Cambridge Isotope Laboratories, Inc.
isotope.com

RESEARCH PRODUCTS

SILAM Feeds

Stable Isotope Labeling in Mammals

The study of animal models of disease provides useful insight into human disease. The SILAM technique allows the global, relative quantitative analysis of mammalian disease models through case-control analyses. In traditional SILAM, rodents are fed either an isotope-rich or isotope-deficient diet for a period of time (tissue-specific due to turnover rates) before LC-MS analysis of the harvested tissue(s) of interest.

Cambridge Isotope Laboratories, Inc. (CIL) is pleased to offer labeled/unlabeled feeds (see tables below) for metabolic incorporation of stable isotope-enriched or natural amino acids into mice (or rats) for use in SILAM-based MS studies.

Mouse Express® L-Lysine

Catalog No.	Description
MF-LYS-C	Mouse Express L-Lysine ($^{13}C_6$, 99%) Mouse Feed*
MLK-LYS-C	Mouse Express L-Lysine ($^{13}C_6$, 99%) Mouse Feed Kit
MF-LYS-C-IR	Mouse Express L-Lysine ($^{13}C_6$, 99%) Irradiated Mouse Feed*
MLK-LYS-C-IR	Mouse Express L-Lysine ($^{13}C_6$, 99%) Irradiated Mouse Feed Kit

*Unlabeled Mouse Express mouse feed (MF-UNLABELED) is also available.

Note: Kits contain 1 kg each of $^{13}C_6$-labeled and unlabeled L-lysine feed.

Mouse Express® L-Leucine

Catalog No.	Description
MF-LEU-D3	Mouse Express L-Leucine (5,5,5-D_3, 99%) Mouse Feed*
MLK-LEU-D3	Mouse Express L-Leucine (5,5,5-D_3, 99%) Mouse Feed Kit
MF-LEU-D3-IR	Mouse Express L-Leucine (5,5,5-D_3, 99%) Irradiated Mouse Feed*
MLK-LEU-D3-IR	Mouse Express L-Leucine (5,5,5-D_3, 99%) Irradiated Mouse Feed Kit

*Unlabeled Mouse Express mouse feed (MF-UNLABELED-LEU) is also available.

Note: Kits contain 1 kg each of D_3-labeled and unlabeled L-leucine feed.

Please inquire if alternative formulations are required with other amino acids and labeling patterns.

Spirulina and Mouse Express®

Catalog No.	Description
CLM-8400	Spirulina Whole Cells (U-^{13}C, 97%)
NLM-8401	Spirulina Whole Cells (U-^{15}N, 98%)
ULM-8453	Spirulina Whole Cells (unlabeled)
MF-Spirulina-N	Mouse Express Spirulina (^{15}N, 98%) Mouse Feed
MF-Spirulina-U	Mouse Express Spirulina (unlabeled) Mouse Feed
MLK-Spirulina-N	Mouse Express Spirulina (^{15}N, 98%) Mouse Feed Kit
MF-Spirulina-N-IR	Mouse Express Spirulina (^{15}N, 98%) Irradiated Mouse Feed
MF-Spirulina-U-IR	Mouse Express Spirulina (unlabeled) Irradiated Mouse Feed
MLK-Spirulina-N-IR	Mouse Express Spirulina (^{15}N, 98%) Irradiated Mouse Feed Kit

Note: Kits contain 1 kg each of ^{15}N-labeled and unlabeled spirulina feed.

Mouse Express® L-Lysine NeuCode™

Catalog No.	Description
MF-LYS-NEU2-1WK	Mouse Express L-Lysine 2-plex NeuCode Mouse Feed

Please visit isotope.com/silam for additional information and complete product listings.

Continued ➤

Other Products of Interest

Methionine (Met) Surrogates

L-Azidohomoalanine·HCl (light, AHA; heavy, hAHA) and L-azidonorleucine·HCl (ANL) can be used to evaluate the synthesis and turnover of newly synthesized proteins *in vivo* through targeted or untargeted MS analysis (e.g., Yates JR et al. JPR 2015). For immediate use in SILAM experiments, CIL offers a collection of Mouse Express mouse feeds (see table below). Please inquire for pricing.

Catalog No.	Description
MF-AHA	Mouse Express AHA Mouse Feed (contains 2 g of AHA per kg of mouse feed)
MF-HAHA	Mouse Express hAHA Mouse Feed (contains 2 g of hAHA per kg of mouse feed)
MF-UNLABELED-MET	Mouse Express Mouse Feed (unlabeled) (contains 2 g of L-Met per kg of mouse feed)
MLK-HAHA-KIT	Mouse Express hAHA Mouse Feed Kit (contains 1 kg each of hAHA, AHA, and unlabeled Met feed)
MF-ANL	Mouse Express ANL Mouse Feed (unlabeled) (contains 20 g ANL per kg of mouse feed)
MF-ANL-NE-CONTROL*	Mouse Express ANL Mouse Feed (unlabeled) (contains 2 g of L-Met per kg of mouse feed)

*Non-essential (NE) amino acids increased proportionally, while keeping other macronutrient sources (e.g., glucose, fat) constant, to compensate for 2% ANL in MF-ANL.

Example Application Notes

Mayers, J.R.; Torrence, M.E.; Fiske, B.P.; et al. **2014**. Analysis of whole-body branched-chain amino acid metabolism in mice utilizing 20% leucine $^{13}C_6$ and 20% valine $^{13}C_5$ mouse feed. (CIL application note #43)

Sirvent, A.; Urbach, S.; Roche, S. **2013**. Analysis of tyrosine kinase signaling in human cancer by stable isotope labeling with heavy amino acids in mouse xenografts utilizing Mouse Express® lysine $^{13}C_6$ mouse feed. (CIL application note #32)

McClatchy, D.B.; Savas, J.; Yates III, J.R. **2009**. Stable isotope labeling in mammals with ^{15}N spirulina. (CIL application note #24)

Technical Note

Wilen, A.P.; Savas, J.N. **2024**. Stable isotope metabolic labeling to investigate protein turnover in rodents. (CIL technical note)

Example References

Yarbro, J.M.; Han, X.; Dasgupta, A.; et al. **2025**. Human and mouse proteomics reveals the shared pathways in Alzheimer's disease and delayed protein turnover in the amyloidome. *Nat Commun, 16(1),* 1533-1548.

Rao, N.R.; Upadhyay, A.; Savas, J.N. **2024**. Derailed protein turnover in the aging mammalian brain. *Mol Syst Biol, 20(2),* 120-139.

Upadhyay, A.; Chhangani, D.; Rao, N.R.; et al. **2023**. Amyloid fibril proteomics of AD brains reveals modifiers of aggregation and toxicity. *Mol Neurodegener, 18(1),* 61-82.

Steinert, N.D.; Jorgenson, K.W.; Lin, K-H.; et al. **2023**. A novel method for visualizing *in-vivo* rates of protein degradation provides insight into how TRIM28 regulates muscle size. *iScience, 26(4),* 106526-106549.

Fornasiero, E.F.; Savas, J. N. **2023**. Determining and interpreting protein lifetimes in mammalian tissues. *Trends Biochem Sci, 48(2),* 106-118.

Wood, N.B.; Kelly, C.M.; O'Leary, T.S.; et al. **2022**. Cardiac myosin filaments are maintained by stochastic protein replacement. *Mol Cell Proteomics, 100274-100289*.

Novak, J.S.; Spathis, R.; Dang, U.J.; et al. **2021**. Interrogation of Dystrophin and Dystroglycan Complex Protein Turnover After Exon Skipping Therapy. *J Neuromuscul Dis, 8(s2),* S383-S402.

Hark, T.J.; Savas, J.N. **2021**. Using stable isotope labeling to advance our understanding of Alzheimer's disease etiology and pathology. *J Neurochem, 159(2),* 318-329.

Ma, Y.; McClatchy, D.B.; Martínez-Bartolomé, S.; et al. **2021**. Temporal quantitative profiling of newly synthesized proteins during αβ accumulation. *J Proteome Res, 20(1),* 763-775.

Hark, T.J.; Rao, N.R.; Castillon, C.; et al. **2020**. Pulse-chase proteomics of the APP knockin mouse models of Alzheimer's disease reveals that synaptic dysfunction originates in presynaptic terminals. *Cell Syst, S2405-4712(20),* 30458-30460.

Jongkamonwiwat, N.; Ramirez, M.A.; Edassery, S.; et al. **2020**. Noise exposures causing hearing loss generate proteotoxic stress and activate the proteostasis network. *Cell Rep, 33(8),* 108431.

Liu, P.; Xie, X.; Jin, J. **2020**. Isotopic nitrogen-15 labeling of mice identified long-lived proteins of the renal basement membranes. *Sci Rep, 10(1),* 5317.

Drigo, R.A.E.; Lev-Ram, V.; Tyagi, S.; et al. **2019**. Age mosaicism across multiple scales in adult tissues. *Cell Metab, 30(2),* 343-351.

Wallace, M.; Green, C.R.; Roberts, L.S.; et al. **2018**. Enzyme promiscuity drives branched-chain fatty acid synthesis in adipose tissues. *Nat Chem Biol, 14(11),* 1021-1031.

Liu, P.; Thomson, B.R.; Khalatyan, N.; et al. **2018**. Selective permeability of mouse blood-aqueous barrier as determined by ^{15}N-heavy isotope tracing and mass spectrometry. *Proc Natl Acad Sci U S A, 115(36),* 9032-9037.

Heo, S.; Diering, G.H.; Na, C.H.; et al. **2018**. Identification of long-lived synaptic proteins by proteomic analysis of synaptosome protein turnover. *Proc Natl Acad Sci U S A, 115(16),* E3827-E3836.

Moody, L.R.; Barrett-Wilt, G.A.; Sussman, M.R.; et al. **2017**. Glial fibrillary acidic protein exhibits altered turnover kinetics in a mouse model of Alexander disease. *J Biol Chem, 292(14),* 5814-5824.

McClatchy, D.B.; Ma, Y.; Liu, C.; et al. **2015**. Pulsed azidohomoalanine labeling in mammals (PALM) detects changes in liver-specific LKB1 knockout mice. *J Proteome Res, 14(11),* 4815-4822.

Zhang, A.; Uaesoontrachoon, K.; Shaughnessy, C.; et al. **2015**. The use of urinary and kidney SILAM proteomics to monitor kidney response to high dose morpholino oligonucleotides in the mdx mouse. *Toxicol Rep, 2,* 838-849.

Hathout, Y.; Marathi, R.L.; Rayavarapu, S.; et al. **2014**. Discovery of serum protein biomarkers in the mdx mouse model and cross-species comparison to Duchenne muscular dystrophy patients. *Hum Mol Genet, 23(24),* 6458-6469.

McClatchy, D.B.; Yates, J.R. III. **2014**. Stable isotope labeling in mammals (SILAM). *Methods Mol Biol, 1156,* 133-146.

Wan, J.; Savas, J.N.; Roth, A.F.; et al. **2013**. Tracking brain palmitoylation change: predominance of glial change in a mouse model of Huntington's disease. *Chem Biol, 20(11),* 1421-1434.

Rayavarapu, S.; Coley, W.; Cakir, E.; et al. **2013**. Identification of disease specific pathways using *in vivo* SILAC proteomics in dystrophin deficient mdx mouse. *Mol Cell Proteomics, 12(5),* 1061-1073.