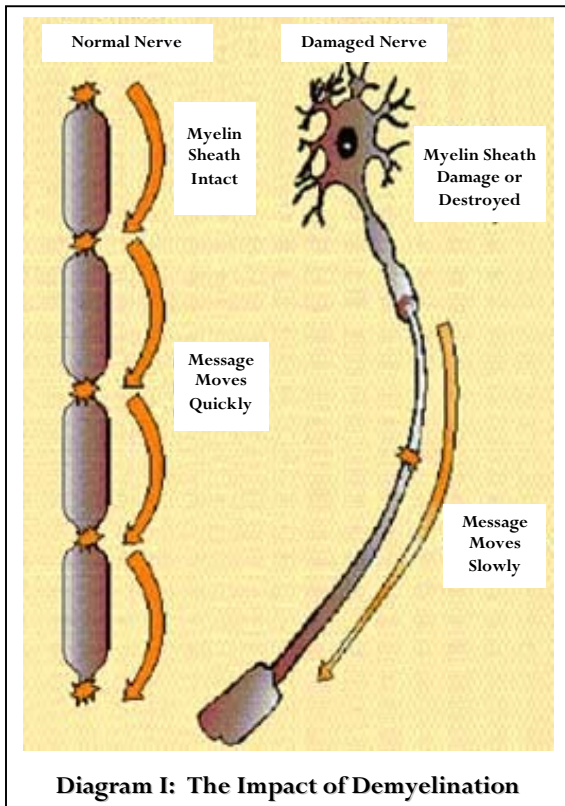


Appendix C

MS & Omega-3 Fatty Acids



Presently, there is no *cure* for MS. In the past two decades western medical treatment has focused on altering symptoms and progression of the disease through injectable immune modulating drugs that have a wide variety of side effects. Beginning more than 50 years ago, neurologist Dr. Roy Swank began researching an alternate method of modulating the course of MS through dietary change.

Early epidemiologic studies indicating inequitable distribution of MS in different parts of Norway inspired Dr. Swank to explore the role of animal based saturated fats and MS. He began strictly limiting MS patients' saturated fat intake and increasing their intake of polyunsaturated oils [notably fish oil]. His observational studies of MS patients on this modified diet spanned more than 40 years. His research showed a clear

correlation between these two factors with those who adhered to the diet experiencing reduced frequency and severity of relapse, consequent reduction of disability and reduced death rates¹. Swank's dietary approach has been adopted or modified by many patients over the years and has inspired additional research into the role of dietary factors and MS. To understand the mechanism by which fat intake influences the functioning of the body, it is important to begin with the cell membrane.

Review of the Phospholipid Bi-layer & Essential Fatty Acids

In Chinese Medicine, the exterior of the body is protected by the *Wei Qi*. The *Wei Qi* is collectively gathered from multiple sources: food combined with the drawing in of *Zong Qi* through the Lung to replenish the *Yuan Qi* housed in the Kidneys. It is the *Wei Qi* which is responsible for protecting the body, regulating the movement of pathogenic factors in and out of

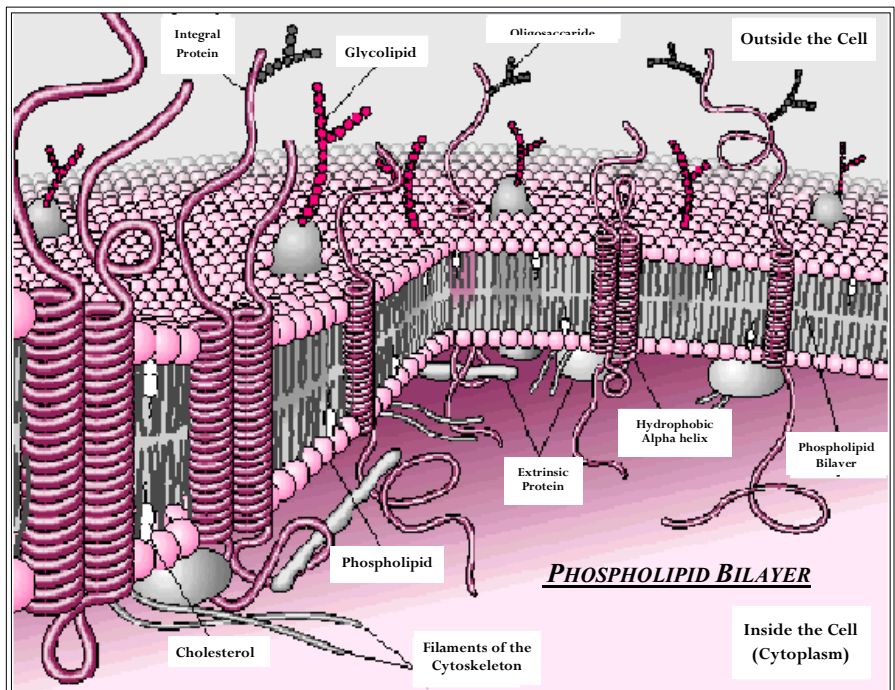
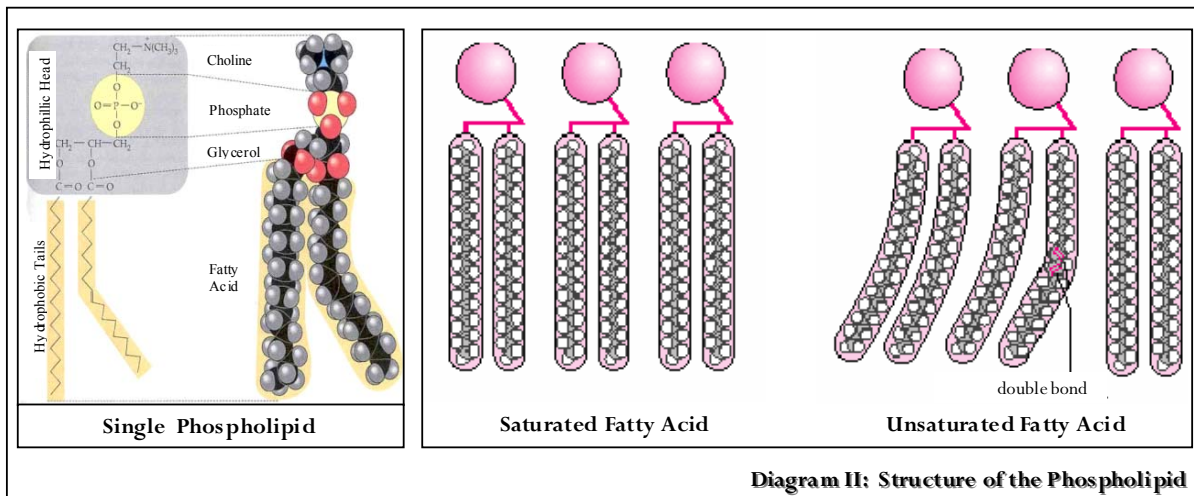


Diagram III: The Phospholipid Bilayer

the body. The phospholipid bi-layer of the cell membrane could be likened to the *Wei Qi* of each individual cell in the body. Saturated FAs are able to pack tightly together in the bi-layer due to their uniform structure² (Diagram II). The presence of at least one double bond in the carbon chain creates a *kink*. This *kink* creates more space between the individual phospholipids and greater fluidity in the cell membrane. (Diagram III – same reference)

The composition of the bi-layer is not indiscriminate. There are differences throughout the body depending on the needs and responsibilities of the cell. For example, the inner mitochondrial membrane is made of approximately 76% protein. This is appropriate for the mitochondrial function in ATP generation and protein synthesis. The myelin membrane of axons in the central nervous system provides critical insulation and a conductive pathway for our body's communication network. The myelin is only 18% protein, and otherwise predominantly lipid in content.³



Essential FAs (EFAs) are required for the body to function and cannot be synthesized within the body itself. They must be taken in through the diet. Monounsaturated FA (MUFA) have one double bond in the carbon chain (carbon=carbon). Generally MUFAs are liquid at room temperature and will solidify if refrigerated (ex. olive oil). Polyunsaturated FAs (PUFA) are those which have more than one double bond in the carbon chain. This makes them more fluid and they generally remain liquid even when refrigerated (ex. flax oil, fish oil).

Amongst PUFAs, two major types of omega FAs are differentiated by the location of the double bonds in the carbon chain. In **Omega 3 FAs** the bond is located three carbon molecules from the end of the chain, in **Omega 6 FAs** the double bond is six from the end. These two PUFAs function very differently in the body.

*“Omega-3 fatty acids reduce inflammation, omega-6 increase inflammation...
Omega-3 are non-immunoreactive, omega-6 are immunoreactive.”⁴*

Omega 3 FAs are further differentiated into EPA, DHA & ALA. Eicosapentaenoic Acid (EPA) and Docosahexanoic Acid (DHA) are found in cold water fish and seaweed. Alpha-linolenic acid (ALA) is found in flax seed oil, certain nuts & seeds, and dark leafy greens. EPA & DHA are directly metabolized by the body. Enzymes exist within the body which can convert ALA to EPA. However, in people who already have difficulty with FA metabolism or integration, it appears that DHA & EPA are most readily metabolized.

Sources of Omega 3s

- Oily cold water fish (EPA & DHA)
- Seaweed (EPA & DHA)
- Dark Leafy Vegetable (ALA)
- Winter Squash (ALA)
- Walnuts (& other nuts ~ ALA)
- Seeds (ALA)
- Venison & buffalo (in comparison with beef when grassfed)

Sources of Omega 6s

- Vegetable Oils (Corn, Sunflower, Soybean ~ commonly used in cooking & processed foods)
- Eggs
- Whole Grains
- Legumes

Immune Moderating Properties of Omega 3s

Augmenting Omega 3s has a direct impact on both the cascade involving arachidonic acid (and consequently eicosanoids) and cytokines. Elucidating these two processes will illustrate the moderating properties of Omega 3s and the direct implications for MS.

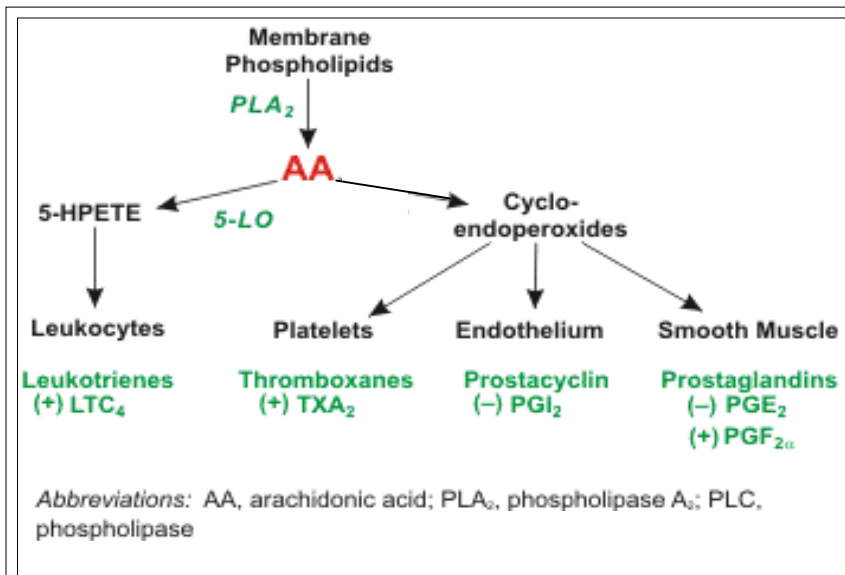


Diagram IV: The Arachidonic Acid Pathway⁵

Arachidonic acid is an essential FA found predominantly in animal fats, including dairy. Arachidonic acid produces eicosanoids, another kind of lipid. Eicosanoids play a critical role in moderating inflammatory response of the immune system, both in intensity and in duration. In patients with inflammatory conditions, eicosanoids are found in elevated levels in the body. If Omega 3 (DHA & EPA) intake is increased, it has been shown that the body will preferentially integrate these FAs instead of

arachidonic acid. The consequent decrease of archidonic acid activation appears to temper the over reactivity of the immune system in someone who has MS.⁶

Cytokines are proteins which act as messengers between cells in the body. A variety of cytokines play critical roles in the regulation of the immune system. Production of one of two particular kinds of cytokines, T-helper 1 (Th1) and T-helper 2 (Th2), directly impacts the pattern of immune response in the body. Activation of Th-1 initiates a pattern dominated by cell mediated cytotoxicity, inflammation and hypersensitivity. By contrast, Th2 activation manifests primarily antibody mediated, allergic responses.⁶ Th1 cytokines predominate in someone who has MS. Increasing dietary intake of Omega 3s in MS patients has demonstrated a concurrent reduction in pro-inflammatory cytokines.⁷ Both of these biochemical mechanisms support the idea of Omega 3s as immune moderating and anti-inflammatory.



Research into the role of Omega 3s and MS continues. Studies designed to test the links between saturated fat and MS tend to be limited by a small number of participants. Self motivated dietary change is not only difficult to sustain for the individual, but it is additionally not lucrative to the pharmaceutical industry which funds a large percentage of MS related research.

Since the early 1900s population based epidemiologic studies have repeatedly demonstrated a relationship between saturated fat intake (from animals other than fish) and MS.⁸ In addition to Swank's research, Omega 3 FAs continue to garner attention in the field of health care for their role (both proven and potential) in moderating atherosclerosis, coronary artery disease and vasoconstriction, auto-immune driven inflammatory conditions including Lupus, Rheumatoid Arthritis and MS, cancer, depressive disorders & mood imbalance, allergic responses and overall immune regulation. In examining the myriad aspects of care for patients with MS, diet and Omega 3 supplementation should be considered essential components of the therapeutic equation.

“Medicine has always sought cures. The lure of a ‘magic’ injection, which can be given to patients to fix their illness, is very strong. We probably have the antibiotic revolution of the mid-20th century to thank for that. Before that, the medical literature is full of descriptions of patient factors in the resolution of illness. Once antibiotics came along, medical treatment could be pictured as a war against disease with the doctor the shinning knight riding in with a cure, administering it, and riding off satisfied with another win. Things that the patient could do seemed less important. The patient became much more of a passive recipient of the magic cure...suffice to say that this startling piece of research, where the patient is empowered to make the changes to lifestyle that may result in successfully delaying the progression of an insidious disease, has been ignored.”

~ Professor George Jelinek, MD

(regarding the lukewarm response to Swank's' research by the medical community)

¹ Swank, Roy L, Brewer Dugan, Barbara The Multiple Sclerosis Diet Book: A Low Fat Diet for Treatment of MS. Doubleday New York, 1987

² http://www.chemistry.emory.edu/justice/chem190j/Nerve_cell_membrane.htm, Sinauer Associates Inc. Fieldman Neuropsychopharmacology 3-17, 3-18

³ Calder PC. Dietary Modification of Inflammation with Lipids. *Proceeding of the Nutrition Society* 2002: 61: 345-358.

⁴ <http://www.yasoo.com/omega-t-adv1.htm>

⁵ <http://www.cvphysiology.com/Blood%20Flow/BF013.htm>

⁶ Kidd PM. Multiple Sclerosis, An Autoimmune Inflammatory Disease: Prospects for its Integrative Management. *Alternative Medicine Review* 2001: 6:6: 540-566.

⁷ Nordvik I, Myhr K-M, Nyland H, Bjerve KS. Effect of Dietary Advice and n-3 supplementation in newly diagnosed MS patients. *Acta Neurol Scand* 2000: 102: 143-149.

⁸ Swartz, S., Leweling, H.. Multiple Sclerosis and Nutrition. *Multiple Sclerosis Journal*. 2005 (11) 24-32.

⁹ Jelinek, G. MD. Taking Control of Multiple Sclerosis: Natural and Medical Therapies to Prevent its Progression. Hyland House Flemington Australia 2000.