CELL BIOLOGY • MOLECULAR BIOLOGY • RESEARCH • BIOCHEMISTRY • BIOPROCESSING

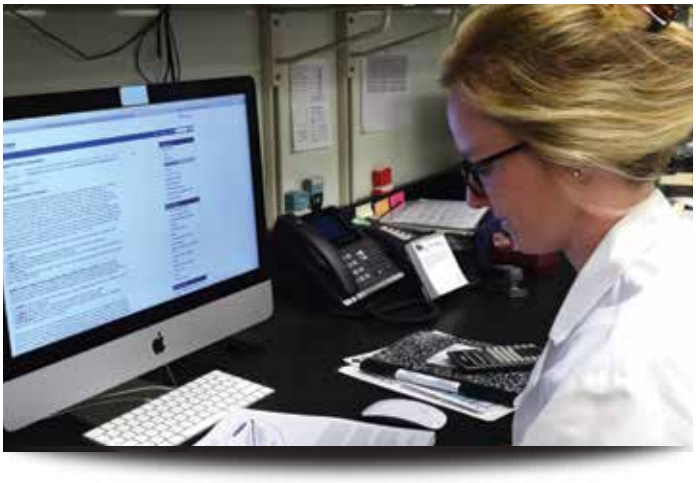
2021-22 ENZYME & BIOCHEMICAL CATALOG

Worthington® Biochemical Corporation

Primary Enzyme Producer

Expanded 18th Edition Tissue Dissociation Guide

Guiding researchers for decades, this comprehensive handbook includes Cell Isolation Theory, Cell Isolation Systems and Optimization Techniques, Tissue Culture and Stem Cell Glossaries, extensive Tissue/Cell reference listings and much more.

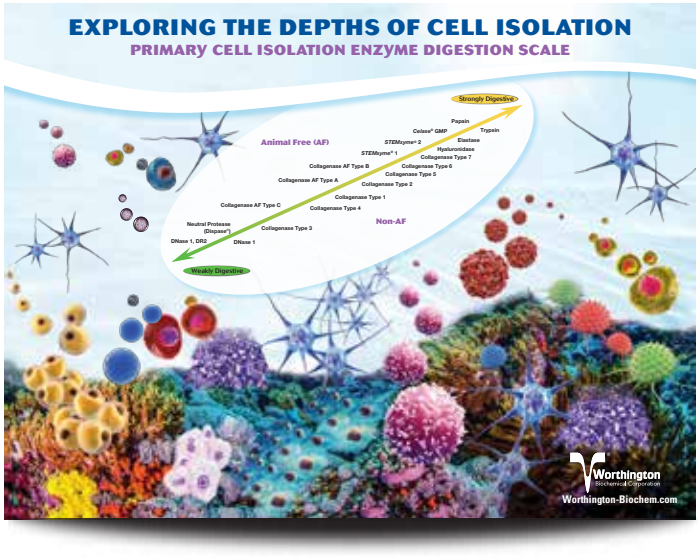


Sharing Our Enzyme Expertise

Worthington is supporting life science research and discovery, and we have done so for over 70 years. Authoring technical manuals and guides both in print and digital formats. And, we are cited in thousands of respected scientific journals across the globe. For additional up-to-the-minute citations you can either go to our product pages at Worthington-Biochem.com or see our new comprehensive citations at Bioz.com and search for Worthington Biochemical /Article Snippets.

Stem Cell Poster

New educational tissue guide includes an eye-catching, 4-color technical wall poster titled, *Exploring the Depths of Cell Isolation.* Request a copy today at Worthington-Biochem/TissueDissociation.com



Cover Art

"Thrive" is a study of ***Tropaeolum*** commonly known as **nasturtium**, a genus of roughly 80 species of flowering plants. The painting is an abstract interpretation of nasturtium leaves, organic shapes and forms, along with cool dark shadows and warm highlights.The image evokes feelings of a cellular nature, a view of cell shaped flowers similar to a billowing nasturtium plant. In the painting, all of the individual, simple pieces come together to form something bigger. They move independently, but also thrive as one. Custer, Bri, *Thrive*, 2018, 20" x 20", Oil on Canvas. Bri Custer is a full-time artist based in Dover, NH. Her landscape paintings are investigations of perception, memory, and color manipulation.

A Personal Note of Thanks

Worthington wishes to thank our loyal customers for their continued support and feedback. Your comments and suggestions help us to constantly evolve our product lines and enhance educational materials and service.

We invite researchers to work with us hand-in-hand to build our technical library by submitting:

- Research photos and data for potential use in future publications and
- Protocols, citations and articles referencing Worthington enzymes that can be shared with your colleagues.

We look forward to working with you, and we welcome the opportunity to discuss your specific application requirements.

The Worthington Family

For details on submissions, contact your local Worthington Account Manager or forward suggestions to: techservice@worthington-biochem.com

Phone: 800.445.9603 • 732.942.1660 • Fax: 800.368.3108 • 732.942.9270
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  TissueDissociation.com
- **Write:** Worthington Biochemical Corporation
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  Lakewood, New Jersey 08701 U.S.A

Terms of Sale

Prices effective January, 2021 and are subject to change without notice.
Not responsible for typographical errors. Shipping charges will be prepaid and added to the invoice unless other arrangements are made at the time of ordering. Insurance will be charged for higher-value shipments at our discretion. An additional $75.00 fee is charged for shipments requiring a USDA endorsed export certificate.

Payment terms are Net 30 Days, F.O.B. Origin, Lakewood, New Jersey USA, payable in US dollars. All checks must be drawn on a US bank or payment made by wire transfer.
Past due accounts may be charged a 1.5% per month late payment fee.

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VISA, MasterCard & American Express are also accepted.

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Quantity Discounts

Quantity	Price
1 to 4	List Price
5 to 9	5% off list
10 to 19	10% off list
20 or more	15% off list
Bulk	Inquire

Standing Orders & Additional Discounts

For orders of greater than 25 packages, or orders of material packed in bulk, contact your representative or the Bulk Sales Office for special pricing consideration. Standing orders may also qualify for discounts. We welcome long-term use projections for which we can consider special rates. Large institutional buyers should contact their representative regarding special purchasing agreements.

Bulk, Contract/Custom & OEM Enzyme Purchasing

As a primary manufacturer, Worthington can supply products in a wide range of purity and activity specifications and in large-scale bulk quantities at substantial discounts. In addition, we welcome inquiries for contract and custom manufacturing, custom analysis, and special packaging for OEM applications. Several products are listed as Bulk Only in this catalog due to limited availability. For more information on our services, see page 102. Please contact Customer Service or our Bulk Sales Office to discuss your specific requirements.

Complete Standard Terms and Conditions of Sale available on our website.

Technical Service

Available 8:00 AM to 5:00 PM Eastern Time Monday through Friday. We can be contacted 24 hours a day by fax, e-mail or through our website.

Worthington makes the products we sell and welcome your questions and suggestions. Because we are a primary manufacturer we have ready access to all production and quality control records of our products by lot number.

Our years of experience in enzyme purification put us in a position to assist individual researchers with special needs. We frequently do customized preparations of entirely new products. We can make modifications of a regular production procedure on a custom basis. Furthermore, our quality control department can do special testing if needed.

Need help with protocols? Ask a representative how we can help update you with our latest technical tools.

Sampling Program Online

Our position as the principal manufacturer of research grade collagenase makes possible our Collagenase Sampling Program. Under the program, we provide 100 mg samples of up to three different lots of collagenase for evaluation in your own cell isolation systems. A period of 60 days is allowed for your evaluation of these samples. A minimum of 3 grams of each lot of collagenase will be placed on HOLD, reserved in your name. When you determine which lot performs best for you, specify the lot desired when ordering. The only requirement, once a suitable lot of collagenase is found, is that you purchase a minimum of 3 grams of the material. **There is no charge for participating in the Collagenase Sampling Program. Contact your representative or our Technical Service group for more information at techservice@Worthington-Biochem.com**.

Collagenase Lot Selection Tool

Worthington's Collagenase Lot Selection Tool is available online at our website. This feature was designed to help researchers select and evaluate current collagenase lots that match previous lots or desired activity profiles. Users may enter target values for collagenase, caseinase, clostripan, and tryptic activities or specify previous lot numbers. Each value can be weighted based on the relative level of importance to the application. After the search for matches is completed, a ranked list of collagenase lots currently available is generated. The selected lots can then be sampled simply by using the built-in link to the Free Collagenase Sampling Program. As always, Worthington Customer and Technical Service personnel are available via phone and e-mail to assist with collagenase or any other products.

ISO 9001 Certified Quality Management System

Worthington Biochemical Corporation is company-wide ISO9001 certified and operates according to GMP guidelines. Our initial ISO assessment audit was performed by ANAB-accredited SGS US Testing Company, Systems & Services Certification in 2005 with continuous successful re-certifications.

Product Use

All Worthington products are sold for manufacturing, research, and laboratory use only by properly trained and authorized personnel. Researchers and clinical laboratory personnel intending to use any of these products for medical investigation on humans are solely responsible for such use, and for compliance with the pertinent regulations of the United States Food & Drug Administration (USFDA) and other regulations. We do not assume liability for damages resulting from the use of these products or from their use in violation of patent or other rights.

U.S.D.A. Certified Raw Materials

All products from animal sources are produced from starting materials of United States Department of Agriculture (USDA) or equivalent approved origin, collected in USDA or equivalent approved facilities, inspected to be free of disease and suitable for exportation. Certificates of Origin are available upon request.

Animal Free Products

Several Animal Free (AF) nucleases, proteases and other products are also available to eliminate BSE/TSE and mammalian viral risks. Please inquire. All animal free products are designated with this symbol for ease of use.

Product Returns

Authorization for any product return must be obtained from Worthington Biochemical Corporation (Customer Service Department), or its authorized representative, prior to the return of product. This authorization is required to insure the proper return of material and, if applicable, the correct issuance of credit. There is no provision for credit of misused, improperly stored or outdated material. Product(s) must be returned in the same condition as received within 30 days of the original shipment by Worthington Biochemical Corporation. A restocking fee may be charged.

Complete Standard Terms and Conditions of Sale available on our website.

Online Resources

Hundreds of pages of technical, product and reference information are available online at: Worthington-Biochem.com

Worthington Enzyme Manual

Tissue Dissociation Guide

Catalog and Price List

Online Collagenase Lot Selection Tool

Additional Features

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Charles C. Worthington lab, 1947

Worthington lab, 2019

Name	Activity	Catalog Number	Package	Price	Code

Actin

Source: Rabbit Muscle **CAS Number: 51005-14-2**

Actin is a protein involved in the conversion of chemical energy into mechanical work. ATP is an essential component of the molecule. Actin is a key component of muscle myofibrils that combines with the heavy meromyosin (HMM) portion of the myosin filament to form the highly viscous actomyosin. Actin is characterized by its super-precipitation with myosin, its activation of myosin ATPase (EC 3.6.1.3) at low ionic strength and its depolymerization, i.e., loss of viscosity, on adding ATP at high ionic strength. Actin is reversibly transformed into a viscous polymerized fibrous form, F-actin, by the addition of neutral salts at a neutral or slightly alkaline pH. The reaction which involves bound nucleotide is:

Stability/Storage: Stable 1-2 years at 2-8°C. Store at 2-8°C.

Actin					**ACT**
Prepared by modification of the procedure of Spudich and Watt, *J. Biol. Chem., 246,* 4866 (1971). Purity checked by SDS-PAGE. A lyophilized powder. Store at 2-8°C.	N/A	LS001041 LS001045 LS001043	1 mg 5 mg Bulk	50.00 185.00 Inquire	

Related Product: Deoxyribonuclease

Name	Activity	Catalog Number	Package	Price	Code

Adenosine Deaminase

Source: Calf Spleen

I.U.B.: 3.5.4.4 **CAS Number: 9026-93-1**

Adenosine deaminase is a purine catabolic enzyme ubiquitous in mammalian tissue that catalyzes the deamination of both adenosine and 2'-deoxyadenosine to inosine and 2'-deoxyinosine, respectively.

Stability/Storage: Stable ≥ 6 months when stored at 2-8°C.

Unit Definition: One Unit converts one micromole of adenosine to inosine per minute at 25°C, pH 7.4.

Adenosine Deaminase					**ADA**
A chromatographically purified, dialyzed, lyophilized powder. Prepared by a modification of the method of Pfrogner, *Arch. Biochim. Biophys., 119,* 141 (1967). Store at 2-8°C.	≥ 15 Units per mg dry weight	LS009043 LS009044	250 un Bulk	175.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Albumin, Nuclease-Free

Source: Bovine Serum **CAS Number: 9048-46-8**

BSA processed to remove exonuclease, endonuclease, ribonuclease, and protease activities. Some degradation of the albumin may occur during treatment. The Worthington product is useful as a stabilizing agent in reactions and dilutions, and as a ballast protein in precipitations where contaminating nucleases and proteases are a concern.

Albumin, Nuclease-Free					**BSANF**
Prepared by a method developed at Worthington. Some degradation products may be present. ≥ 90% of the material is intact BSA as determined by SDS-PAGE. Tested for exonuclease, endonuclease, ribonuclease, and protease. An aqueous solution at neutral pH in 50% glycerol at 50 mg/ml. Store at 2-8°C.	N/A	LS000290 LS000291 LS000292	100 mg 5 x 100 mg Bulk	50.00 225.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Alcohol Dehydrogenase

Source: *Yeast*

I.U.B.: 1.1.1.1 **CAS Number: 9031-72-5**

Alcohol dehydrogenase derived from yeast is a metalloenzyme containing four tightly bound zinc atoms per molecule (Vallee and Hoch, *Proc. Natl. Acad. Sci. USA, 41,* 327, 1955). The optimum pH for the enzymatic oxidation of ethanol is 8.6-9.0 and is closer to 7.0 for the reduction of acetaldehyde.

Stability/Storage: Stable 4-5 months at 2-8°C.

Unit Definition: One Unit reduces one micromole of NAD per minute at 25°C, pH 8.8.

Alcohol Dehydrogenase, Suspension Two times crystallized. A suspension in 2.4 M ammonium sulfate containing 3% pyrophosphate and 0.1% glycine. Store at 2-8°C. SPECIAL SHIPPING: ICE PACK	≥ 300 Units per mg protein	LS001089	Bulk	Inquire	**ADHS**
Alcohol Dehydrogenase, Lyophilized Two times crystallized. A lyophilized powder. Store at -20°C. SPECIAL SHIPPING: ICE PACK	≥ 300 Units per mg protein	LS001069 LS001070 LS001071	100 mg 1 gm Bulk	92.00 695.00 Inquire	**ADHL**

Name	Activity	Catalog Number	Package	Price	Code

Aldolase

Source: Rabbit Muscle

I.U.B.: 4.1.2.13 **CAS Number: 9024-52-6**

Aldolase catalyzes the reversible conversion of fructose-1,6-bisphosphate to dihydroxyacetone phosphate + glyceraldehyde-3-phosphate and plays a key role in glycolysis and energy production.

Stability/Storage: The enzyme is irreversibly denatured at pH values lower than 4.5. A crystalline suspension in ammonium sulfate solution, pH 7.6, is stable for at least six months at 2-8°C.

Unit Definition: One unit causes an increase of 1.0 A_{240} per minute at 25°C, pH 7.5 with the hydrazine/3-phosphoglyceraldehyde assay (Jagannathan *et al., Biochem. J., 63,* 94, 1956).

Aldolase, Suspension Two times crystallized. A suspension in 2.1 M ammonium sulfate, pH 7.8. Store at 2-8°C.	≥ 10 units per mg protein	LS001123 LS001125	100 mg Bulk	130.00 Inquire	**ALD**
Aldolase, Lyophilized Chromatographically purified. A lyophilized powder containing 80% sucrose by weight. Purity checked by SDS PAGE. Useful as a chromatography size marker. Store at 2-8°C. PROTECT FROM MOISTURE.	N/A	LS001130 LS001128	100 mg Bulk	160.00 Inquire	**ALDC**

Name	Activity	Catalog Number	Package	Price	Code

Amino Acid Oxidase, D-

Source: Porcine Kidney

I.U.B.: 1.4.3.3 **CAS Number: 9000-88-8**

D-amino acid oxidase is a flavoprotein. The enzyme is isolated as a stable crystalline complex with benzoate from which the holo- and apoenzyme may be prepared. The benzoate, is readily exchanged for a substrate. D-amino acid oxidase in the presence of molecular oxygen oxidatively deaminates D-amino acids to corresponding α-keto-acids:

$$RCHNH_2COOH + O_2 + H_2O \rightleftharpoons RCOCOOH + NH_3 + H_2O_2$$

Stability/Storage: The enzyme is stable for months at 2-8°C as a dry, lyophilized powder and in solution at high protein concentration at 2-8°C. 1.4×10^{-5} M FAD prevents loss of activity upon dilution (Dixon and Kleppe, *Biochim. Biophys. Acta, 96,* 368, 1965).
Store at 2-8°C.

Unit Definition: 1 Unit oxidizes 1 micromole of D-alanine per minute at 37°C, pH 8.3.

Amino Acid Oxidase, D-					**DAOFF**
Chromatographically purified. A lyophilized powder. Note: This enzyme is sensitive to physical denaturation and should be reconstituted and handled with care. Store at 2-8°C.	≥ 2 Units mg per dry weight	LS006310 LS006308 LS006311	5 mg 25 mg Bulk	150.00 553.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Amino Acid Oxidase, L-

Source: *Crotalus adamanteus* Venom

I.U.B.: 1.4.3.2 **CAS Number: 9000-89-9**

L-Amino acid oxidase is an heterodimeric glycoprotein composed of two approximately 70 kDa subunits. Three electrophoretically different isozymes occur as different combinations of the two subunits. There are approximately two moles of FAD per mole of holo-enzyme. L-amino acid oxidase catalyzes the oxidative deamination of a number of L-amino acids. The enzyme is absolutely specific for L-isomers. The Worthington product is prepared according to Wellner and Meister, *J. Biol. Chem., 235,* 2013 (1960) to the point just prior to crystallization.

Stability/Storage: The enzyme is stable in solution for 6-12 months at 2-8°C. The presence of substrate and the absence of oxygen stabilize the enzyme at elevated temperatures. The enzyme may be reversibly inactivated by incubation at 38°C in phosphate buffer, pH 7.5 (Wellner, *Biochemistry, 5*, 1586, 1966). Curti *et. al.* report reversible inactivation upon freezing (Curti *et. al., J. Biol. Chem., 243,* 2306, 1968). Store at 2-8°C. Do not freeze.

Unit Defintion: One Unit oxidizes one micromole of L-leucine per minute at 25°C, pH 7.6.

Amino Acid Oxidase, L-					**LAO**
An aqueous solution with toluene added as a preservative. Store at 2-8°C. DO NOT FREEZE.	≥ 4 Units per mg protein	LS002763 LS002764 LS002766	2 mg 5 mg Bulk	80.00 162.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Carbonic Anhydrase

Source: Bovine Erythrocytes

I.U.B.: 4.2.1.1 **CAS Number: 9001-03-0**

Carbonic anhydrase is useful in carboxy group transfers and reduction reactions.

Unit Definition: One unit is determined by the electrometric method of Wilbur and Anderson, *J. Biol. Chem., 176*, 147 (1948), in which the time required (in seconds) for a saturated CO_2 solution to lower the pH of 0.02 M Tris-HCl buffer from 8.3 to 6.3, at 0-4°C is determined.

Name	Activity	Catalog Number	Package	Price	Code
Carbonic Anhydrase					**CA**
A dialyzed, lyophilized powder. Store at 2-8°C.	≥ 3,000 units per mg dry weight	LS001260	50 mg	112.00	
		LS001263	250 mg	496.00	
		LS001265	Bulk	Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Carboxypeptidase B

Source: Porcine Pancreas

I.U.B.: 3.4.17.2 **CAS Number: 9025-24-5**

Carboxypeptidase B catalyzes hydrolysis of the basic amino acids lysine, arginine and ornithine from the C-terminal end of polypeptides. The molecular weight is 34.5 kDa and the pH optimum is 7.9. Carboxypeptidase B is competitively inhibited by arginine, lysine and ornithine. The enzyme is not inhibited by di-isopropylfluorophosphate (DFP), but it is inhibited by metal chelating agents such as 1,10-phenanthroline.

Unit Definition: One Unit hydrolyzes one micromole of hippuryl-L-arginine per minute at 25°C, pH 7.65.

Name	Activity	Catalog Number	Package	Price	Code
Carboxypeptidase B, PMSF Treated					**COBPMS**
A solution in 100 mM sodium chloride. PMSF treated to inhibit tryptic and chymotryptic activities. Chymotrypsin and trypsin are less than 0.02%. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 70 Units per mg protein	LS001722	1 ku	45.00	
		LS001724	3 ku	97.00	
		LS001720	Bulk	Inquire	
Carboxypeptidase B					**COBC**
Chromatographically purified. A solution in 100 mM sodium chloride. Chymotrypsin and trypsin ≤ 0.02%. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 170 Units per mg protein	LS005305	5 mg	87.00	
		LS005301	10 mg	152.00	
		LS005304	50 mg	645.00	
		LS005302	Bulk	Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Carboxypeptidase Y

Source: Yeast

I.U.B.: 3.4.16.5 **CAS Number: 9046-67-7**

Carboxypeptidase Y is a glycoprotein exopeptidase of the 'acid' and 'serine' class. Carboxypeptidase Y has a broad amino acid specificity, including proline and amidated amino acid residues.

Unit Definition: One Unit hydrolyzes 1 micromole of benzyl-oxycarbonyl-L-phenylalanyl-L-leucine per minute at 25°C, pH 6.5.

Name	Activity	Catalog Number	Package	Price	Code
Carboxypeptidase Y					**COY**
A highly purified preparation supplied as a lyophilized powder. Store at -20°C.	≥ 50 Units per mg protein	LS009070	1 mg	118.00	
		LS009068	5 mg	505.00	
		LS009071	Bulk	Inquire	

Related Products: Carboxypeptidase B • Chymotrypsin • Clostripain (Endoproteinase-Arg-C) Protease, *Staph aureus* (Endoproteinase Glu-C) • Trypsin

Name	Activity	Catalog Number	Package	Price	Code

Catalase

Source: Bovine Liver

I.U.B.: 1.11.1.6 **CAS Number: 9001-05-2**

Catalase is a tetrameric hemoprotein that decomposes peroxide.

Technical Notes: To remove thymol from Product Code: CTR, measure desired amount of mixed suspension, centrifuge to collect enzyme crystals, remove supernatant. Resuspend crystals in one-half initial volume of water, respin. Discard wash supernatant in an appropriate manner and dissolve crystals in buffer of choice.

Stability/Storage: All preparations are stable for 12 months at 2-8°C. Lyophilized preparations should be protected from moisture. In addition, the Worthington Product Code: CTR should not be stored in plastic.

Unit Definition: One Unit decomposes one micromole of hydrogen peroxide per minute at 25°C, pH 7.0.

Name	Activity	Catalog Number	Package	Price	Code
Catalase, Suspension					**CTR**
A crystalline aqueous suspension of approximately 6 mg/ml containing thymol as a preservative. Store at 2-8°C. DO NOT STORE IN PLASTIC: CONTAINS THYMOL	≥ 20,000 Units per mg protein	LS001872	10 ml	51.00	
		LS001873	100 ml	375.00	
		LS001874	Bulk	Inquire	
Catalase, Filtered					**CTS**
Supplied as an aqueous solution of 2X crystallized catalase (Code: CTR without thymol) filtered through a 0.22 micron membrane. Minimum of 30,000 units/ml; 10 ml/vial. Store at 2-8°C. DO NOT FREEZE.	≥ 40,000 Units per mg protein	LS001896	10 ml	42.00	
		LS001898	10x10 ml	310.00	
Catalase, Lyophilized	≥ 3,000 Units per mg protein	LS001847	2 gm	73.00	**CTL**
A partially purified, lyophilized powder. Store at -20°C. PROTECT FROM MOISTURE.		LS001849	10 gm	302.00	
		LS001851	Bulk	Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Celase® GMP Collagenase Blend

Source: *Cl. histolyticum* Collagenase/*Bacillus* Neutral Protease

I.U.B.: 3.4.24.3/3.4.24.28 **CAS Number: 42613-33-2**

Celase® GMP is a proprietary, blended proteolytic enzyme designed for efficient, gentle and reproducible *in vitro* dissociation of nucleated cells from adipose tissue.

Convenience In Your Lab

- A single, sterile, ready-to-use vial containing both collagenase and a neutral protease can digest up to 280 gm of adipose tissue
- Best-in-class shelf life of up to 72 months

Clarity In Your Approach

- Research protocols are available from Cytori for dissociating canine, equine, human, ovine, porcine, rabbit and rodent adipose tissue
- Technical dossier is available from Cytori to ease the transition from research to clinical applications

Confidence In Your Result

- Included in IDE applications approved by U.S. FDA for alopecia, chronic heart failure, hamstring injuries, osteoarthritis of the knee, and hand manifestations of scleroderma
- Produced using avian and mammalian tissue-free raw materials, aseptic processes and sterile filtration under GMP guidelines to assure the lowest levels of impurities

Ask about our animal free products for a wide range of biomedical research and bulk bioprocessing applications.

Celase® GMP Collagenase Blend (Continued)

Total Protein 34.4 - 51.6 mg/vial

Endotoxin < 50 EU / mg

Stability Lyophilized: 72 months at -25 to -15°C
Reconstituted: 6 months at -25 to -15°C and up to 2 freeze-thaw cycles

Appearance White lyophilizate

Celase® A single, sterile, ready-to-use vial containing both collagenase and a neutral protease which can digest up to 280 gm of adipose tissue. Stable up to 72 months at -20°C. REQUIRES SPECIAL SHIPPING AND PACKAGING: DRY ICE.	Digests ≥ 280 gm of adipose tissue	1235-01	1 vial, 35 mg	915.00	**CLAS**
		1235-PKG	1 ea	65.00	**CLAS-PKG**

Related Products: Cell Isolation Optimizing System • Collagen • Deoxyribonuclease I • Elastase • Hepatocyte Isolation System Hyaluronidase • Neonatal Cardiomyocyte Isolation System • Neutral Protease (Dispase®) • Papain • Papain Dissociation System *STEMxyme*® 1 • *STEMxyme*® 2 • Trypsin • Trypsin Inhibitors

Name	Activity	Catalog Number	Package	Price	Code

Cell Isolation Optimizing System

A complete method development kit containing an assortment of enzymes most frequently used in enzymatic tissue dissociation and cell isolation procedures. Includes instructions, references, and strategies for the handling, use and optimization of enzymatic cell isolation methods for maximum yield of viable cells. Contains all enzymes commonly referenced in tissue dissociation and cell isolation procedures. Also contains the **Cell Isolation Guide** which describes the tissue types commonly used, the mode of action of the various enzymes, tissue culture techniques, and protocol optimization guidelines (with cell- and tissue-specific references for getting started in enzymatic cell isolation).

Tissue dissociation and cell harvesting are two principal applications for enzymes in tissue culture research and cell biology studies. Despite the widespread use of enzymes for these applications over the years, their mechanisms of action in dissociation and harvesting are not well understood. As a result, the choice of one technique over another is often arbitrary and based more on past experience than on an understanding of why the method works and what modifications could lead to even better results.

Investigators searching the scientific literature for information on the ideal enzymes and optimal conditions for tissue dissociation are often confronted with conflicting data. Much of the variation stems from the complex and dynamic nature of the extracellular matrix and from the historical use of relatively crude, undefined enzyme preparations for cell isolation applications. The extracellular matrix is composed of a wide variety of proteins, glycoproteins, lipids and glycolipids, all of which can differ in abundance from species to species, tissue to tissue and with developmental stage. The Worthington Cell Isolation Optimizing System provides an assortment of the widely used enzymes in purified form for establishing an optimized cell isolation procedure on a cost-efficient basis.

Kit Contents:

- **Collagenase Type 1, CLS-1, 500 mgdw**
- **Collagenase Type 2, CLS-2, 500 mgdw**
- **Collagenase Type 3, CLS-3, 500 mgdw**
- **Collagenase Type 4, CLS-4, 500 mgdw**
- **Trypsin, TRL, 500 mgdw**
- **Neutral Protease (Dispase®), NPRO, 10 mgdw**
- **Hyaluronidase, HSE, 50,000 un**
- **Elastase, ESL, 100 mgP**
- **Papain, PAPL, 100 mgP**
- **Deoxyribonuclease I, DP, 25 mgdw**
- **Trypsin Inhibitor, SIC, 100 mgdw**

Cell Isolation Optimizing System A complete method development kit containing an assortment of enzymes most frequently used in tissue dissociation and cell isolation procedures. Includes instructions, references, and strategies or the handling, use and optimization of enzymatic cell isolation methods to achieve maximum yield of viable cells. Kit includes 500 mg of each of four types of collagenase, 500 mg trypsin, 50 ku hyaluronidase, 100 mg elastase, 100 mg papain, 25 mg DNase I, 10 mg neutral protease (Dispase®) and 100 mg trypsin inhibitor. Store at 2-8°C.	N/A	LK003200	1 bx	570.00	**CIT**

Related Products: Collagenase • Deoxyribonuclease I • Elastase • Hepatocyte Isolation System Hyaluronidase • *STEMxyme*® 1 & 2 • Neonatal Cardiomyocyte Isolation System • Neutral Protease (Dispase®) Papain • Papain Dissociation System • Trypsin • Trypsin Inhibitor

Name	Activity	Catalog Number	Package	Price	Code

Cellulase

Source: *Trichoderma reesei* ATCC #26921 (previously *T. viride*)

I.U.B.: 3.2.1.4 **CAS Number: 9012-54-8**

Cellulase refers to a family of enzymes which act in concert to hydrolyze cellulose. *Trichoderma reesei* has an extensively studied cellulase enzyme complex. This complex converts crystalline, amorphous, and chemically derived celluloses quantitatively to glucose.

Unit Definition: One unit releases 0.01 milligrams of glucose per hour from microcrystalline cellulose at 37°C, pH 5.0.

Name	Activity	Catalog Number	Package	Price	Code
Cellulase Purified complex containing exo- and endoglucanase activities. A diafiltered, lyophilized powder. Tested for lipase, protease, and nuclease. Store at 2-8°C.	≥ 45 units per mg dry weight	LS002598 LS002601 LS002603 LS002600	250 mg 1 gm 10 gm Bulk	35.00 85.00 698.00 Inquire	**CEL**
Cellulase A partially purified, lyophilized powder. Store at 2-8°C.	≥ 25 units mg dry weight	LS002610 LS002611 LS002609	1 gm 10 gm Bulk	48.00 342.00 Inquire	**CELF**

Related Product: Pectinase

Choose from a wide range of high quality enzymes for a variety of life science research applications.

Name	Activity	Catalog Number	Package	Price	Code

Cholinesterase, Butyryl

Source: Horse Serum

I.U.B.: 3.1.1.8 **CAS Number: 9001-08-5**

Butyryl cholinesterase catalyzes the hydrolysis of a number of choline esters according to the following reaction:

$$\text{Acylcholine} + H_2O \longrightarrow \text{choline} + \text{carboxylate}$$

It is a homotetrameric glycoprotein, each subunit having a molecular weight of 110 kDa. Butyryl cholinesterase hydrolyzes butyrylcholine four times more rapidly than acetylcholine. Unlike acetyl cholinesterase, it does not hydrolyze D-beta-methyl acetylcholine. It is inhibited by 10µM physostigmine, numerous organophosphate esters, the carbamate derivates and quaternary ammonium salts.

Stability/Storage: Stable for 3 years at 2-8°C. Store at 2-8°C.

Unit Definition: 1 Unit hydrolyzes 1 micromole of acetylcholine per minute at 25°C, pH 7.4.

Cholinesterase, Butyryl A lyophilized powder. Store at 2-8°C.	≥ 4 Units per mg dry weight	LS001628 LS001632 LS001636	500 un 4 ku Bulk	98.00 595.00 Inquire	**CHE**

Name	Activity	Catalog Number	Package	Price	Code

Chymotrypsin

Source: Bovine Pancreas

I.U.B.: 3.4.21.1 **CAS Number: 9004-07-3**

Chymotrypsin preferentially catalyzes the hydrolysis of peptide bonds involving L-isomers of tyrosine, phenylalanine and tryptophan. It also readily acts upon amides and esters of susceptible amino acids. Chymotrypsin catalyzes the hydrolysis of bonds of leucyl, methionyl, asparaginyl and glutamyl residues.

Stability/Storage:: The enzyme is stable for days in solution at pH 3.0 and for years as a dry powder at 2-8°C. Protect from moisture.

Unit Definition: One Unit hydrolyzes one micromole of benzoyl-L-tyrosine ethyl ester per minute at 25°C, pH 7.8 in the presence of calcium. An activity of 45 Units per mg using the above definition, is the equivalent of 10,000 optical density or 1330 N.F. units per mg using ATEE as a substrate.

1 BTEE unit = 29.5 USP/NF units.

Chymotrypsin, Alpha, TLCK Treated, Sequencing Grade Three times crystallized and treated with 1-chloro-3-tosylamido-7-amino-2-heptanone (TLCK) to inhibit trypsin activity (Shaw, *et al., Biochemistry, 4*, 2219, 1965). Dialyzed against 1 mM HCl to remove autolysis products and low molecular weight contaminants. Supplied lyophilized in 25 ug and 100 ug high-recovery vials. Store at 2-8°C.	≥ 45 Units per mg protein	LS02130 LS02132	4 x 25 ug 4 x 100 ug	162.00 428.00	**CDSEQ**

Related Products: Endo-Arg-C • Endo-Glu-C • Trypsin, Modified • Trypsin

Name	Activity	Catalog Number	Package	Price	Code

Chymotrypsin (Continued)

Chymotrypsin, Alpha, TLCK Treated Three times crystallized and treated with 1-chloro-3-tosylamido-7-amino-2-heptanone (TLCK) to inhibit trypsin activity (Shaw, *et al., Biochemistry, 4*, 2219 1965). Dialyzed against 1 mM HCl to remove autolysis products and low molecular weight contaminants. Supplied as a dialyzed, lyophilized powder. Store at 2-8°C.	≥ 45 Units per mg protein	LS001430 LS001432 LS001434 LS001438	25 mg 100 mg 1 gm Bulk	28.00 68.00 530.00 Inquire	**CDTLCK**
Chymotrypsin, Alpha, Purified Chromatographically prepared by the procedure of Yapel *et al., J. Amer. Chem. Soc., 88,* 2573 (1966). A lyophilized powder. Store at 2-8°C.	≥ 45 Units per mg protein	LS001475 LS001479 LS001477	100 mg 1 gm Bulk	69.00 525.00 Inquire	**CDS**
Chymotrypsin, Alpha, 3X Three times crystallized alpha chymotrypsin, which is an activation product of a three times crystallized zymogen. Dialyzed against 1 mM HCl and lyophilized. Store at 2-8°C.	≥ 45 Units per mg protein	LS001448 LS001450 LS001451 LS001453	250 mg 1 gm 10 gm Bulk	40.00 115.00 868.00 Inquire	**CDI**
Chymotrypsin, Alpha, Crystallized Crystallized as zymogen and activated. Dialyzed against 1 mM HCl and lyophilized. Store at 2-8°C.	≥ 35 Units per mg protein	LS001333 LS001334 LS001332	1 gm 10 gm Bulk	32.00 190.00 Inquire	**CDAG**

Related Products: Carboxypeptidase B • Carboxypeptidase Y • Collagenase • Elastase • Hyaluronidase • Neutral Protease (Dispase®) Papain • Pepsin • Protease, *Staph aureus* (Endoproteinase Glu-C) • Proteinase K • Trypsin • Trypsin Inhibitors

Name	Activity	Catalog Number	Package	Price	Code

Chymotrypsinogen A

Source: Bovine Pancreas **CAS Number: 9035-75-0**

The zymogen form of chymotrypsin. Chymotrypsin preferentially catalyzes the hydrolysis of peptide bonds involving L-isomers of tyrosine, phenylalanine and tryptophan. It also readily acts upon amides and esters of susceptible amino acids. Chymotrypsin catalyzes the hydrolysis of bonds of leucyl, methionyl, asparaginyl and glutamyl residues.

Unit Definition: One Unit hydrolyzes one micromole of benzoyl-L-tyrosine ethyl ester per minute at 25°C, pH 7.8 in the presence of calcium. An activity of 45 Units per mg using the above definition, is the equivalent of 10,000 optical density or 1330 N.F. Units per mg using ATEE as a substrate.

1 BTEE unit = 29.5 USP/NF Units.

Chymotrypsinogen A, Purified Five times crystallized, electrophoretically homogeneous. Supplied as a dialyzed, lyophilized powder. Intrinsic activity ≤ 0.55 U/mg chymotrypsin. Store at 2-8°C.	Activates to ≥ 45 Units per mg protein	LS005630 LS005623 LS005622	1 gm 5 gm Bulk	60.00 200.00 Inquire	**CGC**

Name	Activity	Catalog Number	Package	Price	Code

Clostripain (Endoproteinase-Arg-C)

Source: *Clostridium histolyticum*

I.U.B.: 3.4.22.8 **CAS Number: 9028-00-6**

Clostripain (Endoproteinase-Arg-C) is a two chain cysteine proteinase associated with collagenase and isolated from *Clostridium histolyticum*. It is highly specific for the carboxyl peptide bond of arginine. Clostripain is activated by dithiothreitol, cysteine, or other sulfhydryl containing reagents. The presence of calcium ions is essential. The enzyme is inhibited by oxidizing agents, divalent cations such as Co^{2+}, Cu^{2+}, Cd^{2+}, and heavy metal ions. Citrate, borate, and Tris anions are less inhibitory.

Unit Definition: One Unit hydrolyzes one micromole of N-benzoyl-L-arginine ethyl ester per minute at 25°C, pH 7.6, in the presence of dithiothreitol.

Clostripain (Endoproteinase-Arg-C) Sequencing Grade					**CPSEQ**
Chromatographically purified. A dialyzed, pre-activated, lyophilized powder. Supplied in 10 µg high recovery vials. Store at 2-8°C.	≥ 50 Units per mg protein	LS02135 LS02139	10 ug Bulk	94.00 Inquire	
Clostripain (Endoproteinase-Arg-C)					**CP**
Chromatographically purified. A dialyzed, pre-activated, lyophilized powder. Store at 2-8°C.	≥ 50 Units per mg dry weight	LS001641 LS001643 LS001646 LS001647	1 mg 5 x 1 mg 10 mg Bulk	38.00 151.00 231.00 Inquire	

Related Products: Collagenase • Chymotrypsin • Deoxyribonuclease I • Elastase • Endo-Glu-C • Hepatocyte Isolation System Hyaluronidase • Neonatal Cardiomyocyte Isolation System • Neutral Protease (Dispase®) • Papain • Papain Dissociation System Trypsin • Trypsin Inhibitor • Trypsin, Modified

Name	Activity	Catalog Number	Package	Price	Code

Collagen

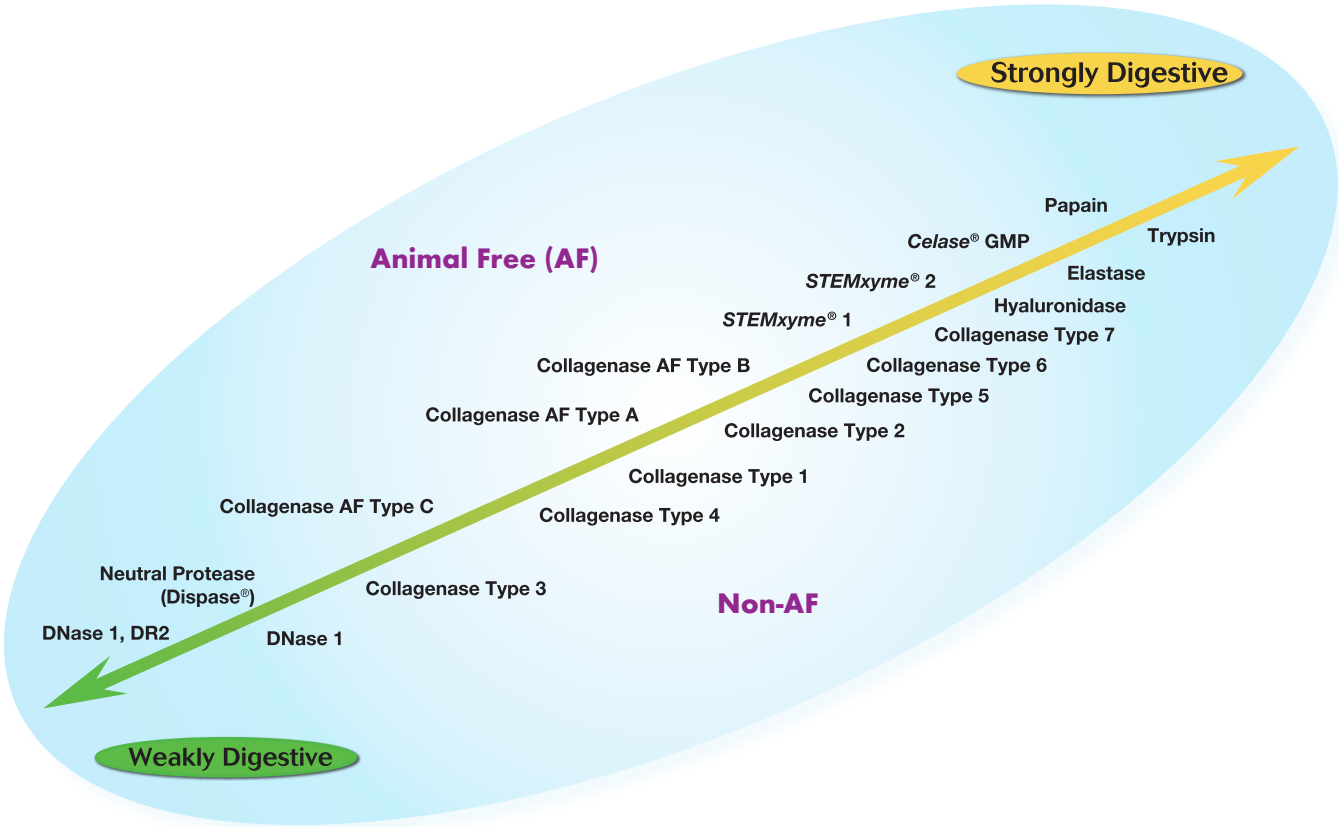
CAS Number: 9007-34-5

Collagen is an inert, rigid protein found predominantly in skin, ligaments, bones and teeth. Its most distinctive characteristic in its role as a transmitter of mechanical force is its inelasticity. The fundamental structural unit is a tropo-collagen, a molecular rod about 2600 Å in length and 15 Å in diameter with a molecular weight of 300 kDa In tendons, these macromolecules, grouped as collagen fibrils, run parallel to the axis; in skin the fibrils are interlaced and branched. Collagen fibers with limited cross-linkages (i.e., unaged) will dissolve to some extent in dilute acid or concentrated neutral salt solutions.

Collagen **Source:** Bovine Achilles Tendon					**CL**
Type I collagen prepared by the method of Einbinder and Schubert, *J. Biol. Chem., 188,* 335 (1951). Supplied as a shredded, lyophilized, insoluble preparation. Store at 2-8°C.	N/A	LS001654 LS001652 LS001656 LS001658	1 gm 5 gm 10 gm Bulk	35.00 115.00 200.00 Inquire	
Collagen, Soluble **Source:** Calf Skin					**CLCS**
Type I collagen supplied as a 6mg/ml liquid preparation in 75 mM sodium citrate, pH 3.6 - 4.0, containing 0.01% thimerosal as a preservative. Store at 2-8°C REQUIRES SPECIAL SHIPPING: ICE PACK Note: Contains thimerosal as a preservative; proper handling and disposal required.	≤ 20 minutes gel time	LS001663	Bulk	Inquire	

Related Product: Collagenase

Worthington Primary Cell Isolation Enzyme Digestion Scale



Tissue dissociation/primary cell isolation and cell harvesting are principal applications for enzymes in tissue culture, stem cell research and cell biology studies. The goal of a cell isolation procedure is to maximize the yield of functionally viable, dissociated cells. There are many parameters which may affect the outcome. The choice of enzyme is an important parameter. Worthington's Tissue Dissociation Guide summarizes our knowledge of how these enzymes accomplish the "routine" operations of tissue dissociation and primary cell harvesting. This technical guide describes standard lab procedures; offers a logical experimental approach for establishing a cell isolation protocol; and lists many tissue specific references to aid development of an effective method. For more information, go to: TissueDissociation.com

Worthington Collagenase Products, Specifications and Applications Table

Product Code	Collagenase	Caseinase	Clostripain	Tryptic	Comments/Applications*
	CDU/mgdw	u/mgdw	u/mgdw	u/mgdw	
Partially Purified					
CLS-1	≥125	≥200	≤4.0	≤0.5	Balanced activities/Adipose, Adrenal, Epithelial, Liver, Lung
CLS-2	≥125	≥200	≥3.5	≥0.1	Higher proteolytic activities/Bone, Heart, Liver, Thymus
CLS-3	≥100	≥50	≤3.0	≤0.3	Lower proteolytic activities/Mammary
CLS-4	≥160	≥100	≤3.0	≤0.1	Lower tryptic activity/Pancreatic Islets
CLS-5	≥450	≥450	≤4.0	≤0.3	Higher collagenase and caseinase activities
CLS-6	≥400	≥1,000	≤4.0	≤0.5	Higher activity with caseinase to collagenase ratio ~2:1, designated to be enriched for Type II (*col* H) collagenase relative to Type I (*col* G)
CLS-7	≥1,000	≥2,000	≤8.0	≤0.5	Contains collagenase and caseinase activities 4X higher than collagenase Types 1 and 2
CLSS-1	≥125	≥200	≤4.0	≤0.5	0.22µ Filtered CLS-1 in 50mg & 1gm Vials
CLSS-2	≥125	≥200	≥3.5	≥0.1	0.22µ Filtered CLS-2 in 50mg & 1gm Vials
CLSS-3	≥100	≥50	≤3.0	≤0.3	0.22µ Filtered CLS-3 in 50mg Vials
CLSS-4	≥160	≥100	≤3.0	≤0.1	0.22µ Filtered CLS-4 in 50mg & 1gm Vials
CLSS-5	≥450	≥450	≤4.0	≤0.3	Higher collagenase and caseinase activities
CLSH	≥125	≥200	≤4.0	≤0.5	0.22µ Filtered, ≥22,500U CLS-1 & 30U ESL component of HIS kit
Animal Free					
CLSAFA	≥150	≥150	≤8.0	≥0.1	Balanced Activities/AF Stem Cell & Tissue Bioprocessing
CLSAFB	≥300	≥300	≤5.0	≤0.5	Higher Activities/AF Stem Cell & Tissue Bioprocessing
CLSAFC	≥200	≥150	≤3.0	≤0.1	Lower Protease Activities/AF Stem Cell & Tissue Bioprocessing
CLSAFAS	≥150	≥150	≤8.0	≥0.1	0.22µ Filtered AF CLSAFA in 50mg vials
CLSAFBS	≥300	≥300	≤5.0	≤0.5	0.22µ Filtered AF CLSAFB in 50mg vials
CLSAFCS	≥200	≥150	≤3.0	≤0.1	0.22µ Filtered AF CLSAFC in 50mg vials
***STEMxyme*® Animal Free Blends of Collagenase and Neutral Protease**					
STZ1	≥250	≥1,000	≤5.0	≤0.5	0.22µ Filtered CLSAFB & NPRO/AF Stem Cell & Tissue Bioprocessing
STZ2	≥250	≥2,000	≤5.0	≤0.5	0.22µ Filtered CLSAFB & NPRO/AF Stem Cell & Tissue Bioprocessing
Chromatographically Purified					
CLSPA	≥500	≤50	≤2.0	≤0.25	Low Protease/Collagen Studies, Tissue Digestion combined with other proteases
CLSPANK	≥500	≤50	≤2.0	≤0.25	0.22µ Filtered, ≥1,500U CLSPA component of NCIS kit

*Correlations between type and effectiveness with different tissues have been good, but not perfect, and may be dependent partly on parameters of use and objectives as well as lot-to-lot variations. For more information see the Collagenase Sampling Program information.

Phone: 800.445.9603 • 732.942.1660 • Fax: 800.368.3108 • 732.942.9270
Worthington-Biochem.com
ISO9001 Certified

Collagenase

Source: *Clostridium histolyticum*

I.U.B.: 3.4.24.3 **CAS Number: 9001-12-1**

Clostridium histolyticum contains two distinct but related genes for collagenase. The *col* G gene codes for a 936 amino acid protein designated Collagenase Type 1 and the *col* H gene codes for a 1021 amino acid protein designated Collagenase Type II. Partially purified preparations contain several isoforms of both these gene products, a sulfhydryl protease, clostripain, a trypsin-like enzyme, and an aminopeptidase. This combination of collagenolytic and proteolytic activities is effective at breaking down intercellular matrices, the essential part of tissue dissociation. One component of the complex is a hydrolytic enzyme that degrades the helical regions in native collagen preferentially at the Y-Gly bond in the sequence Pro-Y-Gly-Pro, where Y is most frequently a neutral amino acid. This cleavage yields products susceptible to further peptidase digestion. Partially purified collagenase is inhibited by metal chelating agents such as cysteine, EDTA or o-phenanthroline but not DFP. It is also inhibited by alpha-2-macroglobulin, a large plasma glycoprotein. Ca^{2+} is required for enzyme activity. Particular enzymatic profiles of each collagenase have been correlated with the tissues from which the cells for study were obtained (or with the uses to which the cells are put). As a result of the correlations, several types of partially purified collagenases have been established by Worthington: Types 1, 2, 3, 4, 5, 6 and 7.

- **Type 1** partially purified collagenase has the original balance of collagenase, caseinase, clostripain and tryptic activities.
- **Type 2** contains higher relative levels of protease activity, particularly clostripain.
- **Type 3** contains lowest levels of secondary proteases.
- **Type 4** is designed to be especially low in tryptic activity to limit damage to membrane proteins and receptors.
- **Type 5** contains higher collagenase and caseinase values.
- **Type 6** contains high collagenase activity with a caseinase to collagenase ratio ~2:1. Designed to be enriched for Type II (*col* H) collagenase relative to Type I (*col* G).
- **Type 7** contains collagenase and caseinase activities four-fold higher than collagenase Types 1 and 2.
- **CLSPA** Chromatographically purified collagenase, contains minimal secondary proteolytic activities along with high collagenase activity. Animal Free Types AFA, AFB and AFC collagenase are derived from cultures grown in medium completely devoid of animal based components and designed for bioprocessing applications where introduction of potential animal derived pathogens must be prevented.

Animal Free:

- **CLSAFA** is the original AF grade designed to have collagenase and secondary proteases similar to Types 1 and 2 collagenase.
- **CLSAFB** contains higher collagenase and caseinase activities than CLSAFA.
- **CLSAFC** has especially low tryptic activity similar to Type 4 collagenase.

Worthington also offers 0.22 micron filtered preparations of many types in 50 mg/vial pre-packaged form for direct reconstitution and use in all isolation procedures.

The collagenase assay is a modification of Mandl wherein collagenase is incubated for five hours with native collagen and the extent of collagen breakdown is determined using the Moore and Stein, *J. Biol. Chem., 176*, 367 (1948) colorimetric ninhydrin method. Amino acids released are expressed as micromoles leucine per milligram collagenase.

Uses: Partially purified collagenases are widely used in enzymatic primary cell isolation and tissue dissociation procedures. Most researchers employ either partially purified collagenase preparations such as Types 1–7 or chromatographically purified collagenase (Code: **CLSPA**); the latter is usually combined with secondary enzymes such as elastase, hyaluronidase, etc. For best results, the precise mixture of proteolytic activities must be tailored to the tissue to be dissociated. Correlations between type and effectiveness with different tissues have been good, but not perfect, and may be dependent partly on parameters of use and objectives, as well as lot-to-lot variations. For more information see the Collagenase Sampling Program information at the beginning of this catalog. Worthington also publishes a Tissue Dissociation Guide, which provides additional information regarding the enzymes used for these applications and specific references for numerous cell and tissue types. A complete copy is available on our website, Worthington-Biochem.com or may be requested through Customer Service at 800.445.9603/732.942.1660.

Collagenase Lot Selection Tool Available Online

Worthington's Collagenase Lot Selection Tool is available online at our website. This new feature was designed to help researchers select and evaluate current collagenase lots that match previous lots or desired activity profiles. Users may enter target values for collagenase, caseinase, clostripan, and tryptic activities or specify previous lot numbers. Each value can be weighted based on the relative level of importance to the application. After the search for matches is completed, a ranked list of collagenase lots currently available is generated. The selected lots can then be sampled simply by using the built in link to the Free Collagenase Sampling Program.

As always, Worthington Customer and Technical Service personnel are available via phone at 800.445.9603 / 732.942.1660 and ***techservice @Worthington-Biochem.com*** to assist with collagenase or any other products.

Collagenase (Continued)

Unit Definition: One unit releases one micromole of L-leucine equivalents from collagen in 5 hours at 37°C, pH 7.5.

Name	Activity	Catalog Number	Package	Price	Code
Collagenase, Purified Chromatographically purified. ≤ 50 caseinase units per milligram. Supplied as a lyophilized powder. Store at 2-8°C.	≥ 500 units per mg dry weight	LS005275 LS005273 LS005277	4 ku 10 ku Bulk	86.00 179.00 Inquire	**CLSPA**
Collagenase Vial, NCIS A component of the NCIS kit. This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 5 ml of HBSS or equivalent yields a solution of 300 units/ml of collagenase, Code: CLSPA. Suitable for cell isolation and culture applications. Store at 2-8°C.	≥ 1500 units per vial	LK003240 LK003245	1 vi 5 vi	32.00 130.00	**CLSPANK**
Collagenase, Type 1 The original balance of enzymatic activities. Each lot assayed for collagenase, caseinase, clostripain and tryptic activities. Suggested for epithelial, liver, lung and adrenal primary cell isolations. A dialyzed, lyophilized powder. Store at 2-8°C.	≥ 125 units per mg dry weight	LS004194 LS004196 LS004197 LS004200	100 mg 1 gm 5 gm Bulk	38.00 195.00 825.00 Inquire	**CLS-1**
Collagenase, Type 2 Prepared to contain higher clostripain activity. Suggested for bone, heart, liver, thyroid and salivary primary cell isolation. Supplied as a dialyzed, lyophilized powder. Store at 2-8°C.	≥ 125 units per mg dry weight	LS004174 LS004176 LS004177 LS004179	100 mg 1 gm 5 gm Bulk	38.00 195.00 825.00 Inquire	**CLS-2**
Collagenase, Type 3 Lower in secondary proteolytic contaminant activities but with typical collagenase activity. Suggested for mammary primary cell isolation. A dialyzed, lyophilized powder. Store at 2-8°C.	≥ 100 units per mg dry weight	LS004180 LS004182 LS004183 LS004185	100 mg 1 gm 5 gm Bulk	38.00 195.00 825.00 Inquire	**CLS-3**
Collagenase, Type 4 Prepared to contain lower tryptic activity levels to limit damage to membrane proteins and receptors but with normal to above normal collagenase activity. Suggested for pancreatic islet primary isolation. A dialyzed, lyophilized powder. Store at 2-8°C.	≥ 160 units per mg dry weight	LS004186 LS004188 LS004189 LS004191	100 mg 1 gm 5 gm Bulk	38.00 195.00 825.00 Inquire	**CLS-4**
Collagenase, Type 5 Prepared to contain higher collagenase and caseinase activities. A dialyzed, lyophilized powder. Store at 2-8°C.	≥ 450 units per mg dry weight	LS005280 LS005282 LS005283 LS005284	100 mg 1 gm 5 gm Bulk	46.00 224.00 946.00 Inquire	**CLS-5**

Name	Activity	Catalog Number	Package	Price	Code
Collagenase (Continued)					
Collagenase, Type 6 Prepared to contain high collagenase activity with a caseinase to collagenase ratio ~2:1. Designed to be enriched for Type II (*col* H) collagenase relative to Type I (*col* G). A dialyzed, lyophilized powder. Store at 2-8°C.	≥ 400 units per mg dry weight	LS005318 LS005319 LS005321 LS005323	100 mg 500 mg 2.5 gm Bulk	52.00 203.00 570.00 Inquire	**CLS-6**
Collagenase, Type 7 Prepared to contain collagenase and caseinase activities four-fold higher than collagenase Type 1/2. A dialyzed, lyophilized powder. Store at 2-8°C.	≥ 1,000 units per mg dry weight	LS005332 LS005333 LS005335 LS005337	100 mg 500 mg 2.5 gm Bulk	59.00 229.00 676.00 Inquire	**CLS-7**
Collagenase, Type 1, 0.22µ Filtered Collagenase, Type 1 (Code: CLS-1), which is filtered through a 0.22 micron membrane and lyophilized in vials. Store at 2-8°C.	≥ 125 units per mg dry weight	LS004214 LS004216 LS004217	50 mg 5 x 50 mg 1 gm	49.00 178.00 445.00	**CLSS-1**
Collagenase, Type 2, 0.22µ Filtered Collagenase, Type 2 (Code: CLS-2), which is filtered through a 0.22 micron membrane and lyophilized in vials. Store at 2-8°C.	≥ 125 units per mg dry weight	LS004202 LS004204 LS004205	50 mg 5 x 50 mg 1 gm	49.00 178.00 445.00	**CLSS-2**
Collagenase, Type 3, 0.22µ Filtered Collagenase, Type 3 (Code: CLS-3), which is filtered through a 0.22 micron membrane and lyophilized in vials to contain ≥ 50 milligrams per vial. Store at 2-8°C.	≥ 100 units per mg dry weight	LS004206 LS004208	50 mg 5 x 50 mg	49.00 178.00	**CLSS-3**
Collagenase, Type 4, 0.22µ Filtered Collagenase, Type 4 (Code: CLS-4), which is filtered through a 0.22 micron membrane and lyophilized in vials. Store at 2-8°C.	≥ 160 units per mg dry weight	LS004210 LS004212 LS004209	50 mg 5 x 50 mg 1 gm	49.00 178.00 445.00	**CLSS-4**
Collagenase, Type 5, 0.22µ Filtered Collagenase, Type 5 (Code: CLS-5), which is filtered through a 0.22 micron membrane and lyophilized in vials. Store at 2-8°C.	≥ 450 units per mg dry weight	LS005286 LS005287 LS005288	50 mg 5 x 50 mg 1 gm	58.00 206.00 520.00	**CLSS-5**
Collagenase/Elastase Vial, HIS Kit Worthington collagenase (Code: CLS-1) and elastase (Code: ESL), filtered through 0.22 µm pore size membrane, and lyophilized. A component of the HIS kit also contains 30 u/vial elastase. Store unreconstituted vials at 2–8°C.	≥ 20,000 units per vial	LK002066 LK002067	1 vi 5 vi	54.00 237.00	**CLSH**

Name	Activity	Catalog Number	Package	Price	Code

STEMxyme® Collagenase/Neutral Protease Blends, Animal Free

STEMxyme®1, Collagenase/Neutral Protease (Dispase®), 0.22 Filtered Animal Free

STZ1

A specialized combination of Animal Free *Clostridium histolyticum* collagenase and Animal Free *Bacillus polymyxa* neutral protease with a minimum of 250 CLS units and 1,000 caseinase units per mg dry weight. Designed for stem cell and other primary cell isolations and bioprocessing applications where introduction of potential animal derived pathogens must be prevented. Store at 2-8°C

Activity	Catalog Number	Package	Price
≥ 250 collagenase units per mg dry weight ≥ 1,000 caseinase units per mg dry weight	LS004106	50 mg	95.00
	LS004107	5 x 50 mg	440.00

STEMxyme®2, Collagenase/Neutral Protease (Dispase®), 0.22 Filtered Animal Free

STZ2

A specialized combination of Animal Free *Clostridium histolyticum* collagenase and Animal Free *Bacillus polymyxa* neutral protease with a minimum of 250 CLS units and 2,000 caseinase units per mg dry weight. Designed for stem cell and other primary cell isolations and bioprocessing applications where introduction of potential animal derived pathogens must be prevented. Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 250 collagenase units per mg dry weight ≥ 2,000 caseinase unit per mg dry weight	LS004112	50 mg	146.00
	LS004113	5 x 50 mg	652.00

Related Products: Celase® Blend • Cell Isolation Optimizing System • Collagen • Deoxyribonuclease I • Elastase Hepatocyte Isolation System • Hyaluronidase • Neonatal Cardiomyocyte Isolation System • Neutral Protease (Dispase®) • Papain Papain Dissociation System • *STEMxyme*® 1 • *STEMxyme*® 2 • Trypsin • Trypsin Inhibitors

Name	Activity	Catalog Number	Package	Price	Code

Collagenases, Animal Free

Collagenase, Animal Free, Type A — **CLSAFA**

Collagenase derived from cultures grown in animal free medium. Suitable for applications needing to avoid introduction of animal derived pathogens into bioprocessing procedures. Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 150 units per mg dry weight	LS004152	100 mg	48.00
	LS004154	1 gm	235.00
	LS004156	5 gm	1015.00
	LS004158	Bulk	Inquire

Collagenase, Animal Free Type A, 0.22 Filtered — **CLSAFAS**

Collagenase, Animal Free which is filtered through a 0.22 micron membrane and lyophilized in vials. Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 150 units per mg dry weight	LS004118	50 mg	62.00
	LS004119	5 x 50 mg	250.00

Collagenase, Animal Free, Type B — **CLSAFB**

Prepared from cultures grown in medium completely devoid of animal based components and designed for bioprocessing applications where introduction of animal derived pathogens must be prevented. Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 300 units per mg dry weight	LS004145	100 mg	48.00
	LS004147	1 gm	235.00
	LS004148	5 gm	1015.00
	LS004150	Bulk	Inquire

Collagenase, Animal Free, Type B, 0.22 Filtered — **CLSAFBS**

Collagenase, Animal Free which is filtered through a 0.22 micron membrane and lyophilized in vials. Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 300 units per mg dry weight	LS004124	50 mg	62.00
	LS004125	5 x 50 mg	250.00

Collagenase, Animal Free, Type C — **CLSAFC**

Prepared from cultures grown in medium completely devoid of animal based components and designed for bio-processing applications where introduction of animal derived pathogens must be prevented. Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 200 units per mg dry weight	LS004138	100 mg	48.00
	LS004140	1 gm	235.00
	LS004141	5 gm	1015.00
	LS004143	Bulk	Inquire

Collagenase, Animal Free, Type C, 0.22 Filtered — **CLSAFCS**

Collagenase Animal Free which is filtered through a 0.22 micron membrane and lyophilized in vials Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 200 units per mg dry weight	LS004130	50 mg	62.00
	LS004131	5 x 50 mg	250.00

Name	Activity	Catalog Number	Package	Price	Code

Deoxyribonuclease I

Source: Bovine Pancreas

I.U.B.: 3.1.21.1 **CAS Number: 9003-98-9**

Bovine pancreatic deoxyribonuclease is an endonuclease that splits phosphodiester linkages, preferentially adjacent to a pyrimidine nucleotide, yielding polynucleotides with free hydroxyl group at the 3' position and a phosphate group at the 5' position. The average chain length of a limit digest is a tetranucleotide.
Uses: Worthington offers DNase at different levels of purity for different applications. Product Codes: DPRF and DPRFS are both especially designed for Molecular Biology applications and contain the lowest levels of RNase and protease activity. They are both suitable for use in techniques requiring digestion of DNA in the recovery of intact RNA or where the integrity of structural proteins or enzymes must be maintained. Applications have included nick translation, DNA mapping, isolation of nuclear RNA and protein, RNA polymerase synthesis of RNA probes and RT-PCR. DNase is also used in tissue culture work to digest DNA from damaged cells thereby reducing viscosity, and removing membrane bound DNA fragments. Worthington Codes: DP and DCLS are suitable for these applications.

Stability/Storage: When properly stored, all grades of Worthington deoxyribonuclease are stable for 2-3 years. Product code DPRFS may be stored at -20°C. For long term storage in solution, Product Codes D and DPFF may be dissolved in 5 mM acetate, 1 mM calcium, pH 4.5 and stored in single use aliquots at -20°C or -70°C for up to one year. Only freeze and thaw once; thawed aliquots are stable refrigerated at least several weeks. Addition of 50% glycerol will maintain a liquid state at -20°C without affecting stability. Material in 50% glycerol can be removed and returned to -20°C repeatedly. DPRF is unusually stable due to the absence of protease. For long term storage of DPRF after reconstitution, use water or any buffer pH 4.0 to 9.0 except phosphate; add 50% glycerol for storage as liquid at -20°C; avoid calcium chelators. Aliquot in single use containers; only freeze and thaw once; thawed aliquots are stable refrigerated at least several weeks.

Unit Definition: 1 unit causes an increase in absorbance at 260 nm of 0.001 per minute per ml at 25°C when acting upon highly polymerized DNA at pH 5.0. **Note**: Kunitz units as reported by other suppliers can be 2 to 4 times higher than Kunitz units as measured at Worthington. As measured at Worthington, one Kunitz unit digests 1 µg of calf thymus DNA in 10 minutes at 37°C in 50 mM Tris, 1 mM Mg^{2+}, 1 mM Ca^{2+}, pH 7.8. Correlation of digestion units with Kunitz units is different for other DNA and buffer systems.

Technical Note: Product Code DPRF: Each vial contains approximately 2 mg glycine and 2 µmoles calcium per 10,000 units of DNase I. Dissolving the entire vial in 5 ml provides the equivalent of a 1 mg/ml solution.

From research and development to manufacturing, continuous quality improvement is everyone's job.

Name	Activity	Catalog Number	Package	Price	Code
Deoxyribonuclease I (Continued)					
Deoxyribonuclease I, Ribonuclease & Protease Free, Solution					**DPRFS**
Molecular Biology Grade. Chromatographically purified to remove RNase and protease. Supplied as a solution at approximately 2 Kunitz units per microliter approximately 1 mg/ml containing 50% glycerol and 1 mM calcium chloride. Store at 2-8°C or -20°C.	≥ 2,000 Kunitz units per ml	LS006342 LS006344 LS006348	100 un 500 un Bulk	29.00 78.00 Inquire	
Deoxyribonuclease I, Ribonuclease & Protease Free					**DPRF**
Molecular Biology Grade. Chromatographically purified to remove RNase and protease. Lyophilized in vials. Each 10,000 unit vial contains 2 mg glycine, 2 µmoles calcium, and ≥ 10,000 units of DNase I. Each 2,500 unit vial contains 0.5 mg glycine, 0.5 µmoles calcium, and ≥ 2,500 units of DNase I. Dissolving the entire 10,000 unit vial in 5 ml, or the entire 2,500 unit vial in 1.25 ml, provides the equivalent of a 1 mg/ml solution. (ku = 1000 un). Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 2,000 Kunitz units per mg dry weight	LS006331 LS006333 LS006343 LS006334	2500 un 10 ku 50 ku Bulk	45.00 160.00 582.00 Inquire	
Deoxyribonuclease I					**DPFF**
Chromatographically purified. A lyophilized powder containing glycine as a stabilizer. Protease Free. Contains ≤ 0.0005% RNase. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 2,000 Kunitz units per mg dry weight	LS006330 LS006328 LS006332	25 ku 125 ku Bulk	93.00 341.00 Inquire	
Deoxyribonuclease I					**D**
Chromatographically purified. A lyophilized powder with glycine as a stabilizer. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 2,000 Kunitz units per mg dry weight	LS002004 LS002006 LS002007 LS002009	5 mg 20 mg 100 mg Bulk	35.00 85.00 300.00 Inquire	
Deoxyribonuclease I, Filtered					**DCLS**
Filtered through a 0.22 micron membrane and lyophilized in vials. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 2,000 Kunitz units per mg dry weight	LS002058 LS002060	11 mg 25 mg	100.00 180.00	
Deoxyribonuclease I, Standard Vial					**DSV**
Lyophilized in vials for assay standardization. Labeled to show established activity. Not suitable for assays at neutral pH. Store at 2-8°C.	~2,000 Kunitz units per vial	LS002173 LS002172	2 ku 5x2 ku	21.00 60.00	

Deoxyribonuclease I (Continued)

Name	Activity	Catalog Number	Package	Price	Code
PDS Kit, DNase Vial A component of the Papain Dissociation System. This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 0.5 ml of EBSS or equivalent yields a solution of 2000 units/ml of deoxyribonuclease (1 mg/ml). Store at 2-8°C.	≥ 1,000 units per vial	LK003170 LK003172	1 vi 5 vi	25.00 84.00	**D2**
Deoxyribonuclease I Partially purified. A lyophilized powder. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 2,000 Kunitz units per mg dry weight	LS002138 LS002139 LS002140 LS002141	25 mg 100 mg 1 gm Bulk	41.00 100.00 815.00 Inquire	**DP**
Deoxyribonuclease I Partially purified. A lyophilized powder. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 1,250 Kunitz units per mg dry weight	LS002145 LS002147 LS002149	100 mg 1 gm Bulk	82.00 590.00 Inquire	**DPB**

Related Products: Actin • Albumin, Nuclease-Free • Deoxyribonuclease II • Deoxyribonucleic Acid and Related Products Histones • Lysozyme • Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline • Phosphodiesterase I • Phosphodiesterase II Proteinase K • Recombinant Deoxyibonuclease • Reverse Transcriptase, Recombinant HIV • Ribonuclease • Ribonuclease T1 Ribonuclease T2 • Ribonucleic Acid

Quality manufacturing practices are followed every step of the way, in all departments, in our ISO9001 certified facility.

Deoxyribonuclease I, Recombinant Bovine Pancreatic, Animal Free

Source: *Pichia pastoris*

I.U.B.: 3.1.21.1 **CAS Number: 9003-98-9**

Bovine pancreatic deoxyribonuclease I produced recombinantly in yeast, *Pichia pastoris*, to decrease levels of contaminating RNase and proteases and eliminate potential pathogens associated with animal based materials.

Bovine pancreas is a rich source of RNase A which is often found in many commercial DNase preparations. Producing DNase I by recombinant means greatly facilitates purification of an enzyme with undetectable levels of RNase. The processes involved in the production and isolation of recombinant DNase I are completely devoid of animal based components, eliminating the possibility of introducing animal derived pathogens into bioprocessing procedures.

Recombinant DNase I is suitable for applications such as:

- Removing genomic DNA from RNA preparations prior to RT-PCR
- Degradation of DNA templates after transcription reactions
- Removing unwanted DNA from samples prior to Northern blotting
- Removing DNA during biopharma and bioprocessing procedures

Unit Definition: One unit causes an increase in absorbance at 260 nm of 0.001 per minute at 25°C when acting upon highly polymerized DNA at pH 5.0, which is the same as other Worthington DNase I products.
Note: Kunitz units as reported by other suppliers can be 2 to 4 times higher than Kunitz units as measured at Worthington. As measured at Worthington, one Kunitz unit digests 1 µg of calf thymus (or pUC19 or λ-phage) DNA in 10 minutes at 37°C in 50 mM Tris, 1 mM Mg^{2+}, 1 mM Ca^{2+}, pH 7.8. Correlation of digestion units with Kunitz units may be different in other buffer systems.

Storage Buffer (DR1S): 5 mM calcium acetate, 4 mg/ml glycine, pH 5.0 and 50% glycerol.

DNase I Reaction Buffer (10X): 500 mM Tris-HCl, 10 mM $MgSO_4$, 1 mM $CaCl_2$, pH 7.8, provided.

DNase I, Recombinant, Produced in *Pichia pastoris*, Ribonuclease & Protease Free, Lyophilized Powder

Molecular Biology Grade. Free of RNase and protease. Chromatographically purified and lyophilized powder containing glycine as a stabilizer. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 5,000 Kunitz units per mg protein	LS006361	10 ku	185.00	DR1
		LS006362	50 ku	775.00	
		LS006360	Bulk	Inquire	

DNase I, Recombinant, Produced in *Pichia pastoris*, Ribonuclease & Protease Free, Solution

Molecular Biology Grade. Chromatographically purified to remove RNase and protease. Supplied as a ready-to-use solution at 2 ≥ Kunitz u/µl in 5 mM calcium acetate, 4 mg/ml glycine, pH 5.0 and 50% glycerol. Includes 10X reaction buffer. Store at -20°C. REQUIRES ICE PACK.	≥ 2 Kunitz units per microliter	LS006353	2 ku	51.00	DR1S
		LS006355	5 x 2 ku	204.00	
		LS006357	Bulk	Inquire	

DNase I, Recombinant, Produced in *Pichia pastoris*, Animal Free, Bioprocess Grade

Chromatographically purified AF bioprocessing grade. Supplied as a lyophilized powder containing glycine as a stabilizer. For the removal of DNA in bioprocessing and primary stem cell isolation applications. May contain protease and RNase. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 2,000 Kunitz units per mg dry weight	LS006320	25 ku	90.00	DR2
		LS006322	100 ku	258.00	
		LS006323	500 ku	842.00	
		LS006325	Bulk	Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Deoxyribonuclease II

Source: Porcine Spleen

I.U.B.: 3.1.22.1 **CAS Number: 9025-64-3**

Deoxyribonuclease II from porcine spleen has a molecular weight of 38 kDa. The enzyme is a glycoprotein endonuclease with trimeric structure. Optimum pH range is 4.5-5.0 at ionic strength 0.15 M. Deoxyribonuclease II (Acid DNase) hydrolyzes deoxyribonucleotide linkages in native and denatured DNA yielding products with 3'-phosphates. It also acts on *p*-nitrophenylphosphodiesters at pH 5.6-5.9. Bernardi, *Biochem. Biophys. Res. Comm., 17*, 573 (1971) describes a three stage degradation of native DNA by DNase II.

Unit Definition: One unit causes an increase in absorbance at 260 nm of 0.001 per minute at 25°C, pH 4.6 using highly polymerized DNA as substrate.

Deoxyribonuclease II					**HDA**
A dialyzed, lyophilized powder. Store at 2-8°C.	≥ 800 units per mg dry weight	LS002425 LS002427	80 ku Bulk	74.00 Inquire	
Deoxyribonuclease II, Purified					**HDAC**
Chromatographically purified in a modification of the procedure of Bernardi, *et al., Biochim. Biophys. Acta, 129,* 1 (1966). A dialyzed, protein lyophilized powder. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 12,000 units per mg protein	LS005410 LS005411	20 ku Bulk	231.00 Inquire	
Deoxyribonuclease II, Purified, Solution					**HDACS**
Chromatographically prepared. A solution in 50% glycerol. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 12,000 units per mg protein	LS005416 LS005418 LS005420	2 ku 5 ku Bulk	49.00 112.00 Inquire	

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products Histones • Lysozyme • Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline • Phosphodiesterase II • Proteinase K Reverse Transcriptase, Recombinant HIV • Ribonuclease • Ribonuclease T1 • Ribonuclease T2 • Ribonucleic Acid

Name	Activity	Catalog Number	Package	Price	Code

Deoxyribonucleic Acid and Related Products

CAS Number: 9007-49-2

Worthington offers DNA purified from these sources:

Calf thymus: (Code: DNA) Prepared and purified by a method developed at Worthington to have lower protein and RNA contamination than most other commercial preparations. This highly polymerized DNA is an excellent substrate for deoxyribonuclease. A sodium salt, it must be converted by adding magnesium ions to be susceptible to DNase.

Calf thymus DNA, covalently bound to cellulose is also available:
DNA Cellulose, Double-Stranded (Code: DNACELDS)
DNA Cellulose, Single-Stranded (Code: DNACELSS)

Salmon Testes: (Code: SDNA) Prepared by a modification of the method of Emanuel and Chaikoff, *J. Biol. Chem., 203*, 164 (1953). A minimum of 75% native nucleic acid.

Salmon Testes DNA, Denatured & Fragmented (Code: SDNAD) is also available.
Prepared by mechanical shearing and heat denaturation.

Deoxyribonucleic Acid and Related Products (Continued)

Escherichia coli: (Code: DNAEC) Isolated as described by Marmur, *J. Mol. Biol., 3*, 208 (1961).

Lambda phage DNA (Code: DNAL) is prepared from CsCl purified phage and is purified to an $A_{260}/A_{280} \geq 1.8$. Homogeneous in agarose gel electrophoresis. A solution in 10 mM Tris-HCl pH 8.0 with 1 mM EDTA.

DNA fragments prepared by restriction endonuclease digestion of purified lambda DNA are available (Codes: DNALBSTE; DNALECOR; DNALHIND). Supplied as solutions in 10 mM Tris-HCl pH 8.0 with 1 mM EDTA.

Technical Note: One A_{260} unit = 50 µg DNA.

Stability/Storage: DNAL: Storage buffer 10 mM Tris-HCl, pH 8.0 containing 1 mM EDTA. Store at -20°C. Once thawed keep at 2-8°C.

Deoxyribonucleic Acid Highly polymerized; hyperchromicity ≥ 27%. A substrate for deoxyribonuclease assays. Prepared by a method developed at Worthington to remove contaminating RNA and protein. Supplied dried. Store at 2-8°C.	Hyper-chromicity ≥ 27%	LS002105 LS002106 LS002107 LS002108	100 mg 1 gm 5 gm Bulk	32.00 174.00 695.00 Inquire	**DNA**
DNA Cellulose, Double-Stranded Prepared by a method developed at Worthington in which native, double-stranded calf thymus DNA is covalently bound to cellulose. Suitable for the purification of many DNA binding proteins such as polymerases, transcription factors, and terminators, etc. Supplied as a dry powder. One gram of DNA-cellulose will swell to 3 - 4 ml when fully hydrated. Store at 2-8°C.	≥ 3 mg DNA per gm dry weight	LS01120 LS01122 LS01124	1 gm 5 gm Bulk	46.00 144.00 Inquire	**DNACELDS**
DNA Cellulose, Single-Stranded Prepared by a method developed at Worthington in which denatured, single-stranded calf thymus DNA is covalently bound to cellulose. Suitable for the purification of many proteins that are associated with nucleic acids such as DNA/RNA polymerases, endo- and exonucleases and reverse transcriptases. Supplied as a dry powder. One gram of DNA-cellulose will swell to 3 - 4 ml when fully hydrated. Store at 2-8°C.	≥ 3 mg DNA per gm dry weight	LS01130 LS01132 LS01134	1 gm 5 gm Bulk	46.00 144.00 Inquire	**DNACELSS**
Deoxyribonucleic Acid Prepared by a modification to the method of Emanuel, C., and Chaikoff, I., *J. Biol. Chem., 203,* 164 (1953). ≥ 75% native nucleic acid. Supplied dried. Store at 2-8°C.	A_{260}/A_{280} ≥ 1.8	LS003554 LS003558 LS003557	1 gm 5 gm Bulk	90.00 400.00 Inquire	**SDNA**

Deoxyribonucleic Acid and Related Products (Continued)

Name	Activity	Catalog Number	Package	Price	Code
Deoxyribonucleic Acid, Denatured, Fragmented Prepared from purified salmon testes DNA (Code: SDNA) by mechanical shearing and heat denaturation to an average fragment size of 200-1000 base pairs. To reverse any renaturation occurring during storage this material should be briefly boiled and rapidly chilled before use. Recommended concentration for use is 100 µg/ml. A solution at 5 mg/ml in 0.05 M NaCl. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK		LS01440 LS01442 LS01444	10 ml 5 x 10 ml Bulk	74.00 265.00 Inquire	**SDNAD**
Deoxyribonucleic Acid Supplied as a dried powder purified from *E. coli* Type B cells (ATCC#11303) as described by Marmur, *J. Mol. Biol.*, *3*, 208 (1961). Store at 2-8°C.	Hyper-chromicity ≥ 27%	LS004449 LS004451	10 mg Bulk	114.00 Inquire	**DNAEC**
Deoxyribonucleic Acid, Lambda Purified to an A_{260}/A_{280} ≥ 1.8 from purified phage. Homogeneous by agarose gel electrophoresis. Generates the characteristic five and eight bands after digestion with EcoR I and Hind III respectively. A solution in 10 mM Tris-HCl, pH 8.0, with 1 mM EDTA. Store at -20°C. REQUIRES SPECIAL SHIPPING: DRY ICE	A_{260}/A_{280} ≥ 1.8	LS01203 LS01206 LS01200	500 µg 4 x 500 µg Bulk	100..00 305.00 Inquire	**DNAL**
Deoxyribonucleic Acid, Lambda, BstE II Fragments DNA fragments prepared by the digestion of lambda DNA with the restriction endonuclease BstE II. On agarose gel electrophoresis the mixture separates into 14 individual bands having the following number of base pairs: 8454, 7242, 6369, 5686, 4822, 4324, 3675, 2323, 1929, 1371, 1264, 702, 224 and 117. A solution in 10 mM Tris-HCl, pH 8.0, with 1 mM EDTA. Store at -20°C. REQUIRES SPECIAL SHIPPING: DRY ICE		LS01430 LS01432 LS01434	100 µg 5 x 100 µg Bulk	80.00 275.00 Inquire	**DNALBSTE**

As a primary producer, we pay close attention to quality assurance in all phases of production.

Name	Activity	Catalog Number	Package	Price	Code

Deoxyribonucleic Acid and Related Products (Continued)

Deoxyribonucleic Acid, Lambda, EcoR I Fragments — **DNALECOR**

DNA fragments prepared by the digestion of purified lambda DNA with the restriction endonuclease EcoR I. On agarose gel electrophoresis the mixture separates into five individual bands having the following number of base pairs: 21226, 7421, 5804, 4878, and 3530. A solution in 10 mM Tris-HCl, pH 8.0, with 1 mM EDTA.
Store at -20°C.
REQUIRES SPECIAL SHIPPING: DRY ICE

Catalog Number	Package	Price
LS01293	100 µg	47.00
LS01296	5 x 100 µg	187.00
LS01290	Bulk	Inquire

Deoxyribonucleic Acid, Lambda, Hind III Fragments — **DNALHIND**

DNA fragments prepared by the digestion of purified lambda DNA with the restriction endonuclease Hind III. On agarose gel electrophoresis the mixture separates into eight individual bands having the following number of base pairs: 23130, 9416, 6557, 4361, 2322, 2027, 564, and 125. (Note: A higher sample load may be required to clearly see the 564 and 125 base pair bands.) A solution in 10 mM Tris-HCl, pH 8.0, with 1 mM EDTA.
Store at -20°C.
REQUIRES SPECIAL SHIPPING: DRY ICE

Catalog Number	Package	Price
LS01303	100 µg	47.00
LS01306	5 x 100 µg	187.00
LS01300	Bulk	Inquire

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonuclease II • Histones • Lysozyme Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline • Phosphodiesterase I • Phosphodiesterase II • Proteinase K Reverse Transcriptase, Recombinant HIV Ribonuclease • Ribonuclease T1 • Ribonuclease T2

Name	Activity	Catalog Number	Package	Price	Code

Diaphorase

Source: *Clostridium kluyveri*

I.U.B.: 1.6.99.1 **CAS Number: 9001-68-7**

Diaphorase catalyzes the reaction of a reduced di- or tri-phosphopyridine nucleotide hydrogen donor with a hydrogen acceptor, usually a dye in the leucoform.

Stability/Storage: Stable for 6-12 months at 2-8°C. Keep lyophilized powder at -20°C for long-term storage. Due to the presence of FMN, the enzyme, especially in solution, is light-sensitive.

Unit Definitions: For Code: DILW, 1 unit equals a decrease in absorbance at 600 nm of 1.0 per minute at 25°C, pH 7.5. For Code: DIL, 1 Unit reduces 1 micromole of DCPIP per minute at 25°C, pH 8.5.

Diaphorase — **DIL**

A lyophilized powder. Dialyzed to remove pyridine nucleotides.
Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 25 Units per mg dry weight	LS004330	2 ku	82.00
	LS004333	Bulk	Inquire

Diaphorase — **DILW**

Supplied as a dialyzed, lyophilized powder.
Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 30 units per mg dry weight	LS004327	1 ku	32.00
	LS004326	Bulk	Inquire

Name	Activity	Catalog Number	Package	Price	Code

Elastase

Source: Porcine Pancreas

I.U.B.: 3.4.21.36 **CAS Number: 39445-21-1**

Porcine pancreatic elastase has a molecular weight of 25.9 kDa, and a pH optimum of 8.5. While elastase will hydrolyze a wide variety of protein substrates, it is unique among proteases in its ability to hydrolyze native elastin, a substrate not attacked by trypsin, chymotrypsin or pepsin. Soybean trypsin inhibitor and kallikrein inhibitor suppress proteolytic but not elastolytic activity. Elastase is assayed using a method adapted from that of Feinstein *et al., Biochem. Biophys. Res. Comm., 50*, 1020 (1973) and using the more soluble substrate of Bieth *et al., Biochem. Med., 11,* 350 (1974).

Stability/Storage: Elastase is unstable at pH ≤ 3.5. When stored as a dry powder the enzyme is stable for 6-12 months at 2-8°C. Elastase product codes: ES and ESL have poor solubility at neutral pH and at concentrations greater than 0.25%. It is helpful to make primary solutions in KCl or alkaline buffers before diluting into the reaction mixtures or media, compensating for ionic strength or pH changes. Stable at pH 4.0-10.4.

Technical Notes: 1 $SucAla_3NA$ unit is approximately equivalent to 6 elastin digestion units. Aqueous liquid suspensions should be aseptically handled to avoid bacterial contamination. Due to the viscous nature of the aqueous suspension (Code: ES) the vial should be rinsed to recover contents.

Unit Definition: One Unit cleaves one micromole of N-succinyl-L-alanyl-L-alanyl-L-alanine-p-nitroanilide per minute at 25°C, pH 8.0.

Name	Activity	Catalog Number	Package	Price	Code
Elastase, Purified					**ESFF**
Chromatographically purified.	≥ 8 Units per	LS006363	5 mg	74.00	
A lyophilized powder.	mg protein	LS006365	20 mg	217.00	
Store at 2-8°C.		LS006367	Bulk	Inquire	
REQUIRES SPECIAL SHIPPING: ICE PACK					
Elastase, Lyophilized					**ESL**
Two times crystallized, (Code: ESL),	≥ 3 Units per	LS002290	25 mg	50.00	
supplied as a dialyzed, lyophilized powder.	mg protein	LS002292	100 mg	142.00	
The enzyme should be 0.22 micron		LS002294	1 gm	1020.00	
filtered after reconstitution and prior		LS002298	Bulk	Inquire	
to use. Suitable for the isolation of					
Type II lung cells. Store at 2-8°C.					
Does not require special shippping.					
Elastase, Suspension					**ES**
Two times crystallized. Supplied as an	≥ 3 Units per	LS002274	25 mg	47.00	
aqueous suspension. This preparation	mg protein	LS002279	100 mg	128.00	
must be diluted to dissolve the enzyme.		LS002280	1 gm	968.00	
The diluted enzyme should be 0.22 micron		LS002276	Bulk	Inquire	
filtered before use. Suitable for the isolation					
of Type II lung cells.					
Store at 2-8°C. DO NOT FREEZE.					
REQUIRES SPECIAL SHIPPING: ICE PACK					

Related Products: Cell Isolation Optimizing System • Collagenase • Deoxyribonuclease I • Hepatocyte Isolation System Hyaluronidase • Neonatal Cardiomyocyte Isolation System • Neutral Protease (Dispase®) • Papain • Papain Dissociation System Pepsin • Proteinase K • *STEMxyme®* 1 • *STEMxyme®* 2 • Trypsin • Trypsin Inhibitors

Name	Activity	Catalog Number	Package	Price	Code

Endoproteinase-Arg-C, see Clostripain, page 12

Endoproteinase Glu-C, see Protease, *Staphylococcus aureus*, page 58

Name	Activity	Catalog Number	Package	Price	Code

Galactose Oxidase

Source: *Dactylium dendroides*

I.U.B.: 1.1.3.9 **CAS Number: 9028-79-9**

Galactose oxidase oxidizes galactose and some galactose derivatives in both free and polymeric forms. Oxidation occurs at the C6 position. The enzyme has a molecular weight of 68 ± 3 kDa, and the optimum pH is 7.0.

Technical Note: One A_{425} unit is approximately equivalent to 0.54 µmole oxidized galactose.

Unit Definition: One unit equals a change in absorbance at 425 nm of 1.000 per minute at 25°C, pH 6.0 using a peroxidase/*o*-tolidine coupled assay with galactose as the substrate.

Galactose Oxidase					**GAO**
Supplied as a lyophilized powder	≥ 30 units per	LS004520	150 un	40.00	
containing sodium phosphate and	mg dry weight	LS004522	450 un	71.00	
sucrose as stabilizers.		LS004524	1 ku	122.00	
Store at -20°C.		LS004523	Bulk	Inquire	
PROTECT FROM MOISTURE.					
REQUIRES SPECIAL SHIPPING: ICE PACK					

Name	Activity	Catalog Number	Package	Price	Code

Galactosidase, Beta

Source: *Escherichia coli*

I.U.B.: 3.2.1.23 **CAS Number: 9031-11-2**

Beta-Galactosidase has a molecular weight of 540 kDa, and an optimum pH range of 6 – 8.
Note: Product code BGC is not suitable for immunoconjugation applications due to the presence of ammonium sulfate.

Unit Definition: One Unit hydrolyzes one micromole of *o*-nitrophenyl-beta-D-galactopyranoside per minute at 25°C, pH 7.5.

Galactosidase, Beta					**BG**
A partially purified, lyophilized powder.	≥ 50 Units per	LS004090	5 ku	57.00	
Store at 2-8°C.	mg dry weight	LS004093	Bulk	Inquire	
Galactosidase, Beta, Purified					**BGC**
Chromatographically purified.	≥ 300 Units per	LS004099	1 ku	70.00	
A suspension in 1.6 M	per mg protein	LS004100	5 ku	284.00	
ammonium sulfate.		LS004102	Bulk	Inquire	
Store at 2-8°C.					

Name	Activity	Catalog Number	Package	Price	Code

Glucose-6-Phosphate Dehydrogenase

Source: *Leuconostoc mesenteroides*

I.U.B.: 1.1.1.49 **CAS Number: 9001-40-5**

The *Leuconostoc* GPDH exhibits dual coenzyme specificity, namely NAD and NADP (Olive and Levy, *Biochem., 6, 730* 730, 1967). When assayed under conditions that are optimal for the particular coenzyme, the ratio of observed catalytic activity is NAD/NADP = 1.8.

Stability/Storage: The *Leuconostoc mesenteroides* glucose-6-phosphate dehydrogenase is a relatively stable enzyme in solution. The lyophilized and ammonium sulfate preparations are stable for 12 months when stored at 2-8°C.

Unit Definition: One Unit reduces one micromole of pyridine nucleotide per minute at 30°C and pH 7.8, using glucose-6-phosphate as substrate.

Glucose-6-Phosphate Dehydrogenase, High Activity Suspension					**ZFDP**
Chromatographically purified for higher specific activity. Same as Code ZF except assayed using NAD. Phosphohexose isomerase, phosphogluconate dehydrogenase, adenylate kinase and creatine phosphokinase contaminant activities 0.02%, 0.003%, 0.002% and 0.002% respectively. A suspension in 3.7M ammonium sulfate. Store at 2-8°C.	≥ 590 NAD Units per mg protein	LS004002 LS004004 LS004006	1 ku 10 ku Bulk	56.00 435.00 Inquire	
Glucose-6-Phosphate Dehydrogenase, Suspension					**ZF**
Chromatographically purified. A suspension in 3.7 M ammonium sulfate. Phosphohexose isomerase, phosphogluconate dehydrogenase, adenylate kinase and creatine phosphokinase contaminant activities ≤ 0.02%, 0.003%, 0.002% and 0.002%, respectively. Store at 2-8°C.	≥ 200 NADP Units per mg protein	LS003983 LS003985 LS003987	500 un 5 ku Bulk	41.00 285.00 Inquire	
Glucose-6-Phosphate Dehydrogenase, Suspension					**ZFD**
Chromatographically purified. Same as Code: ZF except assayed using NAD. Phosphohexose isomerase, phospho-gluconate dehydrogenase, adenylate kinase and creatine phosphokinase contaminant activities ≤ 0.011%, 0.002%, 0.0011% and 0.0011% respectively. A suspension in 3.7 M ammonium sulfate. Store at 2-8°C.	≥ 360 NAD Units per mg protein	LS003992 LS003993 LS003994	900 un 9 ku Bulk	41.00 285.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code
Glucose-6-Phosphate Dehydrogenase (Continued)					
Glucose-6-Phosphate Dehydrogenase, Lyophilized Chromatographically purified. Phosphohexose isomerase, phosphogluconate dehydrogenase, adenylate kinase and creatine phosphokinase contaminant activities ≤ 0.02%, 0.003%, 0.002% and 0.002% respectively. A lyophilized powder. Store at 2-8°C.	≥ 200 NADP Units per mg protein	LS003981 LS003980 LS003982	1 ku 10 ku Bulk	78.00 580.00 Inquire	**ZFL**
Glucose-6-Phosphate Dehydrogenase, Lyophilized Chromatographically purified. Same as Code: ZFL except assayed using NAD. Phosphohexose isomerase, phosphogluconate dehydrogenase, adenylate kinase and creatine phosphokinase contaminant activities ≤ 0.011%, 0.002%, 0.0011% and 0.0011% respectively. A lyophilized powder. Store at 2-8°C.	≥ 360 NAD Units per mg protein	LS003997 LS003998 LS003999	2 ku 18 ku Bulk	78.00 580.00 Inquire	**ZFLD**

Related Products: Hexokinase • Peroxidase • b-Galactosidase • Galactose Oxidase • Lactate Dehydrogenase

Name	Activity	Catalog Number	Package	Price	Code
Hemoglobin **Source:** Bovine Erythrocytes **CAS Number: 9008-02-0** Hemoglobin is the major component of mammalian erythrocytes where it functions as the oxygen-carbon dioxide transport system. The molecule is composed of a heme group with four peptide chains and has a molecular weight of 64.5 kDa.					
Hemoglobin Suitable protease substrate. Prepared from repeatedly washed, then lysed, and dialyzed bovine red cells. A lyophilized powder. Store at 2-8°C.		LS002402 LS002403 LS002404 LS002407	5 gm 25 gm 100 gm Bulk	31.00 76.00 235.00 Inquire	**HB**

Related Products: Pepsin • Myoglobin

Name	Activity	Catalog Number	Package	Price	Code

Hepatocyte Isolation System

Most traditional methods published for isolating hepatocytes use crude and partially purified enzyme preparations including various types of collagenase and other proteases. More recently the use of better characterized preparations of collagenase such as Worthington Types 1 - 7 (CLS-1-7) have provided better results. All partially purified collagenase preparations can contain lot-variable contaminating proteases, esterases and other enzymes requiring researchers to pre-screen several lots of enzyme and/or continually modify isolation parameters and protocols.

The Worthington Hepatocyte Isolation System has been developed to provide researchers with a reliable, convenient, and consistent hepatocyte cell isolation system. By using the pre-optimized combination of enzymes contained in this kit, it is possible to minimize the lot-to-lot variation and improve the quality of the isolated hepatocytes. In addition, Worthington use-tests each lot by isolating hepatocytes from adult rat to assure performance, reliability, and consistent yield of viable cells. The method is based on that described by Berry *et al.*, and modified by Seglen, *Methods in Cell Biology, 13* (Prescott, D. ed.), Academic Press, 29 (1976), and further optimized in conjunction with several researchers.

Stability/Storage: The reagents are stable at ambient temperatures for the periods of time expected in normal shipping procedures, but the package should be refrigerated upon arrival. Contents may be stored at 2-8°C for 4-6 months before use. Store at 2-8°C.

Package Contents: The package contains sufficient materials for five separate adult rat liver perfusions. For larger or smaller tissue applications, prepare proportionate volumes of reagents at each step and combine them in the same ratio as described in the protocol.

• **Vial #1:** 10X CMF-HBSS Concentrate, 1 bottle, 500 ml
Sterile calcium- and magnesium-free Hank's Balanced Salt Solution (CMF-HBSS). The solution is used for washing and perfusing the liver prior to the addition of the dissociating enzyme solution.

• **Vial #2:** Collagenase/Elastase Enzyme Vial, 5 vials
Containing collagenase (Code: CLS-1) and elastase (Code: ESL) ≥ 20,000 u/vial and ≥ 30 u/vial respectively.
Before use, reconstitute with the L-15/MOPS solution and swirl gently to dissolve contents.
Store unreconstituted vials at 2-8°C.

• **Vial #3:** 1,000 units DNase I each, 5 vials
Worthington DNase I (Code: D), filtered through 0.22 µm pore size membrane, and lyophilized. Before use, reconstitute with L-15/MOPS solution and swirl gently to dissolve contents. Store unreconstituted vials at 2-8°C.

• **Vial #4:** 0.15 M MOPS, pH 7.5, 1 bottle, 75 ml
0.15 M MOPS, pH 7.5 buffer concentrate, used to buffer the reconstituted Leibovitz L-15 media.

• **Vial #5:** 7.5% Sodium Bicarbonate ($NaHCO_3$), 1 bottle, 100 ml
7.5% Sodium bicarbonate concentrate, used to buffer the diluted CMF-HBSS.

• **Pouch**, containing Leibovitz L-15 Media Powder, 1 x 1L
Reconstitute entire contents of pouch by cutting open top of envelope and pouring contents into beaker containing approximately 800 ml of cell culture grade water. Rinse pouch 2 - 3 times with an additional 100 ml water. Bring total volume to 1000 ml and filter through a 0.22 micron membrane.

Hepatocyte Isolation System The package contains sufficient materials for five separate adult rat liver perfusions including five single use CLSH enzyme vials, five single use DNase vials, 10X CMF-Hank's Balanced Salt Solution, L-15 Media Powder, 0.15 M MOPS buffer. 7.5% sodium bicarbonate solution and optimized protocol. Store at 2-8°C.	N/A	LK002060	1 bx	460.00	**HIS**

Name	Activity	Catalog Number	Package	Price	Code
Hepatocyte Isolation System (Continued)					
Collagenase/Elastase Vial, HIS Kit Worthington collagenase (Code: CLS-1) and elastase (Code: ESL), filtered through 0.22 µm pore size membrane, and lyophilized. Before use, reconstitute with the L-15/MOPS solution and swirl gently to dissolve contents. Store unreconstituted vials at 2–8°C.	≥ 20,000 u/vial ≥ 30 u/vial	LK002066 LK002067	1 vi 5 vi	54.00 237.00	**CLSH**
DNase Vial, HIS Kit A component of the Hepatocyte Isolation kit containing 1,000 units DNase I each, 5 vials Worthington DNase I (Code: D), filtered through 0.22 µ pore size membrane, and lyophilized. Before use, reconstitute with L-15/MOPS solution and swirl gently to dissolve contents. Store unreconstituted vials at 2–8°C.	≥ 1,000 units per vial	LK003170 LK003172	1 vi 5 vi	25.00 84.00	**D2**
Hank's Balanced Salt Solution (HBSS-CMF) 10X Solution, HIS Kit 10X CMF-HBSS Concentrate, 1 bottle, 500 ml. Sterile calcium- and magnesium-free Hank's Balanced Salt Solution (CMF-HBSS). The solution is used for washing and perfusing the liver prior to the addition of the dissociating enzyme solution. Store at 2-8°C.	N/A	LK002064	1 ea	85.00	**HBSS10**

Our customer centric approach follows every order from start to finish to ensure your satisfaction.

Name	Activity	Catalog Number	Package	Price	Code

Hepatocyte Isolation System (Continued)

L-15 Media Powder, HIS Kit Leibovitz L-15 media powder, a component of the HIS kit. Reconstitute entire contents of pouch, QS to 1 liter with cell culture grade water, and 0.22 micron filter. Suitable for cell isolation and culture applications. Store at 2-8°C.	N/A	LK003250	1 ea	30.00	**L15NK**
0.15 M, MOPS Buffer, HIS Kit 0.15 M MOPS, pH 7.5, 0.22 µ filtered. Buffer concentrate used to buffer the constituted Leibovitz L-15 media in Hepatocyte Isolation System. Store at 2-8°C.	N/A	LK002070	1 ea	36.00	**MOPS**
Sodium Bicarbonate, 7.5%, HIS Kit 7.5% Sodium Bicarbonate ($NaHCO_3$), 1 bottle, 100 ml 7.5% sodium bicarbonate concentrate, used to buffer the diluted CMF-HBSS. Store at 2-8°C.	N/A	LK002069	1 ea	33.00	**NAH**

Related Products: Cell Isolation Optimizing System • Collagenase • Deoxyribonuclease I • Elastase • Hyaluronidase Neonatal Cardiomyocyte Isolation System • Neutral Protease (Dispase®) • Papain • Papain Dissociation System • Hepatocyte Isolation System Proteinase K • Hepatocyte Isolation System • *STEMxyme*® 1 • *STEMxyme*® 2 • Trypsin • Trypsin Inhibitors

Name	Activity	Catalog Number	Package	Price	Code

Hexokinase

Source: Yeast

I.U.B.: 2.7.1.1 **CAS Number: 9001-51-8**

Hexokinase catalyzes the reaction:

D-hexose + ATP ⟶ D-hexose 6-phosphate + ADP

Unit Definition: One Unit reduces one micromole of NAD per minute at 30°C, pH 8.0.

Hexokinase, Lyophilized Chromatographically purified. A dialyzed, lyophilized powder. Phosphohexose isomerase, 6-phosphogluconate dehydrogenase, adenylate kinase and creatine phosphokinase contaminant activities are ≤ 0.1%, ≤ 0.005%, ≤ 0.005% and 0.005%, respectively. Store at 2-8°C.	≥ 150 Units per mg protein	LS002511 LS002512 LS002514	2.5 ku 10 ku Bulk	65.00 212.00 Inquire	**HKQL**

Name	Activity	Catalog Number	Package	Price	Code

Hexokinase (Continued)

Hexokinase, Suspension — **HKQS**

Chromatographically purified. A suspension in 2.8 M ammonium sulfate. Phosphohexose isomerase, 6-phosphogluconate dehydrogenase, adenylate kinase and creatine phosphokinase contaminant activities are ≤ 0.1%, ≤ 0.005%, ≤ 0.005%, and 0.005%, respectively. Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 150 Units per mg protein	LS002500	Bulk	Inquire

Related Products: b-Galactosidase • Galactose Oxidase • Glucose-6-Phosphate Dehydrogenase Lactate Dehydrogenase • Peroxidase

Name	Activity	Catalog Number	Package	Price	Code

Histones

Source: Calf Thymus

CAS Number: 37244-51-2

The histones are a group of water- and dilute acid-soluble basic proteins found associated with DNA in chromosomes. They are characterized by relatively high levels of lysine and arginine. Although histones are classified into a limited number of types of fractions with each particular fraction having a fundamentally distinct amino acid composition and sequence, numerous subfractions are observed due to the acetylation, methylation and phosphorylation of various amino acid residues.

Technical Note: Histones are characterized by gel electrophoresis and solubility. Soluble in physiological saline, phosphate buffered saline (PBS) pH 7.1, or water when pH is adjusted to neutral.

Histone, Dried — **H**

An ethanol dried powder. Unfractionated mixture of histones. Store at 2-8°C.

Activity	Catalog Number	Package	Price
N/A	LS002375	250 mg	36.00
	LS002377	1 gm	106.00
	LS002379	Bulk	Inquire

Histone, Lyophilized — **HLY**

A dialyzed, lyophilized powder. Unfractionated mixture of histones. Store at 2-8°C.

Activity	Catalog Number	Package	Price
N/A	LS002544	250 mg	43.00
	LS002546	1 gm	142.00
	LS002548	Bulk	Inquire

Related Products: Actin • Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonuclease II Deoxyribonucleic Acid and Related Products • Histones • Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline Phosphodiesterase I • Phosphodiesterase II • Proteinase K • Reverse Transcriptase, Recombinant HIV • Ribonuclease • Ribonuclease T1 Ribonuclease T2

Name	Activity	Catalog Number	Package	Price	Code

Hyaluronic Acid

Source: Bovine Vitreous Humor

CAS Number: 9004-61-9

Hyaluronic acid (HA) preparations have variable molecular weights depending on purification procedures, the extent of degradation, as well as the source. The range of molecular weight is 70 kDa to 2,000-4,000 kDa in a highly polymerized preparation. Bovine vitreous humor HA has a lower molecular weight than most other sources. The hyaluronic acids are a class of macromolecular proteoglycans characterized by a highly polymerized chain of the repeating disaccharide glucuronic acid (beta-1,3) N-acetylglucosamine (beta-1,4).

Hyaluronic Acid					**VHHA**
A partially purified powder.	N/A	LS003907	10 mg	72.00	
Suitable as a substrate for		LS003909	50 mg	275.00	
hyaluronidase assays.		LS003910	100 mg	525.00	
Store at 2-8°C.		LS003911	Bulk	Inquire	

Related Product: Hyaluronidase

Name	Activity	Catalog Number	Package	Price	Code

Hyaluronidase

Source: Bovine Testes

I.U.B.: 3.2.1.35 **CAS Number: 37326-33-3**

Testicular hyaluronidase is a glycoprotein containing 5% mannose and 2.7% glucosamine. Optimum pH range is 4.5-6.0. The enzyme catalyzes the hydrolysis of endo-N-acetylhexosaminic bonds of hyaluronic acid and chondroitin sulfate A and C (but not B), primarily to tetrasaccharide residues.

Unit Definition: One unit is based on the change in absorbency (turbidity) at 540nm of an internal standard assayed concurrently with each lot. Internal standard replaces USP/NF reference no longer available.

Hyaluronidase					**HSE**
A partially purified, dialyzed,	≥ 300 units	LS002594	50 ku	49.00	
lyophilized powder.	per mg	LS002592	300 ku	201.00	
Store at -20°C.	dry weight	LS002591	Bulk	Inquire	
Hyaluronidase, Purified					**HSEP**
Chromatographically purified.	≥ 3,000 units	LS005477	5 ku	81.00	
A dialyzed, lyophilized powder.	per mg	LS005475	15 ku	200.00	
Store at -20°C.	dry weight	LS005474	30 ku	320.00	
		LS005479	Bulk	Inquire	

Related Products: Carboxypeptidase B • Carboxypeptidase Y • Cell Isolation Optimizing System • Collagenase Deoxyribonuclease I • Hepatocyte Isolation System • Hyaluronic Acid • Neonatal Cardiomyocyte Isolation System • Papain Papain Dissociation System • Pepsin • Protease, *Staph aureus* (Endoproteinase Glu-C) • Proteinase K • *STEMxyme*® 1 *STEMxyme*® 2 • Trypsin • Trypsin Inhibitors

Hydroxysteroid Dehydrogenase

Source: *Pseudomonas testosteroni*

I.U.B.: 1.1.1.50 and 1.1.1.51 **CAS Numbers: 9028-56-2 / 9015-81-0**

Hydroxysteroid dehydrogenases catalyze the interconversion of hydroxyl and carboxyl groups of steroids. *P. testosteroni* derived hydroxysteroid dehydrogenases are of two types: 3-alpha-hydroxysteroid dehydrogenase (alpha enzyme) and 3-beta-hydroxysteroid dehydrogenase (beta enzyme). The alpha enzyme has a molecular weight of 47 kDa. The alpha enzyme oxidizes only 3-alpha-hydroxysteroids of the C19, C21 and C24 series. It is inhibited by heavy metals and sulfhydryl-binding agents. The beta enzyme catalyzes the oxidation of 3-beta-hydroxy-steroids of the C19 and C21 series, 17-beta-hydroxysteroids of the C18, C19 and C21 series, as well as certain 16-beta-hydroxy-steroids. It is inhibited by heavy metals and reducing agents. The oxidation of testosterone is inhibited by 3,17-alpha-estradiol and other 1,3,5-estradiene derivatives. Worthington supplies two preparations: one from the regular *P. testosteroni* (ATCC 11966) culture which produces both the alpha and the beta enzymes, and a second from a mutant strain which produces almost exclusively the alpha enzyme. By using both, the amount of beta-hydroxysteroid can be determined by the difference in activities.

Technical Note: STDHP and STDH contain both alpha and beta activities. STDHMP, however, contains only the alpha activity.

Unit Definition: One Unit reduces one micromole of NAD per minute at 25°C, pH 9.0 using androsterone or testosterone as substrate.

Hydroxysteroid Dehydrogenase A lyophilized powder obtained from induced cells. Contains both alpha and beta activities. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 0.03 Units per mg dry weight	LS004915 LS004916 LS004918	1 gm 5 gm Bulk	79.00 317.00 Inquire	**STDH**
Hydroxysteroid Dehydrogenase A purified powder obtained from adapted cells of a mutant strain. Activity on androsterone only, no activity exhibited on testosterone. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 0.5 Units per mg dry weight	LS004908 LS004910 LS004911	10 un 50 un Bulk	98.00 350.00 Inquire	**STDHMP**
Hydroxysteroid Dehydrogenase A purified powder obtained from induced cells. Contains both alpha and beta activities. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 0.5 Units per mg dry weight	LS004922	Bulk	Inquire	**STDHP**

Name	Activity	Catalog Number	Package	Price	Code

Lactate Dehydrogenase

Source: Recombinant Rabbit Muscle Lactate Dehydrogenase Produced in *E.coli*

I.U.B.: 1.1.1.27 **CAS Number: 9001-60-9**

Mammalian lactate dehydrogenases (LDH) exist as five tetrameric isozymes composed of combinations of two different subunits. The H subunit predominates in heart muscle, which is geared for aerobic oxidation of pyruvate. The M subunit predominates in skeletal muscle and is concerned more with anaerobic metabolism and pyruvate reduction.

Unit Definition: One Unit oxidizes one micromole of NADH per minute at 25°C, pH 7.3.

Lactate Dehydrogenase, Lyophilized Recombinant Rabbit Muscle					**LADCL**
Chromatographically purified.	≥ 250 Units	LS002755	5 ku	114.00	
A lyophilized powder.	per mg	LS002756	25 ku	537.00	
Store at -20°C	protein	LS002757	Bulk	Inquire	

Related Products: b-Galactosidase • Galactose Oxidase • Glucose-6-Phosphate Dehydrogenase • Hexokinase

Name	Activity	Catalog Number	Package	Price	Code

Lactoperoxidase

Source: Bovine Milk

I.U.B.: 1.11.1.7 **CAS Number: 9003-99-0**

Lactoperoxidase (LPO) is a glycoprotein with a heme prosthetic group which may occur as a mixture of two isozymes. It has a molecular weight of 77.5 kDa. LPO catalyzes the hydrogen peroxide oxidation of iodide according to the following reaction:

$$2I^- + H_2O_2 + 2H^+ \longrightarrow I_2 + 2H_2O$$

Iodide reacts directly with the heme group; upon addition of H_2O_2 the complex iodinates the substrate. LPO is inhibited by hydrazines. The assay procedure has been updated from that of Morrison to an ABTS®/H_2O_2 based method with increased sensitivity and reproducibility.

Unit Definition: One Unit reduces one micromole of hydrogen peroxide per minute at 25°C, pH 6.0.

Lactoperoxidase					**LPO**
Chromatographically purified.	≥ 35 Units	LS000150	10 mg	81.00	
A lyophilized powder.	mg dry weight	LS000151	50 mg	328.00	
Store at -20°C.	ABTS®	LS000152	Bulk	Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Lysozyme

Source: Egg Whites

I.U.B.: 3.2.1.17 **CAS Number: 9001-63-2**

Lysozyme preferentially hydrolyzes the beta-1,4 glycosidic linkages between N-acetylmuramic acid and N-acetylglucosamine which occur in the mucopeptide cell wall structure of certain microorganisms, such as *Micrococcus lysodeikticus* (Product code: ML). A slightly more limited activity is exhibited toward chitin oligomers. It has a molecular weight of 14.4 kDa. Optimum pH is 9.2. Lysozyme is inhibited by surface active agents such as dodecyl sulfate, alcohol and fatty acids. Imidazole and indole derivatives form inhibitory charged transfer complexes.

Stability/Storage: Stable for 3-5 years at 2-8°C. Solutions at pH 4-5 are stable for several weeks refrigerated and for days at ambient temperatures. Store at 2-8°C.

Technical Note: Due to assay differences, 8,000 u/mg by Worthington's assay is equivalent to 50,000 u/mg claimed by other suppliers.

Unit Definition: One unit is equal to a decrease in turbidity of 0.001 per minute at 450 nm at pH 7.0 and 25°C, using a 0.3 mg/ml suspension of *Micrococcus lysodeikticus* cells (WBC product code ML) as substrate.

Lysozyme					**LY**
Two times Crystallized. A lyophilized powder containing sodium chloride and acetate. Store at 2-8°C.	≥ 5,000 units per mg dry weight	LS002880 LS002881 LS002883	1 gm 10 gm Bulk	26.00 140.00 Inquire	
Lysozyme, Purified, Salt Free					**LYSF**
A dialyzed and lyophilized powder. Store at 2-8°C.	≥ 8,000 units per mg dry weight	LS002931 LS002933 LS002934	1 gm 5 gm Bulk	33.00 80.00 Inquire	

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products • Histones *Micrococcus lysodeikticus Cells* • Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline • Phosphodiesterase I Phosphodiesterase II • Proteinase K • Reverse Transcriptase, Recombinant HIV • Ribonuclease • Ribonuclease A • Ribonuclease T1 Ribonuclease T2 • Ribonucleic Acid

Name	Activity	Catalog Number	Package	Price	Code

Micrococcus lysodeikticus Cells

Source: *Micrococcus lysodeikticus*

These are dried cells suitable as a lysozyme substrate.

Lysozyme preferentially hydrolyzes the beta-1,4 glycosidic linkages between N-acetylmuramic acid and N-acetylglucosamine which occur in the mucopeptide cell wall structure of certain microorganisms, such as *Micrococcus lysodeikticus*. It is also a source for the enzyme, polynucleotide phosphorylase.

Micrococcus lysodeikticus Cells					**ML**
Dried cells. Suitable lysozyme substrate. Store at 2-8°C.	N/A	LS008736 LS008737 LS008739	5 gm 25 gm Bulk	95.00 390.00 Inquire	

Related Product: Lysozyme

Name	Activity	Catalog Number	Package	Price	Code

Mucin

Source: Bovine Submaxillary Gland

CAS Number: 84195-52-8

Mucins are glycoproteins abundant with O-linked oligosaccharides secreted by epithelial mucous membranes. Their protective function is due to their high viscosity. Bovine submaxillary mucin has a molecular weight of 4 - 40 x 10^5 daltons. The molecule consists of major and minor components with a protein moiety (36.6% of the molecule) and a carbohydrate moiety (56.7% of the molecule).

Stability/Storage: Protect from moisture. Store at 2-8°C.

Mucin					**MU**
A dry powder prepared by the method of Nisizawa, and Pigman, *Arch. Oral. Biol., 1,* 161 (1959). Suitable as a substrate for neuraminidase. Store at 2-8°C. PROTECT FROM MOISTURE.	N/A	LS002975 LS002976 LS002978	100 mg 500 mg Bulk	36.00 138.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Myoglobin, Lyophilized

Source: Bovine Muscle

CAS Number: 11080-17-4

Myoglobin is a small, globular protein that is responsible for oxygen storage in cardiac and skeletal muscle. It contains a single heme molecule and has a molecular weight of approximately 17 kDa.

Myoglobin, Lyophilized					**MB**
Supplied as a dialyzed, lyophilized powder. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 90% Purity (SDS-PAGE)	LS002408 LS002410 LS002412 LS002414	250 mg 1 gm 5 gm Bulk	52.00 168.00 635.00 Inquire	

Related Products: Hemoglobin • Neuraminidase

Neonatal Cardiomyocyte Isolation System

The Worthington Neonatal Cardiomyocyte Isolation System has been developed to provide researchers with a reliable, convenient, and consistent neonatal rat cardiomyocyte cell isolation method. By using purified, rather than crude enzyme preparations, it has been possible to minimize the lot-to-lot variation. In addition, Worthington use-tests the kits by isolating cardiomyocytes from neonatal rat hearts to assure performance, reliability and consistent yield of viable cells. The kit has been formulated in collaboration with Dr. Ronal MacGregor. The method is based on that described by Toraason *et al*., *Toxicol. 56*, 107 (1988) in which the minced tissue is incubated overnight with purified trypsin at 2-8°C. As pointed out by Toraason, this step reduces the hands-on time required to harvest cells compared to the time involved in sequential incubations in warm trypsin or collagenase. Purified collagenase rather than crude collagenase is used to maximize yield and viability.

Contents of Kit

The package contains sufficient materials for five separate tissue dissociations, each containing up to twelve hearts. For larger or smaller tissue samples prepare proportionate volumes of reagents at each step and combine them in the same ratio as described in the protocol.

• **Vial 1**: 1 bottle, 500 ml: Sterile calcium- and magnesium-free Hank's Balanced Salt Solution (CMF HBSS), pH 7.4. The solution is used for reconstituting the contents of Vials #2 and #3 in addition to serving as the medium for the dissociation.

• **Vial 2**: 5 vials, 1000 µg each: Worthington Trypsin (Code: TRLS), chromatographically purified, dialyzed against 1 mM HCl, filtered through 0.22 micron pore size membrane, and lyophilized. Before use, reconstitute with 2 ml CMF HBSS (Vial #1) and swirl gently to dissolve contents. Store at 2-8°C.

• **Vial 3:** 5 vials, 2000 µg each: Worthington Soybean Trypsin Inhibitor (Code: SIC), a 0.22 micron pore size membrane-filtered, lyophilized powder. Before use, reconstitute with 1 ml CMF HBSS (Vial #1) and swirl gently to dissolve contents. Store at 2-8°C.

• **Vial 4**: 5 vials, 1500 units each: Worthington Purified Collagenase (Code: CLSPA), a 0.22 micron pore size membrane-filtered, lyophilized powder which has been chromatographically purified. It contains less than 50 caseinase units per milligram and is composed of two separable but very similar collagenases. Before use, reconstitute with 5 ml Leibovitz L-15 media (prepared as described below) and swirl gently to dissolve contents. Store at 2-8°C.

• **Pouch Containing Leibovitz L-15 Media Powder**: 1 x 1L, Reconstitute entire contents of pouch by cutting open top of envelope and pouring contents into beaker containing 800 ml of cell culture grade water. Rinse pouch 2-3 times with additional 100 ml. Bring total volume to 1 liter and filter through a 0.22 micron pore size filter.

The kit also includes 5 Cell Strainers (Falcon), a card correlating phenol red color with pH for checking balanced salt solutions and culture media.

Neonatal Cardiomyocyte Isolation System (Continued)

Name	Activity	Catalog Number	Package	Price	Code
Neonatal Cardiomyocyte Isolation System Kit for performing five separate tissue dissociations, each containing up to twelve hearts. Contains single use vials of purified collagenase and trypsin, CMF-HBSS, Leibovitz L-15 media and Falcon cell strainers along with a detailed protocol. The kit is use-tested by Worthington to assure performance. Store at 2-8°C.	N/A	LK003300 LK003303	1 ki 3 ki	288.00 785.00	**NCIS**
Collagenase Vial, NCIS A component of the NCIS kit. This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 5 ml of HBSS or equivalent yields a solution of 300 units/ml of collagenase, Code: CLSPA. Suitable for cell isolation and culture applications. Store at 2-8°C.	≥ 1500 units per vial	LK003240 LK003245	1 vi 5 vi	32.00 130.00	**CLSPANK**
Trypsin Vial, NCIS A component of the NCIS kit. This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 2 ml of HBSS yields a solution of 500 µg/ml of trypsin, Code: TRLS. Suitable for cell isolation and culture applications. Store at 2-8°C.	≥ 180 Units per vial	LK003220 LK003225	1 vi 5 vi	14.00 48.00	**TRLSNK**
Inhibitor Vial, NCIS A component of the NCIS kit. This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 1 ml of HBSS or equivalent yields a solution of 2 mg/ml of trypsin inhibitor, Code: SIC. Suitable for cell isolation and culture applications. Store at 2-8°C.	1 mg inhibits at least 0.75 mg trypsin Code: TRL	LK003230 LK003235	1 vi 5 vi	15.00 45.00	**SICNK**
HBSS Solution Sterile calcium and magnesium free Hank's balanced salt solution (CMFHBSS), pH 7.4, as supplied in the NCIS kit; 1 x 500 ml. Store at 2-8°C.	N/A	LK003210	1 ea	58.00	**HBSS**

Name	Activity	Catalog Number	Package	Price	Code

Neonatal Cardiomyocyte Isolation System (Continued)

L-15 Media Powder Leibovitz L-15 media powder, a component of the NCIS kit. Reconstitute entire contents of pouch, QS to 1 liter with cell culture grade water, and 0.22 micron filter. Suitable for cell isolation and culture applications. Store at 2-8°C.	N/A	LK003250	1 ea	30.00	**L15NK**
Cell Strainers (Falcon) Cell strainers (Falcon), components of the NCIS kit. Suitable for removal of tissue debris in cell isolation applications. Store at room temperature.	N/A	LK003265	5 ea	28.00	**CELSTRNK**

Related Products: Cell Isolation Optimizing System • Collagenase • Deoxyribonuclease I • Hepatocyte Isolation System Hyaluronidase • Neutral Protease (Dispase®) • Papain • Papain Dissociation System • Proteinase K • *STEMxyme*® 1 *STEMxyme*® 2 • Trypsin • Trypsin Inhibitor

Name	Activity	Catalog Number	Package	Price	Code

Neuraminidase

Source: *Clostridium perfringens*

I.U.B.: 3.2.1.18 **CAS Number: 9001-67-6**

Neuraminidase (sialidase) removes N-acetyl neuraminic acid (sialic acid) from a variety of glycoproteins. The enzyme has an optimum pH of 5.0-5.1. Little or no activity is observed at pH 4.0 or above pH 8.0.

Unit Definition: One Unit releases one micromole of sialic acid per minute at 37°C, pH 5.0, from bovine submaxillary mucin.

Neuraminidase, Purified Chromatographically purified. A lyophilized powder containing 50% (w/w) sucrose. Contaminating proteolytic activity ≤ 0.1% using trypsin as the standard. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 10 Units per mg protein	LS004759 LS004761 LS004762 LS004760	5 un 10 un 25 un Bulk	100.00 193.00 400.00 Inquire	**NEUA**
Neuraminidase A partially purified, lyophilized powder. Store at 2-8°C.	≥ 0.5 Units per mg dry weight	LS004779 LS004780 LS004777	4 mg 10 mg Bulk	106.00 216.00 Inquire	**NEUP**

Related Products: b-Galactosidase • Galactose Oxidase • Glucose-6-Phosphate Dehydrogenase • Hexokinase Lactate Dehydrogenase • Mucin

Name	Activity	Catalog Number	Package	Price	Code

Neutral Protease (Dispase®), Animal Free

Source: *Bacillus polymyxa*

I.U.B.: 3.4.24.28 **CAS Number: 42613-33-2**

A metallo, neutral protease, purified by methods developed at Worthington. Its mild proteolytic action makes the enzyme especially suitable for the preparation of primary and secondary (subcultivation) cell culture. This protease is also used as a secondary enzyme in cell isolation and tissue dissociation applications.

Stability/Storage: Stable at 2-8°C for 12 months. Store at 2-8°C. After reconstitution with water or buffer, aliquot and store at -20°C.

Unit Definition: One Unit releases Folin positive amino acids equivalent to 1 micromole tyrosine per minute from casein at 37°C, pH 7.5.

Name	Activity	Catalog Number	Package	Price	Code
Neutral Protease (Dispase®), Purified					**NPRO**
Chromatographically purified. A lyophilized powder. Store at 2-8°C.	≥ 4 Units per mg dry weight	LS02100	10 mg	76.00	
		LS02104	50 mg	320.00	
		LS02106	250 mg	1440.00	
		LS02108	Bulk	Inquire	
Neutral Protease, Partially Purified					**NPRO2**
Partially purified. A lyophilized powder. Store at 2-8°C.	≥ 0.1 Units per mg dry weight	LS02110	100 mg	35.00	
		LS02109	1 gm	155.00	
		LS02111	5 gm	700.00	
		LS02112	Bulk	Inquire	

Related Products: Cell Isolation Optimizing System • Collagenase • Deoxyribonuclease I • Elastase • Hepatocyte Isolation System Hyaluronidase • Neonatal Cardiomyocyte Isolation System • Papain • Papain Dissociation System • Proteinase K • *STEMxyme*® 1 *STEMxyme*® 2 • Trypsin • Trypsin Inhibitors

Name	Activity	Catalog Number	Package	Price	Code

Nuclease, Micrococcal

Source: *Staphylococcus aureus* (Strain ATCC #27735)

I.U.B.: 3.1.31.1 **CAS Number: 9013-53-0**

Micrococcal nuclease catalyzes cleavage of both DNA and RNA to yield 3'-nucleotides. It exhibits exo- and endo-5'-phosphodiesterase activities. The enzyme catalyzes endohydrolysis of the RNA and DNA preferentially at sites rich in adenylate or uridylate and deoxyadenylate or thymidylate. The enzyme has a molecular weight of 16.8 kDa and is calcium dependent. The pH optimum is 9.2 but varies depending upon the concentration of ionized calcium present.

Unit Definition: One unit corresponds to a change in optical density of 1.0 at 260 nm at 37°C, pH 8.0, using DNA as the substrate.

Name	Activity	Catalog Number	Package	Price	Code
Nuclease, Micrococcal					**NFCP**
Chromatographically purified to be essentially homogeneous chromatographically and electrophoretically (SDS-PAGE). A lyophilized powder. Store at 2-8°C.	≥ 6,000 units per mg protein	LS004797	15 ku	85.00	
		LS004798	45 ku	192.00	
		LS004796	Bulk	Inquire	

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products • Histones Lysozyme • Nuclease, Micrococcal • Phosphatase, Alkaline • Phosphodiesterase I • Phosphodiesterase II • Proteinase K Reverse Transcriptase, Recombinant HIV • Ribonuclease • Ribonuclease A • Ribonuclease T1 • Ribonuclease T2 • Ribonucleic Acid

Name	Activity	Catalog Number	Package	Price	Code

Nuclease, S1

Source: *Aspergillus oryzae*

I.U.B.: 3.1.30.1 **CAS Number: 37288-25-8**

Nuclease S1 isolated from certain *Neurospora* and *Aspergillus* species specifically hydrolyzes both terminal and internal phosphodiester bonds of single-stranded DNA and RNA. Nuclease S1 has a molecular weight of approximately 34 kDa and exists as a monomer. The optimum pH range is 4.0-4.6, and it is activated by Zn^{2+} and/or Ca^{2+}. Inhibitors are EDTA, citrate and high concentrations of SDS.

Stability/Storage: For long term storage in solution, for up to six months, dilute SINUC to ≥ 6000 u/ml in water and freeze in aliquots. Dilute solutions can be stabilized by adding 0.1% albumin (Worthington Code: BSANF) and 10% glycerol.

Unit Definition: One unit hydrolyzes one microgram of denatured calf thymus DNA per minute at 37°C, pH 4.6.

Name	Activity	Catalog Number	Package	Price	Code
Nuclease, S1					**SINUC**
Chromatographically purified. Specific for single-stranded DNA (ssDNA) degradation. Activity on native (ds) DNA undetectable under the assay conditions. A frozen solution in 30 mM sodium acetate, pH 4.6, 50 mM NaCl, 1 mM $ZnCl_2$, and 50% glycerol. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 100,000 to 500,000 units per ml	LS04070 LS04072 LS04073	10 ku 50 ku Bulk	49.00 141.00 Inquire	

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products • Histones Lysozyme • Nuclease, S1 • Phosphatase, Alkaline • Phosphodiesterase II • Proteinase K • Reverse Transcriptase, Recombinant HIV Ribonuclease Ribonuclease A • Ribonuclease T1 • Ribonuclease T2 • Ribonucleic Acid

Name	Activity	Catalog Number	Package	Price	Code

Nucleohistone

Source: Calf Thymus

Nucleohistone is a sodium containing complex of histone and deoxyribonucleic acid. The nucleoprotein complex of histone and DNA is referred to as nucleohistone or deoxyribonucleoprotein. Intracellularly, these complexes are important factors in chromosomal structure and gene transcription.

Stability/Storage: Stable. Store at 2-8°C.

Technical Note: Soluble in 2 M NaCl.

Name	Activity	Catalog Number	Package	Price	Code
Histone, Nucleo-					**NHL**
A complex of histone and DNA. Prepared by the procedure of Zamenhof, S., *Methods in Enzymol., 3, 696* (1957). A dialyzed, lyophilized powder. Store at 2-8°C.	N/A	LS003010 LS003011 LS003013	250 mg 1 gm Bulk	60.00 192.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Ovalbumin

Source: Egg White

CAS Number: 9006-59-1

Ovalbumin is a glycoprotein with molecular weight of 45 kDa. The molecule consists of a polypeptide with up to two phosphate groups per mole and a side chain of mannose and glucosamine residues.

LowEndo™ Ovalbumin, Purified					**OAEF**
Ovalbumin, purified to remove endotoxin. A dialyzed, lyophilized powder. Store at 2-8°C.	≥95% Purity (SDS-PAGE) ≤1 Endotoxin unit per mg	LS003059 LS003061 LS003062 LS003064	10 mg 100 mg 500 mg Bulk	141.00 580.00 1575.00 Inquire	
Ovalbumin, Purified					**OAC**
Highly purified. Major protein of egg white, with a molecular weight of 45 kDa. A dialyzed, lyophilized powder. Store at 2-8°C.	N/A	LS003056 LS003054 LS003052	100 mg 1 gm Bulk	37.00 232.00 Inquire	
Ovalbumin					**OA**
Major protein of egg white, with a molecular weight of 45 kDa. A lyophilized powder. Store at 2-8°C.	N/A	LS003049 LS003048 LS003050	1 gm 5 gm Bulk	42.00 156.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Papain

Source: *Carica papaya* Latex

I.U.B.: 3.4.22.2 **CAS Number: 9001-73-4**

Papain is a sulfhydryl protease from *Carica papaya* Latex. It has a molecular weight of 23 kDa and an optimum pH range of 6.0-7.0. The action of papain on leucine methyl ester produces an insoluble polyleucine peptide. Papain breaks down the intercellular matrix of cartilage. Papain is activated by cysteine, sulfide, and sulfite. Stabilizing agents are EDTA, cysteine and dimercaptoethanol.

Stability/Storage: Stable for 6-12 months at 2-8°C. Do not freeze aqueous suspensions.

Technical Notes: Papain preparations should be incubated in the activation solution before use to ensure full activity. Applications include antibody fragmentation and primary/neural cell isolation.

Unit Definition: One Unit hydrolyzes one micromole of benzoyl-L-arginine ethyl ester per minute at 25°C, pH 6.2, after activation in a solution containing 1.1 mM EDTA, 0.067 mM mercaptoethanol and 5.5 mM cysteine-HCl for 30 minutes.

Papain, Suspension					**PAP**
Supplied as a 2X crystalline suspension in 50 mM sodium acetate, pH 4.5. To ensure full activity, the enzyme should be incubated in a solution containing 1.1 mM EDTA, 0.067 mM mercaptoethanol and 5.5 mM cysteine-HCl for 30 minutes. It is recommended that the enzyme be 0.22 micron filtered after dissolution and prior to use. Store at 2-8°C. REQUIRES SPECIAL SHIPPING: ICE PACK	Activates ≥ 20 Units per mg protein	LS003124 LS003126 LS003127 LS003128	25 mg 100 mg 1 gm Bulk	36.00 80.00 520.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code
Papain (Continued)					
Papain, Lyophilized Supplied as a lyophilized powder prepared from a 2X crystalline suspension, Code: PAP. To ensure full activity, the enzyme should be incubated in a solution containing 1.1 mM EDTA, 0.067 mM mercaptoethanol and 5.5 mM cysteine-HCl for 30 minutes. It is recommended that the enzyme be 0.22 micron filtered after dissolution and prior to use. Store at 2-8°C.	Activates ≥15 Units per mg protein	LS003118 LS003119 LS003120 LS003122	25 mg 100 mg 1 gm Bulk	38.00 90.00 595.00 Inquire	**PAPL**
PDS Kit, Papain Vial A component of the Papain Dissociation System, for use in the tissue dissociation method of Huettner, J., and Baughman, R., *J. Neuroscience, 6,* 3044 (1986). Contains papain, L-cysteine, and EDTA. This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 5 ml of EBSS or equivalent yields a solution at 20 Units of papain per ml in 1 mM L-cysteine with 0.5 mM EDTA. Store at 2-8°C.	≥ 100 Units per vial	LK003176 LK003178	1 vi 5 vi	26.00 88.00	**PAP2**

Related Products: Cell Isolation Optimizing System • Collagenase • Deoxyribonuclease I • Hepatocyte Isolation System Hyaluronidase • Neonatal Cardiomyocyte Isolation System • Neutral Protease (Dispase®) • Papain Dissociation System • Proteinase K *STEMxyme®* 1 • *STEMxyme®* 2 • Trypsin • Trypsin Inhibitors

Our mission is to provide superior tools from discovery research through larger scale bioprocessing applications.

Name	Activity	Catalog Number	Package	Price	Code

Papain (Neural) Dissociation System

The Worthington Papain Dissociation System is a set of reagents intended for use in the neural cell isolation method of Huettner and Baughman, *J. Neurosci., 6*, 3044 (1986). The materials are designed for convenience and simplicity and are useful to the occasional user as well as the more experienced and frequent user. Each lot is use-tested for performance in rat spinal neural cell isolation and this kit provides freshly prepared enzyme solutions for each dissociation.

Stability/Storage: The reagents are stable at ambient temperatures for the periods of time expected in normal shipping procedures, but the package should be refrigerated upon arrival. Contents may be stored at 2-8°C for 4 months before use. Store at 2-8°C.

Package Contents
The package contains sufficient materials for dissociation of five separate tissue aliquots of up to 0.3-0.4 cm^3 each. For larger tissue samples prepare proportionately larger volumes of reagents at each step and combine them in the same ratio as described in the protocol.

• **Vial 1:** Sterile Earle's Balanced Salt Solution (EBSS) with calcium, magnesium, bicarbonate and phenol red, one vial per package, 100 ml. Aliquots of this vial are used to reconstitute other vials and to prepare dilute inhibitor solution. Refrigerate between uses and equilibrate with sterile O_2:CO_2 before each use.

• **Vial 2**: Papain containing L-cysteine and EDTA, 5 x 100 Unit single-use vials per package. The material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 5 ml of EBSS (Vial 1) yields a solution at 20 Units of papain per ml in 1 mM L-cysteine with 0.5 mM EDTA. Brief incubation at 37°C is needed to insure full solubility and activity.

• **Vial 3**: Deoxyribonuclease I (DNase), 5 x 1000 unit single use vials per package.
This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 0.5 ml of EBSS (Vial 1) yields a solution at 2000 units of deoxyribonuclease per ml. Avoid vigorous mixing.

• **Vial 4**: Ovomucoid protease inhibitor with bovine serum albumin, one vial per package, 32 ml upon reconstitution. This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 32 ml of EBSS (Vial 1) yields a solution at an effective concentration of 10 mg of ovomucoid inhibitor and 10 mg of albumin per ml. Aliquots of this vial are used for each dissociation. Refrigerate between uses and equilibrate with sterile O_2:CO_2 before each use. Stable after reconstitution when stored at 2-8°C.

Also included is a card correlating color with pH for use as a guide in O_2:CO_2 equilibration.

Papain Dissociation System					**PDS**
Set of five single use vials of papain and five single use vials of DNase, 100 ml of Earle's balanced salt solution (EBSS), and an inhibitor vial for use in the tissue dissociation method of Huettner and Baughman, *J. Neuroscience, 6,* 3044 (1986). Use-tested by Worthington using new-born rat pup spinal cord. The package contains sufficient materials for dissociation of five separate tissue aliquots of up to 0.3-0.4 cm^3 each. Store at 2-8°C.	N/A	LK003150 LK003153	1 bx 3 bx	260.00 692.00	
Papain Dissociation System, Without EBSS					**PDS2**
Complete kit as described for product Code: PDS, but without the Earle's Balanced Salt Solution (EBSS). Store at 2-8°C.	N/A	LK003160 LK003163	1 bx 3 bx	238.00 650.00	

Name	Activity	Catalog Number	Package	Price	Code
Papain (Neural) Dissociation System (Continued)					
PDS Kit, Papain Vial A component of the Papain Dissociation System, for use in the tissue dissociation method of Huettner and Baughman, *J. Neuroscience, 6,* 3044 (1986). Contains papain, L-cysteine, and EDTA. This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 5 ml of EBSS or equivalent yields a solution at 20 Units of papain per ml in 1 mM L-cysteine with 0.5 mM EDTA. Store at 2-8°C.	≥ 100 Units per vial	LK003176 LK003178	1 vi 5 vi	26.00 88.00	**PAP2**
PDS Kit, DNase Vial A component of the Papain Dissociation System. This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 0.5 ml of EBSS or equivalent yields a solution of 2000 units/ml of deoxyribonuclease (1 mg/ml). Store at 2-8°C.	≥ 1,000 units per vial	LK003170 LK003172	1 vi 5 vi	25.00 84.00	**D2**
PDS Kit, Inhibitor Vial Ovomucoid protease inhibitor and bovine serum albumin which is 0.22 micron filtered and lyophilized in autoclaved vials to contain 10 mg/ml each upon reconstitution with 32 ml of EBSS. Store at 2-8°C.	≥ 300 mg TRL inhibited per vial	LK003182	1 vi	78.00	**OI-BSA**
PDS Kit, EBSS Vial Earle's balanced salt solution (EBSS) as supplied in the Papain Dissociation System. Store at 2-8°C.	N/A	LK003188	1 vi	55.00	**EBSS**

Related Products: Cell Isolation Optimizing System • Collagenase • Deoxyribonuclease I • Hepatocyte Isolation System Hyaluronidase • Neonatal Cardiomyocyte Isolation System • Neutral Protease (Dispase®) • Papain Dissociation System Proteinase K • *STEMxyme®* 1 *STEMxyme®* 2 • Trypsin • Trypsin Inhibitors

Name	Activity	Catalog Number	Package	Price	Code

Pectinase

Source: *Aspergillus niger*

I.U.B.: 4.2.2.10 **CAS Number: 9033-35-6**

Purified pectinase is a multi-component preparation highly effective in depolymerizing plant pectins with varying degrees of esterification. The product contains substantial hemicellulase, cellulase, pectinesterase and xylanase activities which, together with pectin lyase and polygalacturonase, work synergistically to digest plant cell wall tissues. When used with Worthington purified cellulase, purified pectinase has been found to be highly successful for generating good yields of viable protoplasts in several plant systems, e.g., corn, soybean, red beet, sunflower, tomato and citrus. In general, a concentration range of 0.1% to 0.5% pectinase (with accompanying 0.5% to 1.5% cellulase) used at 24°C to 37°C for periods of 1 to 16 hours will yield good results.

Stability/Storage: Protect from moisture. If not using entire bottle at once, weigh into single-use aliquots on arrival and store tightly covered and dessicated, at 2-8°C. Material is very hygroscopic and can become tacky and difficult to weigh if exposed to moisture.

Unit Definition: One Unit releases 1 micromole of D-galacturonic acid from polygalacturonic acid per minute at 37°C, pH 5.0.

Technical Note: Pectinase is extremely hydroscopic; store dessicated to protect from moisture.

Pectinase					**PASE**
A chromatographically purified preparation also containing hemicellulase, cellulase, pectinesterase and xylanase activities. Suitable for plant protoplast isolation applications. Supplied as a dialyzed, lyophilized powder. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 20 Units per mg dry weight	LS004297 LS004298 LS004296	250 mg 1 gm Bulk	75.00 255.00 Inquire	

Related Product: Cellulase

Name	Activity	Catalog Number	Package	Price	Code

Pepsin

Source: Porcine Stomach

I.U.B.: 3.4.23.1 **CAS Number: 9001-75-6**

Pepsin is an acidic protease. Its inactive zymogen precursor, pepsinogen, is produced in the stomach mucosa. There are several pepsins designated A, B, C, and D. Pepsin A, the major component, has a molecular weight of 35 kDa and an optimum pH of approximately 1.0 for substrates such as casein or hemoglobin if the substrate is native protein. Pepsin cleaves proteins preferentially at carboxylic groups of aromatic amino acids such as phenylalanine and tyrosine. It will not cleave at bonds containing valine, alanine or glycine. Pepsin is assayed based on the method of Anson, *J. Gen. Physiol., 22*, 79 (1938) using hemoglobin as the substrate. Pepsin is unstable above pH 6.

Stability/Storage: Pepsin is stable for 1-2 years at 2-8°C.

Unit Definition: One unit releases 0.001 A_{280} as TCA soluble hydrolysis products from denatured hemoglobin per minute at 37°C. One FIP Unit, expressed as micromoles of tyrosine equivalents liberated per minute at 25°C, can be calculated as follows: 1 Worthington unit x 0.0071 = FIP Units.

Pepsin A					**PM**
Two times crystallized from dilute alcohol. A lyophilized powder. Store at 2-8°C.	≥ 2,500 units per mg dry weight	LS003319 LS003317 LS003322	1 gm 10 gm Bulk	86.00 595.00 Inquire	

Related Products: Collagenase • Deoxyribonuclease I • Hemoglobin • Hyaluronidase • Neutral Protease (Dispase®) • Proteinase K

Peroxidase

Source: Horseradish Roots

I.U.B.: 1.11.1.7 **CAS Number: 9003-99-0**

Peroxidase (HRP) is a hemoprotein catalyzing the oxidation by hydrogen peroxide of a number of substrates such as ascorbate, ferrocyanide, cytochrome c and the leuco form of many dyes. HRP has a molecular weight of 40 kDa and an optimum pH of 7.0.

Stability/Storage: HPOFF is stable for 9-12 months at 2-8°C. HPOD is stable 2 to 3 years at 2-8°C.

Unit Definition: One Worthington Unit decomposes 1 micromole of H_2O_2 per minute at 25°C, pH 7.0 using aminoantipyrine and phenol.

Technical Note: The RZ (Reinheitzahl), which is the absorbance ratio, A_{403}/A_{275} has been used as an indication of purity. However, Shannon *et al., J. Biol. Chem., 241*, 266 (1966) report that this ratio for the isozymes varies from 2.50 to 4.19. This, together with the influence exerted by buffer and pH, would seem to render questionable the precision of this ratio as a criterion of purity.

Numerous different methodologies are utilized for the determination of peroxidase activity. Listed below are some approximate conversions as determined by Worthington:

- 1 Worthington Unit = 4.6 o-dianisidine units previously used by Worthington
- 1 Worthington Unit = 0.62 ABTS® units (µmole of dye oxidized per minute, pH 6.0, 25°C, 1.7 mM dye)
- 1 Worthington Unit = 2 ABTS® units (µmole of dye oxidized per minute, pH 5.0, 25°C, 8.7 mM dye)
- 1 Worthington Unit = 0.5 guiacol units (µmole of guiacol oxidized per minute, pH 7.0, 25°C)
- 1 Worthington Unit = 0.5 pyrogallol to purpogallin unit (mg of product per 20 seconds, pH 6.0, 20°C)
- 1 Worthington Unit = 5 pyrogallol to purpogallin units (µmole of product per minute at pH 6.0, 30°C)

Peroxidase, EIA Grade, Purified					**HPOFF**
Chromatographically purified.	≥ 500 Units per	LS006474	5 ku	57.00	
Single basic isozyme with RZ ≥ 2.9.	per mg protein	LS006476	50 ku	420.00	
A lyophilized powder. Suitable for		LS006472	Bulk	Inquire	
immunoconjugation.					
Store at 2-8°C or -20°C.					
Peroxidase					**HPOD**
A soluble, dialyzed, lyophilized powder.	≥ 85 Units per	LS002559	100 mg	40.00	
RZ ≥ 1.0.	mg dry weight	LS002560	1 gm	260.00	
Store at -20°C.		LS002561	Bulk	Inquire	

We support the new generation of life science researchers, as well as STEM education programs.

Name	Activity	Catalog Number	Package	Price	Code

Phosphatase, Acid

Source: Wheat Germ (*Triticum vulgare*)

I.U.B.: 3.1.3.2 **CAS Number: 9001-77-8**

Acid phosphatase is an esterase with broad activity at an optimal pH below 7.0. There are three isozymes, EI, EII, and EIII of similar molecular weight (55 kDa ± 5 kDa). Their optimum pHs are 5.5, 4.5 and 4.0, respectively. Acid phosphatase activity was observed by Teller, *Worthington Library Archives* in 1954 in preparations of a wheat germ lipase described by Singer, *J. Biol. Chem., 174*, 11, in 1948. Equivalent commercial preparations have been distributed labeled as lipase and acid phosphatase thus generating some confusion. Subsequent work has confirmed that the non-specific esterase activity of the wheat germ preparation may be measured both as lipase (triacetin as substrate) and phosphatase. The enzyme assay is based on the work of Brandenberger and Hanson, *Helv. Chim. Acta, 36*, 900 (1953) and Hofstee, *Arch. Biochem. Biophys., 51*, 239 (1954).

Unit Definition: One Unit hydrolyzes one micromole of *o*-carboxyphenyl phosphate per minute at 25°C, pH 5.0.

Phosphatase, Acid A non-specific esterase partially purified to the 0.35-0.55 fraction by the method described by Singer, *J. Biol. Chem., 174,* 11 (1948). Also active as a lipase. A lyophilized powder. Store at -20°C.	≥ 0.15 Units per mg dry weight	LS001141 LS001144	1 gm Bulk	102.00 Inquire	**AP**

Name	Activity	Catalog Number	Package	Price	Code

Phosphatase, Alkaline

I.U.B.: 3.1.3.1 **CAS Number: 9001-78-9**

Alkaline phosphatase is a broad term associated with non-specific phosphomonoesterases with an alkaline pH optimum.

Unit Definitions:
CAP: One Worthington Unit hydrolyzes 1 micromole of *p*-nitrophenol phosphate per minute at 37°C, pH 9.8.

BAPF, BAPC, BAPSF: One Unit hydrolyzes 1 micromole of *p*-nitrophenol phosphate per minute at 25°C, pH 8.0.
PC: One Unit hydrolyzes 1 micromole of *o*-carboxyphenol phosphate per minute at 25°C, pH 8.8.

Technical Notes: Worthington chicken intestine alkaline phosphatase (Code: PC) is the preparation used in the NF/USP dexamethasone phosphate measurement.

Phosphatase, Alkaline, Purified **Source:** Calf Intestine Chromatographically purified, EIA grade. A solution in 50% glycerol containing 5 mM $MgCl_2$ and 0.12 mM $ZnCl_2$. Protein concentration is approximately 20 mg/ml. Store at 2-8°C.	≥ 3,000 Units per mg protein (37°C, pH 9.8, DEA)	LS004228 LS004230 LS004234	1 mg 5 mg Bulk	98.00 450.00 Inquire	**CAP**
Phosphatase, Alkaline, Purified **Source:** *Escherichia coli* Chromatographically purified from Code: BAPC. Ribonuclease ≤ 0.002% by weight as RNase A using a poly C assay. Phosphodiesterase not detectable when assayed at 0.1 mg/ml with *p*-nitrophenyl thymidine 5' phosphate. A suspension in 2.6 M ammonium sulfate, pH 8.0. Store at 2-8°C.	≥ 30 Units per mg protein (25°C, pH 8.0)	LS006130 LS006124 LS006123 LS006122	1 mg 5 mg 25 mg Bulk	37.00 135.00 591.00 Inquire	**BAPF**

Name	Activity	Catalog Number	Package	Price	Code

Phosphatase, Alkaline (Continued)

Phosphatase, Alkaline **BAPC**
Source: *Escherichia coli*
Chromatographically purified. A suspension in 2.6 M ammonium sulfate, pH 8.0. Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 20 Units per mg protein (25°C, pH 8.0)	LS005129	5 mg	79.00
	LS005130	10 mg	128.00
	LS005131	Bulk	Inquire

Phosphatase, Alkaline **BAPSF**
Source: *E. coli*
Partially purified. A suspension in 2.6 M ammonium sulfate, pH 8.0. Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 10 Units per mg protein	LS004081	10 mg	50.00
	LS004082	Bulk	Inquire

Phosphatase, Alkaline **PC**
Source: Chicken Intestine
Partially purified. A dried powder. Used in the NF/USP dexamethasone phosphate assay. Store at 2-8°C.

Activity	Catalog Number	Package	Price
≥ 0.9 Units per mg dry weight (25°C pH 8.8)	LS003172	250 mg	112.00
	LS003171	1 gm	370.00
	LS003170	5 gm	1480.00
	LS003174	Bulk	Inquire

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products • Histones • Lysozyme • Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline • Phosphodiesterase II • Proteinase K Reverse Transcriptase, Recombinant HIV • Ribonuclease • Ribonuclease T1 • Ribonuclease T2 • Ribonucleic Acid

Name	Activity	Catalog Number	Package	Price	Code

Phosphodiesterase I

Source: *Crotalus adamanteus* Venom

I.U.B.: 3.1.4.1 **CAS Number: 9025-82-5**

Venom exonuclease (Phosphodiesterase I) successively hydrolyzes 5'-mononucleotides from 3'-OH-terminated ribo- and deoxyribo-oligonucleotides. The enzyme has an optimal pH range of 9.8-10.4 and a molecular weight of 115 kDa. Phosphodiesterase is inhibited by reducing agents such as glutathione, cysteine and ascorbic acids. It is completely inhibited by 5 mM EDTA while ATP, ADP and AMP are partial inhibitors. The enzyme has an absolute requirement for Mg^{2+}.

Unit Definition: One Unit hydrolyzes one micromole of *p*-nitrophenyl thymidine-5-phosphate per minute at 25°C, pH 8.9.

Phosphodiesterase I **VPH**
Purified by the method of Williams, Sung and Laskowski, *JBC, 236,* 1130 (1961). Further treated to inactivate contaminating 5'-nucleotidase activity according to Sulkowski and Laskowski, *Biochim. Biophys. Acta, 240,* 443 (1961). Lyophilized in vials. Store at -20°C.
REQUIRES SPECIAL SHIPPING: ICE PACK

Activity	Catalog Number	Package	Price
≥ 20 Units per mg dry weight	LS003926	100 un	85.00
	LS003928	Bulk	Inquire

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products Histones • Lysozyme • Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline • Phosphodiesterase II • Proteinase K Reverse Transcriptase, Recombinant HIV • Ribonuclease • Ribonuclease T1 • Ribonuclease T2 • Ribonucleic Acid

Name	Activity	Catalog Number	Package	Price	Code

Phosphodiesterase II

Source: Bovine Spleen

I.U.B.: 3.1.16.1 **CAS Number: 9068-54-6**

Spleen exonuclease (Phosphodiesterase II) excises 3'-phosphomononucleotides from oligonucleotides having a free OH terminus. The optimum pH for the enzyme is 5.5 using succinate and phosphate buffer and pH 6-7 with 0.1 M acetate buffer. The enzyme is assayed using a modification of the procedure of Hilmoe, *Biochem. Prep., 8*, (Meister, A., ed.), John Wiley and Sons, NY, 105 (1961).

Unit Definition: One unit increases the absorbance at 260 nm by 0.200 in 30 minutes at 37°C, pH 6.5, with an RNA substrate.

Name	Activity	Catalog Number	Package	Price	Code
Phosphodiesterase II					**SPH**
Prepared from the 1 mM sodium pyrophosphate, pH 6.9, alumina gel eluate of Hilmoe, *Biochem. Prep, 8,* (Meister, A., ed.), John Wiley & Sons, NY, NY, p. 105 (1961). Lyophilized in vials. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 1.2 units per mg dry weight	LS003603 LS003602 LS003600	10 un 25 un Bulk	105.00 233.00 Inquire	

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products Histones • Lysozyme Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline • Phosphodiesterase II • Proteinase K Reverse Transcriptase, Recombinant HIV • Ribonuclease • Ribonuclease T1 • Ribonuclease T2 • Ribonucleic Acid

Name	Activity	Catalog Number	Package	Price	Code

Phospholipase A2

Source: *Crotalus adamanteus* Venom

I.U.B.: 3.1.1.4 **CAS Number: 9001-84-7**

Phospholipase A2 is a member of the class of heat-stable, calcium-dependent enzymes catalyzing the hydrolysis of the 2-acyl bond of 3-n-phosphoglycerides. The enzyme has a molecular weight of 30 kDa. Phospholipase A2 is activated by Ca^{2+}. It is inhibited by zinc, barium, and manganese ions. Activity values for phospholipase A2 preparations which are derived from titrimetric assay procedures can be quite dependent on source and type of lecithin, its preparation as a sub-strate emulsion, other components of the reaction mixture, and the method and instrumentation used.

Unit Definition: One Unit releases one micromole of acid from soybean lecithin per minute at 25°C, pH 8.9

Name	Activity	Catalog Number	Package	Price	Code
Phospholipase A2					**PLA**
A chromatographically purified, dialyzed, lyophilized powder. Store at 2-8°C.	≥ 200 Units per mg dry weight	LS005660 LS005662	1 mg Bulk	69.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Plasma Amine Oxidase

Source: Bovine Plasma

I.U.B.: 1.4.3.21 **CAS Number: 9001-53-0**

Plasma amine oxidase (PAO) catalyzes the reaction: $RCH_2NH_2 + O_2 + H_2O \longrightarrow RCHO + NH_3 + H_2O_2$

Bovine plasma amine oxidase has a molecular weight of 170 kDa and an optimum pH of 6.2 for spermine and 7.2 for spermidine. Amine oxidases are divided into two classes: the pyridoxal- and copper-containing enzyme to which plasma amine oxidase belongs, and the FAD-containing amino oxidases. Natural substrates include catecholamines, tryptamine derivatives and other physiologically active amines. Plasma amine oxidase is used in research requiring nitrogen group transfers. The molecule is composed of two identical polypeptide chains. There are two pyridoxal-phosphates and two atoms of Cu+ per molecule. Bovine plasma amine oxidase is inhibited by copper chelating agents, many carboxyl reagents such as cuprizone, hydroxylamine and cyanide. Benzoic acid and benzyl alcohol are both non-competitive inhibitors (K_I = 30 and 34 mM respectively). The assay for determination of amine oxidases employed at Worthington is essentially that of Tabor *et al., JBC, 208*, 645 (1954) with the reaction temperature reduced to 25°C.

Stability/Storage: Stable for 12 months at -20°C. Store at -20°C.

Unit Definition: 1 Tabor unit oxidizes 1 micromole of benzylamine per minute at 25°C, pH 7.2.

Technical Note: 1 I.U. equals 4,330 Tabor units. (T.U.)

Plasma Amine Oxidase					**PAO**
Chromatographically purified through step five of the procedure of Yamada, and Yasunobu, *J. Biol. Chem., 237,* 1511 (1962). A lyophilized powder. (One IU = 4,330 Tabor Units). Store at -20°C.	≥ 17 Tabor units per mg dry weight	LS003113 LS003114 LS003110	600 un 3 ku Bulk	45.00 195.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code

Polyphenol Oxidase

Source: Mushrooms

I.U.B.: 1.14.18.1 **CAS Number: 9002-10-2**

Polyphenol oxidase (tyrosinase) is a bifunctional, copper-containing oxidase having catecholase and cresolase activity. It is responsible for browning reactions through the phylogenetic scale. The enzyme has a molecular weight of 128 kDa. It is a tetramer containing four atoms of copper per molecule and two binding sites for aromatic compounds including phenolic substrates. There is a distinct binding site for oxygen. The optimum pH range is 6-7.

Unit Definition: One unit causes an increase in the absorbance at 280 nm of 0.001 per minute at 25°C, pH 6.5, using L-tyrosine as substrate.

Polyphenol Oxidase (Tyrosinase)					**TY**
A lyophilized powder. Store at -20°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 500 units per mg dry weight	LS003789 LS003792 LS003793 LS003791	25 ku 100 ku 500 ku Bulk	43.00 110.00 315.00 Inquire	

Worthington Protease Products, Specifications and Applications Table

Enzyme	Specificity	Molecular Weight KDa	pH Optimum	Extinction Coefficient E1%, 280nm	Common Substrates	Activators	Inhibitors	Product Code/ Applications
Partially Purified for Tissue Dissociation and Protein Digestion								
Collagenase	-Pro-X-†-Gly-Pro-Y- X = neutral Y = nonspecific	68-130	6.3-7.5	13.20 (ColH, Theoretical) 13.40 (ColG, Theoretical)	Collagen FALGPA Wünsch	Ca^{2+}, Zn^{2+}	α2-macroglobulin Cysteine, histidine DTT, 2-mercapto EDTA, EGTA Hg^{2+} & other heavy metal ions *o*-phenanthroline	**See page 14 for Collagenase products** Tissue dissociation/ Primary cell isolation applications (see Tissue Dissociation Guide for specific references)
Elastase	Elastin, -X-†-Y- X = uncharged, nonaromatic Y = nonspecific	25.9	8.0-8.5	21.8 (Theoretical)	Casein Denatured collagen Elastin, Fibrin Suc-Ala3-NA	None required	α-antitrypsin DFP α2-macroglobulin PMSF	**ES/ESL**, suspension/ lyo powder, p. 28 Tissue Dissociation/ Primary cell isolation applications (see Tissue Dissociation Guide for specific references)
Neutral Protease (Dispase®)	-X-†-Leu/Phe-†-Y- X/Y = nonspecific	36.0	5.9-7.0	13.96 (Theoretical)	BAEE Casein	Ca^{2+}, Mg^{2+}, Mn^{2+}, Fe^{2+}, and Al^{3+}	EDTA, EGTA Hg^{2+} & other heavy metal ions *o*-phenanthroline	**NPRO/NPRO2**, p. 44 Tissue Dissociation/ Primary cell isolation and cell harvesting applications (see Tissue Dissociation Guide for specific references)
Papain	-X-†-Y- X = nonspecific but Arg, Lys and Phe preferred Y = nonspecific	23.0	6.0-7.0	22.88 (Theoretical)	BAEE	Cysteine EDTA Reducing agents GSH, NBS	AEBSF, Antipain Cystatin, Leupeptin α2-macroglobulin Hg^{2+} & other heavy metal ions DFP, PMSF TLCK, TPCK, E-64	**PAP/PAPL**, suspension/lyo powder, p. 46 Neural tissue dissociation/ primary cell isolation applications (see Tissue Dissociation Guide for specific references) Antibody cleavage RBC modification
Pepsin	-X-†-Y- X = nonspecific but aromatic & hydrophobic preferred Y ≠ Ala, Gly, Val	34.6	1.0-4.0 unstable ≥5	14.39 (Theoretical)	Casein Hemoglobin	None required	Pepstatin A Diazoketones Epoxides	**PM**, p.50 Collagen bioprocessing/ purification Antibody cleavage
Proteinase K	-X-†-Y- X = nonspecific but aliphatic, aromatic & hydrophobic preferred Y = nonspecific	28.9	7.5-12	12.6 (Theoretical)	Casein Hemoglobin Keratin	Ca^{2+} Active in 0.5-1% SDS	DFP EGTA PMSF	**PROKR, PROKRS**, p. 59 DNA/RNA purification
Trypsin	-X-†-Y- X = Arg, Lys Y = nonspecific	23.8	7.5-8.5	14.3	BAEE Casein TAME	Ca^{2+} Lanthanide	Aprotinin, Benzamidine DFP, EDTA, Leupeptin α2-macroglobulin PMSF, TLCK Trypsin Inhibitors (LBI, OI, SI/SIC)	**See page 66 for Trypsin products** Protein Digestion/ Sequencing (purified) Tissue dissociation/ Primary cell isolation applications (see Tissue Dissociation Guide for specific references)

Worthington Protease Products, Specifications and Applications Table

Enzyme	Specificity	Molecular Weight KDa	pH Optimum	Extinction Coefficient E1%, 280nm	Common Substrates	Activators	Inhibitors	Product Code/ Applications
Proteases For Protein Sequencing								
Carboxy-peptidase B	H2-N-Rn-Y-†-X-COOH X = basic amino acids (Arg, Lys, Orn) Y = nonspecific	34.3	7.0-9.0	21.4 (Folk 1971)	Hippuryl-L-arginine	None required	EDTA Hg^{2+} & other heavy metal ions EDTA, EGTA *o*-phenanthroline	**COBC/COBPMS,** p.4 Sequence analysis by successive cleavage of C-terminal basic amino acids Insulin production
Carboxy-peptidase Y	H2-N-Rn-Y-†-X-COOH X ,Y= non-specific, prefers aromatic	64.0	4.5-6.0	15.0 (Hayashi *et al.* 1973, and Kuhn *et al.* 1973)	ATEE Bz-Phe-Ala-Leu Z-Phe-Ala	None required	APCK, Aprotinin DFP 4-Hydroxymercu-ribenzoate PMSF	**COY,** p. 5 C-terminal sequencing & Modification/labeling of peptides and proteins
Chymotrypsin TLCK treated	-X-†-Y- X = aromatic Y = nonspecific	25.6	7.8-8.0	20.57 (Theoretical)	ATEE BTEE	None required	α-antitrypsin Aprotinin DFP, PMSF, TPCK α2-macroglobulin	**CDSEQ, CDTLCK,** p. 10 Sequence analysis Peptide synthesis, mapping/finger-printing
Endo-Arg-C (Clostripain)	-Arg-†-Y- Y = nonspecific	53	7.4-7.8	16.57 (Theoretical)	BAEE	Ca^{2+} Reducing agents	EDTA, TLCK, Tris Hg^{2+} & other heavy metal ions	**CPSEQ, CP,** p.12 Peptide mapping & synthesis Sequence analysis Hydrolysis/ condensation of amide bonds
Endo-Glu-C (Staph. Protease V8)	-Glu-†-Y- (NH4 buffers pH 4, 7.8) -Asp-†-Y- (PO4 buffer pH 7.8)	27.0	4.0 & 7.8	4.26 (Houmard 1976)	Casein Z-Phe-Leu-Glu-4NA	None required	DFP F-, Cl-, Br-, CH3COO- NO3- α2-macroglobulin	**STSEQ, STAP,** p. 58 Peptide mapping & sequence analysis
SequENZ® Trypsin, Sequencing Grade, Modified	-X-†-Y- X = Arg, Lys Y = nonspecific	23.8	7.5-8.5	14.3	BAEE Casein TAME	Ca^{2+} Lanthanide	Aprotinin, Benzamidine DFP, EDTA, Leupeptin α2-macroglobulin PMSF, TLCK Trypsin Inhibitors (egg white, lima bean, pancreatic, soybean)	**TRSEQZ,** Modified Sequencing Grade, p. 66 chemically modified to reduce autolysis Peptide mapping & sequence analysis Cleavage fusion proteins
Trypsin, Sequencing Grade, Native								**TRSEQII,** Sequencing Grade, Native, p. 67 Peptide mapping & sequence analysis Cleavage fusion proteins
Trypsin, TPCK Treated								**TRTPCK, TPCK Treated,** p. 67 Peptide mapping & sequence analysis Cleavage fusion proteins

Name	Activity	Catalog Number	Package	Price	Code

Protease, *Staphylococcus aureus* (Endoproteinase Glu-C)

Source: *Staphylococcus aureus* V8

I.U.B.: 3.4.21.19 **CAS Number: 66676-43-5**

Protease *Staphylococcus aureus* V8 (Endoproteinase-Glu-C) specifically cleaves peptide bonds on the COOH-terminal side of either aspartic or glutamic acids. In the presence of ammonium, the enzyme specificity is limited to glutamic sites. It has a molecular weight of 27 kDa and optimum pH of 4.0 and 7.8 with hemoglobin as the substrate. Protease *Staphylococcus aureus* V8 is inhibited by diisopropylfluorophosphate and monovalent anions such as F^-, Cl^-, CH_3COO^- and NO_3^-. Enzyme activity is determined by the casein digestion assay described by Drapeau, *Methods Enzymol., 45*, 469 (1976).

Stability/Storage: Autolysis occurs at temperatures greater than 40°C. The enzyme is fully active in USP 0.2% SDS. Stable for 12 months at 2-8°C.

Unit Definition: One unit causes a change of 0.001 A_{280} nm per minute at 37°C, pH 7.8 using casein as the substrate.

Protease, *S. aureus* Sequencing Grade					**STSEQ**
Chromatographically purified according to Drapeau, *et al*., *J. Biol. Chem., 247,* 6720 (1972). Supplied in vials containing 10 µg or 50 µg lyophilized powder for protein sequencing applications. Store at 2-8°C.	≥ 500 units per mg dry weight	LS02126 LS02128 LS02129	5x10 ug 5x50 ug Bulk	174.00 472.00 Inquire	
Protease, *S. aureus* (Endoproteinase Glu-C)					**STAP**
Chromatographically purified according to Drapeau, G., Boily, Y., and Houmard, J., *J. Biol. Chem., 247,* 6720 (1972). A lyophilized powder. Store at 2-8°C.	≥ 500 units per mg dry weight	LS003608 LS003605 LS003606	1 mg 5 mg Bulk	67.00 246.00 Inquire	

Related Products: Carboxypeptidase B • Carboxypeptidase Y • Chymotrypsin • Clostripain (Endoproteinase-Arg-C) Endo-Arg-C Endo-Glu-C • Neutral Protease (Dispase®) • Proteinase K • Trypsin, Modified • Trypsin

The Worthington tradition of quality, value and service extends to our families, co-workers and customers.

Proteinase K

Source: Recombinant *tritirachium album* Proteinase K Produced in Yeast

I.U.B.: 3.4.21.64 CAS Number: 39450-01-6

Proteinase K is a serine endopeptidase with a broad spectrum of action, isolated from the fungus *Tritirachium album limber.* Worthington Proteinase K is supplied as a highly purified lyophilized powder. It is tested to be free of DNase and RNase.

Characteristics of Proteinase K from *Tritirachium album limber:*

Molecular weight: 28.9 kDa.

Extinction Coefficient: 14.2

pH Optimum: Stable over a wide pH range: 4.0-12.5, optimum pH 7.5-8.0, using denatured hemoglobin as substrate.

Stability: Although calcium ions do not affect the enzyme activity, they do protect Proteinase K against autolysis and increasethermal stability when present at a concentration of 1 - 5 µmoles. An interesting characteristic of Proteinase K is that it retains its activity in the presence of sodium dodecyl sulphate (SDS) or urea. (0.5 - 1% SDS and 1 - 4 M urea). Raising the temperature of the reaction from 37°C to 50 - 60°C can increase the activity several folds. A special feature of Proteinase K is its ability to digest native proteins, thereby inactivating enzymes such as DNase and RNase without recourse to a denaturation process.

Proteinase K is inactivated by diisopropyl fluorophosphate (DFP) or phenyl methane sulphonyl fluoride (PMSF). Chelating agents such as citrate and EDTA have no affect on the enzyme activity. Proteinase K can also be inactivated by heating above 65°C for 15-20 minutes or by extraction with phenol/chloroform.

Storage: The lyophilized powder is stable for ≥ 1 year at 2-8°C. Solutions in 50 mM Tris-HCl, pH 8.0 with 1 mM $CaCl_2$ are stable for months at 2-8°C. Store at 2-8°C.

Unit Definition: One unit releases one micromole of Folin positive amino acids per minute, measured as tyrosine, at 37°C, pH 7.5, using urea denatured hemoglobin as the substrate.

Specificity: In addition to cleavage of peptide bonds, it is able to catalyze peptide amide hydrolysis.

Application: Note: PROK/PROKS products have been superseded by the recombinant product codes PROKR/PROKRS.The recommended working concentration for Proteinase K is 0.05-1 mg/ml.
Proteinase K is very useful in the isolation of highly native, undamaged DNAs or RNAs, since most microbial or mammalian DNases and RNases are rapidly inactivated by the enzyme, particularly in the presence of 0.2 - 1% SDS.

Name	Activity	Catalog Number	Package	Price	Code
Proteinase K, Recombinant A lyophilized powder. Purified to remove DNase and RNase. Store at 2-8°C.	≥ 20 units per mg dry weight	LS004248 LS004249 LS004250 LS004252	25 mg 100 mg 1 gm Bulk	38.00 81.00 620.00 Inquire	**PROKR**
Proteinase K, Recombinant A lyophilized powder. Purified to remove DNase and RNase. Store at 2-8°C. calcium acetate, pH 7.5 containing 50% glycerol. DNase and RNase free. Store at -20°C REQUIRES SPECIAL SHIPPING: ICE PACK.	≥ 20 units per mg dry weight	LS004254 LS004256 LS004258	5 ml 25 ml Bulk	120.00 480.00 Inquire	**PROKRS**

Related Products: Albumin, Nuclease-Free • DNase I • DNase I, Recombinant • Histones • Ribonuclease A • Lysozyme Nuclease, Micrococcal • Nuclease, S1 • Nucleic Acids • Phosphatase, Alkaline • Phosphodiesterase I • Phosphodiesterase II Reverse Transcriptase, Recombinant HIV • Ribonuclease T1 • Ribonuclease T2 • Ribonucleic Acid

Name	Activity	Catalog Number	Package	Price	Code

Reverse Transcriptase, Recombinant HIV

Source: Recombinant protein produced in *Escherichia coli*

I.U.B.: 2.7.7.49 **CAS Number: 9068-38-6**

Chromatographically purified heterodimer composed of 66 kDa and 51 kDa subunits. Supplied as a solution in 10 mM potassium phosphate, pH 7.4, 1 mM DTT and 20% glycerol. Primarily for AIDS research purposes; this enzyme has less fidelity than all other reverse transcriptases in applications such as the preparation of cDNA from mRNA for cloning purposes.

Unit Definition: One unit incorporates 1 nanomole of tritiated dTMP into acid precipitable products using poly(A)/oligo(dT)12-18 as the template/primer in 20 minutes at 37°C, pH 8.3.

Reverse Transcriptase, Recombinant, HIV					**RTHIV**
Chromatographically purified dimeric form with M.W. of 66 kDa and 51 kDa. A solution in 10 mM potassium phosphate, pH 7.4, 1 mM DTT and 20% glycerol. Store at -20°C. REQUIRES SPECIAL SHIPPING: DRY ICE	≥ 5,000 units per mg protein	LS05003 LS05006 LS05000	200 un 5x200 un Bulk	76.00 280.00 Inquire	

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products • Histones • Lysozyme Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline • Phosphodiesterase I • Phosphodiesterase II • Proteinase K • Ribonuclease Ribonuclease T1 • Ribonuclease T2 • Ribonucleic Acid

From writing the definitive Enzyme Manual decades ago, to our just released Introduction to Enzymes Video, our field account managers are here to assist you with the best products and services for your research.

Ribonuclease

Source: Bovine Pancreas

I.U.B.: 3.1.27.5 **CAS Number: 9001-99-4**

Pancreatic ribonuclease (RNase I) catalyzes cleavage of the phosphodiester bond between the 5'-ribose of a nucleotide and the phosphate group attached to the 3'-ribose of an adjacent pyrimidine nucleotide forming a 2',3'-cyclic phosphate which may then be hydrolyzed to the corresponding 3'-nucleoside phosphate. Ribonuclease A has a molecular weight of 13.7 kDa. It operates in an optimum pH range of 7.0-7.5.

Ribonuclease B has a molecular weight of 14.7 ± 0.3 kDa. It is a glycoprotein which possesses an amino acid composition indistinguishable from that of RNase A. It contains 6 residues of mannose and 2 residues of N-acetylglucosamine per molecule. It is a glycosylated derivative of RNase A.

Ribonuclease is inhibited by heavy metal ions and it is competitively inhibited by DNA. Since Molecular Biology Grade RNase A (Product Code: RPDF) is essentially free of DNase and protease activities, this product is useful in removing RNA from DNA in nucleic acid work and where other enzymes are used or where intact proteins must be recovered.

Stability/Storage: Molecular Biology Grade product (Product Code: RPDF) is stable at least 2 years at 2-8°C or -20°C. Other grades of RNase A are stable 2-3 years at 2-8°C. R and RAF: Store at 2-8°C and protect from moisture. Product Code: RASE: Store at -20°C to maintain monomeric form. Product Code: RPDF: Store at 2-8°C or at -20°C.

Unit Definition: One Kalnitsky unit causes an increase in absorbance of 1.0 at 260nm at 37°C and pH 5.0 when yeast ribosomal RNA is hydrolyzed to acid soluble oliognucleotides. One Kunitz unit equals 50 Worthington units.

Technical Notes: Special care should be given to handling of the enzyme because of its affinity for glass surfaces. The enzyme remains active but aggregates upon lyophilization and in solution at temperatures ≥ 2°C at low ionic strength. Heating solutions of RNase A to inactivate DNase may not be satisfactory since RNase activity may be lost if precipitate formation occurs and heat treated DNase may reactivate over time.
Product Code: RPDF is suitable as supplied for applications requiring minimal DNase and protease levels and needs no further treatment. Product Code: RAF can be used without treatment in some applications. To heat-treat RAF, use 10 mM acetate pH 5.0 with or without 15 mM $CaCl_2$ for 15 minutes at 100°C or longer at 80°C. Product may precipitate if heated at neutral pH. Heat treatment of Product Code: RASE will precipitate product due to the presence of phosphate.

Name	Activity	Catalog Number	Package	Price	Code
Ribonuclease A, DNase & Protease Free Molecular Biology Grade. Supplied as a solution containing approximately 5 mg/ml in 50% glycerol. Prepared specifically for use in purifying DNA plasmids. Each lot is assayed for DNase and protease. Store at 2-8°C Storage at -20°C is acceptable.	≥ 2,000 units per mg protein	LS002131 LS002132 LS002130	1 mg 5 mg Bulk	25.00 80.00 Inquire	**RPDF**
Ribonuclease A, Purified A highly purified, lyophilized preparation which may contain aggregates as a result of lyophilization but which exhibits same specific activity as RASE (below). Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 3,000 units per mg dry weight	LS005649 LS005650 LS005655	25 mg 100 mg Bulk	69.00 215.00 Inquire	**RAF**
Ribonuclease A, Purified Solution Monomeric form, purified by method used for RAF (above) and further processed to remove aggregates. Available as a solution in 0.1 M phosphate buffer, pH 7.4 containing 0.1% v/v phenol as a preservative. Store at -20°C. REQUIRES SPECIAL SHIPPING: DRY ICE	≥ 3,000 units per mg protein	LS005677 LS005679 LS005681	25 mg 100 mg Bulk	54.00 137.00 Inquire	**RASE**

Name	Activity	Catalog Number	Package	Price	Code
Ribonuclease (Continued)					
Ribonuclease A					**R**
Chromatographically purified.	≥ 2,500 units	LS003431	200 mg	94.00	
Lyophilized.	per mg dry	LS003433	1 gm	375.00	
Store at 2-8°C.	weight	LS003435	Bulk	Inquire	
PROTECT FROM MOISTURE.					
Ribonuclease B					**RB**
A partially purified preparation containing	≥ 1,000 units	LS005710	100 mg	103.00	
a mixture of RNase A and RNase B.	per mg dry	LS005715	Bulk	Inquire	
A soluable, dialyzed lyophilized powder.	weight				
Store at 2-8°C.					

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products • Histones Lysozyme • Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline • Phosphodiesterase I • Phosphodiesterase II • Proteinase K Reverse Transcriptase, Recombinant HIV • Ribonuclease T1 • Ribonuclease T2 • Ribonucleic Acid

From biochemical analysis to pre-clinical evalution, Worthington manufacturing practices meet critical industry standards.

Ribonuclease T1, Animal Free

Source: *Aspergillus oryzae*

I.U.B.: 4.6.1.24 **CAS Number: 9026-12-4**

Ribonuclease T1 is a non-mammalian endoribonuclease, highly specific for the cleavage of RNA or deaminated RNA between guanosine 3'-phosphate residues (or inosine 3'-phosphate) and the 5'-OH residues of adjacent nucleotides with the formation of the corresponding intermediate 2', 3'-cyclic phosphates. It cleaves single-stranded RNA releasing oligonucleotides from the guanosine 3'-phosphate termini. The enzyme has a molecular weight of 11 kDa. The optimum pH is 7.5. RNase T1 is inhibited by Ag^{+}, Zn^{2+}, Cu^{2+}, and Hg^{2+} at 1 X mM. The stimulatory effects of both histidine and EDTA are attributed to chelation of contaminating inhibitor cations. The enzyme assay is essentially the method of Egami *et al., Prog. in Nucleic Acid Res. and Molec. Biol., 3*, 59 (1964) based upon the release of acid soluble oligonucleotides following the digestion of yeast RNA.

Uses: Ribonuclease T1 has extensive applications in molecular cloning and DNA sequencing. Because of its specificity it has been a commonly used cleavage enzyme for the determination of structure, nearest neighbor frequencies, and RNA sequencing. The enzyme has further application in the preparation of nucleoside 2',3'-cyclic phosphates, the synthesis of oligonucleotides, and the removal of RNA from DNA preparations.

Animal Free (AF): This enzyme is also used as a non-mammalian source of RNase in various applications.

Stability/Storage: Stable 12-24 months at 2-8°C. Store at 2-8°C.

Unit Definition: One unit releases the equivalent of one A260 unit of acid-soluble products from yeast RNA in 15 minutes at 37°C, pH 7.5.

Technical Note: Some suppliers reference sequencing units; one sequencing unit is equivalent to 0.075 Worthington unit.

Ribonuclease T1, Chromatographically Purified Highly purified, microbial (non-mammalian) RNase prepared with non-animal components. Store at 2-8°C. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 300,000 units per mg protein	LS01485 LS01487 LS01488	100 ku 500 ku Bulk	42.00 130.00 Inquire	**RT1S**
Ribonuclease T1, Chromatographically Purified, Lyophilized Highly purified, microbial (non-mammalian) RNase prepared with non-animal components. Supplied as a dialyzed, lyophilized powder. Store at 2-8°C.	≥ 300,000 units per mg protein	LS01490 LS01492 LS01494	500 ku 2500 ku Bulk	156.00 600.00 Inquire	**RT1L**

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products Deoxyribonuclease • Recombinant Histones • Lysozyme • Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline Phosphodiesterase I • Phosphodiesterase II • Proteinase K Reverse Transcriptase, Recombinant HIV • Ribonuclease Ribonuclease A • Ribonucleic Acid • Ribonuclease T2

Name	Activity	Catalog Number	Package	Price	Code

Ribonuclease T2, Recombinant *Aspergillus oryzae*, Animal Free

Source: Recombinant protein produced in *Pichia pastoris*

I.U.B.: 4.6.1.19 **CAS Number: 37278-25-4**

Aspergillus oryzae Ribonuclease T2 is a member of the RNase T2 family of endonucleases that are present in a wide variety of microbial, plant and animal species. In contrast to *Aspergillus oryzae* Ribonuclease T1, which is an exclusively guanylic-acid specific endonuclease, all RNase T2-like enzymes are essentially base non-specific. However, RNase T2 endonucleases from different species can show slight base preferences. The fungal enzymes, including *Aspargillus oryzae* RNaseT2, show slight base preference in the following order: A>G>C, U. RNase T2 cleaves between the 3'-phosphate residue of one base and the 5'-OH residue of the adjacent nucleotide forming a 2', 3'-cyclic phosphate intermediate followed by the generation of oligonucleotides with 3'-phosphate residues. RNase T2 has a molecular weight of 36 kDa and 12-15% of its mass is composed of carbohydrate. It has an isoelectric point of 5.0 and optimum activity at pH 4.5. RNase T2 is strongly inhibited by Cu++, Zn++ and Hg++ and to a lesser degree by Ca++, Mg++and heparin. Mononucleotides and RNase T2 digestion products can also act as competitive inhibitors. EDTA will stimulate activity, especially in the presence of divalent cations.

Uses: Ribonuclease T2 is often used for 3' analysis of RNA and RNase protection assays.

Animal Free (AF): This enzyme is also used as a non-mammalian source of RNase in various applications.

Stability/Storage: Stable at 12-18 months at 2-8°C. Store at 2-8°C.

Unit Definition: One unit will cause an increase in absorbance of 1.0 at 260 nm at 37°C, pH 4.5 in 15 minutes.

Ribonuclease T2, Recombinant *Aspergillus oryzae*, Produced in *Pichia pastoris*, Deoxyribonuclease and Protease Free, Lyophilized Powder Highly purified recombinant microbial (non-mammalian) RNase prepared with non-animal components. Free of DNase and protease. Supplied as a lyophilized powder. Store at 2-8°C.	≥ 10,000 units per mg protein	LS01501 LS01502 LS01505	50 ku 250 ku Bulk	77.00 310.00 Inquire	**RT2R**

Animal free enzymes, exceeding expectations and meeting industry standards – quality assurance lot-to-lot.

Name	Activity	Catalog Number	Package	Price	Code

Ribonucleic Acid

Source: Baker's *Yeast*

CAS Number: 63231-32-0

Ribonucleic acids are long-chain polymers of nucleotides linked through 3',5'-phosphodiester bonds.

Ribonucleic Acid					**RNA**
Primarily ribosomal RNA.	N/A	LS003452	100 mg	58.00	
Suitable substrate for		LS003453	1 gm	410.00	
ribonuclease assays.		LS003451	Bulk	Inquire	
Store at 2-8°C.					

Related Products: Albumin, Nuclease-Free • Deoxyribonuclease I • Deoxyribonucleic Acid and Related Products Deoxyribonucleic Acid Fragments • Histones • Lysozyme • Nuclease, Micrococcal • Nuclease, S1 • Phosphatase, Alkaline Phosphodiesterase I • Phosphodiesterase II • Proteinase K • Reverse Transcriptase, Recombinant HIV • Ribonuclease Ribonuclease T1 • Ribonuclease T2

Name	Activity	Catalog Number	Package	Price	Code

Superoxide Dismutase

Source: Bovine Erythrocytes

I.U.B.: 1.15.1.1 **CAS Number: 9054-89-1**

Superoxide dismutase (SOD) catalyzes the removal of the O^{2-} free radical. The enzyme protects oxygen-metabolizing cells against harmful effects of superoxide free-radicals. Superoxide dismutase is inactivated by H_2O_2. It consists of two subunits of identical molecular weight joined by a disulfide bond. The molecular weight is 32.5 kDa, and there are two Cu(II) and two Zn(II) atoms per molecule. The isoelectric point of the enzyme is 4.95.

Unit Definition: One unit inhibits by 50% the maximum reduction of nitro blue tetrazolium under the specified conditions.

Superoxide Dismutase					**SODBE**
Chromatographically purified	≥ 1,400 units	LS003540	2 mg	43.00	
essentially as described by McCord	per mg dry	LS003541	10 mg	158.00	
and Fridovich, *J. Biol. Chem., 244*, 6049	weight	LS003542	Bulk	Inquire	
(1969). A dialyzed, lyophilized powder.					
Store at 2-8°C.					

Name	Activity	Catalog Number	Package	Price	Code

Trypsin

Source: Bovine Pancreas

I.U.B.: 3.4.21.4 **CAS Number: 9002-07-7**

Trypsin is a pancreatic serine protease with substrate specificity based upon positively charged lysine and arginine side chains. It is derived from a 34 kDa inactive precursor zymogen, trypsinogen, after enzymatic removal of an N-terminal 6-amino acid leader sequence resulting in the 23.8 kDa trypsin molecule. The optimum pH is 8.0. Trypsin is inhibited by organophosphorus compounds such as diisopropylfluorophosphate and natural inhibitors from pancreas. Soybean, lima bean, and egg white are also sources of natural inhibitors. Trypsin cleaves amide and ester bonds of Arg and Lys. The Worthington Sequencing Grade Trypsin has been further purified to remove trace contaminating proteases and autolysis products which could interfere in trypsin digestion experiments, and exhibits a single band on SDS PAGE.

Uses: For tissue culture work, Worthington trypsin, Codes: TRL, TRLS, TRLVMF and TRTVMF have been used by many researchers. Product Codes: TRSEQZ, TRSEQII and TRTPCK are typically used for protein sequencing, mapping and structure studies. Worthington modified sequencing grade trypsin, Product Code: TRSEQZ, is subjected to extensive purification to remove contaminating proteases and tryptic autolysis by-products which could affect the specificity of the digestion process. Subsequently, the enzyme is chemically modified to minimize the autolysis process as well as increase the stability. The modified trypsin is processed further to remove residual autodegradation products. The specificity of the enzyme is routinely checked after the chemical modification.

Stability/Storage: Most grades of Worthington trypsin are stable for 2-3 years when stored at 2-8°C.
Protect from moisture.

Unit Definition: TAME Unit: One Unit hydrolyzes 1 micromole of *p*-toluene-sulfonyl-L-arginine methyl ester (TAME) per minute at 25°C, pH 8.2, in the presence of 10 mM calcium.
One TAME Unit = 19.2 USP/NF units = 57.5 BAEE units.

Technical Notes: The Virus and Mycoplasma Free trypsin (Code: TRTVMF) has been filtered through an 0.22 micron pore size membrane, lyophilized, subjected to gamma irradiation, and tested for virus and mycoplasma.

Worthington certifies that all lots of Trypsin products are subjected to a pH of less than 3.0 for greater than five (5) hours during processing.

***SequENZ*® Trypsin, Modified, Sequencing Grade**					**TRSEQZ**
Trypsin, treated with L-(tosylamido-2-phenyl) ethyl chloromethyl ketone to inhibit contaminating chymotryptic activity, chemically modified to promote stability and further purified to remove autolysis fragments, resulting in a highly stable trypsin product resistant to autolysis while retaining specificity. Store at -20°C PROTECT FROM MOISTURE. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 150 Units per mg protein (≥ 8,625 BAEE/2875 USP/NF units per mg protein)	LS02120 LS02122 LS02123 LS02124	4 x 25 µg 4 x 100 µg 1 mg Bulk	85.00 236.00 435.00 Inquire	

Name	Activity	Catalog Number	Package	Price	Code
Trypsin (Continued)					
Trypsin, Purified, Sequencing Grade II Bovine trypsin that has been treated with L-(tosylamido-2-phenyl) ethyl chloromethyl ketone (TPCK) to inhibit contaminating chymotryptic activity and extensively purified to remove autolysis products. Supplied as a lyophilized powder. Store at -20°C. PROTECT FROM MOISTURE. REQUIRES SPECIAL SHIPPING: ICE PACK	≥ 150 Units per mg protein (≥ 8,625 BAEE/2875 USP/NF units per mg protein)	LS02115 LS02117 LS02119 LS02118	4 x 25 µg 4 x 100 µg 1 mg Bulk	73.00 199.00 369.00 Inquire	**TRSEQII**
Trypsin, TPCK Treated A chromatographically purified, diafiltered, lyophilized powder that has been treated with L-(tosylamido-2-phenyl) ethyl chloromethyl ketone (TPCK) to inhibit contaminating chymotryptic activity (Kostka and Carpenter, *J. Biol. Chem. 239,* 1799, 1964. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 180 Units per mg protein (≥ 10,350 BAEE/3,450 USP/NF u/mg protein)	LS003740 LS003741 LS003744 LS003742	100 mg 500 mg 1 gm Bulk	100.00 350.00 595.00 Inquire	**TRTPCK**
Trypsin 3X Supplied as a chromatographically purified, diafiltered and lyophilized powder. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 180 Units per mg protein (≥ 10,350 BAEE/3,450 USP/NF u/mg protein)	LS003708 LS003707 LS003709	100 mg 1 gm Bulk	47.00 278.00 Inquire	**TRL3**
Trypsin 2X Supplied as a dialyzed and lyophilized powder. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 180 Units per mg protein (≥ 10,350 BAEE/3,450 USP/NF u/mg protein)	LS003702 LS003703 LS003704 LS003706	100 mg 1 gm 10 gm Bulk	25.00 139.00 1010.00 Inquire	**TRL**

Trypsin (Continued)

Name	Activity	Catalog Number	Package	Price	Code
Trypsin, 0.22µ Filtered Trypsin chromatographically purified, diafiltered, (Code TRL3) filtered through a 0.22 micron pore size membrane and lyophilized in sterile vials. This product is not tested for pyrogenicity. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 180 Units per mg protein (≥ 10,350 BAEE/3,450 USP/NF u/mg protein)	LS003736 LS003734 LS003738	50 mg 5 x 50 mg Bulk	44.00 189.00 Inquire	**TRLS**
Trypsin Vial, NCIS A component of the NCIS kit. This material is 0.22 micron membrane filtered and lyophilized in autoclaved vials. A vial reconstituted with 2 ml of HBSS yields a solution of 500 µg/ml of trypsin, Code: TRLS. Suitable for cell isolation and culture applications. Store at 2-8°C.	≥ 180 Units per vial	LK003220 LK003225	1 vi 5 vi	14.00 48.00	**TRLSNK**
Trypsin, Sterile, Irradiated Chromatographically purified (Code: TRL), lyophilized, irradiated and tested for the absence of mycoplasma and extraneous virus according to 9 CFR113.53c. Each vial is filled to contain ≥ 100 mg. Store at 2-8°C.	≥ 180 Units per mg protein (≥ 10,350 BAEE/3,450 USP/NF u/mg protein)	LS004454 LS004452	100 mg 5 x 100 mg	99.00 363.00	**TRLVMF**
Trypsin, TPCK-Treated, Irradiated Chromatographically purified trypsin treated with L-(tosylamido-2-phenyl) ethyl chloromethyl ketone (TPCK) to inhibit contaminating chymotryptic activity according to (Kostka and Carpenter, *J. Biol. Chem. 239,* 1799, 1964), Code: TRTPCK, lyophilized, irradiated and tested for the absence of mycoplasma and extraneous virus according to 9 CFR 113.53c. Each vial is filled to contain ≥ 100 mg. Store at 2-8°C. PROTECT FROM MOISTURE.	≥ 180 Units per mg protein (≥ 10,350 BAEE/3,450 USP/NF u/mg protein)	LS003750 LS003752	100 mg 5 x 100 mg	148.00 575.00	**TRTVMF**

Related Products: Cell Isolation Optimizing System • Chymotrypsin • Clostripain (Endoproteinase-Arg-C) • Collagenase Deoxyribonuclease I • Hepatocyte Isolation System • Hyaluronidase • Neonatal Cardiomyocyte Isolation System • Neutral Protease (Dispase®) Papain Dissociation System • Protease Staph (Endoproteinase-Glu-C) • Proteinase K • *STEMxyme®* 1 & *STEMxyme®* 2 • Trypsin Inhibitors

Trypsin Inhibitors

CAS Number: 9035-81-8

Lima Bean Inhibitor: Lima bean trypsin inhibitor, which inhibits bovine as well as human trypsin and plasmin, acts upon both trypsin and chymotrypsin by forming equimolar complexes. Lima bean inhibitors may be chromatographically separated into as many as six variants. Jones *et al., Biochem., 2*, 66, (1963) characterized four of them. All have similar but not identical amino acid composition, contain six or seven disulfide bonds and lack methionine and tryptophan. Molecular weights vary between 8 kDa and 10 kDa.
Stability/Storage: The lima bean inhibitor is stable 1-2 years at 2-8°C.

Ovomucoid: Ovomucoids are the glycoprotein protease inhibitors of avian egg white. There are several protease inhibitors in egg white. The Worthington product is that described by Lineweaver and Murray, *J. Biol. Chem., 171*, 565 (1947). It has a molecular weight of approximately 28 kDa.
Stability/Storage: Ovomucoid is stable 1- 2 years when stored at 2-8°C.

Soybean Inhibitor: The soybean trypsin inhibitor was first crystallized by Kunitz in 1945 and is one of several such inhibitors found in soybeans. Its molecular weight is 21.5 ± 0.8 kDa and the optimum pH is 7.0. Soybean inhibitor inhibits trypsin mole-for-mole and to a lesser extent chymotrypsin.
Stability/Storage: The soybean inhibitor is stable for 1-2 years at 2-8°C.

Unit Definition: The activity of the inhibitors is expressed as the amount of twice crystallized trypsin (Worthington Code: TRL) inhibited per milligram of inhibitor. 1 mg TRL ≥ 180 TAME units, 10,350 BAEE units, 3,450 USP/NF units.

Name	Activity	Catalog Number	Package	Price	Code
Trypsin Inhibitor, Lima Bean **Animal Free** Fraction III of the preparation described by Fraenkel-Conrat *et al., Arch. Biochem. Biophys., 37,* 393 (1952). Supplied as a dialyzed, lyophilized powder. Store at 2-8°C.	1 mg inhibits ≥ 2.2 mg trypsin, Code: TRL	LS002829 LS002830 LS002831	100 mg 1 gm Bulk	130.00 920.00 Inquire	LBI ANIMAL FREE
Trypsin Inhbitor, Ovomucoid Mucoprotein and antitryptic factor of egg white described by Lineweaver and Murray, *J. Biol. Chem., 171,* 565 (1947). A dialyzed, dried powder. Store at 2-8°C.	1 mg inhibits ≥ 1.2 mg trypsin, Code: TRL	LS003085 LS003087 LS003086 LS003089	500 mg 1 gm 2 gm Bulk	75.00 128.00 246.00 Inquire	OI
Trypsin Inhibitor, Soybean, Purified **Animal Free** Chromatographically purified. A dialyzed, lyophilized powder. Purity checked using SDS PAGE. Store at 2-8°C.	1 mg inhibits ≥ 1.2 mg trypsin, Code: TRL	LS003570 LS003571 LS003573	100 mg 1 gm Bulk	67.00 416.00 Inquire	SI ANIMAL FREE
Trypsin Inhibitor, Soybean **Animal Free** Partially purified by methods developed at Worthington. A diafiltered, lyophilized powder. Store at 2-8°C.	1 mg inhibits ≥ 0.75 mg trypsin, Code: TRL	LS003587 LS003589 LS003590	1 gm 10 gm Bulk	75.00 580.00 Inquire	SIC ANIMAL FREE

Related Products: Cell Isolation Optimizing System • Chymotrypsin • Collagenase • Deoxyribonuclease I • Hepatocyte Isolation System Hyaluronidase • Neonatal Cardiomyocyte Isolation System • Neutral Protease (Dispase) • Papain • Papain Dissociation System Proteinase K • Trypsin

Name	Activity	Catalog Number	Package	Price	Code

Tyrosine Decarboxylase

Source: *Streptococcus faecalis* (NCTC6783)

I.U.B.: 4.1.1.25 **CAS Number: 9002-09-9**

Tyrosine decarboxylase catalyzes the removal of the carboxyl group from tyrosine to produce tyramine and carbon dioxide. Pyridoxal 5'-phosphate is a necessary cofactor. By using the apoenzyme prepared from cells grown on a vitamin B6-deficient medium, the concentration of pyridoxal phosphate may be determined. The holoenzyme may be used to determine tyrosine, phenylalanine and dihydroxyphenylalanine either manometrically or colorimetrically.

Unit Definition: One Unit results in the decomposition of one micromole of tyrosine per minute at 37°C under the specified conditions.

Tyrosine Decarboxylase					**TYD**
Holoenzyme. Dried cells.	≥ 0.2 Unit per	LS004966	25 un	49.00	
Store at -20°C.	mg dry weight	LS004964	Bulk	Inquire	
REQUIRES SPECIAL SHIPPING: DRY ICE					
Tyrosine Decarboxylase, Apoenzyme					**TYDAPO**
Apoenzyme. Dried cells grown in B6	Activates	LS004968	250 mg	62.00	
deficient media.	≥ 0.2 Units per	LS004970	1 gm	196.00	
Store at -20°C.	mg dry weight	LS004973	Bulk	Inquire	
REQUIRES SPECIAL SHIPPING: DRY ICE					

Name	Activity	Catalog Number	Package	Price	Code

Urease

Source: Jack Bean (*Canavalia ensiformis*)

I.U.B.: 3.5.1.5 **CAS Number: 9002-13-5**

Urease catalyzes the hydrolysis of urea. The molecular weight of the jack bean enzyme is 480 kDa, with an optimum pH of 6.0. It is inhibited by heavy metals.

Unit Definition: One Unit oxidizes one micromole of NADH per minute at 25°C, pH 7.6. The hydrolysis of urea is measured by coupling ammonia production to a glutamate dehydrogenase reaction.

Urease					**URC**
Fractionated from crude jack bean	≥ 45 Units per	LS003885	250 mg	65.00	
meal extract. Tested for ammonia.	mg dry weight	LS003886	1 gm	210.00	
A soluble, lyophilized preparation.		LS003887	10 gm	1650.00	
Store at -20°C.		LS003889	Bulk	Inquire	
REQUIRES SPECIAL SHIPPING: ICE PACK					

Name	Activity	Catalog Number	Package	Price	Code

Uricase

Source: *Candida utilis*

I.U.B.: 1.7.3.3 **CAS Number: 9002-12-4**

Uricase from *Candida* yeast has a molecular weight of ~120,000 daltons and an optimum pH of 8.5. The enzyme is stable at pH 8.5-9.5 and at temperatures below 35°C. The pI is 5.6. It is inhibited by various purine analogs of urate and by copper chelating agents. The enzyme is highly specific for uric acid.

Unit Definition: One Unit oxidizes one micromole of uric acid per minute at 25°C, pH 8.5.

Uricase					**URYW**
A soluble, lyophilized preparation.	≥ 2 Units per	LS003857	100 un	80.00	
Store at -20°C.	mg dry weight	LS003855	Bulk	Inquire	

Worthington employees take pride in developing the highest quality enzymes.

Catalog Number Listing

Number	Product	Code	Package	Price	Page
LK002060	Hepatocyte Isolation System	**HIS**	1 bx	460.00	32
LK002064	Hank's Balanced Salt Solution 10X (HBSS-CMF)	**HBSS10**	1 ea	85.00	33
LK002066	Collagenase/Elastase Vial (CLSH)	**CLSH**	1 vi	54.00	17,33
LK002067	Collagenase/Elastase Vial (CLSH)	**CLSH**	5 vi	237.00	17,33
LK002069	Sodium bicarbonate, 7.5%, (NAH)	**NAH**	1 ea	33.00	34
LK002070	0.15m, MOPS Buffer, (MOPS)	**MOPS**	1 ea	36.00	34
LK003150	Papain Dissociation System	**PDS**	1 bx	260.00	48
LK003153	Papain Dissociation System	**PDS**	3 bx	692.00	48
LK003160	Papain Dissociation System, Without EBSS	**PDS2**	1 bx	238.00	48
LK003163	Papain Dissociation System, Without EBSS	**PDS2**	3 bx	650.00	48
LK003170	DNase Vial (D2)	**D2**	1 vi	25.00	22, 33, 49
LK003172	DNase Vial (D2)	**D2**	5 vi	84.00	22, 33, 49
LK003176	PDS Kit, Papain Vial	**PAP2**	1 vi	26.00	47, 49
LK003178	PDS Kit, Papain Vial	**PAP2**	5 vi	88.00	47, 49
LK003182	PDS Kit, Inhibitor Vial	**OI-BSA**	1 vi	78.00	49
LK003188	PDS Kit, EBSS Vial	**EBSS**	1 vi	55.00	49
LK003200	Cell Isolation Optimizing System	**CIT**	1 bx	570.00	8
LK003210	HBSS Solution	**HBSS**	1 ea	58.00	42
LK003220	Trypsin Vial, NCIS	**TRLSNK**	1 vi	14.00	42, 68
LK003225	Trypsin Vial, NCIS	**TRLSNK**	5 vi	48.00	42, 68
LK003230	Inhibitor Vial, NCIS	**SICNK**	1 vi	15.00	42
LK003235	Inhibitor Vial, NCIS	**SICNK**	5 vi	45.00	42
LK003240	Collagenase Vial, NCIS	**CLSPANK**	1 vi	32.00	16, 42
LK003245	Collagenase Vial, NCIS	**CLSPANK**	5 vi	130.00	16, 42
LK003250	L-15 Media Powder (L15NK)	**L15NK**	1 ea	30.00	34, 43
LK003265	Cell Strainers (Falcon)	**CELSTRNK**	5 ea	28.00	43
LK003300	Neonatal Cardiomyocyte Isolation System	**NCIS**	1 kt	288.00	42
LK003303	Neonatal Cardiomyocyte Isolation System	**NCIS**	3 kt	785.00	42
LS000150	Lactoperoxidase	**LPO**	10 mg	81.00	38
LS000151	Lactoperoxidase	**LPO**	50 mg	328.00	38
LS000152	Lactoperoxidase	**LPO**	Bulk	Inquire	38
LS000290	Albumin, Nuclease-Free	**BSANF**	100 mg	50.00	1
LS000291	Albumin, Nuclease-Free	**BSANF**	5x100 mg	225.00	1
LS000292	Albumin, Nuclease-Free	**BSANF**	Bulk	Inquire	1
LS001041	Actin	**ACT**	1 mg	50.00	1
LS001043	Actin	**ACT**	Bulk	Inquire	1
LS001045	Actin	**ACT**	5 mg	185.00	1
LS001069	Alcohol Dehydrogenase, Lyophilized	**ADHL**	100 mg	92.00	2
LS001070	Alcohol Dehydrogenase, Lyophilized	**ADHL**	1 gm	695.00	2
LS001071	Alcohol Dehydrogenase, Lyophilized	**ADHL**	Bulk	Inquire	2
LS001089	Alcohol Dehydrogenase, Suspension	**ADHS**	Bulk	Inquire	2
LS001123	Aldolase, Suspension	**ALD**	100 mg	130.00	2
LS001125	Aldolase, Suspension	**ALD**	Bulk	Inquire	2
LS001128	Aldolase, Lyophilized	**ALDC**	Bulk	Inquire	2
LS001130	Aldolase, Lyophilized	**ALDC**	100 mg	160.00	2
LS001141	Phosphatase, Acid	**AP**	1 gm	102.00	52

Number	Product	Code	Package	Price	Page
LS001144	Phosphatase, Acid	AP	Bulk	Inquire	52
LS001260	Carbonic Anhydrase	CA	50 mg	112.00	4
LS001263	Carbonic Anhydrase	CA	250 mg	496.00	4
LS001265	Carbonic Anhydrase	CA	Bulk	Inquire	4
LS001332	Chymotrypsin, Alpha, 1X	CDAG	Bulk	Inquire	11
LS001333	Chymotrypsin, Alpha, 1X	CDAG	1 gm	32.00	11
LS001334	Chymotrypsin, Alpha, 1X	CDAG	10 gm	190.00	11
LS001430	Chymotrypsin, Alpha, TLCK Treated	CDTLCK	25 mg	28.00	11
LS001432	Chymotrypsin, Alpha, TLCK Treated	CDTLCK	100 mg	68.00	11
LS001434	Chymotrypsin, Alpha, TLCK Treated	CDTLCK	1 gm	530.00	11
LS001438	Chymotrypsin, Alpha, TLCK Treated	CDTLCK	Bulk	Inquire	11
LS001448	Chymotrypsin, Alpha, 3X	CDI	250 mg	40.00	11
LS001450	Chymotrypsin, Alpha, 3X	CDI	1 gm	115.00	11
LS001451	Chymotrypsin, Alpha, 3X	CDI	10 gm	868.00	11
LS001453	Chymotrypsin, Alpha, 3X	CDI	Bulk	Inquire	11
LS001475	Chymotrypsin, Alpha, Purified	CDS	100 mg	69.00	11
LS001477	Chymotrypsin, Alpha, Purified	CDS	Bulk	Inquire	11
LS001479	Chymotrypsin, Alpha, Purified	CDS	1 gm	525.00	11
LS001628	Cholinesterase, Butyryl	CHE	500 un	98.00	10
LS001632	Cholinesterase, Butyryl	CHE	4 ku	595.00	10
LS001636	Cholinesterase, Butyryl	CHE	Bulk	Inquire	10
LS001641	Clostripain (Endoproteinase-Arg-C)	CP	1 mg	38.00	12
LS001643	Clostripain (Endoproteinase-Arg-C)	CP	5x1 mg	151.00	12
LS001646	Clostripain (Endoproteinase-Arg-C)	CP	10 mg	231.00	12
LS001647	Clostripain (Endoproteinase-Arg-C)	CP	Bulk	Inquire	12
LS001652	Collagen	CL	5 gm	115.00	12
LS001654	Collagen	CL	1 gm	35.00	12
LS001656	Collagen	CL	10 gm	200.00	12
LS001658	Collagen	CL	Bulk	Inquire	12
LS001663	Collagen, Soluble	CLCS	Bulk	Inquire	12
LS001720	Carboxypeptidase B, PMSF Treated	COBPMS	Bulk	Inquire	4
LS001722	Carboxypeptidase B, PMSF Treated	COBPMS	1 ku	45.00	4
LS001724	Carboxypeptidase B, PMSF Treated	COBPMS	3 ku	97.00	4
LS001847	Catalase, Lyophilized	CTL	2 gm	73.00	5
LS001849	Catalase, Lyophilized	CTL	10 gm	302.00	5
LS001851	Catalase, Lyophilized	CTL	Bulk	Inquire	5
LS001872	Catalase, Suspension	CTR	10 ml	51.00	5
LS001873	Catalase, Suspension	CTR	100 ml	375.00	5
LS001874	Catalase, Suspension	CTR	Bulk	Inquire	5
LS001896	Catalase, Filtered	CTS	10 ml	42.00	5
LS001898	Catalase, Filtered	CTS	10x10 ml	310.00	5
LS002004	Deoxyribonuclease I	D	5 mg	35.00	21
LS002006	Deoxyribonuclease I	D	20 mg	85.00	21
LS002007	Deoxyribonuclease I	D	100 mg	300.00	21
LS002009	Deoxyribonuclease I	D	Bulk	Inquire	21
LS002058	Deoxyribonuclease I, Filtered	DCLS	11 mg	100.00	21

Catalog Number Listing

Number	Product	Code	Package	Price	Page
LS002060	Deoxyribonuclease I, Filtered	DCLS	25 mg	180.00	21
LS002105	Deoxyribonucleic Acid, Calf Thymus	DNA	100 mg	32.00	25
LS002106	Deoxyribonucleic Acid, Calf Thymus	DNA	1 gm	174.00	25
LS002107	Deoxyribonucleic Acid, Calf Thymus	DNA	5 gm	695.00	25
LS002108	Deoxyribonucleic Acid, Calf Thymus	DNA	Bulk	Inquire	25
LS002130	Ribonuclease A, DNase & Protease Free	RPDF	Bulk	Inquire	61
LS002131	Ribonuclease A, DNase & Protease Free	RPDF	1 mg	25.00	61
LS002132	Ribonuclease A, DNase & Protease Free	RPDF	5 mg	80.00	61
LS002138	Deoxyribonuclease I	DP	25 mg	41.00	22
LS002139	Deoxyribonuclease I	DP	100 mg	100.00	22
LS002140	Deoxyribonuclease I	DP	1 gm	815.00	22
LS002141	Deoxyribonuclease I	DP	Bulk	Inquire	22
LS002145	Deoxyribonuclease I	DPB	100 mg	82.00	22
LS002147	Deoxyribonuclease I	DPB	1 gm	590.00	22
LS002149	Deoxyribonuclease I	DPB	Bulk	Inquire	22
LS002172	Deoxyribonuclease I, Standard Vial	DSV	5x2 ku	60.00	21
LS002173	Deoxyribonuclease I, Standard Vial	DSV	2 ku	21.00	21
LS002274	Elastase, Suspension	ES	25 mg	47.00	28
LS002276	Elastase, Suspension	ES	Bulk	Inquire	28
LS002279	Elastase, Suspension	ES	100 mg	128.00	28
LS002280	Elastase, Suspension	ES	1 gm	968.00	28
LS002290	Elastase, Lyophilized	ESL	25 mg	50.00	28
LS002292	Elastase, Lyophilized	ESL	100 mg	142.00	28
LS002294	Elastase, Lyophilized	ESL	1 gm	1020.00	28
LS002298	Elastase, Lyophilized	ESL	Bulk	Inquire	28
LS002375	Histone, Dried	H	250 mg	36.00	35
LS002377	Histone, Dried	H	1 gm	106.00	35
LS002379	Histone, Dried	H	Bulk	Inquire	35
LS002402	Hemoglobin	HB	5 gm	31.00	31
LS002403	Hemoglobin	HB	25 gm	76.00	31
LS002404	Hemoglobin	HB	100 gm	235.00	31
LS002407	Hemoglobin	HB	Bulk	Inquire	31
LS002408	Myoglobin	MB	250 mg	52.00	40
LS002410	Myoglobin	MB	1 gm	168.00	40
LS002412	Myoglobin	MB	5 gm	635.00	40
LS002414	Myoglobin	MB	1 mg	Inquire	40
LS002425	Deoxyribonuclease II	HDA	80 ku	74.00	24
LS002427	Deoxyribonuclease II	HDA	Bulk	Inquire	24
LS002500	Hexokinase, Suspension	HKQS	Bulk	Inquire	35
LS002511	Hexokinase, Lyophilized	HKQL	2.5 ku	65.00	34
LS002512	Hexokinase, Lyophilized	HKQL	10 ku	212.00	34
LS002514	Hexokinase, Lyophilized	HKQL	Bulk	Inquire	34
LS002544	Histone, Lyophilized	HLY	250 mg	43.00	35
LS002546	Histone, Lyophilized	HLY	1 gm	142.00	35
LS002548	Histone, Lyophilized	HLY	Bulk	Inquire	35
LS002559	Peroxidase	HPOD	100 mg	40.00	51
LS002560	Peroxidase	HPOD	1 gm	260.00	51

Number	Product	Code	Package	Price	Page
LS002561	Peroxidase	HPOD	Bulk	Inquire	51
LS002591	Hyaluronidase	HSE	Bulk	Inquire	36
LS002592	Hyaluronidase	HSE	300 ku	201.00	36
LS002594	Hyaluronidase	HSE	50 ku	49.00	36
LS002598	Cellulase	CEL	250 mg	35.00	9
LS002600	Cellulase	CEL	Bulk	Inquire	9
LS002601	Cellulase	CEL	1 gm	85.00	9
LS002603	Cellulase	CEL	10 gm	698.00	9
LS002609	Cellulase	CELF	Bulk	Inquire	9
LS002610	Cellulase	CELF	1 gm	48.00	9
LS002611	Cellulase	CELF	10 gm	342.00	9
LS002755	Lactate Dehydrogenase, Lyophilized	LADCL	5 ku	114.00	38
LS002756	Lactate Dehydrogenase, Lyophilized	LADCL	25 ku	537.00	38
LS002757	Lactate Dehydrogenase, Lyophilized	LADCL	Bulk	Inquire	38
LS002763	Amino Acid Oxidase, L-	LAO	2 mg	80.00	3
LS002764	Amino Acid Oxidase, L-	LAO	5 mg	162.00	3
LS002766	Amino Acid Oxidase, L-	LAO	Bulk	Inquire	3
LS002829	Trypsin Inhibitor, Lima Bean	LBI	100 mg	130.00	69
LS002830	Trypsin Inhibitor, Lima Bean	LBI	1 gm	920.00	69
LS002831	Trypsin Inhibitor, Lima Bean	LBI	Bulk	Inquire	69
LS002880	Lysozyme	LY	1 gm	26.00	39
LS002881	Lysozyme	LY	10 gm	140.00	39
LS002883	Lysozyme	LY	Bulk	Inquire	39
LS002931	Lysozyme, Purified, Salt Free	LYSF	1 gm	33.00	39
LS002933	Lysozyme, Purified, Salt Free	LYSF	5 gm	80.00	39
LS002934	Lysozyme, Purified, Salt Free	LYSF	Bulk	Inquire	39
LS002975	Mucin	MU	100 mg	36.00	40
LS002976	Mucin	MU	500 mg	138.00	40
LS002978	Mucin	MU	Bulk	Inquire	40
LS003010	Histone, Nucleo-	NHL	250 mg	60.00	45
LS003011	Histone, Nucleo-	NHL	1 gm	192.00	45
LS003013	Histone, Nucleo-	NHL	Bulk	Inquire	45
LS003048	Ovalbumin	OA	5 gm	156.00	46
LS003049	Ovalbumin	OA	1 gm	42.00	46
LS003050	Ovalbumin	OA	Bulk	Inquire	46
LS003052	Ovalbumin, Purified	OAC	Bulk	Inquire	46
LS003054	Ovalbumin, Purified	OAC	1 gm	232.00	46
LS003056	Ovalbumin, Purified	OAC	100 mg	37.00	46
LS003059	Ovalbumin, LowEndo™, Purified	OAEF	10 mg	141.00	46
LS003061	Ovalbumin, LowEndo™, Purified	OAEF	100 mg	580.00	46
LS003062	Ovalbumin, LowEndo™, Purified	OAEF	500 mg	1575.00	46
LS003064	Ovalbumin, LowEndo™, Purified	OAEF	1 mg	Inquire	46
LS003085	Trypsin Inhbitor, Ovomucoid	OI	500 mg	75.00	69
LS003086	Trypsin Inhbitor, Ovomucoid	OI	2 gm	246.00	69
LS003087	Trypsin Inhbitor, Ovomucoid	OI	1 gm	128.00	69
LS003089	Trypsin Inhbitor, Ovomucoid	OI	Bulk	Inquire	69
LS003110	Plasma Amine Oxidase	PAO	Bulk	Inquire	55

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Number	Product	Code	Package	Price	Page
LS003113	Plasma Amine Oxidase	PAO	600 un	45.00	55
LS003114	Plasma Amine Oxidase	PAO	3 ku	195.00	55
LS003118	Papain, Lyophilized	PAPL	25 mg	38.00	47
LS003119	Papain, Lyophilized	PAPL	100 mg	90.00	47
LS003120	Papain, Lyophilized	PAPL	1 gm	595.00	47
LS003122	Papain, Lyophilized	PAPL	Bulk	Inquire	47
LS003124	Papain, Suspension	PAP	25 mg	36.00	46
LS003126	Papain, Suspension	PAP	100 mg	80.00	46
LS003127	Papain, Suspension	PAP	1 gm	520.00	46
LS003128	Papain, Suspension	PAP	Bulk	Inquire	46
LS003170	Phosphatase, Alkaline	PC	5 gm	1480.00	53
LS003171	Phosphatase, Alkaline	PC	1 gm	370.00	53
LS003172	Phosphatase, Alkaline	PC	250 mg	112.00	53
LS003174	Phosphatase, Alkaline	PC	Bulk	Inquire	53
LS003317	Pepsin A	PM	10 gm	595.00	50
LS003319	Pepsin A	PM	1 gm	86.00	50
LS003322	Pepsin A	PM	Bulk	Inquire	50
LS003431	Ribonuclease A	R	200 mg	94.00	62
LS003433	Ribonuclease A	R	1 gm	375.00	62
LS003435	Ribonuclease A	R	Bulk	Inquire	62
LS003451	Ribonucleic Acid	RNA	Bulk	Inquire	65
LS003452	Ribonucleic Acid	RNA	100 mg	58.00	65
LS003453	Ribonucleic Acid	RNA	1 gm	410.00	65
LS003540	Superoxide Dismutase	SODBE	2 mg	43.00	65
LS003541	Superoxide Dismutase	SODBE	10 mg	158.00	65
LS003542	Superoxide Dismutase	SODBE	Bulk	Inquire	65
LS003554	Deoxyribonucleic Acid, Salmon Testes	SDNA	1 gm	90.00	25
LS003557	Deoxyribonucleic Acid, Salmon Testes	SDNA	Bulk	Inquire	25
LS003558	Deoxyribonucleic Acid, Salmon Testes	SDNA	5 gm	400.00	25
LS003570	Trypsin Inhibitor, Soybean, Purified	SI	100 mg	67.00	69
LS003571	Trypsin Inhibitor, Soybean, Purified	SI	1 gm	416.00	69
LS003573	Trypsin Inhibitor, Soybean, Purified	SI	Bulk	Inquire	69
LS003587	Trypsin Inhibitor, Soybean	SIC	1 gm	75.00	69
LS003589	Trypsin Inhibitor, Soybean	SIC	10gm	580.00	69
LS003590	Trypsin Inhibitor, Soybean	SIC	Bulk	Inquire	69
LS003600	Phosphodiesterase II	SPH	Bulk	Inquire	54
LS003602	Phosphodiesterase II	SPH	25 un	233.00	54
LS003603	Phosphodiesterase II	SPH	10 un	105.00	54
LS003605	Protease, S. aureus (Endoproteinase Glu-C)	STAP	5 mg	246.00	58
LS003606	Protease, S. aureus (Endoproteinase Glu-C)	STAP	Bulk	Inquire	58
LS003608	Protease, S. aureus (Endoproteinase Glu-C)	STAP	1 mg	67.00	58
LS003702	Trypsin	TRL	100 mg	25.00	67
LS003703	Trypsin	TRL	1 gm	139.00	67
LS003704	Trypsin	TRL	10 gm	1010.00	67
LS003706	Trypsin	TRL	Bulk	Inquire	67
LS003707	Trypsin, TRL3	TRL3	1 gm	278.00	67
LS003708	Trypsin, TRL3	TRL3	100 mg	47.00	67

Number	Product	Code	Package	Price	Page
LS003709	Trypsin, TRL3	TRL3	Bulk	Inquire	67
LS003734	Trypsin, Filtered	TRLS	5x50 mg	189.00	68
LS003736	Trypsin, Filtered	TRLS	50 mg	44.00	68
LS003738	Trypsin, Filtered	TRLS	Bulk	Inquire	68
LS003740	Trypsin, TPCK Treated	TRTPCK	100 mg	100.00	67
LS003741	Trypsin, TPCK Treated	TRTPCK	500 mg	350.00	67
LS003742	Trypsin, TPCK Treated	TRTPCK	Bulk	Inquire	67
LS003744	Trypsin, TPCK Treated	TRTPCK	1 gm	595.00	67
LS003750	Trypsin, TPCK-Treated, Irradiated	TRTVMF	100 mg	148.00	68
LS003752	Trypsin, TPCK-Treated, Irradiated	TRTVMF	5x100 mg	575.00	68
LS003789	Polyphenol Oxidase (Tyrosinase)	TY	25 ku	42.00	55
LS003791	Polyphenol Oxidase (Tyrosinase)	TY	Bulk	Inquire	55
LS003792	Polyphenol Oxidase (Tyrosinase)	TY	100 ku	110.00	55
LS003793	Polyphenol Oxidase (Tyrosinase)	TY	500 ku	315.00	55
LS003855	Uricase	URYW	Bulk	Inquire	71
LS003857	Uricase	URYW	100 un	80.00	71
LS003885	Urease	URC	250 mg	65.00	70
LS003886	Urease	URC	1 gm	210.00	70
LS003887	Urease	URC	10 gm	1650.00	70
LS003889	Urease	URC	Bulk	Inquire	70
LS003907	Hyaluronic Acid	VHHA	10 mg	72.00	36
LS003909	Hyaluronic Acid	VHHA	50 mg	275.00	36
LS003910	Hyaluronic Acid	VHHA	100 mg	525.00	36
LS003911	Hyaluronic Acid	VHHA	Bulk	Inquire	36
LS003926	Phosphodiesterase I	VPH	100 un	85.00	53
LS003928	Phosphodiesterase I	VPH	Bulk	Inquire	53
LS003980	Glucose-6-Phosphate Dehydrogenase, Lyophilized	ZFL	10 ku	580.00	31
LS003981	Glucose-6-Phosphate Dehydrogenase, Lyophilized	ZFL	1 ku	78.00	31
LS003982	Glucose-6-Phosphate Dehydrogenase, Lyophilized	ZFL	Bulk	Inquire	31
LS003983	Glucose-6-Phosphate Dehydrogenase, Suspension	ZF	500 un	41.00	30
LS003985	Glucose-6-Phosphate Dehydrogenase, Suspension	ZF	5 ku	285.00	30
LS003987	Glucose-6-Phosphate Dehydrogenase, Suspension	ZF	Bulk	Inquire	30
LS003992	Glucose-6-Phosphate Dehydrogenase, Suspension	ZFD	900 un	41.00	30
LS003993	Glucose-6-Phosphate Dehydrogenase, Suspension	ZFD	9 ku	285.00	30
LS003994	Glucose-6-Phosphate Dehydrogenase, Suspension	ZFD	Bulk	Inquire	30
LS003997	Glucose-6-Phosphate Dehydrogenase, Lyophilized	ZFLD	2 ku	78.00	31
LS003998	Glucose-6-Phosphate Dehydrogenase, Lyophilized	ZFLD	18 ku	580.00	31
LS003999	Glucose-6-Phosphate Dehydrogenase, Lyophilized	ZFLD	Bulk	Inquire	31
LS004002	Glucose-6-Phosphate Dehydrogenase, High-Activity, Suspension	ZFDP	1 ku	56.00	30
LS004004	Glucose-6-Phosphate Dehydrogenase, High-Activity, Suspension	ZFDP	10 ku	435.00	30
LS004006	Glucose-6-Phosphate Dehydrogenase, High-Activity, Suspension	ZFDP	1 ku	Inquire	30
LS004081	Phosphatase, Alkaline	BAPSF	10 mg	50.00	53
LS004082	Phosphatase, Alkaline	BAPSF	Bulk	Inquire	53
LS004090	Galactosidase, Beta	BG	5 ku	57.00	29

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Number	Product	Code	Package	Price	Page
LS004093	Galactosidase, Beta	BG	Bulk	Inquire	29
LS004099	Galactosidase, Beta, Purified	BGC	1 ku	70.00	29
LS004100	Galactosidase, Beta, Purified	BGC	5 ku	284.00	29
LS004102	Galactosidase, Beta, Purified	BGC	Bulk	Inquire	29
LS004106	*STEMxyme*® 1, Collagenase/Neutral Protease (Dispase®)	STZ1	50 mg	95.00	18
LS004107	*STEMxyme*® 1, Collagenase/Neutral Protease (Dispase®)	STZ1	5x50 mg	440.00	18
LS004112	*STEMxyme*® 2 Collagenase/Neutral Protease (Dispase®)	STZ2	50 mg	146.00	18
LS004113	*STEMxyme*® 2 Collagenase/Neutral Protease (Dispase®)	STZ2	5x50 mg	652.00	18
LS004118	Collagenase (Animal Free) - Type A, Filtered	CLSAFAS	50 mg	62.00	19
LS004119	Collagenase (Animal Free) - Type A, Filtered	CLSAFAS	5X50 mg	250.00	19
LS004124	Collagenase (Animal Free) - Type B, Filtered	CLSAFBS	50 mg	62.00	19
LS004125	Collagenase (Animal Free) - Type B, Filtered	CLSAFBS	5x50 mg	250.00	19
LS004130	Collagenase (Animal Free) - Type C, Filtered	CLSAFCS	50 mg	62.00	19
LS004131	Collagenase (Animal Free) - Type C, Filtered	CLSAFCS	5x50 mg	250.00	19
LS004138	Collagenase (Animal Free) - Type C	CLSAFC	100 mg	48.00	19
LS004140	Collagenase (Animal Free) - Type C	CLSAFC	1 gm	235.00	19
LS004141	Collagenase (Animal Free) - Type C	CLSAFC	5 gm	1015.00	19
LS004143	Collagenase (Animal Free) - Type C	CLSAFC	1 mg	Inquire	19
LS004145	Collagenase (Animal Free) - Type B	CLSAFB	100 mg	48.00	19
LS004147	Collagenase (Animal Free) - Type B	CLSAFB	1 gm	235.00	19
LS004148	Collagenase (Animal Free) - Type B	CLSAFB	5 gm	1015.00	19
LS004150	Collagenase (Animal Free) - Type B	CLSAFB	1 mg	Inquire	19
LS004152	Collagenase (Animal Free) - Type A	CLSAFA	100 mg	48.00	19
LS004154	Collagenase (Animal Free) - Type A	CLSAFA	1 gm	235.00	19
LS004156	Collagenase (Animal Free) - Type A	CLSAFA	5 gm	1015.00	19
LS004158	Collagenase (Animal Free) - Type A	CLSAFA	Bulk	Inquire	19
LS004174	Collagenase, Type 2	CLS-2	100 mg	38.00	16
LS004176	Collagenase, Type 2	CLS-2	1 gm	195.00	16
LS004177	Collagenase, Type 2	CLS-2	5 gm	825.00	16
LS004179	Collagenase, Type 2	CLS-2	Bulk	Inquire	16
LS004180	Collagenase, Type 3	CLS-3	100 mg	38.00	16
LS004182	Collagenase, Type 3	CLS-3	1 gm	195.00	16
LS004183	Collagenase, Type 3	CLS-3	5 gm	825.00	16
LS004185	Collagenase, Type 3	CLS-3	Bulk	Inquire	16
LS004186	Collagenase, Type 4	CLS-4	100 mg	38.00	16
LS004188	Collagenase, Type 4	CLS-4	1 gm	195.00	16
LS004189	Collagenase, Type 4	CLS-4	5 gm	825.00	16
LS004191	Collagenase, Type 4	CLS-4	Bulk	Inquire	16
LS004194	Collagenase, Type 1	CLS-1	100 mg	38.00	16
LS004196	Collagenase, Type 1	CLS-1	1 gm	195.00	16
LS004197	Collagenase, Type 1	CLS-1	5 gm	825.00	16
LS004200	Collagenase, Type 1	CLS-1	Bulk	Inquire	16
LS004202	Collagenase, Type 2, Filtered	CLSS-2	50 mg	49.00	17

Number	Product	Code	Package	Price	Page
LS004204	Collagenase, Type 2, Filtered	CLSS-2	5x50 mg	178.00	17
LS004205	Collagenase, Type 2, Filtered	CLSS-2	1 gm	445.00	17
LS004206	Collagenase, Type 3, Filtered	CLSS-3	50 mg	49.00	17
LS004208	Collagenase, Type 3, Filtered	CLSS-3	5x50 mg	178.00	17
LS004209	Collagenase, Type 4, Filtered	CLSS-4	1 gm	445.00	17
LS004210	Collagenase, Type 4, Filtered	CLSS-4	50 mg	49.00	17
LS004212	Collagenase, Type 4, Filtered	CLSS-4	5x50 mg	178.00	17
LS004214	Collagenase, Type 1, Filtered	CLSS-1	50 mg	49.00	17
LS004216	Collagenase, Type 1, Filtered	CLSS-1	5x50 mg	178.00	17
LS004217	Collagenase, Type 1, Filtered	CLSS-1	1 gm	445.00	17
LS004228	Phosphatase, Alkaline, Purified	CAP	1 mg	98.00	52
LS004230	Phosphatase, Alkaline, Purified	CAP	5 mg	450.00	52
LS004234	Phosphatase, Alkaline, Purified	CAP	Bulk	Inquire	52
LS004248	Proteinase K, Recombinant	PROKR	25 mg	38.00	59
LS004249	Proteinase K, Recombinant	PROKR	100 mg	81.00	59
LS004250	Proteinase K, Recombinant	PROKR	1 gm	620.00	59
LS004252	Proteinase K, Recombinant	PROKR	Bulk	Inquire	59
LS004254	Proteinase K, Recombinant, Solution	PROKRS	5 ml	120.00	59
LS004256	Proteinase K, Recombinant, Solution	PROKRS	25 ml	480.00	59
LS004258	Proteinase K, Recombinant, Solution	PROKRS	Bulk	Inquire	59
LS004296	Pectinase	PASE	Bulk	Inquire	50
LS004297	Pectinase	PASE	250 mg	75.00	50
LS004298	Pectinase	PASE	1 gm	255.00	50
LS004326	Diaphorase	DILW	1 ku	Inquire	27
LS004327	Diaphorase	DILW	1 ku	32.00	27
LS004330	Diaphorase	DIL	2 ku	82.00	27
LS004333	Diaphorase	DIL	Bulk	Inquire	27
LS004449	Deoxyribonucleic Acid, E. coli	DNAEC	10 mg	114.00	26
LS004451	Deoxyribonucleic Acid, E. coli	DNAEC	Bulk	Inquire	26
LS004452	Trypsin, Sterile, Irradiated	TRLVMF	5x100 mg	363.00	68
LS004454	Trypsin, Sterile, Irradiated	TRLVMF	100 mg	99.00	68
LS004520	Galactose Oxidase	GAO	150 un	40.00	29
LS004522	Galactose Oxidase	GAO	450 un	71.00	29
LS004523	Galactose Oxidase	GAO	Bulk	Inquire	29
LS004524	Galactose Oxidase	GAO	1 ku	122.00	29
LS004759	Neuraminidase, Purified	NEUA	5 un	100.00	43
LS004760	Neuraminidase, Purified	NEUA	Bulk	Inquire	43
LS004761	Neuraminidase, Purified	NEUA	10 un	193.00	43
LS004762	Neuraminidase, Purified	NEUA	25 un	400.00	43
LS004777	Neuraminidase	NEUP	Bulk	Inquire	43
LS004779	Neuraminidase	NEUP	4 mg	106.00	43
LS004780	Neuraminidase	NEUP	10 mg	216.00	43
LS004796	Nuclease, Micrococcal	NFCP	Bulk	Inquire	44
LS004797	Nuclease, Micrococcal	NFCP	15 ku	85.00	44
LS004798	Nuclease, Micrococcal	NFCP	45 ku	192.00	44
LS004908	Hydroxysteroid Dehydrogenase	STDHMP	10 un	98.00	37
LS004910	Hydroxysteroid Dehydrogenase	STDHMP	50 un	350.00	37

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LS004911	Hydroxysteroid Dehydrogenase	STDHMP	Bulk	Inquire	37
LS004915	Hydroxysteroid Dehydrogenase	STDH	1 gm	79.00	37
LS004916	Hydroxysteroid Dehydrogenase	STDH	5 gm	317.00	37
LS004918	Hydroxysteroid Dehydrogenase	STDH	Bulk	Inquire	37
LS004922	Hydroxysteroid Dehydrogenase	STDHP	Bulk	Inquire	37
LS004964	Tyrosine Decarboxylase	TYD	Bulk	Inquire	70
LS004966	Tyrosine Decarboxylase	TYD	25 un	49.00	70
LS004968	Tyrosine Decarboxylase, Apoenzyme	TYDAPO	250 mg	62.00	70
LS004970	Tyrosine Decarboxylase, Apoenzyme	TYDAPO	1 gm	196.00	70
LS004973	Tyrosine Decarboxylase, Apoenzyme	TYDAPO	Bulk	Inquire	70
LS005129	Phosphatase, Alkaline	BAPC	5 mg	79.00	53
LS005130	Phosphatase, Alkaline	BAPC	10 mg	128.00	53
LS005131	Phosphatase, Alkaline	BAPC	Bulk	Inquire	53
LS005273	Collagenase, Purified	CLSPA	10 ku	179.00	16
LS005275	Collagenase, Purified	CLSPA	4 ku	86.00	16
LS005277	Collagenase, Purified	CLSPA	Bulk	Inquire	16
LS005280	Collagenase, Type 5	CLS-5	100 mg	46.00	16
LS005282	Collagenase, Type 5	CLS-5	1 gm	224.00	16
LS005283	Collagenase, Type 5	CLS-5	5 gm	946.00	16
LS005284	Collagenase, Type 5	CLS-5	1 mg	Inquire	16
LS005286	Collagenase, Type 5, Filtered	CLSS-5	50 mg	58.00	17
LS005287	Collagenase, Type 5, Filtered	CLSS-5	5 x 50 mg	206.00	17
LS005288	Collagenase, Type 5, Filtered	CLSS-5	1 gm	520.00	17
LS005301	Carboxypeptidase B	COBC	10 mg	152.00	4
LS005302	Carboxypeptidase B	COBC	Bulk	Inquire	4
LS005304	Carboxypeptidase B	COBC	50 mg	645.00	4
LS005305	Carboxypeptidase B	COBC	5 mg	87.00	4
LS005318	Collagenase, Type 6	CLS-6	100 mg	52.00	17
LS005319	Collagenase, Type 6	CLS-6	500 mg	203.00	17
LS005321	Collagenase, Type 6	CLS-6	2.5 gm	570.00	17
LS005323	Collagenase, Type 6	CLS-6	1 mg	Inquire	17
LS005332	Collagenase, Type 7	CLS-7	100 mg	59.00	17
LS005333	Collagenase, Type 7	CLS-7	500 mg	229.00	17
LS005335	Collagenase, Type 7	CLS-7	2.5 gm	676.00	17
LS005337	Collagenase, Type 7	CLS-7	1 mg	Inquire	17
LS005410	Deoxyribonuclease II, Purified	HDAC	20 ku	231.00	24
LS005411	Deoxyribonuclease II, Purified	HDAC	Bulk	Inquire	24
LS005416	Deoxyribonuclease II, Purified, Solution	HDACS	2 ku	49.00	24
LS005418	Deoxyribonuclease II, Purified, Solution	HDACS	5 ku	112.00	24
LS005420	Deoxyribonuclease II, Purified, Solution	HDACS	Bulk	Inquire	24
LS005474	Hyaluronidase, Purified	HSEP	30 ku	320.00	36
LS005475	Hyaluronidase, Purified	HSEP	15 ku	200.00	36
LS005477	Hyaluronidase, Purified	HSEP	5 ku	81.00	36
LS005479	Hyaluronidase, Purified	HSEP	Bulk	Inquire	36
LS005622	Chymotrypsinogen A, Purified	CGC	Bulk	Inquire	11
LS005623	Chymotrypsinogen A, Purified	CGC	5 gm	200.00	11

Number	Product	Code	Package	Price	Page
LS005630	Chymotrypsinogen A, Purified	CGC	1 gm	60.00	11
LS005649	Ribonuclease A, Purified	RAF	25 mg	69.00	61
LS005650	Ribonuclease A, Purified	RAF	100 mg	215.00	61
LS005655	Ribonuclease A, Purified	RAF	Bulk	Inquire	61
LS005660	Phospholipase A2	PLA	1 mg	69.00	54
LS005662	Phospholipase A2	PLA	Bulk	Inquire	54
LS005677	Ribonuclease A, Purified Solution	RASE	25 mg	54.00	61
LS005679	Ribonuclease A, Purified Solution	RASE	100 mg	137.00	61
LS005681	Ribonuclease A, Purified Solution	RASE	Bulk	Inquire	61
LS005710	Ribonuclease B	RB	100 mg	103.00	62
LS005715	Ribonuclease B	RB	Bulk	Inquire	62
LS006122	Phosphatase, Alkaline, Purified	BAPF	Bulk	Inquire	52
LS006123	Phosphatase, Alkaline, Purified	BAPF	25 mg	591.00	52
LS006124	Phosphatase, Alkaline, Purified	BAPF	5 mg	135.00	52
LS006130	Phosphatase, Alkaline, Purified	BAPF	1 mg	37.00	52
LS006308	Amino Acid Oxidase, D-	DAOFF	25 mg	553.00	3
LS006310	Amino Acid Oxidase, D-	DAOFF	5 mg	150.00	3
LS006311	Amino Acid Oxidase, D-	DAOFF	Bulk	Inquire	3
LS006320	Deoxyribonuclease I, Recombinant, AF Bioprocess Grade	DR2	25 ku	90.00	23
LS006322	Deoxyribonuclease I, Recombinant, AF Bioprocess Grade	DR2	100 ku	258.00	23
LS006323	Deoxyribonuclease I, Recombinant, AF Bioprocess Grade	DR2	500 ku	842.00	23
LS006325	Deoxyribonuclease I, Recombinant, AF Bioprocess Grade	DR2	Bulk	Inquire	23
LS006328	Deoxyribonuclease I	DPFF	125 ku	341.00	21
LS006330	Deoxyribonuclease I	DPFF	25 ku	93.00	21
LS006331	Deoxyribonuclease I, RNase & Protease Free	DPRF	2500 un	45.00	21
LS006332	Deoxyribonuclease I	DPFF	Bulk	Inquire	21
LS006333	Deoxyribonuclease I, RNase & Protease Free	DPRF	10 ku	160.00	21
LS006334	Deoxyribonuclease I, RNase & Protease Free	DPRF	Bulk	Inquire	21
LS006342	Deoxyribonuclease I, RNase & Protease Free, Solution	DPRFS	100 un	29.00	21
LS006343	Deoxyribonuclease I, RNase & Protease Free	DPRF	50 ku	582.00	21
LS006344	Deoxyribonuclease I, RNase & Protease Free, Solution	DPRFS	500 un	78.00	21
LS006348	Deoxyribonuclease I, RNase & Protease Free, Solution	DPRFS	Bulk	Inquire	21
LS006353	Deoxyribonuclease I, Recombinant, Solution	DR1S	2 ku	51.00	23
LS006355	Deoxyribonuclease I, Recombinant, Solution	DR1S	5x2 ku	204.00	23
LS006357	Deoxyribonuclease I, Recombinant, Solution	DR1S	Bulk	Inquire	23
LS006360	Deoxyribonuclease I, Recombinant	DR1	Bulk	Inquire	23
LS006361	Deoxyribonuclease I, Recombinant	DR1	10 ku	185.00	23
LS006362	Deoxyribonuclease I, Recombinant	DR1	50 ku	775.00	23
LS006363	Elastase, Purified	ESFF	5 mg	74.00	28
LS006365	Elastase, Purified	ESFF	20 mg	217.00	28
LS006367	Elastase, Purified	ESFF	Bulk	Inquire	28
LS006472	Peroxidase, EIA Grade, Purified	HPOFF	Bulk	Inquire	51
LS006474	Peroxidase, EIA Grade, Purified	HPOFF	5 ku	57.00	51

Catalog Number Listing

Number	Product	Code	Package	Price	Page
LS006476	Peroxidase, EIA Grade, Purified	HPOFF	50 ku	420.00	51
LS008736	Micrococcus lysodeikticus Cells	ML	5 gm	95.00	39
LS008737	Micrococcus lysodeikticus Cells	ML	25 gm	390.00	39
LS008739	Micrococcus lysodeikticus Cells	ML	Bulk	Inquire	39
LS009043	Adenosine Deaminase	ADA	250 un	175.00	1
LS009044	Adenosine Deaminase	ADA	Bulk	Inquire	1
LS009068	Carboxypeptidase Y	COY	5 mg	505.00	5
LS009070	Carboxypeptidase Y	COY	1 mg	118.00	5
LS009071	Carboxypeptidase Y	COY	Bulk	Inquire	5
LS01120	DNA Cellulose, Double-Stranded	DNACELDS	1 gm	46.00	25
LS01122	DNA Cellulose, Double-Stranded	DNACELDS	5 gm	144.00	25
LS01124	DNA Cellulose, Double-Stranded	DNACELDS	Bulk	Inquire	25
LS01130	DNA Cellulose, Single-Stranded	DNACELSS	1 gm	46.00	25
LS01132	DNA Cellulose, Single-Stranded	DNACELSS	5 gm	144.00	25
LS01134	DNA Cellulose, Single-Stranded	DNACELSS	Bulk	Inquire	25
LS01200	Deoxyribonucleic Acid, Lambda	DNAL	Bulk	Inquire	26
LS01203	Deoxyribonucleic Acid, Lambda	DNAL	500 ug	100.00	26
LS01206	Deoxyribonucleic Acid, Lambda	DNAL	4 x 500 ug	305.00	26
LS01290	Deoxyribonucleic Acid, Lambda, EcoR I Fragments	DNALECOR	Bulk	Inquire	27
LS01293	Deoxyribonucleic Acid, Lambda, EcoR I Fragments	DNALECOR	100 ug	47.00	27
LS01296	Deoxyribonucleic Acid, Lambda, EcoR I Fragments	DNALECOR	5x100 ug	187.00	27
LS01300	Deoxyribonucleic Acid, Lambda, Hind III Fragments	DNALHIND	Bulk	Inquire	27
LS01303	Deoxyribonucleic Acid, Lambda, Hind III Fragments	DNALHIND	100 ug	47.00	27
LS01306	Deoxyribonucleic Acid, Lambda, Hind III Fragments	DNALHIND	5x100 ug	187.00	27
LS01430	Deoxyribonucleic Acid, Lambda, BstE II Fragments	DNALBSTE	100 ug	80.00	26
LS01432	Deoxyribonucleic Acid, Lambda, BstE II Fragments	DNALBSTE	5x100 ug	275.00	26
LS01434	Deoxyribonucleic Acid, Lambda, BstE II Fragments	DNALBSTE	Bulk	Inquire	26
LS01440	Deoxyribonucleic Acid, Denatured, Fragmented	SDNAD	10 ml	74.00	26
LS01442	Deoxyribonucleic Acid, Denatured, Fragmented	SDNAD	5x10 ml	265.00	26
LS01444	Deoxyribonucleic Acid, Denatured, Fragmented	SDNAD	Bulk	Inquire	26
LS01485	Ribonuclease T1, Chromatographically Purif.	RT1S	100 ku	42.00	63
LS01487	Ribonuclease T1, Chromatographically Purif.	RT1S	500 ku	130.00	63
LS01488	Ribonuclease T1, Chromatographically Purif.	RT1S	Bulk	Inquire	63
LS01490	Ribonuclease T1, Chromatographically Purif., Lyophilized	RT1L	500 ku	156.00	63
LS01492	Ribonuclease T1, Chromatographically Purif., Lyophilized	RT1L	2500 ku	600.00	63
LS01494	Ribonuclease T1, Chromatographically Purif., Lyophilized	RT1L	Bulk	Inquire	63
LS01501	Ribonuclease T2, Recombinant	RT2R	50 ku	77.00	64
LS01502	Ribonuclease T2, Recombinant	RT2R	250 ku	310.00	64
LS01505	Ribonuclease T2, Recombinant	RT2R	Bulk	Inquire	64
LS02100	Neutral Protease (Dispase®), Purified	NPRO	10 mg	76.00	44
LS02104	Neutral Protease (Dispase®), Purified	NPRO	50 mg	320.00	44
LS02106	Neutral Protease (Dispase®), Purified	NPRO	250 mg	1440.00	44
LS02108	Neutral Protease (Dispase®), Purified	NPRO	Bulk	Inquire	44
LS02109	Neutral Protease, Partially Purified	NPRO2	1 gm	155.00	44

Number	Product	Code	Package	Price	Page
LS02110	Neutral Protease, Partially Purified	**NPRO2**	100 mg	35.00	44
LS02111	Neutral Protease, Partially Purified	**NPRO2**	5 gm	700.00	44
LS02112	Neutral Protease, Partially Purified	**NPRO2**	Bulk	Inquire	44
LS02115	Trypsin, Purified, Sequencing Grade II	**TRSEQII**	4x25 ug	73.00	67
LS02117	Trypsin, Purified, Sequencing Grade II	**TRSEQII**	4x100 ug	199.00	67
LS02118	Trypsin, Purified, Sequencing Grade II	**TRSEQII**	Bulk	Inquire	67
LS02119	Trypsin, Purified, Sequencing Grade II	**TRSEQII**	1 mg	369.00	67
LS02120	Trypsin, Modified, SequENZ® Sequencing Grade	**TRSEQZ**	4x25 ug	85.00	66
LS02122	Trypsin, Modified, SequENZ® Sequencing Grade	**TRSEQZ**	4x100 ug	236.00	66
LS02123	Trypsin, Modified, SequENZ® Sequencing Grade	**TRSEQZ**	1 mg	435.00	66
LS02124	Trypsin, Modified, SequENZ® Sequencing Grade	**TRSEQZ**	Bulk	Inquire	66
LS02126	Protease, S. aureus, Sequencing Grade	**STSEQ**	5x10 ug	174.00	58
LS02128	Protease, S. aureus, Sequencing Grade	**STSEQ**	5x50 ug	472.00	58
LS02129	Protease, S. aureus, Sequencing Grade	**STSEQ**	Bulk	Inquire	58
LS02130	Chymotrypsin, Alpha, TLCK Treated, Sequencing Grade	**CDSEQ**	4x25 ug	162.00	10
LS02132	Chymotrypsin, Alpha, TLCK Treated, Sequencing Grade	**CDSEQ**	4x100 ug	428.00	10
LS02135	Clostripain (Endoproteinase-Arg-C) Sequencing Grade	**CPSEQ**	10 ug	94.00	12
LS02139	Clostripain (Endoproteinase-Arg-C) Sequencing Grade	**CPSEQ**	Bulk	Inquire	12
LS04070	Nuclease, S1	**SINUC**	10 ku	49.00	45
LS04072	Nuclease, S1	**SINUC**	50 ku	141.00	45
LS04073	Nuclease, S1	**SINUC**	Bulk	Inquire	45
LS05000	Reverse Transcriptase, Recombinant, HIV	**RTHIV**	Bulk	Inquire	60
LS05003	Reverse Transcriptase, Recombinant, HIV	**RTHIV**	200 un	76.00	60
LS05006	Reverse Transcriptase, Recombinant, HIV	**RTHIV**	5x200 un	280.00	60
1235-01	Celase® GMP Collagenase Blend	**CLAS**	1 vi	915.00	7
1235-PKG	Celase® GMP Collagenase Blend		1 ea	65.00	7

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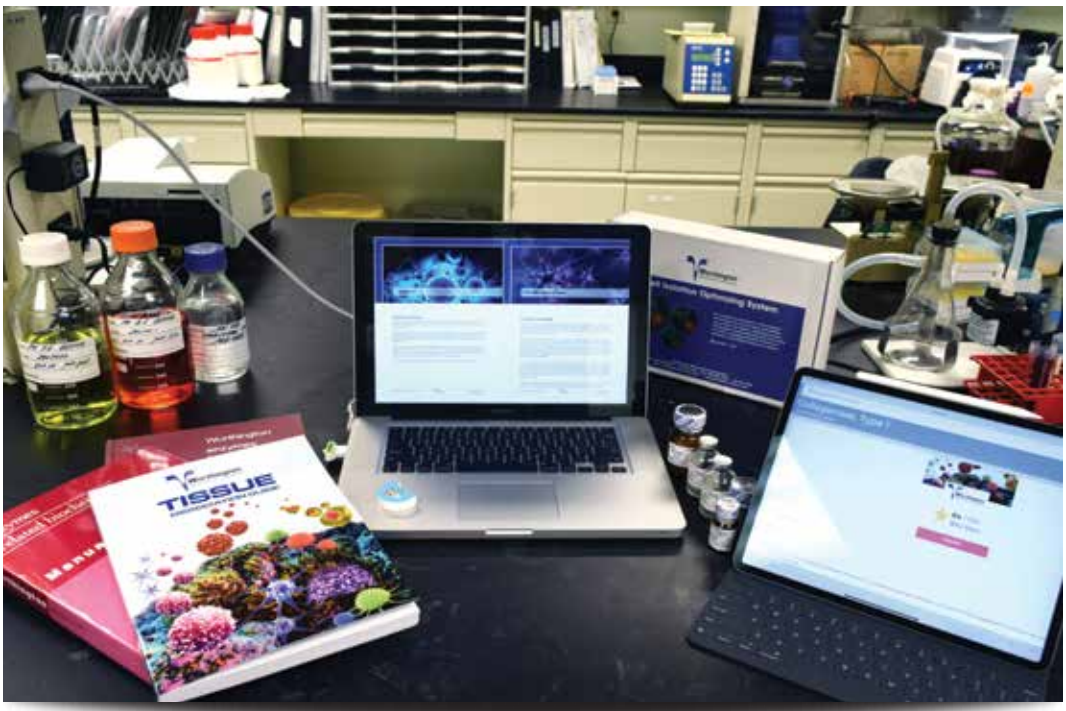

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- Molecular biologicals and proteases for component and OEM applications are ideal for DNA/RNA, protein digestion and vaccine processing.
- USDA or equivalent approved animal sources products are suitable for worldwide exportation.
- Primary producer minimizes lead times with bulk inventories available for immediate shipment with flexible and responsive production scheduling.
- We provide technical expertise and ongoing support before, during and post sale.
- Custom and contract multi-scale manufacturing capabilities included: Extraction • Fermentation • Purification • Analysis • Packaging.

For more information, or assistance with pricing, samples, placement of bulk orders or to discuss your bulk or custom requirements, contact Worthington's Customer Support.

"Value Verified" with Worthington expertise driving product performance and cost-efficient solutions for you.

Phone: 800.445.9603 • 732.942.1660 • Fax: 800.368.3108 • 732.942.9270
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ISO9001 Certified

Our Driving Force is Quality

The energy that drives all Worthington employees is the deep commitment to consistently produce superior quality products while providing personal service.

Our ISO9001 certified enzyme manufacturing facility and proprietary processes are designed specifically for the life science community, bioprocessing and OEM/private label business partners. We are proud to be a primary producer with over 90% of our products manufactured at our core facility located in Lakewood, New Jersey, USA.

Value Verified

- ISO9001 Certified Quality Management System
  All Processes Fully Documented and Traceable from Raw Materials through Final Shipment
- Primary Producer For Biotech, Life Science Research, Diagnostic, Biopharmaceutical and Bioprocessing
  Respected Manufacturer of High Quality, Lot-to-Lot Consistent Enzymes for Over 70 Years
- Multi-Scale Extraction, Fermentation, Protein Purification, Lyophilization and Packaging Capabilities Produced Under GMP Guidelines
  Internal Testing Capabilities include Enzyme, Protein, and Related Biochemical Analysis and Characterization
- Animal-Free Certified and USDA Approved Animal-Sourced Products
  Suitable for Worldwide Exportation
- Flexible and Responsive Production Scheduling
  Sample Lots and Bulk Inventories Available for Immediate Shipment
- Superior Customer Services and Technical Support — Before, During and After Sale
  Volume Purchases, Bulk Packaging, Standing Orders, OEM/Supply Agreements, and Special Arrangements

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