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Smart



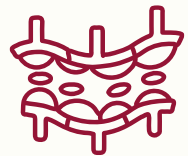
The **New Gold Standard** in Precision **Brain Nutrition**

A Scientific Review of a
Biomimetic Lipid Architecture
for Superior Omega-3 Delivery
and Neuroprotection

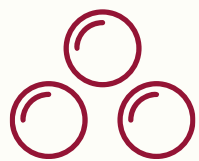


The Central Challenge: The Brain's Selective Gatekeeper

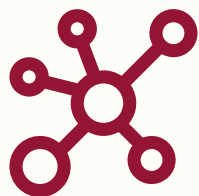
The central nervous system exhibits a highly specialized lipid architecture; therefore, long-chain omega-3 fatty acids (EPA and DHA) are essential for its structural and functional integrity. However, their effective incorporation from diet remains limited.



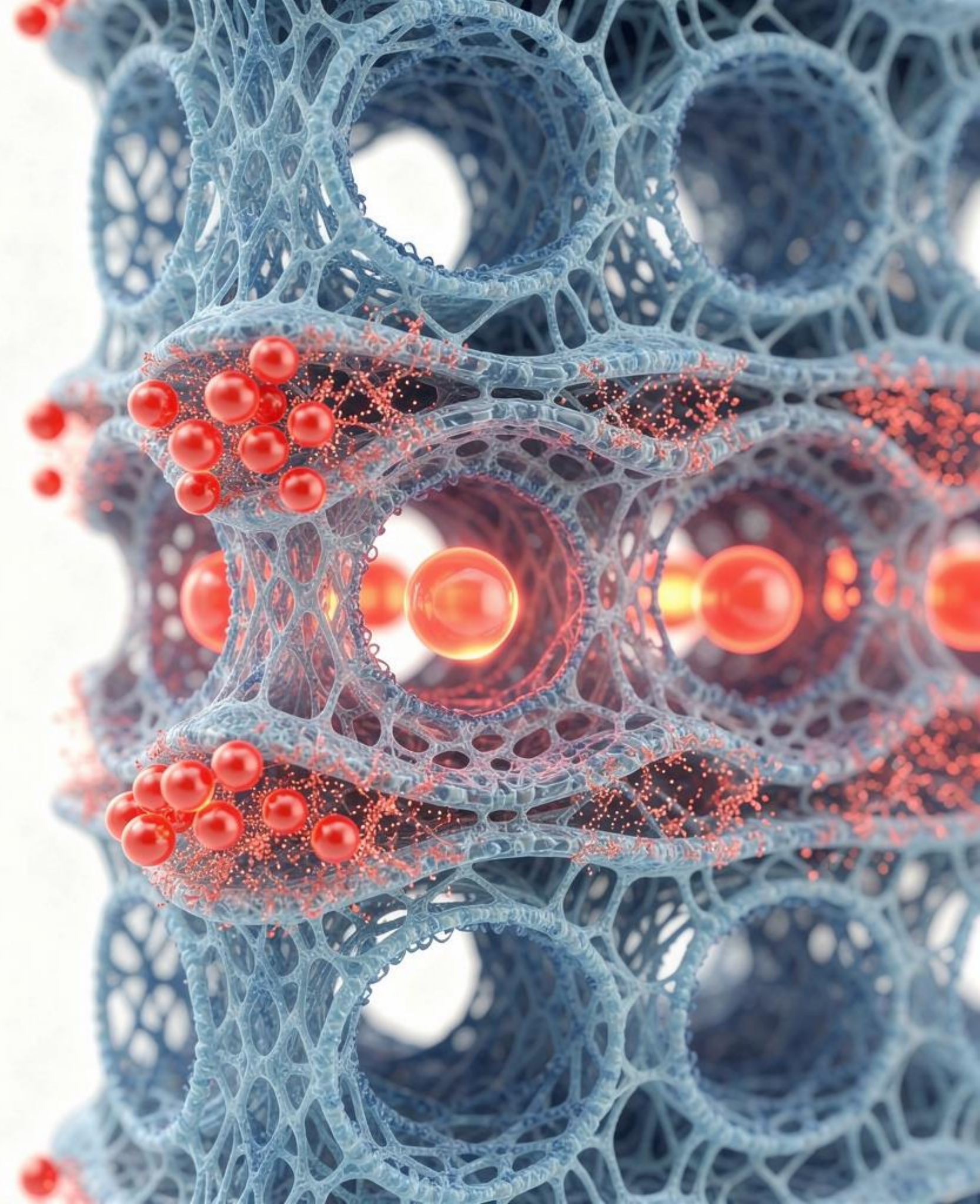
The Obstacle: The Blood-Brain Barrier (BBB) strictly controls nutrient entry.



The Limitation: Conventional Omega-3 forms triacylglycerols (TAG) and ethyl esters (EE) have only marginal capacity to cross the BBB.



The Reason: They lack the specific molecular structure required by the brain's dedicated transport systems [1].

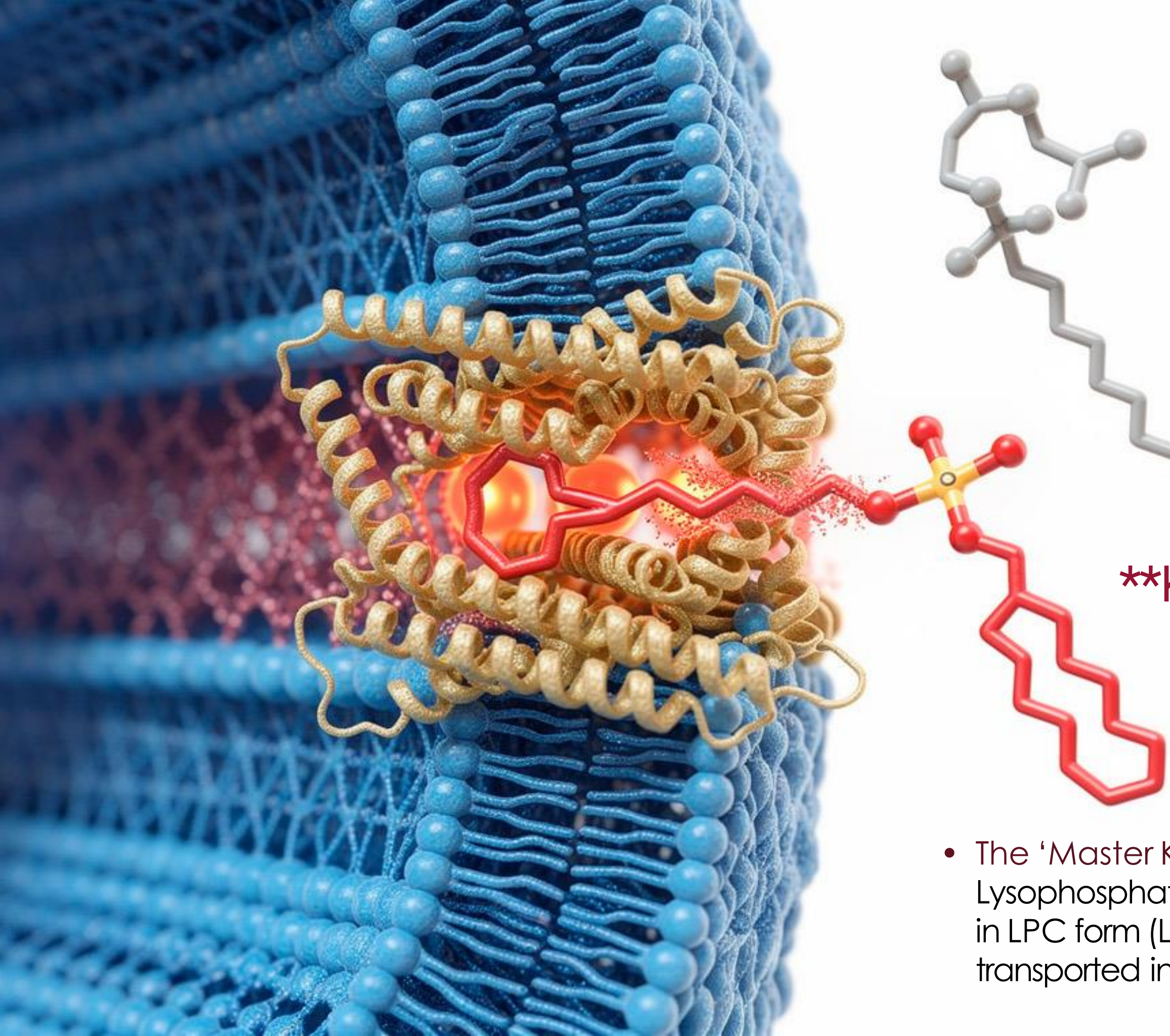


Unlocking Brain Access: Nature's Own Delivery System

Scientific evidence reveals the brain's highly selective transport mechanism for Omega-3s. **The Mfsd2a transporter, located in the BBB endothelium,** is the exclusive *gateway for DHA* and EPA into the central nervous system.

Key Mechanism

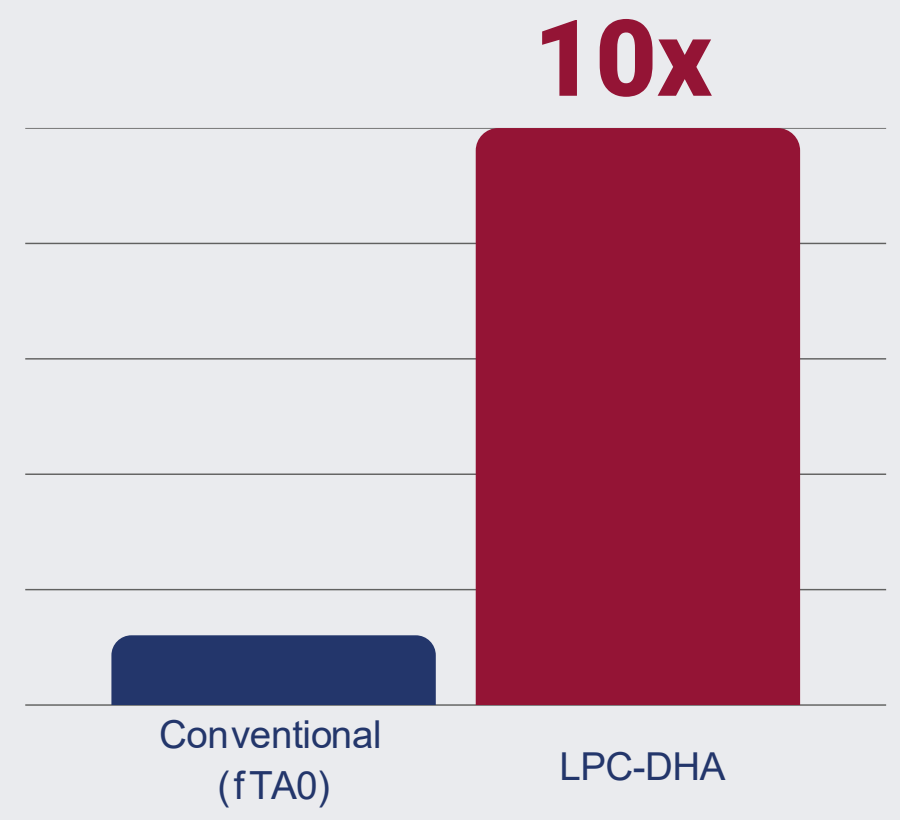
- The Transporter: Mfsd2a exhibits high specificity for Omega-3s bound to a specific carrier molecule [2].
- The 'Master Key*. This carrier is Lysophosphatidylcholine (LPC). DHA and EPA must be in LPC form (LPC-DHA, LPC-EPA) to be actively transported into the brain [2].



Quantifying the Efficiency of LPC-Mediated Transport

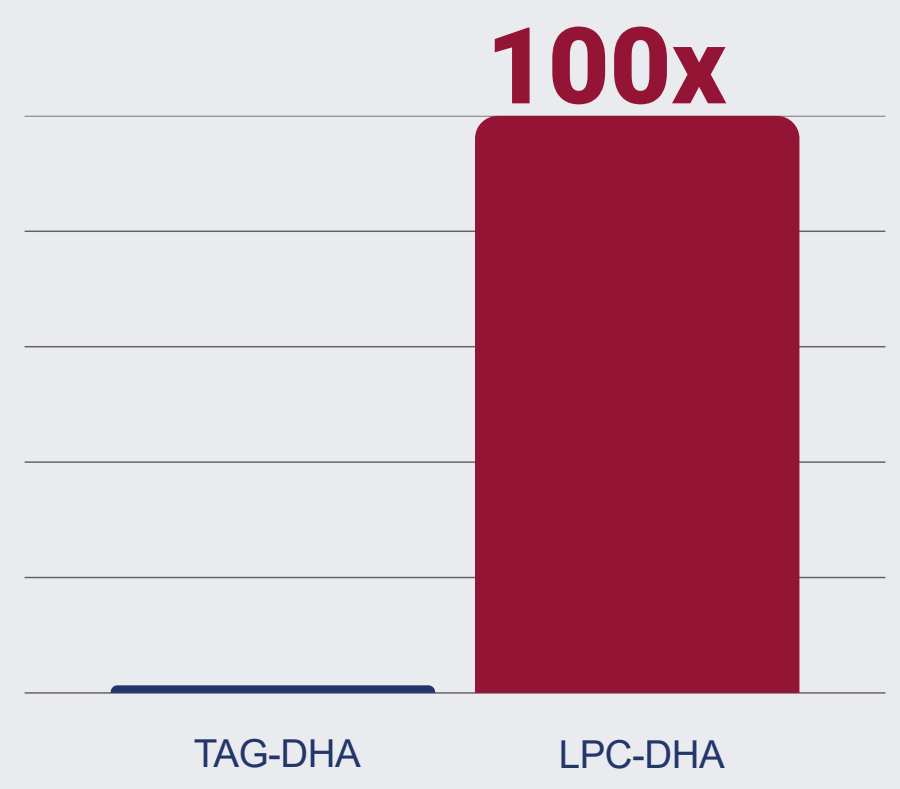
The use of the LPC carrier is not a minor improvement; it represents a paradigm shift in bioavailability for neural and retinal tissues.

10x Higher Brain Delivery



LPC Omega-3 delivers DHA to the brain with up to tenfold greater efficiency compared to conventional forms of Omega-3 [3].

100x Higher Retinal Delivery



For the retina, one of the body's highest DHA concentration sites, LPC DHA is up to 100 times more efficient than TAG-DHA [4].

5x More Efficient Transgenerational Enrichment

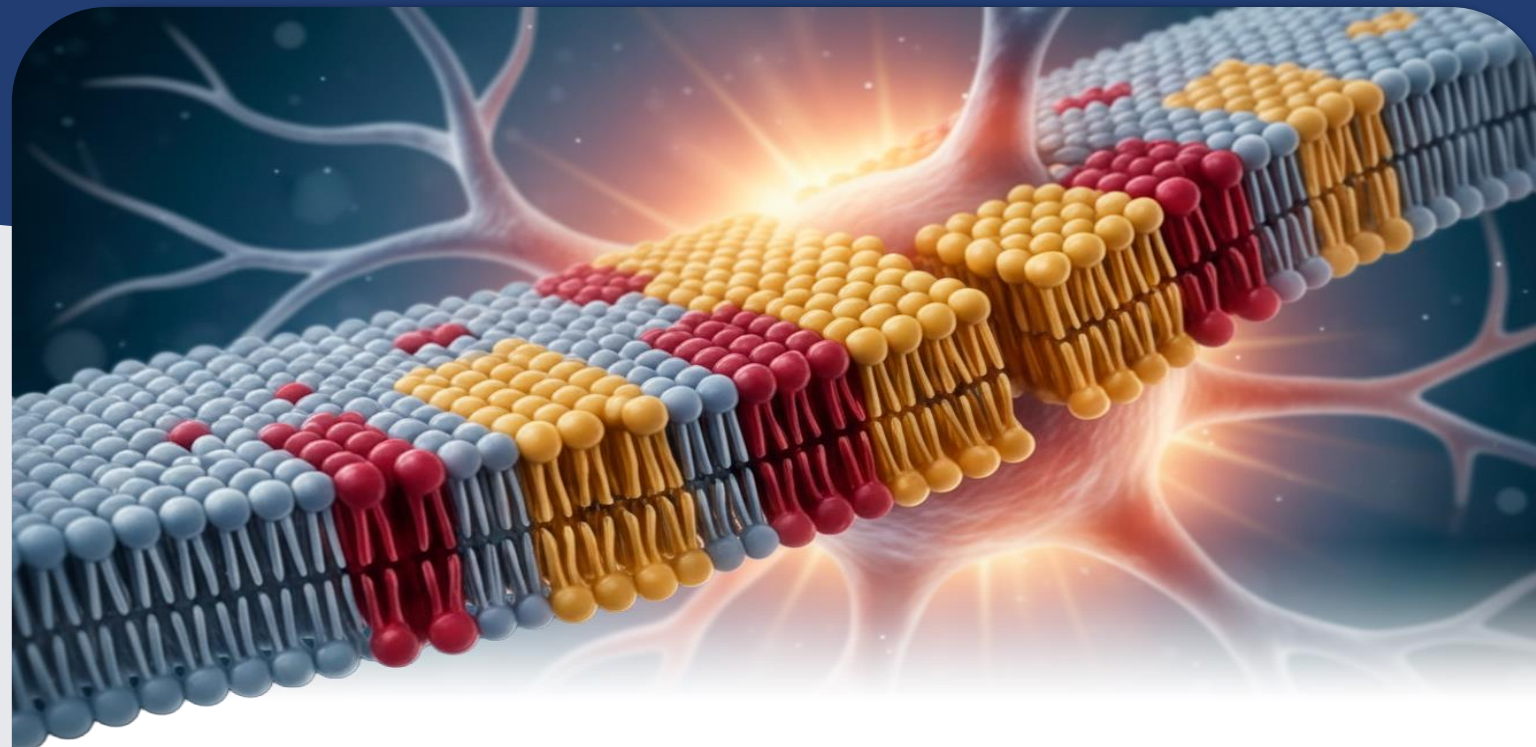
Maternal supplementation with LPC-DHA enriches breast milk, and consequently the infant's brain and retina, with up to fivefold greater efficiency than standard fish oil [5].



Beyond Delivery: Active Remodeling of the Cerebral Environment

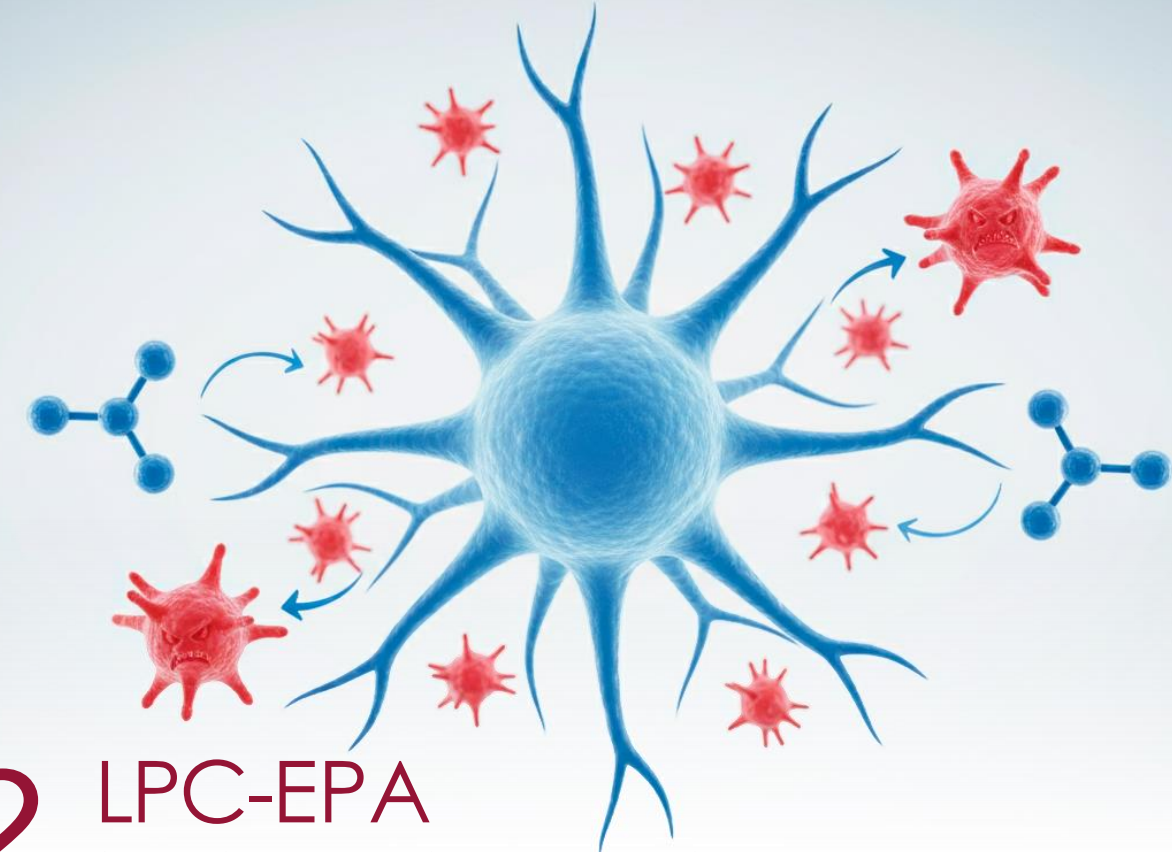
LPC-Omega-3s don't just accumulate in the brain; they actively reprogram its metabolic and signaling environment.

Functional Duality



1 LPC-DHA for Structure & Cognition

- Increases Brain-Derived Neurotrophic Factor (BDNF), improving spatial learning and memory [6]
- Provides the structural foundation for lipid rafts, the infrastructure for cerebral communication [7].



2 LPC-EPA for Inflammation Resolution

- Crosses the BBB and acts as a precursor for E-series resolvins, potent pro-resolving mediators [8]
- Critical for addressing chronic neuroinflammation often linked to depressive disorders [7].



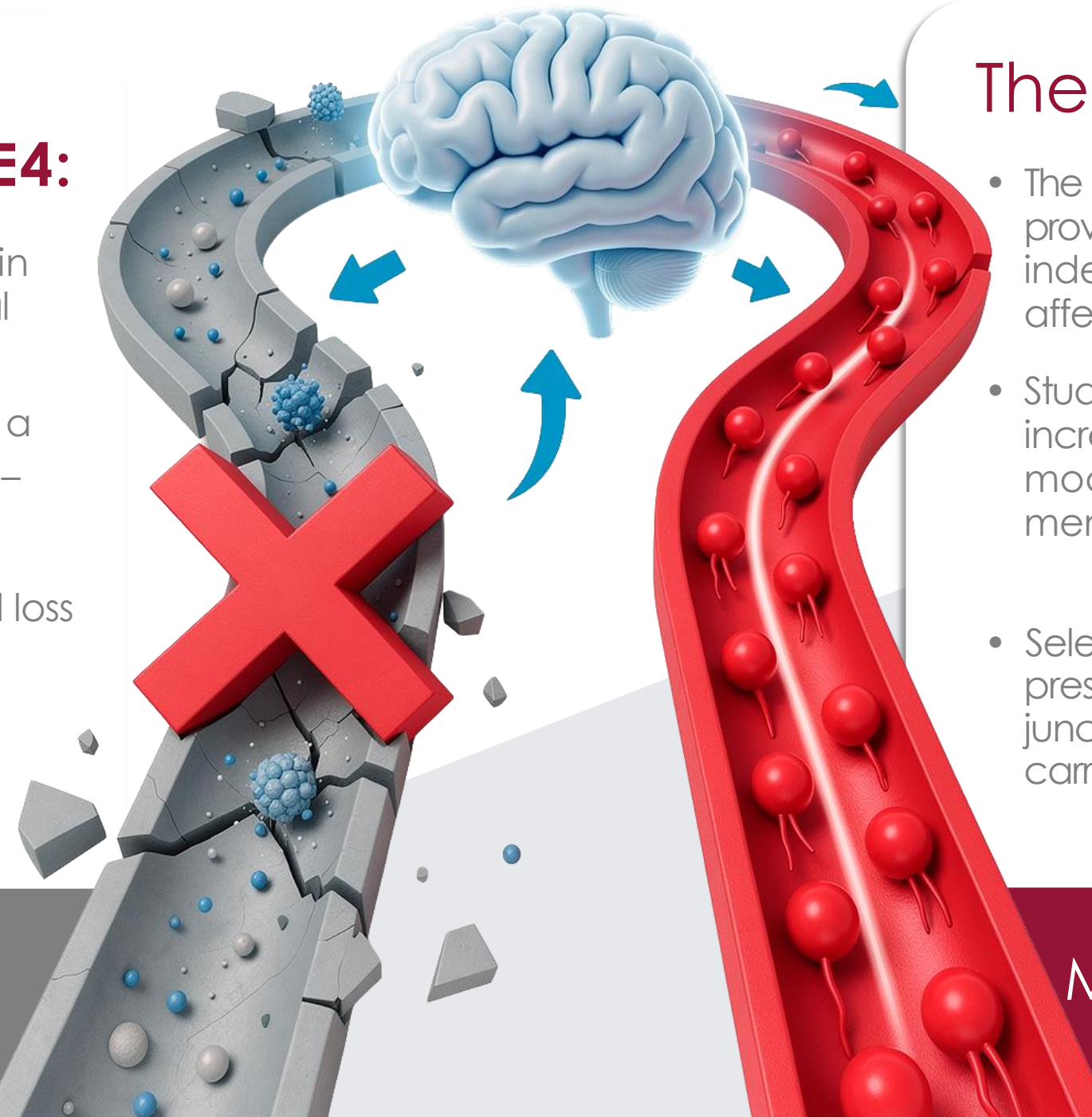
Overcoming Genetic Constraints: The APOE4 Advantage

The APOE4 allele, the primary genetic risk factor for Alzheimer's disease, impairs conventional Omega-3 transport. Ruby-O Smart's mechanism circumvents this critical limitation.

The Problem with APOE4:

- Associated with a systemic defect in omega-3 transport via conventional lipoprotein pathways [9].
- The APOE4 allele is associated with a more fragile and permeable blood-brain barrier [10].
- Oxidation of cerebral lipid rafts and loss of neuronal membrane fluidity [10].

Conventional
Lipoprotein Pathway



The LPC Solution:

- The Mfsd2a transports omega-3 and provides a brain entry route that is independent of the lipoprotein pathways affected by APOE4 [2]
- Studies show LPC-DHA/EPA significantly increases brain Omega-3 levels in APOE4 models, reducing anxiety and improving memory [9]
- Selective LPC-DHA delivery contributes to preserving blood-brain barrier tight junction integrity, particularly in APOE4 carriers.[10]

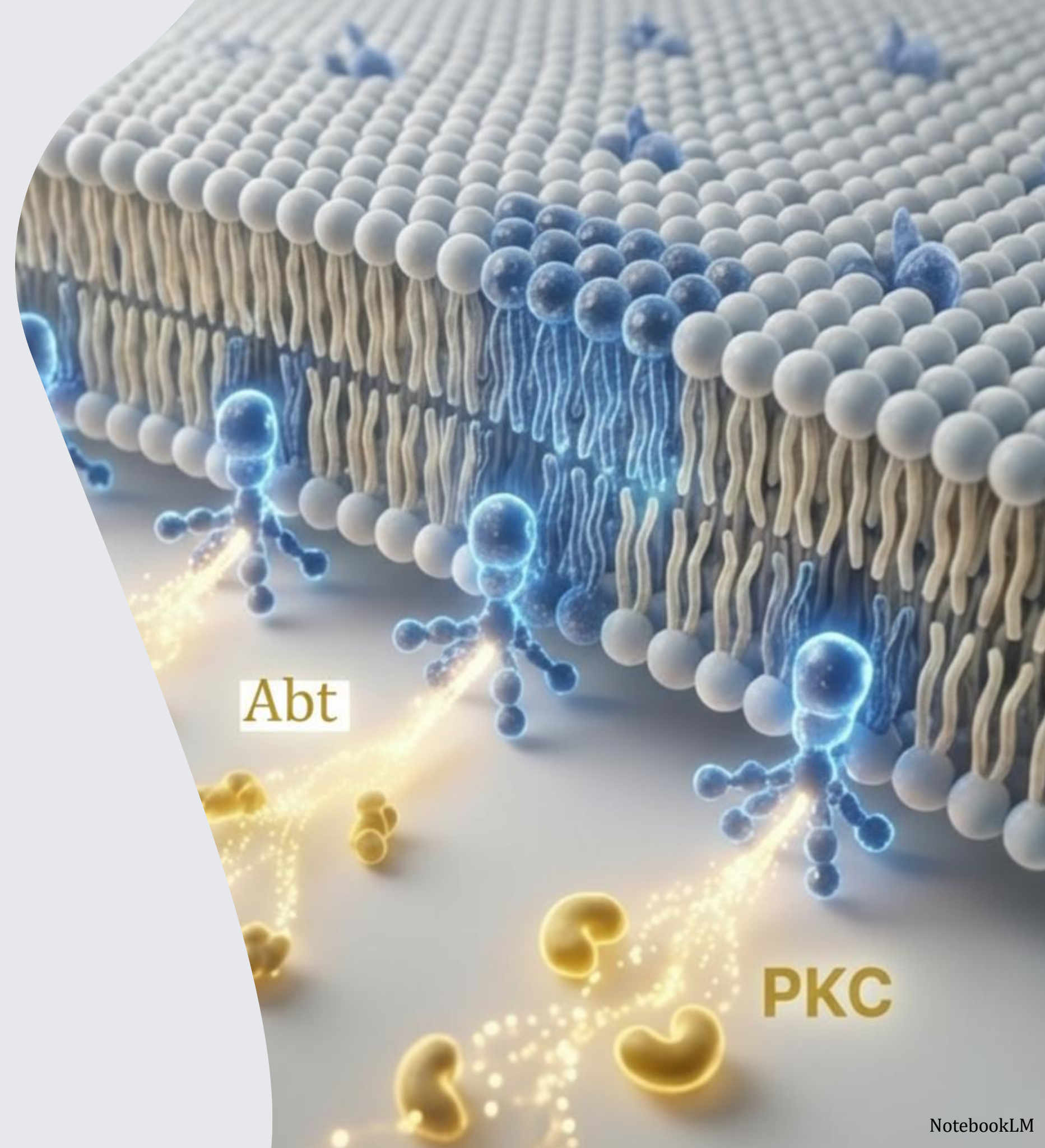
Mfsd2a Transporter
Pathway

Pillar II: Phosphatidylserine (PS) for Neuronal Survival and Protection

Beyond efficient delivery, protecting existing neuronal architecture is critical. Phosphatidylserine (PS), especially when esterified with DHA/EPA, is essential for cellular survival and signaling.

Mechanism of Action

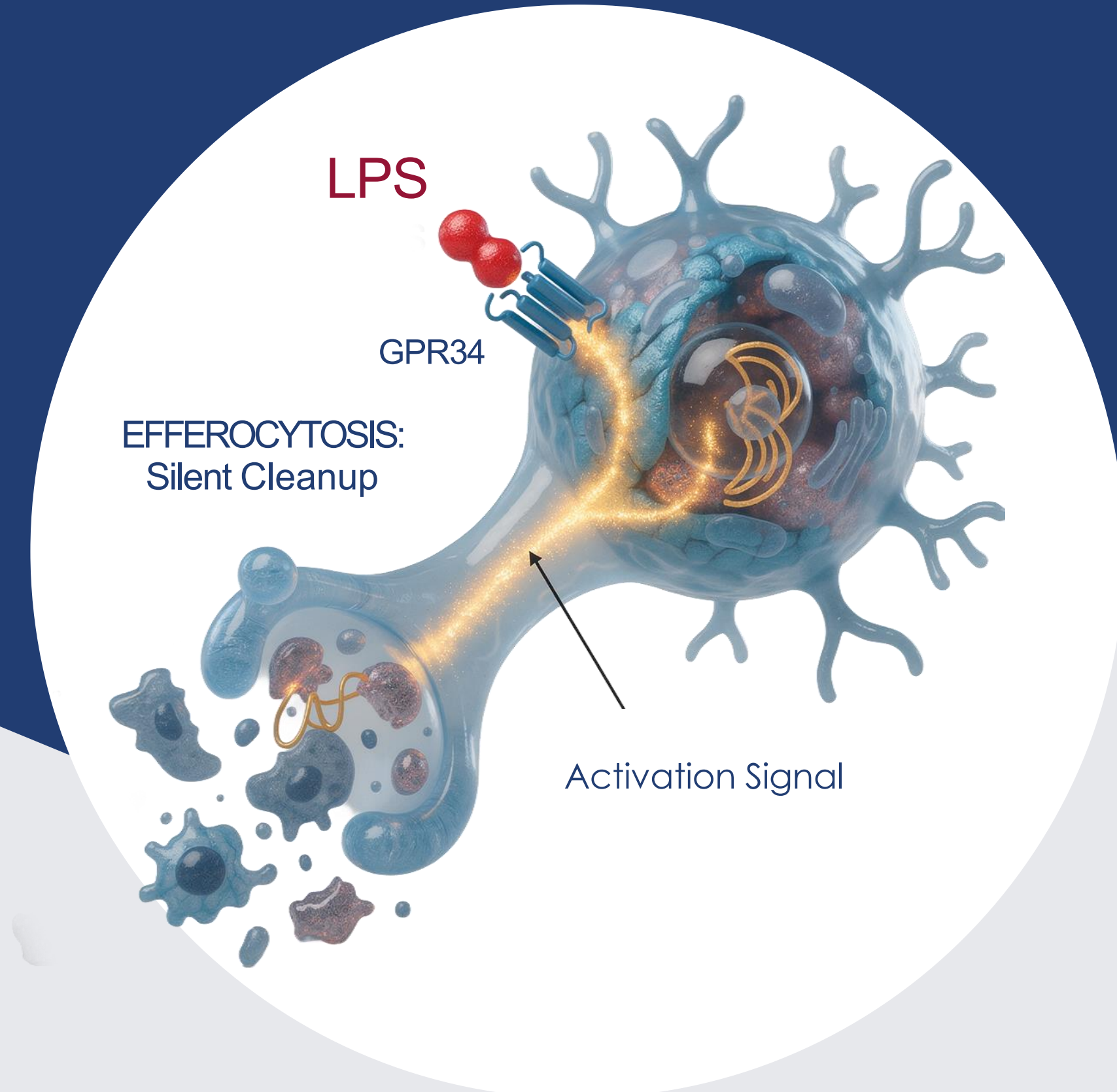
- **Anchors Key Kinases:** PS-DHA facilitates the anchoring and activation of survival-signaling protein kinases like Akt and PKC in response to oxidative stress [13]
- **Superior to Plant-Based PS:** In neurodegenerative disease models, PS-DHA/EPA is superior in reducing beta-amyloid peptide deposition and inhibiting neuronal apoptosis [7].
- **Clinically Validated:** Supplementation with Omega-3 enriched PS shows significant improvements in working memory and word recognition in adults with mild cognitive impairment (MCI) [8].



Pillar III:

Lysophosphatidylserine (LPS) for Active Inflammatory Resolution

Lysophosphatidylserine (LPS) is not just a structural component but a critical bioactive ligand that orchestrates the brain's immune response.



Immunomodulatory Signaling

- **Microglial Regulation:** LPS acts on GPR34 receptors, predominantly expressed on microglia (the brain's resident immune cells), to promote the resolution of inflammation [14, 15].
- **Efferocytosis:** LPS is central to 'efferocytosis' the silent clearance of apoptotic neurons and cellular debris by microglia without releasing harmful pro-inflammatory cytokines. This is vital for maintaining neuronal circuit integrity [17].
- **Mood & Stress Resilience:** By modulating lipid raft architecture and neurotransmitter transporters, LPS helps restore serotonergic and dopaminergic balance in the prefrontal cortex [14].

Ruby-O Smart vs. Conventional Omega-3s: **The Scientific Advantage**

Feature	Conventional Omega-3s (TAG/EE)	Ruby-O Smart (LPC/PS/LPS Matrix)
BBB Transport Mechanism	X Passive, inefficient diffusion	Active, high-affinity transport (Mfsd2a)
Brain Bioavailability	X Marginal	Up to 10x higher
Efficacy in APOE4 Carriers	Impaired by lipoprotein defects	Unaffected, bypasses genetic limitation
Action on Neuroinflammation	X Indirect systemic effect	Direct, targeted resolution via LPS
Neuronal Protection	X None (structural components only) X Commodity Substrate	Active survival signaling via PS
Formulation Strategy		Multi-target, Biomimetic System



Functional Dosing Guide for Brain Health Objectives

Brain Health Objective	Critical Component(s)	Recommended Daily Dose (Ruby-O Smart)	Achieved Biochemical Benefit	Key Reference(s)
Mental Health & Inflammation Resolution	LPS/LPC (EPA/DHA)	1-2 Capsules (delivering 100-200 mg LPS)	Activation of GPR34 receptors' in microglia; promotes efferocytosis and resolves inflammatory stress.	[8, 14]
Cognitive Support & Memory (MCI)	PS-DHA / LPS-DHA	1-2 Capsules (delivering 100 mg PS, 40-80 mg LPS)	Selective BBB crossing, increased BDNF levels, enhanced synaptic plasticity.	[6, 19, 20]
Acute Stress & Cortisol Management	LPS-EPA/ LPC-EPA	2 Capsules (delivering 200 mg LPS, 400 mg EPA)	Modulation of the HPA axis; reduction of salivary cortisol response.	[21]
Maternal & Infant Neurodevelopment	LPC-DHA	1 Capsule (delivering 200 mg DHA in LPC form)	5x more efficient transfer to offspring, securing critical DHA for infant brain and retina.	[5]



The Synthesis: A Biomimetic, Multi-Target Lipid Architecture

Ruby-O Smart is a powerful biotechnological alternative that synergistically integrates three functional lipid classes to address the primary challenges of brain health.



Lysophosphatidylcholine (LPC) actively nourishes the brain and retina by facilitating targeted DHA delivery to neurons at concentrations that conventional triglyceride-based oils cannot achieve.



Lysophosphatidylserine (LPS) may provide direct neurobiological support to help mitigate anxiety and depressive states.



Phosphatidylserine (PS) supports cognitive performance by enhancing memory, attention, and learning capacity.

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The Outcome: A single matrix that simultaneously targets delivery, neuroprotection, and chronic neuroinflammation, providing superior bioavailability even in genetically vulnerable individuals (APOE4).



The Next Generation of Brain Nutrition is Here

Ruby-O Smart is not just an improved Omega-3; it is a precisely engineered, biomimetic platform designed to overcome the fundamental barriers to brain health. By solving transport, providing active protection, and orchestrating immune resolution, it delivers unparalleled efficacy.

Key Takeaways for Innovation

- Superior Bioavailability: Guaranteed delivery to the brain and retina.
- Genetic Inclusivity: Proven efficacy in the high-risk *APOE4* population.
- Multi-Target Action: Simultaneously addresses structure, inflammation, and survival.
- Evidence-Based Formulation: Enables the creation of targeted, clinically relevant products.

Ruby O Smart provides the scientific foundation to develop the market's most advanced and effective solutions for cognitive health, memory, and mood.



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 info@naturmega.com

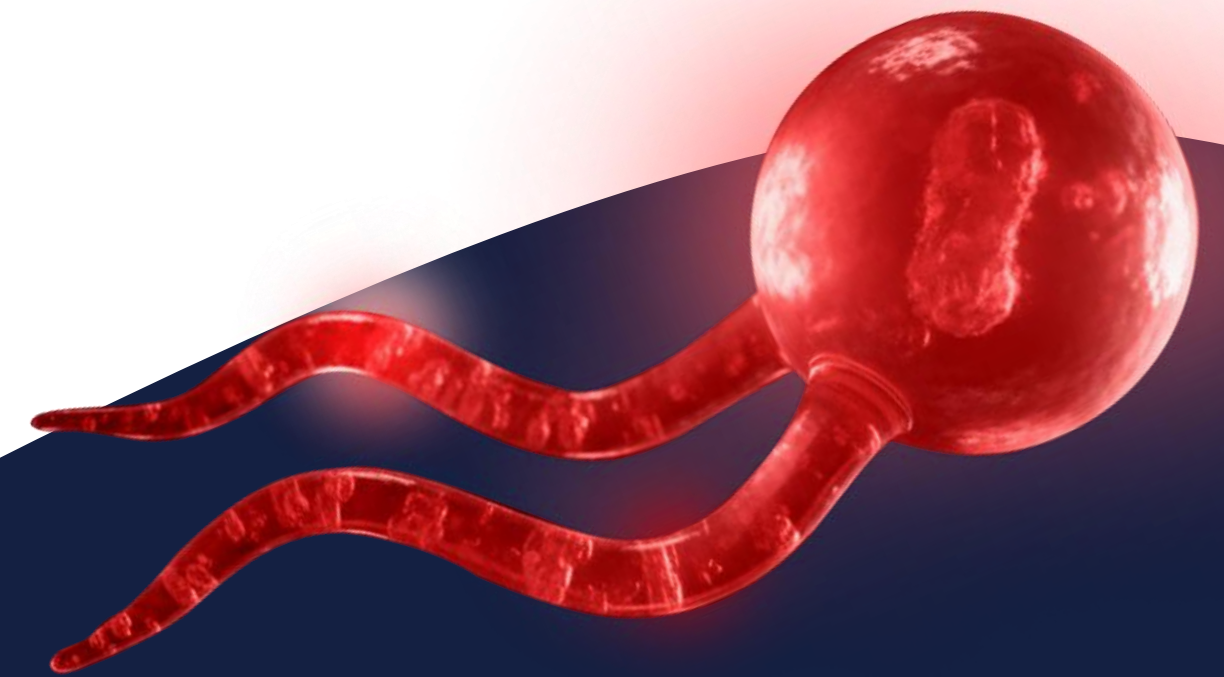


ruby-o®

Next-Generation Omega-3 Platform.

Ruby-O is a **unique** technology designed for delivering Omega-3, **inspired by how the human body naturally receives and uses nutrients.**

Ruby-O is not a formulation.
It is not a finished product.
It is not just another omega-3 oil.



A proprietary architecture where omega-3 fatty acids are bonded with phospholipids, creating a structure the body recognizes and utilizes more efficiently, how nature intended.



The Next Generation of Omega-3 Delivery is here

By improving transport, protection, and biological utilization, Ruby-O allows omega-3 to work the way the body is designed to use it.



TARGETED HEALTH BENEFITS

CARDIOVASCULAR HEALTH

Build clinically differentiated triglyceride solutions. Ruby-O enables brands to position lower-dose, high-response omega-3 products with strong clinical backing and improved responder rates.



COGNITIVE & BRAIN FUNCTION

Elevate DHA performance positioning. Ruby-O supports faster uptake and structural DHA delivery, enabling brands to build sharper cognition, focus, and brain vitality concepts.



WOMEN'S & PRENATAL HEALTH

Deliver smarter DHA + choline combinations. Ruby-O allows co-formulation flexibility to build premium prenatal solutions centered on structural lipid nutrition.



HEALTHY AGING

Position omega-3 at the membrane and cellular level. Ruby-O supports next-generation longevity narratives centered on resilience, vitality, and healthy aging.



SPORTS & ACTIVE LIFESTYLE

Build recovery and resilience platforms. Ruby-O enables performance-focused omega-3 concepts with improved incorporation and user-friendly dosing.

Designed to work the the way your **body needs it to be.**
Exactly as nature intended.
Ready to Build with Ruby-O®?



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