

OMEGA-3'S & ANSWERS TO SOME HEALTH PUZZLES

The omega-3 polyunsaturated fatty acids were driven out of our diet long before scientists had any strong convictions about how necessary they were to our health. By the time hints of their importance began to drift in, the industrial and cultural practices responsible for banishing them, including the wholesale hydrogenating of food oils, were steamrolling through American life. The work of George and Mildred Burr in the 1930's, establishing the omega-6 and omega-3 fatty acids as the only "essential" fats, i.e., they were like vitamins, in that we could get ill and die if we didn't eat them — was viewed largely as theoretical. The general attitude among scientists was that in "real life," a dietary deficiency of the polyunsaturated fatty acids was highly unlikely. The heart attack epidemic gathering momentum at the time was soon to prove them wrong.

Meanwhile, around 1935 at the Karolinska Institute in Stockholm, Sweden, Dr. Ulf von Euler first extracted a biologically active derivative of a polyunsaturated fatty acid and named it a "prostaglandin." Ralph Holman, scientist and editor of *Lipids*, a major research journal, writes:¹

World War II interrupted research on the "essential fatty acids" (EFA) and "prostaglandins" (PG), which in any case was then limited by inadequate technology. The 1950s saw the introduction of radioisotopes, gas liquid chromatography and mass spectrometry. During the 1950s and 60s, EFA were shown to be required by several species, including man.

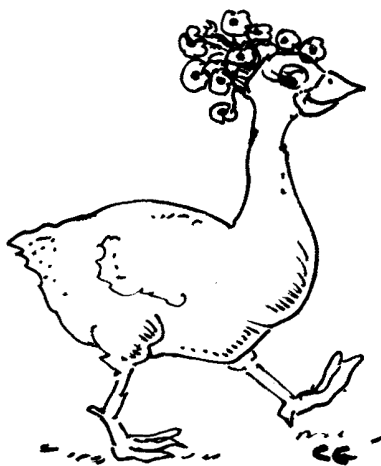
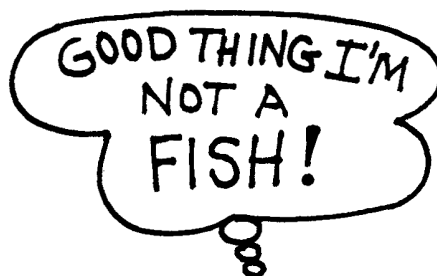
In 1965, in Holland and Sweden, researchers established that the prostaglandins were derived from the EFA. Work on the hormonelike PG began rolling internationally. They were discovered to be powerful local mediators in cells that controlled innumerable biochemical and

physiological functions. Dr. Holman continues:

Pharmaceutical companies became excited by the potential of PG . . . in the fields of reproductive physiology, inflammation and thrombosis. Meanwhile in the EFA camp, advances were made in establishing the role of EFA in cell membrane function, brain growth and the prevention of atherosclerosis and thrombosis.

He notes that in spite of the evidence establishing a link between the essential fatty acids and prostaglandins, *workers in both fields had remained separated.*

In biomedical science, the more data that accumulate, the harder it is to see the forest for the trees! Researchers immersed in experiments that go on for years seldom poke their heads up to see what's happening outside their bailiwick. Decades may go by before efforts are made to weave the fragments of scattered worldwide data into some sort of logical fabric. The same thing happened in lipid research.



Making the Connection

In 1980, Dr. Holman presided at an historic conference on the EFA and prostaglandins at the University of Minneapolis, at which the two great pioneers, Burr and von Euler, "with a combined age of 160 years," were guests of honor. From all around the globe, experts in both fields gathered, at last, to fit the pieces together! Participants were faced squarely, many for the first time, with the realization *that what we eat in the way of unsaturated fats has a direct connection with the mighty prostaglandins our cells make from them.* It's not surprising, therefore, that major medical and biochemical texts and journals today still largely ignore this basic link and most clinicians are, as yet, unaware of it.

"Seafood & Health '85"

The next phase in the biomedical dialogue, I hope, will deal with the recognition that *both families of EFA — the omega-6 and omega-3 — are needed* in our diet before healthy cells and PG activity can exist. A conference last November in Seattle, Washington, took a big step in this direction. Entitled "Seafood & Health '85: Issues, Questions, and Answers,"² it had as keynote speakers some of the leading U.S. scientists in fatty acid/prostaglandin research. William E. Connor, M.D., of Oregon Health Sciences University, has changed the direction of medical thinking with his group's studies on the startling effectiveness of fish oil supplements in dealing with obstinate cardiovascular ailments. Fish oils are rich in two highly polyunsaturated fatty acids of the omega-3 family: EPA and DHA (eicosapentaenoic and docosahexaenoic acids). Until very recently, the thrust of research was on the omega-6 group. Most of the commonly used vegetable oils and margarines contain omega-6 linoleic acid. However, the other essential fat, alpha-linolenic of the omega-3 group, has largely been removed by means of fine-tuned hydrogenation. The commercial rationale is that it oxidizes too easily and produces off-flavors, while the scientific one, up till now, has been that omega-3's didn't seem to be all that necessary to human health.

That's changing fast. As FELIX LETTER readers know, one scientist, Donald O. Rudin, M.D., helped turn the tide with his clinical pilot study in which nutritional linseed oil, a super-rich source of omega-3 alpha-linolenic, was used over a two-year period to treat 44 patients, who had chronic disorders ranging from arthritis to schizophrenia, with remarkable results. A popularized version of his work, which I co-authored, DR. RUDIN'S EAT TO LIVE LONGER DIET, will be released this fall, the publication of his comprehensive biomedical-nutrition text to follow within a year or so, it is hoped.

Alpha-linolenic is the "parent" omega-3 essential fatty acid. **Plants alone make it.** Once we consume it, our system processes it, by means of enzymes and vitamin-mineral cofactors, into super-polyunsaturated EPA and DHA. Alternatively, we can get EPA and DHA directly, mainly from fish and shellfish. Dr. Rudin found in his clinical study that some of his patients who didn't respond to linseed oil improved when fish oils were given. Dr. Connor and the other scientists participating in "Seafood & Health '85" have been looking into the effects of fish and fish oils, first in heart disease, then moving on to cancer, rheumatoid arthritis, bronchial asthma, immune disorders, and so on.

Talk about folk medicine going respectable! It's a replay, if you're middle-aged or older, of the cod-liver oil days of our childhood! Remember those steamy battles with Mom over taking that stuff when you were little? Now, however, it's not the vitamins A and D in the oil, but the wondrous omega-3's that are piquing medical interest. Medical workers have even come up with a fancy new term for

examining the healing qualities of everyday food substances; Dr. Artemis Simopoulos, chairman of the Nutrition Coordinating Committee of the National Institutes of Health, said at the conference that the work on omega-3 fatty acids "appears to move nutrition . . . into a much more exciting area of nutrition and metabolism, closer to what I call **molecular nutrition** research."

Dr. Rudin put it nicely, in describing the medical establishment's disdainful attitude, only a short while ago, towards his eye-opening nutritional findings: "Just as real men don't eat quiche, real scientists don't do nutrition!" If the label "molecular nutrition" makes the players happy and puts nutrition in the respectable big leagues, we all may yet benefit.



Omega-3's Help the Heart

Researchers shared some heartening developments at the Seattle conference. Dr. Connor described the dietary use of salmon and salmon oil in patients to lower abnormally high levels of fats and cholesterol in the blood to acceptable levels. In these patients, low-fat diets and drugs hadn't worked. Omega-6 vegetable oils used in the same patients weren't nearly as effective as the omega-3's. How do the omega-3's produce their effects? Scientists speculate that the main mechanism of action is in the liver, where triglycerides (fats) and their carriers in the blood, VLDL (very low density lipoproteins), are synthesized. Omega-3's in the diet slow down the liver's production of triglycerides and VLDL, so that fewer circulate in the blood.

On an omega-3-rich diet, these fats also are removed from the blood more rapidly, i.e., there is a higher "turnover rate." **There is also increased excretion of cholesterol from the body in the stools with the omega-3 diet.** All of these factors, the researchers point out, have a beneficial influence on the cardiovascular system. Omega-3's help the heart and arteries in another way. Certain prostaglandins (PG) made in our body from omega-6 arachidonic acid can have devastating effects, when we make too many of them. They cause arteries to constrict, and they also cause blood platelets to clump and interact with blood vessel walls to form a clot, or thrombus. In an artery passage already narrowed by gradual buildup of plaque, the formation of a thrombus, along with spasm-like clamping down of an artery, may shut off the blood flow to tissues (ischemia). When these events take place in a vessel in the heart, we have the scenario for a heart attack; in the brain, we call it a stroke.

Dr. Scott Goodnight, professor of medical pathology at Oregon Health Sciences University, said at the conference that the omega-3's we eat **appear to inhibit overproduction of these potentially harmful PG** from arachidonic acid. Moreover, omega-3's produce beneficial PG of their own, which have the opposite effect: **they dilate the blood vessels, and prevent blood platelets from aggregating and forming clots.**



Watch Your Oils & Margarine

Studies using dietary omega-3 (EPA and DHA) from fish and fish oils have also lowered blood pressure in patients. In Dr. Rudin's clinical trials, linseed oil, containing the 'parent' omega-3, alpha-linolenic acid, normalized blood pressure in a number of his subjects. The evidence that omega-3's are inexorably tied to cardiovascular well-being becomes more convincing every day! It's no longer enough for doctors and dietitians to say we need to use "more polyunsaturated fats," i.e., salad oils and margarine, to protect our hearts. Rudin says modern diet contains 80 percent fewer omega-3's than the traditional diets people ate, before heart attacks, cancer, and diabetes descended on us in epidemic form, nullifying some of the benefits of 20th-century control of the infectious diseases that used to kill us off. **Margarines are an unfortunate choice, because alpha-linolenic is deliberately hydrogenated out of them.** Also, they are full of manmade **trans**-fatty acids, which resemble the essential fatty acids enough to fool our cells into incorporating them into membrane structure. Once in our cell membranes, however, they gum up the works, since they can't do the metabolic jobs required of them! A little bit of butter is better.

Most commercial salad oils and margarines provide omega-6 linoleic acid but little or no omega-3's. Until recently, soybean oil, one of the few naturally good

sources of alpha-linolenic, was processed via "light or partial hydrogenation" just to get rid of this omega-3 fatty acid. I am happy to report that David Erickson, director of soy oil programs of the American Soybean Assoc., wrote me last year that several major producers have switched to non-hydrogenated soybean oil, because of the growing information on the value of omega-3's to health. Look for labels that say "100% all natural soybean oil" and stay away from anything that says "hydrogenated" or "partially or lightly hydrogenated." (If you think that's easy, read labels on packaged crackers, cookies, dips, peanut butter, etc. Hydrogenated vegetable shortening is a plague — it's everywhere!) Walnut oil, wheat germ oil, and, of course, linseed oil are the richest available sources of omega-3 alpha-linolenic. These oils should be refrigerated after you unseal the container, to slow down rancidity.

The Eyes Have It

Back to our conference. Dr. Connor described the presence of EPA and DHA in large amounts in neural tissues, such as the brain and the retina of the eye:

"We noted in control animals [rhesus monkeys] that one-third or more of the fatty acids present in the gray matter of the brain is composed of omega-3 fatty acids, particularly docosahexaenoic [DHA]." In an experiment where they deprived rhesus monkeys, in utero and after birth, of omega-3 fatty acids, they found that the retina contained only 7 percent DHA, instead of the normal 37 percent. The question next arose: what would happen to the functions of these monkeys? In special visual testing the experimenters found that the deficient infant monkeys *had 50 percent less vision* than the controls! (I've said this before, and I'm bound to say it again: please, pregnant ladies, eat your fish, take a few teaspoons of cod-liver oil a week, use linseed routinely, while you're pregnant and while you're nursing! The rewards will be incalculable.)



Omega-3's to Fight Cancer

Other participants spoke of promising results, in human and animal studies, of using fish oils for immune disorders, renal disease, bronchial asthma, migraine headache, and rheumatoid arthritis. Dr. Rashida Karmali of Rutgers University's nutrition department, also of Sloan-Kettering Institute for Cancer Research, has been using fish oils in the diet of laboratory animals to tackle the Big C. *Women with breast cancer, she notes, have very high amounts of PG from omega-6 arachidonic acid*, compared with the amounts normal persons make. (These same PG and their derivatives are produced in abnormal amounts in cardiovascular disorders, migraine headache, painful menstrual cramps, bronchial asthma, etc.) She thought it reasonable to test the hypothesis that inhibition of this group of PG "be considered an anti-tumor approach in animal systems. Instead of using nonsteroidal anti-inflammatory drugs such as Indomethacin or Ibuprofen, we decided to use dietary omega-3 fatty acids," to competitively inhibit the synthesis of these PG.

The results? Very, very encouraging. The fish oils were found to inhibit the development of tumors in breast, colon, and prostate cancers in the animals! Dr. Karmali said, "I want to emphasize that these are very preliminary observations that need further confirmation. The ideal conditions under which omega-3 fatty acids may be acting as inhibitory factors in breast cancer development are not established. *It appears that an optimum ratio of omega-3 to omega-6 fatty acids is critical.*"

Omega-3's Inhibit 'Bad' PG

Dr. William Lands, head of the department of biological chemistry at University of Illinois, tied it all together in his talk. [He uses the term "eicosanoids" to describe PG and their derivatives, since "eicosa" is Greek for "containing 20 atoms," and the eicosanoids are all 20 carbons long.] He said, "since then [1972], we have learned that each individual cell in our body has a propensity to make one or another of many eicosanoids, and the eicosanoids allow cells to talk back and forth to each other. These are signaling compounds, ... message units that are used as the cells communicate back and forth ... to regulate the behavior of cells and clusters of cells in tissues."

The PG or eicosanoids from omega-6 arachidonate are produced as "a defensive response to some sort of signal ... There is such a thing, perhaps, as too much investment in defense at times ... It's our oversynthesis of some of these 'defensive' compounds that leads to the symptoms of arthritis, ... asthma, ... dysmenorrhea, ... or plays a role in heart attacks and stroke."

It works something like this: "We don't keep eicosanoids around in our tissues for more than a few seconds before our body metabolizes them and inactivates them. These compounds arise in response to defensive signals, but they are formed and destroyed very quickly. The metabolites then go off and accumulate in the urine, where they can be measured.

"So when everything is kind of slow and no defense is needed, you make some eicosanoids and they go to metabolites ... there's no pathophysiology; it's just dribbling along. It's like when a rain comes, it goes down the gutter and the streets get dry and everything is fine ... In the disease process, it's the amplified, exaggerated biosynthesis that leads to much of the pathophysiology that we recognize."

The omega-3's slow down the deluge of omega-6 PG. We can still make them, "but they dribble through, making eicosanoids and then metabolites." In other words, no flash floods that break the levees!

"The consequence of this picture is that eating fish oil may put into the ... fatty acid pool the antagonist of eicosanoid synthesis, *so that hour by hour, every meal that brings EPA into that pool ... provides a degree of inhibition of the biosynthesis of PG ... from arachidonate.*"



Linseed & Fish Oil Instead of Drugs?

Aspirin, Motrin, Tylenol, Indomethacin and other nonsteroidal, anti-inflammatory drugs have in common an ability to slow down production of inflammatory PG. Unfortunately, while they may relieve symptoms, they have serious side effects and they do not cure the ailments. One reason may be that they not only stop the body from making too many inflammatory PG, **but also the beneficial ones — the PG the body tries to make to fight inflammation, dilate blood vessels and bronchial tubes, and heal tissues.** Dr. Land says we can use the omega-3 fatty acids to **selectively curb the “bad” PG**, and at the same time, permit and even encourage the body to make the “good” ones. In this way, the omega-3’s accomplish what the drugs set out to do, but do it safely and better, because they are a **natural means** to augment the body’s normal healing processes!



Most of the participants enthusiastically endorsed the need to encourage increased fish consumption (in the U.S., we eat a little over 13 lbs per capita a year, compared with 150 pounds of meat), but wavered on the general use of fish oil supplements by the public. For one thing, if cod-liver oil is taken daily in amounts above one teaspoon, vitamins A and D can begin to accumulate in toxic amounts. (My own instinct tells me to keep it to one teaspoon three or four times a week.) While applauding the gratifying effects of the fish-body oils in their clinical studies, most researchers seemed reluctant to advise the public to conduct their own experiments with these oils. (Like fish-liver oils, they contain EPA and DHA, but no A and D.) A few, however, noted the apparent safety of the widespread use of cod-liver oil a few generations ago, when practically every baby and youngster in the country was taking it, happily or not!

Vitamin E Protects Omega-3's

Omega-3 fatty acids are highly oxidizable, whether as food oils or as components of our tissues. In our membranes, they normally are protected by antioxidants, such as the enzyme glutathione peroxidase containing the trace mineral selenium; and by the staunch free-radical defuser, vitamin E. To prevent peroxidation, Dr. Connor's group added antioxidants to the fish oils and gave all their subjects 100 mg of alpha tocopherol (vitamin E) daily. Dr. Rudin routinely uses supplements of vitamin E and selenium with patients in his linseed oil trials. While fish, fish oils, and linseed oil contain some vitamin E, it's a fragile vitamin easily lost in heating and processing, and I'm convinced from long experience, and from literally thousands of studies in the scientific literature, that supplements are a wise precaution, if we're lucky enough to have access to them.

Good News About Shellfish

Another nice piece of news that came out of the conference was the information that shellfish need no longer be on the medical no-no list because of their cholesterol content. Mollusks, in fact have far less cholesterol than was originally estimated, because more than half of it is in the form of “non-cholesterol sterols,” which may even help to lower blood cholesterol by interfering with cholesterol absorption! Mollusks (squid, clams, oysters, mussels, scallops, and abalone) are known as the “vegetarians of the sea” because they feed on floating colonies of phytoplankton, the one-celled plants that make omega-3, just as kelp and other algae do. The other group of shellfish, the crustaceans (crab, crayfish, prawns, lobster, and shrimp) contain as much or more cholesterol than meat and chicken, but, like mollusks, have a very low fat content: only 1 to 3%, compared with 20 to 40% for meat. **What fat they have is full of omega-3's, like mollusks and fish.** Fat is more instrumental in raising cholesterol levels in the blood than dietary cholesterol. Besides, the omega-3's actually help to regulate cholesterol in our bodies, preventing it from becoming the Phantom of the Arteries!

Finger Food

Were you lucky enough to catch the breath-taking television broadcast this spring of pianist Vladimir Horowitz's triumphal return, after more than 60 years, to the concert stage in Moscow? TIME's music critic, Michael Walsh, who flew to Moscow for the recital, wrote: “Horowitz had once more proclaimed himself the greatest of living pianists. By turns elegant, playful, probing, introspective and, finally, heroic, Horowitz had also reaffirmed his lineage as the last romantic, whose artless, effortless, larger-than-life pianism, redolent with spontaneity and freshness, is a vanishing art.”

Walsh's May 5, 1986, cover story in TIME also tells us that Vladimir Horowitz, who at 81 has hands as supple and flexible as a 16-year-old, usually has as his nightly dinner, fresh sole and pasta! Even in Moscow, his daily diet of fresh sole was flown in. I can't think of a higher recommendation for nature's omega-3's. ■

1. Ralph T. Holman et al. Summary of the Golden Jubilee International Congress on Essential Fatty Acids and Prostaglandins. *Lipids*, (15) 7, July 1980.
2. *Seafood & Health '85*, published by West Coast Fisheries Development Foundation, 812 SW Washington, Portland, OR 97205 (inquire about copies).



Illustrations are by Clay Geerdes and other artists as noted.

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