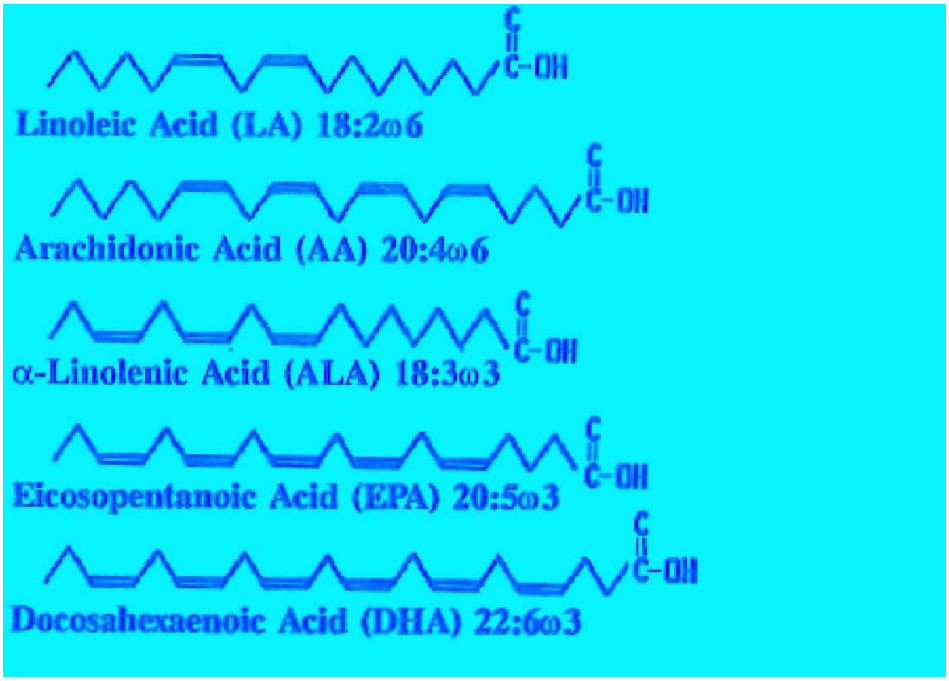
XV. FISH OIL FLIM-FLAM

In 1976 researchers began to note that Eskimos have a low incidence of coronary heart disease (CHD) in spite of high (420-1650 mg/day) cholesterol intakes.[1] They eat a lot of fish. Since then over 576 articles have appeared in 155 journals[2] extolling the virtues of fish oil as a preventive for CHD.[3] Fish oil is high in Omega-3 (ω3) fatty acid (FA) and this leads to high levels of eicosopentanoic fatty acid (EPA) and the high EPA levels depress blood platelet clotting tendencies[4] and thus lessen the chance of clots in the coronary arteries.

Trouble is, fish oil is a two edged sword. It cuts the chances of a heart attack but it may increase the risk of cerebral hemorrhage[5, 6](CH). By thinning the blood, which protects against clots in the 3 mm diameter coronary arteries in the heart, it increases the chance that delicate 0.5 mm cerebral arteries will pop and bleed into the brain.

Unfortunately, there's a good deal of biochemistry involved here, but perhaps pictures will help. A few key fatty acids look like this:



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[1]Ho K, Mikkelson B, et al. *Alaskan Arctic Eskimo: responses to a customary high fat diet.* Am J Clin Nutr. 1972;25:738.

[2]Simopoulos A. *Omega-3 fatty acids in health and disease and in growth and development.* Am J Clin Nutr 1991;54:446. ISSN 0002 9165. p 439.

[3]Sinclair A, and Gibson R. *Essential Fatty Acids and Eicosanoids: Invited papers from the Third International Congress.* p 25. American Oil Chemists Society. Champaign, 1992. ISBN 0-935315-43-8.

[4]Thomas L, and Holub B. *Modification of Human Platelet Phospholipids and Agonist-Stimulated Phosphoinositide Phosphorylation by Omega-3 Fatty Acids.* In note 496. Sinclair, p 305.

[5]Yasugi T, Tochihara T, Fujioka T, *et al. Eicosopentanoic Acid, Docosahexanoic Acid and Cerebral Hemorrhage: EPA and DHA Loading Study in Spontaneously Hypertensive Rats.* In note 496. Sinclair. p339.

[6] Nakamura Y, Ueshima H, Okamura T, Kadowaki T, Hayakawa T, Kita Y, Tamaki S, Okayama *Association between fish consumption and all-cause and cause-specific mortality in Japan*: Am J Med. 2005 Mar;118(3):239-45.

Each angle, end point, or "C" represents a carbon atom and the single connecting lines are (saturated) chemical bonds. The double lines represent (desaturated) double bonds in which a hydrogen atom has been knocked off the carbon on each end of the bond. A good deal of professorial infighting clouds the question of which end to count from but the winning side seems to be counting from the left, so linoleic acid (LA) with eighteen carbons and two double bonds, the first one (the ω) six carbons from the left, is an 18:2ω6 fatty acid. α-linolenic acid (ALA) is an 18:3ω3 and arachidonic acid (AA) is a 20:4ω6. It used to be held that AA is an essential fatty acid but it's now known humans can synthesize it from linoleic acid. Cats cannot and must get it from their flesh diet, further evidence that humans, unlike cats, are not serious meat-eaters.

Given LA or ALA, humans and many other animals can enzymatically elongate the acids (add on by two carbon increments), and desaturate the products (remove hydrogen atoms to form double bonds), which results in a zoo full of variant FAs.[7] From dietary ALA humans can synthesize the other ω3 fatty acids themselves.[8] Two of the most important ones are EPA, a 20:5ω3 FA, and docosahexanoic acid (DHA) a 22:6ω3 FA.

EPA and DHA are present in high quantity in fish oil but only because the bottom rung in the marine food chain is plankton which contain algae. Green plants and most algae contain intracellular organelles called chloroplasts. Chloroplasts contain chlorophyll to trap solar energy, but they also synthesize ALA which is the starting point for all the other ω3 fatty acids in both marine and terrestrial food chains.[9]

Fish oil is high in EPA and DHA only because the tiny fish ate the algae and the bigger fish ate the smaller fish, synthesizing and concentrating the other ω3s at each cannibalistic step.

Since the agricultural revolution 10,000 years ago, ω3 fatty acids have been marginal in the human diet. Why? Because the ag revolution stressed grains, which were cheap and therefore accelerated human population growth. Grains are good sources of LA (18:2ω6), but with the exception of flaxseed, grains and seeds do not have much ALA (18:3ω3), which is found in more plentiful supply in the more expensive and perishable leafy green vegetables such as kale, spinach, or taro leaves.

The ω3:ω6 FA ratio in the human brain[10] is about 1:1. During most of human evolution[11] the dietary ω3:ω6 FA ratio was also about 1:1 but in the present U.S. diet it is about 1:10. The following graph[12] shows that the linolenic (ALA)/Calorie ratio is not highest in fish or fish oils but in plant foods. Flaxseed oil comes in first, but in addition to being a good ALA source, it is also a truly spectacular laxative.

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[7]See note 2. *Harper's 1990.* pp 219-20.

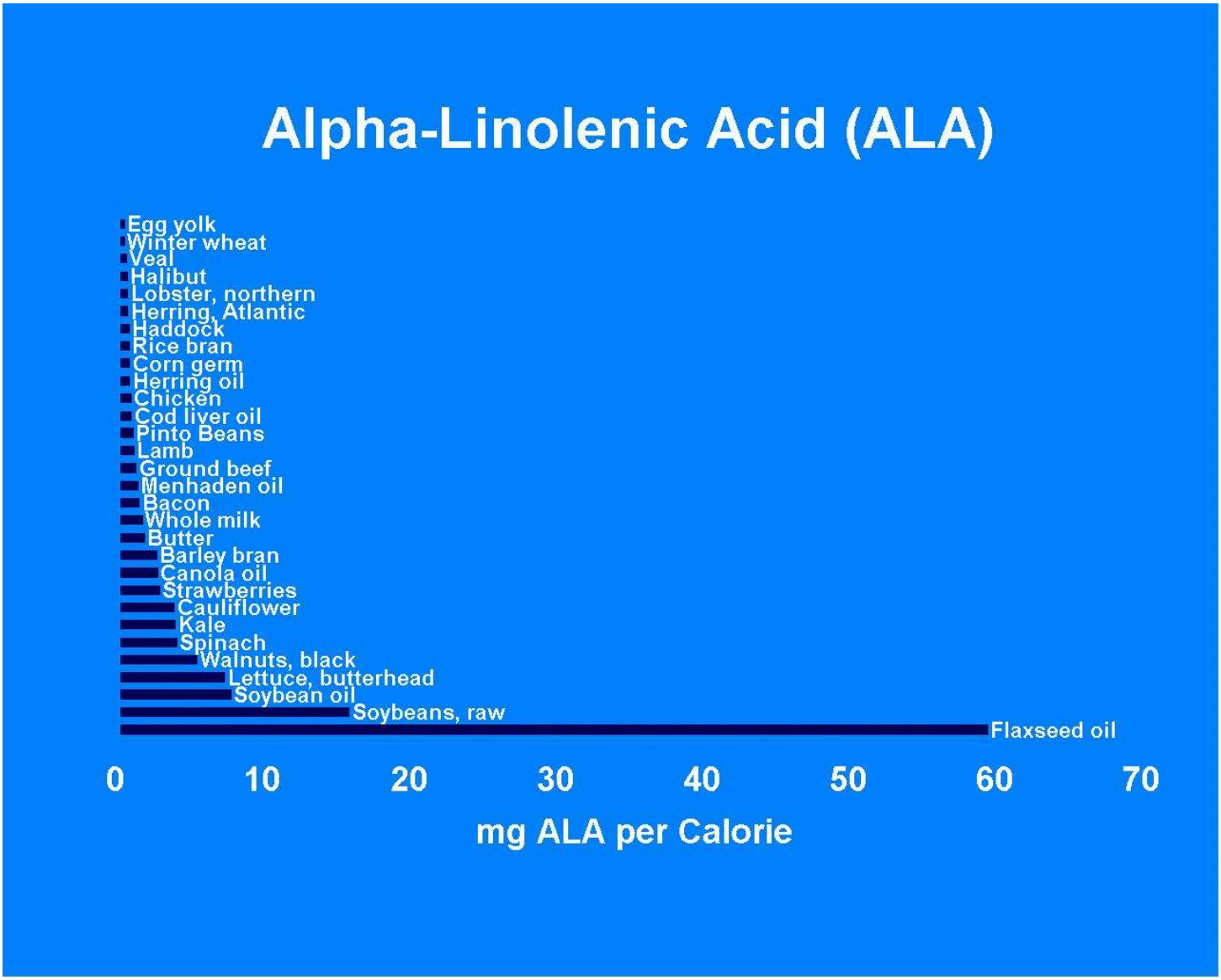
[8]Note 487. Sinclair. p 25.

[9]See note 30. *Simopoulis.* p 446.

[10]See note 487. Sinclair. p 318.

[11]See note 30. Simopoulis. p 438.

[12]Exler J, and Weihrauch JL. *Provisional Table on the Content of Omega-3 Fatty Acids and Other Fat Components in Selected Foods.* United States Department of Agriculture. Human Nutrition Information Service. HNIS/PT-103 1988.



The next table shows that vegetables have higher ω3:ω6 fatty acid ratios than grains. While the USDA grants horticulture no price supports, vegetables are once again shown to have better nutrient value than barley, corn, rice, rye, and wheat, which the USDA in fact does support.

Food Name	ALA/LA		ALA/LA
Spinach-frozen	5.148	Poi-taro root	0.448
Cauliflower-raw	3.294	Rice-white-short grain	0.212
Lettuce-iceberg-raw	2.333	Flour-rye	0.164
Beans-french-cooked	1.728	Wheat germ	0.137
Squash-summer-boiled	1.682	Barley-pearled	0.109
Beans-navy-sprouted	1.354	Wheat bran	0.082
Kale-frozen-boiled	1.296	Peppers-hot chili	0.051
Beans-black-cooked	0.834	Oats-whole grain	0.046
Rice-wild-cooked	0.795	Wheat-hard red	0.044
Seaweed-spirulina	0.657	Corn bran	0.032
Cress-garden-raw	0.5	Corn-sweet-canned	0.029

Leafy greens are probably the best overall food choice, not only for linolenic acid but for protein, calcium, iron, vitamins, and trace minerals. There is a reason for this: plant leaves are the biochemical "guts" of the plant. The stem supports the plant, moves it to face the sun and also transfers nutrients absorbed from the earth by the roots. Seeds and nuts store DNA, proto-nutrients, and fat for the plant's reproductive cycle. But all the photosynthetic and biosynthetic chemical reactions that sustain both plant and animal life occur in the leaves. Sutton's law says, "Go where the money is." Nutritionally speaking, the money is in the leaves, so if it's green and it tastes good, eat it.

Soybean oil is also a good source of ALA; unfortunately, it is almost always hydrogenated in the American diet, as a look at almost any bag of chips, popcorn, or other snack food will show. Hydrogenated ALA is no longer linolenic acid but a mixture of *cis* and *trans* fatty acids produced by heat and metal catalysts rather than by *cis*-specific enzymes. *Trans* fats elevate cholesterol levels and get into cell membranes with dubious results.[13]

HOW ABOUT INFANT NUTRITION?

DHA is a major player in the cell membranes of the central nervous system (CNS). Human adult brains can probably move dietary ALA across the blood-brain barrier, and hand it over to the astrocytes (CNS support cells) which then transform it into DHA and pass it on to the brain cells (neurons). Either that or the DHA is made from ALA in the liver and moved to the brain.[14] However, infant livers and brains can't do this and depend critically on adequate dietary DHA.

DHA is present in cow's milk but so are a number of adverse elements such as antigenic proteins that cause a glossary of pediatric illness.[15] Primarily because of iron absorption problems, The American Academy of Pediatrics Committee on Nutrition discourages the use of cow's milk before the age of one year,[16] but there are better reasons.

So the next possibility for infant nutrition is soy formula. Isomil, Nursoy, Prosobee, and Soyalac are frequently prescribed for cow milk kids who come in with marathon "colds," chronic diarrhea, rashes, and big tonsils. These formulas, free of cow milk, casein, and whey, have been formulated carefully but they're missing at least one thing. They don't have DHA because no plant synthesizes DHA or any of the other elongated ω3 FAs. (Author's note: This article was first written in 1996. Many soy formula manufacturers now add ALA). A recent study showed that breast-fed infants have an eight point IQ edge over formula-fed kids[17] at age 8. It's partly due to the fact that in addition to maternal antibodies, the psychological benefits of mother-child bonding, and tailor made proteins, breast milk also contains DHA.

In spite of this, some mothers continue to bottle- feed. Enter, once again, the fish oil. Fish oil is loaded with DHA so one simply takes fish oil and adds it to soy formula that can be delivered in a tidy Victorian bottle. The fish-oil supplemented premature infant at the age of one year displays slightly better

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[13]Siguel E, Lerman R. *Trans-fatty acid patterns in patients with angiographically documented coronary artery disease.* Am J Cardiol. 1993;71(11):916-20. ISSN 0002-9149.

[14]Spector A, and Moore S. *Role of Cerebromicrovascular Endothelium and Astrocytes in Supplying Docosahexanoic Acid to the Brain.* In note 487. Sinclair. p 100.

[15]See note 141. Halpern.

[16]American Academy of Pediatrics Committee on Nutrition. *The use of whole cow's milk in infancy*. Pediatrics. 1992;89(6 Pt 1):1105-9. ISSN 0031-4005.

[17]See note 487. Sinclair. p 367.

visual acuity, relative to formula kids,[18] and this is thought to be consistent with the notion the infant brain and retina needs DHA. Unfortunately, the infant's physical growth has been retarded apparently because the DHA interferes with the utilization of AA that is needed for growth.

Exeunt fish oils.

So we come again to the old riddle. Why do humans cling so desperately to the bad idea of eating animal food, and then practice damage control by eating reduced amounts or different *types* of animal food? There are now eight studies in the literature, including the Ornish study, showing that lowering serum cholesterol regresses CHD.[19] The solution to both CHD and cerebral hemorrhage is to go vegan and cut all the cholesterol out of the diet, not to eat fish oil and trade off CHD for CH. The solution to infant nutrition is not to dodge the adverse effects of cow's milk by adding fish oil to otherwise deficient plant-based formulas. The solution is for women to breast-feed their infants and perhaps continue for three years, or until by mutual consent weaning occurs. One German lady's four year old daughter simply looked up at her one day and said, "Mommy, I'm through" and that was the end of her breast feeding.

The fish oil flim-flam is founded on the customary error: sorting and preferencing foods by nutrient/weight ratio rather than nutrient/Calorie ratio. One hundred grams of menhaden fish oil may indeed have a lot of ω3 FA, but the oil is 100% of Calories from fat, and it contains 521 mg of cholesterol to boot. One hundred Calories of spinach has 3.16 times as much ALA as 100 Calories of menhaden oil, .0017 as much fat and a cholesterol content so low it cannot be detected by USDA assay methods and is hence reported as zero.

Finally, a Harvard study confirmed that there is no reduction in coronary risk from eating large amounts of fish.[20] A more recent one[21] concluded "long chain and shorter chain omega 3 fats do not have a clear effect on total mortality, combined cardiovascular events, or cancer."

Too bad. The miracle cure folks were making big progress. In a century they went from peddling snake oil to fish oil.

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[18]Carlson S, Werkman S, Peeples J, et al. *Growth and Development of Very Low-Birthweight Infants in Relation to n-3 and n-6 Essential Fatty Acid Status.* In Note 487, Sinclair, p 194.

[19]See note 487. Sinclair. p 279.

[20]Morris MC, Manson JE, Rosner B, Buring JE, Willett WC, Hennekens CH. *Fish consumption and cardiovascular disease in the physicians' health study: a prospective study*. Am J Epidemiol. 1995 Jul 15;142(2):166-75. "These data do not support the hypothesis that moderate fish consumption lowers the risk of cardiovascular disease."

[21]BMJ 2006;332:752-760 (published 24 March 2006) *Risks and benefits of omega 3 fats for mortality, cardiovascular disease, and cancer: systematic review* http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=16565093&query_hl=1&itool=pubmed_docsum