit, Cat. No. STA20-1KT

sufficient for 20 assays

For the quantitative, enzymatic determination of starch in food and other materials. The hydrolysis of starch to glucose is catalyzed by α-amylase and amyloglucosidase. Glucose is oxidized to gluconic acid and hydrogen peroxide by glucose oxidase. Hydrogen peroxide reacts with *o*-dianisidine in the presence of peroxidase to form a colored product. Oxidized *o*-dianisidine reacts with sulfuric acid to form a more stable colored product. The intensity of the pink color measured at 540 nm is proportional to the original glucose concentration.

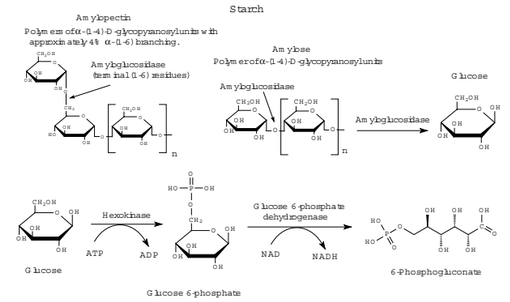


Kits for Nutrient & Metabolite Quantitation

Starch (HK) Assay Kit, Cat. No. SA20-1KT

sufficient for 20 assays

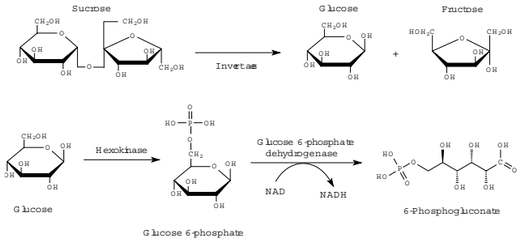
For the quantitative, enzymatic determination of native starch in food and other materials. The hydrolysis of starch to glucose is catalyzed by amyloglucosidase. Glucose is phosphorylated by hexokinase. Glucose-6-phosphate is then oxidized to 6-phosphogluconate in the presence of NAD in a reaction catalyzed by glucose 6-phosphate dehydrogenase. The increase in absorbance at 340 nm is directly proportional to the glucose concentration.



Sucrose Assay Kit, Cat. No. SCA20-1KT

sufficient for 20 assays

For the quantitative, enzymatic determination of sucrose in food and other materials. Sucrose is hydrolyzed to glucose and fructose by invertase. Glucose and fructose are phosphorylated by hexokinase. Glucose 6-phosphate is then oxidized to 6-phosphogluconate in the presence of NAD in a reaction catalyzed by glucose 6-phosphate dehydrogenase. The increase in absorbance at 340 nm is directly proportional to sucrose concentration.



Serum Triglyceride Determination Kit, Cat. No. TR0100-1KT

sufficient for 250 assays

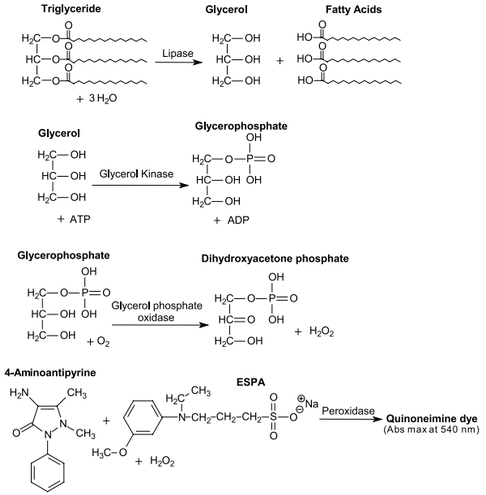
For the measurement of glycerol, true triglycerides, or total triglycerides in serum or plasma. Triglycerides are first hydrolyzed by lipoprotein lipase to glycerol and free fatty acids. Glycerol is then phosphorylated by ATP using glycerol kinase forming glycerol 1-phosphate. Glycerol 1-phosphate is then oxidized by glycerol phosphate oxidase to dihydroxyacetone phosphate and hydrogen peroxide. Peroxidase catalyzes the coupling of hydrogen peroxide with 4-aminoantipyrine and sodium N-ethyl-N-(3-sulfopropyl) *m*-anisidine (ESPA) to produce a quinoneimine dye that shows an absorbance maximum at 540 nm. The increase in absorbance at 540 nm is directly proportional to triglyceride concentration of the sample. Many of the triglyceride reagents which are commercially available, do not differentiate between endogenous glycerol and glycerol derived by hydrolytic action of lipase on glycerides.

The kit also includes sufficient reagent for an additional 250 free glyceride tests for true triglyceride determination.

Free Glycerol Determination Kit, Cat. No. FG0100-1KT

1 kit sufficient for 1,000 reactions

Measures free, endogenous glycerol using coupled enzyme reactions and does not include initial lipase hydrolysis.



Components available separately:

Glycerol Standard G7793

Triglyceride Reagent T2449

Free Glycerol Reagent F6428

New! Metabolite Libraries

New 10 mg package sizes of Metabolite Standards

Individually packaged standards in autosampler vials for metabolomic analysis.

Choose your own components, and build a custom library online using the Sigma-Aldrich Metabolomics Web Resource.

Libraries Available — Choose From:

70 Amino Acids and Metabolic Intermediates

73 Carbohydrates and Metabolic Intermediates

Currently in Development

- Lipid Library
- Nucleotide Library
- Vitamin/Cofactor Library

Hundreds of other metabolites are available in standard packaging and can be found in the Sigma General Catalog or online **(sigmaaldrich.com/metabolites)**.

Custom Packaging Capabilities

Sigma-Aldrich offers custom packaging of metabolite standards with vial content and container specifications to fit your specific requirements. Contact your SAFC sales representative for more details.

Visit us online at: sigma-aldrich.com/metpath

Amino Acid Metabolite Library

Metabolite	Cat. No.
O-Acetyl-L-carnitine hydrochloride	A6706-10MG
O-Acetyl-L-serine hydrochloride	A6262-10MG
*Adenosine 5′-phosphosulfate sodium salt	A5508-5MG
S-(5′-Adenosyl)-L-homocysteine	A9384-10MG
L-Alanine	A7469-10MG
β-Alanine	A9920-10MG
γ-Aminobutyric acid	A5835-10MG
5-Aminolevulinic acid hydrochloride	A7793-10MG
Anthranilic acid	A89855-10MG
L-Arginine	A8094-10MG
Argininosuccinic acid disodium salt	A5707-10MG
L-Asparagine	A0884-10MG
L-Aspartic acid	A8949-10MG
Betaine aldehyde chloride	B3650-10MG
Betaine hydrochloride	B7045-10MG
L-Carnitine hydrochloride	C0283-10MG
L-Carnosine	C9625-10MG
Choline chloride	C7017-10MG
Chorismic acid from *Enterobacter aerogenes*	C1761-10MG
L-Citrulline	C7629-10MG
Creatine	C0780-10MG
Creatinine	C4255-10MG
L-Cystathionine	C7505-10MG
Cysteamine	M9768-10MG
L-Cysteine	C7352-10MG
L-Cystine	C7602-10MG
N,N-Dimethylglycine	D1156-10MG
N-Formyl-L-methionine	F3377-10MG
L-Glutamic acid	G8415-10MG
L-Glutamine	G8540-10MG
L-Glutathione, reduced	G4251-10MG
Glycine	G7126-10MG
Histamine dihydrochloride	H7250-10MG
L-Histidine	H6034-10MG
L-Histidinol dihydrochloride	H6647-10MG
DL-Homocysteine	H4628-10MG

Metabolite	Cat. No.
DL-Homocystine	H0501-10MG
Homogentisic acid	H0751-10MG
L-Homoserine	H6515-10MG
cis-4-Hydroxy-D-proline	H5877-10MG
trans-4-Hydroxy-L-proline	H5534-10MG
Hypotaurine	H1384-10MG
L-Isoleucine	I7403-10MG
α-Keto-γ-(methylthio)butyric acid sodium salt	K6000-10MG
L-Leucine	L8912-10MG
Lithium carbamoylphosphate dibasic	C5625-10MG
L-Lysine	L5501-10MG
L-Methionine	M5308-10MG
L-Methionine sulfoxide	M1126-10MG
L-Ornithine monohydrochloride	O2375-10MG
L-Phenylalanine	P5482-10MG
Phosphocholine chloride calcium salt tetrahydrate	P0378-10MG
Phosphocreatine disodium salt hydrate enzymatic	P7936-10MG
O-Phospho-L-serine	P0878-10MG
Prephenic acid barium salt	P2384-10MG
L-Proline	P0380-10MG
Sarcosine	S7672-10MG
L-Serine	S4500-10MG
Shikimic acid	S5375-10MG
Sodium 2-oxobutyrate	K0875-10MG
Sodium phenylpyruvate	P8001-10MG
O-Succinyl-L-homoserine	S7129-25MG
Taurine	T0625-10MG
L-Threonine	T8441-10MG
*N_E,N_E,N_E-Trimethyllysine	T1660-25MG
Tryptamine	T2891-10MG
L-Tryptophan	T8941-10MG
Tyramine hydrochloride	T2879-10MG
L-Tyrosine	T8566-10MG
L-Valine	V0513-10MG

* NOT currently available in Autosampler vials

New! Metabolite Libraries

Carbohydrate Metabolite Library

Metabolite	Cat. No.
N-Acetyl-D-galactosamine	A2795-10MG
N-Acetyl-D-glucosamine	A8625-10MG
N-Acetyl-D-lactosamine	A7791-10MG
N-Acetyl-D-mannosamine	A8176-10MG
*N-Acetyl-neuraminic acid	A2388-10MG
Adenosine 5′-diphosphoglucose disodium salt	A0627-10MG
Adonitol	A5502-10MG
D-Allose	A6390-10MG
L-(+)-Arabinose	A3256-10MG
L-(-)-Arabitol	A3506-10MG
L-Ascorbic acid	A5960-10MG
D-(+)-Cellobiose	C7252-10MG
2-Deoxy-D-glucose	D8375-10MG
6-Deoxy-D-glucose	D9761-10MG
2-Deoxy-D-ribose	D5899-10MG
*2-Deoxyribose 5-phosphate sodium salt	D3126-25MG
Dihydroxyacetone phosphate dilithium salt	D7137-10MG
*2,3-Diphospho-D-glyceric acid pentasodium salt	D5764-25MG
Dulcitol	D0256-10MG
D-Erythrose 4-phosphate sodium salt	E0377-10MG
D-(-)-Fructose	F0127-10MG
D-Fructose 1,6-bisphosphate trisodium salt	F6803-10MG
D-Fructose 1-phosphate sodium salt	F1127-10MG
D-Fructose 6-phosphate disodium salt hydrate	F3627-10MG
L-(-)-Fucose	F2252-10MG
α-D-Galactosamine 1-phosphate	G5134-25MG
D-(+)-Galactosamine hydrochloride	G0500-10MG
D-(+)-Galactose	G0750-10MG
α-D-Galactose 1-phosphate dipotassium salt pentahydrate	G0380-10MG
D-Gluconic acid sodium salt	G9005-10MG
D-Glucosamine 6-phosphate	G5509-10MG
D-(+)-Glucosamine hydrochloride	G4875-10MG
D-(+)-Glucose	G7528-10MG
α-D-Glucose 1-phosphate disodium salt hydrate	G7018-10MG
D-Glucose 6-phosphate disodium salt hydrate	G7250-10MG
D-Glucuronic acid	G5269-10MG
Guanosine 5′-diphosphoglucose sodium salt	G7502-10MG

Metabolite	Cat. No.
myo-Inositol	I5125-10MG
*Isomaltose	I7253-100MG
α-Lactose monohydrate	L8783-10MG
*D(-)-Lyxose	220477-1G
D-(+)-Maltose monohydrate	M9171-10MG
D-Mannitol	M4125-10MG
D-Mannosamine hydrochloride	M4670-10MG
α-D(+)-Mannose 1-phosphate dipotassium salt	M2152-10MG
D-Mannose 6-phosphate disodium salt hydrate	M6876-10MG
Melibiose	M5500-10MG
Palatinose	P2007-10MG
Phospho(enol)pyruvic acid monopotassium salt	P7127-10MG
6-Phosphogluconic acid trisodium salt	P6888-10MG
D-(-)-3-Phosphoglyceric acid disodium salt	P8877-10MG
D-Psicose	P8043-10MG
D-(+)-Raffinose pentahydrate	R0514-10MG
L-Rhamnose monohydrate	R3875-10MG
D-(-)-Ribose	R7500-10MG
D-Ribose 5-phosphate disodium salt hydrate	R7750-10MG
*D-Ribulose	R2762-100MG
D-Ribulose 1,5-bisphosphate sodium salt hydrate	R0878-10MG
D-Ribulose 5-phosphate sodium salt	R9875-10MG
Sodium pyruvate	P2256-10MG
D-Sorbitol	S1876-10MG
Stachyose hydrate from *Stachys tuberifera*	S4001-10MG
Sucrose	S9378-10MG
D-(-)-Tagatose	T2751-10MG
Trehalose 6-phosphate dipotassium salt	T4272-10MG
D-(+)-Trehalose dihydrate	T9531-10MG
Uridine 5′-diphosphogalactose disodium salt	U4500-10MG
Uridine 5′-diphosphoglucose disodium salt	U4625-10MG
Uridine 5′-diphosphoglucuronic acid trisodium salt	U6751-10MG
Xylitol	X3375-10MG
D-(+)-Xylose	X1500-10MG
D-Xylulose	X4625-10MG

The new Metabolomics Resource Center at:
sigma-aldrich.com/metpath

Sigma-Aldrich is proud of our continuing alliance with the International Union of Biochemistry and Molecular Biology. Together we produce, animate, and publish the Nicholson Metabolic Pathway Charts, created and continually updated by Dr. Donald Nicholson. These classic resources can be downloaded from the Sigma-Aldrich Web site as PDF or GIF files at no charge. This site also features our metabolite libraries and kits for metabolite and dietary analysis.

* NOT currently available in Autosampler vials

Stable-Isotope Labeled Metabolites

Stable isotopically labeled products can provide accurate and non-radioactive *in vivo* studies of both nutrition and metabolism. Compounds labeled with stable isotopes like Carbon-13, Nitrogen-15, Deuterium, and others can be identified and measured using techniques such as MRI and MRS. We provide highly purified stable isotope labeled metabolic precursors and compounds for the study of energy utilization *in vivo*, brain metabolism, protein and glucose metabolism, metabolomics, fatty acid metabolism, and others.

Nutrition & Metabolic Studies

Cat. No.	Product Name	Atom %
48,785-6	Acetic acid-2,2,2-d_3	99
49,170-5	Acetyl-1-^{13}C-L-carnitine • HCl	99
61,746-6	Acetyl-d_3-L-carnitine • HCl	98
58,672-2	L-Alanine-1-^{13}C,3,3,3- d_3	99^{13}C; 99D
48,986-7	L-Alanine-1-^{13}C	99
48,994-8	L-Alanine-3-^{13}C	99
48,987-5	L-Alanine-$^{13}C_3$	99
60,468-2	L-Alanine-2,3-$^{13}C_2$	99
48,584-5	L-Alanine-2,3,3,3-d_4	98
48,677-9	L-Alanine-2-^{13}C	99
48,586-1	L-Alanine-2-d	98
48,992-1	L-Alanine-3,3,3-d_3	99
45,453-2	L-Alanine-d_7	98
48,793-7	Algal fatty acids-^{13}C	99
60,927-7	4-Aminobutyric acid-^{15}N	98
61,558-7	4-Aminobutyric acid-2,2,3,3,4,4-d_6	97
61,745-8	4-Aminobutyric acid-2,2-d_2	98
58,675-7	5-Aminolevulinic acid-5-^{13}C • HCl	99
60,908-0	L-Arginine-(guanidineimino-$^{15}N_2$) • HCl	98
57,986-6	L-Asparagine-4-^{13}C • H_2O	99
57,979-3	L-Aspartic acid-1,2-$^{13}C_2$	99
48,998-0	L-Aspartic-2,3,3-d_3 acid	98
60,489-5	L-Aspartic-2-^{13}C acid	99
60,770-3	L-Aspartic-2-^{13}C, ^{15}N acid	99^{13}C; 98^{15}N
49,118-7	β-Estradiol-16,16,17-d_3	98
48,536-5	Caffeine-trimethyl-$^{13}C_3$	99
48,857-7	Cholesterol-2,2,3,4,4,6-d_6	97
48,858-5	Cholesterol-3,4-^{13}C	99
61,555-2	Choline-1,1,2,2-d_4 bromide	98
61,554-4	Choline-1,1,2,2-d_4 chloride	98
60,926-9	Choline-^{15}N chloride	98
61,553-6	Choline bromide-d_{13} (trimethyl-d_9,1,1,2,2-d_4)	98
61,552-8	Choline bromide-d_9 (trimethyl-d_9)	98
48,859-3	Choline bromide (methyl-$^{13}C_1$)	99
49,205-1	Choline chloride-d_9 (trimethyl-d_9)	98
60,608-1	Citric acid-$^{13}C_6$	99
48,860-7	Citric acid-1,5-$^{13}C_2$	99
49,207-8	Citric-2,4-$^{13}C_2$ acid	99
56,992-5	Creatine-(guanidino-^{13}C) monohydrate	99
60,492-5	Creatine-(methyl-^{13}C) monohydrate	99
61,624-9	Creatine-(methyl-d_3) monohydrate	98
48,861-5	Creatinine-methyl-^{13}C	99
48,544-6	Creatinine-methyl-d_3	98
61,612-5	Decanoic-10,10,10-d_3 acid	99
48,866-6	Decanoic-d_{19} acid	98
60,854-8	Deuterium oxide-^{18}O	98D; 50^{18}O

Cat. No.	Product Name	Atom %
45,243-2	Dodecanedioic-d_{20} acid	98
33,378-6	L-DOPA-ring-d_3	98
49,252-3	Equilin-2,4,16,16-d_4	98
52,495-6	Estrone-2,4,16,16-d_4 3-sulfate sodium	95
48,920-4	Estrone-2,4,16,16-d_4	95
48,564-0	Ethyl acetoacetate-1,3-$^{13}C_2$	99
48,926-3	Ethyl acetoacetate-1,2,3,4-$^{13}C_4$	99
48,927-1	Ethyl acetoacetate-3-^{13}C	99
48,929-8	Ethyl acetoacetate-4-^{13}C	99
48,565-9	Ethyl acetoacetate-2,4-$^{13}C_2$	99
49,257-4	Ethyl acetoacetate-3,4-$^{13}C_2$	99
58,761-3	D-Fructose-1,6-$^{13}C_2$	99
41,555-3	D-Fructose-1-^{13}C	99
58,762-1	D-Fructose-$^{13}C_6$	99
49,214-0	D-Fructose-2-^{13}C	99
48,872-0	D-Fructose-6,6-d_2	98
60,539-5	D-Fructose-6-^{13}C	99
60,601-4	Fumaric acid-$^{13}C_4$	99
60,607-3	Fumaric-2,3-$^{13}C_2$ acid	99
49,507-7	D-Galactose-1-d_1	98
29,704-6	D-Glucose-1-^{13}C	99
38,937-4	D-Glucose-$^{13}C_6$	99
45,318-8	D-Glucose-1,2-$^{13}C_2$	99
31,081-6	D-Glucose-1-d_1	98
31,082-4	D-Glucose-2-d_1	98
28,265-0	D-Glucose-6,6-d_2	98
60,522-0	L-Glutamine-1,2-$^{13}C_2$	99
60,516-6	L-Glutamine-$^{13}C_5$	99
30,606-1	Glycer(ol-d_3)	98
45,452-4	Glycerol-1,1,2,3,3-d_5	98
49,263-9	Glycerol-1,3-$^{13}C_2$	99
48,947-6	Glycerol-$^{13}C_3$	99
48,948-4	Glycerol-2-^{13}C	99
48,951-4	Glyceryl Tri(oleate-1-^{13}C)	99
42,590-7	Glyceryl Tri(palmitate-1-^{13}C)	99
61,696-6	Glyceryl Tri(palmitate-d_{31})	98
27,942-0	Glycine-1-^{13}C	99
28,382-7	Glycine-$^{13}C_2$	99
29,929-4	Glycine-^{15}N	98
33,645-9	Glycine-2,2-d_2	98
27,943-9	Glycine-2-^{13}C	99
17,583-8	Glycine-d_5	98
33,760-9	Glycocholic acid-(glycine-1-^{13}C) monohydrate	99
33,761-7	Glycocholic acid-(glycine-$^{13}C_2$) monohydrate	99
48,957-3	Guanidine-d_5 deuteriochloride	98

Stable-Isotope Labeled Metabolites

Nutrition & Metabolic Studies (cont.)

Cat. No.	Product Name	Atom %
61,595-1	Palmitic acid-16,16,16-d_3 acid	99
48,970-0	Hexanoic acid-1-^{13}C	99
48,889-5	DL-3-Hydroxybutyric-1,3-$^{13}C_2$ acid sodium salt	99
49,231-0	DL-3-Hydroxytetradecanoic-2,2,3,4,4-d_5 acid	98
49,281-7	Indole-3-acetic-2,2-d_2 acid	97
58,638-2	Lauric acid-1,12-$^{13}C_2$	99
58,615-3	Lauric acid-1,2,3,4-$^{13}C_4$	99
58,605-6	Lauric acid-1,2-$^{13}C_2$	99
57,968-8	Lauric acid-2-^{13}C	99
29,216-8	Lauric acid-1-^{13}C	99
48,560-8	Lauric acid-12,12,12-d_3	98
48,663-9	Lauric acid-12-^{13}C	99
48,916-6	Lauric acid-2,2-d_2	98
45,140-1	Lauric-d_{23} acid	98
60,490-9	L-Leucine-1,2-$^{13}C_2$	99
49,005-9	L-Leucine-1-^{13}C	99
49,006-7	L-Leucine-1-^{13}C, ^{15}N	99^{13}C; 98^{15}N
34,096-0	L-Leucine-^{15}N	98
49,294-9	L-Leucine-2,3,3,4,5,5,5,6,6,6-d_{10}	98
48,681-7	L-Leucine-2-^{13}C	99
48,682-5	L-Leucine-5,5,5-d_3	99
60,574-3	Linolenic acid-$^{13}C_{18}$	99
60,896-3	L-Lysine-2-^{15}N • HCl	98
49,018-0	Maleic-2,3-$^{13}C_2$ acid	99
49,298-1	Maleic-2,3-$^{13}C_2$ anhydride	99
49,019-9	Malonic acid-1,3-$^{13}C_2$	99
49,020-2	Malonic acid-$^{13}C_3$	99
27,944-7	Malonic-2-^{13}C acid	99
45,461-3	D-Mannitol-1-^{13}C	99
60,534-4	D-Mannose-2-^{13}C	99
29,914-6	L-Methionine-^{13}C (methyl-^{13}C)	99
29,915-4	L-Methionine-^{13}C, d_3 (methyl-^{13}C, d_3)	99D; 99^{13}C
30,061-6	L-Methionine-d_3 (methyl-d_3)	98
48,771-6	2-Keto-4-methylpentanoic acid-1-^{13}C sodium salt	99
49,158-6	4-Methylvaleric-1-^{13}C acid	99
49,245-0	(±)-Mevalonolactone-1,2-$^{13}C_2$	99
49,246-9	(±)-Mevalonolactone-1-^{13}C	99
48,660-4	(±)-Mevalonolactone-2-^{13}C	99
49,086-5	Myristic acid-1,2-$^{13}C_2$	99
49,087-3	Myristic acid-1-^{13}C	99
36,688-9	Myristic-d_{27} acid	98
49,316-3	Octanoic acid-1,2,3,4-$^{13}C_4$	99
44,821-4	Octanoic-d_{15} acid	99
49,042-3	Oleic acid -1-^{13}C	99
60,613-3	Oleic acid-9,10-d_2	98
49,043-1	Oleic acid-$^{13}C_{18}$	99
29,212-5	Palmitic acid-1-^{13}C	99
48,961-1	Palmitic acid-1,2,3,4-$^{13}C_4$	99
48,966-2	Palmitic-2,2-d_2 acid	98

Cat. No.	Product Name	Atom %
48,967-0	Palmitic-2,2-d_2 acid potassium salt	99
49,275-2	Palmitic-2-^{13}C acid	99
36,689-7	Palmitic-d_{31} acid	98
57,681-6	Palmitoyl-1-^{13}C-L-carnitine • HCl	99
64,432-3	Palmitoyl-$^{13}C_{16}$-L-carnitine • HCl	99
49,303-1	Phenacetin (ethoxy-2-^{13}C)	99
58,949-7	L-Proline-1-^{13}C	99
60,487-9	L-Phenyl-$^{13}C_6$-alanine	99
61,587-0	L-Phenyl-d_5-alanine	98
49,010-5	L-Phenylalanine-^{15}N	98
49,014-8	L-Phenyl-d_5-alanine-2,3,3-d_3	98
49,011-3	L-Phenylalanine-2-^{13}C	99
49,012-1	L-Phenylalanine-3-^{13}C	99
49,009-1	L-Phenylalanine-1-^{13}C	99
60,848-3	Sodium pyruvate-3-^{13}C, d_3	99^{13}C; 50-60D
60,535-2	D-Ribose-1-^{13}C	99
31,083-2	D-Ribose-1-^{13}C	99
31,084-0	D-Ribose-2-^{13}C	99
63,409-3	L-Selenomethionine (methyl-^{13}C)	99
49,015-6	L-Serine-1-^{13}C	99
27,929-3	Sodium acetate-1-^{13}C	99
29,804-2	Sodium acetate-1-^{13}C, d_3	99D; 99^{13}C
28,201-4	Sodium acetate-$^{13}C_2$	99
29,911-1	Sodium acetate-$^{13}C_2$, d_3	99D; 99^{13}C
29,908-1	Sodium acetate-2-^{13}C, d_3	99D; 99^{13}C
37,238-2	Sodium bicarbonate-^{13}C	99
49,159-4	Sodium 4-methylvalerate-1-^{13}C	99
61,620-6	D-Sorbitol-1,1,6,6-d_4	98
48,918-2	D-Sorbitol-1-^{13}C	99
29,916-2	Stearic acid-1-^{13}C	99
49,039-3	Stearic acid-18,18,18-d_3	98
49,315-5	Stearic-2,2-d_2 acid	98
44,824-9	Stearic- d_{35} acid	98
60,541-7	D-Sucrose-$^{13}C_{12}$	99
49,133-0	2-Aminoethanesulfonic acid-^{15}N	98
49,342-2	Tetracosanoic acid-1-^{13}C	99
60,568-9	Myristic acid-$^{13}C_{14}$	99
49,090-3	Thiourea-^{13}C, $^{15}N_2$	99 atom % ^{13}C; 98
48,706-6	Thymine-d_4 (methyl-d_3,6-d_1)	98
48,980-8	L-Tyrosine-2,3,5,6-d_4	98
48,582-9	L-Tyrosine-2,6-d_2	98
48,981-6	L-Tyrosine-3,5-d_2	98
48,984-0	L-Tyrosine-3,3-d_2	98
48,985-9	L-Tyrosine-3-^{13}C	99
48,982-4	L-Tyrosine-1-^{13}C	99
48,979-4	L-Tyrosine (ring-$^{13}C_6$)	99
31,683-0	Urea-$^{15}N_2$	98
49,016-4	L-Valine-1-^{13}C	99
48,602-7	L-Valine-2,3,4,4,4,5,5,5-d_8	98
60,309-0	Water-^{18}O	95
33,208-9	Water-^{18}O	10
60,744-4	Zinc acetate-1-^{13}C, d_3 dihydrate	99^{13}C; 99D

New Products

New proteins manufactured by Sigma

High Purity Cytochrome c from Equine Heart, Cat. No. C2867

purity ≥ 99% by SDS-PAGE

This cytochrome c product is prepared from equine heart using trichloroacetic acid by a modification of a published method. The trichloroacetic acid method reduces the amount of superoxide dismutase (SOD) present, but tends to cause dimerization or acid-modified structures of cytochrome c. In contrast, preparations using acetic acid may have slightly higher amounts of SOD, but a lower proportion of dimeric cytochrome c.

The product is supplied as a lyophilized powder. The final step before lyophilization is extensive dialysis against 6 mM ammonium hydroxide, which is volatile under lyophilization conditions, so the final product should not contain any buffer salts. The product is mainly the oxidized form of the protein. The reduced form of cytochrome c can be prepared with either sodium dithionite or sodium ascorbate, followed by gel filtration.

Dihydrofolate Reductase, Cat. No. D6566

human, recombinant expressed in *E.coli*

Dihydrofolate Reductase (DHFR), a key enzyme in thymidine synthesis, catalyzes the NADPH dependent reduction of dihydrofolate (DHF) to tetrahydrofolate (THF) and, at much lower rate, the conversion of folate to THF. The reaction product, THF, is an essential cofactor in the conversion of deoxyuridylate (dUMP) to deoxythymidylate (dTMP) by thymidylate synthetase.Therefore, DHFR is a critical enzyme in DNA synthesis and has become a target for drug development and cancer therapy. The variations between DHFR from different sources has enabled the development of species selective DHFR inhibitors, such as trimethoprim (antibacterial and antifungal), pyrimethamine (antiprotozoal), and methotrexate, MTX, (antineoplastic, antipsoriatic, and anti-inflammatory).

Human DHFR is an 186 amino acid protein with an apparent molecular weight of 25 kDa. It is 30% homologous to the *E. coli* protein and up to 70% homologous to vertebrate proteins. The human DHFR gene, as well as other mammalian DHFR genes, overcomes the inhibitory effects of methotrexate by the mechanism of gene amplification or by amino acid mutagenesis.

This product is supplied as a solution in 10 mM Tris-HCl, pH 8.0, with 1 mM EDTA, 0.5 mM DTT, 5 µM NADPH, protease inhibitors, and 50% glycerol.

The Enzyme Explorer at:
sigma-aldrich.com/enzymeexplorer
The Enzyme Explorer has become one of the biotech industry's leading Web tools for enzyme related resources and products. The Enzyme Explorer features indices for identifying enzymes, substrates, inhibitors and cofactors, as well as a library of assay procedures, and application guides for specific areas of enzyme related research.

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