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The Oiling of America

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The Oiling of America

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In 1954 a young researcher from Russia named David Kritchevsky published a paper describing the effects of feeding cholesterol to rabbits.[1] Cholesterol added to vegetarian rabbit chow caused the formation of atheromas—plaques that block arteries and contribute to heart disease. Cholesterol is a heavy weight molecule—an alcohol or a sterol—found only in animal foods such as meat, fish, cheese, eggs and butter. In the

same year, according to the American Oil Chemists Society, Kritchevsky published a paper describing the beneficial effects of polyunsaturated fatty acids for lowering cholesterol levels.[2] Polyunsaturated fatty acids are the kind of fats found in large amounts in highly liquid vegetable oils made from corn, soybeans, safflower seeds and sunflower seeds. (Monounsaturated fatty acids are found in large amounts in olive oil, palm oil and lard; saturated fatty acids are found in large amounts in fats and oils that are solid at room temperature, such as butter, tallows and coconut oil.)

Rise of Coronary Heart Disease in the 20th Century

Scientists of the period were grappling with a new threat to public health—a steep rise in heart disease. While turn-of-the-century mortality statistics are unreliable, they consistently indicate that heart disease caused no more than ten percent of all deaths, considerably less than infectious diseases such as pneumonia and tuberculosis. By 1950, coronary heart disease, or CHD, was the leading source of mortality in the United States, causing more than 30% of all deaths. The greatest increase came under the rubric of myocardial infarction (MI)—a massive blood clot leading to obstruction of a coronary artery and consequent death to the heart muscle. MI was almost nonexistent in 1910 and caused no more than three thousand deaths per year in 1930. By 1960, there were at least 500,000 MI deaths per year in the US. What life-style changes had caused this increase?

One change was a decrease in infectious disease, following the decline of the horse as a means of transport, the installation of more sanitary water supplies and the advent of better housing, all of which allowed more people to reach adulthood and the heart attack age. The other was a dietary change. Since the early part of the century, when the Department of Agriculture had begun to keep track of food "disappearance" data—the amount of various foods going into the food supply—a number of researchers had noticed a change in the kind of fats Americans were eating. Butter consumption was declining while the use of vegetable oils, especially oils that had been hardened to resemble butter by a process called hydrogenation, was increasing—dramatically increasing. By 1950 butter consumption had dropped from eighteen pounds per person per year to just over ten. Margarine filled in the gap, rising from about two pounds per person at the turn of the century to about eight. Consumption of vegetable shortening—used in crackers and baked goods—remained relatively steady at about twelve pounds per person per year but vegetable oil consumption had more than tripled—from just under three pounds per person per year to more than ten.[3]

The statistics pointed to one obvious conclusion—Americans should eat the traditional foods that nourished their ancestors, including meat, eggs, butter and cheese, and avoid the newfangled vegetable-oil-based foods that were flooding the grocers' shelves; but the Kritchevsky articles attracted immediate attention because they lent support to another theory—one that militated against the consumption of meat and dairy products. This was the lipid hypothesis, namely that saturated fat and cholesterol from animal sources raise cholesterol levels in the blood, leading to deposition of cholesterol and fatty material as pathogenic plaques in the arteries. Kritchevsky's rabbit trials were actually a repeat of studies carried out four decades earlier in St. Petersburg, in which rabbits fed saturated fats and cholesterol developed fatty deposits in their skin and other tissues—and in their

arteries. By showing that feeding polyunsaturated oils from vegetable sources lowered serum cholesterol in humans, at least temporarily, Kritchevsky appeared to show that animals findings were relevant to the CHD problem, that the lipid hypothesis was a valid explanation for the new epidemic and that by reducing animal products in the diet Americans could avoid heart disease.

The "Evidence" for the Lipid Hypothesis

In the years that followed, a number of population studies demonstrated that the animal model—especially one derived from vegetarian animals—was not a valid approach for the problem of heart disease in human omnivores. A much publicized 1955 report on artery plaques in soldiers killed during the Korean War showed high levels of atherosclerosis, but another report—one that did not make it to the front pages—found that Japanese natives had almost as much pathogenic plaque—65% versus 75%—even though the Japanese diet at the time was lower in animal products and fat.[4] A 1957 study of the largely vegetarian Bantu found that they had as much atheroma—occlusions or plaque buildup in the arteries—as other races from South Africa who ate more meat.[5] A 1958 report noted that Jamaican Blacks showed a degree of atherosclerosis comparable to that found in the United States, although they suffered from lower rates of heart disease.[6] A 1960 report noted that the severity of atherosclerotic lesions in Japan approached that of the United States.[7] The 1968 International Atherosclerosis Project, in which over 22,000 corpses in 14 nations were cut open and examined for plaques in the arteries, showed the same degree of atheroma in all parts of the world—in populations that consumed large amounts of fatty animal products and those that were largely vegetarian, and in populations that suffered from a great deal of heart disease and in populations that had very little or none at all.[8] All of these studies pointed to the fact that the thickening of the arterial walls is a natural, unavoidable process. The lipid hypothesis did not hold up to these population studies, nor did it explain the tendency to fatal clots that caused myocardial infarction.

In 1956, an American Heart Association (AHA) fund-raiser aired on all three major networks. The MC interviewed, among others, Irving Page and Jeremiah Stamler of the AHA, and researcher Ancel Keys. Panelists presented the lipid hypothesis as the cause of the heart disease epidemic and launched the Prudent Diet, one in which corn oil, margarine, chicken and cold cereal replaced butter, lard, beef and eggs. But the television campaign was not an unqualified success because one of the panelists, Dr. Dudley White, disputed his colleagues at the AHA. Dr. White noted that heart disease in the form of myocardial infarction was nonexistent in 1900 when egg consumption was three times what it was in 1956 and when corn oil was unavailable. When pressed to support the Prudent Diet, Dr. White replied: "See here, I began my practice as a cardiologist in 1921 and I never saw an MI patent until 1928. Back in the MI free days before 1920, the fats were butter and lard and I think that we would all benefit from the kind of diet that we had at a time when no one had ever heard the word corn oil."

But the lipid hypothesis had already gained enough momentum to keep it rolling, in spite of Dr. White's nationally televised plea for common sense in matters of diet and in spite of the contradictory studies that were showing up in the scientific literature. In 1957, Dr. Norman Jolliffe, Director of the Nutrition Bureau of the New York Health Department initiated the Anti-Coronary Club, in which a group of businessmen, ranging in age from

40 to 59 years, were placed on the Prudent Diet. Club members used corn oil and margarine instead of butter, cold breakfast cereals instead of eggs and chicken and fish instead of beef. Anti-Coronary Club members were to be compared with a "matched" group of the same age who ate eggs for breakfast and had meat three times a day. Jolliffe, an overweight diabetic confined to a wheel chair, was confident that the Prudent Diet would save lives, including his own.

In the same year, the food industry initiated advertising campaigns that touted the health benefits of their products—low in fat or made with vegetable oils. A typical ad read: "Wheaties may help you live longer." Wesson recommended its cooking oil "for your heart's sake" a *Journal of the American Medical Association* ad described Wesson oil as a "cholesterol depressant." Mazola advertisements assured the public that "science finds corn oil important to your health." Medical journal ads recommended Fleishmann's unsalted margarine for patients with high blood pressure.

Dr. Frederick Stare, head of Harvard University's Nutrition Department, encouraged the consumption of corn oil—up to one cup a day—in his syndicated column. In a promotional piece specifically for Procter and Gamble's Puritan oil, he cited two experiments and one clinical trial as showing that high blood cholesterol is associated with CHD. However, both experiments had nothing to do with CHD, and the clinical trial did not find that reducing blood cholesterol had any effect on CHD events. Later, Dr. William Castelli, Director of the Framingham Study was one of several specialists to endorse Puritan. Dr. Antonio Gotto, Jr., former AHA president, sent a letter promoting Puritan Oil to practicing physicians—printed on Baylor College of Medicine, The De Bakey Heart Center letterhead.[9] The irony of Gotto's letter is that De Bakey, the famous heart surgeon, coauthored a 1964 study involving 1700 patients which also showed no definite correlation between serum cholesterol levels and the nature and extent of coronary artery disease.[10] In other words, those with low cholesterol levels were just as likely to have blocked arteries as those with high cholesterol levels. But while studies like De Bakey's moldered in the basements of university libraries, the vegetable oil campaign took on increased bravado and audacity.

The American Medical Association at first opposed the commercialization of the lipid hypothesis and warned that "the anti-fat, anti-cholesterol fad is not just foolish and futile. . . it also carries some risk." The American Heart Association, however, was committed. In 1961 the AHA published its first dietary guidelines aimed at the public. The authors, Irving Page, Ancel Keys, Jeremiah Stamler and Frederick Stare, called for the substitution of polyunsaturates for saturated fat, even though Keys, Stare and Page had all previously noted in published papers that the increase in CHD was paralleled by increasing consumption of vegetable oils. In fact, in a 1956 paper, Keys had suggested that the increasing use of hydrogenated vegetable oils might be the underlying cause of the CHD epidemic.[11]

Stamler shows up again in 1966 as an author of *Your Heart Has Nine Lives*, a little self-help book advocating the substitution of vegetable oils for butter and other so-called "artery clogging" saturated fats. The book was sponsored by makers of Mazola Corn Oil and Mazola Margarine. Stamler did not believe that lack of evidence should deter Americans from changing their eating habits. The evidence, he stated, " . . was compelling enough to call for altering some habits even before the final proof is nailed down. . . the definitive proof that middle-aged men who reduce their blood cholesterol

will actually have far fewer heart attacks waits upon diet studies now in progress." His version of the Prudent Diet called for substituting low-fat milk products such as skim milk and low-fat cheeses for cream, butter and whole cheeses, reducing egg consumption and cutting the fat off red meats. Heart disease, he lectured, was a disease of rich countries, striking rich people who ate rich food. . . including "hard" fats like butter.

It was in the same year, 1966, that the results of Dr. Jolliffe's Anti-Coronary Club experiment were published in the *Journal of the American Medical Association*.[12] Those on the Prudent Diet of corn oil, margarine, fish, chicken and cold cereal had an average serum cholesterol of 220, compared to 250 in the meat-and-potatoes control group. However, the study authors were obliged to note that there were eight deaths from heart disease among Dr. Jolliffe's Prudent Diet group, and none among those who ate meat three times a day. Dr. Jolliffe was dead by this time. He succumbed in 1961 from a vascular thrombosis, although the obituaries listed the cause of death as complications from diabetes. The "compelling proof" that Stamler and others were sure would vindicate wholesale tampering with American eating habits had not yet been "nailed down."

The problem, said the insiders promoting the lipid hypothesis, was that the numbers involved in the Anti-Coronary Club experiment were too small. Dr. Irving Page urged a National Diet-Heart Study involving one million men, in which the results of the Prudent Diet could be compared on a large scale with the those on a diet high in meat and fat. With great media attention, the National Heart Lung and Blood Institute organized the stocking of food warehouses in six major cities, where men on the Prudent Diet could get tasty polyunsaturated donuts and other fabricated food items free of charge. But a pilot study involving 2,000 men resulted in exactly the same number of deaths in both the Prudent Diet and the control group. A brief report in *Circulation*, March 1968, stated that the study was a milestone "in mass environmental experimentation" that would have "an important effect on the food industry and the attitude of the public toward its eating habits." But the million-man Diet Heart Study was abandoned in utter silence "for reasons of cost." Its chairman, Dr. Irving Page, died of a heart attack.

Hydrogenation and *Trans* Fats

Most animal fats—like butter, lard and tallow—have a large proportion of saturated fatty acids. Saturated fats are straight chains of carbon and hydrogen that pack together easily so that they are relatively solid at room temperature. Oils from seeds are composed mostly of polyunsaturated fatty acids. These molecules have kinks in them at the point of the unsaturated double bonds. They do not pack together easily and therefore tend to be liquid at room temperature. Judging from both food data and turn-of-the-century cookbooks, the American diet in 1900 was a rich one—with at least 35 to 40 percent of calories coming from fats, mostly dairy fats in the form of butter, cream, whole milk and eggs. Salad dressing recipes usually called for egg yolks or cream; only occasionally for olive oil. Lard or tallow served for frying; rich dishes like head cheese and scrapple contributed additional saturated fats during an era when cancer and heart disease were rare. Butter substitutes made up only a small portion of the American diet, and these margarines were blended from coconut oil, animal tallow and lard, all rich in natural saturates.

The technology by which liquid vegetable oils could be hardened to make margarine was

first discovered by a French chemist named Sabatier. He found that a nickel catalyst would cause the hydrogenation—the addition of hydrogen to unsaturated bonds to make them saturated—of ethylene gas to ethane. Subsequently the British chemist Norman developed the first application of hydrogenation to food oils and took out a patent. In 1909, Procter & Gamble acquired the US rights to the British patent that made liquid vegetable oils solid at room temperature. The process was used on both cottonseed oil and lard to give "better physical properties"—to create shortenings that did not melt as easily on hot days.

The hydrogenation process transforms unsaturated oils into straight "packable" molecules, by rearranging the hydrogen atoms at the double bonds. In nature, most double bonds occur in the *cis* configuration, that is with both hydrogen atoms on the same side of the carbon chain at the point of the double bond. It is the *cis* isomers of fatty acids that have a bend or kink at the double bond, preventing them from packing together easily. Hydrogenation creates *trans* double bonds by moving one hydrogen atom across to the other side of the carbon chain at the point of the double bond. In effect, the two hydrogen atoms then balance each other and the fatty acid straightens, creating a packable "plastic" fat with a much higher melting temperature. Although *trans* fatty acids are technically unsaturated, they are configured in such a way that the benefits of unsaturation are lost. The presence of several unpaired electrons presented by contiguous hydrogen atoms in their *cis* form allows many vital chemical reactions to occur at the site of the double bond. When one hydrogen atom is moved to the other side of the fatty acid molecule during hydrogenation, the ability of living cells to make reactions at the site is compromised or altogether lost. *Trans* fatty acids are sufficiently similar to natural fats that the body readily incorporates them into the cell membrane; once there their altered chemical structure creates havoc with thousands of necessary chemical reactions—everything from energy provision to prostaglandin production.

After the second world war, "improvements" made it possible to plasticize highly unsaturated oils from corn and soybeans. New catalysts allowed processors to "selectively hydrogenate" the kinds of fatty acids with three double bonds found in soy and canola oils. Called "partial hydrogenation," the new method allowed processors to replace cottonseed oil with more unsaturated corn and soy bean oils in margarines and shortenings. This spurred a meteoric rise in soybean production, from virtually nothing in 1900 to 70 million tons in 1970, surpassing corn production. Today soy oil dominates the market and is used in almost eighty percent of all hydrogenated oils.

The particular mix of fatty acids in soy oil results in shortenings containing about 40% trans fats, an increase of about 5% over cottonseed oil, and 15% over corn oil. Canola oil, processed from a hybrid form of rape seed, is particularly rich in fatty acids containing three double bonds and the shortening can contain as much as 50% *trans* fats. *Trans* fats of a particularly problematical form are also formed during the deodorization of canola oil, although they are not indicated on labels for the liquid oil.[12a]

Certain forms of *trans* fatty acids occur naturally in dairy fats. Trans-vaccenic acid makes up about 4% of the fatty acids in butter. It is an interim product which the ruminant animal then converts to conjugated linoleic acid, a highly beneficial anti-carcinogenic component of animal fat. Humans seem to utilize the small amounts of *trans*-vaccenic acid in butter fat without ill effects.

But most of the *trans* isomers in modern hydrogenated fats are new to the human physiology and by the early 1970's a number of researchers had expressed concern about their presence in the American diet, noting that their increasing use had paralleled the increase in both heart disease and cancer. The unstated solution was one that could be easily presented to the public: Eat natural, traditional fats; avoid newfangled foods made from vegetable oils; use butter, not margarine. But medical research and public consciousness took a different tack, one that accelerated the decline of traditional foods like meat, eggs and butter, and fueled continued dramatic increases in vegetable oil consumption.

Shenanigans at the AHA

Although the AHA had committed itself to the lipid hypothesis and the unproven theory that polyunsaturated oils afforded protection against heart disease, concerns about hydrogenated vegetable oils were sufficiently great to warrant the inclusion of the following statement in the organization's 1968 diet heart statement: "Partial hydrogenation of polyunsaturated fats results in the formation of *trans* forms which are less effective than *cis*, *cis* forms in lowering cholesterol concentrations. It should be noted that many currently available shortening and margarines are partially hydrogenated and may contain little polyunsaturated fat of the natural *cis*, *cis* form." 150,000 copies of the statement were printed but never distributed. The shortening industry objected strongly and a researcher named Fred Mattson of Procter and Gamble convinced Campbell Moses, medical director of the AHA, to remove it.[13] The final recommendations for the public contained three major points—restrict calories, substitute polyunsaturates for saturates and reduce cholesterol in the diet.

Other organizations fell in behind the AHA in pushing vegetable oils instead of animal fats. By the early 1970's the National Heart Lung and Blood Institute, the AMA, the American Dietetic Association and the National Academy of Science had all endorsed the lipid hypotheses and the avoidance of animal fats for those Americans in the "at risk" category.

Since Kritchevsky's early studies, many other trials had shown that serum cholesterol can be lowered by increasing ingestion of polyunsaturates. The physiological explanation for this is that when excess polyunsaturates are built into the cell membranes, resulting in reduced structural integrity or "limpness," cholesterol is sequestered from the blood into the cell membranes to give them "stiffness." The problem was that there was no proof that lowering serum cholesterol levels could stave off CHD. That did not prevent the American Heart Association from calling for "modified and ordinary foods" useful for the purpose of facilitating dietary changes to newfangled oils and away from traditional fats. These foods, said the AHA literature, should be made available to the consumer, "reasonably priced and easily identified by appropriate labeling. Any existing legal and regulatory barriers to the marketing of such foods should be removed."

Shenanigans at the FDA

The man who made it possible to remove any "existing legal and regulatory barriers" was Peter Barton Hutt, a food lawyer for the prestigious Washington, DC law firm of

Covington and Burling. Hutt once stated that "Food law is the most wonderful field of law that you can possibly enter." After representing the edible oil industry, he temporarily left his law firm to become the FDA's general council in 1971. The regulatory barrier to foods useful to the purpose of changing American consumption patterns was the Food, Drug and Cosmetic Act of 1938, which stated that ". . . there are certain traditional foods that everyone knows, such as bread, milk and cheese, and that when consumers buy these foods, they should get the foods that they are expecting. . . [and] if a food resembles a standardized food but does not comply with the standard, that food must be labeled as an 'imitation'".

The 1938 Food, Drug and Cosmetic Act had been signed into law partly in response to consumer concerns about the adulteration of ordinary foodstuffs. Chief among the products with a tradition of suffering competition from imitation products were fats and oils. In *Life on the Mississippi*, Mark Twain reports on a conversation overheard between a New Orleans cottonseed oil purveyor and a Cincinnati margarine drummer. New Orleans boasts of selling deodorized cottonseed oil as olive oil in bottles with European labels. "We turn out the whole thing—clean from the word go—in our factory in New Orleans. . . We are doing a ripping trade, too." The man from Cincinnati reports that his factories are turning out oleomargarine by the thousands of tons, an imitation that "you can't tell from butter." He gloats at the thought of market domination. "You are going to see the day, pretty soon, when you won't find an ounce of butter to bless yourself with, in any hotel in the Mississippi and Ohio Valleys, outside of the biggest cities. . . And we can sell it so dirt cheap that the whole country has got to take it. . . butter don't stand any show—there ain't any chance for competition. Butter's had its *day*—and from this out, butter goes to the wall. There's more money in oleomargarine than, why, you can't imagine the business we do."

In the tradition of Mark Twain's riverboat hucksters, Peter Barton Hutt guided the FDA through the legal and congressional hoops to the establishment of the FDA "Imitation" policy in 1973, which attempted to provide for "advances in food technology" and give "manufacturers relief from the dilemma of either complying with an outdated standard or having to label their new products as 'imitation' . . . [since]. . . such products are not necessarily inferior to the traditional foods for which they may be substituted." Hutt considered the word "imitation" to be over simplified and inaccurate—"potentially misleading to consumers." The new regulations defined "inferiority" as any reduction in content of an essential nutrient that is present at a level of two percent or more of the US Recommended Daily Allowance (RDA). The new imitation policy meant that imitation sour cream, made with vegetable oil and fillers like guar gum and carrageenan, need not be labelled imitation as long as artificial vitamins were added to bring macro nutrient levels up to the same amounts as those in real sour cream. Coffee creamers, imitation egg mixes, processed cheeses and imitation whipped cream no longer required the imitation label, but could be sold as real and beneficial foods, low in cholesterol and rich in polyunsaturates.

These new regulations were adopted without the consent of Congress, continuing the trend instituted under Nixon in which the White House would use the FDA to promote certain social agendas through government food policies. They had the effect of increasing the lobbying clout of special interest groups, such as the edible oil industry, and short circuiting public participation in the regulatory process. They allowed food processing innovations regarded as "technological improvements" by manufacturers to

enter the market place without the onus of economic fraud that might be engendered by greater consumer awareness and congressional supervision. They ushered in the era of ersatz foodstuffs, convenient counterfeit products—weary, stale, flat and immensely profitable.

Shenanigans in Congress

Congress did not voice any objection to this usurpation of its powers, but entered the contest on the side of the lipid hypothesis. The Senate Select Committee on Nutrition and Human Needs, chaired by George McGovern during the years 1973 to 1977, actively promoted the use of vegetable oils. "Dietary Goals for the United States," published by the committee, cited U.S. Department of Agriculture data on fat consumption, and stated categorically that "the overconsumption of fat, generally, and saturated fat in particular. . . have been related to six of the ten leading causes of death. . ." in the United States. The report urged the American populace to reduce overall fat intake and to substitute polyunsaturates for saturated fat from animal sources—margarine and corn oil for butter, lard and tallow. Opposing testimony included a moving letter—buried in the voluminous report—by Dr. Fred Kummerow of the University of Illinois, urging a return to traditional whole foods and warning against the use of soft drinks. In the early 1970's, Kummerow had shown that *trans* fatty acids caused increased rates of heart disease in pigs. A private endowment allowed him to continue his research—government funding agencies such as National Institutes of Health refused to give him further grants.

One unpublished study that was known to McGovern Committee members but not mentioned in its final report compared calves fed saturated fat from tallow and lard with those fed unsaturated fat from soybean oil. The calves fed tallow and lard did indeed show higher plasma cholesterol levels than the soybean oil-fed calves, and fat streaking was found in their aortas. Atherosclerosis was also enhanced. But the calves fed soybean oil showed a decline in calcium and magnesium levels in the blood, possibly due to inefficient absorption. They utilized vitamins and minerals inefficiently, showed poor growth, poor bone development and had abnormal hearts. More cholesterol per unit of dry matter was found in the aorta, liver, muscle, fat and coronary arteries, a finding which led the investigators to the conclusion the lower blood cholesterol levels in the soybean-oil fed calves may have been the result of cholesterol being transferred from the blood to other tissues. The calves in the soybean oil group also collapsed when they were forced to move around and they were unaware of their surroundings for short periods. They also had rickets and diarrhea.

The McGovern Committee report continued dietary trends already in progress—the increased use of vegetables oils, especially in the form of partially hydrogenated margarines and shortenings. In 1976, the FDA established GRAS (Generally Recognized as Safe) status for hydrogenated soybean oil. A report prepared by the Life Sciences Research Office of the Federation of American Scientists for Experimental Biology (LSRO-FASEB) concluded that "There is no evidence in the available information on hydrogenated soybean oil that demonstrates or suggests reasonable ground to suspect a hazard to the public when it is used as a direct or indirect food ingredient at levels that are now current or that might reasonably be expected in the future."

Enig Speaks Out

When Mary Enig, a graduate student at the University of Maryland, read the McGovern committee report, she was puzzled. Enig was familiar with Kummerow's research and she knew that the consumption of animal fats in America was not on the increase—quite the contrary, use of animal fats had been declining steadily since the turn of the century. A report in the *Journal of American Oil Chemists*—which the McGovern Committee did not use—showed that animal fat consumption had declined from 104 grams per person per day in 1909 to 97 grams per day in 1972, while vegetable fat intake had increased from a mere 21 grams to almost 60.[14] Total per capita fat consumption *had* increased over the period, but this increase was mostly due to an increase in unsaturated fats from vegetable oils—with 50 percent of the increase coming from liquid vegetable oils and about 41 percent from margarines made from vegetable oils. She noted a number of studies that directly contradicted the McGovern Committee's conclusions that "there is . . . a strong correlation between dietary fat intake and the incidence of breast cancer and colon cancer," two of the most common cancers in America. Greece, for example, had less than one-fourth the rate of breast cancer compared to Israel but the same dietary fat intake. Spain had only one-third the breast cancer mortality of France and Italy but the total dietary fat intake was slightly greater. Puerto Rico, with a high animal fat intake, had a very low rate of breast and colon cancer. The Netherlands and Finland both used approximately 100 grams of animal fat per capita per day but breast and colon cancer rates were almost twice in the Netherlands what they are in Finland. The Netherlands consumed 53 grams of vegetable fat per person compared to 13 in Finland. A study from Cali, Columbia found a fourfold excess risk for colon cancer in the higher economic classes, which used less animal fat than the lower economic classes. A study on Seventh-Day Adventist physicians, who avoid meat, especially red meat, found they had a significantly higher rate of colon cancer than non-Seventh Day Adventist physicians. Enig analyzed the USDA data that the McGovern Committee had used and concluded that it showed a strong *positive* correlation with total fat and vegetable fat and an essentially strong *negative* correlation or no correlation with animal fat to total cancer deaths, breast and colon cancer mortality and breast and colon cancer incidence—in other words, use of vegetable oils seemed to predispose to cancer and animal fats seemed to protect against cancer. She noted that the analysts for the committee had manipulated the data in inappropriate ways in order to obtain mendacious results.

Enig submitted her findings to the Journal of the Federation of American Societies for Experimental Biology (FASEB), in May, 1978, and her article was published in the FASEB's *Federation Proceedings*[15] in July of the same year—an unusually quick turnaround. The assistant editor, responsible for accepting the article, died of a heart attack shortly thereafter. Enig's paper noted that the correlations pointed a finger at the trans fatty acids and called for further investigation. Only two years earlier, the Life Sciences Research office, which is the arm of FASEB that does scientific investigations, had published the whitewash that had ushered partially hydrogenated soybean oil onto the GRAS list and removed any lingering constraints against the number one ingredient in factory-produced food.

The Food Giants Fight Back

Enig's paper sent alarm bells through the industry. In early 1979, she received a visit from S. F. Reipma of the National Association of Margarine Manufacturers. Reipma was visibly annoyed. He explained that both his association and the Institute for Shortening and Edible Oils (ISEO) kept careful watch to prevent articles like Enig's from appearing in the literature. Enig's paper should never have been published, he said. He thought that ISEO was "watching out."

"We left the barn door open," he said, "and the horse got out."

Reipma also challenged Enig's use of the USDA data, claiming that it was in error. He knew it was in error, he said, "because we give it to them."

A few weeks later, Reipma paid a second visit, this time in the company of Thomas Applewhite, an advisor to the ISEO and representative of Kraft Foods, Ronald Simpson with Central Soya and an unnamed representative from Lever Brothers. They carried with them—in fact, waved them in the air in indignation—a two-inch stack of newspaper articles, including one that appeared in the *National Enquirer*, reporting on Enig's *Federation Proceedings* article. Applewhite's face flushed red with anger when Enig repeated Reipma's statement that "they had left the barn door open and a horse got out," and his admission that Department of Agriculture food data had been sabotaged by the margarine lobby.

The other thing Reipma told Enig during his unguarded visit was that he had called in on the FASEB offices in an attempt to coerce them into publishing letters to refute her paper, without allowing Enig to submit any counter refutation as was normally customary in scientific journals. He told Enig that he was "thrown out of the office"—an admission later confirmed by one of the FASEB editors. Nevertheless, a series of letters did follow the July 1978 article.[16] On behalf of the ISEO, Applewhite and Walter Meyer of Procter and Gamble criticized Enig's use of the data; Applewhite accused Enig of extrapolating from two data points, when in fact she had used seven. In the same issue, John Bailar, Editor-in-Chief of the *Journal of the National Cancer Institute*, pointed out that the correlations between vegetable oil consumption and cancer were not the same as evidence of causation and warned against changing current dietary components in the hopes of preventing cancer in the future—which is of course exactly what the McGovern Committee did.

In reply, Enig and her colleagues noted that although the NCI had provided them with faulty cancer data, this had no bearing on the statistics relating to *trans* consumption, and did not affect the gist of their argument—that the correlation between vegetable fat consumption, especially *trans* fat consumption, was sufficient to warrant a more thorough investigation. The problem was that very little investigation was being done.

University of Maryland researchers recognized the need for more research in two areas. One concerned the effects of *trans* fats on cellular processes once they are built into the cell membrane. Studies with rats, including one conducted by Fred Mattson in 1960, indicated that the *trans* fatty acids were built into the cell membrane in proportion to their presence in the diet, and that the turnover of *trans* in the cells was similar to that of

other fatty acids. These studies, according to J. Edward Hunter of the ISEO, were proof that "*trans* fatty acids do not pose any hazard to man in a normal diet." Enig and her associates were not so sure. Kummerow's research indicated that the *trans* fats contributed to heart disease, and Kritchevsky—whose early experiments with vegetarian rabbits were now seen to be totally irrelevant to the human model—had found that *trans* fatty acids raise cholesterol in humans.[17] Enig's own research, published in her 1984 doctoral dissertation, indicated that *trans* fats interfered with enzyme systems that neutralized carcinogens and increased enzymes that potentiated carcinogens.[18]

How Much *Trans* Fat Is "Normal"?

The other area needing further investigation concerned just how much *trans* fat there was in a "normal diet" of the typical American. What had hampered any thorough research into the correlation of *trans* fatty acid consumption and disease was the fact that these altered fats were not considered as a separate category in any of the data bases then available to researchers. A 1970 FDA internal memo stated that a market basket survey was needed to determine *trans* levels in commonly used foods. The memo remained buried in the FDA files. The massive Health and Human Services NHANES II (National Health and Nutrition

Examination Survey) survey, conducted during the years 1976 to 1980, noted the increasing US consumption of margarine, french fried potatoes, cookies and snack chips—all made with vegetable shortenings—without listing the proportion of *trans*.

Enig first looked at the NHANES II data base in 1987 and when she did, she had a sinking feeling. Not only were *trans* fats conspicuously absent from the fatty acid analyses, data on other lipids made no sense at all. Even foods containing no *trans* fats were listed with faulty fatty acid profiles. For example, safflower oil was listed as containing 14% linoleic acid (a double bond fatty acid of the omega-6 family) when in fact it contained 80%; a sample of butter crackers was listed as containing 34% saturated fat when in fact it contained 78%. In general, the NHANES II data base tended to minimize the amount of saturated fats in common foods.

Over the years, Joseph Sampagna and Mark Keeney, both highly qualified lipid biochemists at the University of Maryland, applied to the National Science Foundation, the National Institutes of Health, the US Department of Agriculture, the National Dairy Council and the National Livestock and Meat Board for funds to look into the *trans* content of common American foods. Only the National Livestock and Meat Board came through with a small grant for equipment; the others turned them down. The pink slip from National Institutes of Health criticized items that weren't even relevant to the proposal. The turndown by the National Dairy Council was not a surprise. Enig had earlier learned that Phil Lofgren, then head of research at the Dairy Council, had philosophical ties to the lipid hypothesis. Enig tried to alert Senator Mettzanbaum from Ohio, who was involved in the dietary recommendations debate, but got nowhere.

A USDA official confided to the Maryland research group that they "would never get money as long as they pursued the *trans* work." Nevertheless they did pursue it. Sampagna, Keeney and a few graduate students, funded jointly by the USDA and the university, spend thousands of hours in the laboratory analyzing the *trans* fat content of

hundreds of commercially available foods. Enig worked as a graduate student, at times with a small stipend, at times without pay, to help direct the process of tedious analysis. The long arm of the food industry did its best to put a stop to the group's work by pressuring the USDA to pull its financial support of the graduates students doing the lipid analyses, which the University of Maryland received due to its status as a land grant college.

In December of 1982, *Food Processing* carried a brief preview of the University of Maryland research[19] and five months later the same journal printed a blistering letter from Edward Hunter on behalf of the Institute of Shortening and Edible Oils.[20] The University of Maryland studies on *trans* fat content in common foods had obviously struck a nerve. Hunter stated that the Bailar, Applewhite and Meyer letters that had appeared in *Federation Proceedings* five years earlier, "severely criticized and discredited" the conclusions reached by Enig and her colleagues. Hunter was concerned that Enig's group would exaggerate the amount of trans found in common foods. He cited ISEO data indicating that most margarines and shortenings contain no more than 35% and 25% *trans* respectively, and that most contain considerably less.

What Enig and her colleagues actually found was that many margarines indeed contained about 31% *trans* fat—later surveys by others revealed that Parkay margarine contained up to 45% *trans*—while many shortenings found ubiquitously in cookies, chips and baked goods contained more than 35%. She also discovered that many baked goods and processed foods contained considerably more fat from partially hydrogenated vegetable oils than was listed on the label. The finding of higher levels of fat in products made with partially hydrogenated oils was confirmed by Canadian government researchers many years later, in 1993.[21]

Final results of Enig's ground-breaking compilation were published in the October 1983 edition of the *Journal of the American Oil Chemists Society*.[22] Her analyses of more than 220 food items, coupled with food disappearance data, allowed University of Maryland researchers to confirm earlier estimates that the average American consumed at least 12 grams of *trans* fat per day, directly contradicting ISEO assertions that most Americans consumed no more that six to eight grams of *trans* fat per day. Those who consciously avoided animal fats typically consumed far more than 12 grams of *trans* fat per day.

Cat and Mouse Games in the Journals

The ensuing debate between Enig and her colleagues at the University of Maryland, and Hunter and Applewhite of the ISEO, took the form of a cat and mouse game running through several scientific journals. *Food Processing* declined to publish Enig's reply to Hunter's attack. *Science Magazine* published another critical letter by Hunter in 1984,[23] in which he misquoted Enig, but refused to print her rebuttal. Hunter continued to object to assertions that average consumption of *trans* fat in partially hydrogenated margarines and shortenings could exceed six to eight grams per day, a concern that Enig found puzzling when coupled with the official ISEO position that *trans* fatty acids were innocuous and posed no threat to public health.

The ISEO did not want the American public to hear about the debate on hydrogenated vegetable oils—for Enig this translated into the sound of doors closing. A poster

presentation she organized for a campus health fair caught the eye of the dietetics department chairman who suggested she submit an abstract to the Society for Nutrition Education, many of whose members are registered dietitians. Her abstract concluded that ". . . meal plans and recipes developed for nutritionists and dieticians to use when designing diets to meet the Dietary Guidelines, the dietary recommendation of the American Heart Association or the Prudent Diet have been examined for *trans* fatty acid content. Some diet plans are found to contain approximately 7% or more of calories as *trans* fatty acids." The Abstract Review Committee rejected the submission, calling it "of limited interest."

Early in 1985 the Federation of American Societies for Experimental Biology (FASEB) heard more testimony on the *trans* fat issue. Enig alone represented the alarmist point of view, while Hunter and Applewhite of the ISEO, and Ronald Simpson, then with the National Association of Margarine Manufacturers, assured the panel that *trans* fats in the food supply posed no danger. Enig reported on University of Maryland research that delineated the differences in small amounts of naturally occurring *trans* fats in butter, which do not inhibit enzyme function at the cellular level, and man-made *trans* fats in margarines and vegetable shortenings which do. She also noted a 1981 feeding trial in which swine fed *trans* fatty acid developed higher parameters for heart disease than those fed saturated fats, especially when *trans* fatty acids were combined with added polyunsaturates.[24] Her testimony was omitted from the final report, although her name in the bibliography created the impression that her research supported the FASEB whitewash.[25]

In the following year, 1986, Hunter and Applewhite published an article exonerating trans fats as a cause of atherosclerosis in the prestigious *American Journal of Clinical Nutrition*[26], whose sponsors, by the way, include companies like Procter and Gamble, General Foods, General Mills, Nabisco and Quaker Oats. The authors once again stressed that the average per capita consumption of *trans* fatty acids did not exceed six to eight grams. Many subsequent government and quasi government reports minimizing the dangers of trans fats used the 1986 Hunter and Applewhite article as a reference.

Enig testified again in 1988 before the Expert Panel on the National Nutrition Monitoring System (NNMS). In fact she was the only witness before a panel, which began its meeting by confirming that the cause of America's health problems was the overconsumption of "fat, saturated fatty acids, cholesterol and sodium." Her testimony pointed out that the 1985 FASEB report exonerating *trans* fatty acids as safe was based on flawed data.

Behind the scenes, in a private letter to Dr. Kenneth Fischer, Director of the Life Sciences Research Office (LSRO), Hunter and Applewhite charged that "the University of Maryland group continues to raise unwarranted and unsubstantiated concerns about the intake of and imagined physiological effects of *trans* fatty acids and . . . they continue to overestimate greatly the intake of *trans* acids by typical Americans." "No one other than Enig," they said, "has raised questions about the validity of the food fatty acid composition data used in NHANES II and. . . she has not presented sufficiently compelling arguments to justify a major reevaluating."

The letter contained numerous innuendos that Enig had mischaracterized the work of other researchers and had been less than scientific in her research. It was widely

circulated among National Nutrition Monitoring System agencies. John Weihrauch, a USDA scientist, not an industry representative, slipped it surreptitiously to Dr. Enig. She and her colleagues replied by asking, "If the trade association truly believes 'that *trans* fatty acids do not pose any harm to humans and animals'. . . why are they so concerned about any levels of consumption and why do they so vehemently and so frequently attack researchers whose finding suggest that the consumption of *trans* fatty acids is greater than the values the industry reports?"

Maryland researchers argued that *trans* fats should be included in food nutrition labels; the Hunter and Applewhite letter asserted that "there is no documented justification for including *trans* acids . . . as part of nutrition labeling."

During her testimony Enig also brought up her concerns about other national food databases, citing their lack of information on *trans*. The Food Consumption Survey contained glaring errors—reporting, for example, consumption of butter in amounts nearly twice as great as what exists in the US food supply, and of margarine in quantities nearly half those known to exist in the food supply. "The fact that the data base is in error should compel the Congress to require correction of the data base and reevaluation of policy flowing from erroneous data," she argued, "especially since the congressional charter for NHANES was to compare dietary intake and health status and since this data base is widely used to do just that." Rather than "correction of the data base," [The] National Nutritional Monitoring System officials responded to Enig's criticism by dropping the whole section pertaining to butter and margarine from the 1980 tables.

Enig's testimony was not totally left out of the National Nutritional Monitoring System final report, as it had been from the FASEB report three years earlier. A summary of the proceedings and listing of panelists released in July of 1989 by Director Kenneth Fischer announced that a transcript of Enig's testimony could be obtained from Ace Federal Reporter in Washington DC.[27] Unfortunately, his report wrongly listed the date of her testimony as January 20, 1988, rather than January 21, making her comments more difficult to retrieve.

The Enig-ISEO debate was covered by the prestigious *Food Chemical News and Nutrition Week* [28]—both widely read by Congress and the food industry, but virtually unknown to the general public. National media coverage of dietary fat issues focused on the proceedings of the National Heart, Lung and Blood Institute as this enormous bureaucracy plowed relentlessly forward with the lipid hypothesis. In June of 1984, for example, the press diligently reported on the proceedings of the NHLBI's Lipid Research Clinics Conference, which was organized to wrap up almost 40 years of research on lipids, cholesterol and heart disease.

The problem with the 40 years of NHLBI-sponsored research on lipids, cholesterol and heart disease was that it had not produced many answers—at least not many answers that the NHLBI was pleased with. The ongoing Framingham Study found that there was virtually no difference in coronary heart disease "events" for individuals with cholesterol levels between 205 mg/dL and 294 mg/dL—the vast majority of the US population. Even for those with extremely high cholesterol levels—up to almost 1200 mg/dL, the difference in CHD events compared to those in the normal range was trivial.[29] This did not prevent Dr. William Kannel, then Framingham Study Director, from making claims about the Framingham results. "Total plasma cholesterol" he said, "is a powerful

predictor of death related to CHD." It wasn't until more than a decade later that the real findings at Framingham were published—without fanfare—in the *Archives of Internal Medicine*, an obscure journal. "In Framingham, Massachusetts," admitted Dr. William Castelli, Kannel's successor "the more saturated fat one ate, the more cholesterol one ate, the more calories one ate, the lower people's serum cholesterol. . . we found that the people who ate the most cholesterol, ate the most saturated fat, ate the most calories weighed the least and were the most physically active."[30]

NHLBI's Multiple Risk Factor Intervention Trial (MRFIT) studied the relationship between heart disease and serum cholesterol levels in 362,000 men and found that annual deaths from CHD varied from slightly less than one per thousand at serum cholesterol levels below 140 mg/dL, to about two per thousand for serum cholesterol levels above 300 mg/dL, once again a trivial difference. Dr. John LaRosa of the American Heart Association claimed that the curve for CHD deaths began to "inflect" after 200 mg/dL, when in fact the "curve" was a very gradually sloping straight line that could not be used to predict whether serum cholesterol above certain levels posed a significantly greater risk for heart disease. One unexpected MRFIT finding the media did not report was that deaths from all causes—cancer, heart disease, accidents, infectious disease, kidney failure, etc.—were substantially greater for those men with cholesterol levels below 160 mg/dL.[31]

Lipid Research Clinics Trial

What was needed to resolve the validity of the lipid hypothesis once and for all was a well-designed, long-term diet study that compared coronary heart disease events in those on traditional foods with those whose diets contained high levels of vegetable oils—but the proposed Diet-Heart study designed to test just that had been cancelled without fanfare years earlier. In view of the fact that orthodox medical agencies were united in their promotion of margarine and vegetable oils over animal foods containing cholesterol and animal fats, it is surprising that the official literature can cite only a handful of experiments indicating that dietary cholesterol has "a major role in determining blood cholesterol levels." One of these was a study involving 70 male prisoners directed by Fred Mattson[32]—the same Fred Mattson who had pressured the American Heart Association into removing any reference to hydrogenated fats from their diet-heart statement a decade earlier. Funded in part by Procter and Gamble, the research contained a number of serious flaws: selection of subjects for the four groups studied was not randomized; the experiment inexcusably eliminated "an equal number of subjects with the highest and lowest cholesterol values;" twelve additional subjects dropped out, leaving some of the groups too small to provide valid conclusions; and statistical manipulation of the results was shoddy. But the biggest flaw was that the subjects receiving cholesterol did so in the form of reconstituted powder—a totally artificial diet. Mattson's discussion did not even address the possibility that the liquid formula diet he used might affect blood cholesterol differently than would a whole foods diet when, in fact, many other studies indicated that this is the case. The culprit, in fact, in liquid protein diets appears to be oxidized cholesterol, formed during the high-temperature drying process, which seems to initiate the buildup of plaque in the arteries.[33] Powdered milk containing oxidized cholesterol is added to reduced fat milk—to give it body—which the American public has accepted as a healthier choice than whole milk. It was purified, oxidized cholesterol that Kritchevsky and others used in their experiments on

vegetarian rabbits.

The NHLBI argued that a diet study using whole foods and involving the whole population would be too difficult to design and too expensive to carry out. But the NHLBI *did* have funds available to sponsor the massive Lipid Research Clinics Coronary Primary Prevention Trial in which all subjects were placed on a diet low in cholesterol and saturated fat. Subjects were divided into two groups, one of which took a cholesterol-lowering drug and the other a placebo. Working behind the scenes, but playing a key role in both the design and implementation of the trials, was Dr. Fred Mattson, formerly of Procter and Gamble.

An interesting feature of the study was the fact that a good part of the trial's one-hundred-and-fifty-million-dollar budget was devoted to group sessions in which trained dieticians taught both groups of study participants how to choose "heart-friendly" foods—margarine, egg replacements, processed cheese, baked goods made with vegetable shortenings, in short the vast array of manufactured foods awaiting consumer acceptance. As both groups received dietary indoctrination, study results could support no claims about the relation of diet to heart disease. Nevertheless, when the results were released, both the popular press and medical journals portrayed the Lipid Research Clinics trials as the long-sought proof that animal fats were the cause of heart disease. Rarely mentioned in the press was the ominous fact that the group taking the cholesterol-lowering drugs had an increase in deaths from cancer, stroke, violence and suicide.[34]

LRC researchers claimed that the group taking the cholesterol-lowering drug had a 17% reduction in the rate of CHD, with an average cholesterol reduction of 8.5%. This allowed LRC trials Director Basil Rifkind to claim that "for each 1% reduction in cholesterol, we can expect a 2% reduction in CHD events." The statement was widely circulated even though it represented a completely invalid representation of the data, especially in light of the fact that when the lipid group at the University of Maryland analyzed the LRC data, they found no difference in CHD events between the group taking the drug and those on the placebo.

A number of clinicians and statisticians participating in a 1984 Lipid Research Clinics Conference workshop, including Michael Oliver and Richard Krommel, were highly critical of the manner in which the LRC results had been tabulated and manipulated. The conference, in fact, went very badly for the NHLBI, with critics of the lipid hypothesis almost outnumbering supporters. One participant, Dr. Beverly Teter of the University of Maryland's lipid group, was delighted with the state of affairs. "It's wonderful'" she remarked to Basil Rifkind, study coordinator, "to finally hear both sides of the debate. We need more meetings like this" His reply was terse and sour: "No we don't."

National Cholesterol Consensus Conference

Dissenters were again invited to speak briefly at the NHLBI-sponsored National Cholesterol Consensus Conference held later that year, but their views were not included in the panel's report, for the simple reason that the report was generated by NHLBI staff before the conference convened. Dr. Teter discovered this when she picked up some

papers by mistake just before the conference began, and found they contained the consensus report, already written, with just a few numbers left blank. Kritchevsky represented the lipid hypothesis camp with a humorous five-minute presentation, full of ditties. Edward Ahrens, a respected researcher, raised strenuous objections about the "consensus," only to be told that he had misinterpreted his own data, and that if he wanted a conference to come up with different conclusions, he should pay for it himself.

The 1984 Cholesterol Consensus Conference final report was a whitewash, containing no mention of the large body of evidence that conflicted with the lipid hypothesis. One of the blanks was filled with the number 200. The document defined all those with cholesterol levels above 200 mg/dL as "at risk" and called for mass cholesterol screening, even though the most ardent supporters of the lipid hypothesis had surmised in print that 240 should be the magic cutoff point. Such screening would, in fact, need to be carried out on a massive scale as the federal medical bureaucracy, by picking the number 200, had *defined* the vast majority of the American adult population as "at risk." The report resurrected the ghost of Norman Jolliffe and his Prudent Diet by suggesting the avoidance of saturated fat and cholesterol for all Americans now defined as "at risk," and specifically advised the replacement of butter with margarine.

The Consensus Conference also provided a launching pad for the nationwide National Cholesterol Education Program, which had the stated goal of "changing physicians' attitudes." NHLBI-funded studies had determined that while the general population had bought into the lipid hypotheses, and was dutifully using margarine and buying low-cholesterol foods, the medical profession remained skeptical. A large "Physicians Kit" was sent to all doctors in America, compiled in part by the American Pharmaceutical Association, whose representatives served on the NCEP coordinating committee. Doctors were taught the importance of cholesterol screening, the advantages of cholesterol-lowering drugs and the unique benefits of the Prudent Diet. NCEP materials told every doctor in America to recommend the use of margarine rather than butter.

Cholesterol Screening for Everyone

In November of 1986, the *Journal of the American Medical Association* published a series on the Lipid Research Clinics trials, including "Cholesterol and Coronary Heart Disease: A New Era" by longtime American Heart Association member Scott Grundy, MD, PhD.[35] The article is a disturbing combination of euphoria and agony—euphoria at the forward movement of the lipid hypothesis juggernaut, and agony over the elusive nature of real proof. "The recent consensus conference on cholesterol. . . implied that levels between 200 and 240. . carry at least a mild increase in risk, which they obviously do. . ." said Grundy, directly contradicting an earlier statement that "Evidence relating plasma cholesterol levels to atherosclerosis and CHD has become so strong as to leave little doubt of the etiologic connection." Grundy called for ". . . the simple step of measuring the plasma cholesterol level in all adults. . . those found to have elevated cholesterol levels can be designated as at high risk and thereby can enter the medical care system. . . an enormous number of patients will be included." Who benefits from "the simple step of measuring the plasma cholesterol level in all adults?" Why, hospitals, laboratories, pharmaceutical companies, the vegetable oil industry, margarine manufacturers, food processors and, of course, medical doctors. "Many physicians will see the advantages of using drugs for cholesterol lowering. . ." said Grundy, even though

"a positive benefit/risk ratio for cholesterol-lowering drugs will be difficult to prove." The cost in the US of cholesterol screening and cholesterol-lowering drugs alone now stands at sixty billion dollars per year, even though a positive risk/benefit ratio for such treatment has never been established. Physicians, however, have "seen the advantages of using drugs for cholesterol lowering" as a way of creating patients out of healthy people.

Grundy was equally schizophrenic about the benefits of dietary modification. "Whether diet has a long term effect on cholesterol remains to be proved," he stated, but "Public health advocates furthermore can play an important role by urging the food industry to provide palatable choices of foods that are low in cholesterol, saturated fatty acids and total calories." Such foods, almost by definition, contain partially hydrogenated vegetable oils that imitate the advantages of animal fats. Grundy knew that the *trans* fats were a problem, that they raised serum cholesterol and contributed to the etiology of many diseases—he knew because a year earlier, at his request, Mary Enig had sent him a package of data detailing numerous studies that gave reason for concern, which he acknowledged in a signed letter as "an important contribution to the ongoing debate."

Other mouthpieces of the medical establishment fell in line after the Consensus Conference. In 1987 the National Academy of Science (NAS) published an overview in the form of a handout booklet containing a whitewash of the *trans* problem and a pejorative description of palm oil—a natural fat high in beneficial saturates and monounsaturates that, like butter, has nourished healthy population groups for thousands of years, and, also like butter, competes with hydrogenated fats because it can be used as a shortening. The following year the Surgeon General's Report on Nutrition and Health emphasized the importance of making low-fat foods more widely available. Project LEAN (Low-Fat Eating for America Now) sponsored by the J. Kaiser Family Foundation and a host of establishment groups such as the America Heart Association, the American Dietetic Association, the American Medical Association, the USDA, the National Cancer Institute, Centers for Disease Control and the National Heart, Lung and Blood Institute announced a publicity campaign to "aggressively promote foods low in saturated fat and cholesterol in order to reduce the risk of heart disease and cancer."

National Food Processors Association Conference

The following year, Enig joined Frank McLaughlin, Director of the Center for Business and Public Policy at the University of Maryland, in testimony before the National Food Processors Association. It was a closed conference, for NFPA members only. Enig and McLaughlin had been invited to give "a view from academia." Enig presented a number of slides and warned against singling out classes of fats and oils for special pejorative labeling. A representative from Frito-Lay took umbrage at Enig's slides, which listed amounts of trans fats in Frito-Lay products. Enig offered to redo the analyses if Frito-Lay would to fund the research. "If you'd talk different, you'd get money," he said.

Enig urged the association to endorse accurate labeling of *trans* fats in all food items but conference participants—including representatives from most of the major food processing giants—preferred a policy of "voluntary labeling" that did not unnecessarily alert the public to the presence of *trans* fats in their foods. To date they have prevailed in

preventing the inclusion of *trans* fats on nutrition labels.

Enig's cat and mouse game with Hunter and Applewhite of the Institute of Shortening and Edible Oils continued throughout the later years of the 1980's. Their *modus operandi* was to pepper the literature with articles that downplayed the dangers of *trans* fats, to use their influence to prevent opposing points of view from appearing in print and to follow-up the few alarmist articles that did squeak through with "definitive rebuttals." In 1987 Enig submitted a paper on *trans* fatty acids in the US diet to the *American Journal of Clinical Nutrition*, as a reply to the erroneous 1985 FASEB report as well as to Hunter and Applewhite's influential 1986 article, which by even the most conservative analysis underestimated the average American consumption of partially hydrogenated fats. Editor-in-chief Albert Mendeloff, MD rejected Enig's rebuttal as "inappropriate for the journal's readership." His rejection letter invited her to resubmit her paper if she could come up with "new evidence." In 1991, the article finally came out in a less prestigious publication, the Journal of the *American College of Nutrition*,[36] although Applewhite did his best to coerce editor Mildred Seelig into removing it at the last minute. Hunter and Applewhite submitted letters and then an article of rebuttal to the *American Journal of Clinical Nutrition*,[37] which were published shortly thereafter. In the article, entitled "Reassessment of trans fatty acid availability in the US diet," Hunter and Applewhite argued that the amount of *trans* in the American diet had actually declined since 1984, due to the introduction of soft margarines and tub spreads. The media fell in line with their pronouncements, with numerous articles by food writers recommending low-*trans* tub spreads, made from polyunsaturated vegetable oils, as the sensible alternative to saturated fat from animal sources—not surprising as most newspapers rely on the International Food Information Council, an arm of the food processing industry, for their nutrition information.

Other Research on *Trans* Fats

Enig and the University of Maryland group were not alone in their efforts to bring their concerns about the effect of partially hydrogenated fats before the public. Fred Kummerow at the University of Illinois, blessed with independent funding and an abundance of patience, carried out a number of studies that indicated that the *trans* fats increased risk factors associated with heart disease, and that vegetable-oil-based fabricated foods such as Egg Beaters cannot support life.[38] George Mann, formerly with the Framingham project, possessed neither funding nor patience—he was, in fact, very angry with what he called the Diet/Heart scam. His independent studies of the Masai in Africa,[39] whose diet is extremely rich in cholesterol and saturated fat, and who are virtually free of heart disease, had convinced him that the lipid hypothesis was "the public health diversion of this century. . . the greatest scam in the history of medicine."[40] He resolved to bring the issue before the public by organizing a conference in Washington DC in November of 1991.

"Hundreds of millions of tax dollars are wasted by the bureaucracy and the self-interested Heart Association," he wrote in his invitation to participants. "Segments of the food industry play the game for profits. Research on the true causes and prevention is stifled by denying funding to the ‘unbelievers.' This meeting will review the data and expose the rascals."

The rascals did their best to prevent the meeting from taking place. Funding promised by the Greenwall Foundation of New York City was later withdrawn, so Mann paid most of the bills. A press release sent as a dirty trick to speakers and participants wrongly announced that the conference had been cancelled. Several speakers did in fact renege at the last minute on their commitment to attend, including the prestigious Dr. Roslyn Alfin-Slater and Dr. Peter Nixon of London. Dr. Eliot Corday of Los Angeles cancelled after being told that his attendance would jeopardize future funding.

The final pared-down roster included Dr. George Mann, Dr. Mary Enig, Dr. Victor Herbert, Dr. Petr Skrabenek, William B. Parsons, Jr., Dr. James McCormick, a physician from Dublin, Dr. William Stehbens from New Zealand, who described the normal protective process of arterial thickening at points of greatest stress and pressure, and Dr. Meyer Texon an expert in the dynamics of blood flow. Mann, in his presentation, blasted the system that had foisted the lipid hypothesis on a gullible public. "You will see," he said, "that many of our contributors are senior scientists. They are so for a reason that has become painfully conspicuous as we organized this meeting. Scientists who must go before review panels for their research funding know well that to speak out, to disagree with this false dogma of Diet/Heart, is a fatal error. They must comply or go unfunded. I could show a list of scientists who said to me, in effect, when I invited them to participate: ‘I believe you are right, that the Diet/Heart hypothesis is wrong, but I cannot join you because that would jeopardize my perks and funding.' For me, that kind of hypocritical response separates the scientists from the operators—the men from the boys."

'90s See the Nation Well Oiled

By the nineties the operators had succeeded, by slick manipulation of the press and of scientific research, in transforming America into a nation that was well and truly oiled. Consumption of butter had bottomed out at about 5 grams per person per day, down from almost 18 at the turn of the century. Use of lard and tallow had been reduced by two-thirds. Margarine consumption had jumped from less than 2 grams per person per day in 1909 to about 11 in 1960. Since then consumption figures had changed little, remaining at about 11 grams per person per day—perhaps because knowledge of margarine's dangers had been slowly seeping out to the public. However, most of the *trans* fats in the current American diet come not from margarine but from shortening used in fried and fabricated foods. American shortening consumption of 10 grams per person per day held steady until the 1960's, although the content of that shortening had changed from mostly lard, tallow and coconut oil—all natural fats—to partially hydrogenated soybean oil. Then shortening consumption shot up and by 1993 had tripled to over 30 grams per person per day.

But the most dramatic overall change in the American diet was the huge increase in the consumption of liquid vegetable oils, from slightly less than 2 grams per person per day in 1909 to over 30 in 1993—a fifteen fold increase.

Dangers of Polyunsaturates

The irony is that these trends have persisted concurrently with revelations about the

dangers of polyunsaturates. Because polyunsaturates are highly subject to rancidity, they increase the body's need for vitamin E and other antioxidants. Excess consumption of vegetable oils is especially damaging to the reproductive organs and the lungs—both of which are sites for huge increases in cancer in the US. In test animals, diets high in polyunsaturates from vegetable oils inhibit the ability to learn, especially under conditions of stress; they are toxic to the liver; they compromise the integrity of the immune system; they depress the mental and physical growth of infants; they increase levels of uric acid in the blood; they cause abnormal fatty acid profiles in the adipose tissues; they have been linked to mental decline and chromosomal damage; they accelerate aging. Excess consumption of polyunsaturates is associated with increasing rates of cancer, heart disease and weight gain; excess use of commercial vegetable oils interferes with the production of prostaglandins leading to an array of complaints ranging from autoimmune disease to PMS. Disruption of prostaglandin production leads to an increased tendency to form blood clots, and hence myocardial infarction, which has reached epidemic levels in America.[41]

Vegetable oils are more toxic when heated. One study reported that polyunsaturates turn to varnish in the intestines. A study by a plastic surgeon found that women who consumed mostly vegetable oils had far more wrinkles than those who used traditional animal fats. A 1994 study appearing in the *Lancet* showed that almost three quarters of the fat in artery clogs is unsaturated. The "artery clogging" fats are not animal fats but vegetable oils.[42]

Those who have most actively promoted the use of polyunsaturated vegetable oils as part of a Prudent Diet are well aware of their dangers. In 1971, William B. Kannel, former director of the Framingham study, warned against including too many polyunsaturates in the diet. A year earlier, Dr. William Connor of the American Heart Association issued a similar warning, and Frederick Stare reviewed an article which reported that the use of polyunsaturated oils caused an increase in breast tumors. And Kritchevsky, way back in 1969, discovered that the use of corn oil caused an increase in atherosclerosis.[43]

As for the *trans* fats, produced in vegetable oils when they are partially hydrogenated, the results that are now in the literature more than justify concerns of early investigators about the relation between *trans* fats and both heart disease and cancer. The research group at the University of Maryland found that *trans* fatty acids not only alter enzymes that neutralize carcinogens, and increase enzymes that potentiate carcinogens, but also depress milk fat production in nursing mothers and decrease insulin binding.[44] In other words, *trans* fatty acids in the diet interfere with the ability of new mothers to nurse successfully and increase the likelihood of developing diabetes. Unpublished work indicates that trans fats contribute to osteoporosis. Hanis, a Czechoslovakian researcher, found that *trans* consumption decreased testosterone, caused the production of abnormal sperm and altered gestation.[45] Koletzko, a German pediatric researcher found that excess *trans* consumption in pregnant mothers predisposed them to low birth weight babies.[46] *Trans* consumption interferes with the body's use of omega-3 fatty acids found in fish oils, grains and green vegetables, leading to impaired prostaglandin production.[47] George Mann confirmed that *trans* consumption increases the incidence of heart disease.[48] In 1995, European researchers found a positive correlation between breast cancer rates and *trans* consumption.[49]

Until the 1995 study, only the disturbing revelations of Dutch researchers Mensink and

Katan, in 1990, received front page coverage. Mensink and Katan found that margarine consumption increased coronary heart disease risk factors.[50] The industry—and the press—responded by promoting tub spreads, which contain reduced amounts of *trans* compared to stick margarine. For the general population, these *trans* reductions have been more than offset by changes in the types of fat used by the fast food industry. In the early 1980's, Center for Science in the Public Interest campaigned against the use of beef tallow for frying potatoes. Before that they campaigned against the use of tallow for frying chicken and fish. Most fast food concerns switched to partially hydrogenated soybean oil for all fried foods. Some deep fried foods have been tested at almost 50% *trans*.[51]

Epidemiologist Walter Willett at Harvard worked for many years with flawed data bases which did not identify trans fats as a dietary component. He found a correlation with dietary fat consumption and both heart disease and cancer. After his researchers contacted Enig about the trans data, they developed a more valid data base that was used in the analysis of the massive Nurses Study. When Willett's group separated out the trans component in their analyses, they were able to confirm greater rates of cancer in those consuming margarine and vegetable shortenings—not butter, eggs, cheese and meat.[52] The correlation of trans fat consumption and cancer was never published, but was reported at the Baltimore Data Bank Conference in 1992.

In 1993 Willett's research group at Harvard found that trans contributed to heart disease,[53] and this study was not ignored, but received much fanfare in the press. Willett's first reference in his report was Enig's work on the trans content of common foods.

The industry continues to argue that American trans consumption is a low six to eight grams per person per day, not enough to contribute to today's epidemic of chronic disease. Total per capita consumption of margarine and shortening hovers around 40 grams per person per day. If these products contain 30% trans (many shortenings contain more) then average consumption is about 12 grams per person per day. In reality, consumption figures can be dramatically higher for some individuals. A 1989 Washington Post article documented the diet of a teenage girl who ate 12 donuts and 24 cookies over a three day period. Total trans worked out to at least 30 grams per day, and possibly much more. The fat in the chips that teenagers consume in abundance may contain up to 48% trans which translates into 45.6 grams of trans fat in a small ten-ounce bag of snack chips—which a hungry teenager can gobble up in a few minutes. High school sex education classes do not teach American teenagers that the altered fats in their snack foods may severely compromise their ability to have normal sex, conceive, give birth to healthy babies and successfully nurse their infants.

Benefits of Animal Fats

Foods containing trans fat sell because the American public is afraid of the alternative—saturated fats found in tallow, lard, butter, palm and coconut oil, fats traditionally used for frying and baking. Yet the scientific literature delineates a number of vital roles for dietary saturated fats—they enhance the immune system,[54] are necessary for healthy bones,[55] provide energy and structural integrity to the cells,[56] protect the liver[57] and enhance the body's use of essential fatty acids.[58] Stearic acid, found in beef tallow and

butter, has cholesterol lowering properties and is a preferred food for the heart.[59] As saturated fats are stable, they do not become rancid easily, do not call upon the body's reserves of antioxidants, do not initiate cancer, do not irritate the artery walls.

Your body makes saturated fats, and your body makes cholesterol—about 2000 mg per day. In general, cholesterol that the average American absorbs from food amounts to about 100 mg per day. So, in theory, even reducing animal foods to zero will result in a mere 5% decrease in the total amount of cholesterol available to the blood and tissues. In practice, such a diet is likely to deprive the body of the substrates it needs to manufacture enough of this vital substance; for cholesterol, like saturated fats, stands unfairly accused. It acts as a precursor to vital corticosteroids, hormones that help us deal with stress and protect the body against heart disease and cancer; and to the sex hormones like androgen, testosterone, estrogen and progesterone; it is a precursor to vitamin D, a vital fat-soluble vitamin needed for healthy bones and nervous system, proper growth, mineral metabolism, muscle tone, insulin production, reproduction and immune system function; it is the precursor to bile salts, which are vital for digestion and assimilation of fats in the diet. Recent research shows that cholesterol acts as an antioxidant.[60] This is the likely explanation for the fact that cholesterol levels go up with age. As an antioxidant, cholesterol protects us against free radical damage that leads to heart disease and cancer. Cholesterol is the body's repair substance, manufactured in large amounts when the arteries are irritated or weak. Blaming heart disease on high serum cholesterol levels is like blaming firemen who have come to put out a fire for starting the blaze.

Cholesterol is needed for proper function of serotonin receptors in the brain.[61] Serotonin is the body's natural "feel-good" chemical. This explains why low cholesterol levels have been linked to aggressive and violent behavior, depression and suicidal tendencies.

Mother's milk is especially rich in cholesterol and contains a special enzyme that helps the baby utilize this nutrient. Babies and children need cholesterol-rich foods throughout their growing years to ensure proper development of the brain and nervous system. Dietary cholesterol plays an important role in maintaining the health of the intestinal wall,[62] which is why low-cholesterol vegetarian diets can lead to leaky gut syndrome and other intestinal disorders.

Animal foods containing saturated fat and cholesterol provide vital nutrients necessary for growth, energy and protection from degenerative disease. Like sex, animal fats are necessary for reproduction. Humans are drawn to both by powerful instincts. Suppression of natural appetites leads to weird nocturnal habits, fantasies, fetishes, bingeing and splurging.

Animal fats are nutritious, satisfying and they taste good. "Whatever is the cause of heart disease," said the eminent biochemist Michael Gurr in a recent article, "it is not primarily the consumption of saturated fats."[63] And yet the high priests of the lipid hypothesis continue to lay their curse on the fairest of culinary pleasures—butter and Bernaise, whipped cream, souffles and omelets, full-bodied cheeses, juicy steaks and pork sausage.

Coming Full Circle—
And Yet, Learning Nothing

On April 30, 1996 a senior researcher named David Kritchevsky received the American Oil Chemists' Society's Research Award in recognition of his accomplishments as a "researcher on cancer and atherosclerosis as well as cholesterol metabolism." His accomplishments include co-authorship of more than 370 research papers, one of which appeared a month later in the *American Journal of Clinical Nutrition*.[64] "Position paper on *trans* fatty acids" continued the debate on *trans* fats that began in the same journal with Hunter and Applewhite's 1986 attack on Enig's research. "A controversy has arisen about the potential health hazards of *trans* unsaturated fatty acids in the American diet," wrote Kritchevsky and his coauthors.

Actually the controversy dates back to 1954. In the rabbit studies that launched Kritchevsky on his career, the researcher actually found that cholesterol fed with Wesson oil "markedly accelerated" the development of cholesterol-containing low-density lipoproteins; and cholesterol fed with shortening gave cholesterol levels twice as high as cholesterol fed alone.[65] Enig's work—and that of Kummerow and Mann and several others—merely confirmed what Kritchevsky ascertained decades ago but declined to publicize, that vegetable oils, and particularly partially hydrogenated vegetable oils, are bad news.

But the "Position paper on *trans* fatty acids" took no position at all. Studies have given contradictory results, said the authors, and the amount of *trans* in the average American diet is very difficult to determine. As for labeling, "There is no clear choice of how to include *trans* fatty acids on the nutrition label. The database is insufficient to establish a classification scheme for these fats." There may be problems with *trans*, says the senior researcher, but their use "helps to reduce the intake of dietary fats higher in saturated fatty acids. Also, vegetable fats are not a source of dietary cholesterol, unlike saturated animal fats." Kritchevsky and his coauthors conclude that physicians and nutritionists should "focus on a further decrease in total fat intake and especially the intake of saturated fat. . . A reduction in total fat intake simplifies the problem, because all fats in the diet decrease and choices are unnecessary." However, even senior scientists find that fence straddling is necessary. "We may conclude," wrote Kritchevsky and his colleagues, "that consumption of liquid vegetable oils is preferable to solid fats."

Footnote:
Early this year, 1998, a symposium entitled "Evolution of Ideas about the Nutritional Value of Dietary Fat" reviewed the many flaws in the lipid hypothesis and highlighted a study in which mice fed purified diets died within 20 days but whole milk kept the mice alive for several months.[66] One of the participants was David Kritchevsky who noted that the use of low-fat diets and drugs in intervention trials, "did not affect overall CHD mortality." Ever with a finger in the wind, this influential Founding Father of the lipid hypothesis concluded thus: "Research continues apace and, as new findings appear, it may be necessary to reevaluate our conclusions and preventive medicine policies."

About the Authors

Mary G. Enig, PhD is an expert of international renown in the field of lipid biochemistry. She has headed a number of studies on the content and effects of *trans* fatty acids in America and Israel, and has successfully challenged government assertions that dietary animal fat causes cancer and heart disease. Recent scientific and media attention on the possible adverse health effects of *trans* fatty acids has brought increased attention to her work. She is a licensed nutritionist, certified by the Certification Board for Nutrition Specialists, a qualified expert witness, nutrition consultant to individuals, industry and state and federal governments, contributing editor to a number of scientific publications, Fellow of the American College of Nutrition and President of the Maryland Nutritionists Association. She is the author of over 60 technical papers and presentations, as well as a popular lecturer. Dr. Enig is currently working on the exploratory development of an adjunct therapy for AIDS using complete medium chain saturated fatty acids from whole foods. She is the mother of three healthy children brought up on whole foods including butter, cream, eggs and meat.

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