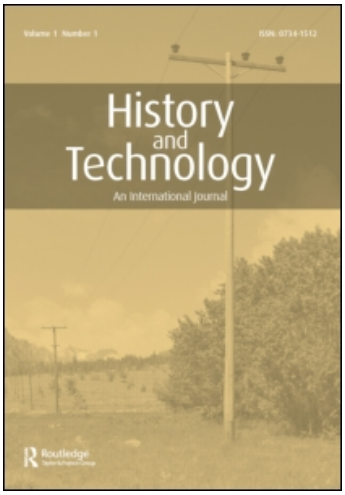

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Redefining food: the standardization of products and production in Europe and the United States, 1880–1914

Uwe Spiekermann*

This article analyzes the interrelationship between expert systems and the creation of public trust in food production in the late nineteenth and early twentieth centuries, focusing on the roles of scientific knowledge and elites in academia, government, and business. The nutrient paradigm of the mid nineteenth century played a crucial part in this history, facilitating new practices of control and standardization based on measurable, empirical 'facts.' This article compares the different approaches, power constellations, and results of the struggle for improved and reliable food quality in Germany, Austria, Switzerland, and the USA. Scientists, especially chemists, the food industries, and public authorities at the local, regional, and federal levels established a structure of science-based standardization and trust-building, which acted on behalf of the consumer in enforcing their own 'objective' ideas about safe products and additives.

Keywords: standardization; regulation; trust; food industry; consumer protection

Trust is a decisive factor for market success in modern consumer societies.[1] The definition of trust, however, is highly controversial. In economic history, for instance, the genesis of trust is most often linked to institutions. Networks, commercial trust wardens, regimes of voluntary agreements and self-commitments, and legal norms are the focus of current research.[2] While innovations and market building mostly result from negotiations, competition, and even conflicts, a common language and common knowledge among all actors are often assumed. This makes sense according to a specific economic rationality or an undisputed dominance of expert systems; however, markets of goods for basic needs normally function differently. Food markets are a prominent example of this difference. Growing suspicion of industrially processed food – and, indeed, all the varieties of adaptations to modernity once emphasized by Anthony Giddens – result from the intimate connection of food markets to body and health, the existence of varying concepts and perceptions of related risks, the fundamental difference between practical and objective knowledge of food, and heterogeneous ideas about food security.[3]

Consequently, sociological risk and trust research has become an emerging and even fashionable field.[4] In spite of this, however, there is a severe lack of historical case studies. This paper will analyze the historical establishment of current expert systems in the food branch to deepen our understanding of trust creation by experts and scientific knowledge.[5] At the turn of the nineteenth to the twentieth century, existing control systems were professionalized and based on chemically defined food standards generally accepted by business. This chemical redefinition of food was possible because it seemed to be the most promising way to fight fraud and deception in the food markets, which were perceived as a problem of industrial and capitalist modernity since the 1870s and 1880s. New additives and food

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products, anonymous and nearly unregulated markets, unfair competition, and a lack of market transparency led to a growing desire among scientific experts and established businessmen to introduce broadly accepted rules on how to produce and promote food products.

Although these experts claimed to be acting at the request and for the good of consumers, ordinary people in the late nineteenth century did not play a direct and active role in this long-lasting transfer – they were mainly discussed as victims of food scandals (Figure 1) or used as tools of support in the experts' struggle for cheap and safe food. The benefits of the new control measures were so convincing and the confidence in science so dominant that

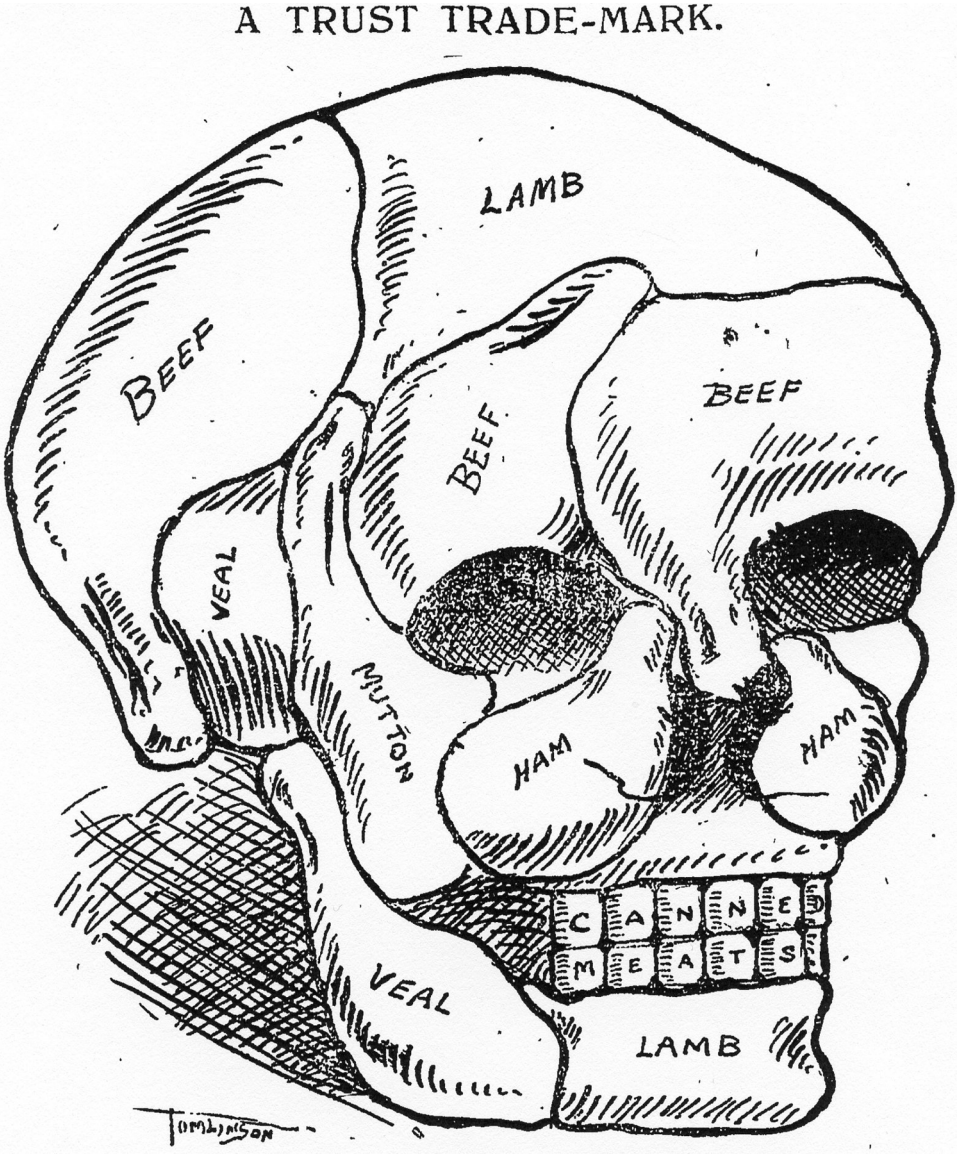

Figure 1. The threat of harmful food: scandals as a structural element of modernity – cartoon regarding the Chicago meat scandals, 1906. Source: *Los Angeles Times*, 18 June 1906, 16.

critics of this redefinition of food remained a small minority: standards were essential for the proper enforcement of any food legislation and control. They were efficient and a starting point for growing reflexivity in business. Without standards, each case had to stand on its own facts, which was both expensive and burdensome. Standards were also necessary to fight against the incompetence of many food inspectors during the first phase of food examination and to promote the public image of emerging scientific expert elites. Based on severe struggles with interest groups and courts – on details, not on the basic principles – the knowledge of the new profession of organic chemists became the foundation of a long-lasting compromise, leading to a nutrient-oriented food system accepted by the public. Despite ongoing insecurity with food quality, nutrient-based standards and control systems created some basic trust in modern food by consumers. The chemical redefinition of food was a Western phenomenon, typical of all advanced industrial states – and modernity – at the turn of the century. To back this thesis, my analysis covers the standardization process in different countries with varying political and economic systems.[6]

1. Establishing food standards: European examples of trust-building

1.1. A new foundation of trust and distrust: the nutrient paradigm

Modern food consumption and trust in food cannot be understood without constantly reflecting upon the knowledge structure of societies, market actors, commodification, and consumer goods. Food consumption, a risky undertaking, was always knowledge-based – and since the late eighteenth century, this has increasingly meant science-based. The rise of science has led to a new understanding of the world, its laws, and its resources. It has changed the way goods are produced, distributed, and marketed. This did not only create new worlds of goods for a quickly growing number of consumers but also new experiences and practices, mentalities and desires, as well as fears and symbols. Therefore, modern consumer societies can and should be read as permanently changing knowledge societies.

In the field of nutrition, a paradigm shift started in the middle of the nineteenth century. Although the 'chemical revolution' began in the late eighteenth century, the first steps toward a modern nutritional science were taken during the 1830s in France, Denmark, and the Netherlands, where nutrients, namely proteins, carbohydrates, and fats were denominated and analyzed.[7] But it was not until the 1840s that German chemist Justus von Liebig formulated a new model of 'nature' based on the idea of a metabolism of energy equal for plants, animals, and human beings.[8] Liebig constructed life as a set of 'material facts.' The Giessen professor strictly classified nutrients on the basis of their chemical composition, assigning them distinct functions and values. He understood protein as a 'plastic' nutrient necessary for building up the human body. Parallel to this, he viewed carbohydrates and fats as essential to the operation of the body for breathing and power. With polemical reasoning and bolstered by popular instinct, Liebig managed to establish his vision of nature in science, business, and, increasingly, everyday bourgeois life. His practical works on agriculture, especially on new methods of chemical fertilization, were crucial to his success.[9] The popularity of his work was based on his position as the leading European chemist formerly trained in France whose work was widely translated into English, French, and other western languages.

Since the middle of the nineteenth century, the understanding of food changed from an integral part of human life and health, to a combination of nutrients and a necessity of metabolism. Nutritional science propagated a new hierarchy of knowledge to rationalize and improve everyday behavior and traditional eating habits. Based on empirical evidence, this scientific knowledge grew more specialized in theory, methodology, and language. The aim of science was no longer to understand man-made reality comprehensively, but to gain

control over the human environment, food, and man himself.[10] Eating was defined as the ingestion of nutrients, and the human body was seen as analogous to the steam engine, which needed fuel to function.[11]

This new objective or explicit scientific knowledge replaced older forms of practical or implicit knowledge; although this took time and was often 'ignored' by the majority of 'ordinary' people. A key element for the success of the new scientific knowledge was that it was not limited to the laboratories, but became more and more important for producers and entrepreneurs. Scientific knowledge made it possible to handle the material 'food' in a new and different way. Foodstuffs were increasingly dissociated from their traditions and cultural settings, while their nutrient content established a new ranking of consumer goods. This nutrient paradigm, however, did more than change the normative value of foodstuffs. It expanded the ways in which the raw materials could be used. Nutrients could be isolated and recombined. On the basis of this paradigm, innovative technology was developed that made it possible to analyze and optimize every single part of the products and production process. The result was a wide range of new processed foodstuffs symbolizing scientific progress and the victory of human knowledge over nature. The nutrient paradigm led to goods with standardized content and taste, thereby enabling branding and new conceptions in advertising.

This scientific knowledge was essential to securing a supply of food for a rapidly growing and increasingly urbanized population. Agriculture was intensified, resulting in continually rising yields during the nineteenth century, and industrially processed food changed, first, essential niche branches such as child or military nutrition.[12] The availability of everyday luxuries, e.g. sugar, coffee, and cocoa, increased significantly, and cheap mass-produced staple foods, e.g. soup products and noodles, facilitated 'modern' patterns for daily diets.[13] However, it also created new insecurities and quality differences unknown in the pre-scientific centuries. Preservatives, dyestuffs, flavors, and industrial surrogates changed the way daily food was perceived, while scientists and producers created new myths based on one-sided dreams of rational, artificial nutrition that would feed human machinery. The nutrient paradigm allowed both: a new transparency and hidden forms of food adulteration, trust in foods and growing distrust in consumer markets.

1.2. The rag rug of unsealed standards: the German case

Since the 1860s the global center of nutritional science turned from Western and Northern Europe to Germany. Stimulated by Liebig's pioneering work, the so-called Munich school of physiology analyzed human metabolism. Their work led to a science-based recommendation for calorie intake and the combination of proteins, fats, carbohydrates, and minerals needed for a healthy diet.[14] The leading representatives of the Munich school – for instance Carl Voit, Max Rubner and Max Pettenkofer – were still aware of the cultural and economic embeddedness of nutrition, but their experimental work evinced the specialization of science in general and nutritional science in particular.[15] Parallel to metabolic studies, the chemical analysis of food was a second field of modern research. Since the middle of the nineteenth century, pharmacists, chemists, and the emerging group of agricultural chemists dominated nutrient research.[16]

The new profession of nutritional chemists was not officially accepted until the late nineteenth century, but even before the founding of the German Empire in 1871, pharmacists and chemists started to establish a new order of nature and food based on the nutrient paradigm. Commerce and daily nutrition were recognized as a dynamic world of preliminary and changing impressions, while sound knowledge of nutrients was expected to reveal nature and

its inner workings. Organic chemistry emerged in the 1870s and was financed not only by the German states, but first and foremost by the German chemical industry, which dominated the world's markets by the late nineteenth century. Since the early 1880s, new monographs arranged and classified foodstuffs according to their nutrient content.[17] They offered – according to their authors – 'objective' quantitative knowledge and distinguished it from 'qualitative methods, which mostly carry the stamp of superficiality and can give inducement for crude deception.'[18] The nutrient paradigm enabled knowledge-based discussions about the distinction between the 'normal' composition of a foodstuff and fraud. It shaped the thinking and daily work of a new expert group, which recognized in the first German food law of 1879 leverage to establish a new order in the food sector and a new era of public trust in the wholesomeness of food.

Nevertheless, in spite of all the preliminary work by Liebig, the Munich School, and the agricultural sciences, the dominance of nutrient-oriented science was not self-evident at the beginning of the German Empire. Like today, chemistry was often seen as a threat to everyday nutrition and a source of distrust. In the German parliament, conservative representatives vowed 'to stop the black art goings-on of chemistry, which have spread especially in the last decades and are also appearing in the press in shameless fashion.'[19] Against this background, it was not clear whether chemical knowledge should be the basis of the control system and food law. Many liberal members of Parliament argued in favor of a critical and well-informed consumer, whose detailed knowledge of good and honest products should be a guarantee against overreaching and deception. Transparency and practical knowledge were supposed to build the foundation of public trust. Abstract knowledge propagated by science was often discussed as less effective than the subjective knowledge of consumers acquired through experience in the marketplace. The richness and heterogeneity of nature could not be reduced to mere numbers. Most politicians, many of whom represented conflicting interests of trade, industry, and agriculture, criticized the 'vague character of technical terms' and claimed that 'all juridical definitions are more or less elastic, oscillating; there is nowhere a precise definition, nowhere an unquestionable matter of fact.'[20] In any event, the precursors of the nutrient paradigm won out. The main argument for this victory of abstract, 'objective' knowledge was the neutrality of science, which permitted the equitable adjudication of contradictory commercial interests. In contrast to the British Public Health Act of 1875, the German Food Law was more closely linked to nutrients as the decisive evaluation criterion. It aimed at the 'essence'[21] of food, which chemists and veterinarians had redefined.

For pharmacists and chemists this represented an opportunity, not a diminution of the public understanding of food.[22] In the early 1880s, Joseph König, a leading agricultural chemist, stated 'that there is not only distrust in the public against all kinds of science and chemistry, but even escalated panic according to the insecurity of jurisdiction.'[23] But according to his expertise the answer needed to be more and not less awareness of nutrients. Clear-cut, nutrient-based standards should set new rules in the food sector, which could be enforced by chemists acting as 'guardians of the law.'[24] Like the language of law in society, the language of nutrients should guide food production and content. 'Public offices and private persons, those of means and without, the rich and the poor will [all] benefit in the same way; only falsifiers, swindlers, and quacksalvers, the bloodsuckers of the people, will be vitiated in their business, and this is something we can wish for soon and everywhere in the public interest.'[25] But the infrastructure of food control was still weak. In 1880, there were only 300 agricultural scientists and 100 chemists working in public service.[26] Although pharmacists, veterinarians, and local doctors were also engaged in food control, the first task was to establish a network of experts to ensure that existing laws, norms, and

standards were enforced throughout the country. The small groups of experts shared common ideas about the composition of foodstuffs, reliable examination methods, and the proper means of supplying food. In Germany, their codification was only the second step, which was enforced after some success in the establishment of nutritional chemistry.

In Central Europe, local and regional food examination offices became the driving force behind the redefinition of food. In contrast to pharmacists, local control personnel, and trade chemists, they focused on routine controls to enforce the food law, but in their laboratories they also conducted research into the precise composition of foodstuffs. Research was necessary to react to new products and frauds, but, in the long run, it permitted the establishment of a new set of nutrient-based standards. Again, Bavaria was the front runner and established an innovation cluster. Beginning in 1876, the first public examination institutes run by chemists were founded in Munich, Erlangen, and Würzburg, and they were directly linked to university institutes.[27] In 1883, the Free Association of Bavarian Representatives of Applied Chemistry was founded. Its members formed the core for a nationwide organization in 1901, the Free Association of German Nutritional Chemists.

Food control varied significantly, however, with severe consequences for consumer trust. Germany had a federal system, and food control was the responsibility of the states and municipalities. The Imperial Health Office, founded in 1876, failed to set nationwide standards, because the control of epidemics seemed to be more important than the control of food.[28] Prussia, the largest German State, tried to encourage the founding of municipal examination offices in 1879, 1880, 1882, and 1893, but it did not finance regional offices. The network of commercial examination offices could not compensate for the lack of examination institutes at the local level, because their fees were expensive and they had to consider the interests of food producers, which were their most important clients.[29] Before 1900, Prussia and other northern German states failed to establish efficient infrastructure for food control.[30] However, things changed, because the growing number of nutritional chemists – nearly 500 in 1905 – had worked effectively in southern and central Germany, convincing politicians and food producers that investing in food control officials was a way to strengthen trust in the food market.

Four factors contributed to this development. First, in 1894 a state examination of nutritional chemists was introduced to address frequent complaints about the 'insufficient preparatory training of chemists serving in the food sector.'[31] With their own doctoral title, nutritional chemists established themselves as the dominant expert group in food control. This helped, second, to strengthen non-binding agreements about examination methods and the 'normal' composition of foodstuffs and products, which were introduced by the Free Association beginning in the early 1880s.[32] They were used by the association's members, but were not obligatory for other control personnel or food producers. Food was judged differently in different regions, for traditions and local customs were highly important in Germany, a country without any national cuisine.[33] During the 1890s, these standards were constantly revised, because the examination methodology was becoming more advanced and the scientific knowledge of nutrients growing more sophisticated by the year. Third, chemists, pharmacists, and health officials generated detailed standards for the most important or adulterated foodstuffs. For instance, milk, butter, and cheese were standardized, and examination methods became obligatory in Prussia in 1897.[34] Fourth, since 1892 the nutritional chemists started to cooperate with the Imperial Health Office to enforce general food standards and obligatory examination methods.[35] As a result, three large volumes of 'agreements for the uniform examination and evaluation of food and luxuries' were published between 1897 and 1902. While these compromises of chemists and health officials were broadly accepted, however, they were still not obligatory.[36]

Criticism came first of all from food producers, who argued in favor of local food manufacturing traditions, the acceptance of local specialty goods, and the self-reliance of consumers. To create trust in their products and promote their own ideas about proper food, they developed the *German Food Book*, published in 1905, which presented examination methods and food composition standards compiled by chemists working for the food industry. The nutritional chemists were quite successful in enforcing their own standards, however, and thousands of lawsuits protected their image as guardians of the public interest fighting for reliability and transparency in the food market.[37] Yet the courts decided differently, and, more and more, the state was asked to intervene in favor of the public interest.

This changed during the World War I when food became an essential for Germany's ability to remain in combat. However, it was not until the early 1920s that scientists, businessmen, and state officials formed an iron triangle to handle the problems of food supply and consumer goods in a cooperative way. Even then, however, the role of the state remained ambivalent, and governmental regulation was mostly grounded in the knowledge of scientists.

1.3. Model for a global market: Austria-Hungary and the Codex alimentarius Austriacus

While German nutritional science dominated the academic world during the late nineteenth century, Austrian-Hungarian scientists concentrated on other fields of research, especially medicine. Although the multiethnic monarchy was one of the leading powers in Europe, its industrial capacities were concentrated in Bohemia, Vienna, and the western parts of Austria, while the economy was still dominated by agriculture. Austria-Hungary had relatively weak institutions, and the food control system was even less effective than the Prussian one. Consequently, German experts argued that these foreign 'measures were basically the same'[38] as in Germany – with a delay of probably one or two decades.

But there were two crucial differences. First, the delayed professionalization of the nutritional sciences and chemistry gave pharmacists and doctors a greater significance than in other European countries. The Austrian Pharmaceutical Society played an important role in coordinating research and organizing conferences, and the laboratory of the General Austrian Druggist Association in Vienna was one of the most important institutions for food control and basic research. At the same time, food and health issues were more closely linked than in Germany. The Austrian Sanitary Board, founded in 1870, when the medical system of Austria was fundamentally reformed, remained the most important institution for regulating food production before World War I.[39] During the 1880s, these experts promoted a new food law, which was intended to combine German and British elements, as well as medical and chemical expertise, but passage of this law failed in 1888.[40] Instead, in 1893 a permanent scientific advisory board at the Ministry of the Interior was established to advise the regulation of the Austro-Hungarian Empire and recommend proper methods of food examination.

The second difference was the introduction of the *Codex alimentarius Austriacus*, which was the ultimate answer of Austrian-Hungarian scientists to the changing world of food products. Its aim was a comprehensive compilation of all foodstuffs, examination methods, quality grades, and food denominations. The *Codex* became a model for early twentieth-century Europe, and it influenced food standardization in the European Community and – via the FAO and WHO – in our globalized world of today.[41] The idea of such a compilation was typical for pharmacists, who had begun to classify all known pharmaceuticals in the *Codex*

medicamentarius and the *Pharmacopoea Germania* in the 1870s, although this pharmaceutical tradition of standardization can be traced back to the eighteenth century.[42] Initial proposals were discussed at the international congress of nutritional chemists (many of whom were pharmacists) in Vienna in 1891.[43] In 1892 a working group was created to establish product standards in a kind of Austrian-Hungarian statute book, which was also supposed to allow for the establishment of international standards in the future.[44] For the experts, the *Codex* was above all a scientific project, necessary to know what simple foodstuffs like beer or wine really were.[45] Public reactions oscillated between complaints about scientific megalomania and deep concerns that experts and the state might abolish traditional foodstuffs and production processes.[46] Officials assured the public that the *Codex* was supposed to give clear orientation to controllers, producers, and consumers – and to reintroduce trust and honesty in the food supply.

When the food law was finally introduced in 1896 – two years before the first version of the *Codex* was completed – six public, three specialist, and three autonomous examination offices were officially established.[47] The Austrian state was allowed to prescribe examination methods, regulate food production, standardize packages, ban the use of additives, and define the composition of food and luxuries. When in 1897 a new state examination by nutritional chemists was introduced, Austria-Hungary had a more advanced food control system than Germany, at least from a legal point of view.[48]

In reality, however, Austria-Hungary suffered from severe deficits in enforcement. Outside the urban centers, control officials were badly trained and not very efficient.[49] The revision of the *Codex* from 1908 considered the interests of trade and industry systematically.[50] Although consumer cooperatives backed the revised food standards and the whole system of nutrient-based standardization,[51] the *Codex* only became a kind of minimal standard – broadly accepted, but still not obligatory. Despite such limitations, the structure of the Austrian-Hungarian standardization process remained a model for other states.

1.4. Legal commitment: the involvement of the Swiss state

Switzerland, the last European example, was an early industrialized democratic state that was successful not only in the textile industry, engineering, and chemistry, but also in the dairy and chocolate sectors. The federal structure of 25 cantons did not favor a Swiss food law, which was not introduced until 1905. Food control was part of local and regional health care; doctors, agricultural scientists, and chemists, financed by local and cantonal health departments, began to examine food quality in the 1870s.[52] These experts oriented themselves towards Germany, first, and France, second, where an initial food law was introduced in 1884.[53] The professionalization of the nutritional chemists led to the founding of the Association of Swiss Analytical Chemists in 1886, while attempts to enact a Swiss food law failed in the late 1880s and early 1890s, following the refusal of the cantons to consign the right of nationwide regulation to the federal level.[54]

The standardization of products and production began in parallel in the late 1880s, when the Association of Swiss Analytical Chemists focused on examination methods for their members all over Switzerland.[55] Such standards helped to harmonize food control and were recommended by the Swiss federal state.[56] To enforce a uniform federal food law, the chemists decided in 1892 to edit a 'food book,' which would contain short definitions of foodstuffs and accepted methods for food control. An initial lay version was published in 1897 to inform food controllers and explain to laymen the fundamental issues of food analysis.[57] In 1899, the first Swiss food book was published by an attorney of the Ministry of the Interior.[58] Such attempts helped to reinforce plans for a Swiss food law, which was again

discussed in 1895, albeit without success.[59] The experts succeeded 10 years later, supported, first, by many producers searching for market security, and, second, by a public referendum in 1897 demanding a uniform Swiss food law similar to those in Britain, Germany, France, Austria, Belgium, and Italy. After long negotiations, the cantons and – again – the voters accepted a new form of food law that only provided general guidelines requiring further elaboration by specialized decrees.[60] This Swiss law allowed much more flexibility than the rigid German and Austrian-Hungarian laws.

This was not the only Swiss peculiarity, however. In 1909, after a complete revision, the Swiss Bundesrat declared the standards of the Swiss food book obligatory for the whole country. For the first time, food standards based on the nutrient paradigm were legally binding. This new circumstance helped Swiss food chemists fight deception and fraud in the courts, provided clear imperatives for food production, and made it possible for consumers to seek legal redress. Although food adulteration remained an important issue in Switzerland, obligatory food standards allowed the enforcement of the general principles of trust and faith as anchored in the 1905 food law.[61]

2. Pure food: food regulation in the United States between chemists, business, the public, and the states

Similar to Europe, food adulteration became a public topic in the USA in the late 1870s.[62] In this country, food control was organized by individual states and local authorities, who acted differently from state to state and town to town. While consumers mostly concentrated on local or regional protection, businessmen tried to introduce a national food law that would guarantee not only unadulterated food, but also market security. In 1880, the National Board of Trade proclaimed: 'The main objects of legislation upon this subject should be to prevent deception, to furnish to the public authoritative information, and to nullify the operations of ignorant and sensational alarmists, who damage the business interests of the country quite as much as do the evils of which they complain.'[63] The Board of Trade was skeptical about fixed standards, however, because of the danger of 'over-rigidness.' It started a competition to formulate a national food law, which resulted in a widely discussed proposal similar to the British Public Health Act of 1875.[64] Obligatory food standards were not really discussed, but the idea of pure, unmixed foodstuffs without any substitutes or additives was generally accepted (Figure 2).

Nonetheless, such debates did not change the marketplace. Food control attempted to protect consumer health, but regulation was weak and deception common. These were at least the findings of detailed investigations by the Bureau of Chemistry in the Department of Agriculture, which started documenting fraud in 1887.[65] From 1883, the Bureau was headed by the agricultural chemist Harvey W. Wiley, who became the key figure of the 'pure food' struggle during the next decades.[66] In his view, chemistry was a tool to distinguish between 'pure' and 'adulterated' food, make production processes transparent, and keep the marketplace clean from food additives harmful to people's health and wallets. Transparency was his first concern, and nutrient-based food standards were therefore decisive for any progress in the marketplace. In his view, trust had to be established by science.

He used scientific expertise as an argument for regulation and public pressure. In 1884, the Association of Official Agricultural Chemists was founded under the auspices of the Department of Agriculture, and membership was restricted to analytic chemists in public service. Under Wiley's chairmanship, the association first concentrated on adopting uniform examination methods for fertilizers. From 1889 on, the organization widened its perspective on foodstuffs, initially concentrating on examination methods, afterwards

Figure 2. Uncle Sam as a chemist – cartoon, 1912. Source: *Washington Post*, 12 June 1912, Prosperous Washington suppl., 59.

focusing on the 'normal' and 'pure' composition of first unprocessed and then processed food. These standards were used by food controllers and were recommended by the growing number of 'pure food laws' on the state level.[67] But such research was not a starting point for a US food book, although pharmacists had already formulated a pharmacopoeia.[68] This was a consequence of the federal structure of the USA, which gave states supremacy in regulating commerce and health issues, and restricted the federal government to questions of interstate commerce.[69] Though the regulation of trusts offered some additional options for Washington, congressional opposition protected the rights of the states and rejected all requests for a nationwide food law during the 1890s.[70]

But scientists continued organizing their technical knowledge to formulate and improve food standards and promote the idea of a federal pure food law. In 1896, the Association of American Dairy, Food and Drug Officials as well as the National Association of State Dairy and Food Departments were founded, both of which created their own food standards in the following years. In 1898, the Association of Official Agricultural Chemists established a committee to recommend food standards and made proposals to improve food control legislation relating to purity standards.[71] Such efforts were supported by a broad public movement for pure food. This movement was driven by journalists, academics, and bourgeois women who demanded state intervention for the public benefit and criticized big business power, represented by the huge trusts dominating the food market in the USA.[72] Scientific arguments were intended to help create a more efficient and rational society but also prevent the emergence of a 'race of weaklings'[73] resulting from unhealthy and adulterated food. Consequently, the claim that pure food should be based on chemical standards was supported by leading medical organizations.[74] As a result of this scientific and public pressure, in 1902 Congress authorized the Department of Agriculture 'to establish standards of food and food products, and to determine what are regarded as adulterations therein for the guidance of the officials of the various States and the courts of justice.'[75] In 1903 the Bureau of Chemistry began to publish 'Standards of Purity for Food Products,' which were relevant for food controllers all over the country, but which were not legally binding.[76] They were formulated by the National Committee of Food Standards, which was formed by the Department of Agriculture, the Association of Official Agricultural Chemists, the Association of State Dairy and Food Departments, and other experts.

The Pure Food Act of 1906, which is mostly praised as a milestone in the federal government's efforts to assume responsibility for the growing number of urban consumers, did not change this precarious situation (Figure 3). An amendment to the act, that 'it shall be the duty of the Secretary of Agriculture to fix standards of food products when advisable for the guidance of the officials charged with the administration of food laws and for the information of the courts,'[77] was deleted during the negotiations at Congress. In the end, the act strengthened the Bureau of Chemistry, where hundreds of jobs were created in the following years; it accomplished the accuracy of product labeling and ensured the absence of adulterants;[78] and it opened the chance for greater harmonization in the food market. A Committee of (advisory) Food Standards was established, and, similar to the Swiss example, the Department of Agriculture gained the right to issue additional food inspection decisions.[79] The struggle for federal regulation and food standards continued, however, not only because of some categorical opposition from the states.[80]

Two main problems must be highlighted. First, the struggle for 'pure food' was guided by the idea that chemical science could define 'purity' consensually. The Bureau of Chemistry focused on regulating and banning most additives, above all preservatives and dyestuffs, and on labeling inferior products, for example, 'blended' whiskey.[81] This regulation resulted in sharp opposition from special interests and scientists. In their argumentation, cheaper, inferior products were legitimate, necessary for poorer people, and not to be discriminated against. They also favored different concepts of risk, especially in fixing thresholds for potentially harmful additives. When in 1908 the so-called Remsen-Committee

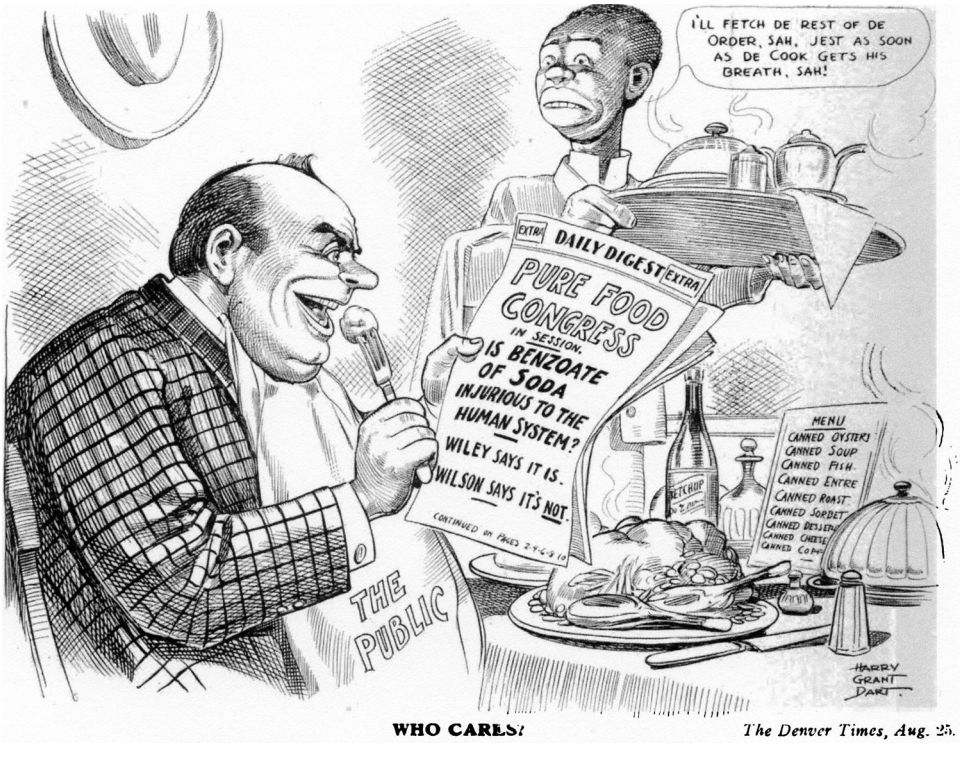

Figure 3. Delegation of responsibility or: the unimpressed consumer – cartoon, 1909. Source: *American Food Journal* 4, no. 9 (1909): 96.

decided that benzoate of soda was not harmful if consumed in small quantities, the structural problems of scientific knowledge production became clear once again (Figure 4). The relative failure of Harvey Wiley's crusade for 'pure food' was based on the idea of scientific objectivity, which was bound to fail because it excluded many other elements of the food sector.

Second, the political system of the USA favored the independence of courts, which could easily question and revise legislative and executive decisions in public. Several decisions by the Department of Agriculture were revoked by the Supreme Court, because the government was not able to show precise connections between the use of additives and harm to humans. In 1914, the Supreme Court ruled in the *United States v. Lexington Mill & Elevator Company* that 'the mere presence of such an ingredient is not sufficient to make a food illegal.'[82] In 1916, *Hutchinson Ice Cream Co. v. Iowa* emphasized 'that in the absence of legislative regulation the ordinary purchaser at retail does not and cannot know exactly what he is getting when he purchases ice cream,' and that the seller cannot be made responsible for selling such a product.[83] The courts reintegrated common sense into the fierce

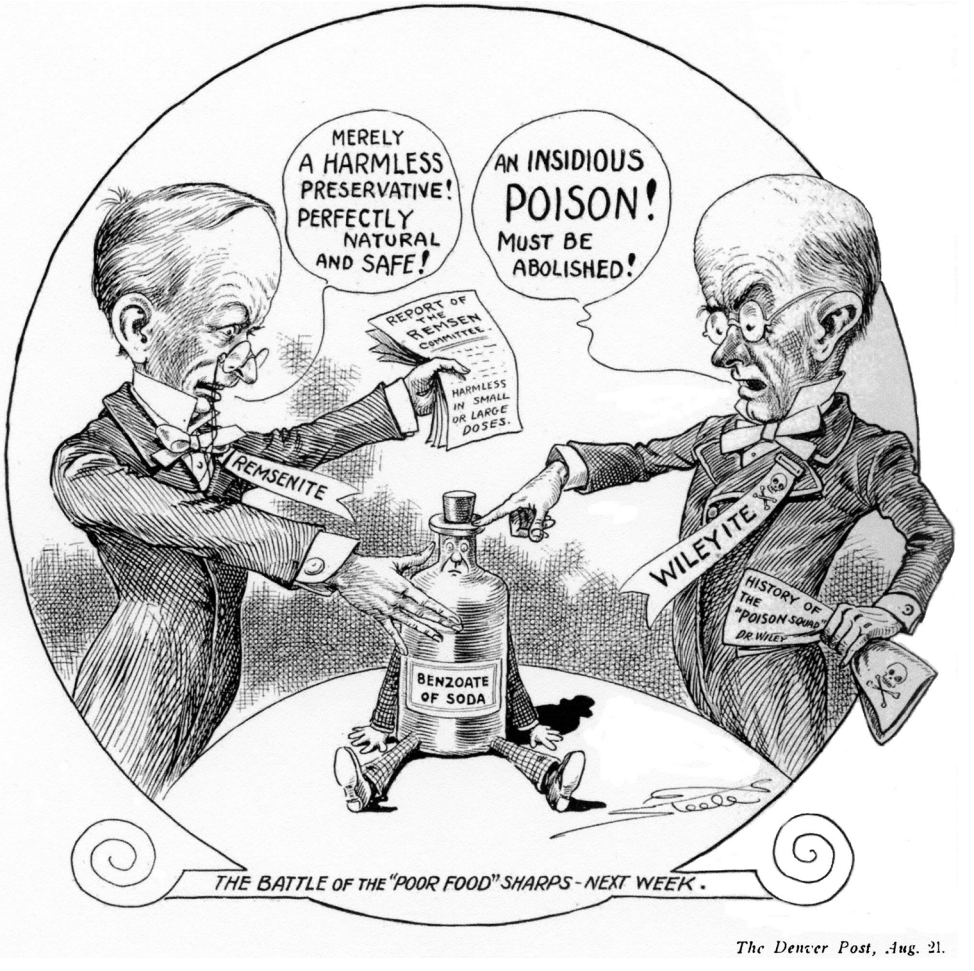

Figure 4. Problems of 'objective' knowledge: contradictory judgments on benzoate of soda – cartoon, 1909. Source: *American Food Journal* 4, no. 9 (1909): 100.

disputes between scientists and special interests. This dimension could not be neglected even by legally binding food standards.

Summarizing the experience in the USA until 1914, we find scientific knowledge used public concerns about food security and adulteration to propagate food standards and a more intense food control system.[84] Although the results were important improvements in food content and quality, they created no real trust in the consumer market. The discussion about 'pure food' and food standards highlighted the structural dilemmas and paradoxes of modern knowledge production. In a free and open society, many people thought that fixing standards by law 'smacks strongly of imperialism.'[85] In the USA, experts had a different status and were often not recognized as the consumer's guardians: 'These officials are seeking to have delegated wholly to themselves the power to fix standards and include or exclude from foods and drinks any ingredients they may now or hereafter, in their own technical way of reasoning, see fit to include or exclude.'[86] Consequently, ordinary people's competence for deciding on such a fundamental and intimate issue as food were not to be restricted by experts and their skepticism about the consumer's knowledge of food processing and the potential harm of additives. Problems with technological progress and delegating functions to an executive department – problems which were primarily legislative and judicial – were further important issues in a democratic and capitalistic society more strongly based on individuality than most European countries.

Despite such arguments, however, debate continued on legally binding food standards and the need for a foodacopeoia.[87] Their advocates were successful in 1938, when the Food, Drug, and Cosmetic Act gave the FDA, the successor to the Bureau of Chemistry, the authority to set identity standards for foods by listing required and permitted ingredients.

3. Adaption, cooperation, and conflict: business and food standardization

Food businesses were crucial for the success of food standardization. This was clear according to the politics of obstruction, which was often practiced by branches using new food additives systematically; but food businesses were more than just an obstacle to establishing standards set by scientists. The nutrient paradigm was accepted by businesses, and they professionalized its use in their own right. Although the majority of entrepreneurs, jobbers, and retailers were guided by the practical needs of business, branch associations and large firms professionalized their own sources of knowledge production. Therefore, food businesses played an active role in the establishment of food standards based on their own expertise. State regulation was not necessary to secure the interests of the public in backing the definitions of the public control officials, but to find compromises between different manifestations of the same type of objective science-based knowledge. This process had already begun in Switzerland before World War I, but fixed standards anchored in law were characteristic of the 1920s and 1930s.

The emergence of the nutrient paradigm changed the food business fundamentally. With the formation of anonymous and supra-regional markets and the rise of industrially produced food products, abstract quality standards became crucial for market success. They had to be integrated into the production process, and they were a crucial element of public relations. Knowledge became a key element of competition, first in the luxuries and stimulants markets, later in ordinary processed food markets.

A good example of such changes was the production of chocolate in Germany.[88] In the middle of the nineteenth century, commodity overviews still presented the raw material cocoa in terms of its regional origin, appearance, feel, smell, and taste, while the abstract knowledge of its chemical composition was already known by merchants and producers.[89]

During the 1870s – a decade marked by fundamental technological changes – the nutrient paradigm had practical consequences. Improvements and manipulations of quality changed the product 'chocolate' profoundly.[90] The nutrient-based analysis of cocoa allowed a well-directed substitution of individual ingredients through cheaper alternatives. Expensive cocoa butter was replaced by cheaper animal fats; some producers even added starch or farina.[91] Economic freedom and new knowledge disintegrated the product world of the early industrial era. Protected only by inefficient penal laws against deception,[92] self-help was necessary. In rapidly changing markets, producers, not consumers, pushed uniform and transparent norms and quality grades.[93] The new cheap 'chocolates' led to a larger assortment and an intensified price and quality competition. The reaction of the leading chocolate producers was typical for the German corporate system, which was formed during the 1870s.[94] In 1876 the Association of German Chocolate Manufacturers was founded in Dresden.[95] This product of cooperative capitalism aimed at mandatory labeling and uniform control methods, whereby the nutrient paradigm formed the common denominator of the association's work. In 1877 it was settled: the association 'excludes all mineral substances, acorn flour, chicory, beet flour, and animal fats from the manufacture of chocolate; [it] permits instead the use of all dyestuffs allowed by the police up to 2%.'[96] Organoleptic examination was, increasingly over time, replaced by chemical analysis. The supremacy of science was established in 1878: 'The members of the association submit to the decision of the association's chemist; in all cases in which an accusation against one member can be made by means of such examinations, based on the association's statutes, the bureau is to consult a further chemist for examination. For a final appeal, the bureau has to consult the Association of Analytical Chemists.'[97] Despite such efforts, the association did not succeed in winning over official institutions, notably the newly established Imperial Health Department, for legally binding definitions of chocolate. On the other hand, the association propagated its ideal of a nutrient-based quality standard with an official certification label that was used on the individual packages of higher priced products and in joint advertising. Using the label guaranteed a minimal content of cocoa and sugar, at that time still an expensive stimulant. By 1901, 93 million, and by 1911, 147 million packages of cocoa and chocolate received the association's label (Figure 5).[98]

The first standards, however, were mostly based on unreliable examination methods. The association invested time and money in new options to detect adulterations, especially the addition of cheaper fats and flours, to reduce fraud and persecute falsifiers.[99] From the beginning, producers cooperated with public food chemists to develop and establish reliable examination methods.[100] Economic success and reliable advertising of 'pure' and 'inspected' products led to a growing acceptance of nutrient-based thinking on the part of the producers. At the same time, their products and advertisements familiarized consumers with the nutrient paradigm.[101]

The continuous endeavors for a 'statutory settlement of the cocoa trade'[102] were in vain, but in 1902 the quality definitions of the association were at least integrated into the semi-official agreements of the Imperial Health Office.[103] The cocoa product standards offered market security and a transparent competition framework for the leading firms, reliable quality, and attractive prices. Competition was not reduced, but shifted to higher quality and more expensive products. This was first of all true for brand names, which prevailed quickly after the trademark protection law of 1894 and covered nearly one quarter of the food market before 1914.[104] Standardized quality, however, was only a one-sided guarantee on the part of producers or retailers.

In 1900, the cocoa market saw newly intensified competition. On the one hand, the number of disposable and technically manageable fats grew because organic chemists

Figure 5. Purity based on chemical examination – advertisement with the label of the Association of German Chocolate Producers, 1905. Source: *Fliegende Blätter* 122, no. 3310, suppl. (1905): 14.

developed a new 'fat saver.' On the other hand, the chocolate consumption of the lower and middle classes increased – cheaper sugar being one reason – and so cheaper chocolate substitutes had good market chances.[105] Their producers argued that a combination of cocoa, starch, flours, and cheap fat was not unhealthy and would allow a 'democratization' of the consumption of former luxuries.[106] As a consequence, the Association of German Chocolate Producers adjusted their standards, although the basic definitions remained constant.[107]

Debates like these make clear that the *fin-de-siècle* marketplace was characterized by evenly matched interests, which were articulated in the framework of the nutrient paradigm and propagated by experts and counter-experts – a typical phenomenon for modern knowledge societies, which are always creating and reordering hierarchies of existing knowledge. Therefore, the producers of higher quality products tended to follow not only voluntary, but also legally binding food standards. Chemical analysis provided an essential basis of knowledge, but only state-run standards enabled the sanctions necessary to threaten falsifiers.

Similar developments can be analyzed in other branches. As already mentioned, food producers, who had concentrated their power in 1901 in the Union of German Food Producers and Trades, began to question the abstract food standards set by the nutritional chemists and the Imperial Health Office. This interest group favored regional trade practices and propagated local experts familiar with such commercial customs.[108] The producers benefited from growing and even national markets, but at the same time they favored local peculiarities. Such arguments were rejected by universally arguing chemists: 'If the habits of a particular branch are accepted as a reason for an exemption from punishment, then hardly

any adulteration or bad habits can be punished by the courts, because such reasons can be found for nearly every adulteration.'[109] Only uniformity could guarantee trust.

The struggle over product and production standards was sharpened in 1905, when the Union presented its *German Food Book*.[110] Despite broad cooperation with the organized nutritional chemists, the producers set their own standards based on nutrients and chemical analysis – used not only for more precise definitions, but also for a growing number of quality grades and varieties of processed food. The Union offered a modest compromise, but for most members of the Free Association of German Food Chemists, the standards were contrary to trust and faith in the marketplace. These chemists criticized not only the definitions of individual foodstuffs, but also the missing declaration of individual nutrients, the approval of dyestuffs and preservatives, and the use of cheap substitutes.

The consequence was a long feud over symbolic issues, mainly food additives. This phase of intensified confrontation improved the image of the food controllers. Most consumers were convinced that those groups who had introduced the nutrient paradigm were looking out for themselves. In the long run, the public chemists gained widespread acceptance for their understanding of honesty and transparency. They knew that this was a hard task because 'the concepts of the essence and the purity of food and luxuries are diverse and changing, depending on market and production conditions';[111] but they were convinced that chemical expertise was needed not only to protect people from poisoned or spoiled food – which was untypical for the German market around 1900 – but also to protect them from deception and overreaching. Therefore, they attempted to convince state-run institutions to introduce legally binding food standards, based on the expertise of nutritional chemists.

The growing number of conflicts between control institutions and producers encouraged governmental institutions to reconsider their *laissez-faire* policies. Hundreds of lawsuits caused public resonance and were used by the labor movement to weaken the legitimacy of the German monarchy. By 1912, after a long period of preliminary work, the Imperial Health Office started to publish the first mandatory food standards to fight some undeniable grievances.[112] The new standards for honey, fats, vinegar, cheese, coffee, and coffee substitutes were the result of analytic experiments and intense negotiations with scientists and producers. At the same time, both scientists and producers agreed to amend the German food law, although there was no majority in the parliament. World War I then changed the peacetime agenda. From 1914 onward, food shortages and quality deterioration were rampant, and even the inadequate food law of 1879 was nothing more than a chimera.[113]

It is not necessary to include additional examples from the USA, because this has already been done by Donna Wood.[114] It is clear that during the late nineteenth century 'legitimate manufactures were becoming more concerned that their trade would be undermined by purveyors of deceitful goods.'[115] In the USA, entire food branches and individual producers supported food standards and an intensified food control, and they used scientific experts and expertise as elements of their advertisements. After the Pure Food Act of 1906, the terms 'purity' and 'pure' were used generally – even if the consumption of some 'pure' products was not closely linked to a healthy or sustainable diet.

4. Conclusion: food standardization between science, business, state, and consumers

At the end of this analysis of the standardization of food products and food production in Europe and the USA between 1880 and 1914, I would like to emphasize some aspects relevant for a more general discussion of food, technology, and trust.

First, during the late nineteenth century the perception and the regulatory system of the food sectors changed throughout the Western world. The nutrient paradigm altered the

perception of food fundamentally, first in science, then in business, and, in the end, in politics. This was not only typical for modern knowledge societies, but also for the reflexivity of modernity. Scientists, above all chemists, but also pharmacists, agricultural scientists, and doctors, were convinced that deeper knowledge would lead to a more rational society and a fairer way of acting in the marketplace. Food standards were their weapon in fighting harm and fraud. Although many adulterations resulted from innovations in organic chemistry and process technology, they believed that bad science could be cured with good science. Businessmen used the new knowledge to create a wider variety of products and cheaper, more efficient production methods. They used food standards mainly for quality control. However, quality was not defined by abstract concepts such as 'purity' or 'nature' but by the capacity to satisfy wants. Focusing on different consumer groups, businessmen acted ambivalently. They fought and they supported the endeavors of the majority of scientists; however, more importantly, they accepted the nutrient paradigm with all its consequences. Doing so meant believing in a kind of 'objective' knowledge that was superior to the subjective knowledge of the consumers. Before 1914, the state concentrated its efforts primarily on the protection of consumers against health risks and fraud. The nutrient paradigm was accepted, because it seemed to be easier to handle and cheaper than more qualitative approaches to health care and consumer assistance. There existed another advantage: the nutrient paradigm allowed for the delegation of controversial issues to expert systems and the choices of modern consumers.

Second, the debates over food standards in Germany, Austria-Hungary, Switzerland, and the USA had a similar structure and – in the long run – similar results. In all countries, we find the establishment and professionalization of expert systems, the harmonization of, first, examination methods and, second, food and product profiles. As a result, there were, first, struggles in and among different professions and, second, intense struggles with 'falsifiers,' mostly food producers. The last step was the inclusion of the political system with its ability to fix legally binding standards and decide among disparate interests. The extreme variations in the food standardization processes among different states resulted from heterogeneous traditions and political institutions, but they were also part of the competition of Western nation-states for the best solution to the structural problems of modernity.

Third, my analysis uses terms like 'science,' 'business,' and 'state,' but it shows that these are also misleading. 'Science' was not only a changing structure of different disciplines, but it was also bound up in different interests. Food controllers stood against falsifiers, state officials against the scientists of industrial branches and large firms. This is similar with 'business' and 'state,' terms which represent competing and sometimes contradictory interests. This may be typical for the dynamics of modernity, but it must be recognized in order to analyze consumer markets and trust building adequately.

Fourth, although my analysis is full of severe conflicts and struggle, the main topic is the establishment of a compromise among functional elites on how to regulate people, markets, and societies. It is about the establishment of a structure of knowledge production and diffusion that is still relevant today. Science, and more and more business, produced 'objective' knowledge relevant for regulation and a market-driven innovation process. The state largely financed this work and standardized and regulated markets on the basis of the nutrient paradigm. Based on the relevant forms of knowledge, the state could claim to be working in the interests of society and consumers.

Fifth, although scientists, businessmen, and political representatives always claimed to be acting at the suggestion and for the good of consumers, in the late nineteenth century, laymen did not play an active role in this long-lasting transfer. They were dominantly used as an argument and not asked for their needs or suggestions. However, the examples of the

Swiss referenda and the US pure food movement prove that important groups of consumers preferred science-based systems of protection to the competitive interaction in free markets.

Sixth, even before World War I, science-based nutrition was characterized by ambivalence and uncertainty, driven by heterogeneous risk scenarios and the unrealistic belief that nutrients – and not man himself – are decisive for a healthy and rational way of consumption. In a market society, this also meant a larger variety of processed food and a broader range of science-based products. However, the redefinition of food did not lead to more trust, because the nutrient paradigm was based on knowledge and rationality far from the consumer. Trust was a kind of hegemonic concept, a way for experts to control and regulate precarious and fragile food supply systems. Consequently, science-based standardization is an integral element of public distrust and health concerns – although there are no real alternatives.

Notes

1. Berghoff, 'Zähmung'; Meijboom, 'Trust.'
2. Berghoff and Sydow, 'Unternehmerische Netzwerke.'
3. Giddens, *Konsequenzen*. See also Fischler, 'Food, Self and Identity'; Frewer and Miles, 'Risk Perception'; Fischler, 'Food Selection'; Bildtgard, 'Trust.'
4. Current studies can be found in Harvey, McMeekin and Warde, *Qualities of Food*; Möllering, *Inviting*; Greiner and Bockenfels, 'Vom Labor ins Feld.'
5. Bruegel and Stanziani, 'Pour une histoire.'
6. Trumbull, *Consumer Capitalism*; Trumbull, 'National Varieties.'
7. A descriptive overview gives Carpenter, *Protein and Energy.* A long-term perspective: Spiekermann, *Künstliche Kost.*
8. Liebig, *Die organische Chemie*; Liebig, *Die Thier-Chemie*.
9. Liebig, *Theorie und Praxis*; Liebig, *Die moderne Landwirthschaft*.
10. Voit, *Handbuch der Physiologie*, 518–28; Forster, 'Ernährung und Nahrungsmittel.'
11. Rabinbach, *The Human Motor*.
12. Uekötter, *Die Wahrheit*; Orland, 'Wissenschaft, Markt und Erfahrung.'
13. Ellerbrock, *Geschichte*.
14. Pettenkofer and Voit, 'Untersuchungen'; Voit, 'Entwicklung der Lehre'; Rubner, 'Calorimetrische Untersuchungen.'
15. Voit, *Theorien der Ernährung*; Rubner, *Volksernährungsfragen*.
16. Wiegert, *Anfangsprobleme der Nahrungsmittelchemie*.
17. Good examples are Ranke, *Ernährung*; Meinert, *Armee- und Volksernährung*; Fleck, *Ernährungsgesetze*; König, *Chemie*.
18. König, *Chemie*, VIII.
19. 'Erste Berathung des Gesetzentwurfs,' 627 (Mendel).
20. Ibid., 637 (Braun).
21. 'Gesetz, betreffend den Verkehr mit Nahrungsmitteln,' 772. For Britain, see Wigner, 'Adulteration.'
22. Geissler, 'Frage der Normalzahlen.'
23. König, *Bestand*, 152.
24. Ibid., 156.
25. Ibid., 163.
26. König, 'Bedeutung der Chemie,' 181–2.
27. Sendtner, 'Kontrolle,' 385–8; Gerum, '50 Jahre.' For the institutional development, see Pappe, 'Geschichte.'
28. For an overview, see Rubner, 'Mitarbeit.'
29. Detailed data can be found in Würzburg, *Nahrungsmittel-Gesetzgebung*; Kerp, 'Übersicht.'
30. Juckenack, 'Nahrungsmittelkontrolle'; König, 'Controle der Nahrungsmittel,' 8. At the same time, Prussia was the pioneer of modern meat inspection: Spiekermann, 'Dangerous Meat?'
31. König, 'Bedeutung der Chemie,' 182–3; similar: Hilger, 'Untersuchungsanstalten,' 16–19.
32. *Vereinbarungen betreffs der Untersuchung*; Hilger, *Vereinbarungen*.
33. Spiekermann, 'Deutsche Küche.'
34. *Technische Anhaltspunkte*; Sell, 'Kunstbutter'; 'Anweisungen zur Prüfung.'

35. May and Maercker, 'Nahrungsmittel-Kontrole,' 193; 'Vereinbarungen einheitlicher Untersuchungsmethoden'; *Vereinbarungen zur einheitlichen Untersuchung*, issue I–III.
36. *Entwürfe*, III.
37. Spiekermann, 'Warenwelten.'
38. Fischer, 'Nahrungsmittelpolizei.'
39. An overview is available in Mahl, 'Gesetzgebung.'
40. 'Entwurf eines österreichischen Lebensmittel-Gesetzes'; 'Motivenbericht.'
41. Frenzel, 'Lebensmittelbuch'; Merkle, *Codex alimentarius*.
42. *Pharmacopoea Germanica*.
43. 'Stenographisches Protokoll'; Zmrzlik, 'Entstehung.'
44. 'Codex alimentarius Austriacus' (1892).
45. *Huitème Congrès International*, 13 (Mankiewicz).
46. 'Die Debatte,' 231 (Wiedersperg).
47. 'Gesetz vom 16. Jänner 1896.' Most of the examination offices already existed: 'Verordnung der Ministerien.'
48. 'Verordnung des Ministeriums'; Lafar, 'Stellungnahme.'
49. 'Österreich. Erlaß'; Ludwig, 'Bericht.'
50. 'Codex alimentarius Austriacus' (1908), 95; 'Codex alimentarius Austriacus' (1908), 309–11.
51. 'Der "codex alimentarius austriacus".'
52. Winkler, 'Markt, Norm und Staat.'
53. Wolfensberger, 'Normierung des Stoffwechsels.'
54. Bührer, 'Lebensmittel-Gesetzgebung'; Bührer, 'Nahrungsmittel-Controle'; 'Das Schweizerische Bundesgesetz.'
55. See, for instance, 'Beschlüsse … Weinfarbstoffe'; 'Beschlüsse … Cacao und Chocolade.' Attempts to standardize food: 'Ernährungstabellen.'
56. 'Ausführungsverordnung.'
57. *Lebensmittelbuch. Populärer Theil*.
58. Attorney of Switzerland. *Schweizerisches Lebensmittelbuch.* For the German receptions. Grünhut, 'Lebensmittelbuch,' 714.
59. 'Entwurf eines schweizerischen Bundesgesetzes.'
60. 'Eidgenössische Lebensmittelgesetzgebung'; 'Zum Referendum'; 'Regelung des Verkehrs'; Schwab, 'Geschichte'; Grüne, *Anfänge*, 291–2.
61. Bertschinger, 'Stand'; Strahlmann, 'Analytische Chemie.' The professionalization of the chemists: 'Die Anforderungen.'
62. 'The Question'; 'Food Adulteration'; 'Proben auf Verfälschung.'
63. *Proceedings*, 76 (and ibid., 77, for the following quotation). Please see particularly 75–83 in this reference.
64. Wigner, 'Model Act.'
65. *Food and Food Adulterants*.
66. Anderson, *Health of a Nation*; Okun, *Fair Play*; Young, *Pure Food*.
67. The state laws: Kane, 'Populism'; Law, 'Origins.'
68. Hinrichs, 'Pure Food Law.'
69. Johnson, *Governing the American State*, 85–115.
70. Bailey, 'Congressional Opposition.'
71. Skinner, 'Official Food Standards,' 9.
72. Goodwin, *Crusaders*; Law and Libecap, 'Determinants.' A good example for contemporary arguments is Mason, 'Food Adulterations.'
73. Wiley, 'Food and Efficiency,' 9.
74. Motter, 'Pure-Food Legislation.'
75. *Pure Food*, 18.
76. 'Lebensmittelbuch der Vereinigten Staaten.'
77. 'Washington Letter,' 75.
78. Gardner, 'Quality Standards,' 725.
79. The main decisions and guiding principles can be found in Wiley, *Foods and Their Adulteration*.
80. *Pure Food*, 17; 'Reflections.' The structural problems inside the Republican Party and the Department of Agriculture are discussed by Anderson, 'Pure-Food Issue'; Coppin, 'James Wilson and Harvey Wiley.'
81. High and Coppin, 'Wiley and the Whiskey Industry.'
82. Quoted by Swann, 'History of the FDA,' 10.
83. 'Ice Cream Standards'; Lannen, 'Food Lawyer's Comment.'

84. Sussman and Gamer, 'Standards and Grades,' 582–3.
85. 'Food Standards,' 69 (J.J. Farrel).
86. 'Food Standards,' 73 (Thomas E. Lannen).
87. 'Secretary Houston's Report'; Regier, 'Struggle'; Young, 'Food and Drug Regulation.'
88. Their significance during the nineteenth century: Rossfeld, *Schweizer Schokolade*, 72–90.
89. Wagner, 'Kakao und Chokolade,' 111.
90. Rossfeld, 'Innovation'; Rossfeld, *Schweizer Schokolade*, 90–103.
91. 'Gesetz,' 797.
92. Juckenack, 'Nahrungsmittelkontrolle.'
93. Some data can be found in Kuntze, 'Kakao- und Chokoladeindustrie.'
94. Abelshauser, 'Umbruch und Persistenz'; Berghoff, *Moderne Unternehmensgeschichte*, 96–102.
95. Kirmse, *Kakao- und Schokolade-Industrie*, 111–17.
96. Greiert, *Festschrift*, 6.
97. Ibid., 8.
98. Ibid., 17.
99. Filsinger, 'Untersuchung'; Stollwerck, *Kakao*, 76–7.
100. 'Bericht,' 245–7.
101. Schwädke, *Mauxion*, 16–22.
102. Zipperer, 'Fortschritte,' 452.
103. *Vereinbarungen zur einheitlichen Untersuchung*, issue 3, 68–81. However, the public reactions remained critical: 'The "Vereinbarungen" are nothing more, than a valuable semiofficial guide for the valuation and examination of food and comestibles, the provisions of which, not being obligatory, have no legal effect' (Zipperer, *Manufacture*, 248).
104. Details can be found in Spiekermann, *Basis der Konsumgesellschaft*, 522–34.
105. 'Zum Nahrungsmittelbuch.' See also Harnack, 'Streitfrage.' At the same time, coloring was used on a broader scale; see 'Gefärbte Chocoladen.'
106. 'Zur Beurteilung.'
107. 'Bestimmungen.' The proposals of the public chemists were quite similar; see Beckurts, 'Vorschläge.' Critical: 'Die allerneuesten "Leitsätze".'
108. 'Behördliche Anordnungen'; 'Eingabe.'
109. König, 'Bedürfnisse,' 321.
110. 'Anträge.'
111. König, 'Bedürfnisse,' 321.
112. *Entwürfe*, IV. Until 1915 six volumes were published.
113. Wolff, 'Verschlechterung,' esp. 66.
114. Wood, 'Strategic Use'; Wood, *Strategic Uses*.
115. Swann, 'History,' 10.

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