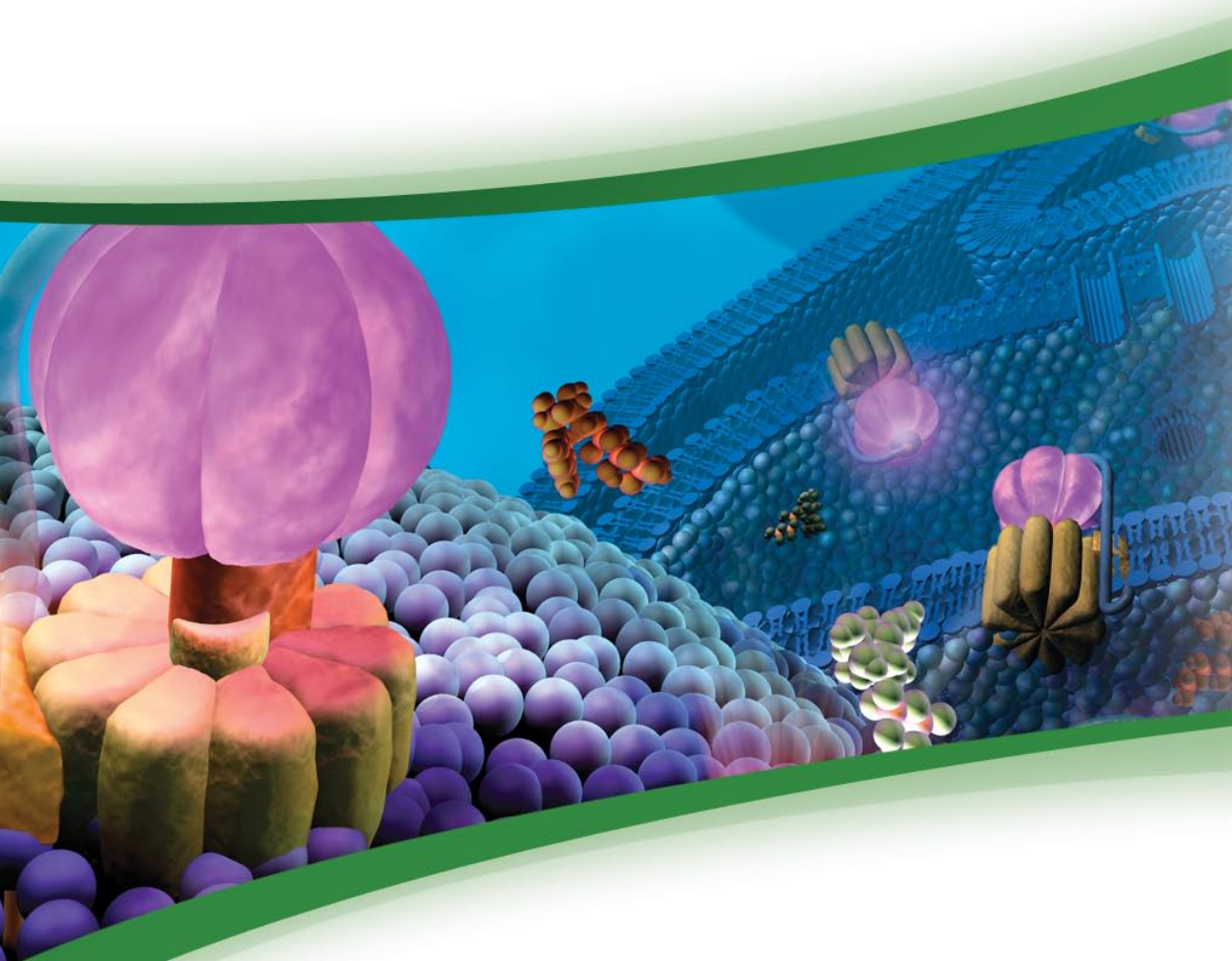


BIOFILES

FOR LIFE SCIENCE RESEARCH

Issue 1, 2006



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

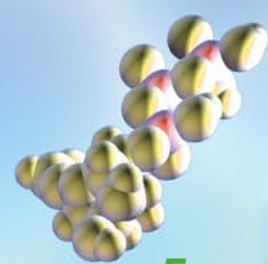
Stable Isotope Metabolites

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.

Product Highlights address specific new tools for your research.

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.

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

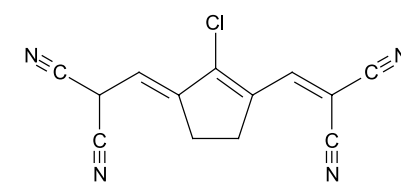
Enzymatic Kits and Reagents for the Quantitation and Characterization of Nutrients and Metabolites

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.



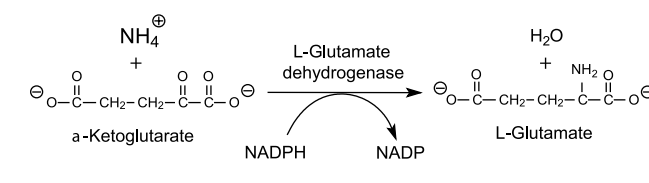
Albumin Blue 580

Reference

¹Kessler 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 μ g/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

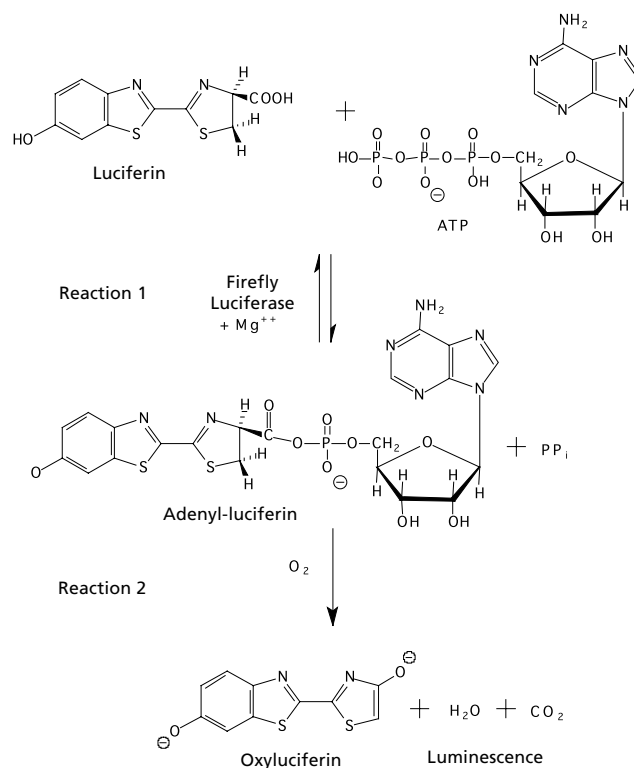
ATP Bioluminescent Assay Kit, Cat. No. FL-AA
For ATP determination in aqueous solutions

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 2×10^{-12} to 8×10^{-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 2×10^5 viable somatic cells (or a sample containing from 400 to 8×10^6 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 adenylyl-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:

¹Official 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)

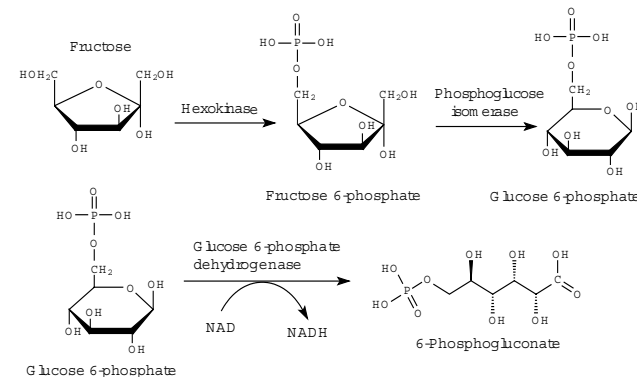


Visit the Nutrition Research & the Bioactive Nutrient Explorer at: sigma-aldrich.com/nutrition

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.

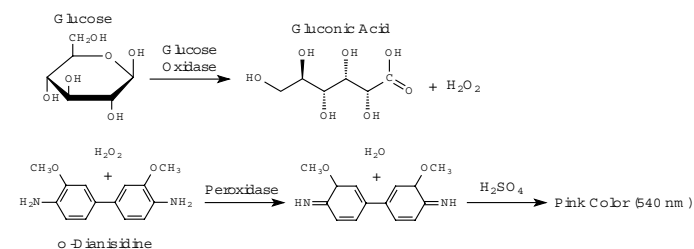
Fructose Assay Kit, Cat. No. FA20-1KT
sufficient for 20 assays

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.



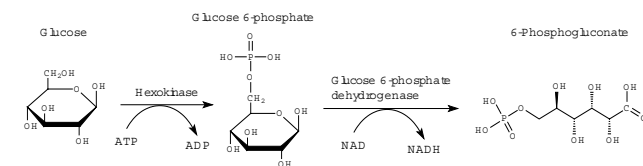
Glucose (GO) Assay Kit, Cat. No. GAGO20-1KT
sufficient for 20 assays

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.



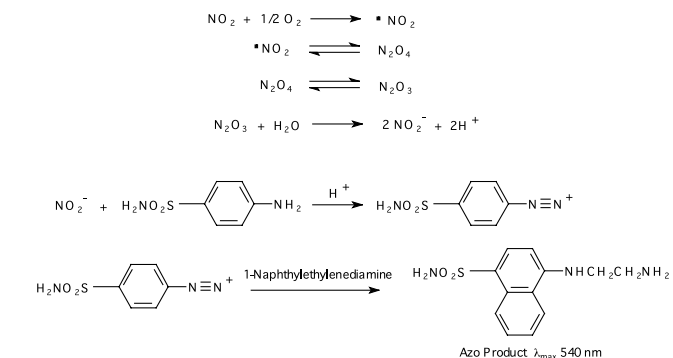
Glucose (HK) Assay Kit, Cat. No. GAHK20-1KT
sufficient for 20 assays

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.



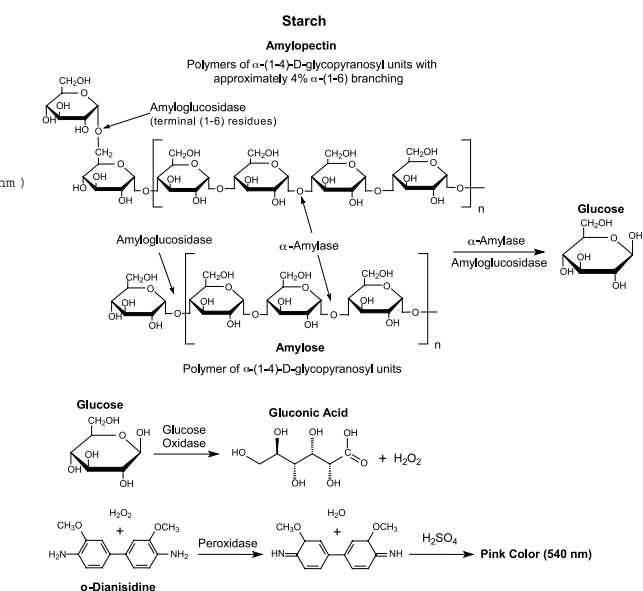
Nitrate/Nitrite Colorimetric Assay Kit, Cat. No. 23479-1KT-F

Based on the Griess assay, total NO, NO₂, and NO₃ metabolites are easily detectable using this kit. The NO₂/NO₃ Assay Kit contains indicator dyes, nitrate reductase, co-factor, buffer, and NO₂ and NO₃ standards. The NO₂ detection range is from 10 to 100 μ M.



Starch (GO/P) Assay Kit, Cat. No. STA20-1KT
sufficient for 20 assays

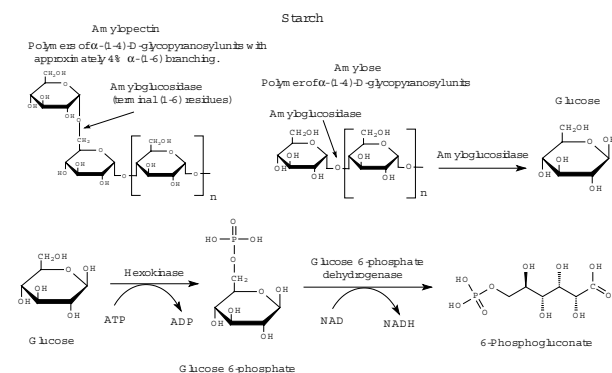
For the quantitative, enzymatic determination of starch in food and other materials. The hydrolysis of starch to glucose is catalyzed by α -amylase and amyloglucosidase. Glucose is oxidized to gluconic acid and hydrogen peroxide by glucose oxidase. Hydrogen peroxide reacts with *o*-dianisidine in the 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

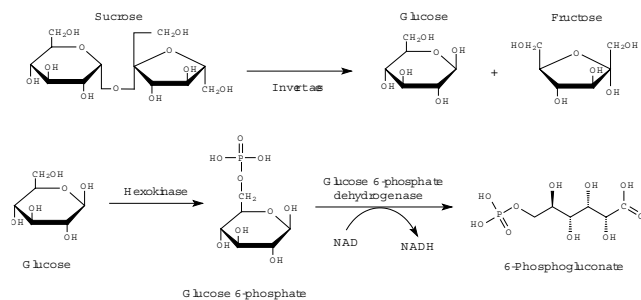
Starch (HK) Assay Kit, Cat. No. SA20-1KT
sufficient for 20 assays

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.



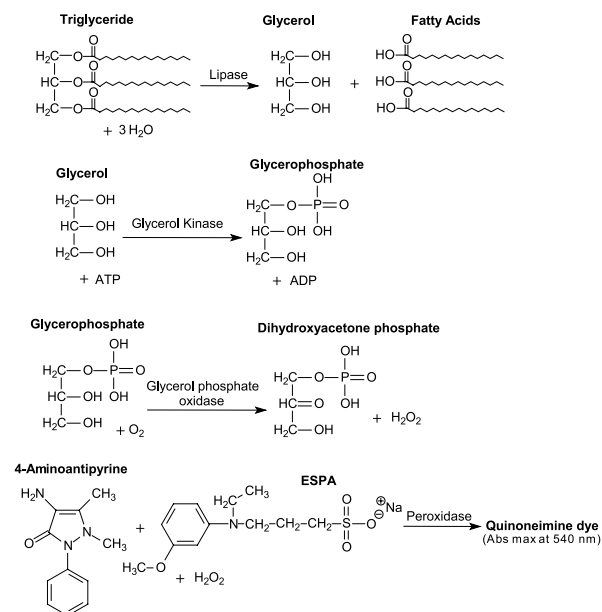
Serum Triglyceride Determination Kit, Cat. No. TR0100-1KT
sufficient for 250 assays

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.

Amino Acid Metabolite Library

| Metabolite | Cat. No. | Metabolite | Cat. No. |
|---|------------|--|------------|
| O-Acetyl-L-carnitine hydrochloride | A6706-10MG | DL-Homocystine | H0501-10MG |
| O-Acetyl-L-serine hydrochloride | A6262-10MG | Homogentisic acid | H0751-10MG |
| *Adenosine 5'-phosphosulfate sodium salt | A5508-5MG | L-Homoserine | H6515-10MG |
| S-(5'-Adenosyl)-L-homocysteine | A9384-10MG | cis-4-Hydroxy-D-proline | H5877-10MG |
| L-Alanine | A7469-10MG | trans-4-Hydroxy-L-proline | H5534-10MG |
| β-Alanine | A9920-10MG | Hypotaurine | H1384-10MG |
| γ-Aminobutyric acid | A5835-10MG | L-Isoleucine | I7403-10MG |
| 5-Aminolevulinic acid hydrochloride | A7793-10MG | α-Keto-γ-(methylthio)butyric acid sodium salt | K6000-10MG |
| Anthranyl acid | A8985-10MG | L-Leucine | L8912-10MG |
| L-Arginine | A8094-10MG | Lithium carbamoylphosphate dibasic | C5625-10MG |
| Argininosuccinic acid disodium salt | A5707-10MG | L-Lysine | L5501-10MG |
| L-Asparagine | A0884-10MG | L-Methionine | M5308-10MG |
| L-Aspartic acid | A8949-10MG | L-Methionine sulfoxide | M1126-10MG |
| Betaine aldehyde chloride | B3650-10MG | L-Ornithine monohydrochloride | O2375-10MG |
| Betaine hydrochloride | B7045-10MG | L-Phenylalanine | P5482-10MG |
| L-Carnitine hydrochloride | C0283-10MG | Phosphocholine chloride calcium salt tetrahydrate | P0378-10MG |
| L-Carnosine | C9625-10MG | Phosphocreatine disodium salt hydrate enzymatic | P7936-10MG |
| Choline chloride | C7017-10MG | O-Phospho-L-serine | P0878-10MG |
| Chorismic acid from <i>Enterobacter aerogenes</i> | C1761-10MG | Prephenic acid barium salt | P2384-10MG |
| L-Citrulline | C7629-10MG | L-Proline | P0380-10MG |
| Creatine | C0780-10MG | L-Sarcosine | S7672-10MG |
| Creatinine | C4255-10MG | L-Serine | S4500-10MG |
| L-Cystathionine | M9768-10MG | Shikimic acid | S5375-10MG |
| Cysteamine | C7352-10MG | Sodium 2-oxobuturate | K0875-10MG |
| L-Cysteine | C7602-10MG | Sodium phenylpyruvate | P8001-10MG |
| N,N-Dimethylglycine | D1156-10MG | *O-Succinyl-L-homoserine | S7129-25MG |
| N-Formyl-L-methionine | F3377-10MG | Taurine | T0625-10MG |
| L-Glutamic acid | G8415-10MG | L-Threonine | T8441-10MG |
| L-Glutamine | G8540-10MG | *N _E ,N _E ,N _E -Trimethyllysine | T1660-25MG |
| L-Glutathione, reduced | G4251-10MG | Tryptamine | T2891-10MG |
| Glycine | G7126-10MG | L-Tryptophan | T8941-10MG |
| Histamine dihydrochloride | H7250-10MG | Tyramine hydrochloride | T2879-10MG |
| L-Histidine | H6034-10MG | L-Tyrosine | T8566-10MG |
| L-Histidinol dihydrochloride | H6647-10MG | L-Valine | V0513-10MG |
| DL-Homocysteine | H4628-10MG | | |

* NOT currently available in Autosampler vials



Visit us online at: sigmaaldrich.com/metpath

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 <i>Stachys tuberosa</i> | 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.

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 % | Cat. No. | Product Name | Atom % |
|----------|---|--|----------|---|--------|
| 48,785-6 | Acetic acid-2,2,2-d ₃ | 99 | 45,243-2 | Dodecanedioic-d ₂₀ acid | 98 |
| 49,170-5 | Acetyl-1- ¹³ C-L-carnitine • HCl | 99 | 33,378-6 | L-DOPA-ring-d ₃ | 98 |
| 61,746-6 | Acetyl-d ₃ -L-carnitine • HCl | 98 | 49,252-3 | Equilin-2,4,16,16-d ₄ | 98 |
| 58,672-2 | L-Alanine-1- ¹³ C,3,3,3-d ₃ | 99 ¹³ C; 99D | 52,495-6 | Estrone-2,4,16,16-d ₄ 3-sulfate sodium | 95 |
| 48,986-7 | L-Alanine-1- ¹³ C | 99 | 48,920-4 | Estrone-2,4,16,16-d ₄ | 95 |
| 48,994-8 | L-Alanine-3- ¹³ C | 99 | 48,564-0 | Ethyl acetoacetate-1,3- ¹³ C ₂ | 99 |
| 48,987-5 | L-Alanine- ¹³ C ₃ | 99 | 48,926-3 | Ethyl acetoacetate-1,2,3,4- ¹³ C ₄ | 99 |
| 60,468-2 | L-Alanine-2,3- ¹³ C ₂ | 99 | 48,927-1 | Ethyl acetoacetate-3- ¹³ C | 99 |
| 48,584-5 | L-Alanine-2,3,3,3-d ₄ | 98 | 48,929-8 | Ethyl acetoacetate-4- ¹³ C | 99 |
| 48,677-9 | L-Alanine-2- ¹³ C | 99 | 48,565-9 | Ethyl acetoacetate-2,4- ¹³ C ₂ | 99 |
| 48,586-1 | L-Alanine-2-d | 98 | 49,257-4 | Ethyl acetoacetate-3,4- ¹³ C ₂ | 99 |
| 48,992-1 | L-Alanine-3,3,3-d ₃ | 99 | 58,761-3 | D-Fructose-1,6- ¹³ C ₂ | 99 |
| 45,453-2 | L-Alanine-d ₇ | 98 | 41,555-3 | D-Fructose-1- ¹³ C | 99 |
| 48,793-7 | Algal fatty acids- ¹³ C | 99 | 58,762-1 | D-Fructose- ¹³ C ₆ | 99 |
| 60,927-7 | 4-Aminobutyric acid- ¹⁵ N | 98 | 49,214-0 | D-Fructose-2- ¹³ C | 99 |
| 61,558-7 | 4-Aminobutyric acid-2,2,3,3,4,4-d ₆ | 97 | 48,872-0 | D-Fructose-6,6-d ₂ | 98 |
| 61,745-8 | 4-Aminobutyric acid-2,2-d ₂ | 98 | 60,539-5 | D-Fructose-6- ¹³ C | 99 |
| 58,675-7 | 5-Aminolevulinic acid-5- ¹³ C • HCl | 99 | 60,601-4 | Fumaric acid- ¹³ C ₄ | 99 |
| 60,908-0 | L-Arginine-(guanidineimino- ¹⁵ N ₂) • HCl | 98 | 60,607-3 | Fumaric-2,3- ¹³ C ₂ acid | 99 |
| 57,986-6 | L-Asparagine-4- ¹³ C • H ₂ O | 99 | 49,507-7 | D-Galactose-1-d ₁ | 98 |
| 57,979-3 | L-Aspartic acid-1,2- ¹³ C ₂ | 99 | 29,704-6 | D-Glucose-1- ¹³ C | 99 |
| 48,998-0 | L-Aspartic-2,3,3-d ₃ acid | 98 | 38,937-4 | D-Glucose- ¹³ C ₆ | 99 |
| 60,489-5 | L-Aspartic-2- ¹³ C acid | 99 | 45,318-8 | D-Glucose-1,2- ¹³ C ₂ | 99 |
| 60,770-3 | L-Aspartic-2- ¹³ C, ¹⁵ N acid | 99 ¹³ C; 98 ¹⁵ N | 31,081-6 | D-Glucose-1-d ₁ | 98 |
| 49,118-7 | β -Estradiol-16,16,17-d ₃ | 98 | 31,082-4 | D-Glucose-2-d ₁ | 98 |
| 48,536-5 | Caffeine-trimethyl- ¹³ C ₃ | 99 | 28,265-0 | D-Glucose-6,6-d ₂ | 98 |
| 48,857-7 | Cholesterol-2,2,3,4,4,6-d ₆ | 97 | 60,522-0 | L-Glutamine-1,2- ¹³ C ₂ | 99 |
| 48,858-5 | Cholesterol-3,4- ¹³ C | 99 | 60,516-6 | L-Glutamine- ¹³ C ₅ | 99 |
| 61,555-2 | Choline-1,1,2,2-d ₄ bromide | 98 | 30,606-1 | Glycer(ol-d ₃) | 98 |
| 61,554-4 | Choline-1,1,2,2-d ₄ chloride | 98 | 45,452-4 | Glycerol-1,1,2,3,3-d ₅ | 98 |
| 60,926-9 | Choline- ¹⁵ N chloride | 98 | 49,263-9 | Glycerol-1,3- ¹³ C ₂ | 99 |
| 61,553-6 | Choline bromide-d ₁₃ (trimethyl-d ₉ ,1,1,2,2-d ₄) | 98 | 48,947-6 | Glycerol- ¹³ C ₃ | 99 |
| 61,552-8 | Choline bromide-d ₉ (trimethyl-d ₉) | 98 | 48,948-4 | Glycerol-2- ¹³ C | 99 |
| 48,859-3 | Choline bromide (methyl- ¹³ C ₁) | 99 | 48,951-4 | Glyceryl Tri(oleate-1- ¹³ C) | 99 |
| 49,205-1 | Choline chloride-d ₉ (trimethyl-d ₉) | 98 | 42,590-7 | Glyceryl Tri(palmitate-1- ¹³ C) | 99 |
| 60,608-1 | Citric acid- ¹³ C ₆ | 99 | 61,696-6 | Glyceryl Tri(palmitate-d ₃₁) | 98 |
| 48,860-7 | Citric acid-1,5- ¹³ C ₂ | 99 | 27,942-0 | Glycine-1- ¹³ C | 99 |
| 49,207-8 | Citric-2,4- ¹³ C ₂ acid | 99 | 28,382-7 | Glycine- ¹³ C ₂ | 99 |
| 56,992-5 | Creatine-(guanidino- ¹³ C) monohydrate | 99 | 29,929-4 | Glycine- ¹⁵ N | 98 |
| 60,492-5 | Creatine-(methyl- ¹³ C) monohydrate | 99 | 33,645-9 | Glycine-2,2-d ₂ | 98 |
| 61,624-9 | Creatine-(methyl-d ₃) monohydrate | 98 | 27,943-9 | Glycine-2- ¹³ C | 99 |
| 48,861-5 | Creatinine-methyl- ¹³ C | 99 | 17,583-8 | Glycine-d ₅ | 98 |
| 48,544-6 | Creatinine-methyl-d ₃ | 98 | 33,760-9 | Glycocholic acid-(glycine-1- ¹³ C) monohydrate | 99 |
| 61,612-5 | Decanoic-10,10,10-d ₃ acid | 99 | 33,761-7 | Glycocholic acid-(glycine- ¹³ C ₂) monohydrate | 99 |
| 48,866-6 | Decanoic-d ₁₉ acid | 98 | 48,957-3 | Guanidine-d ₅ deuteriochloride | 98 |
| 60,854-8 | Deuterium oxide- ¹⁸ O | 98D; 50 ¹⁸ O | | | |

Stable-Isotope Labeled Metabolites

Nutrition & Metabolic Studies (cont.)

| Cat. No. | Product Name | Atom % | Cat. No. | Product Name | Atom % |
|----------|--|--|----------|---|-------------------------------|
| 61,595-1 | Palmitic acid-16,16-d ₃ acid | 99 | 48,967-0 | Palmitic-2,2-d ₂ acid potassium salt | 99 |
| 48,970-0 | Hexanoic acid-1- ¹³ C | 99 | 49,275-2 | Palmitic-2- ¹³ C acid | 99 |
| 48,889-5 | DL-3-Hydroxybutyric-1,3- ¹³ C ₂ acid sodium salt | 99 | 36,689-7 | Palmitic-d ₃₁ acid | 98 |
| 49,231-0 | DL-3-Hydroxytetradecanoic-2,2,3,4,4-d ₅ acid | 98 | 57,681-6 | Palmitoyl-1- ¹³ C-L-carnitine • HCl | 99 |
| 49,281-7 | Indole-3-acetic-2,2-d ₂ acid | 97 | 64,432-3 | Palmitoyl- ¹³ C ₁₆ -L-carnitine • HCl | 99 |
| 58,638-2 | Lauric acid-1,12- ¹³ C ₂ | 99 | 49,303-1 | Phenacetin (ethoxy-2- ¹³ C) | 99 |
| 58,615-3 | Lauric acid-1,2,3,4- ¹³ C ₄ | 99 | 58,949-7 | L-Proline-1- ¹³ C | 99 |
| 58,605-6 | Lauric acid-1,2- ¹³ C ₂ | 99 | 60,487-9 | L-Phenyl- ¹³ C ₆ -alanine | 99 |
| 57,968-8 | Lauric acid-2- ¹³ C | 99 | 61,587-0 | L-Phenyl-d ₅ -alanine | 98 |
| 29,216-8 | Lauric acid-1- ¹³ C | 99 | 49,010-5 | L-Phenylalanine- ¹⁵ N | 98 |
| 48,560-8 | Lauric acid-12,12,12-d ₃ | 98 | 49,014-8 | L-Phenyl-d ₅ -alanine-2,3,3-d ₃ | 98 |
| 48,663-9 | Lauric acid-12- ¹³ C | 99 | 49,011-3 | L-Phenylalanine-2- ¹³ C | 99 |
| 48,916-6 | Lauric acid-2,2-d ₂ | 98 | 49,012-1 | L-Phenylalanine-3- ¹³ C | 99 |
| 45,140-1 | Lauric-d ₂₃ acid | 98 | 49,009-1 | L-Phenylalanine-1- ¹³ C | 99 |
| 60,490-9 | L-Leucine-1,2- ¹³ C ₂ | 99 | 60,848-3 | Sodium pyruvate-3- ¹³ C, d ₃ | 99 ¹³ C; 50-60D |
| 49,005-9 | L-Leucine-1- ¹³ C | 99 | 60,535-2 | D-Ribose-1- ¹³ C | 99 |
| 49,006-7 | L-Leucine-1- ¹³ C, ¹⁵ N | 99 ¹³ C; 98 ¹⁵ N | 31,083-2 | D-Ribose-1- ¹³ C | 99 |
| 34,096-0 | L-Leucine- ¹⁵ N | 98 | 31,084-0 | D-Ribose-2- ¹³ C | 99 |
| 49,294-9 | L-Leucine-2,3,3,4,5,5,5,6,6,6-d ₁₀ | 98 | 63,409-3 | L-Selenomethionine (methyl- ¹³ C) | 99 |
| 48,681-7 | L-Leucine-2- ¹³ C | 99 | 49,015-6 | L-Serine-1- ¹³ C | 99 |
| 48,682-5 | L-Leucine-5,5,5-d ₃ | 99 | 27,929-3 | Sodium acetate-1- ¹³ C | 99 |
| 60,574-3 | Linolenic acid- ¹³ C ₁₈ | 99 | 29,804-2 | Sodium acetate-1- ¹³ C, d ₃ | 99D; 99 ¹³ C |
| 60,896-3 | L-Lysine-2- ¹⁵ N • HCl | 98 | 28,201-4 | Sodium acetate- ¹³ C ₂ | 99 |
| 49,018-0 | Maleic-2,3- ¹³ C ₂ acid | 99 | 29,911-1 | Sodium acetate- ¹³ C ₂ , d ₃ | 99D; 99 ¹³ C |
| 49,298-1 | Maleic-2,3- ¹³ C ₂ anhydride | 99 | 29,908-1 | Sodium acetate-2- ¹³ C, d ₃ | 99D; 99 ¹³ C |
| 49,019-9 | Malonic acid-1,3- ¹³ C ₂ | 99 | 37,238-2 | Sodium bicarbonate- ¹³ C | 99 |
| 49,020-2 | Malonic acid- ¹³ C ₃ | 99 | 49,159-4 | Sodium 4-methylvalerate-1- ¹³ C | 99 |
| 27,944-7 | Malonic-2- ¹³ C acid | 99 | 61,620-6 | D-Sorbitol-1,1,6,6-d ₄ | 98 |
| 45,461-3 | D-Mannitol-1- ¹³ C | 99 | 48,918-2 | D-Sorbitol-1- ¹³ C | 99 |
| 60,534-4 | D-Mannose-2- ¹³ C | 99 | 29,916-2 | Stearic acid-1- ¹³ C | 99 |
| 29,914-6 | L-Methionine- ¹³ C (methyl- ¹³ C) | 99 | 49,039-3 | Stearic acid-18,18,18-d ₃ | 98 |
| 29,915-4 | L-Methionine- ¹³ C, d ₃ (methyl- ¹³ C, d ₃) | 99D; 99 ¹³ C | 49,315-5 | Stearic-2,2-d ₂ acid | 98 |
| 30,061-6 | L-Methionine-d ₃ (methyl-d ₃) | 98 | 44,824-9 | Stearic- d ₃₅ acid | 98 |
| 48,771-6 | 2-Keto-4-methylpentanoic acid-1- ¹³ C sodium salt | 99 | 60,541-7 | D-Sucrose- ¹³ C ₁₂ | 99 |
| 49,158-6 | 4-Methylvaleric-1- ¹³ C acid | 99 | 49,133-0 | 2-Aminoethanesulfonic acid- ¹⁵ N | 98 |
| 49,245-0 | (±)-Mevalonolactone-1,2- ¹³ C ₂ | 99 | 49,342-2 | Tetracosanoic acid-1- ¹³ C | 99 |
| 49,246-9 | (±)-Mevalonolactone-1- ¹³ C | 99 | 60,568-9 | Myristic acid- ¹³ C ₁₄ | 99 |
| 48,660-4 | (±)-Mevalonolactone-2- ¹³ C | 99 | 49,090-3 | Thiourea- ¹³ C, ¹⁵ N ₂ | 99 atom % ¹³ C; 98 |
| 49,086-5 | Myristic acid-1,2- ¹³ C ₂ | 99 | 48,706-6 | Thymine-d ₄ (methyl-d ₃ ,6-d ₁) | 98 |
| 49,087-3 | Myristic acid-1- ¹³ C | 99 | 48,980-8 | L-Tyrosine-2,3,5,6-d ₄ | 98 |
| 36,688-9 | Myristic-d ₂₇ acid | 98 | 48,582-9 | L-Tyrosine-2,6-d ₂ | 98 |
| 49,316-3 | Octanoic acid-1,2,3,4- ¹³ C ₄ | 99 | 48,981-6 | L-Tyrosine-3,5-d ₂ | 98 |
| 44,821-4 | Octanoic-d ₁₅ acid | 99 | 48,984-0 | L-Tyrosine-3,3-d ₂ | 98 |
| 49,042-3 | Oleic acid -1- ¹³ C | 99 | 48,985-9 | L-Tyrosine-3- ¹³ C | 99 |
| 60,613-3 | Oleic acid-9,10-d ₂ | 98 | 48,982-4 | L-Tyrosine-1- ¹³ C | 99 |
| 49,043-1 | Oleic acid- ¹³ C ₁₈ | 99 | 48,979-4 | L-Tyrosine (ring- ¹³ C ₆) | 99 |
| 29,212-5 | Palmitic acid-1- ¹³ C | 99 | 31,683-0 | Urea- ¹⁵ N ₂ | 98 |
| 48,961-1 | Palmitic acid-1,2,3,4- ¹³ C ₄ | 99 | 49,016-4 | L-Valine-1- ¹³ C | 99 |
| 48,966-2 | Palmitic-2,2-d ₂ acid | 98 | 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 deoxyuridylylate (dUMP) to deoxythymidylylate (dTMP) by thymidylylate 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

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