

## Scientific Support for Chapter 7: Fish Oil Fallacies: Debunking the Fish Oil Myth Explore Volume 20.6

### ***Inconvenient Truth #1: DHA and fish oil shown completely worthless in treatment for Alzheimer's.***

Quinn, J, et al., “Docosahexaenoic Acid Supplementation and Cognitive Decline in Alzheimer Disease: A Randomized Trial,” *Journal of the American Medical Association*, November 3, 2010, Vol. 304, No. 17, pages 1903-1911:

- “Conclusion: Supplementation with DHA [marine based oils] compared with placebo [no marine based oils] did *not slow the rate of cognitive and functional decline* in patients with mild to moderate Alzheimer disease. [Note: Since the condition was “moderate,” patients were still quite capable of improvement.]
- “This study was designed to determine if supplementation with DHA would slow the rate of cognitive and functional decline in patients with *mild to moderate Alzheimer disease*. Despite enrollment of the target population of individuals with low baseline DHA...
- “The *hypothesis* [guess] that DHA slows the progression of mild to moderate Alzheimer disease was not supported, so there is *no basis for recommending DHA supplementation for patients with Alzheimer disease*.
- “In summary, these results indicate that DHA supplementation is not useful for the population of individuals with mild to moderate Alzheimer disease.” (Emphasis added.)

### ***Inconvenient Truth #2: Fish oil increases risk of colon cancer.***

“Link Between Fish Oil And Increased Risk Of Colon Cancer In Mice,” J. Fenton, et al., *Medical News Today (Colorectal cancer)*, Article URL: [www.medicalnewstoday.com/articles/203683.php#post](http://www.medicalnewstoday.com/articles/203683.php#post), October 7, 2010; and Woodworth, Hillary, L., et al., “Dietary Fish Oil Alters T Lymphocyte Cell Populations and Exacerbates Disease in a Mouse Model of Inflammatory Colitis,” *Cancer Research*; 70(20); 7960–9; 0008-5472.CAN-10-1396; Published OnlineFirst August 26, 2010; doi:10.1158/0008-5472.CAN-10-1396.

Following are the exact markers that were negatively impacted by Fenton’s experiment that showed fish oil accelerating aggressive cancer. Again, it is significant to note that even the researcher was expecting completely opposite results; she wasn’t even aware of the vast amount of negative fish oil studies until she experienced her own personal research failure and started researching the literature for other failures:

- “Contrary to expectations, DFO [***dietary fish oil***] ***induced severe colitis and adenocarcinoma [epithelial tissue cancer of the colon] formation***. DFO consumption was associated with *decreased CD8+ cell frequency and diminished CD69 expression* on CD4+ and CD8+ T-cell populations. Mice consuming DFO ***also exhibited higher FoxP3+ CD25+ CD4+ T regulatory cell frequency, FoxP3 expression, and altered L-selectin expression*** during infection.”

Additionally, the article stated:

- “We found that mice developed deadly, late-stage colon cancer when given high doses of fish oil,’ [Fenton] said.
- “More importantly, with the increased inflammation, it only took four weeks for the tumors to develop.
- “...not only the mice receiving the highest doses of DHA but those receiving *lower doses as well*.
- “Our findings support a *growing body of literature implicating harmful effects of high doses of fish oil consumption in relation to certain diseases*,’ Fenton said.
- “We hypothesized [guessed] that feeding fish oil enriched with DHA to mice would decrease the cancer risk; ***we actually found the opposite***.’
- “[Fenton] said people already receiving enough omega-3 fatty acids through their normal diet and foods have no need for added [fish oil] supplementation.” (Emphasis added.)

### ***Inconvenient Truth #3: Fish oil decreases proper immune system responses.***

The International Society for the Study of Fatty Acids and Lipids (ISSFAL) 4<sup>th</sup> Congress, which met on June 4-9, 2000 in Tsukuba, Japan, and was reported in the article titled “Omega-3 Polyunsaturated Fatty Acids, Inflammation

and Immunity,” by Philip C. Calder, Institute of Human Nutrition, University of Southampton, Bassett Crescent End, Southampton, UK:

- “...[S]tudies indicate that at the levels used, fish oil [omega-3 derivatives] **decrease a wide range of immune cell responses** (natural killer cell, cytotoxic T lymphocyte activities, lymphocyte proliferation and production of IL-2 and IFN- $\gamma$  (1,2))...”
- “...Recent studies have indicated that relatively low levels **of the long chain omega-3 fatty acids (EPA or DHA)...**are sufficient to bring about some of the suppressive effects ...”
- “... This decrease (of inhibited lymphocyte proliferation and natural killer cell activity) causes increased cellular bacteria [**infection**] and impaired [cancer] tumor cell killing.” (Emphasis added.)

#### ***Inconvenient Truth #4: Cod liver oil significantly increases risk of skin cancer.***

Veirord, MB, et al., “Diet and Risk of Cutaneous Malignant Melanoma: A Prospective Study of 50,757 Norwegian Men and Women,” *Int. J. Cancer*: 71,600-604 (1997):

- “A significant risk was found in women who used cod liver oil supplement. [W]e found a **strong increased risk for the women using cod liver oil, a supplement rich in omega-3 fatty acids (EPA and DHA).**” [There was approximately 3xs more incidence of melanoma (the most dangerous type of skin cancer) in the cod liver oil users.]
- “The **increase is considered to be real and not due to chance.**
- “Mean time of follow-up was 12.4 years.... [Note: Sufficient time for an excellent analysis.]
- “The strengths of the study are the high number of participants selected in an **unbiased manner**, the **high participation** and response rate, the prospective design with *dietary data collected prior to onset of cancer* and a **complete follow-up** with regard to incidence of cancer, deaths, and emigration. The complete follow-up is secured by the procedure established by the **Cancer Registry**, ensuring that all physicians, hospital departments and histopathology laboratories in Norway are obligated to report malignant diseases to the Registry: as many as 98% of the **cases** were histologically [microscopic tissue analysis] **verified**. [Note: This guarantees superb tracking and confirmation of cancer cases.]

#### **Four more studies confirming increased skin cancer:**

Rogers, HW, et al., “Incidence Estimate of Nonmelanoma Skin Cancer in the United States, 2006,” *Archives of Dermatology* Vol. 146 (No. 3), March **2010**, pages 283-287 reports:

- “The total number of procedures for **skin cancer in the Medicare fee-for-service population increased by 76.9%** from 1,158,298 in 1992 to 2,048,517 in 2006.
- “Nonmelanoma skin cancer (NMSC) is the **most common malignancy** in the United States.
- “...[T]he incidence of **skin cancer** in the United States has **substantially increased** from 1992 through 2006 and **is now almost double the last published estimate** from 1994.” (Emphasis added.)

Linos, EL, et al., “Increasing burden of melanoma in the United States,” *Journal of Investigative Dermatology*, **2009** July, 129(7): 1666-1674:

- “**Malignant melanoma** is one of the fastest growing **cancers worldwide.**
- “Overall melanoma **incidence increased at 3.1%** (1992-2004) **per year.**
- “We observed that melanoma **incidence increased for both men and women** across all categories of **tumor thickness**, including a **significant 3.86% annual increase among thickest tumors (>4mm).**” [Important note: The researchers clearly stated the increase is not due to better reporting, but a true increase in severity.] (Emphasis added.)

*Journal of Investigative Dermatology*, **2008** December; 128(12):2905-2908, “Recent trends in incidence of cutaneous melanoma among U.S. Caucasian young adults”:

- “Among women, age adjusted annual incidence [of melanoma] per 100,000 increased from 5.5 in 1973 to 13.9 in 2004.”

*Actas Dermosifiliogr.* **2010**;101(1) 39-46, “Changes in the incidence of skin cancer between 1978 and 2008,” reports:

- “The incidence of skin cancer continues to increase and can now be considered a worldwide epidemic.”

*British Journal of Cancer* (**2008**) 99, 1549-1554, “Cancer mortality in the United Kingdom: projections to the year 2025,” reports:

- “Malignant melanoma projections are +48% [Note: Although absolute numbers are small, the percentage should decrease, not increase!]

### ***Inconvenient Truth #5: Fish oil is WORTHLESS in preventing heart disease in Type I diabetic women.***

“Women With Type 1 Diabetes Receive No Heart Benefit From Omega-3, *Medical News Today (Diabetes)*, Article URL: <http://www.medicalnewstoday.com/articles/193107.php>, June 28, 2010:

- “Consuming higher amounts of **omega-3 fatty acids [as found in fish oil] does not appear to lower heart disease risk for women with type 1 diabetes**, according to a University of Pittsburgh Graduate School of Public Health study presented at the *70th Scientific Sessions of the American Diabetes Association*.
- “Omega-3 fatty acids [omega-3 derivatives], primarily found in fish, [**supposedly**] promote heart health by preventing the buildup of cholesterol in the arteries. Little is known about the effect of consuming omega-3 in *people with type 1 diabetes, who are at much greater risk for heart disease*.
- “Although omega-3 [derivatives] is **typically associated** [not directly causal] with decreased risk for cardiovascular disease, this may not be the case for women who have type 1 diabetes....” (Emphasis added.)

### ***Inconvenient Truth #6: Glycemic (blood sugar) control WORSENS during fish oil administration:***

Stacpoole, P, Alig, A., Ammon, L, and Crockett, E., “Dose-Response Effects of Dietary Marine Oil on Carbohydrate and Lipid Metabolism in Normal Subjects and Patients With Hypertriglyceridemia,” *Metabolism*, Vol. 38, No 10 (October), 1989, pages 946-956:

- “**The glycemic [blood sugar] control of [all of] the four insulin dependent diabetic patients worsened during the fish oil administration.**
- “...[T]he **insulin** dose of the subjects **had to be increased** throughout the six-month period of fish oil administration to maintain constant blood glucose and glycosylated hemoglobin concentrations (HbA1c—average blood sugar level).
- “Despite the stable bodyweight by patients on the basal diet, glycosylated hemoglobin [A1c] levels **after six months of fish oil administration increased 16% from 4.9% to 5.7%**. [Note: This is an awful effect for a diabetic.]
- “Another **important finding** of our investigation was that consumption of a **fish oil-enriched diet worsens glycemic tolerance.**” (Emphasis added.)

“Fish-oil supplementation reduces stimulation of plasma glucose fluxes during exercise in untrained males,” *British Medical Journal of Nutrition* (2003), 90, 777-786.

- “It is concluded that fish oil reduced Rd [rate of glucose disappearance] glucose by **26% by reducing glucose metabolic clearance rate ...**” [Note: This is an awful effect for a diabetic.]
- “[I]t was observed in healthy human subjects that a **3-week supplementation of the diet with fish oil (6g/day) decreased by 40% the insulin response** [a horrific effect] to an oral glucose challenge without altering either endogenous glucose production or plasma utilisation.
- “[N]-3 long-chain fatty acids are incorporated into **membranes whose composition remains altered at least 18 weeks after interruption of fish-oil supplementation....**” (Emphasis added.)

### ***Inconvenient Truth #7: Consumption of “fatty fish” decreases insulin levels.***

Karlström, BE, et al., “Fatty fish in the diet of patients with type 2 diabetes: comparison of the metabolic effects of foods rich in n23 and n26 fatty acids,” *Am J Clin Nutr* 2011;94:26–33.

- “The reduction in fasting blood glucose and in the glucose area under the curve during the day was significantly greater with the n-6 [with lean fish] than with the n-3 [fatty fish] diet (table 5) [Showing 21% less insulin production from fatty fish compared to lean, non-fatty fish].”

Anthony P. Bimbo, “Raw material sources for the long-chain omega-3 market: Trends and sustainability. Part 2,” April 2009, [www.aocs.org/Membership/FreeCover.cfm?itemnumber=1085](http://www.aocs.org/Membership/FreeCover.cfm?itemnumber=1085), accessed 10.8.11:

### ***Inconvenient Truth #8: Amount of supplemented DHA incorporated into the brain is insignificant.***

Umhau, JC, et al., “Imaging incorporation of circulating docosahexaenoic acid [DHA] into the human brain using positron emission tomography,” *Journal of Lipid Research*, Vol. 50, 2009, pages 1259-1268:

- “The characteristics of brain DHA metabolism permit the use of an irreversible uptake model over the time course of a PET scan. This is because the other forms of plasma PUFA (i.e., esterified in lipoproteins) were shown not to contribute measurably to brain uptake and because circulating precursors of ARA (linoleic acid, 18:2n-6) and of DHA (alpha-linolenic acid, 18:3n-3) after entering the adult brain are largely lost by metabolism and are **not elongated** to ARA or **DHA [rather, staying in parent form]**.
- Docosahexaenoic acid (**DHA**; 22:6n-3) is a critical constituent of the brain, but its metabolism has **not been measured in the human brain** in vivo [in the body]. In monkeys, using positron emission tomography (PET), we first showed that intravenously injected [1-<sup>11</sup>C] DHA mostly entered nonbrain organs, with **approximately 0.5% entering the brain**.
- “Then, using **PET** and intravenous [1-<sup>11</sup>C] DHA in 14 healthy adult humans, we **quantitatively imaged** regional rates of incorporation (K\*) of DHA.
- “For the entire human brain, the net DHA incorporation rate Jin, the product of K\*, and the unesterified plasma DHA concentration **equaled 3.8 +/- 1.7 mg/day**.
- “This net rate is equivalent to the net **rate of DHA consumption by brain** and, considering the reported amount of DHA in brain, **indicates that the half-life of DHA in the human brain approximates 2.5 years**. Thus, PET with [1-<sup>11</sup>C] DHA can be used to **quantify regional and global human brain DHA metabolism in relation to health and disease**.” (Emphasis added.)

“Alpha-Linolenic Acid Conversion Revisited,” ([www.fatsoflife.com](http://www.fatsoflife.com)) by Norman Salem, et al.

- “A recent article in the 2003 PUFA [Polyunsaturated Fatty Acid] Newsletter indicated that in adult men and women the ‘average estimated conversion of ... [EPA/DHA]... **is likely to be an overestimate of the actual overall conversion rates for several reasons.**’ We see even with this excessive estimate of the parent omega-3 derivative conversion that theoretically no more than 37% of them are converted to derivatives.
- “However, The article makes the case that, “these amounts correspond to a conversion rate of one gram alpha-linolenic acid in the order of < **0.02%** for total n-3 LC-PUFAs or **0.002% for conversion to DHA**.... [based on blood lipid conversion].
- “In conclusion, we believe the estimates and interpretations currently put forward as **best estimates can be substantially improved**. The best estimates of alpha-linolenic acid **conversion to n-3 LC-PUFA [DHA/EPA] are much smaller than those claimed**. More rigorous determinations of n-3 fatty acid metabolism must serve as the foundation for more accurate nutritional conclusions and dietary recommendations.”

### ***Inconvenient Truth #9: EFA derivatives are made by the body “as needed.”***

“Flaxseed oil and fish-oil capsule consumption alters human red blood cell n–3 fatty acid composition: a multiple-dosing trial comparing 2 sources of n–3 fatty acid,” *American Journal of Clinical Nutrition*, Vol. 88, No. 3, 801-809, September **2008**.

Hussein, Nahed, et al., *Journal of Lipid Research*, Volume 46, 2005, pages 269-280.

- **“Although an increased intake of dietary ALA might be expected to upregulate ALA conversion, *this has . . . not been found...*” [This means your body does not want more regardless how much can easily be made.]**
- **“Overall conversion rates of LA and ALA, calculated from peak.**
- “[13C] LCP concentrations adjusted for dietary influences on pool sizes of LA and ALA, were low and of similar magnitude overall for AA and EPA (**0.18% and 0.26%**)....
- “Few studies have attempted more than **relatively crude estimates of isotope transfer** from tracer into the various tracee pools, and it is recognized that AUC [area under the curve] **values will overestimate true conversion rates** and provide only approximate relative rates of transfer.” [Note: Not using radioactive isotopes that directly appear in specific tissue so you can measure them is why so many health professionals have been misled; thinking the PEO-to-derivative conversion rates are much higher than they actually are.]

### ***Inconvenient Truth #10: The body only uses extremely small amounts of ALA to make DHA.***

Pawlosky, RJ, et al., “Physiological compartmental analysis of alpha-linolenic acid metabolism in adult humans,” *Lipids Res* **2001** 42: 1257-65.

- Research at the United States Department of Agriculture’s USDA food composition laboratory concludes that: “Only about 0.2% of the plasma 18:3n-3 [ALA] was destined for synthesis of 20:5n-3 [EPA], approximately 63% of the plasma 20:5n-3 was accessible for production of 22:5n-3, and 37% of 22:5n-3 [0.23% of the 0.2% = 0.046% net ALA] was available for synthesis of 22:6n-3 [DHA].” Unlike what you are told by sellers of fish oil supplements, this is confirmation of the extremely small amounts your body uses to make DHA.

### ***Inconvenient Truth #11: Amounts of EPA/DHA in fish oil are pharmacological plasma over-doses***

There were other published warnings about the overestimate of parent-to derivative amounts. The article, “Comparison of bolus versus fractionated oral applications of [13C]-linoleic acid in humans,” *European Journal of Clinical Investigation*, Volume 29 Issue 7 (2001), Pages 603 - 609, had this to say regarding over-estimations of derivatives (EPA/DHA): “**Conclusions:** Using areas under the curve [the simple, standard method of analysis] overestimates the conversion, because different residence times are **not considered.**” (Emphasis added.)

### ***Inconvenient Truth #12: Babies DO produce the omega-6 derivative, arachidonic acid (AA), and the omega-3 derivative, DHA.***

Carnielli, V.P., et al., “The very low birth weight premature infant is capable of synthesizing arachidonic and docosa-hexaenoic acids from linoleic and linolenic acids,” *Pediatric Research*, Vol. 40, No. 1, 1996, pages 169-174.

- “...[T]his clearly shows that **all infants were capable of actively synthesizing** the long chain polyunsaturated FA from their dietary precursors.
- “We report a **newly developed approach** which enabled us to measure *in vivo* [in the body] the biosynthesis of LCP with stable isotopes. The study shows that **small preterm infants are capable of converting both LA and LNA into LCP [long chain polyunsaturated fatty acid]**. We were also able to measure the 13C enrichment of all major metabolites of the essential FA including C18:3n-6, which is the delta-6 desaturase product of LA and thought [guessed] to be the limiting step in EFA metabolism. “**The major finding of this study** is that the healthy preterm infant at approximately 1 month of age can desaturate and elongate LA and LNA into n-6 and n-3 LCP, respectively.
- “This observation suggests that the D6 desaturation *may not be a rate-limiting step* in our patients.
- “We chose to study preterm infants receiving a formula with a 10: 1 ratio of LA and LNA because this ratio is often found in human milk lipids. [Note: In this experiment, the infant was given adequate “parent” PEOs to ensure conversions.]

- “The duration of *our studies was far longer* than any other published work, and we show that at 168 hours the plasma phospholipid LCP were still highly enriched.” (Emphasis added.)

### ***Inconvenient Truth #13: Fish oil increases platelet aggregation.***

Knapp, H, et al., “In vivo indexes of platelet and vascular function during fish-oil administration in patients with atherosclerosis,” *The New England Journal of Medicine*, Vol. 314, April 10, 1986, No. 15, pages 937-942: In patients with atherosclerosis, prostacyclin biosynthesis **fell** by a mean [average] of 42% during the fish-oil period.

- “...In patients with atherosclerosis, **prostacyclin** biosynthesis **fell** by a mean [average] of 42% during the fish-oil period.”

### ***Inconvenient Truth #14: Fish were found to be worthless in decreasing abnormal heart rhythm (called atrial fibrillation, or AF).***

Jarrett D. Berry, MD, et. al., “Dietary Fish Intake and Incident Atrial Fibrillation,” 15 March 2010, *The American Journal of Cardiology*, V. 105, I. 6, 844-848.

### ***Inconvenient Truth #15: Fish oil supplements increased sudden cardiac death in those with coronary heart disease.***

Burr, et al., “Lack of benefit of dietary advice to men with angina: results of a controlled trial,” *Eur J Clin Nutr* 2003, 57:193-200.

### ***Inconvenient Truth #16: Fish oil does not slow atherosclerosis.***

Angerer, P., et al., “Effect of dietary supplementation with omega-3 fatty acids on progression of atherosclerosis [plaque buildup in interior of arteries] in carotid [heart to brain] arteries,” *Cardiovascular Research*; 54:183-190, 2002.

- Both **fish oil** groups and the control groups showed close to equal atherosclerotic progression (**getting more clogged**). Fish oil **did not stop thickening of the artery**. On the contrary, the artery wall got thicker (bad) with fish oil ingestion!
- “In this group of selected patients with documented coronary artery disease, omega-3 PUFA [polyunsaturated fatty acids] **given for 2 years did not demonstrate an effect on slowing progression** of atherosclerosis in carotid arteries as measured by ultrasound.” [Note: 1.65 grams per day of fish oil supplement were taken. This is a great enough dose to cause adverse immunity and bleeding effects.]

“Sacks, Frank M., et al., “Controlled Trial of Fish Oil for Regression of Human Coronary Atherosclerosis,” *Journal of the American College of Cardiology* Vol. 25, No. 7, June 1995: 1492-8.

- “Fish oil **treatment for 2 years DOES NOT** promote major **FAVORABLE CHANGES** in the diameter of atherosclerotic coronary arteries.”

### ***Inconvenient Truth #17: Fish oil does not decrease inflammation***

Pot, GK, et al., “No effect of fish oil supplementation on serum inflammatory markers and their interrelationships: a randomized controlled trial in healthy, middle-aged individuals,” *European Journal of Clinical Nutrition*, 2009 (62), 1353-1159.

- “In conclusion, **this 12-week randomized, double-blind placebo-controlled** intervention trial **did not show** that 1.5 g/day n-3 PUFA [fish oil] significantly affected the serum inflammatory response in healthy individuals, nor did patterns of inflammatory markers. Thus, a healthy **middle-aged population may not benefit from fish oil as an anti-inflammatory agent**.
- “Overall, it seemed **that all serum inflammatory markers were increased rather than decreased after fish oil supplementation** than with placebo; however, these increases were not statistically significant.”

## Inconvenient Truth #18: Fish oil adversely affects chemotherapy<sup>32</sup>

- “Patients receiving virtually **all types of chemotherapy have been advised not to take fish oil supplements because they can make chemotherapy drugs ineffective**, researchers from the University Medical Centre Utrecht, the Netherlands wrote in the journal *Cancer Cell*.
- “Cancer **patients commonly take fish oil supplements** in addition to their standard treatment.
- “Lead scientist, Professor Emile Voest, an oncologist, said: ‘Whilst waiting for the results of further research, **we currently recommend that these products should not be used whilst people are undergoing chemotherapy.**’” (Emphasis added.)

### ENDNOTES

- <sup>1</sup> “Having implemented EFA supplementation **for over 25 years, clinical results were mediocre until I began using your protocol**. Dr. Rudin’s work with flax oil was important but lacked clinical effectiveness; likewise with Horrobin regarding GLA [*Gamma-linolenic acid (GLA)* is a plant-based omega-6 fatty acid] from Borage, Black Currant, and Evening Primrose oils. **Unlike the studies suggested, fish oil, too, was disappointing. With the Peskin (PEO) Protocol I experienced clinical success.** I have seen positive results (dermatological, cardiovascular, pediatric, and neurological) in over 100 of my patients.” Abram Ber, MD.
- <sup>2</sup> Hieb, MD, Lee, *Journal of Physicians and Surgeons*, Fall **2011**, Vol. 16, No. 3, pages 69-70.
- <sup>3</sup> Quinn, J, et al., “Docosahexaenoic Acid Supplementation and Cognitive Decline in Alzheimer Disease: A Randomized Trial,” *Journal of the American Medical Association*, November 3, **2010**, Vol. 304, No. 17, pages 1903-1911.
- <sup>4</sup> “Link Between Fish Oil And Increased Risk Of Colon Cancer In Mice,” J. Fenton, et al., *Medical News Today (Colorectal cancer)*, Article URL: [www.medicalnewstoday.com/articles/203683.php#post](http://www.medicalnewstoday.com/articles/203683.php#post), October 7, **2010**; and Woodworth, Hillary, L., et al., “Dietary Fish Oil Alters T Lymphocyte Cell Populations and Exacerbates Disease in a Mouse Model of Inflammatory Colitis,” *Cancer Research*; 70(20); 7960–9; 0008-5472.CAN-10-1396; Published OnlineFirst August 26, **2010**; doi:10.1158/0008-5472.CAN-10-1396.
- <sup>5</sup> The metabolism of n-6 [omega-6] and n-3 [omega-3] PUFAs [polyunsaturated fatty acids] in rats and mice are similar to humans. Ref.: Lands, W.E., et al., “Quantitative Effects of Dietary Polyunsaturated Fats [EFAs] on the Composition of Fatty Acids in Rat Tissues,” *Lipids*, Vol. 25(9), 1990, pages 505-516.
- <sup>6</sup> “Omega-3 Polyunsaturated Fatty Acids, Inflammation and Immunity,” by Philip C. Calder, Institute of Human Nutrition, University of Southampton, Bassett Crescent End, Southampton, UK.
- <sup>7</sup> © 2005 “Introducing The Body of Evidence,” Reliant Pharmaceuticals, Inc. (September 2005), page 17.
- <sup>8</sup> “Omega-3 Fatty Acids Unlikely to Prevent Cancer,” reported by the National Cancer Institute (NCI Cancer Bulletin, vol. 3/no. 5, Jan. 31, **2006**).
- <sup>9</sup> Veirord, MB, et al., “Diet and Risk of Cutaneous Malignant Melanoma: A Prospective Study of 50,757 Norwegian Men and Women,” *Int. J. Cancer*: 71,600-604 (1997).
- <sup>10</sup> Rogers, HW, et al., “Incidence Estimate of Nonmelanoma Skin Cancer in the United States, 2006,” *Archives of Dermatology* Vol. 146 (No. 3), March **2010**, pages 283-287.
- <sup>11</sup> *Journal of Investigative Dermatology*, **2008** December; 128(12):2905-2908, “Recent trends in incidence of cutaneous melanoma among U.S. Caucasian young adults.
- <sup>12</sup> Linos, EL, et al., “Increasing burden of melanoma in the United States,” *Journal of Investigative Dermatology*, **2009** July, 129(7): 1666-1674.
- <sup>13</sup> *Actas Dermosifiliogr.* **2010**;101(1) 39-46, “Changes in the incidence of skin cancer between 1978 and 2008.”
- <sup>14</sup> “Women With Type 1 Diabetes Receive No Heart Benefit From Omega-3,” *Medical News Today (Diabetes)*, Article URL: <http://www.medicalnewstoday.com/articles/193107.php>, June 28, **2010**.
- <sup>15</sup> Stacpoole, P, Alig, A., Ammon, L, and Crockett, E., “Dose-Response Effects of Dietary Marine Oil on Carbohydrate and Lipid Metabolism in Normal Subjects and Patients With Hypertriglyceridemia,” *Metabolism*, Vol. 38, No 10 (October), 1989, pages 946-956.
- <sup>16</sup> “Fish-oil supplementation reduces stimulation of plasma glucose fluxes during exercise in untrained males,” *British Medical Journal of Nutrition* (**2003**), 90, 777-786.
- <sup>17</sup> Karlström, BE, et al., “Fatty fish in the diet of patients with type 2 diabetes: comparison of the metabolic effects of foods rich in n23 and n26 fatty acids,” *Am J Clin Nutr* **2011**;94:26-33.
- <sup>18</sup> Anthony P. Binbo, “Raw material sources for the long-chain omega-3 market: Trends and sustainability. Part 2,” April **2009**, [www.aocs.org/Membership/FreeCover.cfm?itemnumber=1085](http://www.aocs.org/Membership/FreeCover.cfm?itemnumber=1085), accessed 10.8.11
- <sup>19</sup> Umhau, JC, et al., “Imaging incorporation of circulating docosahexaenoic acid [DHA] into the human brain using positron emission tomography,” *Journal of Lipid Research*, Vol. 50, **2009**, pages 1259-1268. **DHA incorporation is a mere 3.8 ± 1.7 mg/day.**
- <sup>20</sup> “Flaxseed oil and fish-oil capsule consumption alters human red blood cell n-3 fatty acid composition: a multiple-dosing trial comparing 2 sources of n-3 fatty acid,” *American Journal of Clinical Nutrition*, Vol. 88, No. 3, 801-809, September **2008**.
- <sup>21</sup> Hussein, Nahed, et al., *Journal of Lipid Research*, Volume 46, 2005, pages 269-280.
- <sup>22</sup> Pawlosky, RJ, et al., “Physiological compartmental analysis of alpha-linolenic acid metabolism in adult humans,” *Lipids Res* **2001** 42: 1257-65.
- <sup>23</sup> “Comparison of bolus versus fractionated oral applications of [13C]-linoleic acid in humans,” *European Journal of Clinical Investigation*, Volume 29 Issue 7 (**2001**), Pages 603 - 609: “Using areas under the curve overestimates the conversion, because different residence times are *not considered*.”
- <sup>24</sup> Carnielli, V.P., et al., “The very low birth weight premature infant is capable of synthesizing arachidonic and docosahexaenoic acids from linoleic and linolenic acids,” *Pediatric Research*, Vol. 40, No. 1, 1996, pages 169-174.
- <sup>25</sup> Knapp, H, et al., “In vivo indexes of platelet and vascular function during fish-oil administration in patients with atherosclerosis,” *The New England Journal of Medicine*, Vol. 314, April 10, 1986, No. 15, pages 937-942: In patients with atherosclerosis, prostacyclin biosynthesis **fell** by a mean [average] of 42% during the fish-oil period.
- <sup>26</sup> Jarrett D. Berry, MD, et al., “Dietary Fish Intake and Incident Atrial Fibrillation,” 15 March **2010**, *The American Journal of Cardiology*, V. 105, I. 6, 844-848.
- <sup>27</sup> Burr, et al., “Lack of benefit of dietary advice to men with angina: results of a controlled trial,” *Eur J Clin Nutr* **2003**, 57:193-200.
- <sup>28</sup> Angerer, P, et al., “Effect of dietary supplementation with omega-3 fatty acids on progression of atherosclerosis [plaque buildup in interior of arteries] in carotid [heart to brain] arteries,” *Cardiovascular Research*; 54:183-190, **2002**.
- <sup>29</sup> “Sacks, Frank M., et al., “Controlled Trial of Fish Oil for Regression of Human Coronary Atherosclerosis,” *Journal of the American College of Cardiology* Vol. 25, No. 7, June 1995: 1492-8.
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