needed.®

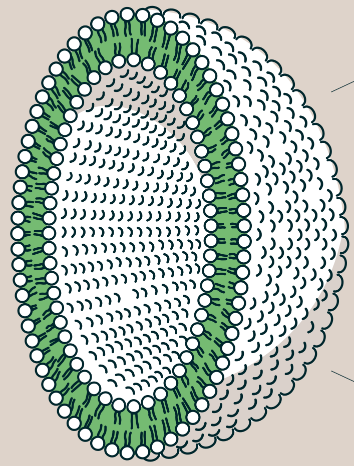
We take our cues from Mother Nature, and back her up with scientific rigor and real world testing.

Our Omega-3 is delivered in liposomes – a molecular structure found in nature. Liposomes are nature's way of carrying Omega-3 in breastmilk.

Within our liposomes, our Omega-3 is delivered with other nutrients needed for utilizing Omega-3, is clinically-proven to be 5x better absorbed than standard fish oil pills (read our clinical study results at thisisneeded.com/study), and is protected from harmful oxidation that often leads to rancidity (a common problem with standard Omega-3 supplements).

We created our liposomes in partnership with the world's leading experts in liposomal delivery, BioUp. Together, we perform highly controlled manufacturing procedures and verify that every batch results in optimally-made liposomes.

Pair Omega-3 with natural helper nutrients, including phospholipids from sunflowers. Our phospholipids are also a good source of choline, a nutrient that works synergistically with DHA and further supports a healthy pregnancy.*



Facilitate near-perfect Omega-3 absorption (90-95%, a 5x improvement over a standard pill).*

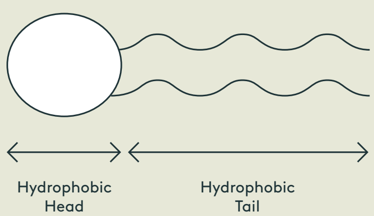
Protect the Omega-3 from harmful oxidation that leads to rancidity.

√ Expertly-formulated | √ Clinically-validated | √ Third-party tested

What is a liposome?

A liposome is a molecular aggregate made of one or more lipid (fat) bilayers forming
a closed, spherical structure with an
internal cavity.

A lipid bilayer is a membrane made of two layers of lipids called phospholipids. Phospholipids, unlike most other lipids, are made of a charge carrying, hydrophilic (water-loving/fat-hating) head and an uncharged, hydrophobic (fat-loving/water-hating) tail.



To form a bilayer, "like" groups with "like" - meaning that the hydrophobic tails face towards each other, allowing for the hydrophilic heads to face outwards (towards the exterior of the liposome) and inwards (towards the internal cavity of the liposome). See the diagram above.

Liposomes are important in nature because of their role:

1. in solubility - they make lipophilic/hydrophobic (fat-loving/water-hating) molecules effectively soluble in water or other aqueous solutions (such as intestinal fluid).
2. as a stable carrier - they can carry other molecules. They protect those molecules and themselves (i.e. the structure stays intact) through processes where they might otherwise get broken down, such as in the acidic stomach
3. in bioavailability – they often present the other molecules they carry in a form that improves their absorption by modifying or facilitating their interaction with cells

Liposomes form naturally in the body during the processes of exocytosis (secretion of molecules out of a cell), endocytosis (uptake of molecules into a cell), and transport of materials within the cytoplasm or in breastmilk, among others.

And, they can be created outside of the body to be injected (in pharmaceutical drug applications), orally ingested, or dermally applied.

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What is special about our Liposomes?

Our liposomes are modeled after the liposomes found in breastmilk and are specifically designed to optimally deliver more of the Omega-3 you and your baby need. Our liposomes are formed from a single bilayer that carries the fat soluble nutrient, Omega-3, in the bilayer itself. This arrangement and the size of our liposomes improve the uptake of, and offer protection to, the Omega-3. Additionally, our liposomes are made from other natural ingredients, including Phospholipids from sunflower lecithin that contain Choline, both of which are important nutrients for you and your baby.

Mother Nature got it right, we look to her when creating our Liposomes.

Our Omega-3 is as close to its natural state, and synergistic with the body, as it gets.

- Our liposomes are made with only natural and high quality ingredients, both in processing and in the end product. This is uncommon for commercially made liposomes.
- Our liposomal structure itself – the assembly into bilayers is natural – is found in nature again and again, including in breastmilk
- Our liposomes have the same submicron particle size range that is found in nature; this size is the "right" one for interaction with bile salts and enzymes for the final step of digestion

How do our Liposomes improve uptake and protect the Omega-3?

The bilayer structure of our liposomes stays intact before consumption (protecting the Omega-3 from exposure to air, which leads to oxidation causing harmful rancidity) and throughout its passage through the stomach once consumed. (We know this from in vitro studies with simulated gastric fluid).

In the small intestine, our liposomes mix with aqueous intestinal fluid and are poised for the last stage of digestion. The size and arrangement of our liposomes allow for easier mixing with bile salts and enzymatic hydrolysis (clipping of the Omega-3 triglycerides and phospholipids by enzymes). This readies our liposomes' components, including the Omega-3, for uptake by enterocytes (absorptive cells) lining the small intestine. As a result, more "quality" Omega-3 is absorbed.

How is Needed best-positioned to create these liposomes?

Experience. Replicating nature and so finely tuning these liposomes is not easy to do. Our team has over two decades of experience perfecting liposomes in the injectable drugs space starting at Caltech to ultimately becoming a multi-billion dollar drug for Gilead. They have built upon those years of experience with more than ten years working to create the best liposomes for our supplements.

What is important about the size and arrangement of our Liposomes (if you really want to dig-in)?

1. **They are single bilayer versus multi bilayer liposomes**
    a. Multi bilayer liposomes must be broken apart to create a single layer, creating extra work and inefficiency for the body

2. **The Omega-3 is held in the bilayer itself**
    a. Most commercially-made liposomes carry water soluble nutrients. Importantly, in nature, liposomes are generally only formed with fat-soluble nutrients, like the Omega-3 we use. The benefits of liposomes are far less effectively pronounced with water-soluble nutrients for two main reasons:
        i. First, any encapsulated nutrient is carried in the internal cavity (volume in contact with the interior facing hydrophilic heads), rather than in the bilayer. The nutrients are therefore further away from the surface of the liposomes, and the bilayer must be broken apart to release the nutrients for absorption.
        ii. Second, in formation of the liposomes, often very little of the nutrient gets encapsulated within the internal cavity. The majority of the water soluble nutrients are "happy" staying in the aqueous solution outside the exterior facing hydrophilic heads. So, the majority of the nutrient is often left effectively unprotected outside of the liposome structure in whatever aqueous solution the liposomes are made in.
    b. We've created a novel process to encapsulate Omega-3 (a fat-soluble nutrient) within the bilayer itself, so it mimics liposomes found in nature (i.e. in breastmilk) and is perfectly "tuned" for uptake because it sits so close to the surface of the liposome.

3. **They leverage the right molecular ratio of nutrient to lipid to maximize the amount of Omega-3 they carry while retaining stability**
    a. To make a bilayer structure carrying a nutrient, the right ratio of phospholipid to nutrient is needed. The ratio (molecular ratio: weight divided by molecular weight, the number of molecules) varies by nutrient. Significant testing is required to determine the appropriate ratio, and we've optimized this for Omega-3

4. **They leverage the right lipid molecules to produce a bilayer structure with the right size and molecular curvature**
    a. Charge impacts packing geometry - how "easily" and how "tightly" the phospholipids get packed to form a bilayer, how much of the nutrient can be packed into that bilayer, and how much surface area the liposome has. A greater negative charge on the head group allows for easier self-assembly into liposomes. The greater the charge, the smaller the radius and tighter the curve, i.e the less surface area. However, if negative charge is too strong, the liposomes' bilayers will be too tightly packed - and, there is not enough room for the nutrient within the bilayer. At the other extreme, liposomes made without any charged phospholipid component are prone to aggregation; they lack the "like-repels-like" repulsion of charged surfaces. There is a balance in creating optimal liposomes and we have found that balance through many years of R&D

5. **The molecular dispersion found in our liposomes dramatically improves bioavailability of the Omega-3**
    a. Molecular dispersion refers to the fact that the Omega-3 is dispersed down to the molecular level within the bilayer of our liposomes. The phospholipids making up the bilayer separate individual molecules of the Omega-3 that are interspersed in the fatty tail portion of the membrane. This leaves all of the Omega-3 sitting at or just 1 molecular width away from the outer surface, i.e. readily accessible for the last stage of digestion. Without the bilayer structure, the Omega-3 molecules would all be clumped together in chyme (gastric juices based emulsion from the stomach) and many molecules would be far away from the surface of chyme droplets and not easily accessible for digestion.
        i. The typical diameter for our liposomes is about 0.25 microns, compared to about 25 microns for a chyme droplet that enters the duodenum from the stomach. On a crude geometry level, for fixed total mass for a collection of spheres the total surface area is inversely proportional to diameter, so the liposomes provide a 100-fold enhancement. However, because the liposomes are hollow and and all the mass is in a single bilayer, the calculated geometric enhancement is even greater. A chyme droplet is a non-hollow structure so it has a lot of material in the center of the structure that is hard to access for uptake.