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Energy Metabolism Assay Kits

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Catalog

Introduction of Energy Metabolism

1.1 Energy Metabolism Pathways

Primary energy sources taken up by cells include glucose, amino acids, and fatty acids. These metabolites are converted into the final energy product, ATP, through a series of metabolic pathways in living organisms, which are essential for maintaining vital activities. Energy metabolism involves multiple pathways, including glycolysis, lipid metabolism, the tricarboxylic acid (TCA) cycle, and oxidative phosphorylation. Different cell types rely on distinct metabolic pathways.

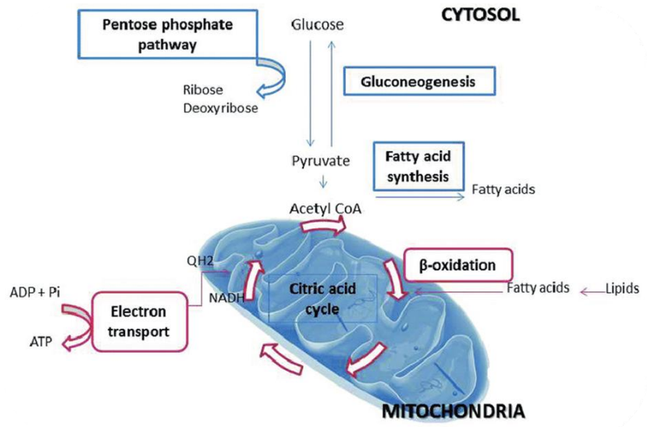

Figure 1. Energy Metabolism Pathway

Glycolysis

After glucose is taken up by cells via glucose transporters (GLUTs), it undergoes a series of enzymatic reactions to generate pyruvate with limited ATP production. Pyruvate can enter the mitochondria as a means to enter with the TCA cycle, after which it is converted into carbon dioxide and water. In the cytoplasm, pyruvate can be converted into lactate by means of lactate dehydrogenase. Lactate is then transported out of the cell via monocarboxylate transporter 4 (MCT4).

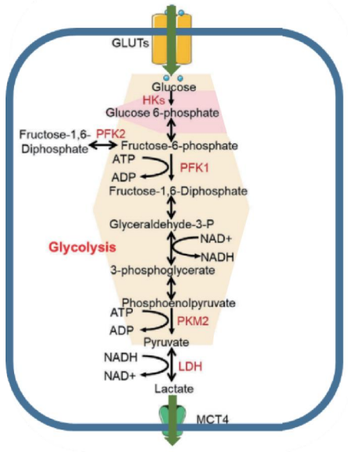

Figure 2. Glycolysis Pathway

Fatty Acid Oxidation

Fatty acid oxidation primarily refers to β-oxidation, a process in which fatty acids are broken down into acetyl-CoA through a series of enzymatic reactions. Acetyl-CoA can then enter the TCA cycle to generate energy. In the cytoplasm, fatty acids bind to coenzyme A (CoA) to form acyl-CoA, which is transported into the mitochondria by carnitine palmitoyltransferase. Inside the mitochondria, β-oxidation occurs in a cyclic manner, producing acetyl-CoA.

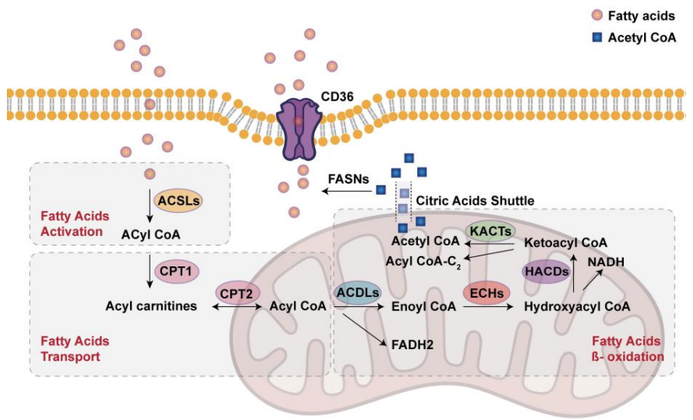

Figure 3. Schematic of β-Oxidation Pathway

TCA Cycle

The TCA cycle is the final metabolic pathway for all macronutrients including carbohydrates, lipids, and amino acids, and is the heart of cellular metabolism. Initially, acetyl-CoA and oxaloacetate form citrate, following oxidation, it regenerates oxaloacetate, creating a cycle. This process produces 3 NADH and 1 $FADH_2$, which under aerobic conditions, enter the respiratory chain to produce energy.

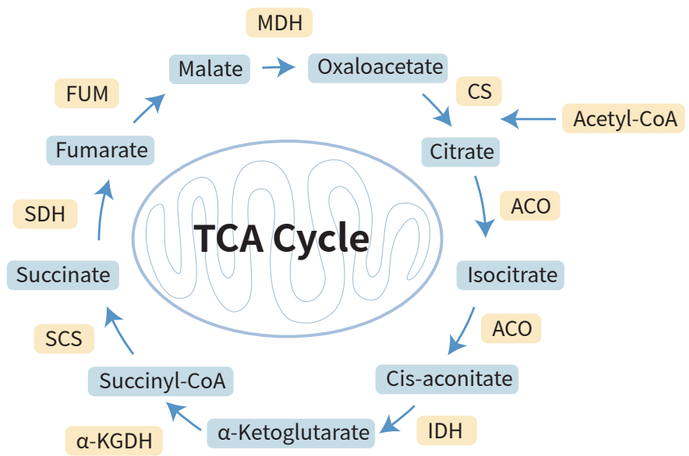

Figure 4. TCA Cycle

Oxidative Phosphorylation

Oxidative phosphorylation is another pathway for ATP production. The TCA cycle produces NADH, which transfers electrons through the mitochondrial electron transport chain on the inner mitochondrial membrane, facilitating proton movement and leading to ATP synthesis by F_0F_1-ATPase. This chain comprises five complexes (complex I-V). Evaluating the activity of these complexes helps gauge the efficiency of electron transfer in oxidative phosphorylation. A decline in mitochondrial complex activity can indicate mitochondrial dysfunction-related diseases, aiding in their diagnosis and further research.

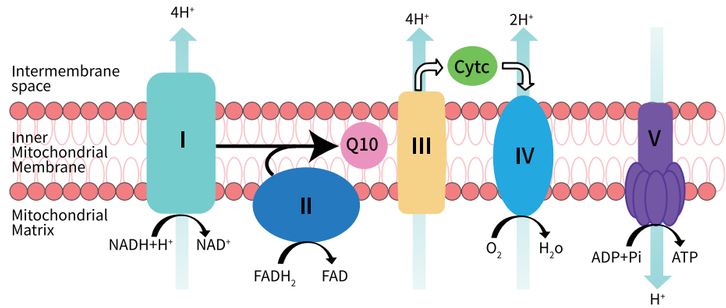

Figure 5. Mitochondrial Electron Transport Chain Complexes

1.2 Detection Method

Daily activities depend on energy metabolism. Monitoring cellular energy metabolism is essential for studying metabolic-related diseases like metabolic syndrome, cancer, neurodegenerative diseases, and Alzheimer's disease. Currently, there are various detection methods available on the market for studying energy metabolism, utilizing instruments such as microplate readers, HPLC systems, and specialized metabolic analyzers.

Table 1. Comparison of Different Energy Metabolism Detection Methods

Category	Characteristic	Example
ELISA based detection	✧ Broad Sample Compatibility (serum, tissue, and cells) ✧ High-throughput (96-well format) ✧ Widely Compatible Instrumentation (microplate reader or fluorescence microplate reader) ✧ Diverse range of measurable parameters	Glucose uptake, extracellular acidification rate, oxygen consumption, mitochondrial complex enzyme activity, metabolites
Seahorse	✧ Requires specialized equipment ✧ Measures specific indicators such as oxygen consumption and acidification rate ✧ High-throughput with automated liquid handling	Extracellular acidification rate, oxygen consumption
Metabolomics	✧ Lack of targeted methods ✧ Multi-parameter detection, measuring 1000s of metabolites per sample ✧ Requires specific instrumentation ✧ Complex sample processing, including extraction	TCA cycle metabolites

Recommended Energy Metabolism Indicators

2.1 Glycolysis

Target	Cat. No.	Product Name	Size
ECAR	E-BC-F069	Extracellular Acidification Rate (ECAR) Fluorometric Assay Kit HOT	48 T/96 T
F-6-P	E-BC-F087	Fructose-6-Phosphate (F-6-P) Fluorometric Assay Kit	96 T
G6P	E-BC-K011-M	Glucose-6-phosphate (G6P) Colorimetric Assay Kit	96 T
GAPDH	E-BC-K790-M	Glyceraldehyde-3-Phosphate Dehydrogenase (GAPDH) Activity Assay Kit	48 T/96 T
GLU	E-BC-F037	Glucose (GLU) Fluorometric Assay Kit	48 T/96 T
	E-BC-K234-M	Glucose (Glu) Colorimetric Assay Kit (GOD-POD Method)	48 T/96 T/ 500 Assays
Glucose Uptake	E-BC-F041	Glucose Uptake Fluorometric Assay Kit HOT	96 T/500 Assays
Glycogen	E-BC-F040	Glycogen Fluorometric Assay Kit	96 T
Glycolysis Stress	E-BC-F084	Glycolysis Stress Fluorometric Assay Kit HOT	48 T/96 T
HK	E-BC-K610-M	Hexokinase (HK) Activity Assay Kit	96 T
LA	E-BC-K044-M	L-Lactic Acid (LA) Colorimetric Assay Kit	48 T/96 T
LDH	E-BC-K046-M	Lactate Dehydrogenase (LDH) Activity Assay Kit	96 T/500 Assays
	E-BC-K766-M	Lactate Dehydrogenase (LDH) Activity Assay Kit (WST-8 method)	48 T/96 T
PC	E-BC-K608-M	Pyruvate Carboxylase (PC) Activity Assay Kit	48 T/96 T
PFK	E-BC-K612-M	Phosphofructokinase (PFK) Activity Assay Kit	48 T/96 T
PK	E-BC-K611-M	Pyruvate Kinase (PK) Activity Assay Kit	48 T/96 T
Pyruvate	E-BC-F058	Pyruvate Fluorometric Assay Kit HOT	48 T/96 T
Pyruvic Acid	E-BC-K130-M	Pyruvic Acid Colorimetric Assay Kit	48 T/96 T

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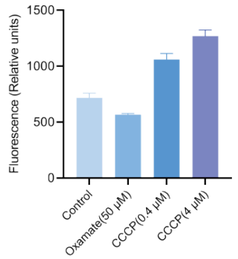
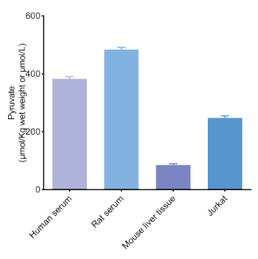
Featured Products



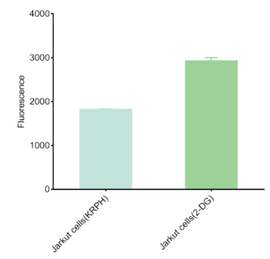
Extracellular Acidification Rate (ECAR) Fluorometric Assay Kit (E-BC-F069)

Fluorescence microplate reader, compatibility for seamless detection



Pyruvate Fluorometric Assay Kit (E-BC-F058)

High sensitivity, capable of detecting cell samples



Glucose Uptake Fluorometric Assay Kit (E-BC-F041)

Compatible with fluorescence microplate readers

Product Citations

- L-Lactic Acid (LA) Colorimetric Assay Kit (E-BC-K044-M)
  Light modulates glucose metabolism by a retina-hypothalamus-brown adipose tissue axis, *Cell*, 2023.
- Extracellular Acidification Rate (ECAR) Fluorometric Assay Kit (E-BC-F069)
  A subcellular selective APEX2-based proximity labeling used for identifying mitochondrial G-quadruplex DNA binding proteins, *Nucleic Acids Research*, 2025.

2.2 Fatty Acid Oxidation

Target	Cat. No.	Product Name	Size
Adipogenesis	E-BC-F065	Adipogenesis Fluorometric Assay Kit	96 T
FAO	E-BC-K784-M	Fatty Acid Oxidation (FAO) Colorimetric Assay Kit HOT	96 T
Fatty Acid Uptake	E-BC-F067	Fatty Acid Uptake Fluorometric Assay Kit HOT	96 T
G3P	E-BC-F081	Glycerol-3-phosphate (G3P) Fluorometric Assay Kit	48 T/96 T
GK	E-BC-K791-M	Glycerol Kinase (GK) Acitivity Colorimetric Assay Kit	48 T/96 T
Glycerol	E-BC-K340-M	Glycerol Colorimetric Assay Kit	48 T/96 T
Lipolysis	E-BC-K798-M	Lipolysis Colorimetric Assay Kit	48 T/96 T
LPS	E-BC-K786-M	Lipase (LPS) Activity Assay Kit	48 T/96 T

Target	Cat. No.	Product Name	Size
MAGL	E-BC-K793-M	Monoacylglycerol Lipase (MAGL) Activity Colorimetric Assay Kit	96 T
NEFA/FFA	E-BC-F039	Free Fatty Acids (NEFA/FFA) Fluorometric Assay Kit	48 T/96 T
	E-BC-K792-M	Free Fatty Acids (NEFA/FFA) Colorimetric Assay Kit	48 T/96 T
TG	E-BC-K261-M	Triglyceride (TG) Colorimetric Assay Kit (Single Reagent, GPO-PAP Method)	96 T/500 Assays
Triglyceride	E-BC-F033	Triglyceride Fluorometric Assay Kit	48 T/96 T
β-Hydroxybutyrate	E-BC-K785-M	β-Hydroxybutyrate (Ketone Body) Colorimetric Assay Kit	48 T/96 T

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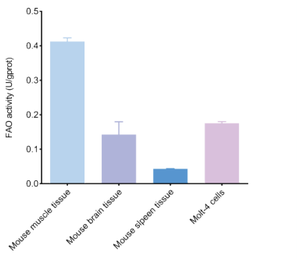
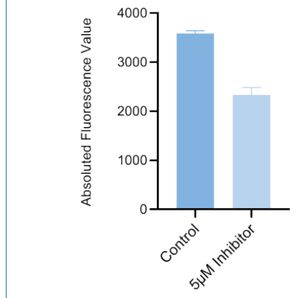
Featured Products



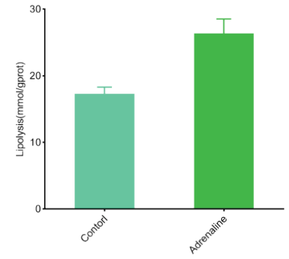
Fatty Acid Oxidation (FAO) Colorimetric Assay Kit (E-BC-K784-M)

Conventional microplate reader, user friendly



Fatty Acid Uptake Fluorometric Assay Kit (E-BC-F067)

Simple Operation compatible with multiple instruments



Lipolysis Colorimetric Assay Kit (E-BC-K798-M)

High sensitivity, capable of detecting cell supernatant

Product Citations

- Triglyceride Fluorometric Assay Kit (E-BC-F033)
  Inhibition of fatty acid uptake by TGR5 prevents diabetic cardiomyopathy, *Nature Metabolism*, 2024.

- Free Fatty Acids (NEFA/FFA) Colorimetric Assay Kit (E-BC-K792-M)
  Integrative clinical and preclinical studies identify FerroTerminator1 as a potent therapeutic drug for MASH, *Cell Metabolism*, 2024.

2.3 TCA Cycle

Target	Cat. No.	Product Name	Size
Acetyl-CoA	E-BC-F046	Acetyl Coenzyme A (Acetyl-CoA) Fluorometric Assay Kit HOT	48 T/96 T
ACO	E-BC-K656-M	Aconitase (ACO) Activity Assay Kit	48 T/96 T
α-KG	E-BC-F047	α-Ketoglutarate (α-KG) Fluorometric Assay Kit HOT	48 T/96 T
α-KGDH	E-BC-K083-M	α-Ketoglutarate Dehydrogenase (α-KGDH) Activity Assay Kit	96 T
CA	E-BC-K351-M	Citric Acid (CA) Colorimetric Assay Kit	48 T/96 T
CoA	E-BC-K907-M	Coenzyme A (CoA) Colorimetric Assay Kit	48 T/96 T
CS	E-BC-K178-M	Citrate Synthase (CS) Activity Assay Kit	48 T/96 T
FUM	E-BC-K908-M	Fumarase (FUM) Activity Colorimetric Assay Kit	96 T
Malic Acid	E-BC-K905-M	Malic Acid Colorimetric Assay Kit	96 T
NAD-IDH	E-BC-K651-M	NAD-Isocitrate Dehydrogenase (NAD-IDH) Activity Assay Kit	96 T
NAD-MDH	E-BC-K561-M	NAD-Malate Dehydrogenase (NAD-MDH) Activity Assay Kit	48 T/96 T
NADP-IDH	E-BC-K554-M	NADP-Isocitrate Dehydrogenase (NADP-IDH) Activity Assay Kit	96 T
NADP-MDH	E-BC-K562-M	NADP-Malate Dehydrogenase (NADP-MDH) Activity Assay Kit	48 T/96 T
Oxaloacetate	E-BC-K901-M	Oxaloacetate Colorimetric Assay Kit	48 T/96 T
PDH	E-BC-K650-M	Pyruvate Dehydrogenase (PDH) Activity Assay Kit	96 T
SCS	E-BC-K906-M	Succinyl-CoA Synthetase (SCS) Activity Assay Kit	48 T/96 T
SDH	E-BC-K649-M	Succinate Dehydrogenase (SDH) Activity Assay Kit	48 T/96 T
Succinic Acid	E-BC-K902-M	Succinic Acid Colorimetric Assay Kit HOT	96 T
WST-8	E-BC-K804-M	NAD+/NADH Colorimetric Assay Kit (WST-8)	96 T

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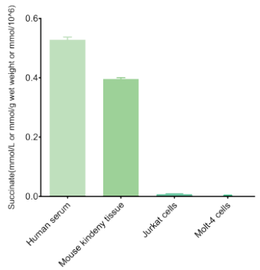
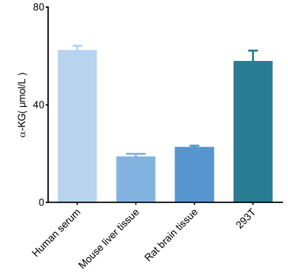


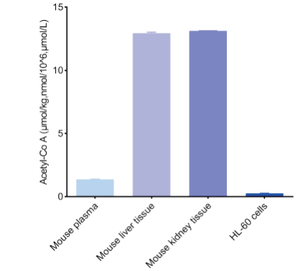
Succinic Acid Colorimetric Assay Kit (E-BC-K902-M)

Multiple sample verifications for greater confidence in use



α-Ketoglutarate (α-KG) Fluorometric Assay Kit (E-BC-F047)

Wide sample applicability, suitable for cell samples



Acetyl Coenzyme A (Acetyl-CoA) Fluorometric Assay Kit (E-BC-F046)

Fluorometric assay, high sensitivity

Product Citations

- NAD-Isocitrate Dehydrogenase (NAD-IDH) Activity Assay Kit (E-BC-K651-M)
  Clinically relevant mutations in regulatory regions of metabolic genes facilitate early adaptation to ciprofloxacin in Escherichia coli, *Nucleic Acids Research*, 2024.

- Citrate Synthase (CS) Activity Assay Kit (E-BC-K178-M)
  Ketogenic β-hydroxybutyrate regulates β-hydroxybutyrylation of TCA cycle-associated enzymes and attenuates disease-associated pathologies in Alzheimer's mice, *Aging Cell*, 2025.

2.4 Oxidative Phosphorylation

Target	Cat. No.	Product Name	Size
ADP	E-BC-F009	Adenosine Diphosphate (ADP) Fluorometric Assay Kit	48 T/96 T
ATP	E-BC-F002	ATP Chemiluminescence Assay Kit	48 T/96 T
	E-BC-K774-M	ATP Colorimetric Assay Kit (Enzyme Method)	96 T
ATP/ADP	E-BC-F004	ATP/ADP Ratio Chemiluminescence Assay kit HOT	48 T/96 T
Complex I	E-BC-K149-M	Mitochondrial Complex I Activity Assay Kit (For Tissue)	48 T/96 T
	E-BC-K834-M	Cell Mitochondrial Complex I Activity Assay Kit (For Cell) HOT	48 T/96 T
Complex II	E-BC-K150-M	Mitochondrial Complex II Activity Assay Kit (For Tissue)	48 T/96 T
	E-BC-K835-M	Cell Mitochondrial Complex II Activity Assay Kit (For Cell) HOT	48 T/96 T

Target	Cat. No.	Product Name	Size
Complex III	E-BC-K151-M	Mitochondrial Complex III Activity Assay Kit (For Tissue)	48 T/96 T
	E-BC-K836-M	Cell Mitochondrial Complex III Activity Assay Kit (For Cell)	48 T/96 T
Complex IV	E-BC-K152-M	Mitochondrial Complex IV Activity Assay Kit (For Tissue)	48 T/96 T
	E-BC-K837-M	Cell Mitochondrial Complex IV Activity Assay Kit (For Cell)	48 T/96 T
Complex V	E-BC-K153-M	Mitochondrial Complex V Activity Assay Kit (For Tissue)	48 T/96 T
	E-BC-K838-M	Cell Mitochondrial Complex V Activity Assay Kit (For Cell)	48 T/96 T
Mitochondrial Superoxide	E-BC-F008	Mitochondrial Superoxide Fluorometric Assay Kit	96 T
OCR	E-BC-F070	Enhanced Oxygen Consumption Rate (OCR) Fluorometric Assay Kit HOT	48 T/96 T
ROS	E-BC-F005	Reactive Oxygen Species (ROS) Fluorometric Assay Kit (Red)	96 T
	E-BC-K138-F	Reactive Oxygen Species (ROS) Fluorometric Assay Kit (Green)	96 T

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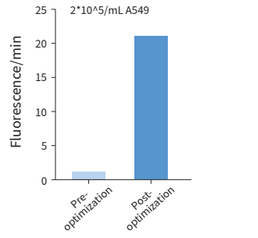
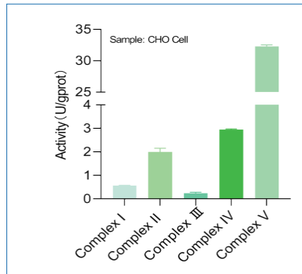
Featured Products



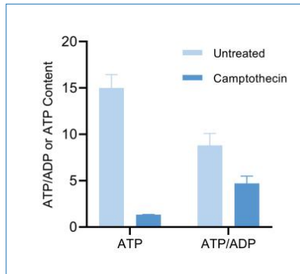
Enhanced Oxygen Consumption Rate (OCR) Fluorometric Assay Kit (E-BC-F070)

Highly sensitivity, suitable for low-metabolism samples



Cell Mitochondrial Complex Activity Assay Kit (E-BC-K834-M–E-BC-K838-M)

High sensitivity, capable of detecting cell supernatant



ATP/ADP Ratio Chemiluminescence Assay Kit (E-BC-F004)

Multiple sample verifications for greater confidence in use

Product Citations

- Cell Mitochondrial Complex IV (Cytochrome C Oxidase) Activity Assay Kit (E-BC-K837-M)
  Ginsenoside Rg3 restores mitochondrial cardiolipin homeostasis via GRB2 to prevent parkinson's disease, *Advanced Science*, 2024.

- ATP/ADP Ratio Chemiluminescence Assay kit (E-BC-F004)
  Impaired mitochondria-initiated crosstalk with lysosomes reciprocally aggravates mitochondrial defect through LManVI, *Nature Communications*, 2025.

Elabscience® Energy Metabolism Assay Kits Citations

Target	Cat. No.	Citation Information
Complex I Complex II Complex III Complex IV Complex V	E-BC-K149-M E-BC-K150-M E-BC-K151-M E-BC-K152-M E-BC-K153-M	Tian Y, Hong X, Xie Y, et al. 17β-estradiol (E2) upregulates the ERα/SIRT1/PGC-1α signaling pathway and protects mitochondrial function to prevent bilateral oophorectomy (OVX)-induced nonalcoholic fatty liver disease (NAFLD). *Antioxidants*, 2023, 12(12): 2100.
Complex IV	E-BC-K837-M	Qi LF, Liu S, Fang Q, et al. Ginsenoside Rg3 restores mitochondrial cardiolipin homeostasis via GRB2 to prevent parkinson's disease. *Advanced Science*, 2024, 11(39).
CS	E-BC-K178-M	Han W, Zhang B, Zhao W, et al. Ketogenic β-hydroxybutyrate regulates β-hydroxybutyrylation of TCA cycle-associated enzymes and attenuates disease-associated pathologies in Alzheimer's mice. *Aging Cell*, 2025, 24(1): e14368.
ECAR	E-BC-F069	Xu W, Geng Q, Jie Y, et al. A subcellular selective APEX2-based proximity labeling used for identifying mitochondrial G-quadruplex DNA binding proteins. *Nucleic Acids Research*, 2025, 53(1): gkae1259.
Gln	E-BC-K853-M	Wan Y, Chen M, Li X, et al. Single-cell RNA sequencing reveals XBP1-SLC38A2 axis as a metabolic regulator in cytotoxic T lymphocytes in multiple myeloma. *Cancer Letters*, 2023, 562: 216171.
Glu	E-BC-K234-M	Lin Q, Huang J, Zhang Y, et al. A smartphone-assisted “all-in-one” paper chip for one-pot noninvasive detection of salivary glucose level. *Chemical Engineering Journal, 2023*, 468: 143608.
Glu	E-BC-F037	Li Y, Wang Y, An T, et al. Non-thermal plasma promotes boar sperm quality through increasing AMPK methylation. *International Journal of Biological Macromolecules*, 2024, 257: 128768.
Glycogen	E-BC-F040	Dai Y, Xu R, Chen J, et al. Thromboxane A2/thromboxane A2 receptor axis facilitates hepatic insulin resistance and steatosis through endoplasmic reticulum stress in non-alcoholic fatty liver disease. *British Journal of Pharmacology*, 2024, 181(7): 967-986.
LA	E-BC-K044-M	Meng JJ, Shen JW, Li G, et al. Light modulates glucose metabolism by a retina-hypothalamus-brown adipose tissue axis. *Cell*, 2023, 186(2): 398-412.

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Target	Cat. No.	Citation Information
LA	E-BC-K044-M	Yang Y, Liu S, Wang P, et al. DNA-dependent protein kinase catalytic subunit (DNA-PKcs) drives chronic kidney disease progression in male mice. *Nature Communications*, 2023, 14(1): 1334.
LDH	E-BC-K046-M	Ding L, Liang M, Li Y, et al. Zinc-organometallic framework vaccine controlled-release Zn^{2+} regulates tumor extracellular matrix degradation potentiate efficacy of immunotherapy. *Advanced Science*, 2023, 10(27): 2302967.
LDH	E-BC-K766-M	Su P, Mao X, Ma J, et al. ERRα promotes glycolytic metabolism and targets the NLRP3/caspase-1/GSDMD pathway to regulate pyroptosis in endometrial cancer. *Journal of Experimental & Clinical Cancer Research*, 2023, 42(1): 274.
NAD-IDH	E-BC-K651-M	Arijit P, Dipannita G, Pratyusha T,et al. Clinically relevant mutations in regulatory regions of metabolic genes facilitate early adaptation to ciprofloxacin in Escherichia coli. *Nucleic Acids Research*, 2024, (17): 17.
NEFA/FFA	E-BC-K792-M	Tao L, Yang X, Ge C, et al. Integrative clinical and preclinical studies identify FerroTerminator1 as a potent therapeutic drug for MASH. *Cell Metabolism*, 2024, 36(10): 23.
OCR	E-BC-F068	Dai Y, Liu Y, An L, et al. Afatinib boosts CAR-T cell antitumor therapeutic efficacy via metabolism and fate reprogramming. *Journal for Immunotherapy of Cancer*, 2024, Nov 17;12(11): e009949.
Pyruvic Acid	E-BC-K130-M	Chi W, Kang N, Sheng L, et al. MCT1-governed pyruvate metabolism is essential for antibody class-switch recombination through H3K27 acetylation. *Nature Communications*, 2024, 15(1):163.
TG	E-BC-F033	Wang H, Wang J, Cui H, et al. Inhibition of fatty acid uptake by TGR5 prevents diabetic cardiomyopathy. *Nature metabolism*, 2024, 6(6): 1161-1177.

For more citation information, please visit www.elabscience.com.

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Appendix: Energy Metabolic Pathway Diagram