

AMPK, Insulin and Leptin Signaling

The enzyme 5'-AMP-activated protein kinase (AMPK) plays a major role in the regulation of cellular lipid and protein metabolism and is a mediator of the metabolic effects of hormones such as leptin, ghrelin, adiponectin, glucocorticoids and insulin. Both leptin and insulin are known to act as adiposity signals. Insulin is a hormone that regulates the energy and glucose metabolism in the body and causes cells in the liver, muscle, and fat tissue to take up glucose from the blood, storing it as glycogen in the liver and muscle. Leptin, one of the most important adipose derived hormones, is a 16 kDa protein hormone that plays a key role in regulating energy intake and energy expenditure, including appetite and metabolism. In general, AMPK stimulates catabolism (glycolysis, fatty acid oxidation and mitochondrial biogenesis) while inhibiting anabolic pathways (gluconeogenesis, glycogen, fatty acid and protein synthesis) and has a direct effect on the hypothalamus to regulate appetite. AMPK activation is believed to upregulate insulin receptor substrate-1 through inhibition of the mTOR pathway, which has been implicated in the pathogenesis of insulin resistance and many types of cancer. Insulin has been shown to inhibit AMPK's hypothalamic activity. Insulin can also inhibit AMPK in fat by activating the Akt complex leading to phosphorylation of α -AMPK at S485/491 which causes a reduction of phosphorylation at T172 (required for AMPK activation). Furthermore, AMPK and insulin differ with respect to anabolic and catabolic processes. One of leptin's many metabolic roles includes the upregulation of fatty acid oxidation in skeletal muscle via the AMPK pathway. Recent studies indicate that abnormalities in cellular lipid metabolism are involved in the pathogenesis of the metabolic syndrome, possibly because of dysregulation of AMPK and malonyl-CoA, a closely related molecule. Leptin and insulin also modulate one another. Although there is some controversy on mechanism, it appears that leptin inhibits insulin secretion from pancreatic β -cells, either indirectly or directly. In addition, recent studies suggest that leptin down-regulates insulin by mediating the phosphorylation of IRS-1 through a JAK2, IRS-2 and PKC δ dependent pathway. This serine site is known to reduce the coupling of IRS-1 to the insulin receptor. In contrast, insulin is a potent stimulator of leptin secretion from white adipocytes.

Assay Kits

Product Name	Cat. No.	Size
C-Peptide (human/mouse/rat) EIA Kit	K4757	100 assays
Glucagon (human/mouse/rat) EIA Kit	K4756	100 assays
Glucose and Sucrose Colorimetric/Fluorometric Assay Kit	K616	100 assays
EZScreen™ Glucose Colorimetric Assay Kit (384 Well)	K950	384 assays
Glucose Colorimetric Assay Kit II	K686	100 assays
Glucose Colorimetric Assay Kit II	K686	100 assays
Glucose Colorimetric/Fluorometric Assay Kit	K606	100 assays
Glucose Colorimetric/Fluorometric Assay Kit	K606	100 assays
Glucose Dehydrogenase Activity Colorimetric Assay Kit	K786	100 assays
PicoProbe™ Glucose Fluorometric Assay Kit	K688	100 assays
PicoProbe™ Glucose Fluorometric Assay Kit	K688	100 assays
Glucose Uptake Colorimetric Assay Kit	K676	100 assays
Glucose Uptake Fluorometric Assay Kit	K666	100 assays
Glucose-1-Phosphate (G1P) Colorimetric Assay Kit	K697	100 assays

155 S. Milipitas Blvd, Milipitas, CA 95035

T: 408-493-1800 F: 408-493-1801

Toll Free: 800-891-9699 (US Only)



Assay Kits

Product Name	Cat. No.	Size
Glucose-6-Phosphate Colorimetric Assay Kit	K657	100 assays
Glucose-6-Phosphate Dehydrogenase Activity Colorimetric Assay Kit	K757	100 assays
PicoProbe™ Glucose-6-Phosphate Fluorometric Assay Kit	K687	100 assays
PicoProbe™ Glucose-6-Phosphate Fluorometric Assay Kit	K687	100 assays
EZScreen™ Glycogen Colorimetric Assay Kit (384-Well)	K960	400 assays
Glycogen Colorimetric Assay Kit II	K648	100 assays
Glycogen Colorimetric/Fluorometric Assay Kit	K646	100 assays
Hexokinase Colorimetric Assay Kit	K789	100 assays
Insulin (human) ELISA Kit	K4742	100 assays
EZScreen™ Lactate Colorimetric Assay Kit (384 Well)	K951	384 assays
Maltose and Glucose Colorimetric/Fluorometric Assay Kit	K618	100 assays
Nesfatin (human/mouse/rat) EIA Kit	K4758	100 assays
Obestatin (human/mouse/rat) EIA Kit	K4759	100 assays
Phosphofructokinase (PFK) Activity Colorimetric Assay Kit	K776	100 assays
Phosphoglucomutase Colorimetric Assay Kit	K774	100 assays
Phosphoglucose Isomerase Colorimetric Assay Kit	K775	100 assays

Antibodies

Product Name	Cat. No.	Size
Alpha-Amylase Antibody	3925	30 µg, 100 µg
AMPK1 Antibody	3112	100 µg
AMPK2 Antibody	3118	100 µg
AMPKα Antibody	3113	100 µg
AMPKα1 Antibody	3110	100 µg
AMPKα2 Antibody	3169	100 µg
AMPKα2 Antibody	3117	100 µg
AMPKβ Antibody	3108	100 µg
AMPKγ Antibody	3109	100 µg
Anti-Rat IGF-1 Antibody	5121	30 µg, 100 µg
ASK1/MAPKKK5 Antibody	3128	100 µg
ATGL Antibody	3814	30 µg, 100 µg
cAMP Antibody	3567	30 µl, 100 µl
C-Peptide Antibody (Clone HCP-B2)	3103	100 µg
Elk-1 Antibody	3387	100 µg
Erk2 Antibody	3442	100 µg
Erk5 Antibody	3397	100 µg
GAPDH Antibody	3777R	30 µg, 100 µg
GLP-1 Antibody (Clone HGL-B5)	3104	100 µg
GLUT4 Antibody	3945	30 µg, 200 µg
HK2 (Hexokinase II) (Center) Antibody	3145	100 µg
HK2 (Hexokinase II) (NT) Antibody	3144	100 µg
HK3 (Hexokinase III) (CT) Antibody	3143	100 µg
HK3 (Hexokinase III) (NT) Antibody	3198	100 µg

Antibodies

Product Name	Cat. No.	Size
HNF-4 Antibody	3688	30 µg, 100 µg
HNF4A Antibody	3119	100 µg
HNF4A Antibody	3121	100 µg
IGF-I Antibody	5119	30 µg, 100 µg
IGF-I Antibody	5120R	30 µg, 100 µg
IGF-II Antibody	5122	30 µg, 100 µg
Insulin Antibody	5772	30 µg, 100 µg
IRS-1 Antibody	3424	100 µg
Leptin Antibody	5366	30 µg, 100 µg
Leptin Antibody	5367	30 µg, 100 µg
Leptin Receptor Antibody	5582	100 µg
MAPKAPK-2 Antibody	3100	30 µg, 100 µg
Mek1/2 Antibody	3518	100 µl
p38 MAP Kinase Antibody	3114	30 µg, 100 µg
p42/44 MAPK Antibody	3542	100 µg
p70S6 Kinase Antibody	3485	100 µg
PDK1 Antibody	3449	30 µg, 100 µg
Phospho-ATF-2 Antibody	3359	100 µg
Phospho-Elk-1 Antibody	3388	100 µg
Phospho-Erk1/2 Antibody	3441	100 µg
Phospho-IRS (Ser616) Antibody (Clone HIR-B1)	3105	100 µg
Phospho-JKK/SEK1/MKK4 Antibody	3478	100 µg
Phospho-MAPKAPK-2 Antibody	3434	100 µg
Phospho-Mek1/2 Antibody	3519	100 µl
Phospho-p38 MAPK Antibody	3438	100 µg
Phospho-p70 S6 Kinase Antibody	3505	100 µg
Phospho-Raf Antibody	3504	100 µg
PKA Antibody	3115	30 µg, 100 µg
Proinsulin Antibody (Clone HPI-B5)	3106	100 µg
PTEN Antibody	3479	100 µg
PTP1B Antibody	3171	100 µg
PTP1B Antibody	3174	100 µg
PTP1B Antibody (Clone 107AT531)	3122	100 µg
Raf1 Antibody	3116	30 µg, 100 µg
RasGAP Antibody	3311	30 µg, 100 µg
Rat Pancreatic Amylase Antibody (Clone RPA-B5)	3102	100 µg
RSK2 Antibody	3546	100 µg
SGLT-1 Antibody	3711	30 µg, 100 µg
SGLT-2 Antibody	3690	30 µg, 100 µg
Sphingosine Kinase 1 (SPK1) Antibody	3883	30 µg, 100 µg
Sphingosine Kinase 2 (SPK2) Antibody	3884	30 µg, 100 µg
Tau Antibody	3549R	30 µg, 100 µg

Proteins/Enzymes

Product Name	Cat. No.	Size
Insulin, human recombinant	4772	5 mg, 25 mg
Leptin, human recombinant	4366	200 µg, 1 mg, 5 mg, 10 mg
Leptin, murine recombinant	4367	200 µg, 1 mg, 5 mg
MAPKAPK2, Active	7737	5 µg
MAPKAPK3, Active	7755	5 µg
p38 beta, Active	7763	5 µg, 100 µg
p38alpha, Active	7756	5 µg
P38delta, Active	7754	5 µg
p70 S6K, Active	7725	5 µg, 100 µg
PDK1, Active	7706	5 µg
PKC iota, Active	7705	5 µg
PKCzeta, Active	7718	5 µg
PTEN, human recombinant	4838	5 µg
RAF1, Active	7726	5 µg, 100 µg
RSK1, Active	7721	5 µg
RSK2, Active	7768	5 µg
RSK3, Active	7774	5 µg
SGK1, Active	7748	5 µg
SGK2, Active	7749	5 µg

AMPK Activators

Product Name	Cat. No.	Size	CAS #
A-769662	1719	5 mg	844499-71-4
AICAR	1687	50 mg, 250 mg	2627-69-2
EZSolution™ AICAR	2344	50 mg	2627-69-2
EZSolution™ AICAR	2344	50 mg	2627-69-2
Metformin, Hydrochloride	1691	5 g	1115-70-4
Phenformin hydrochloride	1889	100 mg, 1 g	834-28-6

AMPK Inhibitors

Product Name	Cat. No.	Size	CAS #
Dorsomorphin	1686	5 mg	866405-64-3

PTEN Inhibitors

Product Name	Cat. No.	Size	CAS #
bpV(phen)	1793	5 mg	42494-73-5
bpV(pic)	1794	5 mg	148556-27-8
VO-OHpic, Trihydrate	1801	5 mg, 25 mg	476310-60-8

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