



2nd Edition

Obesity & Diabetes Research

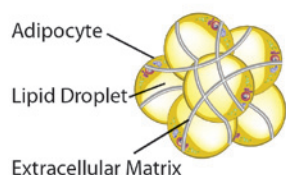
Focus: White, Brown & Beige/Brite Adipose Tissue

During obesity, excess fat accumulates in adipose tissue leading to **low-grade chronic inflammation**. Obesity is a major risk factor for many metabolic diseases, especially diabetes and cardiovascular diseases, increasing the risk of hypertension, hyperglycemia and dyslipidemia, recognized as the metabolic syndrome. Obesity is also linked to a broad spectrum of pathological disorders including neurodegenerative diseases, airway disorders and cancer.

Two major types of adipose tissue exist in mammals, named white (WAT) and brown adipose tissue (BAT) composed mainly of white or brown adipocytes, respectively. **White adipose tissue (WAT)** is found throughout the body, primarily under the skin (subcutaneous fat) as well as in larger deposits in the abdomen (visceral fat). WAT represents as much as 20-25% of the body weight in humans. White adipocytes are cells of large diameter that consist of one massive lipid droplet and a thin rim containing the cytoplasm and the nucleus. White adipocytes act as storage cells for neutral triacylglycerols, storing excess calories for use in times of scarcity. WAT contributes to whole body insulation and actively communicates with key organs to maintain metabolic homeostasis by secreting adipokines (see page 2).

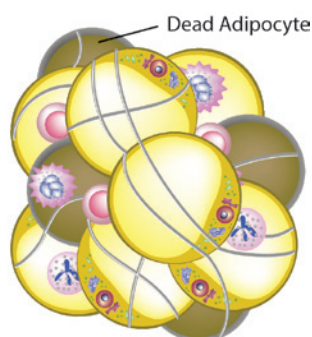
Brown adipose tissue (BAT) was only found in hibernating animals and to some extent in human at infancy in the past. Recently, BAT was shown to exist in human adults around the neck and collarbone, similar to where brown fat is found in mice. Brown adipocytes are usually of smaller diameter and composed of several small lipid droplets (see page 9). Their cytoplasm contains a high amount of mitochondria that are functionalized by uncoupling protein 1 (UCP1). BAT dissipates stored chemical energy in the form of heat and protects against obesity. Recently WAT was found containing cells with the characteristics of brown adipocytes. These cells were named **brite (brown-in-white), beige or brown adipocyte-like cells**. The beige cells have low basal levels of UCP1 that are highly inducible upon stimulation with cold or other agents (see page 10), while brown cells have high basal levels of UCP1. In addition, brown and beige cells derive from different cell lineages and express different molecular signatures (see section "Brown and Beige/Brite Adipocytes", page 9).

Normal Fat Tissue



Obese Fat Tissue

- Adipocyte Death
- Hypoxia
- Chronic low-grade Inflammation
- Insulin Resistance
- Metabolic Disease



Macrophages, Lymphocytes, Neutrophils and other Inflammatory Immune Cells

FIGURE: Adipocyte matrix interactions play an important role in pathology of obesity.
Adapted from: *What we talk about when we talk about fat*: E.D. Rosen & B.M. Spiegelman; *Cell* 156, 20 (2014)

SELECTED REVIEW ARTICLES

White, brown, beige/brite: different adipose cells for different functions?: M. Giralt & F. Villarroya; *Endocrinology* 154, 2992 (2013) • The origin and definition of brite versus white and classical brown adipocytes: M. Rosenwald & C. Wolfrum; *Adipocyte* 3, 4 (2014) • Brown and Beige Fat: Physiological Roles beyond Heat Generation: S. Kajimura, et al.; *Cell Metab.* 22, 546 (2015)

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Adipokines – Obesity, Insulin Resistance & Cardiovascular Biomarkers

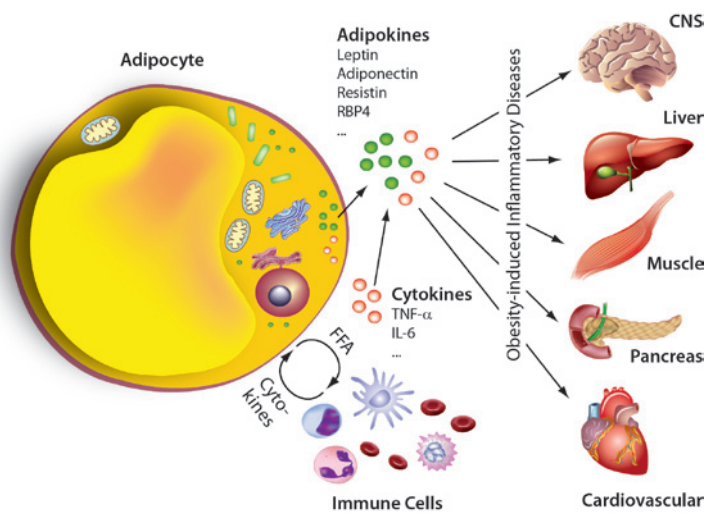


FIGURE: Schematic interaction between adipocytes and immune cells. Adapted from H. Cao; *J. Endocrinol.* 220, T47 (2014)

Adipokines are defined generally as biologically active substances produced in white adipose tissue (WAT) that act in an autocrine/paracrine or endocrine fashion and communicate with the brain, heart, vasculature, liver and muscle.

Some adipokines are produced exclusively or predominantly by adipose tissue, whereas others may be produced in a variety of different tissues. The diversity of the adipokines is considerable, in terms of both protein structure and function. Adipokines include classical cytokines (e.g. TNF- α , IL-6), chemokines (e.g. MCP-1), proteins of the alternative complement system (e.g. Adipsin), proteins involved in vascular hemostasis (e.g. PAI-1), the regulation of blood pressure (Angiotensinogen), lipid metabolism (e.g. RBP4), glucose homeostasis (e.g. Adiponectin, Leptin, Progranulin, Nampt/Visfatin/PBEF, Resistin, Vaspin, Omentin, Lipocalin-2, Apelin, DPP-4, CTRPs, selected ANGPTLs), angiogenesis (e.g. VEGF, NGF) and lipid mobilization (Zinc- α -2-glycoprotein). Adipokines have either pro-inflammatory or anti-inflammatory activities and exhibit a wide range of functions including the regulation of food intake and body weight homeostasis, insulin sensitivity, cell proliferation and angiogenesis, immunity, inflammation or vascular homeostasis. During obesity, adipokines are dysregulated and create a state of **chronic low-grade inflammation** responsible for the different obesity-linked pathologies and the onset of insulin resistance. Although brown adipose tissue (BAT) also produces adipokines (see Figure page 10), the endocrine role of BAT in metabolic diseases is not fully investigated.

A growing interest in the potential role of adipokines and myokines (see page 11) as biomarkers of low-grade inflammation and metabolic diseases emerges.

SELECTED REVIEW ARTICLE: Adipocytokines in obesity and metabolic disease: H. Cao; *J. Endocrinol.* 220, T47 (2014)

STANDARD Nampt/Visfatin ELISA Kits – Trusted Quality

	PID	SINGLE 96 wells	TWIN PLEX 2x96 wells	PENTA PLEX 5x96 wells	LIT
Nampt <i>Diabetes, Obesity, Sepsis, IBD, Crohn's Disease, Rheumatoid Arthritis, Preeclampsia</i>					
Nampt [Visfatin/PBEF] (human) ELISA Kit THE STANDARD	AG-45A-0006Y	✓	✓	✓	✓
Species reactivity:	Human	Detection type:			Colorimetric
Sensitivity:	30 pg/ml	Assay type:			Sandwich
Range:	0.125 to 8 ng/ml	Sample type:			Serum
Nampt [Visfatin/PBEF] (mouse/rat) Dual ELISA Kit	AG-45A-0007Y	✓	✓	✓	✓
Species reactivity:	Mouse / Rat	Detection type:			Colorimetric
Sensitivity:	50 pg/ml	Assay type:			Sandwich
Range:	0.5 to 32 ng/ml	Sample type:			Serum
For Nampt [Visfatin/PBEF] (human) IntraCellular ELISA Kit		see AG-45A-0008Y			

Potent Nampt/Visfatin Inhibitors from the Manufacturer! BULK available!

CHS-828 AG-CR1-0064	BULK 5 mg 25 mg	FK-866 AG-CR1-0011	1 mg 5 mg
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High Quality Adipokines ELISA Kits – THE STANDARDS

- Reproducible results with low inter- and intra-assay variation
- High sensitivity
- Broad range of sample types (e.g serum, plasma, cell culture supernatant, urine)
- Unique intracellular detection systems



Many product specific key literature references!

		PID	SINGLE 96 wells	TWIN PLEX 2x96 wells	PENTA PLEX 5x96 wells	LIT
Adiponectin <i>Obesity, Insulin Resistance, Type 2 Diabetes (T2D), CVD, NAFLD, Obesity-related Inflammation, Various Cancers</i>						
Adiponectin (human) ELISA Kit THE STANDARD		AG-45A-0001Y	✓	✓	✓	✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	100 pg/ml	Assay type:	Sandwich			
Range:	0.5 to 32 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant, Urine			
Adiponectin (mouse) ELISA Kit		AG-45A-0004Y	✓	✓	✓	✓
Species reactivity:	Mouse	Detection type:	Colorimetric			
Sensitivity:	50 pg/ml	Assay type:	Sandwich			
Range:	0.125 to 8 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
Adiponectin (rat) ELISA Kit		AG-45A-0005Y	✓	✓	✓	✓
Species reactivity:	Rat	Detection type:	Colorimetric			
Sensitivity:	50 pg/ml	Assay type:	Sandwich			
Range:	0.375 to 24 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
CTRP3 <i>Metabolic Syndrome, Type 2 Diabetes (T2D)</i>						
CTRP3 (human) Competitive ELISA Kit		AG-45A-0042Y	✓	✓		✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	1 ng/ml	Assay type:	Competitive			
Range:	0.001 to 1 µg/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
Broad Panel of CTRP3 Antibodies & Proteins! Visit www.adipogen.com						
Lipocalin-2 <i>Obesity, Insulin Resistance, Coronary Heart Diseases, Fatty Liver Diseases, Various Cancers</i>						
Lipocalin-2 (human) ELISA Kit		AG-45B-5003	✓			
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	200 pg/ml	Assay type:	Sandwich			
Range:	0.39 to 25 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
Lipocalin-2 (mouse) ELISA Kit		AG-45B-5004	✓			
Species reactivity:	Mouse	Detection type:	Colorimetric			
Sensitivity:	100 pg/ml	Assay type:	Sandwich			
Range:	0.156 to 10 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
Broad Panel of Lipocalin-2 Antibodies & Proteins! Visit www.adipogen.com						
Resistin <i>Insulin Resistance, Type 2 Diabetes (T2D), Obesity, NAFLD, Various Inflammatory Diseases</i>						
Resistin (human) ELISA Kit		AG-45A-0023Y	✓	✓	✓	✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	100 pg/ml	Assay type:	Sandwich			
Range:	0.125 to 8 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			

High Quality Adipokines ELISA Kits – THE STANDARDS

		PID	SINGLE 96 wells	TWIN PLEX 2x96 wells	PENTA PLEX 5x96 wells	LIT
RBP4 <i>Insulin Resistance, Microalbuminuria, Type 2 Diabetes (T2D), CVD, Obesity, NAFLD</i>						
RBP4 (human) ELISA Kit (Quantitative)		AG-45A-0035Y	✓	✓	✓	✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	380 pg/ml	Assay type:	Sandwich			
Range:	0.39 to 25 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant, Urine			
RBP4 (human) Competitive ELISA Kit Standard		AG-45A-0010Y	✓	✓	✓	✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	1 ng/ml	Assay type:	Competitive			
Range:	0.001 to 5 µg/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant, Urine			
For RBP4 (mouse/rat) Dual ELISA Kit			see AG-45A-0012Y			

Vaspin *Type 2 Diabetes (T2D), Obesity, Insulin Resistance, CVD, NAFLD*

		PID	SINGLE 96 wells	TWIN PLEX 2x96 wells	PENTA PLEX 5x96 wells	LIT
Vaspin (human) ELISA Kit Standard		AG-45A-0017Y	✓	✓	✓	✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	12 pg/ml	Assay type:	Sandwich			
Range:	0.016 to 1 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			

NEW

ZAG (human) TurboELISA™ Kit

Zinc- α -2-glycoprotein (ZAG) is expressed in the major white fat depots and in the interscapular brown fat of mice defining it as an adipokine. ZAG has been shown to stimulate lipolysis in *in vitro* and *in vivo* experiments. Data from genetic studies suggest that ZAG may be a candidate gene for body weight. ZAG is up-regulated in urine from diabetic patients and is reported to be associated with several diseases, such as cancers, metabolic syndrome and acute sepsis.

LIT: Proteomic identification of human urinary biomarkers in diabetes mellitus type 2: S.S. Alam, et al; Diabetes Technol. Ther. 12, 979 (2010) • Zn-alpha 2-glycoprotein levels in breast cancer cytosols and correlation with clinical, histological and biochemical parameters: I. Diez-Itza, et al; Eur. J. Cancer 29A, 1256 (1993) • Circulating anti-inflammatory adipokines High Molecular Weight Adiponectin and Zinc- α 2- glycoprotein (ZAG) are inhibited in early sepsis, but increase with clinical recovery: a pilot study: I.D. Welters, et al; BMC Anesthesiol. 14, 124 (2014)



		PID	SINGLE 96 wells	TWIN PLEX 2x96 wells	PENTA PLEX 5x96 wells	LIT
Zinc-α-2-glycoprotein (human) TurboELISA™ Kit		AG-48B-1000	✓			
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	0.23 ng/ml	Assay type:	Sandwich			
Range:	0.9375 to 60 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
For Zinc-α-2-glycoprotein (human) Matched Pair Detection Set			see AG-46B-0008			

Also available:

PROTEIN	PID	SIZE	SOURCE	ENDOTOXIN	SPECIES
Zinc-α-2-glycoprotein (human) (rec.)	AG-40B-0146	10 µg 50 µg 3 x 50 µg	E. coli	<0.1EU/µg	Hu
ANTIBODIES	PID	SIZE	ISOTYPE	APPLICATION	SPECIES
anti-Zinc-α-2-glycoprotein (human), mAb (Zagy-1)	AG-20B-0065	100 µg	Ms IgG1	ELISA, WB	Hu
anti-Zinc-α-2-glycoprotein (human), mAb (Zagy-2)	AG-20B-0066	100 µg	Ms IgG1	ELISA, WB	Hu

High Quality Obesity-related ELISA Kits

		PID	SINGLE 96 wells	TWIN PLEX 2x96 wells	PENTA PLEX 5x96 wells	LIT
ANGPTL3 <i>CVD, NAFLD, Insulin Resistance, Rheumatoid Arthritis</i>						
ANGPTL3 (human) ELISA Kit		AG-45A-0014Y	✓	✓		✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	75 pg/ml	Assay type:	Sandwich			
Range:	0.156 to 10 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
ANGPTL3 (mouse/rat) Dual ELISA Kit		AG-45A-0015Y	✓	✓		✓
Species reactivity:	Mouse / Rat	Detection type:	Colorimetric			
Sensitivity:	15 pg/ml	Assay type:	Sandwich			
Range:	0.016 to 1 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
ANGPTL6 <i>Type 2 Diabetes (T2D), Obesity, Insulin Resistance, Preeclampsia</i>						
ANGPTL6 (human) ELISA Kit		AG-45A-0016Y	✓	✓		✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	1.2 ng/ml	Assay type:	Sandwich			
Range:	1.56 to 100 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
Broad Panel of ANGPTL Antibodies & Proteins! Visit www.adipogen.com						
Clusterin <i>Type 2 Diabetes (T2D), Cancer (Hepatic, Pancreatic, Gastric), Neurodegenerative Diseases</i>						
Clusterin (human) Competitive ELISA Kit		AG-45A-0013Y	✓	✓		✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	1 ng/ml	Assay type:	Competitive			
Range:	0.001 to 5 µg/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
GPX1 <i>Insulin Resistance, Obesity, Type 2 Diabetes (T2D), Prostatic Cancer</i>						
GPX1 (human) ELISA Kit		AG-45A-0037Y	✓	✓		
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	45 pg/ml	Assay type:	Sandwich			
Range:	0.0625 to 4 ng/ml	Sample type:	Plasma			
GPX1 (human) (IntraCellular) ELISA Kit		AG-45A-0034Y	✓	✓		✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	45 pg/ml	Assay type:	Sandwich			
Range:	0.063 to 4 ng/ml	Sample type:	Cell Lysate			
GPX3 <i>Hypertension, Type 1 (T1D) and Type 2 Diabetes (T2D), CVD, Atherosclerosis</i>						
GPX3 (human) ELISA Kit		AG-45A-0020Y	✓	✓	✓	✓
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	100 pg/ml	Assay type:	Sandwich			
Range:	0.5 to 32 ng/ml	Sample type:	Serum, Plasma, Cell Culture Supernatant			
Sirtuin 1 <i>Metabolic Syndrome, Type 2 Diabetes (T2D), Alzheimer's Disease, Various Cancers, Inflammatory Diseases</i>						
Sirtuin 1 (human) (IntraCellular) ELISA Kit		AG-45A-0029Y	✓	✓		
Species reactivity:	Human	Detection type:	Colorimetric			
Sensitivity:	30 pg/ml	Assay type:	Sandwich			
Range:	0.032 to 2 ng/ml	Sample type:	Cell Lysate			

[Visit www.adipogen.com](http://www.adipogen.com) for a complete Overview on ELISA Kits!

Obesity-related Recombinant Proteins & Antibodies

PROTEINS	PID
Calreticulin (human) (rec.) (His)	AG-40A-0132
Cbln3 (human) (rec.)	AG-40A-0171
Cbln4 (human) (rec.)	AG-40A-0173
Clusterin (secretory form) (human) (rec.)	AG-40A-0050
Clusterin (nuclear form) (human) (rec.) (His)	AG-40A-0047
Clusterin (nuclear form) (mouse) (rec.) (His)	AG-40A-0057
CREB-binding Protein (mouse) (rec.) (His)	AG-40T-0016
FABP1 (human) (rec.) (His)	AG-40A-0039T
FABP3 (human) (rec.) (His)	AG-40A-0036
FABP4 (human) (rec.) (His)	AG-40A-0035
FABP4 (human) (rec.) (His)	AG-40A-0035
IDO (human) (rec.) (His) (highly active)	AG-40B-0161
Lipocalin-2 (human) (rec.)	AG-40B-6001
Meteorin-like (mouse) (rec.)	AG-40B-0149
NAD Kinase (human) (rec.) (His) (highly active)	AG-40T-0091
Nampt (Visfatin/PBEF) (human) (rec.)	AG-40A-0031Y
Nampt (Visfatin/PBEF) (mouse) (rec.)	AG-40A-0056Y
Nampt (Visfatin/PBEF) (rat) (rec.)	AG-40A-0058
NMNAT1 (human) (rec.) (His) (highly active)	AG-40T-0092
NMNAT3 (human) (rec.) (His) (highly active)	AG-40T-0093
NQO1 (human) (rec.) (His)	AG-40A-0152
NUCB2 (mouse) (rec.) (His)	AG-40A-0074
Omentin (human) (rec.)	AG-40B-0042
PEDF (human) (rec.)	AG-40B-0077
PEDF (mouse) (rec.)	AG-40B-0118
RBP4 (human) (rec.)	AG-40A-0041
RBP4 (mouse) (rec.)	AG-40A-0045
RBP4 (rat) (rec.)	AG-40A-0049
Resistin (human) (rec.) <i>Produced in HEK293 Cells</i>	AG-40A-0010Y
Resistin (mouse) (rec.) <i>Produced in HEK293 Cells</i>	AG-40A-0011
Sirtuin 1 (human) (rec.) (His)	AG-40A-0117
Sirtuin 1 (mouse) (rec.) (His)	AG-40A-0149
Sirtuin 2 (human) (rec.) (His)	AG-40A-0121
Sirtuin 5 (human) (rec.) (His)	AG-40A-0144
Sirtuin 5 (intact form) (human) (rec.) (His)	AG-40A-0139
Sirtuin 6 (human) (rec.) (His)	AG-40A-0140
Sirtuin 7 (human) (rec.) (His)	AG-40A-0147
Vaspin (human) (rec.)	AG-40A-0064Y
Vaspin (mouse) (rec.)	AG-40A-0094

ANTIBODIES	PID
Adiponectin Receptor 1 (human), pAb (AL238)	AG-25B-0010
Adiponectin Receptor 2 (mouse), pAb (AL241)	AG-25B-0012
Calreticulin (human), mAb (CR213-2AG)	AG-20A-0079
Calreticulin (human), pAb	AG-25A-0094
Clusterin (human), pAb	AG-25A-0099
Clusterin (mouse), pAb	AG-25A-0054
FABP3 (human), pAb	AG-25A-0040
FABP4 (human), pAb	AG-25A-0041
IDO (human), mAb (ID 177)	AG-20A-0035
IDO (mouse), pAb	AG-25A-0032
Leptin (human), mAb (HLEP 155)	AG-20A-0019
Leptin (mouse), pAb	AG-25A-0008
Leptin (rat), mAb (RLEP 227)	AG-20A-0018
Nampt (Visfatin/PBEF) (human), pAb	AG-25A-0025
Nampt (Visfatin/PBEF) (mouse), pAb	AG-25A-0028
Nampt (Visfatin/PBEF) (rat), pAb	AG-25A-0033
Nampt (Visfatin/PBEF), mAb (OMNI379)	AG-20A-0034
NMNAT2 (human), mAb (Nady-1)	AG-20A-0087
Obestatin (human), pAb	AG-25A-0043
Obestatin (mouse), pAb	AG-25A-0044
Omentin (human), mAb (Lecty-1)	AG-20B-0031
PEDF (human), mAb (rec.) (Serpy-1-4)	AG-27B-0014
PEDF, pAb (IN104)	AG-25B-0029
RBP4 (human), pAb	AG-25A-0053
RBP4 (mouse), pAb	AG-25A-0036
RBP4 (rat), pAb	AG-25A-0039
RELM- α (mouse), mAb (MREL 384)	AG-20A-0020
RELM- α (rat), mAb (RREL 804)	AG-20A-0021
RELM- β (human), mAb (HRB 149)	AG-20A-0012
RELM- β (mouse), mAb (MRB 46L)	AG-20A-0026
Resistin (human), pAb	AG-25A-0013
Resistin (mouse), mAb (MRES 06)	AG-20A-0004
Resistin (rat), mAb (RRES 07)	AG-20A-0015
SHP (human), mAb (SH2G5-C)	AG-20A-0016
Stearoyl-CoA Desaturase-1 (mouse), pAb	AG-25A-0031
TDO (human), pAb	AG-25A-0106
TRB-3 (human), pAb	AG-25A-0059
Vaspin (human), mAb (VP63)	AG-20A-0045
Vaspin (mouse), pAb	AG-25A-0075

Visit www.adipogen.com for a comprehensive Overview on Antibodies & Recombinant Proteins for Metabolism Research!

IL-33 and Adipose Tissue Homeostasis

Lean adipose tissue contains adipocytes, regulatory immune cells and adipose stroma that contribute to fat tissue homeostasis. Adipocytes of lean tissue secrete adipokines (e.g. adiponectin, an anti-inflammatory protein), which play important roles in the regulation of systemic metabolism and have a profound impact on immune cell behavior. Various immune cells are implicated in the lean adipose tissue remodeling, such as invariant-chain natural killer T (iNKT) cells, eosinophils, type 2 innate lymphocytes ILC2s and regulatory T cells (Tregs). These immune cells maintain homeostasis, preserving insulin sensitivity and glucose tolerance. They also secrete type 2 cytokines, such as IL-4, IL-5, IL-10 and IL-13, which keep adipose tissue macrophages (ATMs) in an anti-inflammatory, M2-like state [1] (see Figure).

During high-fat diet and obesity, fat cells increase (hypertrophy) producing less adiponectin and more pro-inflammatory molecules such as leptin, IL-6 and monocyte chemo-attractant protein-1 (MCP-1). Inflammatory immune cells such as neutrophils or NK cells detect the adipose stress, accumulate and secrete IFN- γ , driving pro-inflammatory M1 macrophage differentiation. A rapid accumulation of pro-inflammatory cells follows, leading to a loss of fat tissue homeostasis and a chronic inflammatory state.

A cytokine of particular importance for adipose homeostasis is the cytokine IL-33 that is abundantly expressed by adipose tissue stroma, predominantly endothelial cells and fibroblast-like reticular cells. Although upon infection and allergy, IL-33 is classified as a pro-inflammatory mediator, under non-inflammatory conditions, IL-33 sustains Tregs, eosinophils, as well as ILC2 to keep an anti-inflammatory state in adipose tissue (see Figure). IL-33 is also involved in the formation of beige adipocytes from adipocyte precursors by a mechanism involving IL-13 and the endogenous opioid Met-Enkephalin secreted by activating ILC2s [2]. A direct negative role of IL-33 on adipocyte differentiation has been reported recently [3].

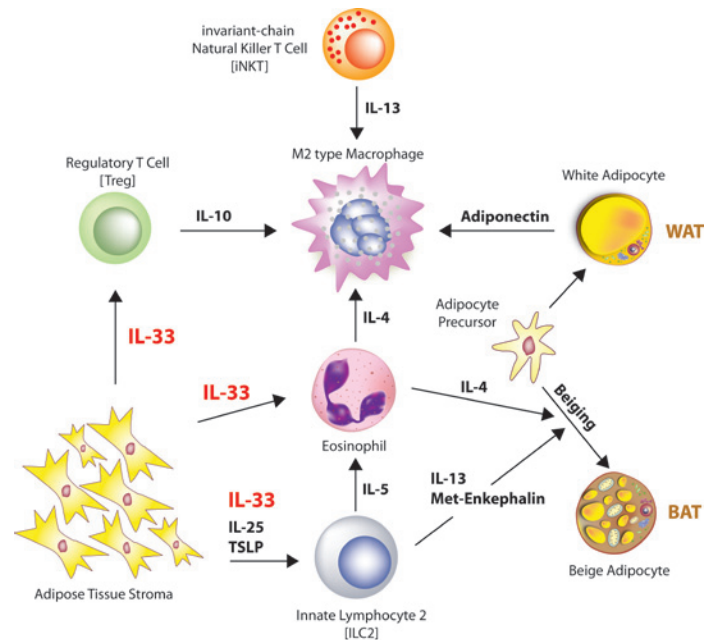


FIGURE: Control of adipose tissue homeostasis.

iNKT: Invariant-Chain Natural Killer T Cell; Treg: Regulatory T Cell; Eo: Eosinophil; M2: M2 Type Macrophage; ILC2: Innate Lymphocyte 2.

LIT: [1] The "Big Bang" in obese fat: Events initiating obesity-induced adipose tissue inflammation: F.M. Wensveen, et al.; Eur. J. Immunol. **45**, 2446 (2015) • **[2]** Activated type 2 innate lymphoid cells regulate beige fat biogenesis: M.W. Lee, et al.; Cell **160**, 74 (2015) • **[3]** Regulation of de novo adipocyte differentiation through crosstalk between adipocytes and pre-adipocytes: T.D. Challa, et al.; Diabetes **64**, 4075 (2015)

UNIQUE

Potent Functional Antibody – Adipocyte Differentiation Inducer

IL-33 (mouse), mAb (rec.) (blocking) (Bondy-1-1) (preservative free)

AG-27B-0013PF

100 μ g | 500 μ g | 1 mg

LIT: Regulation of de novo adipocyte differentiation through crosstalk between adipocytes and pre-adipocytes: T.D. Challa, et al.; Diabetes **64**, 4075 (2015)

UNIQUE

NEW Highly Active Protein

IL-33 (oxidation resistant) (human) (rec.) (untagged)

AG-40B-0160

10 μ g | 100 μ g

LIT: Oxidation of the alarmin IL-33 regulates ST2-dependent inflammation: E.S. Cohen, et al.; Nat. Commun. **6**, ID8327 (2015)

PROTEINS	PID
IL-33 (human) (rec.) (His)	AG-40A-0042
IL-33 (human) (rec.) (untagged)	AG-40B-0038
IL-33 (mouse) (rec.)	AG-40B-0041
IL-33 (mouse) (rec.) (His)	AG-40A-0053

ANTIBODIES	PID
IL-33 (human), mAb (IL33305B)	AG-20A-0041
IL-33 (human), pAb	AG-25A-0045
IL-33 (mouse), mAb (rec.) (Carly-1-4)	AG-27B-0012
For IL-33 (human) ELISA Kit	see www.adipogen.com

FTO – A Gene Contributing to Human Obesity

Fat mass- and obesity-associated protein (FTO) is a Fe(II) and 2-oxoglutarate dependent DNA/RNA demethylase that could be involved in RNA/DNA repair. In 2007, several genetic studies demonstrated a strong link between genetic variance within FTO and human obesity. Although the exact function of FTO in obesity is not so clear yet, overexpression of FTO increases body size and body fat accumulation with an increase in the food intake. FTO seems to regulate the thermogenesis and the control of adipocyte differentiation into brown or white fat cells.

LIT: Obesity and FTO: Changing Focus at a Complex Locus: Y.C. Tung, et al.; Cell Metab. 20, 710 (2014)

PROTEINS	PID	SIZE	SOURCE	ENDOTOXIN	SPECIES
FTO (human) (rec.) (His)	AG-40A-0112	10 µg 50 µg	E. coli	<1EU/µg	Hu
FTO (mouse) (rec.) (His)	AG-40A-0127	10 µg 50 µg	E. coli	<1EU/µg	Ms
ANTIBODIES	PID	SIZE	ISOTYPE/SOURCE	APPLICATION	SPECIES
FTO (human), mAb (AG103)	AG-20A-0092	50 µg 100 µg	Ms IgG2aκ	ELISA, IHC, IP, WB	Hu
FTO, mAb (FT86-4)	AG-20A-0064	50 µg 100 µg	Ms IgG1κ	ELISA, IP, WB	Hu, Ms, Rt
FTO, mAb (FT342-1)	AG-20A-0088	50 µg 100 µg	Rt IgG2aκ	ELISA, WB	Ms, Rt
FTO (mouse), mAb (FT62-6)	AG-20A-0083	50 µg 100 µg	Ms IgG1κ	ELISA, IHC, IP, WB	Ms

Betatrophin/ANGPTL8 – A new Adipokine interacting with ANGPTL3

Betatrophin (RIFL; Lipasin; ANGPTL8) is a novel protein expressed in human liver, white and brown adipose tissues. Betatrophin expression is induced upon nutriment intake, insulin, irisin and thyroid hormone stimulation. It modulates serum triglyceride and lipase activity in an ANGPTL3-dependent way. Experiments in KO mice showed that betatrophin does not play a role in β-cell proliferation as previously thought.

LIT: Emerging regulation and function of betatrophin: Y.H. Tseng, et al.; Int. J. Mol. Sci. 15, 23640 (2014)

PROTEINS	PID	SIZE	SOURCE	ENDOTOXIN	SPECIES
Betatrophin (human):Fc (human) (rec.)	AG-40B-0145	10 µg 3 x 10 µg	HEK 293 cells	<0.1EU/µg	Hu
Betatrophin (mouse) (rec.)	AG-40B-0144	10 µg 3 x 10 µg	CHO cells	<0.1EU/µg	Ms
Betatrophin (mouse):Fc (human) (rec.)	AG-40B-0142	10 µg 3 x 10 µg	HEK 293 cells	<0.1EU/µg	Ms
ANTIBODY	PID	SIZE	ISOTYPE/SOURCE	APPLICATION	SPECIES
NEW Betatrophin (human), pAb (IN108)	AG-25B-0033	100 µg	Rb	ELISA, WB	Hu

Progranulin – A New Adipokine

Progranulin (PGRN) is a cysteine rich secreted protein, expressed in epithelial cells, immune cells, neurons and adipocytes. Recently, PGRN was recognized as an adipokine related to obesity and insulin resistance, revealing its metabolic function and inflammatory properties.

LIT: The role of progranulin in diabetes and kidney disease: B.B. Nicoletto & L.H. Canani; Diabetol. Metab. Syndr. 7, 117 (2015)

Standard Progranulin ELISA Kits

Progranulin (human) ELISA Kit	AG-45A-0018Y
Progranulin (mouse) ELISA Kit	AG-45A-0019Y
Progranulin (rat) ELISA Kit	AG-45A-0043Y

Tag-free Progranulins

- Higher activity compared to tagged Progranulins
- Suitable for *in vitro* and *in vivo* studies
- Reflects the native sequence with no additional amino acids
- Affinity purified
- Low endotoxin levels (<0.1EU/µg)

Progranulin (human) (rec.) (untagged)

AG-40A-0188Y 10 µg | 50 µg | BULK

Progranulin (mouse) (rec.) (untagged)

AG-40A-0189Y 10 µg | 50 µg | BULK

Progranulin (rat) (rec.) (untagged)

AG-40A-0196Y 10 µg | 50 µg

Brown and Beige/Brite Adipocytes

White adipocytes are easily characterized with their large liquid droplet and their absence of thermogenic gene expression. **Brown or beige adipocytes** share many morphological (multiple lipid droplets, high mitochondrial density) and biochemical characteristics, including a well-characterized β -adrenergic receptor/cAMP-dependent pathway that regulates expression of the thermogenic gene UCP1, an inner mitochondrial membrane protein that dissipates the proton gradient to uncouple fuel oxidation from ATP. However, multiple lines of evidence have demonstrated that **brown and beige adipocytes are in fact distinct cell types** dispersed at different locations in the body. The classical brown adipocytes are found both in the interscapular region as well as in the perirenal area. Beige adipocytes are found interspersed in various white fat depots. Brown and beige adipocytes are also distinct by their differential response to various hormonal stimuli or genetic manipulations and by their gene expression signatures in cell culture.

Efforts to identify the stem cell progenitors of adipose tissue have revealed that the origin of white and brown preadipocytes is different. Brown adipocytes arise from a $Myf5^+/Pax7^+$ skeletal muscle lineage and require the transcription coregulator PRDM16. White adipocytes come from a non-myogenic precursor. Although beige cells were thought to come from a non-myogenic origin, a recent study demonstrated that beige cells come from smooth muscle-like cells ($Myh11^+$), suggesting that smooth muscle lineage may constitute a portion of previously identified white preadipocyte populations. As beige adipocytes can be differentiated using several factors (see page 10) from smooth muscle-like precursor present in white fat population, a promising and emerging avenue for **obesity treatment** is to **increase energy expenditure** by augmenting the number or the activity of thermogenic adipocytes.

SELECTED REVIEW ARTICLES: The origin and definition of brite versus white and classical brown adipocytes: M. Rosenwald & C. Wolfrum; *Adipocyte* 3, 4 (2014) • Distinction of white, beige and brown adipocytes derived from mesenchymal stem cells: A. Park, et al.; *World J. Stem Cells* 6, 33 (2014) • Brown and beige fat: development, function and therapeutic potential: M. Harms & P. Seale; *Nat. Med.* 19, 1252 (2013)

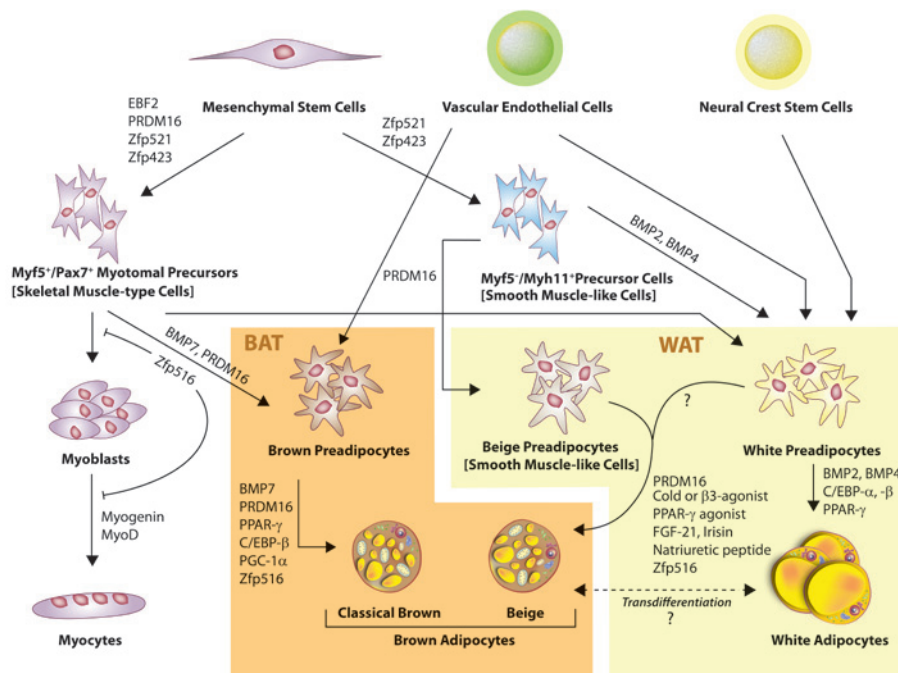
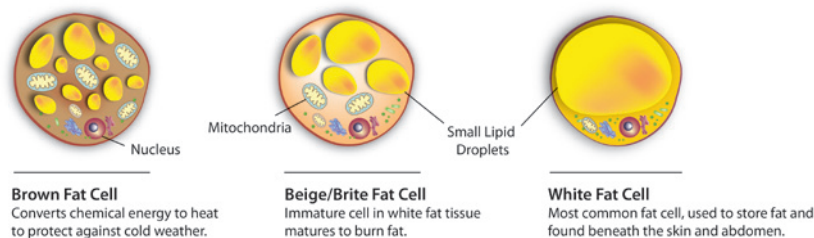


FIGURE: Schematic overview of adipocyte differentiation.

Adapted from M. Rosenwald & C. Wolfrum; *Adipocyte* 3, 4 (2014)

Different Shapes of Adipocytes



High Purity IBMX

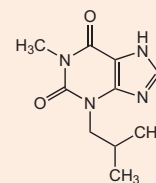
Enhances Differentiation of 3T3-L1 Cells

IBMX [3-Isobutyl 1-methylxanthine]

AG-CR1-3512-M500
AG-CR1-3512-G001

500 mg
1 g

Formula: $C_{10}H_{14}N_4O_2$
MW: 222.3
CAS: 28822-58-4



Visit www.adipogen.com for Biologically Active Notch Ligands to induce Adipogenesis!

Factors that lead to WAT Browning

Several proteins, peptides, small molecules or other stimuli induce WAT browning. Some of these molecules are directly expressed and secreted from brown and beige/beige fat. These secreted factors are induced in response to thermogenic activation (see Figure).

Inducers of browning (but not secreted by BAT):

- **Cold exposure** is a strong inducer of beige cells. Thermogenic activity is regulated by a canonical β -adrenergic receptor pathway via the sympathetic nervous system. The **TRPM8 channel** is a cold-sensing cation channel present in sensing neurons that has a role in detecting environmental temperature. Treatment with TRPM8 agonists (e.g. menthol) also induces BAT activity, promotes energy expenditure and protects against obesity in rodents.
- **Catecholamines** activate β -adrenergic receptors that are coupled to a G-protein and increase the intracellular cAMP level. In a subsequent process, this signal leads to fatty acid mobilization and induces the UCP1 expression in mitochondria, related to non-shivering thermogenesis.
- **PPARs** are master regulators of adipogenesis. Recently, PPAR- γ activators thiazolidinediones were shown to promote WAT browning as well.
- **Bile acid stimulation of TGR5** (or G-protein coupled bile acid receptor 1) signaling induces the release of the GLP-1 by the intestine, and activation of GLP-1 receptor signaling in the cen-

tral nervous system (CNS) was found to contribute to BAT thermogenic activation.

- **Cardiac-derived Natriuretic Peptides (NPs)** are potent activators of lipolysis in human fat cells and can promote the browning of white fat and thermogenesis.
- The neuropeptide **Orexin and its Receptors** are also involved in the induction of browning and affect brown fat thermogenesis.
- The myokine **Irisin** released from muscle during exercise has been shown to be a novel hormonal factor that converts white fat into the more thermogenic beige fat. Irisin's browning effect has been recently questioned while a new role of Irisin in cortical bone mass has been reported.
- **3-Aminoisobutyric acid (BAIBA)** is a browning molecule secreted from contracting muscles (see page 13).

Inducers of browning and secreted by BAT:

- **Fibroblast Growth Factor 21 (FGF-21)** is induced in BAT by cold exposure and induces the thermogenic program in brown adipocytes by interacting with FGF receptor/ β -Klotho complexes at the cell surface and, subsequently, inducing mitochondrial uncoupled respiration and glucose oxidation. FGF-21 is currently developed as potential drug.
- **BMPs (Bone Morphogenetic Protein)** promote brown and beige fat formation and act on the central nervous system to regulate thermogenesis.

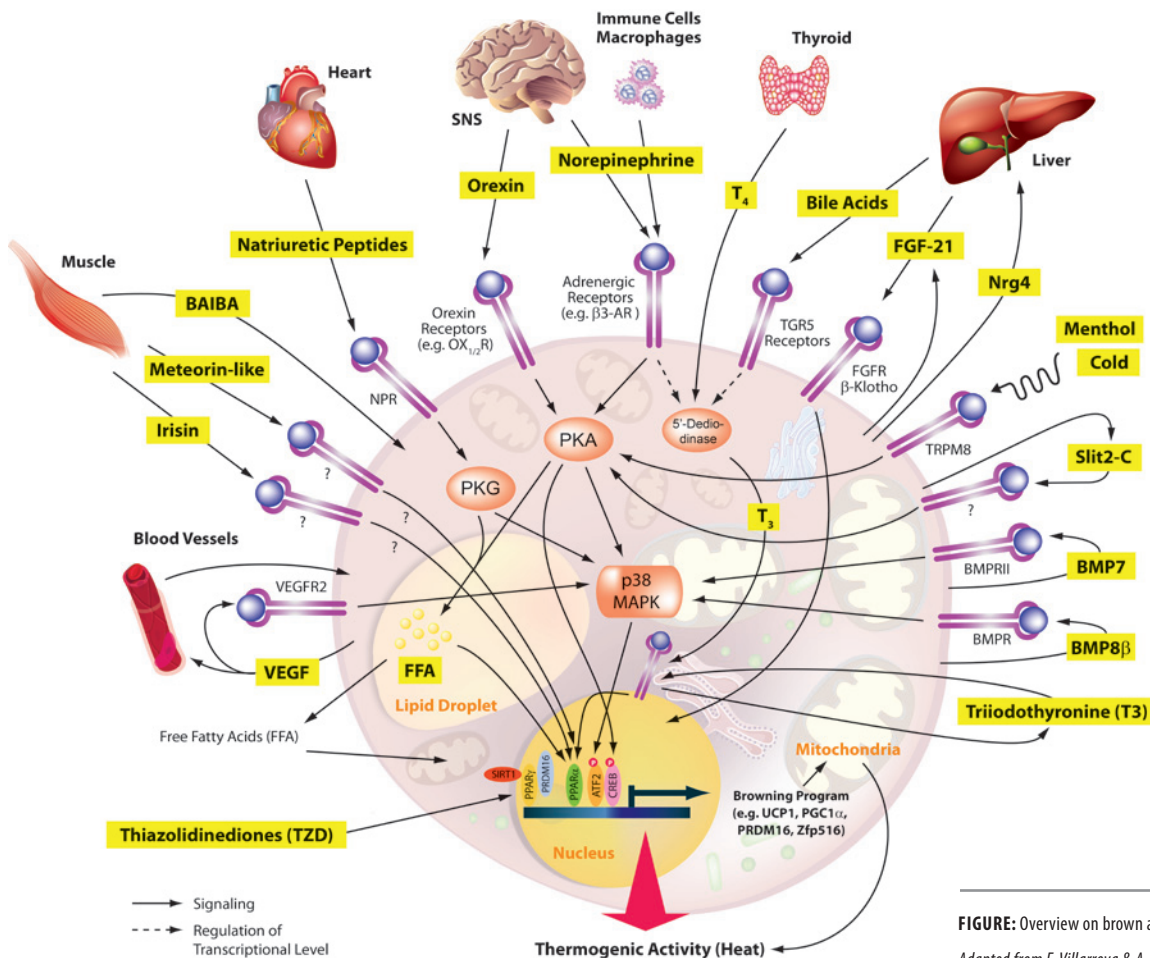


FIGURE: Overview on brown and beige fat activators.

Adapted from F. Villarroya & A. Vidal-Puig; *Cell Metab.* 17, 638 (2013)

- **Nrg4 (Neuregulin-4)**, an EGF-like endocrine factor is enriched in brown fat. It binds to ErbB receptors in the liver and preserves metabolic homeostasis in obesity through attenuating hepatic lipogenesis.
- **VEGF A and VEGF B (Vascular Endothelial Growth Factor A and B)** are expressed at high levels in brown fat and regulate angiogenesis, thermogenesis and macrophage function.
- **Slit2-C** is secreted from brown/beige fat and activates a thermogenic PKA pathway in adipocytes.
- **T3 (Triiodothyronine)** exerts effects locally to promote thermogenesis.

- Additional secreted factors include **IL-6 (Interleukin-6)**, **adiponectin** and metabolites released upon thermogenic activation, such as **FFA (Free Fatty Acid)**, **retinaldehyde**, **retinoic acid** and **lactate**.

SELECTED REVIEW ARTICLES: Searching for ways to switch on brown fat: are we getting warmer?: A. Whittle; *J. Mol. Endocrinol.* **49**, R79-87 (2012) • Beyond the sympathetic tone: the new brown fat activators: F. Villarroya & A. Vidal-Puig; *Cell Metab.* **17**, 638 (2013) • Understanding the brown adipocyte as a contributor to energy homeostasis: K. Chechi, et al.; *Trends Endocrinol. Metab.* **24**, 408 (2013) • Adipose tissue plasticity from WAT to BAT and in between: Y.H. Lee, et al.; *Biochim. Biophys. Acta* **1842**, 358 (2014) • A secreted Slit2 fragment regulates adipose tissue thermogenesis and metabolic function: K.J. Svensson, et al.; *Cell Metab.* **23**, 1 (2016) • Breaking BAT: can browning create a better white? A. Warner & J. Mittag; *J. Endocrinol.* **228**, R19 (2016)

Irisin – A New Myokine involved in Exercise & Obesity

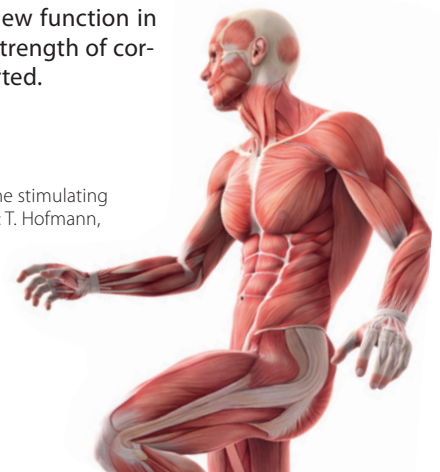
Exercise training enhances muscular endurance and strength, expends calories and exerts beneficial effects on systemic metabolism. It combats the development of common diseases such as obesity and type 2 diabetes (T2D) by adaptive structural and metabolic changes in skeletal muscle, including a change in the type of muscle fiber, mitochondrial biogenesis and angiogenesis. Additionally, skeletal muscle secretes cytokines and growth factors, called **myokines** that can potentially act in an autocrine, a paracrine and an endocrine manner to modulate metabolic, inflammatory and other processes. Irisin is a recently described exercise and PGC1- α -induced myokine secreted by skeletal muscle in mice and humans. Irisin is cleaved by an unknown protease from the membrane fibronectin type III domain containing protein 5 (FNDC5). Irisin has been shown to induce browning of white adipose tissue, but this role has

been questioned and a new function in the control of mass and strength of cortical bone has been reported.

SELECTED REVIEW ARTICLES:

Irisin as a muscle-derived hormone stimulating thermogenesis - A critical update: T. Hofmann, et al; *Peptides* **54C**, 89 (2014)

Bone: Irisin boosts bone mass: D. Holmes; *Nat. Rev. Endocrinol.* **11**, 689 (2015)



Myokine: Protein or metabolite that is produced and secreted by muscle fibers and exerts either paracrine or endocrine effects.

	PID	SINGLE 96 wells	TWIN PLEX 2x96 wells	PENTA PLEX 5x96 wells	LIT
Irisin ELISA Kit	AG-45A-0046Y	✓	✓	✓	✓
Irisin Competitive ELISA Kit					
Species reactivity:	Human, Monkey, Mouse, Rat				Colorimetric
Sensitivity:	1 ng/ml				Competitive
Range:	0.001 to 5 µg/ml				Serum, Plasma, Cell Culture Supernatant
LIT: Irisin, a novel myokine is an independent predictor for sarcopenia and carotid atherosclerosis in dialysis patients: M.J. Lee, et al; <i>Atheroscler.</i> 242 , 476 (2015)					

Related Antibodies & Proteins

PROTEINS	PID	SIZE	SOURCE	ENDOTOXIN	SPECIES
Irisin (rec.) (CHO)	AG-40B-0136	10 µg 3 x 10 µg	CHO	<0.01EU/µg	Hu, Ms
Irisin (rec.) (E. coli)	AG-40B-0103	10 µg 5 x 10 µg	E. coli	<0.1EU/µg	Hu, Ms
Irisin:Fc (human) (rec.)	AG-40B-0115	10 µg 5 x 10 µg	HEK293	<0.01EU/µg	Hu, Ms, Rt, Mo
FNDC4 (rec.) (untagged)	AG-40B-0124	10 µg	E. coli	<0.01EU/µg	Hu, Ms, Rt, Mo, Dg
FNDC5 (rec.) (untagged)	AG-40B-0128	10 µg	E. coli	<0.01EU/µg	Hu, Ms, Rt
FNDC5:Fc (human) (rec.)	AG-40B-0153	10 µg 3 x 10 µg	HEK293	<0.01EU/µg	Hu, Ms, Rt
ANTIBODIES	PID	SIZE	SOURCE	APPLICATION	SPECIES
anti-Irisin, pAb (IN102)	AG-25B-0027	100 µg	Rb	WB	Hu, Ms, Rt, Mo
anti-Irisin, pAb (IN102) (Biotin)	AG-25B-0027B	100 µg	Rb	WB, ELISA	Hu, Ms, Rt, Mo

Fibroblast Growth Factors & Adipose Tissues

	PID	SINGLE 96 wells	TWIN PLEX 2x96 wells	PENTA PLEX 5x96 wells	LIT
FGF-21 (human) ELISA Kit	AG-45B-5001	✓			
Species reactivity:	Human	Detection type:			Colorimetric
Sensitivity:	7 pg/ml	Assay type:			Sandwich
Range:	30 to 1920 pg/ml	Sample type:			Serum, Plasma, Cell Culture Supernatant
FGF-19 (human) ELISA Kit	AG-45B-5002	✓			
Species reactivity:	Human	Detection type:			Colorimetric
Sensitivity:	10 pg/ml	Assay type:			Sandwich
Range:	31.2 to 2000 pg/ml	Sample type:			Serum, Plasma, Cell Culture Supernatant

PROTEINS	PID	SIZE	SOURCE	ENDOTOXIN	SPECIES
FGF-1 (human) (rec.)	AG-40B-0137	10 µg 3 x 10 µg	E. coli	<0.01EU/µg	Hu
FGF-1 (mouse) (rec.)	AG-40B-0148	10 µg 3 x 10 µg	E. coli	<0.01EU/µg	Ms
FGF-19 (human) (rec.)	AG-40A-0186	10 µg 50 µg	HEK 293 cells	<0.1EU/µg	Hu
FGF-19 (human):Fc (human) (rec.)	AG-40A-0187	10 µg 50 µg	HEK 293 cells	<0.1EU/µg	Hu
FGF-21 (human) (rec.)	AG-40A-0091	10 µg 50 µg	HEK 293 cells	<0.1EU/µg	Hu
FGF-21 (human):Fc (human) (rec.)	AG-40A-0095	10 µg 50 µg	HEK 293 cells	<0.1EU/µg	Hu
FGF-21 (mouse) (rec.)	AG-40B-0143	10 µg 3 x 10 µg	HEK 293 cells	<0.01EU/µg	Ms
FGF-21 (mouse):Fc (human) (rec.)	AG-40A-0097	10 µg 50 µg	HEK 293 cells	<0.1EU/µg	Ms

Interleukin-6: From Cytokine to Myokine

Interleukin-6 (IL-6) has a broad impact in a variety of (patho)physiological conditions, including functions related to the resolution of inflammation. The complex biological functions governed by IL-6 include role in inflammation-associated cancer and metabolic disorders such as obesity and type 2 diabetes mellitus (T2DM).

LIT: Versatile functions for IL-6 in metabolism and cancer: J. Mauer, et al.; Trends Immunol. 36, 92 (2015)

PROTEINS	PID	SIZE	SOURCE	ENDOTOXIN	SPECIES
IL-6 (human):Fc (human) (rec.)	CHI-HF-21006	50 µg 3 x 50 µg	CHO cells	<0.06EU/µg	Hu
IL-6 (human):Fc (human) (rec.) (non-lytic)	CHI-HF-22006	50 µg 3 x 50 µg	CHO cells	<0.06EU/µg	Hu
IL-6 (mouse):Fc (human) (rec.)	AG-40B-0108	10 µg 3 x 10 µg	HEK 293 cells	<0.01EU/µg	Ms
IL-6 (mouse):Fc (mouse) (rec.) (non-lytic)	CHI-MF-12006	50 µg 3 x 50 µg	CHO cells	<0.06EU/µg	Hu
IL-6R (human):Fc (human) (rec.)	CHI-HF-21006R	50 µg	CHO cells	<0.06EU/µg	Hu
IL-6R (mouse):Fc (mouse) (rec.)	CHI-MF-11006R	50 µg	CHO cells	<0.06EU/µg	Hu

For a full Panel of IL-6 Proteins and ELISA Kits please visit www.adipogen.com

LATEST INSIGHT

Neuregulin-4 – Preserving Metabolic Homeostasis

PROTEINS	PID	SIZE	SOURCE	ENDOTOXIN	SPECIES
NEW Neuregulin-4 (human) (rec.)	AG-40B-0155	10 µg 3 x 10 µg	E. coli	<0.01EU/µg	Hu
Neuregulin-4 (mouse) (rec.)	AG-40B-0159	10 µg 3 x 10 µg	E. coli	<0.01EU/µg	Ms

VEGF – Regulator of Thermogenesis

VEGF A and VEGF B (Vascular Endothelial Growth Factor A and B) are expressed at high levels in brown fat and regulate angiogenesis, thermogenesis and macrophage function.

LIT: The brown fat secretome: metabolic functions beyond thermogenesis: G.X. Wang, et al.; Trends Endocrinol. Metab. **26**, 231 (2015)

PROTEINS	PID	SIZE	SOURCE	ENDOTOXIN	SPECIES
VEGF 164 (mouse) (rec.)	AG-40T-0044	5 µg 20 µg	Sf9 cells	n.d.	Ms
VEGF 165 (human) (rec.)	AG-40T-0043	5 µg 20 µg	E. coli	n.d.	Hu
VEGF 165 (human) (rec.)	AG-40T-0045	5 µg 20 µg	Sf9 cells	n.d.	Hu
VEGFR-1, Soluble (human) (rec.)	AG-40T-0049	5 µg 20 µg	Sf9 cells	n.d.	Ms
ANTIBODIES	PID	SIZE	ISOTYPE	APPLICATION	SPECIES
VEGF-A (human), mAb (3(6D3))	AG-20T-0105	200 µg	Mouse IgG1	ELISA, WB, FUNC	Hu
VEGFR-1 (human), mAb (EWC)	AG-20T-0106	100 µg	Mouse IgG1	ELISA, WB	Hu
VEGFR-1 (human), mAb (EWF)	AG-20T-0107	100 µg	Mouse IgG1	ELISA, IP, WB	Hu

NEW

UCP1-dependent Thermogenesis Inducer

K. Shinoda, et al. showed that inhibition of Casein Kinase 2 (CK2) using CK2 inhibitor 10 (AG-CR1-3626) promotes beige adipocyte biogenesis, leads to an increase in whole-body energy expenditure and ameliorates diet-induced obesity and insulin resistance in mice *in vivo* by promoting UCP1-dependent thermogenesis.

LIT: Phosphoproteomics identifies CK2 as a negative regulator of beige adipocyte thermogenesis and energy expenditure: K. Shinoda, et al.; Cell Metab. **22**, 997 (2015)

CK2 Inhibitor 10

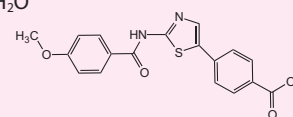
AG-CR1-3626

1 mg | 5 mg

Formula: C₁₈H₁₄N₂O₄S · xH₂O

MW: 354.4

CAS: 1361229-76-6



BAIBA

LATEST INSIGHT: The contracting muscle has been shown to act as an endocrine organ, secreting “myokines” that participate in tissue crosstalk. L.D. Roberts, et al. (2014) identified the substance BAIBA as a contraction-induced myokine that results in browning of white adipose tissue and increases fat oxidation in the liver.

LIT: β-Aminoisobutyric acid induces browning of white fat and hepatic β-oxidation and is inversely correlated with cardiometabolic risk factors: L.D. Roberts, et al.; Cell Metab. **19**, 96 (2014)

3-Aminoisobutyric acid (BAIBA)

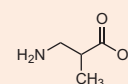
AG-CR1-3596

250 mg | 1 g

Formula: C₄H₉NO₂ · H₂O

MW: 103.1 · 18.0

CAS: 214139-20-5



Also available:

(R)-BAIBA (CDX-A0148) | (S)-BAIBA (CDX-A0147)

Obesity-related Transcription Factor Proteins

Highly Active

PROTEINS	PID	SIZE	SOURCE	SPECIES
GCN5 (human) (rec.) (His) (highly active)	AG-40T-0017	2 µg	Sf21 cells	Hu
p300 (human) (rec.) (His) (highly active)	AG-40T-0023	2 µg	Sf21 cells	Hu
PCAF (mouse) (rec.) (His) (highly active)	AG-40T-0018	20 µg	Sf21 cells	Ms
TIP60 (human) (rec.) (His) (highly active)	AG-40T-0019	2 µg	Sf21 cells	Hu

AMPK Modulators

AMPK (AMP-activated protein kinase) plays a role in cellular energy homeostasis, regulating several intracellular systems including hepatic fatty acid oxidation and ketogenesis, inhibition of cholesterol synthesis, lipogenesis and triglyceride synthesis, stimulation of skeletal muscle fatty acid oxidation and muscle glucose uptake as well as modulation of insulin secretion by pancreatic β cells.

SELECTED REVIEW ARTICLE: Past strategies and future directions for identifying AMP-activated protein kinase (AMPK) modulators: S.E. Sinnott & J.E. Brenman; Pharmacol. Ther. 143, 111 (2014)

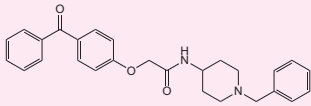
NEW

AdipoRon
AG-CR1-0154

10 mg | 50 mg

BULK | Original Source

Formula: $C_{27}H_{28}N_2O_3$
MW: 428.5
CAS: 924416-43-3



AdipoR agonist. AMPK & PGC1 α activator. Improves diabetes.

AICAR (Potent AMPK activator)

AG-CR1-0061 10 mg | 50 mg | 100 mg

AdipoRon . HCl (water soluble) (AMPK & PGC1 α activator)

AG-CR1-0156 10 mg | 50 mg

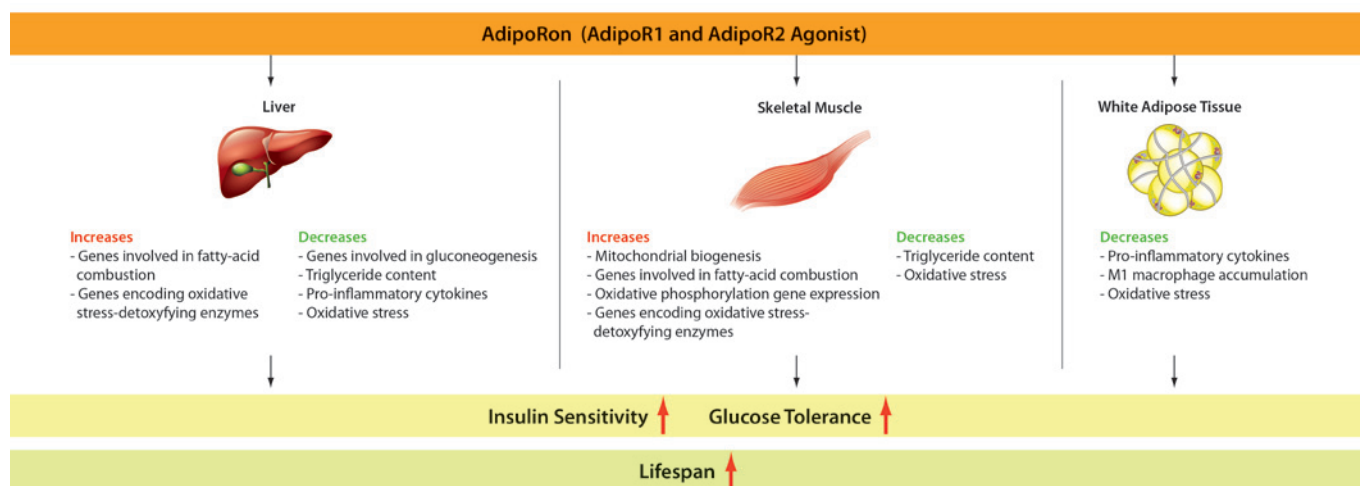
Compound 112254 . HCl (water soluble) (AMPK activator)

AG-CR1-0157 10 mg | 50 mg

MOTS-c (human) (AMPK inducer)

NEW

AG-CP3-0026 1 mg | 5 mg



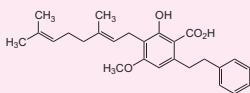
PPAR (Peroxisome Proliferator-activated Receptor) Agonists

NEW

Amorfrutin B
AG-CN2-0464

500 μ g

Formula: $C_{26}H_{32}O_4$
MW: 408.5
CAS: 1174387-94-0
Source: *Amorpha fruticosa*



Natural PPAR γ agonist with potent glucose-lowering properties.

Also available: **Amorfrutin A (AG-CN2-0462)**

GW1929 (Selective PPAR γ agonist)

BULK

AG-CR1-0116 1 mg | 5 mg | 25 mg

Ionomycin (free acid) (PPAR γ ligand with a unique binding mode)

AG-CN2-0416 1 mg | 5 mg

Pioglitazone (Selective PPAR γ agonist)

AG-CR1-0067 1 mg | 5 mg | 25 mg

Rosiglitazone . maleate (Potent PPAR γ agonist)

AG-CR1-3571 25 mg | 100 mg | 1 g

Pseudolaric acid B (PPAR α agonist)

AG-CN2-0083 100 μ g | 1 mg

Troglitazone (Potent and selective PPAR γ agonist)

AG-CR1-3565 5 mg | 25 mg

WY-14643 [Pirinixic acid] (Potent PPAR α activator)

AG-CR1-3566 10 mg | 50 mg | 250 mg

Astaxanthin (PPAR α agonist & PPAR γ antagonist)

AG-CN2-0055 5 mg | 25 mg

Ciglitazone (Selective PPAR γ agonist)

AG-CR1-0033 1 mg | 5 mg | 25 mg

Selection of a Broad Range of Metabolic Research Reagents

Atpenin A5 (synthetic)

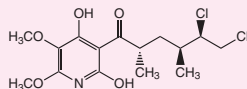
AG-CN2-0100

250 µg | 1 mg

Formula: C₁₅H₂₁Cl₂NO₅

MW: 366.2

CAS: 119509-24-9



Potent and specific mitochondrial complex II (succinate-ubiquinoneoxidoreductase) inhibitor.

AK-7 (Brain-permeable SIRT2 inhibitor)

AG-CR1-3511

5 mg | 25 mg

Asteltoxin (Mitochondrial respiration inhibitor)

AG-CN2-0441

250 µg

Amlexanox (Selective TBK1 and IKKε inhibitor)

AG-CR1-3579

10 mg | 50 mg

EM574 (Orexigenic; Motilin receptor agonist)

AG-CN2-0102

250 µg | 1 mg

Emodin (Potent selective 11β-HSD1 inhibitor)

AG-CN2-0457

50 mg | 250 mg

Empagliflozin (SGLT-2 inhibitor)

AG-CR1-3619

10 mg | 50 mg

Glyburide (USP) (Antidiabetic)

AG-CR1-3613

1 g | 5 g | 10 g

Hyperforin . DCHA (Potent SIRT1 & SIRT2 inhibitor)

AG-CN2-0008

500 µg | 1 mg

Isoliquiritigenin (Antidiabetic/Antihyperglycemic)

AG-CN2-0459

10 mg | 50 mg

Kaempferitrin (Insulinomimetic/Hypoglycemic)

AG-CN2-0039

1 mg | 5 mg

Linagliptin (DPP4 inhibitor)

AG-CR1-3618

10 mg | 50 mg

Orlistat (DAGLα inhibitor/Antiobesity)

AG-CN2-0050

50 mg | 250 mg

BULK

Pellitorine (α-Glucosidase inhibitor)

AG-CN2-0009

1 mg | 5 mg

Resveratrol (Potent SIRT1 activator)

AG-CN2-0033

50 mg | 100 mg | 500 mg

BULK

Salsalate (Anti-inflammatory/Antidiabetic)

AG-CR1-3574

1 g | 5 g

Sirtinol (Cell permeable SIRT1 inhibitor)

AG-CR1-0055

1 mg | 5 mg | 25 mg

BULK

Skyrin (Antidiabetic)

AG-CN2-0001

1 mg

Stevioside (Antidiabetic)

AG-CN2-0077

10 mg | 50 mg

BULK

Suramin . 6Na (SIRT1 & SIRT5 inhibitor)

AG-CR1-3575

50 mg | 250 mg | 1 g

BULK

(±)-Verapamil . HCl (USP Grade) (Antidiabetic)

AG-CR1-3627

100 mg | 1 g | 5 g

Vitexin (α-Glucosidase inhibitor)

AG-CN2-0425

5 mg | 25 mg

BULK

High Purity Streptozotocin

STANDARD Diabetes Inducer

Streptozotocin

AG-CN2-0046-M050

50 mg

AG-CN2-0046-M250

250 mg

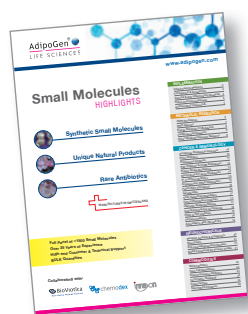
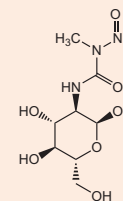
AG-CN2-0046-G001

1 g

Formula: C₈H₁₅N₃O₇

MW: 265.2

CAS: 18883-66-4

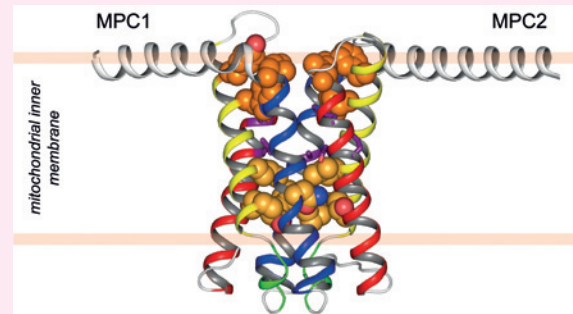


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NEW

Mitochondrial Pyruvate Carriers in Metabolic Diseases

Pyruvate is the end-product of glycolysis, a major substrate for oxidative metabolism, and a branching point for glucose, lactate, fatty acid and amino acid synthesis. The mitochondrial enzymes that metabolize pyruvate are physically separated from cytosolic pyruvate pools and rely on a membrane transport system to shuttle pyruvate across the impermeable inner mitochondrial membrane (IMM). Two newly discovered proteins, mitochondrial pyruvate carriers MPC-1 and MPC-2, form a heterooligomeric complex in the IMM to facilitate pyruvate transport. This step is required for mitochondrial pyruvate oxidation and carboxylation-critical reactions in intermediary metabolism that are dysregulated in several common metabolic diseases.



LIT: Monitoring mitochondrial pyruvate carrier activity in real time using a BRET-based biosensor: Investigation of the Warburg Effect: V. Compan, et al.; Mol. Cell 59, 491 (2015)

ANTIBODY	PID	SIZE	ISOTYPE	APPLICATION	SPECIES
anti-MPC-2, mAb (JCM-1)	AG-20B-0071	100 µg	Mouse IgG2bk	IP, WB	Hu, Ms

CTHRC1 – Controlling Adipose Tissue Formation?

Collagen triple helix repeat containing-1 (CTHRC1) is a 30kDa glycosylated secretory protein containing a short collagen-like motif contributing to vascular remodeling by limiting collagen matrix deposition and promoting cell migration. Aberrant expression of CTHRC1 is present in human solid cancers and likely to be associated with cancer invasion and metastasis. A recent study identifies CTHRC1 as a novel circulating hormone with metabolic effects.

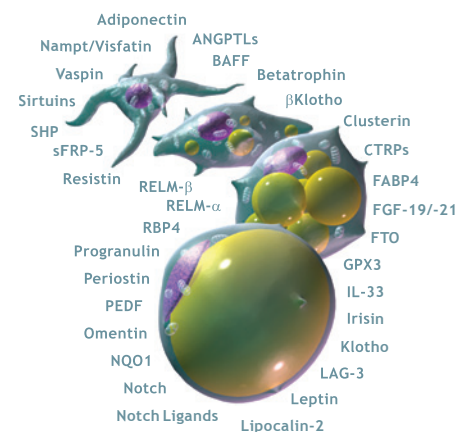
LIT: Cthrc1 controls adipose tissue formation, body composition, and physical activity: J.P. Stohn, et al.; Obesity (Silver Spring) 23, 1633 (2015)

PROTEINS	PID	SIZE	SOURCE	ENDOTOXIN	SPECIES
CTHRC1 (human) (rec.)	AG-40B-0157	10 µg 3 x 10 µg	CHO cells	<0.01EU/µg	Hu
CTHRC1 (mouse) (rec.)	AG-40B-0154	10 µg 3 x 10 µg	CHO cells	<0.01EU/µg	Ms

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