

WHAT IS YOUR BRAIN MADE OF?



The science of omega-3, DHA, and brain function

Based on meta-analyses, prospective cohorts, and EU-authorized claims

THE BRAIN IS FAT

~60%

of the brain's dry weight
is made up of lipids

DHA = >90% of brain omega-3

DHA completely dominates the omega-3 fraction in neural tissue

DHA = ~20% of total brain lipids

A structurally critical fraction

The brain is rich in lipids, and DHA is the dominant omega-3.

The 6 Functions of DHA in the Brain



Membrane Fluidity

Keeps neuronal membranes flexible, enabling efficient communication between neurons



Neurotransmitters

Supports the production of - and binding of - serotonin, dopamine, and endorphins to their receptors



BDNF

Increases BDNF, a protein that supports the growth and survival of new neurons



Anti-Inflammation

Produces resolvins and neuroprotectins that fight neuroinflammation



Myelin

An essential component of the myelin sheath, which speeds nerve impulse transmission



Neuroplasticity

Promotes neurogenesis and the brain's ability to form new connections throughout life

THE STRONGEST PROOF WE HAVE



"Maternal intake of DHA contributes to the normal brain development of the fetus and breastfed infant."

AUTHORIZED EU CLAIM
REG. 440/2011

DHA accumulates massively
in the first 2 years of life

If it is critical to build a brain...
does it make sense to ignore it later?

THE PROBLEM: ALMOST NO ONE GETS ENOUGH

ALA -> DHA conversion <1%

Plant sources of omega-3 (flax, chia) do not guarantee adequate DHA status. Endogenous conversion is very limited.

Modern diet low in EPA/DHA

Low intake of fatty fish, combined with high intake of omega-6-rich vegetable oils, creates a chronically deficient pattern.

EFSA: inadequate intake

The European Food Safety Authority recognizes that populations with low fish intake may have inadequate EPA and DHA intake.

EFSA SCIENTIFIC OPINION, 2010

TWO PROBLEMS, NOT ONE

HIGH RATIO (ω -6: ω -3)

Inflammatory environment

Greater metabolic competition between n-6 and n-3 families

Fewer pro-resolution mediators (resolvins, protectins)

A more favorable terrain for chronic neuroinflammation

LOW STATUS (DHA/EPA)

Lack of structural material

Less DHA available for neuronal membranes

Less support for synaptogenesis and plasticity

Greater vulnerability in development and aging

Note: The ratio is a useful indicator of imbalance, but absolute DHA/EPA status (e.g., Omega-3 Index) may be a more informative metric.

MOOD AND DEPRESSION

EVIDENCE: MODERATE

The most consistent signal of imbalance

2022 meta-analysis [Meta-analysis]

A high dietary n-6/n-3 ratio is associated with greater risk of depression. The signal is particularly strong in pregnancy.

Li et al., Front Nutr, 2022

2024 Mendelian study [Mendelian randomization]

Supports a causal role for EPA in the etiology of depression, with caveats around genomic pleiotropy.

Nature Transl Psychiatry, 2024

NIH - Professional Fact Sheet [Institutional review]

Evidence is rated "small to modest" for mood. The effect is not uniform - more consistent in clinical and inflammatory contexts.

NIH ODS Omega-3 Fact Sheet

Honest reading: the association is biologically plausible and supported by meta-analysis, but it does not mean every case of low mood is primarily caused by the ratio.

BRAIN AGING

EVIDENCE: MODERATE

What prospective studies show

~20%

lower risk of
cognitive
decline

2023 meta-analysis [Prospective cohorts]

Higher DHA intake is associated with about 20% lower risk. Erythrocyte DHA and plasma EPA were used as biomarkers.

Rotterdam Study [Cohort - mixed result]

The initial finding was strong (lower risk of dementia), but later follow-up did not confirm the same effect.

Calibrated interpretation: even with inconsistencies across studies, the direction of evidence consistently points toward benefit. The question is not whether the evidence is perfect - it is whether it makes sense to wait for perfect certainty while biomarkers remain low.

High Omega-6:3 Ratio = Brain Inflammation



The Mechanism of Neuroinflammation

When the omega-6:3 ratio is high:

1. Arachidonic acid (AA, omega-6) produces excess pro-inflammatory eicosanoids
2. Microglia (the brain's immune cells) become chronically activated
3. Inflammatory cytokines (IL-6, TNF-alpha, IL-1beta) increase in brain tissue
4. Chronic inflammation progressively damages neurons and synapses

What Science Confirms

- A high ratio promotes microglial activation and inflammatory branching in animal models
- Diets high in omega-6:3 caused spatial memory deficits and anxious behavior in rats
- A 15:1 ratio increased IL-17 and reduced anti-inflammatory cytokines (IL-4, IL-10) in human microglial cells
- An ideal 1:1 ratio is considered necessary for healthy brain function

Balanced Ratio = Protected Brain



When the ratio approaches 1:1 to 3:1

The body shifts the lipid mediators it produces. Instead of pro-inflammatory eicosanoids (from omega-6), the brain begins to produce resolvins, neuroprotectins, and maresins (derived from DHA and EPA). These molecules do not just reduce inflammation - they actively resolve it and promote neuronal repair.

Resolvins

Actively resolve inflammatory processes in the brain, protecting neurons from damage

Neuroprotectins

Protect against neuronal apoptosis and promote cell survival, especially NPD1

Optimized Conversion

A 3:1 to 4:1 ratio maximizes ALA-to-DHA conversion, ensuring adequate supply to the brain

The Science of Brain Recovery



The good news: the brain responds to supplementation

Studies show that even when supplementation starts late, the brain still benefits. In older rats, 8 weeks of omega-3 partially reversed hippocampal and prefrontal cortex atrophy. In humans, 4-6 months are needed to reach stable DHA concentrations in erythrocytes, depending on dose.

Week 1-4

DHA begins to incorporate into erythrocyte membranes and peripheral tissues

Month 2-3

Improved neuronal membrane fluidity, gradual rise in BDNF. Subtle improvements in mood and focus

Month 4-6

DHA reaches a stable concentration. Measurable cognitive benefits in memory and processing speed

6+ Months

Structural effects: preserved hippocampal volume, reduced neuroinflammation, long-term protection

WHAT SCIENCE ALSO SAYS

Honesty is what separates information from propaganda

Established Alzheimer's: supplementation does not reverse it

Multiple clinical trials and Cochrane reviews show that omega-3 does not improve cognition in established dementia. The focus should be prevention.

Cochrane Database, multiple RCTs - PMID: 39991006

There is improvement, but there is no "memory explosion"

Claims of dramatic cognitive improvement with supplementation are not supported by the best available level of evidence.

EFSA, NIH ODS, Cochrane - agreement across sources

This is not weakness. It is proof that timing matters.

Science does not say omega-3 cures.

Science says that people who maintained good status throughout life had better outcomes.

*The conclusion is simple:
the best time to correct it is before you need it.*

WHAT CHANGES WITH ADEQUATE STATUS

Normal brain function maintained

An authorized EU claim: DHA contributes to the maintenance of normal brain function (Regulation 432/2012).

AUTHORIZED EU CLAIM

Larger hippocampal volume

Observational studies associate better omega-3 status with larger hippocampal volume and greater total brain volume.

OBSERVATIONAL STUDIES

Better conditions for mood and plasticity

Less metabolic competition, more pro-resolution mediators, and better support for BDNF and neurotransmission.

BIOLOGICAL MECHANISM

Lower vulnerability to aging

A consistent prospective association links better status with lower risk of cognitive decline. It is a more favorable terrain.

PROSPECTIVE COHORTS

3 QUESTIONS YOU SHOULD ASK



Do you regularly eat fatty fish - or another reliable source of EPA/DHA?

Plant sources (flax, chia) convert to DHA at <1%.



Do you know your true DHA/EPA status?

The Omega-3 Index is now considered a more informative biomarker alongside the ratio.



Are you acting before you need it?

The strongest evidence is in prevention and maintenance - not in late reversal of brain plasticity.

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Note: This material is educational and does not replace medical evaluation. Individual results depend on diet, dose, age, genetics, and baseline status. Consult a health professional.