

Coenzyme Q₁₀: A Miracle Nutrient Advances in Understanding

Ross Pelton, RPh, PhD, CCN

Ross Pelton, RPh, PhD, CCN, is a pharmacist, a certified clinical nutritionist (CCN) and he is currently the Scientific Director for Essential Formulas. Ross “brands” himself as The Natural Pharmacist and he is the author of The Drug-Induced Nutrient Depletion Handbook. IMCJ readers can use the following link to get a FREE copy of Ross’ Quick Reference Guide to Drug-Induced Nutrient Depletions: naturalpharmacist.net/dind Join Ross in the Life Extension Revolution. To be on Ross’ mailing list and receive periodic updates on cutting edge health information, click on the Subscribe link on his website: naturalpharmacist.net

In the past several years, there have been some important breakthroughs in understanding coenzyme Q₁₀’s biological effects and how to achieve maximum therapeutic benefits from CoQ₁₀ supplementation.

The purpose of this article is to provide a brief overview of the history of CoQ₁₀ and the role it plays in the prevention and treatment of cardiovascular disease. After this brief introduction, I will mention newer areas of therapeutic potential and then end by addressing the following two very important CoQ₁₀ topics: a) the issue of crystallization and absorption and, b) the difference between ubiquinone and ubiquinol, and which form is best.

History

In 1957, University of Wisconsin biochemist Fred Crane isolated a yellowish substance from beef hearts. He sent samples to a colleague, biochemist Dr. Karl Folkers who worked at the pharmaceutical company Merck, Sharpe and Dohme. In 1958, Dr. Folkers successfully determined the chemical structure of CoQ₁₀ and conducted some preliminary studies, which led him to believe that CoQ₁₀ had enormous potential as a cardiovascular drug. At the time, Merck executives were not interested in developing a new cardiovascular drug. Consequently, the patent rights to CoQ₁₀ were sold to a company in Japan.

It took Japanese scientists about ten years to develop industrial fermentation technology that resulted in the

production of commercial quantities of CoQ₁₀. This enabled the initiation of the first clinical trials in which CoQ₁₀ was used to treat patients with heart failure in Japan. In 1976, CoQ₁₀ was approved in Japan as a drug to treat cardiovascular disease, and it remained one of the top-selling cardiovascular drugs in Japan for over twenty years.

In the 1970s, Dr. Folkers and his colleague, Dr. Gian-Paolo Littarru of Italy published data they had collected with tissue biopsies from 200 patients, which revealed that patients with heart disease and patients undergoing heart surgery had blood and tissue Coenzyme Q₁₀ levels significantly below normal levels.¹

In 1978, British biochemist Peter Mitchell was awarded the Nobel Prize in Chemistry for discovering the key role coenzyme Q₁₀ plays in the electron transport chain in mitochondrial membranes, which results in the generation of cellular energy in the form of ATP.² Folkers’ early work along with Mitchell’s Nobel prize dramatically increased scientific interest in CoQ₁₀ around the world.

Biosynthesis of CoQ₁₀

The biosynthesis of CoQ₁₀ from the amino acid tyrosine is a multistage process requiring at least eight vitamins and several trace elements. Considering the widespread consumption of nutrient-deficient fast foods and highly processed foods and the fact that nutritional content of our commercial food supply has been steadily declining since the end of World War II, due to the use of toxic chemicals, artificial fertilizers and other destructive farming practices, it is easy to see why many people have nutritional deficiencies that hinder the body’s ability to synthesize coenzyme Q₁₀.

Drug-Induced Nutrient Depletions

I am the author of *The Drug-Induced Nutrient Depletion Handbook*.³ In this handbook, I present peer-reviewed scientific studies which document that 11 different classes of drugs deplete coenzyme Q₁₀. The classes of drugs that deplete CoQ₁₀ are oral contraceptives,

hormone replacement therapy (HRT), tricyclic antidepressants, adrenergic stimulants, thiazide diuretics, antipsychotics, statins, most chemotherapy drugs, beta-blockers and oral hypoglycemics: both sulfonylureas and biguanides.

Thus, it is easy to see why many people are coenzyme Q₁₀ deficient due to poor nutrient intake from poor diets and the fact that many people may be taking one or more drugs that deplete coenzyme Q₁₀.

The Drug-Induced Nutrient Depletion Handbook is out-of-print. However, I have created a **Quick Reference Guide to Drug-Induced Nutrient Depletions**. As part of my commitment to help people improve their health, I am offering this Quick Reference Guide FREE to everyone. Use the link below to get your free copy of the Quick Reference Guide to Drug-Induced Nutrient Depletions and feel free to distribute this offer to your patients, family and friends. LINK: naturalpharmacist.net/dind **Let's Make Good Health Go Viral...!!!™**

Coenzyme Q₁₀ Exists in Two Forms

Ubiquinone is the oxidized form, which has a molecular weight of 864. Ubiquinol, which is the reduced form, has two more hydrogen molecules in its structure, giving it a molecular weight of 866. Ubiquinone and ubiquinol are a redox pair (oxidation-reduction) that can be rapidly converted from one form to the other in cells, lymph or blood depending on the demand for their various functions.

CoQ₁₀'s Antioxidant Functions

The reduced form of CoQ₁₀, ubiquinol, is a powerful lipid-soluble antioxidant that provides critical antioxidant protection in the lymph and blood throughout the body.⁴ Ubiquinol is the only known fat-soluble antioxidant that human cells can synthesize.⁵ In its reduced form, ubiquinol coenzyme Q₁₀ plays a major role in preventing oxidation in both the lipids that make up much of the structure of cellular membranes in cells throughout the body and also in lipoprotein lipids present in circulation.⁶ Coenzyme Q₁₀ can also recycle or regenerate other antioxidants such as vitamin E⁷ and vitamin C.⁸

Cellular Energy Production

The oxidized form of CoQ₁₀, ubiquinone, is required for energy production in the mitochondria of all cells except the red blood cells. Specifically, CoQ₁₀ is required in several steps of the electron transport chain in mitochondrial inner membranes, which is where cellular energy, known as ATP, is produced. This is the work that earned Peter Mitchell his 1978 Nobel Prize.

Bi-directional Conversion of Ubiquinone to Ubiquinol

When ubiquinone is taken orally, it is converted to ubiquinol during absorption and remains in its reduced form in the lymph and in blood. CoQ₁₀ is not needed to

produce energy when it is circulating in the lymph or blood. This conversion takes place so that reduced ubiquinol form of CoQ₁₀ can provide antioxidant protection as it is being circulated throughout the body.

For decades, physicians have prescribed statin drugs in the belief that elevated LDL-cholesterol is a major risk factor for cardiovascular disease. This is unfortunate because LDL-cholesterol is not a "bad" molecule. However, when LDL-cholesterol becomes oxidized, it becomes a "damaged" molecule that is capable of causing vascular endothelial injury which contributes to atherosclerosis and cardiovascular disease.⁹

A 1997 study by cardiologist Svend Aage Mortensen made the following important statement. Dr. Mortensen announced that CoQ₁₀ is an antioxidant that is "packaged into the LDL & VLDL fractions of cholesterol." This means that LDL cholesterol is the "carrier" that transports coenzyme Q₁₀ around the body. It also means that when CoQ₁₀ is being transported on the LDL cholesterol molecule, its antioxidant properties enable it to protect LDL cholesterol against oxidative damage. This explains why CoQ₁₀ helps prevent the formation of oxidized LDL cholesterol, which is one important way that CoQ₁₀ reduces cardiovascular disease risks.¹⁰

CoQ₁₀ Studies

In this section I will present some selected studies that show coenzyme Q₁₀'s therapeutic benefits in various medical conditions.

CoQ₁₀ & Cardiovascular Disease

Over the past 40 years, the results of many clinical trials confirm that coenzyme Q₁₀ supplementation is useful in the prevention and treatment of many aspects of cardiovascular disease such as congestive heart failure, hypertension, ischemic heart disease, cardiac arrhythmias.¹¹

The 2014 Q-Symbio Study¹²

Chronic heart failure patients (average age: 63 years) administered 3 × 100 mg of ubiquinone coenzyme Q₁₀ or matching placebo daily for two years along with patient's conventional heart failure medicine.

RESULT: significantly improved symptoms and survival in the coenzyme Q₁₀ group. Sub-group analysis of just the European study participants showed significantly improved ejection fraction in the coenzyme Q₁₀ treatment group.¹³

The 2013 KiSel-10 Study

Community living senior citizens (average age: 78 years) administered 2 × 100 mg of ubiquinone CoQ₁₀ in combination with 200 mcg of selenium or matching placebo daily for four years.

RESULT: significantly reduced risk of death from heart disease and improved heart function in the active treatment group.¹⁴

Langsjoen Hypertension Study

Cardiologist Peter Langsjoen selected 109 patients with essential hypertension. Patients added high-dose CoQ₁₀ (average dose 225 mg/day) to their existing antihypertensive drugs.

RESULT: New York Heart Association (NYHA) functional class improved from a mean of 2.40 to 1.36, and 51% of patients came completely off from 1 to 3 blood pressure meds within average of 4.4 months after starting high-dose CoQ₁₀.¹⁵

CoQ₁₀ & Cancer

Studies reveal that cancer patients have low levels of coenzyme Q₁₀.¹⁶ Thomas Seyfried, MD has written an important book titled *Cancer as a Metabolic Disease: On the Origin, Management and Prevention of Cancer*.¹⁷ Seyfried explains that cancer is a metabolic disease that initiates with damage to mitochondrial DNA, which hinders the ability of cells to produce adequate energy. This causes the metabolic shift from oxygen to glucose for energy production, which is the hallmark of cancer cell metabolism. Coenzyme Q₁₀ in its reduced form—ubiquinol plays a critically important role in mitochondria by protecting mitochondrial membranes and mitochondrial DNA (mtDNA) from free radical damage.¹⁸

Breast Cancer. In a small study, 32 advanced breast cancer patients with lymph metastasis were treated with 390 mg of CoQ₁₀ daily. Either partial or complete tumor regression was documented in 6 of the 32 women.¹⁹

Prostate Cancer. In men with prostate cancer, treatment with high-dose CoQ₁₀ resulted in substantial reductions in PSA and tumor size. An important finding was that the men did not begin to show any signs of response until about 90 days into the trial.²⁰

Reducing Chemotherapy Side Effects. clinical trials have also reported that coenzyme Q₁₀ substantially protects against and/or reduces side effects in patients undergoing various forms of chemotherapy.²¹

Neurological Conditions. Reduced levels of coenzyme Q₁₀ are associated with several neurological diseases and its ability to reduce oxidative stress suggests that CoQ₁₀ may be able to slow the progression and in some cases, possibly provide some therapeutic benefit. Conditions in which CoQ₁₀ may play a role include Parkinson's disease²², Huntington's disease²³ and Alzheimer's disease.²⁴

Life Extension. Coenzyme Q₁₀'s ability to protect mitochondria against excessive free radical damage makes it a candidate for consideration as a life extension nutrient. Although studies in animal models have had mixed results, a study conducted by Emile Bliznakov, MD has fascinating implications.

Dr. Bliznakov started his experiment with 100 "old" female white mice 16 to 18 months of age, which is equivalent to humans in their 60s to 70s. Being elderly, these mice were already beginning to show some signs of

decreased immunity and aging bodily functions.²⁵ Fifty mice regularly received CoQ₁₀; the other 50 old mice served as controls. All mice were maintained on optimally nutritious diets.

- At 36 weeks into the study, 100% of the control mice were dead while 40% of the CoQ₁₀-treated mice were still alive, active and not showing the normal signs of physical deterioration commonly associated with advanced age.
- At week 56, 10% of the CoQ₁₀-treated mice were still alive and thriving. This is 2X longer than these mice would normally be expected to survive beyond the beginning of the experiment.
- At the 80th week 4 mice were still alive; at the 82nd week, the last mouse died. In human terms, this is a life span of roughly 130 years of age! (the last control mouse died at week 36).

I spoke with Dr. Bliznakov personally, and he explained the following remarkable visual differences between the two groups of mice at 30 weeks, when some of the control mice were still alive. The fur on the controls was dull, coarse, matted and on some mice, clumps of hair had fallen out, leaving bald patchy spots. All the remaining control mice were very listless and spent most of their time lying around and not socializing. On the other hand, the fur in the coats of the CoQ₁₀-treated mice remained smooth and soft, and they maintained a much greater level of activity and socialization.

Ubiquinone vs Ubiquinol

CoQ₁₀ is poorly absorbed because of its lipophilic nature and its large molecular weight. In 2006, Kaneka Corporation in Japan began marketing the ubiquinol (reduced) form of CoQ₁₀ with claims that it was better absorbed than ubiquinone and hence, more effective. This has been a very successful marketing strategy for Kaneka, but actually, the claims are not scientifically accurate.

Ubiquinol CoQ₁₀ products are substantially more expensive than ubiquinone CoQ₁₀ products. However, when ubiquinol is ingested, it is oxidized by gastric acid to ubiquinone before it is absorbed.²⁶ Hence, people pay more for ubiquinol, but really do not get added benefit(s). Research has shown that it is not necessary to take ubiquinol in order to significantly increase ubiquinol levels in plasma and in plasma lipoproteins. Taking a ubiquinone supplement will do the same.²⁷

Dosing Advice

The following advice pertains to all CoQ₁₀ products, regardless of the type of CoQ₁₀ being taken. Coenzyme Q₁₀ is a fat-soluble nutrient and humans do not absorb fat-soluble nutrients very efficiently. CoQ₁₀ supplements should be taken at a meal that contains some fat. This enhances the absorption of the CoQ₁₀.

The following data was gathered from multiple human clinical trials. On average, participants' pre-test CoQ₁₀ blood levels were 1.09 ug/ml. After ingestion of a single 100 mg dose of CoQ₁₀, blood levels increased to 2.33 ug/ml. However, when people ingested 200 mg of CoQ₁₀ in a single dose, the blood level only increased to 2.35 ug/ml—almost no different than the blood level following a 100 mg dose. However, when individuals took 100 mg of CoQ₁₀ in divided doses, twice daily, blood levels rose to 3.47 ug/ml.

Because coenzyme Q₁₀ is a large molecular weight, fat-soluble compound, its absorption is slow and limited. This explains why better blood levels are achieved with divided doses rather than taking a large single dose of coenzyme Q₁₀.²⁸

The Crystallization Problem

CoQ₁₀'s melting point is 10°C higher than human body temperature, which equates to about 118° F. Consequently, at temperatures below 118° F, single molecules of CoQ₁₀ dissolved in water or oil begin to clump into crystals. We cannot absorb CoQ₁₀ crystals; we can only absorb single molecules. Upon microscopic examination, many CoQ₁₀ softgel capsules contain crystals, which partially explains why many CoQ₁₀ products have low absorbability. Even CoQ₁₀ products that are dissolved in oil recrystallize in the body, which prevents absorption.

Absorption Studies

Until recently, there was a lack of standardization in most CoQ₁₀ absorption studies, which made it difficult to make product comparisons. However, a recently published, head-to-head study that compared the absorption of variously formulated ubiquinone products with a well-formulated ubiquinol product, revealed conclusively that a well-formulated ubiquinone product is about 200% better absorbed than ubiquinol products.²⁹ However, this is not the end of the story.

The Oil Matrix

William Judy, PhD, has been a highly respected coenzyme Q₁₀ scientist for over 40 years. In the past several years, he has focused on CoQ₁₀ absorption issues and conducting CoQ₁₀ absorption studies. Dr. Judy's absorption studies have led him to realize that the form of coenzyme Q₁₀ in a product (ubiquinone or ubiquinol) is less important than the oil matrix that the CoQ₁₀ is dissolved in. Most coenzyme Q₁₀ products are not simply CoQ₁₀, they contain other ingredients such as various oils or a substance like piperine, which is a compound derived from black pepper. These substances may enhance the absorption of coenzyme Q₁₀.

Formulation is More Important Than Form

Dr. Judy's research has revealed that the following two important factors determine the absorption (and

effectiveness) of coenzyme Q₁₀. One is the composition of the oil matrix in which the CoQ₁₀ is dissolved and the second factor is the heating and cooling process used prior to filling the coenzyme Q₁₀/oil mixture into the soft-gel capsules. These are the factors that differentiate between a crystal free CoQ₁₀ product vs a product with CoQ₁₀ crystals.

Crystal Free CoQ₁₀

Numerous companies that produce coenzyme Q₁₀ products are engaged in research to develop their own patented delivery system that keeps their CoQ₁₀ in solution, both in the capsule and after it has been ingested. These are called Crystal Free coenzyme Q₁₀ products.

Pharma Nord is a Denmark-based company that has been committed to producing quality coenzyme Q₁₀ products for over 30 years. During the 1990s they funded numerous absorption and bioavailability studies on their **Bio-Quinone™ Active CoQ₁₀ GOLD** product. These studies confirmed that their patented oil mixture provided a crystal free product that is well absorbed.^{30,31,32}

Industry Acceptance

Pharma Nord's willingness to fund studies that document the superior absorbability of their Bio-Quinone CoQ₁₀ resulted in their products being selected to be used in a majority of the large clinical trials conducted around the world. To date, 78 human studies have been conducted using **Bio-Quinone Active CoQ₁₀ GOLD**, and 26 of these studies are randomized, double-blind, placebo-controlled studies with 30 or more participants.

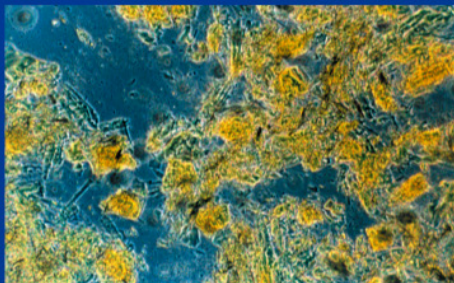
CoQ₁₀ & Immunity

The global COVID-19/coronavirus pandemic has made people much more conscious about taking steps to boost their immune system. Coenzyme Q₁₀ supports and/or enhances immune function in the following ways: stimulates production of red blood cells and hemoglobin³³, improves ratio between T4/T8 lymphocytes³⁴, increases production of natural killer cells³⁵ and stimulates the production of antibodies.³⁶ Thus, coenzyme Q₁₀ should be considered along nutrients like vitamin C and vitamin D, as important natural therapies to enhance immune function.

Bio-Quinone's Superior Absorbability

One of the world's leading coenzyme Q₁₀ scientists, Dr. Guillermo Lopez-Lluch of Spain, conducted a bioavailability study with seven of the leading coenzyme Q₁₀ formulations on the market. In this double-blind, crossover study, individuals were given a single 100 mg dose of CoQ₁₀ and plasma CoQ₁₀ levels were measured 48 hours after ingestion. Pharma Nord's Bio-Quinone was found to be from 3 to 10 times better absorbed than the other 6 brands tested.³⁷ This explains why Pharma Nord's Bio-Quinone has been the CoQ₁₀ product selected to be used

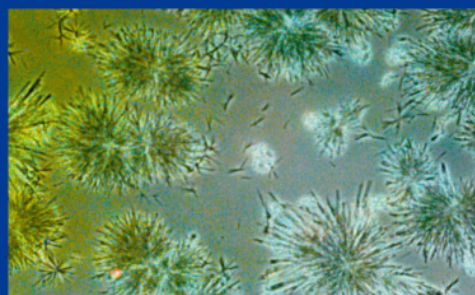
Pharma Nord's CoQ10 Stays in Solution



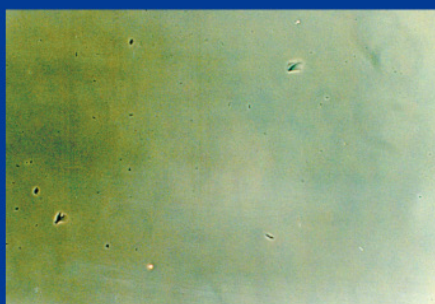
CoQ10
Crystals
⇄



Most formulations contain CoQ10 crystals in oil. Humans can not absorb crystals, we can only absorb single molecules.



Bio-Quinone Q10 undergoes a special heat treatment that changes crystals into snowflake-like structures with greater surface area which stay in solution



These "snowflakes" completely dissolve at body temperature and remain in solution, which provides better absorption and higher plasma CoQ10 levels

in the majority of large coenzyme Q₁₀ clinical trials around the world over the past thirty years.

The slide/image above shows how Pharma Nord's patented process keeps their coenzyme Q₁₀ in solution, which results in a product that is largely crystal free. Coenzyme Q₁₀ is an incredibly important nutrient, but in order to be effective, it must be well absorbed and bioavailable. That's why I use and recommend Pharma Nord's *Bio-Quinone Active CoQ₁₀ GOLD*.

To Order: Practitioners, if you would like to get product information or order Pharma Nord's Bio-Quinone for yourself or for your patients, send a request to: practitioner@pharmanord.com

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