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Nutritionism. Hydrogenation

Margarine, butter, and the trans-fats fiasco

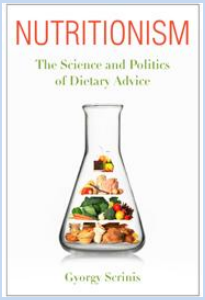


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The century-old butter vs margarine wars overlooked toxic trans-fats (above, left) still present in processed pizzas, French fries, baked goods, packaged snacks, deep-fried foods – and margarine. But the trans-fat fiasco masks bigger issues, about the nature of processed products, and about the real purpose of nutrition science in promotion of health and well-being and prevention of disease.

Summary



Gyorgy Scrinis is the originator of the concept of 'nutritionism'. This is the name of the still-dominant reductive theory that identifies diets and foods with their constituent chemicals, generally known as nutrients. In his commentary he gives as an example the history of margarine and *trans*-fats research, and its impact on food product manufacturing, food supplies, health and disease. A reductive interpretation of the health effects of dietary fats has allowed margarine to be promoted by policy-makers, scientists and industry, as superior to butter.

Following evidence of the toxicity of the *trans*-fats created by the partial hydrogenation of oils, and therefore found in margarine and a great variety of processed products using vegetable oils (see examples in the pictures above), margarine has been re-engineered. Alternative oil processing techniques are used to reduce its *trans*-fat content. But identification of *trans*-fats as 'the bad fats', reinforces the nutritionism paradigm.

The margarine vs. butter wars, now a century old, illustrate how conventional nutrition science can overlook the basic issue of the nature, purpose and type of processing of food products. Nutritionism manifests itself in nutrition science research, dietary guidelines, food engineering and marketing, and in the public understanding of food and dietary health. It decontextualises, simplifies and exaggerates the role of nutrients in health and disease.

Nutritionism, the book

This commentary is an edited chapter from the 2013 book by Gyorgy Scrinis, *Nutritionism: The Science and Politics of Dietary Advice*, published by Columbia University Press. In the book he explores the changing forms of nutritionism across what he identifies as three periods. These are the eras of quantifying nutritionism, of good-and-bad nutritionism, and of functional nutritionism. Case studies include the battles between weight-loss diets based on their macronutrient profile; the diet-heart hypothesis; the low-fat campaign; caloric reductionism and the energy balance equation; functional foods – and the *trans*-fat fiasco.

In the book, Gyorgy Scrinis shows that food manufacturing, catering and allied corporations have appropriated nutritionism, because of its commercial value. They have become the primary promoters of a reductive understanding of nutrients to the lay public, notably through their use of nutrition and health claims in the advertising, marketing and packaging of their products. The book proposes an alternative paradigm to nutritionism. This is the food quality paradigm, which is an integrated understanding of nutrition. It gives a proper appreciation of the overall quality of foods, of the cultural and traditional knowledge of food, and of the sensual and practical experience of preparing and consuming food. The book also proposes less reductive ways to analyse nutrients, foods and dietary patterns.

Introduction

Chemists or cows?

Which is the better choice, butter or margarine? Beginning in the 1960s, many nutrition scientists and other experts leaned heavily toward margarine. They did so entirely on the basis of relative ratios of polyunsaturated and saturated fats, while overlooking or being ignorant of the presence of the highly processed ingredients used to manufacture margarine, and the artificial *trans*-fats produced by the partial hydrogenation technology used to harden vegetable oils. However, a crisis for the reputation of margarine became inescapable when a study by two Dutch investigators published in a leading journal in 1990 highlighted the harmful effects of these *trans*-fats. It was evident that *trans*-fats had an even more detrimental effect on blood cholesterol levels than saturated fats, and therefore – within the logic of the dominant diet-heart hypothesis – posed a greater risk of heart disease.

In 1986 Joan Dye Gussow, the outspoken public health nutritionist, said: 'As for butter versus margarine, I trust cows more than chemists' (1). The take-home message of what has become the *trans*-fats fiasco may be that we should have placed our trust in cows rather than chemists all along. Certainly, we should question the reductive evaluation of foods and processed food products on the basis of their so-called good and bad fat content.

However, policymakers have responded to this new evidence by re-categorising *trans*-fats as a 'bad fat', and food scientists and technologists and margarine manufacturers have sought new chemical processing techniques to produce a 'virtually *trans*-fat-free' margarine. In this way, focus is maintained on the nutrient composition of margarine, rather than bringing to light and opening up to scrutiny the types of processing techniques, ingredients and additives now being used in its production.

This commentary outlines the history of margarine and its wars with butter, and the continual re-engineering of margarine across what I see as the three eras of nutritionism, in response to changing nutritional fears and fetishes. I trace the transformation of the public profile and nutritional facade of margarine from being seen as a cheap imitation of butter in the first era of quantifying nutritionism; to a 'hyper-real' spread boasting a superior fatty acid profile in the second, good-and-bad era; and then to a cholesterol-lowering and omega-3-enriched functional food in the third, functional era.

I also examine the research and the debate over *trans*-fats which originated with pioneering work as long ago as the 1960s, and how the discourse of 'good' and 'bad' fats continues to obscure the underlying ingredients and processing quality of margarine and other spreads.

The invention of margarine
Food alchemy



The chemists who discovered fatty acids, who created margarine, and who invented hydrogenation: From left: Hippolyte Mége-Mouriés, Michel-Eugène Chevreul, Wilhelm Normann, Paul Sabatier

French chemist Hippolyte Mége-Mouriés (1817-1880, at left above) invented margarine in 1869, following initial identification of margaric acid by Michael-Eugēne Chevreul (1786-1889, next to him). Mége-Mouriés had accepted an assignment from the French government to develop a cheap substitute for butter and an alternative source of fat, in response to butter shortages prevailing in France at the time (2). His proto-margarine was produced using beef tallow – a plentiful by-product of meat production – mixed with skim milk. This food product was markedly different from later margarines in terms of its ingredients, manufacturing techniques, and nutrient profile. Mége-Mouriés called it margarine, since margaric acid, a type of saturated fat, was one of the key fatty acid constituents. It later became known as oleo margarine after the Latin word for beef (3). By the mid-1870s this beef tallow margarine was being sold in Europe, the US, New Zealand, and Australia.

The next advance came in 1902 when German scientist Wilhelm Normann (1870-1939, next to right) patented the hydrogenation process for solidifying liquid vegetable oils, a process that manufacturers began to use around 1910 (2,4). He built on earlier investigations by Paul Sabatier (at right, 1854-1941), who won a Nobel prize for his work on hydrogenation. In the following decades, margarine manufacturers mixed into their products a combination of hydrogenated (which is to say, hardened) vegetable oils, liquid vegetable oils, and animal fats. The use of animal fats was not phased out by the US margarine industry until 1950 (5).

In the first half of the twentieth century, margarine was considered by the public, and by the dairy industry, as a cheap imitation of butter. Margarine manufacturers, such as the Dutch and British companies that merged in 1930 to become Unilever, largely aimed to simulate some of the characteristics of butter, such as its taste, texture, colour, and nutritional profile. In the late nineteenth century several countries and US states introduced laws prohibiting the use of yellow colouring in margarine; indeed, some states required it to be coloured pink. These colouring regulations remained in place until the late 1960s (3,6). Canada's federal government also prohibited the production, importation, and sale of margarine for most of the period

between 1886 and 1949, and lifted regulations prohibiting the use of yellow colouring only in 2008 (6,7). Legislators largely used colouring restrictions, as well as production quotas and taxes levied on margarine producers, to protect the commercial interests of the dairy industry, and particularly to prevent the sale of what some considered as 'counterfeit' margarines masquerading as butter.

In this era of quantifying nutritionism, while following the requirements of food regulatory authorities, margarine manufacturers merely attempted to replicate the type and quantity of the nutrients in butter, to achieve 'nutritional equivalence' (8). The primary nutritional and culinary role of margarine was as a more affordable source of fat and energy to be placed on the table of the poorer classes and to be used in cooking (9). To simulate the nutrient profile of butter, manufacturers fortified margarine with the fat-soluble vitamins A and D. This occurred from the 1920s in the United Kingdom and somewhat later in other countries (10,11). As noted in 1970 in a history of margarine: 'By 1940 the nutritional equivalency of the two "spreads" had been established as far as nutritional knowledge then went' (8).

Hydrogenation
The creation of *trans*-fats



Hydrogenation is a complex industrial process. Chemistry of hydrogenation (left). A hydrogenation plant (centre). A hydrogenation reactor made in China recently being delivered in India (right)

The process of hydrogenation involves mixing vegetable oils with a catalyst, such as finely ground nickel, subjecting the oil to high temperatures and pressures, and then pumping hydrogen gas through the liquid. Complete hydrogenation results in a very solid and largely inedible fat. Before the 1990s manufacturers typically made margarines by partially hydrogenating the vegetable oil in order to achieve a soft and spreadable texture. The smelly, gray, unpleasant-tasting substance that emerges requires steam cleaning under high temperature and pressure to remove the foul odour. Manufacturers bleach this substance to remove the gray colour and later add chemical colourings and flavourings to mimic the appearance and taste of butter. Emulsifiers are added to integrate the oil with water and to create desired texture and consistency. Manufacturers blend in skim milk powder to some margarines, adding

vitamins A and D to imitate the profile of butter. Hydrogenated oils may contain trace elements of the metal catalysts used to produce them (4,12).

The partial hydrogenation of vegetable oils chemically transforms some of the unsaturated fats into the novel forms of *trans*-fatty acids, and also leads to an increase in the proportion of saturated fats in these oils. When oils are fully hydrogenated, all of the unsaturated fats become fully saturated, producing a very solid product that contains no *trans*-fats. Table margarine and cooking oils have typically been either partially hydrogenated, or produced by blending fully hydrogenated, partially hydrogenated, and liquid vegetable oils. In the 1970s and 1980s, margarines and spreads usually contained between 15 and 25 percent *trans*-fats, and margarines produced before that time may have had even higher ratios (13). The hydrogenation process eliminates from margarine most of the omega-3 fats found in vegetable oils, thus increasing its stability and shelf life (14).

Some naturally occurring types of *trans*-fatty acids can also be found in low concentrations in dairy and meat products, typically making up between 2 and 5 percent of dairy and beef fats (15). However, the industrial or artificial *trans*-fats created by the hydrogenation process are novel, and have been produced and consumed in much larger quantities than ruminant *trans*-fats from meat and dairy sources. Another source of these industrial *trans*-fats – one rarely acknowledged or publicised by nutrition experts or by the food industry – is the process of extracting and refining vegetable oils. When extracting vegetable oil, processing companies use an intensive process that involves extreme heating, mechanical extraction, and chemical solvents. The high temperatures involved in deodorising the oils may produce between 1 and 4 percent *trans*-fats out of the total fat content (16).

Partially hydrogenated oils meet requirements of the food processing and fast food industries. In 1911 Procter and Gamble introduced Crisco, the first hard shortening made entirely from vegetable oil (17). Crisco was initially marketed as a cheap alternative to lard and butter for the manufacture of processed foods, for frying, and for housewives to use in home cooking (18). For many years the food industry has used partially hydrogenated vegetable oils extensively for deep frying, because they improve the stability and the longevity of oils subjected to high temperatures, and they make French fries (chips) and other deep-fried foods appealingly crunchy.

Manufacturers of a wide range of processed foods, including ice cream, cookies (biscuits), potato chips (crisps), sauces, frozen foods, confectionery, and baked goods, also use hydrogenated oils as cheap bulk for their products, to provide good texture and mouth-feel, to make baked goods crispy, and to impart heat tolerance and a longer shelf life. (See the pictures introducing this commentary). By the 1990s the largest source of *trans*-fats in the US diet was not from margarines and spreads, but from the partially hydrogenated oils used for deep-frying or added to very many processed and baked foods (19). This remains the case.

Heart disease
The saturated fat hypothesis



Ancel Keys (left) dominated thinking in the US and elsewhere on the role of fats in heart disease. Biochemist Fred Kummerow (right) identified trans-fats as problematic as long ago as the 1960s

The undermining of butter's perceived superiority over margarine is a key marker of the shift from the first, quantitative era, to the second, good-and-bad era of nutritionism. It follows the rise of the diet-heart hypothesis linking saturated fats to heart disease advocated by Ancel Keys (1904-2004, above left) from the late 1950s. As from the 1960s most nutrition scientists in the field attributed the increase in coronary heart disease to foods and diets high in dietary cholesterol and saturated fats, because these raise blood cholesterol levels. By contrast, they found that polyunsaturated fats lower total cholesterol levels.

At first, investigators did not distinguish *trans*-fats from saturated fats, because they thought that these acted similarly in the body. So they may have blamed saturated fats for some of the cholesterol-raising effects actually due to *trans*-fats. From the late 1950s, a number of human and animal studies found that when vegetable oils high in polyunsaturated fat were hydrogenated, they lost their ability to lower cholesterol levels, although some other studies have failed to confirm this relationship (20-22).

At that time the American Heart Association (AHA) remained unenthusiastic about margarine. It noted in 1957 and 1961 that hydrogenated vegetable fats both raised cholesterol levels and decreased the amount of polyunsaturated fats in oils (23). Until the late 1960s, the AHA continued to caution against hydrogenated oils.

In 1968, biochemist Fred Kummerow (right, above, still active age 99 in 2013), sat on an AHA committee. He has stated that the committee was concerned about the health effects of hydrogenated oils, but the vegetable oil industry had objected to the AHA new draft position that made reference to *trans*-fats and their effects on blood cholesterol. The industry later agreed to lower the levels of *trans*-fats in margarine and shortening, and after 1968 the *trans*-fat content of margarines fell from around 40 percent to 27 percent. However, as their part of the deal, the AHA modified its position and only warned against the use of 'heavily hydrogenated' oils, omitting

reference to *trans*-fats. From then until the 1990s, the AHA was largely silent on the effects of *trans*-fats on blood cholesterol, while continuing to promote soft margarines that contain lower levels of *trans*-fats than hard margarines (24,25).

Given that partially hydrogenated polyunsaturated fats were being promoted over saturated fats precisely because of their claimed effects on blood cholesterol levels, it is surprising that research into the health effects of these fats was not urgently pursued. Margarine was promoted as being healthier than butter largely out of ignorance of partially hydrogenated oils and *trans*-fats, rather than from substantial knowledge of their safety or any beneficial effects.

Box 1

Early warnings on trans-fats

Biochemists who warned against hydrogenation and trans-fats before the 1990s were generally ignored or regarded as eccentric. One is Fred Kummerow, mentioned above (25). Two others are the Canadian Ross Hume Hall, and Mary Enig from the US.

Ross Hume Hall was the senior biochemist at McMaster University, Canada. He wrote in 1974 (4). 'Medical scientists for a generation have promoted the eating of commercially processed vegetable fat in lieu of butter and other animal fats, knowing nothing of what they recommend'. He emphasised that hydrogenation and other oil processing techniques transformed the fundamental chemical structure and physical properties of many of the polyunsaturated fats in the vegetable oils. Yet nutrition scientists continued to describe these chemically modified fats as polyunsaturated fats: 'They do not seem to care about the fact that these are unnatural polyunsaturates whose biological properties remain unknown. ... The original molecular architecture of the vegetable oil has been reorganized: The product is completely unnatural, yet no hint of the changes appears on the label of the final product. At the tme, he reported, some margarines contained up to 40 per cent trans-fats.

He cited studies showing that hydrogenated oils seemed to raise cholesterol levels. These studies considered only the effects on heart disease or, more narrow still, on blood cholesterol levels as a marker of heart disease risk. For Hall, the failure of these kinds of studies to examine broader health consequences of oil processing techniques meant that 'North Americans have been subjected unwittingly to a massive experiment involving consumption of *trans* and other unnatural fats ever since about 1914'. He was also concerned about the degradation of vegetable oils subjected to modern refining and extraction processes, even prior to the oils being put through the hydrogenation process.

Mary Enig is also a biochemist by training, and a former editor of the *Journal of the American College of Nutrition*. She has criticised *trans*-fats since the 1970s (12, 26-28). She has examined the possible role of refined vegetable oils and partially hydrogenated oils in heart disease and cancer. She reports that much of the increase in fat consumption during the 20th century was in the form of unsaturated fats from vegetable oils, and that since 1910 per capita *trans*-fat consumption in the US rose from 4 to 12 grams per day. Since margarine contains a proportion of saturated fat, margarine accounted for a large portion of the saturated fat consumption over this period (29).

Trans-fats
The Dutch discovery



Ronald Mensink (left) and Martijn Katan (centre) broke through with the news that trans-fats seemed to be more harmful than saturated fats. They were helped by Onno Korver of Unilever (right)

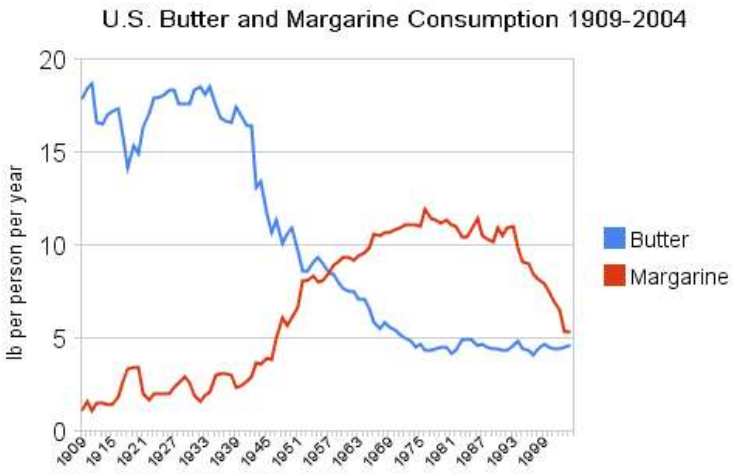
Research published in the prestigious *New England Journal of Medicine* in 1990 changed the picture. Only then did the nutrition and public health communities take seriously the possible health hazards of *trans*-fats and partially hydrogenated oils. In a landmark study done with practical support from Unilever. Dutch investigators Ronald Mensink and Martijn Katan reported that *trans*-fatty acids increased LDL cholesterol levels and also decreased HDL cholesterol levels (21,30). Within the terms of the prevailing diet-heart hypothesis, this meant that *trans*-fats were now identified as the most harmful fats of all, worse than the already demonised saturated fats. This new understanding of *trans*-fats did not arise from any paradigm shift or revolution in the methodologies of nutrition science, but rather emerged from within the terms of the dominant nutritionist paradigm.

The Dutch study was followed by a 1993 report by Walter Willett and colleagues from the Harvard School of Public Health, showing a positive association between *trans*-fat intake and heart disease risk (31). Other studies have since confirmed the association between *trans*-fats and blood cholesterol levels and have linked *trans*-fats, by biochemical pathways other than those related to blood cholesterol, to the increased risk of cardiovascular disease and also of other conditions and diseases, such as obesity and diabetes (32-33) and even cancer and allergies (12,28). A number of studies have reported that *trans*-fats promote inflammation and may worsen insulin sensitivity (33). *Trans*-fats also become incorporated into cells and have been found to disrupt cellular functioning in a number of adverse ways (28, 34).

Some of the evidence against *trans*-fats has come from epidemiological studies that estimate *trans*-fat consumption using relatively brief food-frequency questionnaires. In the 1990s Samuel Shapiro of the Boston School of Medicine warned against prematurely interpreting as causal relationships these associations between a high consumption of *trans*-fats and increased heart disease risk (35). He noted that because of the claimed heart-health benefits of margarine prior to the 1990s, many people with pre-existing heart conditions or with cardiovascular disease risk factors may

have been more likely to consume margarine, and therefore to have increased their *trans*-fat intake. If that were the case, then the positive association between heart disease and *trans*-fat intake may have been exaggerated by, or a by-product of, the people in this high-risk group changing their behaviour (35). This highlights a difficulty when scientists attempt to isolate the effects of a single nutrient from epidemiological data on broader dietary patterns.

Hyperreality
The imitation outshines the original



The astounding story of relative consumption of butter and margarine is graphically shown above. The drop in butter consumption in the period of the rise in coronary heart disease rates is intriguing

Margarine is one of the earliest and most successful examples of a food product that has been nutritionally engineered and nutritionally marketed. It has been explicitly advertised in terms of its nutrient content, with ingredients and nutritional profile that manufacturers have specifically designed for this purpose. As shown above, by 1957 the US population was consuming more margarine than butter, largely because of its cheaper price. But margarine and vegetable oil producers were recognising the great marketing potential offered by the emerging diet-heart hypothesis, now challenged by some scientists and by influential science writers (36).

From the late 1950s, margarine was reformulated to reduce its saturated fat content and to increase the proportion of polyunsaturated fat, thereby also producing a softer, more spreadable product that could be sold in tubs rather than as solid block or sticks (37). The polyunsaturated fat came from vegetable oils such as sunflower, safflower, and soya. Margarine manufacturers effectively constructed a nutritional facade around margarine, a particular image of its nutritional content and health benefits. Those who marketed margarine by means of this nutritional facade were

able to conceal, or distract consumers' attention from, the underlying ingredients and additives and the processing technologies used in the production of margarine.

The pharmaceutical company Pitman-Moore released the first margarine high in polyunsaturates in 1958, as Emdee (as in M.D) and initially marketed it as a medicinal product (38). The same year, Fleischmann's launched its margarine made from corn oil, with advertisements that proclaimed its heart-health benefits. But a year later the US Food and Drug Administration (FDA) ruled that such heart-health claims were 'false and misleading' (38,39). Then, in 1960, very soon after the AHA's new policy statement endorsing the diet-heart hypothesis, manufacturers of highly polyunsaturated oils such as Mazola corn oil and Wesson oil took out full-page newspaper advertisements echoing the AHA's statement on the benefits of polyunsaturated fats (37). A *Business Week* article at the time noted that 'some of the margarine makers think they have discovered in recent medical findings a weapon that will enable them to lop off a fat slice of butter's share of the market' (37).

Eventually, in 1971 the FDA began to allow producers of margarine and other processed foods to advertise the types of fats contained in food products (40). While margarine and oil producers could not make explicit health claims for their products, knowledge of the claimed relationship among polyunsaturated fats, blood cholesterol, and heart disease had already been sufficiently popularised, so the lay public as well as professionals were able to make the connection between the nutrient-content claims and the implied health benefits of these new foods (41-43).

In response to developments in nutrition science and dietary advice, food scientists continued to re-engineer margarine. By the mid-1970s, nutrition experts were differentiating between LDL (low-density lipoprotein, the so-called 'bad' cholesterol) and HDL (low-density lipoprotein, the 'good' cholesterol), leading to a re-ordering of the fat hierarchy (36,44). They continued to classify saturated fatty acids as bad fats, because they increased both HDL and LDL cholesterol levels, while polyunsaturated fats remained good fats because they lowered LDL cholesterol levels. In the 1980s, scientists re-categorised monounsaturated fats as potentially the best fats of all, since they lowered LDL cholesterol levels but seemed also to raise HDL cholesterol levels. Margarine manufacturers responded to these shifts in scientific classification by using oils high in monounsaturated fats, particularly canola oil and olive oil blends, in some of their margarine brands.

The 1980s marked the beginning of the low-fat era, with public authorities, the nutrition profession, other health professionals and the media all united, and recommending that people reduce their consumption of fat, and saturated fats in particular. Margarine producers responded with a range of reduced-fat and low-fat products. They renamed these low-fat margarines 'spreads', since the term 'margarine' requires the product to contain at least 80 percent fat. To produce these low-fat spreads, manufacturers replaced some of the vegetable oils present in

margarine with water. They also used new formulations of emulsifiers to blend the oil with the water, as well as other ingredients and additives to imitate the texture, mouth-feel, and taste of regular, high-fat margarines.

Meanwhile, the food manufacturing and food service industries were increasingly using hydrogenated vegetable oils in a range of other food products, including in deep-frying oils for restaurants and fast-food outlets. However, by the 1980s many fast-food chains, such as McDonald's and Burger King, were still frying many of their foods in beef fat, or in tropical oils high in saturated fats such as palm oil and coconut oil (46). Beginning in 1984, the influential public health advocacy group Center for Science in the Public Interest (CSPI) pressured restaurant chains to switch from using animal fats and vegetable oils high in saturated fats, to using hydrogenated vegetable oils. CSPI stigmatised 'those troublesome tropical oils', particularly palm oil (51 percent saturated fat) and coconut oil (92 percent).

In their 1988 report *Saturated Fat Attack* (46) CSPI defended the food industry's use of hydrogenated oils, and dismissed any health concerns the public or professionals may have had, saying: 'Hydrogenated (or partially hydrogenated) fats are widely used in foods and cause untold consternation among consumers. ... Overall, hydrogenated fats don't pose a significant risk. Exceptions are hydrogenated coconut, palm, or palm kernel oils, which are bad to start with, but even worse after hydrogenation'. CSPI was stretching credibility here. These tropical oils were least likely to be hydrogenated, because of their natural high saturated fat content. In 1986 McDonald's succumbed to the pressure and switched its deep-frying oils from beef fat to hydrogenated vegetable oil. By 1990, most other fast-food chains had followed suit (47).

In this era of good-and-bad nutritionism from the early 1960s to about 1990, margarine was promoted as a healthier spread than butter, exclusively on a chemical basis – their respective fatty acid profiles. The idea that margarine is healthier than butter was to become an everyday assumption, formulated within the logic of nutritionism, and embraced and repeated by all concerned. Margarine shifted from attempting to merely imitate butter to being portrayed in advertisements as superior to butter in terms of its health benefits, as well its other enhanced features, such as spreadability, shelf life, and cheaper price.

A 1970s food technology book, *Fabricated Foods* (48), acknowledged margarine's successful transformation from a poor imitation to a 'sophisticated fabricated food': 'A well-known example of a fabricated food is margarine. Despite the long legal, marketing, scientific, and technological hurdles, margarine has become a respectable, highly regarded, and useful food. Many foods are now undergoing a *trans*ition, from a poor imitation of an existing food, to a sophisticated fabricated food'.

Box 2

Hyper-reality

In the 1970s, Italian cultural theorist Umberto Eco referred to 'hyper-reality' as the cultural space in which distinction between the original and the copy blurs, and the copy takes on an aura of being more real than the original (49). Thus Disneyland is a 'fantasy space more real than reality', in which reconstructions of streetscapes, animals, and objects are not merely reproduced as replicas. It produces fantasies, or fantastic reconstructions, with qualities that surpass the merely real objects and the experiences upon which they are modelled. 'Disneyland tells us that technology gives us more reality than nature can' (49, 50).

Margarine was one of the first hyper-real foods seen as better—more real—than the original product. The artificially coloured golden lustre of margarine made the pale yellow of butter look drab. The philosopher of technology Albert Borgmann has pointed to the hyper-reality of products such as calorie-reduced, artificial whipped cream, fats and sugars: 'Chemistry has been employed to disburden us of the calories that are the unwelcome extension of the real foods we love. Cool Whip is hyper-real whipped cream, cheaper, more durable, and far less caloric than the real thing' (51). With margarine and other hyper-real foods the level of nutrients is how we engage with and understand food, ignoring concerns with the quality of the ingredients and the processing techniques used to manufacture them.

Fats and oils

Bad guys and good girls



Sat and Trans are the bad guys dreamed up for the American Heart Association in an attempt to explain that some fats are 'bad' and that others are not bad, or 'good'. Note the gender distinction

The 1990 Mensink and Katan study threatened the reputation of margarine. It might also have opened up nutrition science and its dominant paradigms to examination by policy-makers, civil society organisations or indeed the public, or prompted leaders of the nutrition profession to reflect. Instead, this new understanding of the dangers of *trans*-fats has since become the new nutritional certainty, and the reversal in dietary

advice on *trans*-fats has become seen as little more than an embarrassing mistake. Indeed, the *trans*-fat fiasco has been used by most influential decision-makers in industry and the nutrition and allied professions to reinforce, rather than challenge, a number of aspects of the nutritionism paradigm. The addition of *trans*-fats to the 'bad fats' category, has extended the 'good-and-bad-fats' discourse, partially displaced by the more simplified low-fat message in the 1980s. The expression '*trans*-fats are bad fats' has become yet another everyday nutritionist rationale.

The framing by the nutrition profession and others of both *trans*-fats and saturated fats as 'bad fats' overlooks and ignores the distinction between an unmodified, naturally occurring nutrient, on the one hand, and an artificial, chemically reconstituted food component, on the other. The official US 2010 *Dietary Guidelines for Americans*, for example, reinforces this conflation of *trans*-fats and saturated fats by referring to them collectively as 'solid fats' (52). The categorisation of *trans*-fats as bad fats has also directed attention away from the hydrogenation process, and from other oil and margarine processing techniques and also from chemical additives, and toward just one product of the manufacturing process – the *trans*-fats. An alternative to this good-and-bad-fats discourse would be to categorise these chemically reconstituted oils as 'bad oils'. This would not please the powerful plant oil industry.

Many public health and nutrition organisations and qualified professionals say that under no circumstances should *trans*-fats simply be replaced with saturated fats – in the form of animal fats or palm and coconut oils – but instead should be substituted with *trans*-fat-free plant oils high in polyunsaturates or monounsaturates, such as canola, soybean, or olive oil. The proceedings of a 2006 AHA conference on *trans*-fats warned: 'The unintended consequence of greatest concern is that fats and oils high in saturated fats, instead of the healthier unsaturated fats, might be used to replace fats and oils with *trans* fatty acids' (53,54). The AHA has thereby used the *trans*-fats controversy as an opportunity to renew their long-running anti-saturated fats campaign.

In 2007 the AHA launched an online campaign called 'Meet the Fats'. As seen in the cartoon above, it features the Bad Fats Brothers – two sleazy cartoon characters called Sat and Trans who 'clog arteries and break hearts.' On the Meet the Fats website, mention is made that *trans*-fats are a component of partially hydrogenated vegetable oils. However, the emphasis is on identifying the types of foods in which both *trans*-fats and saturated fats are typically found (55):

> Go easy on bakery goodies like doughnuts and pastries and fried foods like French fries. And eat less fatty meat, chicken with skin, butter and full-fat dairy products. ... Saturated and *trans*-fats can often be replaced with better alternatives, like monounsaturated and polyunsaturated fats. For example, use tub margarine instead of traditional stick margarine or liquid vegetable oil instead of butter. ... Just because a label says *trans*-fat-free doesn't mean the food is healthy. It might still be high in the other bad fat – saturated - or have lots of empty calories.

The assumption of this advice is that all of these foods contain significant quantities of *trans*-fats as well as saturated fats, even though some *trans*-fats were already in the process of being removed from many of these products. Whole categories of foods are stigmatised on the basis of their presumed *trans*-fat content, rather than distinguishing between good-quality and poor-quality varieties of these foods, with the latter more likely to contain *trans*-fats. Croissants, for example, are condemned as containing *trans*-fats, even though a traditionally prepared and good-quality croissant is made using butter. Nor is information given on what ingredients are now being used to replace these partially hydrogenated oils.

The Meet the Fats campaign equates the dangers of *trans*-fats and saturated fats, as well as the types of foods that contain both of these fats. The AHA also continues to advise consumers to 'use soft margarine as a substitute for butter,' as long as these products are labelled *trans*-fat free (56). The AHA is reported to have opposed the introduction of New York City's ban on *trans*-fats in its restaurants out of fear that this would lead to a shift back to the use of oils high in saturated fats (57). Having been instrumental in promoting the switch to *trans*-fat laden foods, the AHA now only seems interested in criticising *trans*-fats and hydrogenated oils to the extent that these can be linked to saturated fats. This is a continuation of the AHA heavy promotion since the 1960s of polyunsaturated-rich vegetable oils.

The *trans*-fats controversy could also have been an opportunity to question nutrition experts' reductive focus on LDL and HDL blood cholesterol biomarkers as the basis for evaluating the effects of foods on heart health. Instead, their focus on these biomarkers has been reaffirmed. The *trans*-fat fiasco has provided another opportunity for all professionally concerned to disseminate the 'HDL equals good, LDL equals bad' message. The dominant *trans*-fats discourse has also tended to reinforce rather than challenge the myth of nutritional precision, and particularly the claimed precision with which the association between fats and the incidence of chronic diseases is understood and can be quantified. Scientists have come to measure and quantify the detrimental health effects of *trans*-fats and saturated fats in much the same way. For example, an epidemiological study led by Walter Willett published in 2006 estimated that every year in the United States *trans*-fats contribute to 30,000 deaths from heart disease (33, 58, 59).

Food regulatory agencies in most countries have been very slow to enact legislation to regulate the levels of *trans*-fats in food products or to require *trans*-fat labelling. In 2004, the Netherlands government was the first to begin regulating *trans*-fat content, introducing legislation specifying a maximum of 2 percent *trans*-fats in all food products. The FDA merely specified *trans*-fat labelling on the Nutrition Facts label of packaged foods in 2006. However, the new US labelling regulations allow manufacturers to claim that foods containing up to 0.5 gram of *trans*-fats per serving are '*trans*-fat-free.' So '*trans*-fat-free' in some cases means low *trans*-fats. A person could therefore unwittingly consume several grams of *trans*-fats per day from eating

foods labelled as *trans*-fat free. In 2006, New York became the first city in the US to 'ban' the presence of *trans*-fats in foods sold in its restaurants. But this was not really a ban. Its terms meant that foods could still contain up to 0.5 gram of *trans*-fats per serving (60). The FDA's *trans*-fat food labelling regulations require that the total *trans*-fats listed on the label include not only industrial *trans*-fats, but also some kinds of ruminant *trans*-fats, thereby collapsing the distinction between them (61,62).

The food industry has also been allowed to transform a marketing and commercial crisis into a new marketing opportunity to promote the health benefits of their reformulated low-*trans*-fat and *trans*-fat-free products. Paul Marantz of the Albert Einstein University, New York, points out that in terms of nutrient-content claims, the labelling of foods as '*trans*-fat free' and '0 grams *trans*-fats' can give these food products a 'health halo', even on a par with low-fat or no-fat nutrient claims (63,64). In November 2006, the FDA went further, by approving the following disease prevention health claim for food products that contain less than 1 gram of fat and 0.5 gram of *trans*-fats: 'Diets low in saturated fat and cholesterol, and as low as possible in *trans*-fat, may reduce the risk of heart disease'(65). This health claim suggests that the practice of not adding artificial or industrially manufactured *trans*-fats to a food product will somehow enhance its nutritional value and reduce heart disease risk.

Trans-Fats
The war is over



Walter Willett of Harvard (left) and Marion Nestle of New York University (right) are two US leading nutrition scientists who advocate healthy diets based on foods, as can be seen in these pictures

Walter Willett of the Harvard School of Public Health acknowledges the consequences of evolving knowledge, and to the best of my knowledge is one of the few nutrition scientists to acknowledge the mistake of promoting margarine in the past. He has said: 'There was a lot of resistance from the scientific community [to the detrimental health effects of *trans*-fats] because a lot of people had made their careers telling people to eat margarine instead of butter. When I was a physician in the

1980s, that's what I was telling people to do, and unfortunately we were often sending them to their graves prematurely' (66).

He acknowledges that the initial recommendation to switch from butter to margarine was not based on solid evidence, but states that at the time 'this recommendation made sense' based on scientists' understanding of the dangers of saturated fat (67). It was simply overturned by new studies demonstrating the opposite. 'To a scientist, this is the normal path of scientific progress – a recommendation based on a good guess is tested and toppled by one based on good science. To the rest of the world, though, it is a frustrating contradiction' (67). There is no suggestion here that scientists and policy-makers should have waited for more solid evidence, or that they should have then erred on the side of promoting whole foods rather than a processed-reconstituted food such as margarine.

In the early 1990s, the Centre for Science in the Public Interest also began vigorously campaigning against *trans*-fats, but without being as candid as it might have been about its earlier role in pressing food companies to switch to hydrogenated vegetable oils in the 1980s. In 2006 CSPI successfully sued McDonald's for failing to change back to a low-*trans*-fat cooking oil as it had publicly announced it would do in 2003. The court ordered McDonald's to pay $US 7 million of its settlement fee to the AHA, and these funds were used to fund the AHA's Meet the Fats campaign (68).

Marion Nestle of New York University believes that there has been no significant shift in expert advice regarding margarine and hydrogenated oils since the 1960s. She defends the AHA's position on margarine and *trans*-fats (69):

I often hear margarine used as a prime example of how nutrition advice changes all the time. First it was supposed to be good for you, then bad, and now it is supposed to be good for you again. But a careful reading of cardiologists' advice over the years gives a more consistent story. For more than forty years, the American Heart Association (AHA) has issued cautious and nuanced advice about margarine. It has always put hard margarines in the same category as butter. ... In 1968, the American Heart Association noted that heavily hydrogenated margarines 'are ineffective in lowering the serum cholesterol' and the next year suggested replacing butter with polyunsaturated margarines (these are the softer ones that come in tubs; they have less saturated fat and also less *trans*-fat).

There was indeed a shift in the AHA advice during the 1960s, from acknowledging the cholesterol-raising effects of all hydrogenated oils, to only warning against hard (that is to say, heavily hydrogenated) margarines, and recommending soft margarines. Yet even these softer margarines contained significant quantities of *trans*-fats. The AHA explanation for their preference for soft margarines was that they contained more polyunsaturated fats and less saturated fats than hard margarines, but without explaining that the fats in both products had been chemically transformed and contained *trans*-fats (4,70).

The lack of serious reflection on the lessons of the *trans*-fat fiasco is evidence of a failure to interrogate the assumptions that continue to inform scientific research and dietary advice. Most institutions and organisations have simply adjusted their dietary messages and joined the campaign against *trans*-fats. Going against this trend, and as indicated above, epidemiologist Paul Marantz and colleagues have warned of the public health risks of the campaign to stigmatise and regulate *trans*-fats without consideration of the consequences. They suggest the marketing of foods as *trans*-fat free may 'affect dietary behaviour in unpredictable ways', such as fostering a belief that more *trans*-fat-free foods can be consumed (63). It is also unclear what the *trans*-fats would be replaced with, and what the consequences of these changes might be. They therefore warn against any repeat of other ill-considered and ill-fated dietary campaigns, such as the low-fat campaign and promotion of margarine over butter.

Following a precautionary principle, there are good grounds for immediately removing hydrogenated oils from the food supply. A simple way to achieve this would be to prohibit any use of hydrogenation in food product manufacture. Hydrogenation fundamentally transforms the chemical structure of fats, and these chemically reconstituted oils should not have been permitted to enter the food supply in the first place – particularly in such quantities – until they had been proven safe and nutritious. But the question of their replacement is important.

The post-trans world
Back to the reformulation board



Supermarkets are now heaving with products claiming to be free of trans-fats and by implication healthy. Many are unhealthy. Many are being reformulated in ways that may prove troublesome

Focus on *trans*-fats in food products has framed the solution to the *trans*-fat problem as need to eliminate or at least to minimise levels of artificial *trans*-fats in margarines and many other products. This does not stop the continued use of fully and partially hydrogenated oils by food manufacturers, restaurants and fast food outlets. It also leads to reformulation using other technologies to transform fats and to obtain novel fats that have similar commercial advantages to partially hydrogenated oils (64).

Policy-makers in government, the professions, civil society and industry have now all welcomed the gradual removal of *trans*-fats and partially hydrogenated oils from the food supply. But there has been little public discussion about their replacements (71-73). Before the 1990s the public was not properly informed that the oils used in margarine production and other foods had been hydrogenated and contained *trans*-fats, and most professionals were also uninformed. Now it would seem that the denial of information is being repeated in this virtually *trans*-fat-free era. Meanwhile, some food manufacturers and caterers are simply returning to the use of unprocessed and non-chemically engineered vegetable oils. But this is just one of the many available options for industry. There are others. Some may be troublesome.

Partially hydrogenated oils have been a cheap, all-purpose ingredient for a great range of food products made by the food manufacturing, restaurant, and fast-food industries, as illustrated by the range of pictures introducing this commentary. The challenge for food product corporations since the 1990s has been to develop a range of processing techniques and also new ingredients to replace partial hydrogenation and the trans-fats it generates.

In many cases, manufacturers have opted for a combination of fully hydrogenated, partially hydrogenated, and unhydrogenated oils, often using improved processing techniques for chemically transforming liquid oils (74). Another strategy has been to switch to vegetable oils believed to have favourable fat profiles, often by breeding and genetically engineering plants to yield seed oils with selected characteristics, such as high-oleic canola oil (which is high in monounsaturated fats). Alternatively, they may use new additives, including emulsifiers, enzymes, and modified starches, to create the required texture, consistency, and taste, in processed products (75,76).

The processing techniques that margarine manufacturers have now started using to produce hardened vegetable oils, typically involve a combination of fractionation, interesterification, and full hydrogenation (76). Fractionation is a process for physically separating the solid and liquid fractions of oils. Because of its highly saturated character, palm oil is used most often in this process (77). Margarines can be made harder or softer by varying the ratio of these solid and liquid fractions. Interesterification involves the use of a chemical catalyst (for example, sodium methoxide) or enzymes, to modify the physical properties of an oil or fat blend (78). As with partially hydrogenated oils, the interesterified oil may then be washed, bleached, and deodorised. The deodorisation process produces small quantities of trans-fats. The end product may contain other chemical residues (4).

Manufacturers can use interesterification to blend liquid oils with hard fats to produce oil with the desired properties, such as a higher melting point. The hard fats used in this process may be fully or partially hydrogenated oils, or else the hard fractions of vegetable oils such as palm oil. The interesterification process itself does not produce *trans*-fatty acids, nor does it modify the existing fatty acids, but it does

rearrange the constituent fatty acids within the larger fat molecules. In this sense, these interesterified fats – what I call i-fats for short – have a chemically transformed molecular structure and, like *trans*-fats, are a novel kind of fat not found in nature. The interesterification process produces not one but a number of different types of rearranged fatty acid molecules (4). Each of these novel fatty acid sequences can be expected to be metabolised differently. Some may have adverse health effects.

Many table margarines are now labelled as virtually *trans*-fat free, meaning that they contain 1 percent or less of *trans*-fats. A common margarine manufacturing practice is to combine fully hydrogenated and unhydrogenated vegetable oils, modifying the composition of fats used by interesterification and fractionation techniques. Unilever's Flora brand is manufactured using this combination of full hydrogenation, fractionation, and interesterification, applied to a blend of sunflower, canola, and palm oils (72,80). Unilever has pioneered margarine innovation over the past fifty years, leading the development of polyunsaturated margarines in the 1960s, low-fat spreads in the late 1970s and 1980s, and virtually *trans*-fat-free and cholesterol-lowering margarines from the mid-1990s (76).

Food manufacturers' development of virtually *trans*-fat-free alternatives to other food products and applications involves choosing the right combination of techniques and oils for the task (81). For instance, interesterified and fully hydrogenated oils can be used as shortening agents for baked food products. For deep-frying, one option is to blend lightly hydrogenated oils with unhydrogenated oils to achieve a low-*trans*-fat end-product (82). However, food companies have tended to favour new varieties and blends of unhydrogenated vegetable oils to lower the *trans*-fat content, such as low-linolenic soybean oil and high-oleic canola oil varieties. These new oil varieties are more stable and less prone to oxidation, in part due to their lower levels of highly unsaturated omega-3 fats. These oils are therefore better suited than conventional unhydrogenated oils to repeated frying and other exposures to high temperatures (78,82). Some new oils have been genetically engineered, such as Monsanto's herbicide-tolerant, low-linolenic soya bean oil (53,64,78, 83).

While food companies rush to remove and replace *trans*-fats, there have been few studies conducted on the health effects of processing techniques and ingredients being used to replace them, such as fully hydrogenated, low-*trans*-fat partially hydrogenated, fractionated, and interesterified oils. A couple of studies of i-fats have claimed that these do not have adverse effects on LDL and HDL cholesterol levels, while other preliminary studies have suggested that they do (79,84-86). One study has reported that interesterification may increase the susceptibility of oils to oxidation, now considered to be a possible cause of inflammation (and therefore as promoting cardiovascular disease) (87). Other studies have not found adverse effects of reformulated margarines on biomarkers of cardiovascular disease and inflammation (88). It may be some time before the health impacts of interesterification and i-fats are adequately tested. Again, following the precautionary principle would mean

removing these chemically reconstituted oils from food supplies until they have been thoroughly and independently investigated and shown to be safe and healthful.

In 2004 the FDA introduced new regulations allowing interesterified fats (at least those with a stearate content of more than 20 percent) to be labelled as 'interesterified oils,' or even as 'high-stearate' or 'stearate-rich' oils – even those that have been hydrogenated before being interesterified (78). This enabled food companies to avoid making reference on labels to hydrogenated oils – a tainted term. At the same time, food companies are not obliged to state whether an oil has been interesterified. These labelling regulations conceal from consumers the presence of hydrogenated or interesterified oils, and also reduce the ability of nutrition and public health experts to monitor and evaluate the possible health effects of these modified fats (85). So far little has been done to alert the public to the presence of these reconstituted i-fats in food supplies.

Functional fats
Margarine as medicine



Functional spreads from Johnson and Johnson, Lipton and Unilever. These are allowed to carry claims suggesting that they prevent heart disease, or even that they are treatment for heart disease

As the *trans*-fat fiasco became apparent in the 1990s, margarine manufacturers such as Unilever were reformulating their products to minimise *trans*-fat content below the 1 percent level. At the same time, margarine's nutritional facade continued to be redesigned in response to changing industry initiatives, nutritional trends and consumer expectations in the era of functional nutritionism. With the development

of cholesterol-lowering and omega-3-enriched varieties, margarine has managed to retain and to enhance its healthful image to nutricentric consumers.

Beginning in the mid-1990s in Europe, and then in the United States, food manufacturers introduced margarines that contained high concentrations of cholesterol-lowering plant sterols and stanols (89,90). Johnson & Johnson's Benecol was introduced in Europe in 1995 and proved especially popular in Finland, a country with high rates of heart disease (89). In 2000 Unilever introduced its Pro Activ sterol-enriched margarine in Europe (90).

Plant sterols and stanols are naturally occurring components of plants, fruits, and vegetables, chemically similar to cholesterol. They block the absorption of cholesterol in the body and have been shown to lower blood cholesterol levels (91). However, the sterols and stanols added to margarine and other food products have been extracted from a range of food sources, such as plant oils, and non-food sources, such as wood pulp, which may then undergo further processing (92). The sterols and stanols in Benecol are primarily sourced from tall oil derived from the pulping of pinewood. The crude tall oil is first fractionated into its component parts, with the plant sterols hydrogenated to form stanols and then esterified with monounsaturated and polyunsaturated fats (92).

Manufacturers now add these extracted and reconstituted sterols and stanols to a range of foods and drinks, including orange juice and milk. In order to achieve significant blood cholesterol–lowering effects, the stanols and sterols are added in greater quantities than typically found in single whole foods. While many studies have demonstrated the ability of food products containing sterols and stanols to reduce LDL cholesterol levels, there are as yet no human studies that demonstrate that the plant sterols and stanols added to food directly reduce the incidence of heart disease. The causal connection is assumed, on the basis that other cholesterol-lowering therapies, particularly those involving statin drugs, have been associated with a reduced risk of coronary heart disease (92,93).

Choosing margarine as the vehicle for these cholesterol-lowering food additives was a clever marketing decision, for the claimed link between margarine and blood cholesterol levels was already well established in the public mind. But communication of the claimed health benefits of cholesterol-lowering margarines could not rely on the type of nutrient-content claims that had previously been effective. The low level of public awareness of plant sterols, and of their effects on blood cholesterol, meant that promoting the sterol content of margarine – such as the claim 'high in plant sterols' would be largely meaningless. Instead, a more explicit health claim, stating that the products actively lowered blood cholesterol levels, was sought. In 1999, the FDA gave approval for two margarine brands – Johnson & Johnson's Benecol and Lipton's Take Control – to be advertised with explicit health claims that these foods were able to lower cholesterol levels (89). In the FDA's terminology, these are

technically known as structure/function claims because they refer to particular bodily functions or processes, in contrast with disease prevention type of health claims, which require a higher level of scientific substantiation (94).

These plant-sterol enriched margarines can be described as trans-nutric foods. They involve the addition of a nutrient or food component that is not otherwise associated with margarine, butter, or other spreads. The claim that the direct modification of blood cholesterol levels leads to a reduction in heart disease risk is a form of biomarker reductionism and indeed of biomarker determinism. It assumes that there is a direct causal relationship between blood cholesterol levels and heart disease.

In the concentrated quantities added to these margarine products, plant sterols have been shown to block the absorption of beta-carotene and therefore to lower vitamin A levels in the body. In this sense, sterol-enriched margarines produce a nutrient-level contradiction, whereby the addition of a particular nutrient or food component inadvertently reduces the availability to the body of another beneficial nutrient. Consumers of sterol-enriched foods are therefore encouraged to eat more fruits and vegetables to increase their vitamin A levels (91). Recent studies have also raised questions about other possible detrimental health effects of increased plant sterol intake, with some studies ironically suggesting that sterol and stanol esters may increase the risk of atherosclerosis (95-100).

The introduction and commercial success of cholesterol-lowering margarines and spreads signal the rise to dominance of the functional nutritionism paradigm since the 1990s. Functional nutritionism is characterised by a heightened emphasis on the relationship between individual foods and nutrients and specific internal bodily functions, biomarkers, and health conditions. Cholesterol-lowering margarines appeal to this focus on particular biomarkers of bodily health.

The production and marketing of cholesterol-lowering spreads also represent a further shift in the relationship among margarine, butter, and the nutriscape – the nutritional environment and ethos. In the era of good-and-bad nutritionism, hyper-real margarine's primary reference point was butter, with margarine's claimed health benefits justified by reference to the nutrient profiles of these two products. In the functional era now, margarine inhabits a surreal world of spreads with diverse features designed to meet a range of consumer desires, hopes and demands.

Margarine's primary reference point now is no longer butter. The new functional margarines are designed to simulate the nutritional characteristics and health benefits of a range of foods, including plant foods (plant sterols), fish (omega-3 fats), and vegetable oils (polyunsaturated and monounsaturated fats). Margarine's primary reference points are in fact no longer foods at all, but nutrients. These margarines and other functional food products inhabit a world of nutrients and nutritional concepts. They have floated free of any engagement with actual foods (101).

Butter engineered
I can't believe it's not margarine



Once margarine tried to imitate superior butter. Now with the triumph of super-margarine as a functional food, butter is re-engineered to imitate margarine, with light and whipped varieties

Butter has also been re-engineered and re-marketed since the 1990s in response to the success of margarine and to the changing nutriscape. The relationship between butter and margarine has been turned on its head, with butter now simulating some of margarine's characteristics (102). More spreadable varieties of butter blended with vegetable oils released in the late 1980s and early 1990s were packaged in margarine-like plastic tubs.

These butter-oil blends also have what is seen as a more favourable fat profile. Another type of spreadable butter is whipped butter aerated with nitrogen gas. Manufacturers have also developed reduced-fat and low-fat varieties of butter, with water replacing some of the milk fat found in butter, with the aid of additives such as gelatins and starter cultures to maintain a butter-like texture (103).

In 1992 the Belgian company Balade introduced a low-cholesterol product in Europe named Light Butter. This butterish product had 90 percent of the cholesterol in its milk fat removed by the addition of crystalline beta-cyclodextrin, an enzyme-modified starch derivative that binds to the cholesterol (104,105). This is another case of a more highly processed food being promoted as a healthy alternative to the original product. Many other dairy products have also been nutritionally engineered, from reduced-fat milk and cheeses to sterol-enriched yoghurts, yoghurt drinks, cheeses, and milk products (106,107).

In this commentary and in my book I show that all this activity is based on the paradigm of nutritionism. It is time for the paradigm to be shifted.

Nutritionism
Shifting the paradigm

Editor's note

As stated, this commentary is based on a chapter in Gyorgy Scrinis's book *Nutritionism*, published by Columbia University Press, available on Amazon and other on-line suppliers.

Kerin O'Dea of the department of population health and nutrition, University of South Australia, says it is 'A provocative and comprehensive critique of the science of nutrition – demonstrating that much of this science is reductionist, frequently creating public confusion in its simplistic translation into dietary advice'. David Jacobs of the school of public health at the University of Minnesota says: 'Gyorgy Scrinis details the ideology of "nutritionism", in which the great majority of dietary advice is reduced to statements about a few nutrients. The resulting cascade is nutrient-based dietary guidelines, nutrition labeling, food engineering, and food marketing. I agree with Scrinis that a broader focus on foods would lead to quite a different scientific and political cascade, including a more healthful diet for many people and a different relationship between the public and the food industry'.

The book includes case studies. The chapter on which this commentary is based is one of them. The evidence in these studies, and the conclusions from them, are all inspired by the same general principle. This can be simply expressed. The modern science of nutrition is based on the idea, so ingrained as often not perceived, that what nutrition is primarily about, is the constituent parts of foods – their nutrients. This remains the prevailing paradigm. Gyorgy Scrinis first identifies this paradigm and then makes a powerful case to shift it.

The history of margarine, butter, and the *trans*-fat fiasco, is a lesson. It shows how the reductive idea that identifies nutrition as the study of known nutrients and bioactive substances, has led to the creation of some highly processed, fabricated food products promoted as nourishing and even as protective against disease. Little attention is given to the processes used to create these products. A reason for the *trans*-fat disaster, is that food processes themselves are mostly not regarded as of any special nutritional significance.

Trans-fats are now commonly identified as toxic. Gyorgy Scrinis believes that this misses the crucial point. It ignores the process of hydrogenation that generates trans-fats. It also ignores other processes that transform the nature of fats whose effects are not well understood, including some now being developed, which may also generate toxic substances. As long as the nutritionism paradigm remains in place, and the health qualities of foods and products remain judged in terms of their constituent nutrients and bioactive compounds, the science and practice of nutrition, and its translation into food policies and actions, can be seen as being up a blind alley.

Nutritionism, and its account of butter, margarine, hydrogenation, sees the trans-fats story as an ignominious disaster – a fiasco. It carries an awful warning. It should make us all, professionals and consumers, realise that what is done to food before it is purchased and consumed, is crucial. Health professionals cannot afford to overlook the nature, type and impact of food processing, benign and malign. If we overlook this warning there could be more troubles ahead, as yet unforeseen.

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Status

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