

Mitochondrial Cofactors

Cellular Energy Formula*

The body is a complex organism that requires substantial energy for everyday functioning. The energy that drives biological activity comes from adenosine triphosphate (ATP), which contains high-energy bonds for use in biochemical reactions. Because ATP cannot be stored, it must constantly be replenished. ATP is produced in a series of enzymatic steps within the mitochondria. If this process is disturbed by nutrient deficiencies, stress, or a myriad of other conditions, fatigue can occur.*

Mitochondrial Cofactors (Cellular Energy Formula*) contains coenzyme Q10, PANMOL® NADH, acetyl-L-carnitine, magnesium, and vitamin B6 as pyridoxal-5-phosphate. These bioactive cofactors have been shown to enhance energy production, with particular benefits for skeletal muscles, heart, and brain.*



#78270

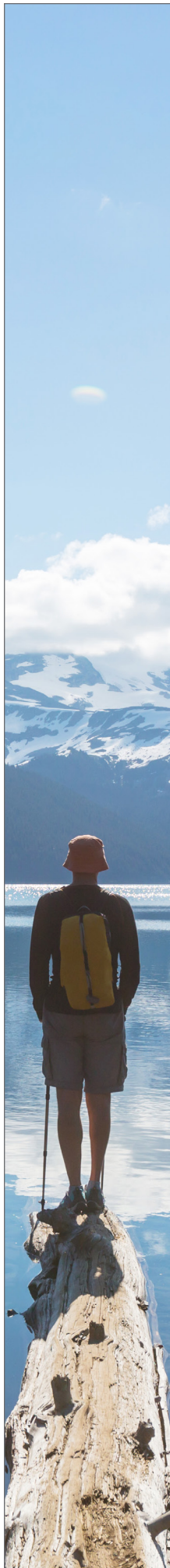
90 vegetarian capsules

Key Features

- Supports ATP production by activating key mitochondrial enzymes.*
- Facilitates the transport of fatty acids into the mitochondria for use as fuel.*
- May alleviate normal everyday mental and physical fatigue.*



800.545.9960
 info@allergyresearchgroup.com
 www.allergyresearchgroup.com



CoQ10 Ubiquinone (Ubidecarenone) is an excellent source of coenzyme Q10, a cofactor that has both bioenergetic and antioxidant properties.* The main function of CoQ10 is to transfer electrons along the complexes of the mitochondrial electron transport chain, culminating in the formation of ATP.* Low levels of CoQ10 are consistently associated with fatigue.* In human studies, supplementation with CoQ10 increased mitochondrial efficiency in the brain.* Healthy adults consuming CoQ10 experienced significantly less fatigue and greater exercise capacity compared to placebo groups.*

NADH (PANMOL®) is a microencapsulated form of nicotinamide adenine dinucleotide (NADH), a bioactive derivative of niacin (vitamin B3).* NADH serves an electron carrier for the ultimate production of ATP.* An analysis of human mitochondria revealed that NADH metabolism was one of the most important biological determinants of fatigue.* In a clinical study, individuals were asked to rate the extent to which fatigue had interfered with certain aspects of their day-to-day functioning.* Those who received supplemental NADH, along with CoQ10, reported improvements in physical and cognitive functioning after eight weeks.*

Acetyl-L-Carnitine is a short-chain ester of L-carnitine that is naturally produced in the body.* However, the biosynthesis of carnitine only accounts for 25% of daily needs.* Carnitine plays a key role in energy metabolism, since it enables fatty acids to enter the mitochondria, where they are broken down to form ATP.* Low blood and tissue carnitine levels often correlate with fatigue.* Supplemental carnitine was shown to increase energy production in the brain and to reduce muscle fatigue under various conditions.* In clinical studies, individuals receiving carnitine reported greater subjective energy levels compared to placebo groups.*

Pyridoxal-5-phosphate (PLP, also known as P5P) is a form of vitamin B6 that serves as a cofactor for numerous biosynthetic enzymes.* PLP is needed for the synthesis of heme, the oxygen-binding molecule within hemoglobin, which supplies oxygen to every tissue in the body.* A supply of PLP is important for normal heart and skeletal muscle contractions.* The intake of vitamin B6 also upregulates pathways that promote the growth and repair of skeletal muscle.* Low PLP levels are associated with decreased mitochondrial oxidative capacity and fatigue.*

Magnesium Bisglycinate Chelate is a highly soluble form of magnesium that is chelated with the neutral amino acid, glycine.* Magnesium influences the rate of ATP production by stimulating the activity of several enzymes in the trichloroacetic acid cycle (TCA, also known as the Krebs' cycle).* Additionally, magnesium plays a pivotal role in the activity of the mitochondrial ATP synthase, the enzyme that produces the bulk of cellular ATP.* Human and animal studies have shown that magnesium supports the normal daily functioning of the heart, brain, and skeletal muscle.* Healthy adults experiencing fatigue reported improved energy levels after magnesium supplementation.*

Supplement Facts

Serving Size 3 Capsules
Servings Per Container 30

Amount Per Serving	% Daily Value**
Vitamin B6 (as Pyridoxal-5-Phosphate)	25 mg 1470%
Magnesium (as Magnesium Bisglycinate)	100 mg 23%
Acetyl-L-Carnitine	300 mg †
Coenzyme Q10 (Ubiquinone)	100 mg †
NADH (PANMOL® NADH) (Reduced B-Nicotinamide Adenine Dinucleotide)	5 mg †

† Daily value not established.

**Percent Daily Value are based on a 2,000 calorie diet.

Other ingredients: Hydroxypropyl methylcellulose, microcrystalline cellulose, silicon dioxide, calcium palmitate, stearic acid.

Suggested Use: As a dietary supplement, 3 capsules, one or two times daily with meals, or as directed by a healthcare practitioner.

PANMOL®
NADH

References:

- An JH, et al. *Endocr J*. 2016 Oct 29;63(10):885-95.
 Andreani C, et al. *Oxid Med Cell Longev*. 2018 Oct 24;2018:8936251.
 Atamna H, et al. *Proc Natl Acad Sci USA*. 2002 Nov 12;99(23):14807-12.
 Badrasawi M, et al. *Clin Interv Aging*. 2016;11:1675.
 Barbiroli B, et al. *J Cereb Blood Flow Metab*. 1999 May;19(5):528-32.
 Bonora M, et al. *Purinergic Signal*. 2012 Sep;8(3):343-57.
 Bremer J. *Physiol Rev*. 1983 Oct 1;63(4):1420-80.
 Capaldi RA, Aggeler R. *Trends Biochem Sci*. 2002;27(3):154-60.
 Castro-Marrero J, et al. *Antioxid Redox Signal*. 2015 Mar 10;22(8):679-85.
 Castro-Marrero J, et al. *Clin Nutr*. 2016 Aug;35(4):826-34.
 Chee C, et al. *Aging Cell*. 2021 Feb;20(2):e13303.
 Chen HC, et al. *Nutrients*. 2019 Oct 23;11(11):2550.
 Chiechio S, et al. *Int J Mol Sci*. 2018 Jan;19(1):11.
 Ciacci C, et al. *Dig Liver Dis*. 2007 Oct 1;39(10):922-8.
 Ciregia F, et al. *Transl Psychiatry*. 2016 Sep 27;6(9):e904.
 Cojocaru IM, et al. *Rom J Intern Med*. 2009 Jan 1;47(2):169-71.
 Cox IM, et al. *Lancet*. 1991 Mar 30;337(8744):757-60.
 Dhalla NS, et al. *Clin Chem Lab Med*. 2013 Mar 1;51(3):535-43.
 Diaz-Castro J, et al. *Nutrients*. 2020 Feb 6;12(2):424.
 Dutta A, et al. *Exp Physiol*. 2008 Oct 1;93(10):1139-46.
 El Alaoui-Talibi ZA, et al. *Am J Physiol*. 1997 Apr 1;272(4):H1615-24.
 Fielding R, et al. *Nutrients*. 2018 Mar 13;10(3):349.
 Filler K, et al. *BBA Clin*. 2014 Jun 1;1:12-23.
 Fiorentini D, et al. *Nutrients*. 2021 Mar 30;13(4):1136.
 Fluge O, et al. *JCI Insight*. 2016 Dec 22;1(21):e89376.
 Forsyth LM, et al. *Ann Allergy Asthma Immunol*. 1999 Feb;82(2):185-91.
 Freo U, et al. *Front Neurosci*. 2021;15:322.
 Fukuda S, et al. *Biofactors*. 2016 Jul 8;42(4):431-40.
 Galkin MA, Syroeshkin AV. *Biochemistry*. 1999;64:1176-85.
 Garrido-Maraver J, et al. *Mol Syndromol*. 2014 Jul;5(3-4):187-97.
 Golf SW, et al. *Cardiovasc Drugs Ther*. 1998 Sep;12 Suppl 2:197-202.
 Golshani-Hebroni S, et al. *Gene*. 2016 Apr 25;581(1):1-13.
 He L, et al. *Ind Health*. 2008;46(5):506-12.
 Hiatt WR, et al. *J Clin Invest*. 1989;84:1167-73.
 Kalicki B, et al. *Cent Eur J Immunol*. 2019;44(1):23-32.
 Kepka A, et al. *Postepy Hig Med Dosw (Online)*. 2016 Jan 1;70.
 Kummungsee T, et al. *Eur J Nutr*. 2021 Aug 26. PMID: 34436643.
 Heap AC, et al. *J R Soc Med*. 1999 Apr;92(4):183-5.
 Hernandez-Camacho JD, et al. *Front Physiol*. 2018 Feb 5;9:44.
 Horowitz RI, Freeman PR. *Healthcare (Basel)*. 2018 Nov 5;6(4):129.
 Huang A, Owen K. *Med Sport Sci*. 2012;59:135-42.
 Hunter GA, Ferreira GC. 2009 Feb 16;55(1):102-10.
 Johnson S. *Med Hypotheses*. 2001 Feb 1;56(2):163-70.
 Kennedy DO, et al. *Nutr Metab (Lond)*. 2016 Dec;13(1):1-6.
 Kerner J, Hoppel C. *Biochim Biophys Acta*. 2000;1486:1-17.
 Ko YH, et al. *J Biol Chem*. 1999 Oct 8;274(41):28853-6.
 Kolte D, et al. *Cardiol Rev*. 2014 Jul 1;22(4):182-92.
 Kumar A, et al. *Sci Rep*. 2020 Jul 16;10(1):11824.
 Kuratsune H, et al. *Neuroimage*. 2002 Nov 1;17(3):1256-65.
 Kwon OS, Chung YB. *Arch Pharm Res*. 2004 Jun;27(6):676-81.
 Langsjoen PH, Langsjoen AM. *Clin Pharmacol Drug Dev*. 2014 Jan;3(1):13-7.
 Littaru GP, Tiano L. *Nutrition*. 2010;26(3):250-4.
 Lohninger A, et al. *Monatsh. Chem*. 2005 Aug;136(8):1425-42.
 Madsen KL, et al. *J Clin Endocrinol Metab*. 2018 Dec 1;103(12):4580-8.
 Malaguamera M, et al. *Arch Gerontol Geriatr*. 2008 Mar 1;46(2):181-90.
 Malaguamera M, et al. *J Interferon Cytokine Res*. 2011 Sep;31(9):653-9.
 Marcovina SM, et al. *Transl Res*. 2013;161 (2):73-84.
 Mendelsohn BA, et al. *PLoS Biol*. 2018 Aug 27;16(8):e2004624.
 Modanloo M, Shokrzadeh M. *Iran J Kidney Dis*. 2019 Mar;13(2):74-86.
 Montesano A, et al. *Oxid Med Cell Longev*. 2015 Mar 8;2015.
 Nicolson GL, et al. *Funct Foods Health Dis*. 2012 Mar 28;2(3):35-47.
 Nicolson GL. *Altern Ther Health Med*. 2014 Aug;13(4):35.
 Odai T, et al. *Nutrients*. 2020 Nov 9;12(11):3437.
 Orsucci D, et al. *Curr Med Chem*. 2011;18(26):4053-64.
 Pilchova I, et al. *Oxid Med Cell Longev*. 2017;2017:6797460.
 Pizzorno J. *Integr Med (Encinitas)*. 2014 Apr;13(2):8-15.
 Pioplys AV, Pioplys S. *Neuropsychobiology*. 1995;32(3):132-8.
 Poljsak B, et al. *Oxid Med Cell Longev*. 2020 Dec 12;2020:8819627.
 Rebouche CJ. *FASEB J*. 1992;6:3379-86.
 Rebouche CJ. *Ann N Y Acad Sci*. 2004 Nov;1033(1):30-41.
 Reinhart RA. *Arch Intern Med*. 1988 Nov;148(11):2415-20.
 Reuter SE, Evans AM. *Clin Pharmacokinet*. 2012;51(9):553-72.
 Ringsseis R, et al. *Eur J Nutr*. 2013 Aug;52(5):1421-42.
 Rosenfeldt F, et al. *Biofactors*. 2003;18(1-4):91-100.
 Santaella ML, et al. *P R Health Sci J*. 2004;23(2).
 Santos DA, et al. *Magnes Res*. 2011 Dec;24(4):215-9.
 Sarmiento et al. *Curr Drug Metab*. 2016;17(4):345-58.
 Schuette SA, et al. *JPEN J Parenter Enteral Nutr*. Sep-Oct 1994;18(5):430-5.
 Smealand OB, et al. *Neurochem Int*. 2012 Jul 1;61(1):100-7.
 Stein LR, Imai SI. *Trends Endocrinol Metab*. 2012 Sep;23(9):420-8.
 Suidasari S, et al. *Front Nutr*. 2016 Jan 19;2:39.
 Syroeshkin AV, et al. *Biochemistry (Moscow)*. 1999 Oct;64(10):1128-37.
 Tanabe K, et al. *Jpn Circ J*. 1998 May;62(5):341-6.
 Tardy AL, et al. *Nutrients*. 2020 Jan;12(1):228.
 Tomas C, et al. *PLoS One*. 2017 Oct 24;12(10):e0186802.
 Uberti F, et al. *Nutrients*. 2020 Feb 22;12(2):573.
 Uziel G, et al. *Muscle Nerve*. 1988 Jul 1;11(7):70-4.
 van Dijk M, et al. *J Cachexia Sarcopenia Muscle*. 2018 Feb;9(1):146-59.
 Varanoske AN, et al. *Nutrients*. 2017 Sep 7;9(9):988.
 Vermeulen RC, Scholte HR. *Psychosom Med*. 2004 Mar 1;66(2):276-82.
 Veronesi N, et al. *Am J Clin Nutr*. 2014 Sep 1;100(3):974-81.
 Wall BT, et al. *J Physiol*. 2011;589:963-73.
 Yamanaoka R, et al. *Sci Rep*. 2016 Jul 26;6(1):1-2.
 Zhang Y, et al. *Nutrients*. 2017 Sep;9(9):946.