



## The Cell Membrane – Doorway to Your DNA



Dr. Kate Thomsen and Silky

"Fish Oil helped save our son" was the story on CNN on Oct. 22, 2012. Early morning news told of the story of a 17 year old man who was severely injured in a car crash. He was hospitalized and in a coma for 10 days when his father reached out for help. A doctor friend proposed using fish oil to treat his traumatic brain injury. The doctor relayed a prior case from 2006 where high dose fish oil was used to normalize neurologic function. This was the case of a 26 year old man who had suffered multiple injuries including carbon monoxide induced brain damage after being trapped in a mine for 41 hours. High dose fish oil was used in both cases – 10 times the normal dose was added via feeding tube. In both cases, the men came out of the coma much faster than they would have had the fish oil not been given. And there was speculation they might not have recovered from the coma without it. Both had a nearly complete recovery which amazed the families and doctors alike. It appears that the high dose fish oil had significant anti-inflammatory actions. Now, the Section on Nutritional Neurosciences at the NIH plans to do intervention trials on the use of omega 3 fish oils for the treatment of traumatic brain injury. I love it! The only thing that bothered me about the clip was that, at the end, one of the doctors was extolling the benefits of fish oil and ended with, "...it's great stuff and you can't take too much of it..." That's what I'd like to discuss. In non-extreme situations, there needs to be balance among the fats.

We take in fats from our diets. Knowing that fats and

water do not mix, did you ever wonder how those fats move around in your watery blood and gastrointestinal tract? Your amazing body has enzymes that take fats apart, allow them to be absorbed and then be reassembled. It also uses fat transporter molecules. Bile salts, released from the gall bladder, surround fats and carry them around in a little ball called a micelle. Dietary fats, cholesterol made by your liver, and some proteins are packaged into a ball called a chylomicron for transporting through the bloodstream. The fats are then delivered to the right tissues: to make energy for muscles or to be stored in a fat cell. But the storage and production of energy is not the only role of the dietary fats and cholesterol. A crucial and life sustaining role for these fats is the production of cell membranes. And this is an area that will continue to be a major focus of interest in the medicine of the future.

A cell membrane is the thin outer skin of the cell. Made up of fats, it keeps the watery inner workings of your cells separated from the watery exterior of your cells. Not only is each cell separated from its environment by this fatty shell, there are several places inside the cells that are also "walled off" by a fatty membrane – the nucleus, the mitochondria, etc. The nucleus (where you store your DNA), the mitochondria (the energy factories that produce ATP to fuel your life), and the myelin sheath (which insulates and promotes the signaling of your nerve cells) are totally dependent on this fatty membrane. Needless to say, we should stop damning fats and start to understand, nurture, and treat this body part with the respect it deserves.

The cell membrane helps the cell maintain its shape and protects the integrity of the interior of the cell by allowing certain substances into the cell, while keeping other substances out. It is also the base of attachment for proteins that stick out to the exterior of the

cell announcing its identity. Since there are food particles, bacteria, viruses, etc floating around in your tissues, you need this identification signal to alert your immune system that your cells are "self" and not to attack. The cell membranes surrounding the mitochondria and the nerve cells take advantage of the electrical charge generated by separating different salt concentrations on each side of the their membrane. The electrical gradient is what runs the Krebs cycle, creating energy in the form of ATP from the food you eat. In the nerve cell, the electrical gradient transmits nerve impulses.

Cell membranes are primarily composed of phospholipids. These are fats that have a water soluble head and 2 fatty tails. They line up in 2 rows with the fatty tails facing each other and 1 set of water soluble heads facing into the watery interior of the cell and the other set of watery heads facing the exterior of the cell. This is called a bilayer. The fatty tails in the inner layer of this membrane vary and include: saturated fats, monounsaturated fats (MUFAs), and polyunsaturated fats (PUFAs). The essential fats (omega 6s and omega 3s) are PUFAs. They are called essential because the body cannot assemble them out of other fats. Essential fats must be included in the diet. The Omega 6s (Linoleic Acid from plant oils) comprise ~30% of the fatty tails in the membranes and the Omega 3s (Alpha-linolenic Acid from fish oil) comprise ~ 7%.

Inserted into this bilayer is cholesterol, a rigid fat. It makes up about 30 – 40 % of the cell membrane composition and contributes to its mechanical strength. Proteins are also inserted in the membrane to form channels and gates, allowing desired substances in and allowing other substances to exit the cell. It is thought that 30% of the proteins made by our DNA are proteins that are used in the cell membrane itself. It was 1972 when Singer and Nicholson published a

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paper in Science titled "The Fluid Mosaic Model of the Structure of the Cell Membrane". They described how the fats in the cell membrane are continuously vibrating and the proteins and fats diffuse laterally and migrate throughout the matrix. This is a dynamic structure and the model has become even more complex in the present day. Reflecting on the complex composition and function of this amazing membrane, Dr. Bruce Lipton (The Biology of Belief) likened it to a computer keyboard. He refers to the body's vital genetic information (the DNA) as the hard drive. How does the external world (our thoughts and experiences, our exposures, our diets) tell our DNA which responses (proteins) to make? There are 2 cell membranes separating the "outside world" from your DNA. You can't get to this library without going

through a door; you can't access the hard drive without a keyboard. That's the cell membrane – a delicate balance of fats and proteins that controls everything!!!! More on the cell membrane in the next article.

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