

Food Quality in a Changing Social Environment: A Historical Perspective

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Today, food quality is undoubtedly one of the basic concepts of nutritional science. The Food Science and Technology Abstracts contain not less than 18,849 titles regarding issues of food quality for the period between 1990 and 1996 – and they certainly are not complete. Quality management systems according to ISO 9000s are established around the world – by the end of 1995, more than 125,000 companies from all sectors had been certified [1]. At the same time, the consumer emphasises his demands for a high food quality. Quality as far as the eye can see. The quality of communication, however, has hardly improved, because quality is seen as something which has to increase continuously, but also because people understand the concept differently.

This situation is confusing, in particular for natural scientists. But it is obvious that also basic concepts like food quality are not natural facts, but the work of man. They have become established, appear more or less plausible, more or less useful. They serve for communication. This is, however, the starting point of the problem. Food quality is, in fact, not merely a scientific construct, but at the same time an important element of our daily nutrition. It is part of a social total phenomenon. Thus, the scientific definition is accompanied by the claims of everyday life [2]. As a consequence, the concept of food quality is split into a series of subconcepts today. Thereby, scientific discussions mainly focus on the nutritional value, the technical value and the taste value of food [3]. According to scientific literature – things look slightly different in the food industry – the taste value is rather like an unpredictable child [4]. Taste is difficult to measure and can hardly be objectified. Natural sciences, however, set themselves the goal to deliver objective (this means it is measurable) and comparable evaluation criteria. The taste value of food is strongly characterised by subjective opinions and, thus, according to tendency escapes from the generalising access of scientific instruments. The dilemma of heterogeneous evaluation criteria has, however, significantly intensified during the last two decades. Food is more and more assessed according to ecological and ethical aspects [5]. This is often connected with political demands for change. But they are not dealt with exhaustively in politics; however, those who give substance and structure to these alternative approaches are not the worst scientists.

The internal fragmentation of the concept “food quality” clearly shows that science of today is not able to keep up a universal claim for truth in this sector – even if it still is a superior form of knowledge. Scientists are in desperate need of self-moderation as it is essential that they recognise the limits of their own knowledge. In fact with this background, the concept of food quality which is discussed so broadly and controversially, gains a different quality. The claim for truth of single sciences is replaced by a social discussion on food quality. As a consequence, however, social sciences are also challenged to deal with this new issue.

If I, as a historian, look back into the history of the human dealings with food quality, then it is not in order to burden you with the past. I would rather like to try to make clear how changeable even basic concepts were and how heterogeneous the interpretations of these concepts were. Clear, unsentimental looking back is similar to looking into a mirror. It is not always comfortable, but it is a starting point for various attempts at improvement.

Looking back, however, is more difficult than commonly believed, because the search for the concept “food quality” quickly reaches its limits. The term itself appears only after the Second World War, and has been generally used since the 1960s [6]. The research into the “quality” of food leads to a different result. This concept was already used here and there before the First World War, but spread only after the 1920s [7]. But exactly as DNA existed before scientists proved its existence, food quality existed before it was conceptually focused. But then it was always the “value” of food to be discussed or, for example, the “nutritional value”, the “calorific value” or the “food value” [8]. In general, it becomes apparent that quality issues have always been discussed at the level of actual foodstuff first, for example, the value of milk or “milk quality”. Only decades later, was an abstract generic term coined which summarised the single qualities. Thus, our conceptual search for “food quality” shows that we – from a historical perspective – are at the end of a long definition tradition and, at the same time, have to examine a relatively new term [9].

You have certainly noticed that I have focused on Germany. I will do so also in the following. It serves to illustrate conclusively and is, at the same time, based on the conviction that the methods of evaluating food quality in Western Europe follow similar patterns of development.

Well, at what time did people begin to reflect about food quality? The various protective rights against the adulteration of food date back to the Late Middle Ages [10]. Thereby, local authorities and guilds concentrated on the health and the economic protection of the town residents. Controls were prepared and performed in the individual towns, violations were forbidden with severe penalties. There was, however, no binding standard of assessment, so that only obvious adulteration which could be identified by means of external characteristics could be detected. This was based on conceptions of a “natural” quality

of food which differed strongly from town to town. Apart from these protective rights, the consumer assumed the whole responsibility for the qualitative distinction of foodstuffs. In view of the rather limited supply – in spite of the remarkable national and international trade – this did not seem to be an overburden.

This situation has changed since the end of the 18th century. The increasing consumption of new colonial products (coffee, tea, cocoa, sugar) and their surrogates (chicory coffee, beet sugar) demonstrate lasting changes in international trade and agriculture. Agricultural production was intensified and cities became more important. From the second third of the 19th century, industrialisation began slowly but steadily. Especially in this initial phase, the food industry was a leading sector, as an increasing number of people had to be supplied [11]. Wholesale and retail trade began to develop, supply from unknown producers gained significance [12]. The importance of new, industrially manufactured products increased especially during the 1860s/1870s. Freedom of trade, freedom of movement and settlement, and the end of protectionism created new opportunities, but at the same time opened up new risks because the old local protective rights collapsed. As a consequence in 1879, a first food law was developed which was applicable to the entire German Empire [13]. It followed the tradition of the old local rights, because it focused in a similar manner on the warding off of dangers to health and the economy caused by adulteration and deception. Food control remained the responsibility of the States and there were still no uniform food standards. Food quality was still determined by the fiction of naturalness. This was, however, outdated.

In fact, since the late 18th century a new power of definition has begun its triumphant march: modern nutritional science [14]. Doctors, physiologists, chemists and hygienists got to the bottom of the things and analysed the single components. The conception of a holistic foodstuff was replaced by the idea of a synthesis: food was considered being the sum of certain substances at the latest from the middle of the 19th century [15]. Proteins, carbohydrates, fats, ashes, and water were indicated by name. A specific calorific value was assigned to them on which the calorie theory was based. Thereby, inquiries about food quality gained a new dimension. The nutritional science – and this meant more and more chemists working analytically – suggested the possibility of determining the value of the single foodstuffs by means of exact figures. The higher the substance content, the higher the quality. The quality of food seemed to be absorbed by the quantity of nutrients.

Food was considered a means in order to replace consumed substances, which the body required for its maintenance. Thereby, fats and carbohydrates served as fuel of the human machine, but protein alone seemed to be the source of muscular power. Correspondingly, a high value was assigned to food with a

high protein content, animal protein seemed to be superior to vegetable protein due to its better assimilation. Parallel to this, a new hierarchy of food was created: The relative quality depended upon the question how many calories, how much protein could be obtained for a certain price [16]. Meat became the super food of the 19th century while fruit and vegetables lost significance [17]. On the other hand, this concept had political consequences: It applied equally to all social classes. Everybody should get his daily meat; labour claims were supported by nutritional science.

The ideal of nature as the basis of an optimum food quality continued to apply also for the nutritional science [18]. By means of the results of their own analyses, however, scientists believed they were able to measure naturalness [19]. Only a few figures which helped to decode the secret of nature. Inferior food quality could be made visible by deviations from the basic values. Thereby, the focus was laid on some indicators which were easy to determine. The fat content, for example, became the quality marker for milk [20]. At the same time, however, analytical figures allowed the establishment of standards for new industrially produced foodstuffs. The quickly growing supply was examined and evaluated. Thereby, the harmlessness to health was the main subject. Organic chemists created new options for food processing – and chemists established themselves as protectors against new chemical risks. Under the pressure of chemists, for example, a series of colourings and preservatives, which detectably could have toxic effects, were forbidden [21]. With the increasing advance of industrially processed and treated food – at the turn of the century, their share of the entire consumption amounted to ca. 50% – the economic protection of consumers and competitors became the centre of attention to an increasing extent. A broader and deeper supply required the setting-up of internal quality levels. From the middle of the 1880s, the food chemists began to systematically establish standards for single foodstuffs, but they were only timidly supported by the government. Producers and dealers, however, established more and more branded articles after the trademark law of 1894. Furthermore, they presented their own quality standards after the turn of the century [22]. This was the beginning of violent disputes between science and the economy, whereby the food chemists really worked as guarantors of consumer protection. Although economy was, thanks to governmental support, able to significantly reduce the foreign food imports to a certain extent by means of specific quality standards, at home the food chemists finally met with success in most cases – even if in part only in the 1920s [23].

Up to now, we have heard little about the quality demands of the consumers. They neither possess a pressure group, nor have representation. Mainly women's associations and consumer co-operatives assumed this task. They shared the assessment criteria of modern nutritional science and passed them on to their members [24]. At the same time, however, they always pleaded for

low-priced products with a standardised quality [25]. They hardly discussed the taste value because the main task of food was to feed. Anyone who wanted taste had to consume luxury food instead.

Shortly before the First World War, the evaluation of food quality seemed to get going properly, the parts seemed to be definitely cast. Chemical, biochemical and medical research, however, changed the existing picture of nutrition once more. While new protein chemistry still fitted into the framework of the existing limits, the discovery of vitamins in 1911 went well beyond the former analytical limits [26]. Obviously, food contained new substances which had not been considered up to that time, but were at least of the same importance for health as the nutrients which had been known before. Calorie theory was overtaken by vitamin theory at the latest in the 1920s. Long before their chemical isolation, the “vitamins” had been considered a sensitive indicator of food quality. Not without good reason, people began to talk explicitly about “quality” from that time [27]. The vitamin theory created a new hierarchy of food: fruit, vegetables and fresh products came to the fore. At the same time – and this is more important for our current situation – the substances contained in food were kept in view. More and more detailed analytical methods created a more and more detailed picture of our foodstuffs. The framework of the picture, however, was not changed, the substances as such were still kept in view. The number of the analytical indicators of food quality was further increased, partly by means of a more differentiated knowledge of the substances already known (nutrients, vitamins, minerals, fibres), partly by means of the discovery and analysis of new groups of substances (flavours, special plant ingredients, genes). Thus, the nutritional sciences have created a dynamic structure in which they produce new results again and again due to a rigid view. These results strengthen the point of view of nutritionists again and again. Therefore, it was not inherently scientific demands, but mainly economic and political demands which led to new quality criteria.

In this context, three developments are to be particularly stressed: Firstly, industry more and more became the working field of nutritional scientists, mainly chemists and engineers [28]. Technology was refined, progress was made in particular in the area of conservation [29]. Since that time, scientific know-how has concentrated systematically on food production. And this was the starting point for a broader discussion of the technical value of food. Quality demands with respect to the food to be processed has increased since the same time [30]. Secondly, agriculture was put under pressure in the 1920s due to competition in quality from foreign suppliers. Americans, Dutch, and Danish offered standardised agricultural products in top-quality packaging. This time, however, the reaction was not only higher customs duties, but also extensive efforts with respect to quality improvement. The grades of quality law policy has concentrated on external characteristics (weight, shape) since

1930, but at the same time the content of certain chemical substances became the basis of a quality grouping [31]. Thirdly, an increasing approximation of state, industry and science can be noted during the 1920s. It was expressed most clearly during the preparation and formulation of the food law of 1927 [32]. The fundamental identity of interests was based on the general advance of scientists into state and industry. They all shared a similar, substance-oriented understanding of food quality. And they founded their considerations with respect to the safeguarding the supply of the population, to the technical management of the production and the optimum storage and preparation of food exactly on that understanding.

This meant significant changes for the development of food quality, because previously separated sectors were combined in a dynamic manner [33]. Food has not been examined exclusively in an isolated manner anymore since the middle of the 1920s, but from the point of view of the entire process of cultivation and processing, storage and preparation. A systematic "scientizing" began at all levels of the nutrition chain. Scientifically defined quality standards had their firm position at each level.

What was the aim of an optimised food quality? At the beginning of the 1930s, this question was answered throughout Europe as follows: the aim was the protection of the national food supply, the consolidation of the national economy. Autarky endeavours were followed by an increasing governmental influence. In Germany, it was further overridden by the systematic preparations for war. The defeat in the First World War was often attributed to a bad nutrition policy, but, in particular, to insufficient food quality. Therefore, the nutritional sciences were promoted systematically [34]. According to this, human beings were really machines which had to be fed with food of a certain quality to ensure their maximum efficiency [35]. Thus, the taste value of the food and meals was examined systematically, sensory testing methods were developed [36]. This followed a clear objective, as the experience gained during the First World War had proven the political importance not only of a sufficient, but also a tasty diet.

In Germany, however, food quality was not defined exclusively in view of war. During the 1930s and 1940s, in fact, also within science, alternative quality standards developed. They were based on traditions dating far back, for example the life reform movement, as well as on disappointments experienced with the mainstream of nutritional science. Obviously, isolated vitamin preparations did not have the same medical quality as food containing vitamins. An extensive use of artificial fertiliser increased the yields, but presented a danger to the environment. In the framework of a biological medicine and hygiene, ecological criteria of food quality were established [37]. In this context, "Forward to nature" was a prevalent slogan, the development of technology and science should be utilised, not condemned [38]. In view of the dominant

marking direction of the nutritional science, however, these ideas did not become generally accepted.

I should exercise restraint at this point, I could arrive in the 1950s and then slowly shift to the present. But I hope that you realise that stopping before the middle of our century does not just tell us things from the past. At that time – even if the signs were tied to historical circumstances – the most important criteria of our current understanding of food quality already existed: Nutritional, technical and taste value in the area of state, industry and economy, the ecological value in the framework of biological medicine and hygiene, the ethical value in view of the life reform movement. In my opinion, however, the temporal distance shows how valuable such basic concepts can be, in which different contexts they turned out to be useful. To recognise this in a productive manner, to render one's own normative judgements transparent and also to analyse the framework within which quality definitions are of importance – this seems to me the basis of scientific discussion on food quality in our days [39].

Finally, allow me to make a more professional remark. Historians try to analyse how people act in the course of time. The common quality definition, however, practically excludes this social dimension, reduces it to a fictive expectation of the consumers [40]. But human thinking, feelings and actions are, in fact, relevant for the quality concept, they affect the perception and experience of food. These are assessed differently depending upon the region. Not only social and town-country differences, but also gender show important effects on the understanding of quality. The same applies to issues of age, generation and religion. Food quality depends upon the context, that means it also depends upon seasons, days of the week and time of the day, upon the difference between everyday fare and celebrations. Maybe you will consider such thoughts regarding food quality a little bit far-fetched [41]. But at least food marketing knew how to develop supplies and markets on the basis of such criteria.

Today the level of prosperity in Western Europe is so high that we can afford food quality not only in the sense of a limited scientific understanding. Nowadays, it is generally possible to consume food which complies with ecological, ethical and also social quality criteria. And to provide enlightenment and clarification in this context is, in my opinion, exactly the task of a modern scientific understanding of food quality.

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References and Notes

- Oelrich C (1997) Sicherheit dank ISO 4074. Internationales Büro normt für den Handel fast alles. *Frankfurter Rundschau* 53, No. 238, 14. 10. 1997, 26
- It is not very helpful in this context, when e.g. Diehl JF (1991) Qualität der Nahrung – früher und jetzt. *Deutsche Geflügelwirtschaft und Schweineproduktion* 43: 1010–1017, profoundly emphasizes decreasing pollution of German foodstuffs. Arguments of this kind are far removed from everyday life and do not reflect this as a fault. Similarly Gierschner K (1993) Lebensmittelqualität durch moderne Technologien. *Zeitschrift für die Lebensmittelwirtschaft* 44: 468, 470, 472, 475, 574, 577–580, who developed a different concept of quality, which has no consequences for his following exposition
- For a general view cf. Anemüller H (ed) (1993) *Lebensmittelkunde und Lebensmittelqualität in der Ernährungsberatung*. Hippokrates Verlag, Stuttgart (esp. the papers of Anemüller, Leitzmann and Paulus); Steinhart H, Eulitz K (ed) (1996) *Lebensmittelqualität – Anspruch und Erfüllung*. Gesellschaft dt. Chemiker, Frankfurt a. M.; Escher F (1999) Die Qualität von Lebensmitteln. *Lebensmittel-Technologie* 32: 50–52, 54–55
- Cf. e.g. Heyns K (1989) 25 Jahre Institut für Forschung und Entwicklung. In: Stute R (ed.) *Lebensmittelqualität: Wissenschaft und Technik*. Wiley-VCH, Weinheim, pp 14–25, here pp 18–19
- Cf. Koerber K von, Mämle T, Leitzmann C (1993) *Vollwert-Ernährung. Konzeption einer zeitgemäßen Ernährungsweise*, 7th compl. rev. and enlarged edn. Haug, Heidelberg, pp 47–59; Hoffmann M (1996) *Lebensmittelqualität. Neue Erkenntnisse zu aktuellen Fragen*, 2nd rev. edn. SÖL-Sonderausgabe, No. 62. Deukalion Verlag, Bad Dürkheim
- Between 1969 and June 1995 the FSTA contained 1400 titles, which used the term “food quality”. Their publication dates are distributed quite regularly. If you are looking for the topic “quality” you will find 79,262 titles during this period. Nienhaus, A (1995) *Lebensmittelqualität von der Rohware bis zum Endprodukt – ein Begriff im Wandel der Zeiten*. In: *In Sachen Lebensmittel*. Jahrestagung '95. Bonn. Schriftenreihe des Bundes für Lebensmittelrecht und Lebensmittelkunde e.V., Issue 121: 31–37, is not very helpful
- An early use of the term can be found in Rubner M (1892) *Lehrbuch der Hygiene*, 4th edn. Franz Deuticke Verlag, Leipzig/Wien, p 481 (absorption quality of protein); Jucknack A, Sendner R (1899) *Ueber das Färben und die Zusammensetzung der Rohwurstwaren des Handels mit Berücksichtigung der Färbung des Hackfleischs*. *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel* 2: 177–197, here p 178 (meat quality). At the turn of the century qualitative (existence of a substance) and quantitative (amount of a substance) research methods were separated, cf. e.g. Weinwurm S (1899) *Ueber eine qualitative und quantitative Bestimmung von Weizenmehl im Roggenmehl*. *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel* 1: 98–101. The term “quality” is still lacking in the central work of Beythien A (1919) *Handbuch der Nahrungsmitteluntersuchung*. Chr. Hermann Tauchnitz, Leipzig
- Cf. e.g. Schwarz E (1852) *Ueber die chemische Zusammensetzung und den Ernährungswert der thierischen Nahrungsmittel*. Dingler's Polytechnisches Journal 126: 128–147; Liebig H von (1877) *Ueber den physiologischen Werth der concentrirten Milch*. *Berliner klinische Wochenschrift* 14: 191–192; Rubner M (1879) *Ueber den Nährwerth des Fluid Meat*. *Zeitschrift für Biologie* 15: 485–492. Similar to the concept of “quality” the use of the term “value” was characterized by an increasing differentiation of several subconcepts. Apart from the economic value (cf. König J (1882) *Procentische Zusammensetzung und Nährgehaltwerth der menschlichen Nahrungsmittel nebst Kostationen und Verdaulichkeit einiger Nahrungsmittel*. Julius Springer, Berlin) social and dietic aspects were discussed later on (cf. e.g. *Der soziale Wert der alkoholischen Getränke* (1905) *Die Umschau* 9: 981–985; *Gesundheitlicher Wert der pflanzlichen Beigerichte* (1909) *Blätter für Volksgesundheitspflege* 9: 139–140)
- These remarks are based – beside specific bibliographic enquiries – on the analysis of my own database of sources and literature. These consist of ca. 50,000 titles mainly from the period between 1850 and 1950. But this of course cannot take the place of a profound analysis of terms and concepts used in the past
- Cf. Sieveking (1909) *Geschichtliches über die Entwicklung der amtlichen Beaufsichtigung des Verkehrs mit Nahrungsmitteln, Genussmitteln und Gebrauchsgegenständen*. *Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege* 41: 290–312
- Cf. Ellerbrock K-P (1993) *Geschichte der deutschen Nahrungs- und Genussmittelindustrie 1750–1914*. *Zeitschrift für Unternehmensgeschichte*, suppl. 76. Steiner, Stuttgart
- Cf. Spiekermann U (1999) *Basis der Konsumgesellschaft. Entstehung und Entwicklung des modernen Kleinhandels in Deutschland 1850–1914*. *Schriftenreihe zur Zeitschrift für Unternehmensgeschichte*, vol. 3. C.H. Beck, München
- For the genesis comp. Grüne J (1994) *Anfänge staatlicher Lebensmittelüberwachung in Deutschland*. Der “Vater der Lebensmittelchemie” Joseph König (1843–1930). Steiner, Stuttgart, pp 43–63
- For lack of alternatives cf. Mant N (1976) *Die wissenschaftliche Ernährungslehre im 19. Jahrhundert*. In: *Heischel-Artelt E (ed): Ernährungs- und Ernährungslehre im 19. Jahrhundert*. *Studien zur Medizingeschichte im neunzehnten Jahrhundert*, vol. 6. Vandenhoeck & Ruprecht, Göttingen, pp 22–75
- Good examples are Voit C von (1881) *Physiologie des allgemeinen Stoffwechsels und der Ernährung*. In: *Herrmann L (ed) Handbuch der Physiologie*, vol. 6, part 1. F.C.W. Vogel, Leipzig; Forster J (1882) *Ernährung und Nahrungsmittel*. In: *Handbuch der Hygiene und Gewerbekrankheiten*, part 1, sect. 1. F.C.W. Vogel, Leipzig, pp 11–236; Munk I (1893) *Einzelernährung und Massenernährung*. In: *Weyl T (ed) Handbuch der Hygiene*, part 3, sect. 1. Gustav Fischer, Jena
- The monetary value of food was discussed e.g. by Wurm E (1889) *Die Volksernährung wie sie ist und wie sie sein soll*. R. Schnabel, Dresden; Rubner (1892) pp 469–471. Since that time corresponding tables have been an integral part of nutritional advice. For the later discussion comp. Fincke H (1926) *Über die Begriffsbestimmung des Nährwertes bei Nahrungs- und Genussmitteln*. *Zeitschrift für Untersuchung der Lebensmittel* 52: 65–80 (incl. disc.)
- Cf. Tanner J (1996) *Der Mensch ist, was er isst*. *Ernährungsmythen und Wandel der Esskultur*. *Historische Anthropologie* 4: 399–419

18. The cultural construction of nature (and the neglect of this) is one important question of the inspiring work of Latour B (1995) *Wir sind nie modern gewesen*. Versuch einer symmetrischen Anthropologie. Akademie Verlag, Berlin
19. The best proofs for this myth of figures are the compendiums of the chemist Joseph König, e.g. König J (1904) *Chemie der menschlichen Nahrungs- und Genussmittel*, vol. 2, 4th improved edn. Julius Springer, Berlin
20. Cf. Fink A (1991) *Von der Bauernmilch zur Industriemilch. Zur Entwicklung und Funktion der Qualitätsnormen bei Milch*. Kassel (Microfilm)
21. A comprehensive view can be found in Ellerbrock K-P (1987) *Lebensmittelqualität vor dem Ersten Weltkrieg: Industrielle Produktion und staatliche Gesundheitspolitik*. In: Teuteberg HJ (ed) *Durchbruch zum modernen Massenkonsum. Lebensmittelmärkte und Lebensmittelqualität im Städtewachstum des Industriezeitalters*. Studien zur Geschichte des Alltags, vol. 8. Copenrath, Münster, pp 127–188
22. Cf. Gerlach V (ed) (1922) *Deutsches Nahrungsmittelbuch*. Im Auftrage des Bundes Deutscher Nahrungsmittelfabrikanten und -Händler e.V., 3rd rev. edn. Carl Winter, Heidelberg, pp 1–3
23. Comp. Juckack A (1922) *Über Ernährungsfragen vom Standpunkte der Wissenschaft, Wirtschaft und Gesetzgebung*. Zeitschrift für Untersuchung der Nahrungs- und Genußmittel 43:9–24; Beyhien A (1927) *25 Jahre Verein Deutscher Nahrungsmittelchemiker*. Zeitschrift für Untersuchung der Lebensmittel 54: 10–21. But you should also notice the critic of Notthohn FE (1934) *Erföffnungsansprache*. Zeitschrift für Untersuchung der Lebensmittel 68:3–5
24. Cf. Peus H (1902) *Warenkontrolle der kaufenden Frau*. Frauen-Genossenschaftsblatt 1:73–74
25. Cf. Rohdich (1930) *Grundsätzliches zur Beurteilung der Lebensmittel nach dem Lebensmittelgesetz und den Qualitätseigenschaften*. Jahrbuch des Zentralverbandes Deutscher Konsumgenossenschaften 28,3:395–411
26. Cf. Berg R (1922) *Die Vitamine*. Kritische Übersicht der Lehre von den Ergänzungstoffen. S. Hirzel, Leipzig, pp 1–9; Spiekermann U (1999) *Bruch mit der alten Ernährungslehre*. Die Entdeckung der Vitamine und ihre Folgen. Internationaler Arbeitskreis für Kulturforschung des Essens. Mitteilungen 4: 16–20
27. Examples are Jacoby M (1919) *Die Bedeutung der Qualität der Ernährung*. Die Therapie der Gegenwart 60:401–404; Wondzinski A (1924) *Findet in der gegenwärtigen Volksernährung Deutschlands die Qualität der Nahrung besonders hinsichtlich des Vitamingehalts die genügende Berücksichtigung?* Archiv für soziale Hygiene und Demographie 15:320–338
28. Paul T (1919) *Das Studium der Lebensmittelchemie nach dem Kriege*. Zeitschrift für angewandte Chemie 32,1:105–108; as well as Fincke H (1933) *Begriff und Aufgabe der Lebensmittelchemie, ihre Beziehungen zu anderen Wissenschaften, ihre Bedeutung für die Volksgesundheit und die Volkswirtschaft und ihre Geschichte*. In: Bömer A, Juckack A, Tilmans J (ed) *Handbuch der Lebensmittelchemie*, vol. 1. Julius Springer, Berlin, pp 1–94
29. Cf. Spiekermann U (1997) *Zeitenprünge: Lebensmittelkonservierung zwischen Haushalt und Industrie 1880–1940*. In: *Ernährungskultur im Wandel der Zeiten*, ed. by Katalyse e.V. and Buntstift e.V., Köln, pp 30–42

30. An earlier development can be noticed in the food production for the canning industry, comp. Meinecke F (1914) *Die volkswirtschaftliche Bedeutung der deutschen Gemüse-Konservenindustrie*. Friedrich Vieweg & Sohn, Braunschweig. *More generally: Erzeugungs- und Absatzverhältnisse im deutschen Gemüse- und Obstbau*. Verhandlungen und Berichte des Unterausschusses für Landwirtschaft, II. Unterausschuss, vol. 9 (1929). E.S. Mittler & Sohn, Berlin
31. Cf. Ritter K (1926) *Absatz und Standardisierung landwirtschaftlicher Produkte (Agrarpolitische Aufsätze und Vorträge, issue 7)*. Paul Parey, Berlin; Schindler A (1932) *Die Standardisierung und die Reform des Absatzes deutscher landwirtschaftlicher Erzeugnisse Veröffentlichungen der Friedrich List Gesellschaft*, vol. 51. In: Beckmann F et al (ed) *Deutsche Agrarpolitik im Rahmen der inneren und äußeren Wirtschaftspolitik*, part 1. Reimar Hobbing, Berlin, pp 743–772; Kruse W (1934) *Die deutsche Landwirtschaft und die Handelsklassengesetzgebung*. Dissertation Berlin (Ms.)
32. Cf. Merres E (1928) *Zur Entwicklung der deutschen Lebensmittelgesetzgebung*. *Reichs-Gesundheitsblatt* 3:829–843; Merres E, Schreiber W (1933) *Übersicht über die Gesetzgebung des Deutschen Reiches auf dem Gebiete des Verkehrs mit Lebensmitteln und Bedarfsgegenständen (Stand vom 1. Oktober 1933)*. *Reichs-Gesundheitsblatt* 8:791–795
33. Cf. Täufel K (1927) *Die Begriffe potentielle Acidität, aktuelle Acidität, Pufferungskapazität und ihre Bedeutung für die Lebensmittelchemie*. Zeitschrift für Untersuchung der Lebensmittel 54:43–53; Täufel K (1949) *Entwicklungslinien der Lebensmittelforschung*. *Universitas* 4:945–950; Schormüller J (1973) *Lebensmittelchemie und Lebensmitteltechnologie*. Entwicklung und aktuelle Probleme. In: Heyns K (ed) (1973) *Aktuelle Probleme der Lebensmitteltechnologie*. Zeitschrift für Ernährungswissenschaft, suppl. 16. Dr. Dietrich Steinkopf, Darmstadt, pp 9–15
34. Cf. e.g. Meyer K (1937) *3 Jahre Forschungsdiensst. In: Forschung für Volk und Nahrungsfreiheit*. Arbeitsbericht 1934 bis 1936 des Forschungsdiensst. *Der Forschungsdiensst, special issue* 8. J. Neumann, Berlin, pp 1–8; Tornow W (1957) *Die Entwicklungslinien der landwirtschaftlichen Forschung*. In: *Spiegel der westdeutschen Landwirtschaft*, 3rd version. Landwirtschaftsverlag, Hiltrup, pp G/1 1–20, here pp G/1 10–15
35. There is an analogy to the principles, which had been developed for the feeding of animals. Quality standards for fodder had had a longer tradition, but at this time they gained importance for human nutrition, too. Cf. e.g. Schmitt L (1943) *Möglichkeiten der Qualitätsbeurteilung landwirtschaftlicher und gärtnerischer Erzeugnisse mit Hilfe biochemischer Methoden*. *Vorratspflege und Lebensmittel-forschung* 6:27–33, here 27–28
36. Cf. Reinhold J (1940) *Der Geschmack als Qualitätsfaktor*. Zeitschrift für Volksernährung 15:187–89; as well as the various methods mentioned in Planck R (1943) *Über die Wahl eines Bewertungsschemas für die Qualitätsprüfung von Gefriererzeugnissen*. *Vorratspflege und Lebensmittel-forschung* 6:4–27
37. Good examples are Kollath W (1937) *Grundlagen, Methoden und Ziele der Hygiene*. Eine Einführung für Mediziner und Naturwissenschaftler, Volkswirtschaftler und Techniker. S. Hirzel, Leipzig; resp. Kollath W (1943) *Grundlagen einer dauerhaften Ernährungslehre*. Jahrbuch des Auslandsamtes der Deutschen Dozenten-schaft 2:38–49

38. Cf. the quality criteria in Vogel M (1938) Bericht über das Forschungs-Institut der Deutschen Lebensreform-Bewegung e.V. Hippokrates 9:1095–1096; resp. Fürst T (1944) Neuere Gesichtspunkte zur biologischen Reform der Ernährung. Hippokrates 15:412–414
39. "Jede Beschreibung und Bewertung von Nahrungsmittelqualität muß deshalb das betrachtete Bezugssystem benennen, da sich daraus Kriterienwahl, Kategorisierung und Maßstäbe ableiten." (Faust M et al. (1987) Ökotrophobiose – Ernährung in einem ökologischen Kontext, part 3: Nahrungsmittelqualität ist nicht allein stofflich zu definieren. Deutsche Apotheker-Zeitung 127:550–554; here p 550)
40. Cf. Hamann V (1950) Die Verbraucher-Erwartung. Über die Problematik eines Rechtsbegriffs im Lebensmittelverkehr. Deutsche Lebensmittel-Rundschau 46: 53–57
41. If you think differently, you will find a lot of relevant literature in Spiekermann U (1997) Nahrung und Ernährung im Industriezeitalter. Ein Rückblick auf 25 Jahre historisch-ethnologischer Ernährungsforschung (1972–1996). In: Bodenstedt A et al. Materialien zur Ermittlung von Ernährungsverhalten. Berichte der Bundesforschungsanstalt für Ernährung, BfE-R-97-1, Karlsruhe, pp 35–73

Gene Technology, Food and the Environment

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It is difficult to accept that green farming methods and genetic engineering cannot co-exist. But this would require us to jettison the ideologically based slogans of both the commercial and green extremists.

Ecologically responsible progress can only come about as the result of dialogue between researchers, industry and consumers; but a dialogue which also addresses the issues at local level. Precedents exist: the Technical University of Zurich working together with the International Rice Research Institute of the Philippines. The aim is to improve local strains while maintaining the local production structures which have often been adapted and refined for centuries.

A planning strategy is needed for the second generation which is not based on rigid, preconceived goals (the triumph of genetic engineering or environmentally friendly farming excluding novel technologies), rather on the desire of all parties to find a solution: to achieve more ecologically-sound farming methods for all. This requires that all parties declare their own interests and respect those of others. The principle of symmetry of ignorance (experts and non-experts have different types of knowledge, yet both have equal status) must be accepted.

We should beware, however, of being too optimistic. It is precisely ecologically relevant, genetically determined characteristics such as resistance to cold and drought that are based on interactions of genes – and these are still insufficiently understood. However, knowledge about the systemic relationships of such genetic properties is increasing rapidly. Widespread prejudices such as, "genetic engineering encourages monoculture farming and helps the seed multinationals to consolidate their billion-dollar profits" do nothing to help. This might well be the case for products which are already on the market because most of them have indeed been developed to improve farming in areas where vast monocultures exist. However, these first genetically modified plants had been designed to help intensive farming, with its high energy input, be more ecological. These pesticide-resistant strains of cotton and maize enable millions of litres of pesticide to be saved. In the case of the new transgenic soy bean, the implantation of a foreign gene makes it possible to replace significant quantities of conventional herbicide with organic pesticide, which

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