Food Marketing and Selling Healthy Lifestyles with Science

Transhistorical Perspectives

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150 Years of Modern Nutrition Science

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Introduction

In this chapter, we present a brief overview of major developments in the field of nutrition science over the past 150 years as a means of contextualising the 13 core chapters that make up *Food Marketing and Selling Healthy Lifestyles with Science*. Demonstrating how understandings around what we eat and how it affects our bodies have evolved from the late nineteenth century to modern day provides a framework for much of the discussion that follows in terms of how scientific claims are used in food marketing. Across the volume, we see how food advertisements are reflective not only of the social and cultural zeitgeist but are also strongly linked to nutritional and dietetic understanding. We begin this chapter by briefly exploring the concept of nutrition in the Ancient World and throughout the centuries that followed until the Chemical Revolution of the late 1700s when the foundations were laid for modern nutrition science. Our focus then shifts to key nutritional research conducted throughout the nineteenth and early twentieth centuries, which ultimately led to the identification of individual micronutrients. Finally, we outline how the now well-established field of nutrition science has continued to develop and the state of the research area today.[1]

Nutrition Science in the Ancient World

Theories on how food is used in our bodies date back to the Ancient World and classical antiquity, where both physicians and philosophers studied human diets and generally agreed that certain foods and drinks were important for preventing illness and restoring health. The first known teachings on nutrition are attributed to Imhotep of Ancient Egypt (4000 BCE), Emperor Huang Ti of China (2500 BCE) and the Indian Ayurvedic tradition (200 BCE), all of which stressed the link between a balanced diet and good health (Cannon, 2007). However, it is the work of Ancient Greeks, such as Pythagoras, Anaxagoras, Hippocrates and Galen, that is said to have provided the basis for Western nutrition and whose ideas remained in place up until the Age of Enlightenment (1685–1815).

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Both Hippocrates and Galen promoted the concept of humourism, which dominated medical practice in Europe and the Middle East for centuries. According to humourism, the body consists of four fluids—black bile, yellow bile, blood and phlegm—that determine a person's temperament, and a correct diet is needed to balance them and stave off sickness (Conrad, 2011). Writing in 1621 in his *Anatomy of Melancholy*, Robert Burton blamed beef, venison, rabbit, milk, fish, pulses, fruit and vegetables for poor mental health, while in his *A Treatise of the Hypochondriack and Hysterick Passions* (1711), Bernard Mandeville claimed that mental illness was a result of overindulgence in rich food, strong liquor and self-drugging. George Cheyne's *The English Malady* (1733) also stated that lunacy, madness and a disordered brain could be "accounted for from no other natural Cause, but a Malregimen of Diet." It was not until the advent of germ theory in the 1850s that humourism began to fall out of favour as external causes for pathological changes in cells, tissues and organs were identified (Lagay, 2002).

Nutrition Science in the Chemical Revolution and Beyond

The Chemical Revolution in France, which took place at the end of the eighteenth century, is generally accepted as the first time that the relationship between food and our bodies was tested in a quantitative, scientific way through chemical analysis (Trüeb, 2020). A major figure in these early days of nutrition science was the French chemist Antoine Lavoisier who had a particular interest in metabolism. With his assistant Armand Seguin, Lavoisier measured human respiratory output of carbon dioxide (which he then called carbonic acid) both at rest and when lifting weights. They found that carbon dioxide increased with activity, which disproved previous theories that the sole purpose of respiration was to cool down the heart and that the weight of ingested material not recovered in stools or urine was lost through "insensible perspiration" (Carpenter, 2003a).

Lavoisier theorised that food was fuel and that the body, therefore, expelled carbon dioxide as a product of combustion (Stafford, 2010). In order to test this theory, together with mathematician Pierre-Simon Laplace, he designed an ice calorimeter and placed a guinea pig inside. They compared the heat produced by the animal with its production of carbon dioxide and then compared these results with the heat produced by a lit candle or burning charcoal. Their findings led them to conclude that respiratory gas exchange is a combustion, and this is what enabled the guinea pig to maintain its body temperature above that of its surroundings (Buchholz and Schoeller, 2004). Lavoisier's discovery was a major breakthrough at the time in terms of establishing that the body needed energy to function and that one major role of food was to supply it. This research formed the basis for determining what a person needs to survive and what causes weight gain or weight loss, as well as the relationship between food and physical labour (Stafford, 2010).

At the same time, many scientists were also investigating nitrogen and whether animals could use atmospheric nitrogen to "animalise" ingested foods

of low nitrogen content. One of the pioneers in this area was French chemist Jean-Baptiste Boussingault who developed the first balance trial (i.e. an assessment of food input and waste output) in the 1830s. Boussingault compared the nitrogen content of hay, oats and potatoes fed to cows and horses to keep them at a constant weight with their excrement (and milk, in the case of cows). He discovered that animal feed contained sufficient nitrogen to meet bodily requirements, which ended the speculation that additional nitrogen was obtained from the atmosphere (Carpenter, 2003a).

Nutrition Science in the Mid-Nineteenth Century

Nutrition science experienced a huge growth in the mid-nineteenth century as a result of the emerging modern nation-state and governmentality (Cannon, 2007). In the 1840s, states became concerned about political turbulence across Europe, which had led to food supply shortages, and feared an outbreak of food riots. To govern the situation, they began to invest in nutrition research to find cheaper and easier methods to feed populations (Stafford, 2010). Concurrently, as industrialisation began and urban populations grew, retailers struggled to keep up with large-scale demand, which led them to resort to unscrupulous practices, adulterating their foods as a way of increasing profits and gaining a competitive advantage (Collins, 1993). Over the course of the 1800s, the dangers of food adulteration and impure foodstuffs were slowly exposed by chemists who found that it was a major contributor to the poor quality of life in industrial towns and cities, particularly for the working classes (O'Hagan, 2020). Following this exposure, states began to increasingly intervene in people's diets amid growing concerns about workers' efficiency and health, pumping vast sums of money into research institutes and university research centres (Kamminga and Cunningham, 1995). At the heart of this initiative were the beliefs that citizens had a duty to be fit in order to work, while the state was obliged to provide such conditions to do so (Kamminga and Cunningham, 1995). The food adulteration scandals also paved the way for stricter laws on food regulation across the Western world, led by the United Kingdom with its Adulteration of Food and Drugs Act 1860.

A notable figure in mid-nineteenth-century nutritional research was German chemist Justus von Liebig. By this time, the four elements of food had been identified (carbon, nitrogen, hydrogen and oxygen), as well as the three food constituents (carbohydrates, fats and protein). However, there was no knowledge of their chemical make-up. From his work in the area of plant nutrition, Liebig began to wonder whether physiological chemistry could be used to understand nature and, consequently, to engineer the food systems of industrialising countries (Cannon, 2007). With this in mind, he invented the *kaliapparat* to analyse carbon in organic compounds, publishing his chemical theory of metabolism in the treatise *Animal Chemistry* in 1842. Here, he argued that muscular labour by horses or humans required mainly protein, not carbohydrates and fats—something contradictory to what we know now. The isolation and

identification of protein as a master nutrient was revolutionary and led to growing food experiments that sought to develop cheap protein-based foods to build up workers' resilience and create a national advantage (Cannon, 2007). Naturally, Liebig was at the forefront of these experiments.

Building on his claim that eating both meat juices and muscle fibre was important, Liebig established a formula to produce beef extract. In 1862, Belgian entrepreneur George Christian Giebert became interested in commercialising Liebig's formula and, three years later, they founded the Liebig's Extract of Meat Company together in London (Finlay, 1995). Through heavy marketing campaigns, they promoted their meat tea as curative and a highly nutritious alternative to real meat. They later shifted their focus towards convenience and flavour when questions were raised about its actual health benefits (Finlay, 1995). Liebig collaborated with popular cookery writers, such as Henriette Davidis and Katharina Prato, to popularise his meat tea. He also advertised the product with calendars, trading cards, games, posters and toys.

While Liebig was a pioneer in food engineering and marketing through science, he was not operating alone. Another major impetus was the Great Exhibition of 1851. Although it is oversimplistic to say that the Great Exhibition revolutionised food marketing, it certainly had an impact on the use of scientific discourse to sell products through its promotion of the latest technological advancements (Richards, 1990:39). Moreover, it showed producers the importance of knowing customers' desires to compete successfully and survive in an ever more competitive market (O'Hagan, 2019a).

Although there was a long history of (pseudo)science in advertisements for patent medicines (cf. Porter, 2000; Barker, 2009), this was not the case for food. Thus, the introduction of science into food marketing was both novel and powerful, shaping consumption patterns and consumer behaviour, particularly around the need to choose foods that promoted a healthy diet. From the 1850s onwards, advertisements for old products started to emphasise their improved scientific processes, while advertisements for new products began to foreground their scientific origins (Loeb, 1994:10). Emphasising a single health quality of a product created a "health halo" effect (Fernan et al., 2018), whereby consumers acquired positive impressions of other non-claimed health qualities, thereby increasing the perceived healthiness of the food or drink in question.

This practice increased throughout the nineteenth century as goods became branded and food manufacturers recognised their privileged position as knowledge shapers (Church, 2000:632). Narratives of health and wellbeing, therefore, became key in differentiating products from competitors and building consumer trust. Capitalising upon the public's growing knowledge of the latest medical and scientific advances, thanks to the popular press and increased literacy rates, manufacturers emphasised the importance of proper diet and good hygiene to prevent illness, as well as the strong link between health and morality (O'Hagan, 2020:57). Through this marketing, the public gained a new idea that certain food products could provide widespread benefits for them and their families and were encouraged to buy them, even if they did not fully

understand the claims made and the information provided was not always strictly true (Hansen, 1999:632; Jones, 2012:387).

Here, then, we see the roots of the nutritionism ideology—what Scrinis (2013:2) describes as "a reductive *focus* on the nutrient composition of foods as the means for understanding their healthfulness, as well as a reductive *interpretation* of the role of these nutrients in bodily health." The major focus in this era on protein as essential to building strong bodies marked the start of "nutri-quantification" (Scrinis, 2013:42), with consumers repeatedly informed that an adequate quantity of a certain nutrient was necessary for good health. As Scholliers (2018) warns, this could, however, conceal the actual production and processing quality of foods and their ingredients, as well as fail to take into account broader contextual factors that may determine bodily health.

Nutrition Science in the Late Nineteenth and Early Twentieth Centuries

By the late nineteenth century, it was now widely accepted that there was a strong link between diet and physical vigour based on investigations of the physiology of nutrition in terms of quantitative chemistry (Kamminga and Cunningham, 1995). There was also a broad consensus that (1) health depends on the calorie content of diet; (2) the three major energy substrates (carbohydrates, fats and protein) can replace each other in proportion to their calorific content; and (3) different proteins have equivalent energy content (Kamminga and Cunningham, 1995).

The calorie offered a scientifically rational way to understand food and, according to Scrinis (2013:52), enabled the science of nutrition to be translated into everyday personal terms. It grew from an attempt to offer a nutritional version of Taylorism—a scientific measurement of the labour process and productivity, which conceived the body as "mechanomorphic" (Cullather, 2007:338). However, it took as given that all foods could be equally measured and compared in terms of the number of calories that they contained without considering how different food components and ingredients may have been transformed through processing techniques.

Throughout the early twentieth century, this gap was exploited by marketers who frequently used calories to present scientific comparisons between dissimilar foods. Their credibility was supported by the fact that many governments had adopted the calorie as a standard of food values. A 1919 British advertisement for Quaker Oats (Figure 0.1), for example, emphasises the government definition of a calorie and compares the calories in three different types of foods: eggs (624), fish (228) and Quaker Oats (1,810). Interestingly, no units are supplied alongside the numbers and the numbers indeed relate more to kilojoules than kcal, despite the claim of "calorie" in the government definition. Despite this ambiguity, the numbers work effectively in putting Quaker Oats forward as the best food for supplying workers with energy, its headline and accompanying photograph emphasising that one packet is equal to 40 eggs in food value.

Figure 0.1 Calorie Comparisons in a Quaker Oats Advertisement (1919)

Credit: *Derby Daily Telegraph*, 20 January 1919, p. 4. With thanks to the British Newspaper Archive, on behalf of Reach, for permission to use.

Throughout the beginning of the twentieth century, nutrition research shifted from chemical physiology to biochemistry, with a move away from energy and macronutrients towards health and micronutrients. Marking a period concerned with *undernutrition*, scientists became particularly concerned with the links between nutritional deficiencies and certain diseases, such as rickets, scurvy and beriberi. It was Japanese physician Takaki Kanehiro who first demonstrated in the 1880s that beriberi (previously thought to be an infectious disease) actually came from nutrition, while Scottish physician James Lind first identified the link between a lack of citrus fruit and scurvy in the mid-1700s. However, at this time, the role of vitamins was not known. The big discovery came in 1912 when Polish biochemist Casimir Funk was studying beriberi and found that those who ate newly peeled rice rather than unpeeled rice felt weaker. This led him to investigate the rice husk, which he believed contained something essential for health that the human body could not produce, and he identified a nitrogenous compound (which today we know as thiamine B1). Funk named this mysterious substance "vitamine," implying that it was a "vital amine" (i.e. a nitrogenous organic compound essential to life).[2] Around the same time, American biochemists Elmer McCollum and Marguerite Davis were experimenting with rat diets. They discovered that rats stopped growing until they were fed certain egg or butter extracts, which brought about the conclusion that there were "certain accessory articles" in food essential for normal growth. They called this accessory article "factor A" (what we now know as vitamin A).[3]

Funk and McCollum's discoveries ushered in several decades of vitamin research with a clear focus on single-nutrient deficiency diseases (Trüeb, 2020). Between 1913 and 1948, all major vitamins were isolated and synthesised: vitamin E (1922), vitamin B1 thiamine (1926), vitamin C (1928), vitamin D (1932), vitamin B2 riboflavin (1934), vitamin B7 biotin (1936), vitamin B3 niacin (1937), vitamin B5 (1938), vitamin B6 pyridoxine (1938), vitamin K (1939), vitamin B9 folate (1941) and vitamin B12 (1948). These discoveries proved the nutritional basis of serious deficiency diseases, such as beriberi (B1), pellagra (B3), scurvy (C), pernicious anaemia (B12) and rickets (D), and led to dietary strategies to tackle them (Gibney et al., 2009). There was also a growing focus on mineral deficiencies, such as copper, zinc and magnesium, as well as increasing recognition of the link between iodine and thyroid problems and low fluoride and tooth decay (Carpenter, 2003c). Nutrition science was now well and truly consolidated as a discipline in its own right.

These discoveries accelerated interest in nutri-quantification, with the nutritionism paradigm increasingly infiltrating public understanding of food and dietary health. Specifically, food manufacturers began to focus on protective nutrients required for normal body functioning and to prevent nutrient deficiency diseases. Immediately, selected staple foods, such as bread, cereal, fat spreads, milk, juice and salt, became fortified with micronutrients and marketed as staving off single-nutrient deficiency diseases. These new marketing campaigns emphasised the vitamin or mineral content of products and their

"protective" nature, thereby convincing consumers of their necessity. The discovery of vitamins also gave rise to an entire vitamin supplement industry (see Apple, 1996 for an excellent account of this within a US context). Although the industry and even health professionals have been criticised for working in a nutritionally reductive manner, offering people a "false sense of protection" (Guallar et al., 2013) and even increasing the risk of certain diseases, it remains a multi-billion-dollar industry today as people seek ways to keep healthy.

Women became particular targets of marketing campaigns, urged to buy such fortified foods for the sake of their children's health. This strategy—described by Apple (1995) as scientific motherhood—used scientific rationale to tap into women's fears about infant mortality, but also their concerns with respectability. From this point, we also witness the rise of the "nutricentric person" (Scrinis, 2013:32) who "accepts, embraces and internalises" the nutricentric understanding of foods and the body. However, this acceptance often comes from a place of anxiety and pressure to "keep up" to remain healthy. It, therefore, creates a false need for products as they question their own knowledge, develop a growing dependency on what experts say and become increasingly susceptible to marketing claims.[4]

Nutrition Science in the Mid-Twentieth Century

The interest in quantifying nutritionism continued up until the 1950s, gradually giving way to a new type of nutritionism focused on "good" and "bad" nutrients (Scrinis, 2013). This shift was motivated by growing concerns about the overconsumption of certain nutrients and foods and their link with chronic non-infectious diseases, such as heart attacks, strokes and cancer. In other words, quantifying nutritionism had successfully addressed nutritional deficiencies, yet the growth of processed foods and the consumption of too many "bad" nutrients had now brought about a new problem of *overnourishment*.

This finding emerged from epidemiological studies after World War Two, which revealed that the incidence of some chronic diseases was generally reduced as a result of rationing and food shortages. This led to the hypothesis that the dietary patterns of most affluent countries were conducive to chronic disease (Carpenter, 2003c). Such ideas were embraced by governments and public health institutions who produced the first recommendary dietary allowances (RDAs) and provided new guidelines for total calories and selected nutrients based on these "binary moral judgements" (Fischler, 1993). The new era of good and bad nutritionism, thus, became dominated by what Belasco (2007) calls "negative nutrition," with discourses emphasising the need to eat less "harmful" nutrients and using words like "avoid," "reduce," "limit" and "decrease."

Fears were particularly centred around "good" and "bad" fats and the link between high cholesterol and disease, as advocated by the diet–heart hypothesis. The diet–heart hypothesis was postulated by physiologist Ancel Keys who claimed that saturated fat caused cardiovascular disease by raising serum

cholesterol. Keys based his hypothesis on animal data and feeding experiments conducted on humans, which suggested that high blood cholesterol caused fatty deposits that clogged arteries and caused heart attacks. He had also observed a lower rate of heart attacks in Mediterranean countries and linked this to their consumption of less saturated fat-rich foods (Teicholz, 2023).

The fears around "good" and "bad" fats played out particularly in the war between butter and margarine that took place during this period. While margarine had historically been seen as a "poor man's" food, lacking all the nutritional benefits of butter, it was now reframed as a medicinal product that had heart health benefits (O'Hagan, 2022). This was based purely on its unsaturated fatty acid profile, but also included partially hydrogenated oils—so-called trans fats—which were initially completely ignored (but later revealed to have similar associations with blood cholesterol concentrations as saturated fat). Margarine, thus, became what Scrinis (2013:30) calls a part of "everyday nutritionism," that is, an everyday nutritional expression, formulated within the logic of nutritionism, and that has been embraced and repeated by nutrition experts and the lay public alike. We see this in the 1977 Swedish advertisement for Flora in Figure 0.2 whose focus on nutrients undermines concerns of the quality of ingredients and processing techniques. The heading carries a big warning that children should be taught this in school, followed by the claim that saturated fat increases the risk of atherosclerosis but polyunsaturated fats decrease risk. A table is then presented with different cooking fats and types of fat, singling out Flora as best.

Mozaffarian et al. (2018) call out a major flaw with this type of nutritionism: it relied on the nutritional model developed to address deficiencies, which entailed identifying and isolating a single relevant nutrient, assessing its isolated physiological effect and quantifying its optimal intake level to prevent disease. This reductionist method translated poorly to non-communicable diseases and suggested a black-and-white one-dimensional understanding of the role of nutrients and biomarkers on bodily health, which blurred distinctions between whole foods and ingredients. This meant a "decontextualisation, simplification and exaggeration of the role of nutrients in determining bodily health" (Scrinis, 2013:5). Nonetheless, its ideas were still heavily taken up by the food industry and used in marketing.

At the same time as the "good" and "bad" fats debate, there was also a parallel discussion taking place, advocated by Dr Robert Atkins. In his 1972 book *Diet Revolution*, he promoted a low-carb, high-fat diet, arguing that carbohydrates, rather than fats, were the principal elements in foods that fatten people. This idea did not take off properly until the late 1990s. There were also other claims by John Yudkin about excess sugar and its link with coronary thrombosis. Yudkin published his ideas for a lay audience in the 1972 book *Pure, White and Deadly*, arguing that sugar was more harmful than refined grains. However, as has come to light since, the sugar industry paid scientists to play down the link and promote saturated fat instead as the culprit (O'Connor, 2016). The discrediting was largely successful. Instead, the decade was one of "at risk"

Figure 0.2 Everyday Nutritionism in a Flora Advertisement (1977)

Credit: *Svenska Dagbladet*, 24 March 1977, p. 17. With thanks to Upfield for permission to use.

bodies, with the vilification of saturated fat, the stigmatisation of cholesterol and a shift from "eat less" to "eat more" (Scrinis, 2013:79–80).

The 1970s were also marked by the rise of healthism, described by Crawford (1980:368) as a "heightened awareness and interest in health." Healthism is concerned with an elevated pursuit of personal health as a supreme goal, but this goes beyond illness and is concerned with responsibility for one's own health. These arguments bear some resemblance with the earlier Physical Culture Movement, which drew on Victorian self-help ideology and advocated regular exercise alongside broader health reforms, including vegetarianism, temperance, fresh air and frequent bathing, to avoid the physical degeneration of the human race and limit the burden that one might place upon society (O'Hagan, 2021).

By the 1980s, "good" and "bad" fats, coupled with healthism, were dominant strategies that guided marketing practices. This obsession also provided a lucrative opportunity for the food industry to introduce low-fat alternatives to the market. As Scrinis (2013:8) notes, such alternatives constructed a "nutritional façade" around the food that distracted attention from its other ingredients, additives and processing techniques. Geyskens et al. (2007), in fact, note that low-fat foods can encourage overconsumption because health claims on packaging exaggerate the role of a single nutrient and associate low fat with good health. As a result, people feel less guilty and tend to consume more, which has worsened rather than alleviated obesity problems.

Nutrition Science in the Late Twentieth Century Onwards

Moving into the late twentieth century, it became clear that the food industry had succeeded in exploiting the nutritionism paradigm and colonising the nutriscape. It was now the primary disseminator of simplified and reductive understandings of food and nutrients and was just as likely to shape and inform dietary advice and public understanding of food as scientists, nutritionists, governments and public health institutions (Nestle, 2018). As the number of nutricentric consumers grew, they looked increasingly to food marketing and packaging for advice, embracing and internalising the scientific and health discourses on display.

The 1990s began with a shift away from the "good" and "bad" fats paradigm. This was influenced by emerging research which showed that the decade of low-fat food marketing had actually coincided with a steady growth in obesity and diabetes levels. Furthermore, it found that the consumption of low-fat products did not translate into reductions in total fat consumption (La Berge, 2008). Additionally, new research revealed that trans fats were more harmful than previously thought. As a result, whole categories of foods suddenly became stigmatised based on their presumed trans fats content rather than distinguishing between good- and poor-quality versions (Scrinis, 2013:145). This is best exemplified through the case of margarine which, previously favoured as a healthy alternative to butter, was now seen as "a disastrous mistake" and its hydrogenation process as "the biggest food processing disaster in US history"

(Lawrence, 2010). In response, there was a general move towards alternative weight loss approaches instead of focusing around macronutrients and understanding food in terms of its macronutrient profiles. Scrinis (2013) has outlined three main trends in this respect: a return to nineteenth-century understandings of calorie reduction, low-carb diets (harking back to Dr Atkins' 1972 book) and low GI eating plans based on how foods affect blood sugar levels.

For the last three decades, we have been in a new period of functional nutritionism, which offers a "more positive and targeted view of nutrients and food as 'functional' in relation to bodily health" (Scrinis, 2013:12). Now, it is no longer enough to be healthy; there is an expectation that people should constantly look to enhance and optimise their bodies and that only certain nutrients can provide this enhancement and optimisation (Eriksson, 2022). In other words, we see a move towards a "biomedicalised food culture" (Durocher, 2020), which participates in defining how "healthy" food is understood and "healthy" eating is practised and creates new relationships between bodies and food. The emergence and popularity of functional foods—or superfoods—exemplify this point.

Functional foods are claimed to offer health benefits beyond their nutritional value, which can optimise the body's functioning and reduce disease risk. However, there is no common definition of a functional food, meaning that brands can use the term to construct a health halo around their products and create an "aura of precision" when it comes to the scientific knowledge underpinning the health claims that they put forward (Scrinis, 2013:197). This is apparent in food trends over the past decade, including quinoa, kale, turmeric, kefir and chia seeds (see Loyer's discussion in Chapter 11), as well as the rise of functional beverages, or nootropic drinks, marketed as actively improving one's health (Chen and Eriksson, 2022). While the term "functional food" is new, similar strategies have been used by marketers for the past 150 years, with the buzzwords "health drinks," "protein foods" and "nerve foods" just a few examples that presage today's obsession (cf. O'Hagan, 2019b, 2021, 2023). Sprackley (2020:76) notes how functional foods exist somewhere between food and medicine, and it is this liminality upon which marketers capitalise.

Numerous nutrients have been (re)positioned as *the* ultimate nutrient to consume in order to enhance a particular bodily function, whether that be brain health, digestion or sports performance. Recent years have seen emphasis placed on omega-3, vitamin D and biotin, as well as a growing interest in phytochemicals, antioxidants, plant sterols and probiotics, which are all seen as having medicinal or therapeutic qualities. This has created a sense that these functional nutrients cannot be obtained sufficiently from ordinary food, thus driving the market of dietary supplements and intensifying a perception of "nutrition scarcity" (Scrinis, 2013:259) that echoes the era of quantifying nutritionism. As Scrinis (2013) notes, the message has now changed to "eat smarter," with consumers informed that eating a balanced diet is no longer enough and that they must focus on particular bodily functions by optimising quantities and ratios of consumption.

Coupled with this interest in functional nutritionism has been the promotion of certain types of diets, such as palaeolithic or ancestral diets (consisting of foods thought to mirror those eaten by humans during the Palaeolithic era), the DASH diet (designed to reduce blood pressure and the risk of cardiovascular disease), the Mediterranean diet (inspired by the eating habits of Portugal, Spain, Italy and Greece) and the prudent diet (high intake of vegetables, fruit, legumes, whole grains and fish and other seafood). There has also been an accelerated growth in vegetarian and—more recently—vegan diets, with growing numbers of people turning to plant-based diets for health and environmental reasons. Gheihman (2021) argues that veganism has become an "emerging lifestyle movement" that, thanks to famous figures—or cultural entrepreneurs—has brought about a cultural shift into the mainstream, moving it away from traditional associations with animal rights activists.

Nutrition Science Now and in the Future

Mozaffarian et al. (2018) point out that, after decades of focusing on simple, reductionist metrics, the emerging true complexities of different foods and diet patterns are creating genuine challenges for understanding influences on health and wellbeing. In recent years, concerns about over-supplementation of vitamins have arisen (Forgie et al., 2023), for example, as well as the risk of "double burden"—that is, the combination of conventional malnutrition (insufficient calories and micronutrients) causing poor health and at the same time modern malnutrition (poor diet) increasing risk of obesity, cancer and heart disease (Kosaka and Umezaki, 2017). According to Mozaffarian et al. (2018), these issues have not been helped by nutrition policies, which continue to have a single nutrient or caloric focus. Although some nutrition policies do consider non-communicable diseases, they tend to overfocus on obesity, which fails to identify the root problem of unhealthy diets, as well as the various risk pathways and conditions affected by nutrition.

There are some promising advancements in the field of nutrition science that may help address such concerns, but they do not come without risks. Nutrigenomics, for example, studies the relationship between the human genome, human nutrition and health. It seeks to understand how people's responses to nutrients are influenced by their gene expression, with the ultimate aim of tailoring diets to people's genetic profiles to combat obesity and other health issues, such as diabetes and metabolic syndrome (Sales et al., 2014). Scrinis (2013:189) is sceptical of nutrigenomics, arguing that its promises are yet another claim by scientists that they have discovered the "truth" about food and health, but this time at a deeper molecular and genetic level. He argues that it is the paradigms within which this research and knowledge are interpreted and applied that will shape whether or not they perpetuate many of the issues with current nutrition science research and dietary advice.

Mainly in line with Scrinis's (2013) argument that food processing should be taken into consideration when considering the health value of foods,

there has been increased support for the NOVA Food Classification system among scholars in the field of nutrition science (Montiero, 2018; Juul et al., 2021). Based on the level of processing that the products have undergone, this system differentiates between four categories: (1) minimally processed foods (e.g. fresh, dry or frozen fruits or vegetables); (2) processed culinary ingredients (e.g. olive oil, butter); (3) processed foods (e.g. canned fruits and vegetables); and (4) ultra-processed products (e.g. soft drinks, cereals, fast food and salty snacks). The latter category consists of foods that have gone through several stages of processing and contain additives, as well as often an assembly of unmodified and/or modified food substances. Montiero (2018:730) describes ultra-processed foods as "typically branded, distributed internationally and globally, heavily advertised and marketed, and very profitable." Generally, these foods are depicted as "junk food" (see Zazueta's discussion in Chapter 3). Summarising the existing evidence about the presumed associations between consumption of ultra-processed foods and the risk of cardiovascular diseases, Juul et al. (2021) put forward the argument that nutrition counselling as the cornerstone of preventive cardiology should address the problems of intake of such foods. If the aim is to help people follow healthier diets and maintain a healthy lifestyle, the best advice is to minimise the intake of ultra-processed foods and drinks (Montiero, 2018; Montiero et al., 2019).

Given growing environmental concerns, the decades ahead are also likely to see an extended interest in sustainable nutrition, particularly in terms of plant-based foods and upcycling (McClements and Grossman, 2021; Idrishi et al., 2022). The Nordic Nutrition Recommendations 2023 (Nordic Council of Ministers, 2023) take into consideration the impact of food consumption on the environment and the climate, with the ambition of "present[ing] the best available data for how to eat for the health of our bodies and for our planet" (6). In this context, the recent development in the field of nutrition science of "cultured meat" appears as a possible solution (see Vezovnik, Chapter 13 of this volume). Using tissue engineering techniques pioneered in regenerative medicine, animal cells are cultured *in vitro* to produce a lab-based meat, which may help address many of the ethical, environmental and public health issues associated with conventional meat production (Bryant, 2020). However, there are concerns that cultured meat may create more problems than it solves, as it lacks many of the vitamins and minerals present in "normal" meat (e.g. vitamin B1277, creatin, vitamin D3, iron) and may contain endocrine-disrupting chemicals that affect anabolic sex hormones (Treich, 2021). A 2023 report from the Food Standard Agency warns of the "promissory narrative" of cultured meat that purports it is healthier by design. They argue that controlling the amount of polyunsaturated fatty acids in cultured meat does not necessarily mean that the final product is healthier than "normal" meat. Moreover, this belief that it is healthier could even lead to overconsumption, as previously identified by Geyskens et al. (2007) and Scrinis (2013) with the low-fat trend of the 1980s.

Looking towards the future then, we can expect that other new products will continue to emerge, targeting ever increasingly more specific bodily functions. The importance of consuming prebiotics and postbiotics, in addition to the more established probiotics, will also continue to flourish. While research suggests that they can alleviate symptoms of digestive disorders and help increase body immunity, scientists warn of holding them up as a wonder cure, citing their adverse effects on immunocompromised individuals (Vallianou et al., 2020). While legislation is in place to protect consumers from harmful food labelling and marketing, new buzzwords keep surfacing and saturating products, from "flavonoid foods" to "bioactive foods." "The public is understandably bewildered by these evolving dietary messages," caution Mozaffarian et al. (2018). As Cannon (2007) emphasises, problematic food marketing messages are further compounded by the fact that much nutrition advice is distorted by trade groups or nutrition foundations who lobby legislators to protect their own personal interests.

Mozaffarian et al. (2018) believe that nutrition policies must move from simplistic reductionist strategies to multifaceted approaches that bring together modern scientific advances with trusted communication to the public and modern evidence on effective systems level behaviour change. Additionally, attention must shift from the global medicalisation of health to interconnected personal, community, sociocultural, national and global determinants of food environments and choices. Studies must also be carried out on the long-term health consequences of modern shifts in agricultural practices, livestock feeding, crop breeding and food processing methods, which remain poorly understood. Scrinis (2013) proposes a new food quality paradigm with a stronger contextualisation of foods and dietary patterns in order to reduce nutricentric analyses and ensure that research findings do not result in oversimplified or misleading interpretations. Arguably, it is only through knowledge of history that we can learn from past mistakes and apply these lessons to the future of nutrition science and food marketing, ensuring that it is less reductionist, fairer and has the public's best interests at heart. These arguments, grounded in a transhistorical approach, lie at the centre of *Food Marketing and Selling Healthy Lifestyles with Science*.

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Notes

1 For a full account of the history of nutrition science, see the excellent articles of Carpenter (2003a, 2003b, 2003c, 2003d).
2 The name was subsequently changed to "vitamin" in 1920 to fit with the standard nomenclature of the Chemical Society and to reflect the fact that not all the substances were amines (Banoub, 2018:3). An alphabetical designation system was also developed, with substances labelled Vitamin A, B, C, etc.

3 It is also important to mention two early landmark studies in the discovery of vitamins. In 1881, Russian surgeon Nikolai Lunin demonstrated that mice could not survive on purified diets consisting only of carbohydrates, fats and protein, yet they developed normally when milk was added. This suggested that there was an unknown substance in milk that was an essential component of nutrition (Semba, 2012). Twenty years later, the English biochemist Frederick Gowland Hopkins challenged the view that all proteins are nutritionally equivalent when he discovered the amino acid tryptophan and showed that it (and other amino acids) could not be synthesised by the body and needed to be supplied in diet (Carpenter, 2003b).
4 It should be pointed out that not all fortification were superfluous or a "trend." Calcium fortification in flour in England, for example, as recommended by Elsie Widdowson, helped prevent point malnutrition in the 1940s (Burki, 2018).

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