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REPORT

Lipoic Acid Reverses Mitochondrial Decay

By Michael Anderson

It is estimated that **85%** of the oxygen contained in every breath you take is consumed by the **mitochondria** within each cell of your body.¹

The decay of these energy-producing powerhouses in turn lies at the core of most age-related pathologies.

In experimental models examining the mitochondrial theory of aging, it has been shown that cells microinjected with mitochondria isolated from old animals degenerate far more rapidly than those microinjected with mitochondria from *young* animals.²

The good news is that when supplied with a nutrient regimen that includes **lipoic acid**, a profound regeneration is observed in similar animal models,³ including improved metabolic function and a marked decline in oxidative stress.

In this article, the recent data on lipoic acid's multimodal power to combat a host of age-related diseases is detailed. You will learn how it may help prevent cardiovascular disease, obesity, diabetes, neurodegenerative disorders, and cancer. You will also learn of drug company efforts to produce high-cost, *synthetic* forms of lipoic acid to capitalize on its unique health-promoting properties at your expense.



MITOCHONDRIAL DECAY AND AGING

The mitochondrial theory of aging has long held a prominent place in scientists' understanding of the processes that impact aging. First proposed by Denman Harman in 1972, this theory posits that accumulated DNA damage to mitochondria, the cells' energy generators, leads to increased free radical stress and decreased cellular energy production.⁴ In the past 30 years, a wealth of evidence supporting the mitochondrial theory of aging has led prominent researchers such as Bruce Ames to consider it a major contributor to aging.⁵

Experimental models support this theory and demonstrate the importance of youthful mitochondria function in maintaining cellular health. For example, cells microinjected with mitochondria from aged animals display greater cellular degeneration, compared with cells microinjected with mitochondria from youthful animals.² The mitochondrial theory of aging has analyzed the components of young and old cells. Youthful organisms contain abundant numbers of smaller, bioenergetically efficient mitochondria, while older organisms contain larger, inefficient mitochondria that decrease energy supply in the cells.^{6,7}

Delaying mitochondrial aging through the use of nutrients such as lipoic acid and acetyl-L-carnitine has been proposed as a top-line strategy for preventing aging-related diseases.⁸

HOW LIPOIC ACID COMBATS CELLULAR DEGENERATION

Lipoic acid is a vital "co-factor" for enzymatic reactions within the mitochondria, helping to optimize energy conversion.^{9,10} It possesses unique properties that specifically slow mitochondrial aging by preventing release of mutagenic oxidants.¹¹ Recent research further reveals lipoic acid's ability to alleviate mitochondrial dysfunction in aging cells (thus improving **mitochondrial function**).^{12,13}

Researchers have further discovered that **lipoic acid** enhances the effects of **insulin**, benefitting glucose metabolism and lowering blood sugar levels.¹⁰

This in turn mitigates the pathologic cross-linking of glucose and protein that result in *advanced glycation end products* (AGEs).¹⁴

These advanced glycation end products have been shown to *accelerate* the onset of cardiovascular disease, brain degeneration, ocular disorders, and cancer.¹⁴⁻¹⁷

Lipoic acid also suppresses production of inflammatory cell-signaling molecules, while increasing production of molecules involved in vascular tone, such as endothelial nitric oxide synthase (eNOS).^{18,19}

Owing to its pronounced power to combat mitochondrial aging, behemoth pharmaceutical companies are now attempting to *manipulate* its molecular structure and render it *patentable*.²⁰ Such drugs include more complex molecules in which lipoic acid is “conjugated,” or chemically joined, to form hybrid compounds with additional biological characteristics.

This would allow drug manufacturers to make absurd claims of superior benefit for their artificial, synthetic lipoic acid products. The result would be needless additional cost for what is already a proven multi-modal nutrient.

Lipoic acid in the biologically active “R” form (see below) is readily available without a prescription and affordable.

USE THE “RIGHT” FORM OF LIPOIC ACID

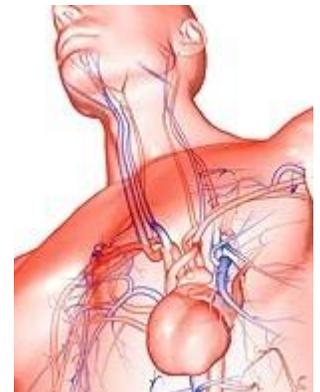
Lipoic acid comes in two “mirror image” forms labeled “R” and “S.” Only the R form is produced and used by life processes. Inexpensive chemical manufacturing produces equal quantities of R and S lipoic acid, often labeled “R/S Lipoic Acid” or simply “alpha lipoic acid” (ALA).

Newer precision techniques allow production of a pure R-lipoic acid, which has a much higher potency. A dose of pure R-lipoic acid provides twice the active ingredient as a typical R/S-alpha lipoic acid supplement, simply because the whole dose consists of the active “R” molecule. Look for the “R” label to assure you are getting the most potent form of this valuable nutrient.^{21,22}

CARDIOVASCULAR DEFENSE

Lipoic acid’s powerful antioxidant, anti-inflammatory, and lipid-lowering capabilities make it an ideal, multi-targeted nutrient for reducing cardiovascular risk.^{23,24} Lipoic acid helps protect the endothelium, the delicate, one-cell-thick lining of blood vessels. Additionally, lipoic acid improves blood vessels’ ability to relax, helping to lower blood pressure, improve blood flow, and reduce risk for cardiovascular events such as heart attack and stroke.²⁵⁻²⁸ Better blood flow in legs can also mean reduced pain with prolonged walking or other exercise.²⁹

Cardiac surgeons are now beginning to recommend lipoic acid, along with other antioxidants such as CoQ10, prior to surgery in order to protect delicate blood vessels during surgery. Improved physical and mental quality of life in such patients has been reported to last for more than a month after the surgery.³⁰



You can use lipoic acid to help lower your risk for cardiovascular disease long before you need cardiac surgery, though. Lipoic acid lowers total cholesterol and low-density lipoprotein (LDL) levels and reduces the size and number of atherosclerotic plaques, the dangerous points of arterial narrowing that produce heart attacks and strokes.^{23,24,28,31} In addition, lipoic acid may also lower levels of certain cellular toxins that contribute to cardiovascular diseases, especially those related to diabetes.^{32,33}

Even people with pre-existing heart disease can benefit from lipoic acid. Cardiac stents, intended to improve blood flow following a heart attack, can become blocked by formation of unwanted new tissue, an effect that is prevented by lipoic acid supplementation.³⁴ And, lipoic acid prevents death of heart cells exposed to high blood sugar levels, a contributor to diabetic heart disease.³⁵

TARGETING OBESITY

Lipoic acid has beneficial effects on the forces that cause us to gain weight and store excess fat. It works on brain areas to reduce appetite, food intake, and body weight.³⁶⁻³⁹ Lipoic acid also stimulates increased energy expenditure, burning excess calories by activating cellular energy signaling complexes.^{13,36}

Overweight and obese people lose their normal sensitivity to insulin, resulting in ever-higher levels of blood sugar and advanced glycation end product–induced tissue damage. Lipoic acid improves insulin sensitivity and stimulates sugar uptake from the blood to help normalize sugar levels.⁴⁰⁻⁴³ In the liver, lipoic acid decreases fat production and accumulation, helping to prevent development of dangerous non-alcoholic fatty liver disease (NAFLD).^{44,45}



Lipoic acid has been successfully used in patients taking medications that stimulate weight gain, such as antipsychotic drugs.⁴⁶ Even in people who are only overweight (not yet obese), lipoic acid reduced body weight by 8% while shrinking waist size by more than 2 inches.⁴⁷ In patients who are already obese, there was a 9% loss of weight and a decrease in waist size of more than 3 inches.⁴⁷

WHAT YOU NEED TO KNOW: LIPOIC ACID REVERSES MITOCHONDRIAL AGING

- Cells with mitochondria isolated from old animals degenerate far more rapidly than those with mitochondria from young animals.
- When supplied with a nutrient regimen that includes lipoic acid, a profound regenerative effect is observed.
 - Experimental models show that lipoic acid optimizes function of the mitochondria in aging cells and *reverses* cell aging.
- Recent data reveal that lipoic acid specifically targets factors that contribute to mitochondrial aging, dysfunction, and cell death.
- Lipoic acid can help to prevent cardiovascular disease, obesity, insulin resistance, and diabetic complications.
 - Lipoic acid protects against nerve and brain cell damage induced by aging and trauma.
- New evidence suggests that lipoic acid may also have important cancer-preventive effects, even against some of the most difficult-to-treat malignancies.

AN ANTI-DIABETIC

Lipoic acid has an important role in managing diabetes, particularly the massive oxidative and inflammatory changes the disease produces.^{48,49} The benefits of lipoic acid include promoting insulin sensitivity and glucose uptake.⁵⁰⁻⁵² Diabetics are at increased risk for the kinds of cardiovascular problems that lipoic acid can prevent, including accumulation of cellular toxins.^{32,53} By protecting against endothelial damage, lipoic acid reduces the threat of diabetic vascular and kidney complications.^{26,54}

Lipoic acid is proving to be especially effective at preventing the painful and debilitating condition known as diabetic neuropathy, an almost inevitable complication in people with poor blood sugar control.⁵⁵ Diabetic neuropathy begins with pain, burning, and/or stabbing sensations in the extremities.⁵⁶ In more advanced stages of this condition, the pain disappears as severe damage is done to microscopic blood vessels. Ultimately the loss of nerve function can lead to open sores, infections, and even amputations. Despite considerable knowledge about how diabetic neuropathy arises, no drug treatment has yet proved effective in preventing or reversing the condition.⁵⁶



Lipoic acid's powerful antioxidant actions limit damage to the lining and blood supply of nerves, helping to reduce both symptoms and nerve dysfunction.⁵⁷ Clinical studies have uniformly demonstrated improvements in pain, numbness, and stinging, while also improving nerve conduction velocity, a measure of how efficiently nerves transmit electrical impulses.⁵⁸⁻⁶¹ Studies have shown that lipoic acid produces significant improvements when administered for 3 weeks, and longer studies have shown sustained effects.^{62,63} Lipoic acid also has beneficial effects on circulation in patients with diabetic neuropathy, improving blood flow and the amount of blood reserve available during high demand.⁶⁴

It's essential to start early with optimal levels of lipoic acid to prevent diabetic neuropathy. People with good blood sugar control and younger patients do better, as do women, and thinner patients in general.⁵⁸ While doses of up to 1,800 mg/day are welltolerated, 600 mg/day of alpha-lipoic acid seems to produce the best results in those with diabetes.⁵⁹ This translates into a **300 mg dose of R-lipoic acid** to obtain the same biological activity.^{21,22}

PROTECTION FROM BRAIN CELL DEGENERATION

Lipoic acid protects brain tissue from the long-term effects of advanced glycation end products and the resulting inflammation and oxidative damage, conditions that lead to neurodegenerative diseases like Alzheimer's disease.^{9,65,66} A hallmark of

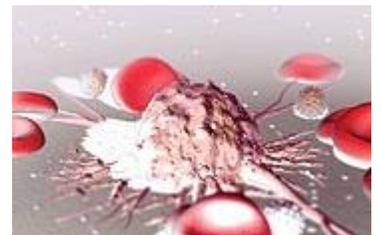
Alzheimer's disease is the formation of an abnormal protein called amyloid-beta, the result of chronic inflammation and a producer of increased oxidative stress. Lipoic acid reduces amyloid-beta-induced inflammation and improves brain cells' production of the chemical signaling molecules called neurotransmitters.^{67,68} Mitochondrial function is significantly impaired in the brains of Alzheimer's and Parkinson's disease patients and lipoic acid decreases mitochondrial oxidant stress in those cells.^{69,70}

These effects work together with other nutrients like acetyl-L-carnitine, docosahexaenoic acid (DHA), phosphatidylserine (PS), and glyceryl-phosphoryl-choline (GPC) to improve cognitive performance.⁷¹ Research has shown that lipoic acid prevents cell death in the brain regions most affected in Parkinson's disease.⁷² These findings are both good news and important reminders of the need to incorporate lipoic acid early, before symptoms progress in these chronic, debilitating diseases. Lipoic acid may also have an important role in preventing the immune over-response that causes multiple sclerosis, another chronic, progressive brain disease.⁷³⁻⁸¹

By increasing antioxidant capacity, scavenging free radicals, reducing lipid peroxidation, and enhancing energy utilization, lipoic acid may also minimize the damage produced by brain trauma.⁸² Lipoic acid has shown benefit in preventing trauma-related injuries to the brain, spinal cord, and even peripheral nerves, all of which are vulnerable following a major accident.⁸³⁻⁸⁵

ANTI-CANCER MECHANISMS

Cancer scientists are growing increasingly interested in lipoic acid because cancer cells offer many targets for its anti-inflammatory attributes.⁸⁶ These attributes allow lipoic acid to intervene at multiple points in the chain of carcinogenesis.^{86,87} In experimental studies, lipoic acid shows promise against cancers of the blood (leukemia), lung, breast, and liver.⁸⁸⁻⁹³ Preliminary research indicates that lipoic acid acts to halt the cell reproductive cycle of cancer cells, slowing or stopping tumor growth.^{88,89} Lipoic acid may also help induce apoptosis, the programmed cell death that is the body's natural control mechanism for weeding out nascent cancers.⁸⁸⁻⁹³ Lipoic acid also protects against chemical-induced DNA damage that can lead to cancerous transformation.⁹⁴ Lipoic acid may help prevent metastatic cancer spread by reducing activity of enzymes that tumors use to invade tissues.⁹³ Finally, in those unfortunate enough to require chemotherapy to treat an existing cancer, lipoic acid can afford powerful protection against some of the side effects, such as diarrhea, intestinal cramping, and ulcers, thanks to its antioxidant capabilities.⁸⁷



LIPOIC ACID: RESEARCH UPDATE

An abundance of recently published studies reveals a wide range of new findings about lipoic acid:

- **Weight loss support.** Overweight or obese individuals who received 1,800 mg of alpha lipoic acid daily for 20 weeks lost more weight compared with subjects who did not receive lipoic acid.⁹⁵ This translates into 900 mg of the biologically active **R-lipoic acid**.
- **Migraine prevention.** Individuals with frequent or poorly controlled migraine attacks who consumed lipoic acid each day displayed a trend toward fewer migraines.⁹⁶ These findings build on earlier research suggesting a role for lipoic acid in migraine prevention.⁹⁷
- **Improving endothelial function.** Impaired glucose tolerance contributes to endothelial function, an underlying cause of cardiovascular disease. When lipoic acid was administered to individuals with newly diagnosed impaired fasting glucose, endothelial function improved, as did a marker of oxidative stress.⁹⁸
- **Benefits for polycystic ovary syndrome.** Polycystic ovary syndrome (PC OS) is characterized by hormone imbalances, irregular or absent menstrual periods, and blood sugar and lipid abnormalities. Lean, non-diabetic women with PC OS who consumed 600 mg of alpha lipoic acid daily demonstrated improved insulin sensitivity, decreased triglycerides, and beneficial changes in low-density lipoprotein (LDL), and some experienced more regular menstrual periods.⁹⁹
- **Relieving back pain.** Individuals undergoing rehabilitation therapy for back pain caused by disc compression of nerves who consumed 600 mg of alpha lipoic acid and 360 mg of gamma-linolenic acid (GLA) daily experienced greater improvements in nerve pain, compared with patients undergoing rehabilitation alone.¹⁰⁰
- **Preventing steroid-induced osteonecrosis.** Corticosteroids such as prednisone threaten bone health and increase fracture risk by impairing blood flow to bone.¹⁰¹ In an animal model, lipoic acid helped prevent steroid-induced osteonecrosis (bone death that increases fracture risk), possibly by reducing oxidative stress and/or by improving endothelial function.¹⁰²
- **Decreasing leptin levels.** Elevated levels of the fat-secreted hormone leptin are involved in the development of metabolic syndrome and diabetes. Lipoic acid administration to animals decreased circulating leptin and leptin expression in fat tissue.¹⁰³

SUMMARY

Cells with mitochondria isolated from old animals degenerate far more rapidly than those with mitochondria from young animals, revealing the importance of healthy mitochondria to delay the aging process. When supplied with a nutrient regimen that includes lipoic acid, a profound regenerative effect is observed, including improved metabolic function and significant declines in oxidative stress.

Recent data reveal that lipoic acid specifically targets factors that contribute to mitochondrial aging, dysfunction, and cell death.

Lipoic acid can prevent and even mitigate cardiovascular diseases, obesity, insulin resistance, and complications of diabetes. Lipoic acid protects against nerve and brain cell damage induced by aging and trauma.

New evidence suggests that lipoic acid may also have important cancer-preventive effects, even against some of the most difficult-to-treat malignancies.

If you have any questions on the scientific content of this article, please call a Life Extension® Health Advisor at 1-866-864-3027.

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