

AMPK, Insulin & 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 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/Fluorometric Assay Kit | K606 | 100 assays |
| Glucose Dehydrogenase Activity Colorimetric Assay Kit | K786 | 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 |
| 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 |
| EZScreen™ Glycogen Colorimetric Assay Kit (384-Well) | K960 | 400 assays |
| Glycogen Colorimetric Assay Kit II | K648 | 100 assays |

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Assay Kits

| Product Name | Cat. No. | Size |
|---|----------|------------|
| 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 |
| C-Peptide (human/mouse/rat) EIA Kit | K4757 | 100 assays |
| Glucagon (human/mouse/rat) EIA Kit | K4756 | 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 | 3117 | 100 µg |
| AMPKα2 Antibody | 3169 | 100 µg |
| AMPKβ Antibody | 3108 | 100 µg |
| AMPKγ Antibody | 3109 | 100 µg |
| Anti-AGPAT3 Antibody | A1043 | 100 µl |
| 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 |
| 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 |
| HNF-4 Antibody | 3688 | 30 µg, 100 µg |

Antibodies

| Product Name | Cat. No. | Size |
|--|----------|---------------|
| 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 |
|---------------------------|----------|---------------------------|
| Leptin, human recombinant | 4366 | 200 µg, 1 mg, 5 mg, 10 mg |

Proteins/Enzymes

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

AMPK Activators

| Product Name | Cat. No. | Size | CAS. No. |
|--------------------------|----------|---------------|--------------|
| A-769662 | 1719 | 5 mg | 844499-71-4 |
| EZSolution™ AICAR | 2344 | 50 mg | 2627-69-2 |
| AICAR | 1687 | 50 mg, 250 mg | 2627-69-2 |
| Metformin, Hydrochloride | 1691 | 5 g | 1115-70-4 |
| PF-06409577 | B2033 | 5 mg, 25 mg | 1467057-23-3 |
| Phenformin hydrochloride | 1889 | 100 mg, 1 g | 834-28-6 |
| PT1 | B2035 | 5 mg, 25 mg | 331002-70-1 |
| ZLN024 hydrochloride | B2034 | 5 mg, 25 mg | 723249-01-2 |

AMPK Inhibitors

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

PTEN Inhibitors

| Product Name | Cat. No. | Size | CAS. No. |
|----------------------|----------|-------------|-------------|
| 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 |

TGR5 Receptor Agonist

| Product Name | Cat. No. | Size | CAS. No. |
|-----------------------|----------|----------------|----------|
| Oleanolic Acid | 1731 | 100 mg, 500 mg | 508-02-1 |
| TGR5 Receptor Agonist | 1722 | 5 mg | N/A |

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