Kaneka NUTRIENTS

Kaneka UBIQUINOL®
FOR HEALTHY AGING
Active antioxidant form of CoQ10

WHITE PAPER

Ubiquinol and the Science Behind Healthy Aging

Ubiquinol, the active antioxidant form of coenzyme Q10 (CoQ10), is naturally found throughout the body's cells, tissues, and organs and is vital for maintaining cellular integrity and function. It supports physiological processes crucial for healthy aging through its ability to neutralize harmful free radicals, protect energy-producing mitochondria from damage, and aid energy generation.

The efficacy of antioxidants in healthy aging is significantly influenced by their ability to reach the site of free radical generation. Ubiquinol is a powerful antioxidant, in part because it is lipid soluble and, therefore, acts in the lipid membrane of mitochondria, where the majority of free radicals originate.

However, ubiquinol levels taper off with age and as a result of cumulative environmental stressors. At the same time, the increase in free radicals associated with aging can contribute to oxidative stress, which may impair mitochondrial and cellular function, leading to premature aging. Supplementing with ubiquinol can replenish the body's ubiquinol levels, providing potent antioxidant protection at the cellular level.

In this white paper, we explore the science behind ubiquinol, its role in healthy aging, and the Kaneka Ubiquinol® difference.

Mitochondria: Cellular Energy Powerhouses — and Producers of Free Radicals

Maintaining mitochondrial health and proper function is vital for supporting healthy aging. In the human body, ingested sugars, fats, and proteins are transformed into energy through a series of reactions in the mitochondrial electron transport chain (ETC). As electrons move through the ETC, they enable the conversion of adenosine diphosphate (ADP) into adenosine triphosphate (ATP), the cell's primary energy molecule.

However, the process is not 100% efficient. As a normal part of cellular metabolism, some electrons leak and form superoxides. These molecules — highly unstable and reactive free radicals — are the primary form of reactive oxygen species (ROS), a category that also includes hydroxyl radicals, hydrogen peroxide, and other chemically reactive molecules containing oxygen.

While they are natural byproducts of carbon/oxygen metabolism and play a role in cell signaling, ROS, by definition, contain unpaired electrons, an instability that drives them to seek out and steal electrons from other molecules. This can cause damage to cell structures, including lipids, proteins, and DNA[1,2] — damage that can impair the ETC, disrupt mitochondrial membranes, and affect mitochondrial DNA integrity.[3] Furthermore, mitochondria damaged by free radicals release increased levels of ROS, creating a negative feedback loop that affects their own membranes and the cell at large, diminishing the body's capacity for efficient energy (ATP) production.[4,5]

The Detrimental Effects of Oxidative Stress on Healthy Aging

Oxidative stress — characterized by an imbalance between free radical molecules and protective antioxidants — can damage cell components, impairing mitochondrial and cellular function. The energetic, homeostatic, and cellular repair breakdowns that occur due to excess oxidative stress are further exacerbated by a natural decline in the body's antioxidative mechanisms over time. This decline is also associated with loss of mitochondrial function due to the detrimental effects of oxidative stress on mitochondrial DNA (mtDNA), including increased mutation rates. It is now thought that mutations to the mtDNA greatly contribute to the decline of cellular and organismal health that is manifest in aging.[6,7]

Mitochondrial DNA

Mitochondria are unique structures in the body in that they contain their own DNA, separate from the cell's DNA. Inherited solely from the mother, mtDNA controls the development and functional activities of the mitochondria and is subject to the same kind of cumulative oxidative damage that affects cellular DNA with aging.[7]

The decline in cellular function and mitochondrial integrity caused by excess free radicals is linked to premature aging in several ways. In addition to their role in cellular energy production, mitochondria are critical for cellular homeostasis and the health of the body as a whole. Mitochondrial repair, programmed cell death, redistribution of mitochondrial resources, and flow of key small molecules are essential to maintaining overall wellness. When these functions falter, it can trigger cellular changes that, over time, can impact bodily organs and systems, which can lead to common age-related health conditions.[8,9]

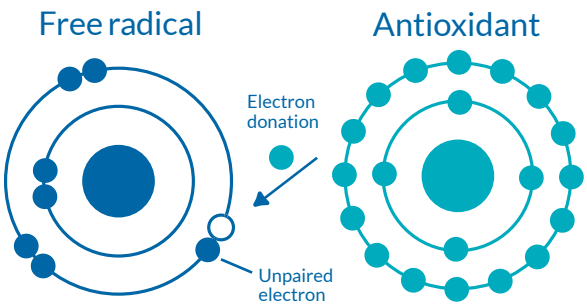
The cumulative effects of environmental exposure to pollution and lifestyle factors such as diet and stress levels can also negatively affect healthy aging by further intensifying oxidative stress.

Ubiquinol: A Superior Antioxidant

The Redox Reaction

CoQ10 is produced by the body and found in small amounts in certain foods. When its oxidized form, ubiquinone, is converted to ubiquinol, it becomes a powerful antioxidant that helps mitigate the damage caused by free radicals. Because ubiquinol is the reduced form of CoQ10, meaning it has received extra electrons, it can donate electrons to other molecules, giving it its antioxidant properties.

The process by which ubiquinone becomes ubiquinol and vice versa is a redox (reduction-oxidation) reaction. By donating electrons to free radicals, ubiquinol converts them into stable molecules that no longer seek electrons from vital cell components. It does this without destabilizing itself. This action interrupts the chain reaction of cellular damage. Once neutralized, the stable molecule can be utilized by the body in various biochemical pathways.

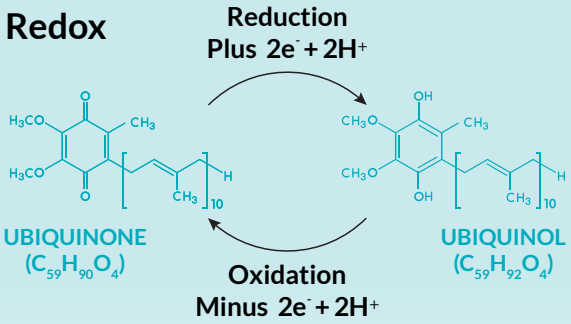


Lipid Solubility and Antioxidant Protection

Ubiquinol is the only lipid-soluble antioxidant synthesized in the body.[10] Its lipid solubility is a key characteristic, enabling it to effectively penetrate the lipid-rich membranes of cells and the mitochondrial double lipid membranes. This capability allows ubiquinol to neutralize free radicals precisely where they are most prolific — within the mitochondrial membranes themselves.

The Ubiquinone/Ubiquinol Redox Reaction

In addition to providing antioxidant protection, this redox reaction is essential for generating cellular energy and supporting mitochondrial function.



Reduction

Ubiquinone ($C_{59}H_{90}O_4$) is reduced to ubiquinol, accepting electrons from protein complexes in the ETC, such as Complex I (NADH: ubiquinone oxidoreductase) or Complex II (succinate dehydrogenase).

Oxidation

Ubiquinol ($C_{59}H_{92}O_4$) is oxidized to ubiquinone by transferring electrons to protein Complex III (cytochrome bc1 complex) in the ETC or to a free radical.

Water-soluble antioxidants, by contrast, are not effective in these environments due to their inability to act in lipid membranes. Ubiquinol's lipid solubility and concentration in the mitochondria give it a highly protective role in neutralizing harmful free radicals, reducing oxidative stress in the body and protecting cellular integrity.[9]

Ubiquinol is also found in the blood, bound to the blood lipids, including low-density lipoprotein (LDL) cholesterol. Here it plays an important role, helping to protect LDL cholesterol from oxidation.[11-14] When blood ubiquinol is depleted, oxidized LDL levels can increase, potentially impacting vessel health.

Protecting Mitochondrial Health

Ubiquinol helps maintain mitochondrial health, promoting the efficiency of the ETC to ensure effective energy production, and also facilitating other cell-critical mitochondrial functions. It plays distinct roles, including modulating gene expression and cellular repair mechanisms, as well as regulation and flow of small molecules.[4,15,16]

Regenerating Other Antioxidants

Ubiquinol also actively contributes to a healthy antioxidant response, playing a pivotal role in recycling and regenerating other antioxidants. It directly regenerates vitamin E and supports the regeneration of the antioxidant glutathione, which helps recycle vitamin C and vitamin E, further enhancing the body's antioxidant capabilities.[10]

Kaneka Ubiquinol®: Support for Healthy Aging

Starting around age 40, the body's ability to convert ubiquinone into ubiquinol naturally diminishes, which can lead to a reduction in ubiquinol levels and an imbalance of ubiquinol/ubiquinone in the blood. Even a balanced diet cannot replenish ubiquinol levels that have been diminished as a result of aging.[17] Thus, bioavailability becomes increasingly significant with aging and in the presence of oxidative stress.

Kaneka Ubiquinol®, a patented form of ubiquinol, is bioidentical to the body's natural ubiquinol and, unlike conventional CoQ10 supplements, requires no conversion in the body to provide potent antioxidant protection at the cellular level. When taken as a supplement, Kaneka Ubiquinol® has been shown to be two times better absorbed than conventional CoQ10.[18] Kaneka Ubiquinol® is shown in clinical trials to increase baseline blood ubiquinol levels by eight times in healthy adults taking 200 mg for at least 30 days.[19] In a consumer use study, 80% of post-menopausal women taking 200 mg Kaneka Ubiquinol® per day reported decreased irritability, sensitivity, stress, and mood swings after 60 days of supplementation.[20]

Supplementation with Kaneka Ubiquinol® supports healthy aging and has been shown in clinical trials to replenish and maintain plasma ubiquinol levels.[14] Healthy total CoQ10 levels in the blood have been correlated with better strength and physical function in older adults.[21,22] Higher blood ubiquinol levels also promote:

- Cardiovascular health[14]
- Muscle health[21]
- General health and well-being during menopause/post-menopause [20,23]

Partner With Kaneka for Advanced Healthy Aging Solutions

Kaneka Nutrients is committed to quality, efficacy, and consumer trust. Backed by decades of rigorous scientific research and extensive clinical experience, and produced using a patented manufacturing process, Kaneka Ubiquinol® offers superior bioavailability and a proven safety profile, positioning the ingredient as a superior product and a leader in the CoQ10 space.

Setting the Gold Standard in Ingredient Quality and Efficacy

At Kaneka Nutrients, we recognize that quality ingredients are the foundation of your high-quality products. That's why we have spent decades rigorously researching and testing our ingredients. Our commitment to quality, safety, reliability, and purity ensures the safety and efficacy of our ingredients, providing you with superior options you can trust to enhance your premium products.

Dedication to Scientific Research and Clinical Trials

With more than 30 years of clinical research on CoQ10 and more than 85 human clinical studies using Kaneka Ubiquinol®, including pivotal studies published in peer-reviewed journals such as *Regulatory Toxicology and Pharmacology*, Kaneka Nutrients has established a substantial body of evidence supporting the health benefits of Kaneka Ubiquinol®.

Kaneka Ubiquinol® is a trusted brand of ubiquinol used by researchers in clinical trials, including those funded by the National Institutes of Health. Clinical studies confirm the bioavailability and safety of Kaneka Ubiquinol® and demonstrate its benefits in areas like cardiovascular wellness, healthy aging, and preconception and menopausal health.

Patented, Proprietary Manufacturing Process

Kaneka Ubiquinol® is a proprietary CoQ10 made by non-genetically modified natural yeast strains through a patented microbiological fermentation process. This method ensures the production of the trans-isomer ubiquinol, which is bioidentical to the CoQ10 naturally produced in the human body. Our proprietary approach yields a pure, high-quality product, ensuring the body can use it effectively. It does not contain the impurities commonly found in synthetic CoQ10 ingredients.

Made in the USA

As a trusted leader in ubiquinol production in the United States, Kaneka Nutrients ensures the quality, reliability, and purity of our ingredients, delivering the safety and efficacy necessary to enhance your premium product formulations.

Get the Kaneka Ubiquinol® Advantage

Embrace the future of healthy aging by incorporating Kaneka Ubiquinol® into your product lineup. Whether you are a healthcare practitioner dedicated to enhancing patient outcomes or a supplement manufacturer striving to deliver top-tier products, Kaneka Ubiquinol® offers the scientific edge your clients need. Connect with us today to get the Kaneka Ubiquinol® advantage.

Contact Us

Nutrients.Sales@Kaneka.com

KanekaNutrients.com

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Nutrients.Sales@Kaneka.com

KanekaNutrients.com