



MEMBRANE MEND™



Supplement Facts

Serving Size: 5 mL (1 tsp.)	Amount	% Daily
Servings Per Container: 20	Per Serving	Value
Natural Astaxanthin (from <i>Haematococcus pluvialis</i> extract)	7mg	**
DeltaGold® Tocotrienols	10mg	**
Ahiflower® (refined <i>Buglossoides arvensis</i>) seed oil	150mg	**
Phosphatidylcholine (from purified sunflower seed lecithin)	460mg	**

**Daily Value not established

Other Ingredients: Water, glycerin, ethanol, tocopherolan, natural citrus oils, antioxidants (rosemary extract, natural tocopherols, ascorbyl palmitate)

Membrane Mend is a synergistic blend of phosphatidylcholine, plant-based essential fatty acids, astaxanthin, and tocotrienols designed to promote the health and resilience of cell and organelle membranes.

THE SCIENCE OF BIOLOGICAL MEMBRANES

Every cell and organelle in the human body is encapsulated by a biological membrane composed of orderly lipid molecules called phospholipids. Biological membranes maintain the architecture and physiology of cells and organelles and serve as the initiation point for critical intracellular signaling pathways.¹

THE COMPOSITION OF BIOLOGICAL MEMBRANES

Biological membranes are composed primarily of phospholipids. Phospholipids create a barrier to the passage of molecules and ions in and out of cells, allowing cells to carefully monitor their environment. The predominant phospholipid in biological membranes is phosphatidylcholine. Unsaturated fatty acids, such as alpha-linolenic acid (ALA), are interspersed within the phospholipid bilayer, lending fluidity to cell membranes.² Carotenoids and vitamin E molecules, including the tocopherols and tocotrienols, nestle inside biological membranes, acting as sentinels that rapidly address oxidative threats to the membrane.

BIOLOGICAL MEMBRANES ARE ESSENTIAL FOR CELL AND ORGANELLE FUNCTION

The cell membrane is the interface between the body's extracellular space and the complex intracellular milieu. The three most significant lipids in cell membranes are phospholipids, glycolipids, and cholesterol; phosphatidylcholine accounts for 23 percent of the lipids in cell membranes, making it an integral component of the cellular interface.³

Mitochondria, the minuscule yet powerful energy factories of our cells, have their own biological membranes. Intact mitochondrial membranes ensure the maintenance of mitochondrial membrane potential.⁴ Factors that damage mitochondrial membranes compromise this membrane potential. Because mitochondria generate the energy necessary for every cell and tissue in the body, these organelles' structural and functional integrity is paramount.

The endoplasmic reticulum (ER) is a network of membranous tubules studded with ribosomes involved in protein and lipid synthesis. The ribosomes are tiny particles consisting of RNA that synthesize polypeptides and proteins. The ER is intrinsically involved in the synthesis of steroid hormones, including estrogen and testosterone.

BENEFITS & APPLICATIONS:

- Repairs damaged lipid membranes
- Reduces cellular inflammation
- Optimizes cellular energy generation
- Promotes detoxification
- Improves intestinal barrier function
- Supports hormone synthesis
- Improves brain function
- Protects membranes against oxidative stress

The Golgi apparatus is a complex set of folded membranes inside the cell involved in the transport, modification, and packaging of proteins and lipids. It synthesizes the peptide-based fibers of the intracellular matrix. Like mitochondria, the ER and Golgi apparatus are encased in phospholipid membranes.

Without intact, healthy biological membranes, our cells cannot function properly, and our health may suffer as a result. Unfortunately, modern life is rife with factors that compromise biological membrane integrity, including environmental toxins, infectious agents, and chronic stress.

THE MODERN LIFESTYLE COMPROMISES MEMBRANE INTEGRITY

A variety of modern-day factors disrupt the integrity and health of biological membranes. Anthropogenic pollutants, such as particulate matter, pesticides, and heavy metals damage mitochondrial membranes, impairing ATP production.^{5,6} Environmental toxins also damage the delicate lipid membranes of the endoplasmic reticulum. A growing body of research indicates that ER damage is a significant contributor to chronic disease processes, including cardiometabolic and neurodegenerative diseases.^{7,8} Alterations to membrane lipids generate unhealthy conditions inside of cells and organelles. Conversely, restoring membrane lipid composition may improve cellular and organelle integrity and, subsequently, the health of the entire body.”¹

Other aspects of the modern lifestyle, including antibiotic use and non-native electromagnetic fields disrupt cell and organelle membranes.^{9,10} Fortunately, nutraceutical formulations like Membrane Mend can be used to repair and maintain the integrity of our biological membranes.

THE THERAPEUTIC POTENTIAL OF SUPPLEMENTAL MEMBRANE LIPIDS

The body accumulates damaged membrane lipids throughout lifetime, resulting in decrements in cellular and organelle function. Membrane lipid therapy aims to normalize and optimize membrane lipid composition and support healthy cellular function by supplying supplemental membrane lipids to replace damaged lipids. Supplemental PC is the cornerstone of membrane lipid therapy and the main ingredient in Membrane Mend. Through its effects on membrane integrity, supplemental PC improves many aspects of health, ranging from optimization of energy production to hormone synthesis.

OPTIMIZE ENERGY PRODUCTION

The mitochondrial membrane potential is a proton electrochemical gradient across the inner mitochondrial membrane that produces the potential energy necessary to create ATP, our cellular energy “currency.”¹¹ PC is an essential element of mitochondrial membranes, and damage to these membranes disrupts the membrane potential and ATP production. Membrane lipid therapy repairs mitochondrial membranes, restoring the membrane potential and energy production while reducing fatigue.¹²

PROMOTE DETOXIFICATION & PROTECT THE LIVER

Phosphatidylcholine solubilizes bile acids, ushering toxins out of the body via the stool. PC also offers hepatoprotective effects, guarding the liver against anthropogenic toxins, such as solvents, as well as the deposition of hepatic fat triggered by the pro-inflammatory Western diet and lifestyle.^{13,14}

IMPROVE INTESTINAL BARRIER FUNCTION

Intestinal epithelial cells harbor membranes enriched in phosphatidylcholine.¹⁵ A variety of inflammatory triggers, including NSAIDs and the Western diet, may disrupt intestinal epithelial cell membranes, compromising gut health. Emerging research indicates that membrane lipid therapy may reduce gut inflammation in inflammatory bowel disease, reverse increased intestinal permeability (aka “leaky gut”) and protect the gastrointestinal mucosa from pathogens such as *Helicobacter pylori*.^{16,17,18}

BOLSTER BRAIN FUNCTION

As we age, the composition of our neuronal membrane lipids changes, adversely affecting neuronal signaling. Supplemental phosphatidylcholine may support healthy neuronal membranes, improving neurotransmission and protecting brain function as we age.¹⁹ Supplemental phospholipids may also aid recovery from traumatic brain injury (TBI) by replacing oxidized lipids in neuronal membranes, improving neuronal function.²⁰

SUPPORT HORMONE SYNTHESIS

The smooth endoplasmic reticulum is the site of hormone synthesis, including that of testosterone, estrogen, and thyroid hormones.^{21,22} Without intact ER membranes, hormones cannot be synthesized in adequate amounts. Restoration of ER membranes with supplemental PC may thus improve hormone synthesis and secretion.

ESSENTIAL FATTY ACIDS OFFER ADJUNCT SUPPORT FOR HEALTHY MEMBRANES

Phospholipids aren't the only lipid molecules that support healthy biological membranes; essential fatty acids (EFAs) also play vital roles in membrane health. Linoleic acid (LA), alpha-linolenic acid (ALA), gamma-linolenic acid (GLA), and stearidonic acid (SDA) work together to support the health and function of cell membranes while also reducing inflammation. LA and GLA are omega-6 fatty acids, or polyunsaturated fatty acids with their first double bond in the n-6 position. ALA and SDA, on the other hand, are omega-3 fatty acids.

While both omega-6 and omega-3 fatty acids are essential, a delicate balance between these two fats must be achieved to promote optimal membrane health and function. Our formula provides the ideal ratio of omega-6 to omega-3 in the form of Ahiflower[®] oil, a plant-based fatty acid blend derived from *Buglossoides arvensis* that has been shown to increase circulating and tissue levels of omega-3 fatty acids.^{23,24}

MEMBRANE-TARGETED ANTIOXIDANTS SUPPORT CELL AND ORGANELLE HEALTH

Defects in biological membranes trigger oxidative stress. Oxidative stress is a hallmark of numerous disease processes, including metabolic syndrome, cardiovascular disease, and chronic fatigue syndrome. While supplemental phospholipids supply the raw materials needed to restore healthy cell membranes, membrane-targeted antioxidants are equally crucial for protecting delicate membrane phospholipids against oxidative stress.

Carotenoids are vitamin A precursors and natural pigments that impart vegetables and fruits with yellow, orange, and red colors. While β -carotene is the most well-known carotenoid, it is but one of more than 750 carotenoids that have been characterized to date. Astaxanthin is a carotenoid abundant in marine life, including krill, shrimp, wild salmon, and certain microalgae species that confer these organisms with a rich pink color. Unlike β -carotene, astaxanthin cannot be converted into vitamin A. However, it is a potent lipid-soluble antioxidant that supports biological membrane integrity, protecting delicate membrane phospholipids against oxidative stress.²⁵ It has a particular affinity for mitochondrial membranes, where it squeezes itself in-between phospholipids to provide frontline protection against oxidative stress. The absorption of astaxanthin is increased when it is consumed with omega-3 rich oils. The combination of astaxanthin with Ahiflower[®] EFAs may enhance this unique carotenoid's bioavailability, providing maximal support for healthy cell and organelle membranes.

Astaxanthin has secondary effects beyond its antioxidant potential. It activates AMPK, an evolutionarily-conserved pathway present in all complex life forms that is a central regulator of metabolism and energy and an exquisite nutrient sensor. It also promotes mitochondrial biogenesis, upregulates tight junction proteins, and protects the kidney against inorganic mercury toxicity.

Tocotrienols are compounds within the vitamin E family with powerful antioxidant properties. Delta tocotrienol is a highly-bioavailable form of tocotrienol that quenches free radicals with membrane-damaging potential, supporting membrane

integrity. Our formula combines delta tocotrienols with phosphatidylcholine, astaxanthin, and Ahiflower® fatty acids for comprehensive membrane support.

IN THIS FORMULA:

Phosphatidylcholine: Phosphatidylcholine (PC) provides the building blocks for cell membranes. Exogenous PC administration has been shown to repair damaged lipid membranes, restoring healthy cellular and mitochondrial function. Our formula contains injectable-grade PC, offering PC of unsurpassed quality and bioavailability.

Astaxanthin: Astaxanthin protects delicate membrane lipids against oxidative stress, preserving biological membrane integrity. Our astaxanthin is sourced from microalgae, making it suitable for vegans and those with shellfish allergies.

Ahiflower® Plant-Based Essential Fatty Acids: Ahiflower® is a blend of plant-based essential fatty acids that include linoleic acid (LA), alpha-linolenic acid (ALA), gamma-linoleic acid (GLA), and stearidonic acid (SDA) that, together, support the health and function of cell membranes. This omega-3-rich blend reduces inflammation and supports the fluidity and the integrity of cell and organelle membranes.

Delta Tocotrienols: Delta tocotrienol quenches membrane-damaging free radicals to support membrane integrity.

Quicksilver Delivery Systems® improves upon liposomal and emulsification technology with smaller, more stable particles made from the highest-grade ingredients available. In addition to exceptional absorption rates, these tiny liposomal and nanoemulsified particles increase diffusion across mucous membranes, enhance lymphatic circulation of nutrients and support cellular delivery.

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