

Understanding L-Carnitine

Carnitine exists in two isomeric forms: l-carnitine and d-carnitine. The latter has no physiological role other than acting as a competitive inhibitor of l-carnitine, the only isomer biologically active and with a fundamental role in the utilization of lipid substrates by the cellular mitochondria. There are in the marketplace other sources of d- or dl-carnitine of highly improbable efficacy and, in the case of d-carnitine, not allowed for food or feed use. Sigma-tau HealthScience does not now nor has it ever been a supplier of any forms of carnitine other than the pure l-carnitine form. L, dl- and l-Isomers can be distinguished optically by using refractometric techniques that determine the specific rotation and therefore the optical purity of the isomer. Sigma-tau HealthScience l-carnitine meets or exceeds all USP as well as other existing codex requirements for optical purity and, of course, other codex parameters. The ratio of allowable d- and l-Isomer is strictly governed within the USP and other codices and is represented by specific rotation values and acceptable limits within the monograph(s), as well as an indexed refractometric technique, that is, not to exceed d-carnitine by more than the allowable 0.5% permitted in all codices. Sigma-tau HealthScience products always fall well within the normal range for this as well as all codex parameters. Those readers who would like a free copy of the refractometric procedure used by USP (Sigma-tau authored the monograph for USP) for the determination of optical purity (specific rotation) may obtain one by contacting Sigma-tau HealthScience directly.

The newly USP certified AminoCarnitines[®], have received considerable attention in literature and/or in the press. Two such AminoCarnitines[®] are ArginoCarn[®], USP (brand of Acetyl-L-Carnitine Arginate Dihydrochloride, USP) and GlycoCarn[®], USP (brand of Glycine Propionyl-L-Carnitine Hydrochloride, USP). The basis for the rationale for the AminoCarnitines[®] is as follows:

 **ArginoCarn[®], USP (brand of Acetyl-L-Carnitine Arginate Dihydrochloride, USP)**

Support for healthy neuron and cognitive function; may promote healthy male reproductive function

Precursors of carnitine and acetyl-l-carnitine, including the amino acid arginine, may help to enhance the metabolic activities of these compounds. An acetyl-l-carnitine arginine complex supported healthy neuron viability in a cellular in vitro experiment. In the same study, the acetyl-l-carnitine arginine complex was able to help maintain calcium homeostasis in nervous system cells stimulated with glutamate, preserving healthy cerebellar cell function. In a separate study, acetyl-l-carnitine arginate demonstrated potential support for maintaining healthy central nervous system function by promoting healthy neurite function. Neurites are the hair like projections of neurons, or nervous system cells, responsible for proper signal transmission. The acetyl group from acetyl-l-carnitine

(ALC) is also responsible for production of acetylcholine, an important neurotransmitter for optimal mental functioning. The efficacy of long-term acetyl-l-carnitine supplementation was investigated in a double-blind, placebo-controlled, randomized trial, in which acetyl-l-carnitine demonstrated the ability to slow negative cognitive changes and supported memory and attention. A randomized double-blind study and a multi-center trial suggested that acetyl-l-carnitine supplementation provided statistically significant support for mental function, including memory and attention, and behavioral and emotional support. Acetyl-l-carnitine and arginine also play roles in healthy male reproductive function. Acetyl-l-carnitine is present in human sperm and seminal fluid and plays an important part in energy metabolism, which may support healthy sperm motility and spermatogenesis, or sperm production. As a nitric oxide precursor, l-arginine may support healthy sexual function in men with low urinary nitric oxide values. Furthermore, some but not all research involving l-arginine supplementation for sperm motility is tested; otherwise healthy males have produced healthy results.

Summary: ArginoCarn[®], USP is an innovative Acetyl-L-Carnitine Arginate complex providing important protection for healthy neuron function and cognitive health and could offer a potential for healthy support for male reproductive health.



GlycoCarn[®], USP (brand of Glycine Propionyl-L-Carnitine Hydrochloride, USP)

Enhanced support for healthy cardiovascular performance and exercise tolerance

Propionyl-l-carnitine (PLC) as derived from GlycoCarn[®], USP is a carnitine derivative naturally produced in the body. It has been specifically investigated for its role in cardiovascular metabolic function, peripheral artery health, and exercise capacity. It has been noted for promoting energy metabolism and oxygen availability in muscles with a high workload. Studies suggest that PLC supports healthy myocardial contractility, heart muscle meta-bolism, heart cell membrane stability, skeletal muscle metabolism, Krebs cycle activity and lactate modulation. A 6-month randomized, double-blind study involving 50 subjects suggested that PLC supplementation supported

maximum exercise capacity and promoted vascular health. In a controlled double-blind trial with 60 participants, PLC promoted exercise tolerance and supported healthy ventricular function. PLC was attributed with enhanced peak oxygen consumption and exercise time in a single blind, randomized, placebo controlled study. Data from a double-blind investigation indicated that PLC provided positive support for walking capacity and quality of life for volunteers after a six-month assessment period. In a related study involving almost 500 subjects, similar findings were reported. A multi-center trial with over 200 individuals and a smaller double - blind, randomized trial also revealed the ability of PLC supplementation to promote maximal walking distance and blood flow velocity. In one study comparing l-carnitine, acetyl-l-carnitine and PLC, PLC offered support for ventricular function while the other available forms of l-carnitine did not.

Summary: Propionyl-l-carnitine as derived from GlycoCarn[®], USP is a well-researched derivative of l-carnitine recognized for its role in promoting healthy cardiovascular performance, peripheral artery function and exercise tolerance.

Company Profile

Sigma-tau HealthScience is part of the Sigma-tau group, the second largest pharmaceutical company in Italy, with affiliates worldwide. Sigma-tau, a leading investor in pharmaceutical R&D, is undisputed as the worldwide leader in carnitine and metabolic research and additionally ranks among the top 25 niche companies in the world in patent activity. More than 20% of Sigma-tau's revenues, a rate that exceeds the industry average, are devoted to clinical research, including analysis and inborn metabolic diseases. Sigma-tau is also focused on the development and production of orphan drugs for small numbers of patients whose pharmaceutical needs might not otherwise be met. One of them is an FDA-approved levo-carnitine injection drug for the prevention and treatment of carnitine deficiency in chronic uremia patients affected by end stage renal disease.

You can learn more about us by visiting
www.sigma-tau.com
www.aminocarnitines.com
www.modernarteries.com



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