CHAPTER IX

FROM LABORATORY EXPERTISE TO LITIGATION: THE MUNICIPAL LABORATORY OF PARIS AND THE LONDON INLAND REVENUE LABORATORY, 1870–1914 A COMPARATIVE ANALYSIS

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In our opinion, the history of food quality is closely related to the evolution of laboratory expertise, although not reducible to it. In this paper we wish to explore the connexions between the two in the period 1870-1914 and to compare and contrast the situations in London and Paris, Europe's two largest cities. We will feature the fight against food adulteration and a major portion of our argument will focus upon milk and wine, both controversial in terms of their "genuine" quality.

In order to provide a basis for comparison, we will address three points. First, we will explore the designation of experts, the nature of their methods, and the *imprimatur* of their pronouncements.[1] On the one hand, traders considered themselves as the best qualified people to judge product quality; for example, wine merchants in France stressed that only they had the required know-how to conclude that a wine has been falsified or not. In contrast, the municipal administration and a part of public opinion were favourable to a recourse to scientists, whose methods were presented as "objective." As such, the organoleptic analysis of traders stood against scientific chemical expertise.

Second, to these conflicts between traders and scientists, we must add the question of disputes between the State and the municipalities. Because different municipal laboratories used different methods of analysis, the question arose of how to prevent meat that had, for instance, been rejected in Lyon or Liverpool being accepted in Paris or Portsmouth. The French response was to establish an official list of the methods of analysis valid for all municipal laboratories.

[1] For discussions about the construction of expertise, see MacLeod, *Government*; and Ingold, *Négocier la ville*.

However, in the early twentieth century, strong centralization reversed previous policies: municipalities lost any control over the quality of food products. This was accompanied by a standardization of the methods of analysis. Several decrees fixed in detail the methods and the instruments of analysis. In Britain the system remained devolved and it was a combination of vigorous scientific communication about methodologies and a series of court cases that provided the basis for greater standardization.

Third, we will argue that laboratory organization was important. The most extreme example is the investment in commercial laboratories undertaken by the large dairy companies that emerged in the late nineteenth century and which completely overshadowed the efforts of the central and local state on milk analysis. It was these "industrial" laboratories that led the debate on compositional standards, particularly in Britain, and their scientific expertise held such weight that it influenced government policy and helped define what were to be considered "natural" percentages of fat in milk.

The paper begins with a brief introduction to the problem of adulteration, which proved to be a testing ground of scientific knowledge about food and of laboratory methods of analysis. This is followed by a discussion of the nature of expertise in food testing in the period 1870-1914. We review the establishment of the city laboratory in Paris as an example of contestation between seemingly incompatible political and commercial interests. Its status and organization are then compared with the system in London, which had a rather different mix of administrative and scientific motivations for food science. Finally, our conclusions suggest a direction for further work.

The problem of food adulteration

Food adulteration was a major social and economic issue in Europe in the nineteenth century. It was a scandal that inspired moral debate about dishonesty and the reasonable expectations of consumers. It raised economic issues about quality and the degree to which traders were justified in processing and manipulating natural constituents. It also sparked concerns about the toxic effect of the chemicals that were introduced into food in order to enhance a particular characteristic or to increase its shelf-life. It inspired critical literature and even black humour in satirical magazines such as *Punch*.[2] In a sense, the debate that raged for a century or so from the 1820s was a precursor to the food scares of today. As a result, there was attention to scientific and technological expertise as

[2] Long, "Dickens."

a means of establishing statements of authenticity, and also the exercise of state regulatory control for both prevention and policing.

British interest in the falsification of food was first aroused in 1820, with revelations by Friedrich Accum.[3] The public's attention span was short, however, and it was not until the 1850s that the well-publicised efforts of Arthur Hill Hassall and his "*Lancet* Analytical Sanitary Commission" rekindled popular indignation.[4] Meanwhile, Alphonse Chevallier was responsible for a similar surge of interest in France from 1850 and his book went into seven editions over the next half-century.[5] A particular French concern with the plastering and watering of wine gave the issue momentum and contributed to the growth of a substantial scientific and polemical literature.

Most countries in western Europe developed systems of food quality control in the second half of the nineteenth century. The first major city to establish a laboratory to investigate and pronounce on fraud was Brussels in 1856.[6] Paris followed in 1878 but the situation in London was complex. The Sale of Food and Drugs Act of 1875 was the stimulus for London's local authorities to appoint their own analysts but the situation was confused because the central government also had its own laboratory.[7] A comparison between Paris and London is valuable because of the different pace and nature of change in the two capitals.

Expertise

It will become obvious to readers of this book that there is a vast literature on expertise. In a sense this is an *embarras de richesse* because of the complexity of assumptions and disciplinary perspectives that have loaded much meaning into one word. We will not comment on the pioneering work by psychologists into the roles of learning and intelligence (human and artificial) in skill development and expertise but a brief introduction to the contribution of Science and Technology Studies will provide a starting point.[8] This STS work derives impetus from the recent undermining of the authoritative voice of "experts" in food scares such as Mad Cow Disease (Bovine Spongiform

[3] Accum, *A Treatise on Adulteration of Food*. See Burnett, *Plenty and Want*.
[4] Hassall, *Food and Its Adulteration.*
[5] Chevallier, *Dictionnaire des altérations*.
[6] Scholliers, "Food, Fraud and the Big City."
[7] Oddy, "Food Quality in London."
[8] For the work of psychologists and others, see Ericsson *et al.*, *The Cambridge Handbook of Expertise*; and also Crease and Selinger, *The Philosophy of Expertise*.

Encephalopathy) or Genetically Modified Organisms. Ulrich Beck has even identified a challenge to the whole notion of expertise in the latest phase of modernity, which he calls the "risk society."[9]

Harry Collins has argued that understanding expertise is the foundation of a "third wave" of science studies, which seeks answers to the question "how do you make decisions based on scientific knowledge before there is an absolute scientific consensus?" He asserts that this is "the pressing intellectual problem of the age" because of the recent questioning of scientific authority, but we will argue in the present paper that there were similar problems of legitimacy in the past.[10] The issues at hand are, first, the indeterminacy of standards—in this paper the quality of foodstuffs—and, second, the ferocious arguments that erupted around the solidification of standards (agreed or imposed) into the form of regulations and their enforcement through the law. In the period under review the debate was partly philosophical, about the relationship between food and nature, and partly about the degree to which the practical methods used by the food industry to make profit were socially and commercially acceptable.

Michel Callon would have us call such debates "hybrid forums," where laboratory expertise mixes with "recherche de plein air."[11] He argues that both knowledge and democracy benefit from the controversies that form here like storms at a meteorological front. In today's extensive debates about the quality of food and drink, which have often taken on the guise of deliberative democracy, the interests of the consumer-citizen are at least represented, even if they are frequently overshadowed by the corporate power of the food industry; but in the late nineteenth and early twentieth centuries such voices were subdued. In fact, more often that not, we must ask in whose real interests food laws and regulations were established: those of the public or those of certain sections of the food producers, processors, manufacturers and retailers. Moreover, as we shall see, the historical experience in turn of the century France shows that the increasing attention devoted to "experts" coincided with a decline in the political authority of Parliament, to the benefit of the power of the Executive.

[9] Beck, *Risk Society*; Beck, *World Risk Society*; Mythen, *Ulrich Beck*.
[10] Collins and Evans, "The Third Wave," quotation on 241. For critiques and a response, see Gorman, "Levels of Expertise;" Jasanoff, "Breaking The Waves;" Rip, "Constructing Expertise;" Wynne, "Seasick;" Collins and Evans, "King Canute."
[11] Callon and Rip, "Humains, non humains;" Callon et al. *Agir*.

Paris

A general political tendency during the first years of the French Third Republic was to grant municipalities more power. It was in this context that the question of municipal laboratories arose. After the first International Congress of Hygiene and Demography held in Brussels in 1876 had highlighted the role that the municipal laboratory played in that city, the second Congress in Paris two years later stressed the need to organize similar laboratories in the main French towns. This was achieved in Paris in 1878, Le Havre 1879, Reims 1882, Rouen 1883, Saint-Etienne and Amiens 1884, and Pau 1885.[12] In these units, medical doctors acted as statisticians and demographers; they were in charge of hygiene, vaccination and food safety problems. This was not only because of budgetary constraints but also because, according to the hygienist credo, prevention had to be "global," covering food habits, vaccination, housing, and general education.

We may ask whether these laboratories were primarily intended to serve traders (for example, wine retail merchants who were suspicious of the composition of the product they bought from wholesalers), consumers (complaining about retailers), or local authorities (the prefecture, the municipality in their campaign against adulterated products). We can also question whether they were supposed to protect public health (and thus the consumer) or to regulate competition (and, thus, the relationship between traders).[13] In Paris, the organization of a municipal laboratory was at first conceived as a form of public control of the markets; as such, services of the municipal laboratory would not have been accessible to the public, only the police. This type of laboratory was agreed upon in 1878; however, there were protests from both traders and consumers and two years later the municipal laboratory and its activity became a public service. It aimed to solve the problem of increasing information asymmetries on the food market, and to do this the laboratory was accessible not only to the police and the prefecture, but also to private actors. This hybrid solution testified at the same time to the increasing involvement of both the central state and the municipalities in food matters and in economic activity generally, and also the aim of private economic actors to regulate contractual problems by appealing to a third party.

The laboratory's budget quickly increased during the 1880s. In 1881, it made 3,958 analyses free of charge and 378 were paid for by private customers.

[12] Du Mesnil, *Bureaux municipaux d'hygiène*; Stanziani, "Municipal Laboratories."
[13] For a further development of this point, see Stanziani, *Histoire de la qualité*, chapt. 13, 315–361.

To this, one has to add 2,181 samples that municipal inspectors seized—that is 6,517 analyses in total. In 1882, 5,188 analyses were free of charge, 50 for paid by private customers and 5,238 samples came from inspectors. In 1883 almost 15,000 analyses were made. If we now distinguish by product, wine was the most analysed product: in 1883 almost half of the analyses (7,444) concerned wine, 5,280 of them free of charge (that is related to watering down), 283 paid for by private customers and 1,581 referred by inspectors. Second was milk: in 1883 there were 4,172 analyses as a whole, including 491 free on the request of private individuals, 14 paying, and 3,667 from inspectors.

The major importance devoted to wine and milk is above all an outcome of the private-public purpose of the laboratory. In fact, while wine inspection and analysis was often required by cabaretiers (publicans) and débitants (retailers) in order to protect themselves from litigation, milk analysis was mostly the result of the autonomous action of inspectors. This created indirect political pressure and gave milk and milk adulteration a mediating role in encouraging change.

Despite the sharp increase in analyses, food inspection lagged behind: in 1882, inspectors managed only 5,260 visits to markets, 17,626 to restaurants, grill rooms, dairies, wine merchants cellars, etc., 1,392 to pork-butchers, 3,460 to butchers, 6,317 to grocers, 1,576 to breweries and coffee shops, and 4,347 to other places (bazaars, tanners, etc.).[14] Controls were also limited in view of the size of Paris. For wine alone, every day the 16 to 20 inspectors sampled five bistros each. This meant that many bistros were never inspected in a year. 43 inspectors dealt with butchers, and 20 with grocers, restaurants, etc; however they were not empowered to seize samples, only to destroy foodstuffs that were clearly unsuitable for consumption.[15] Overall, the probability that a food or drink retailer would be visited was remote and the incentive to renounce fraud was low, unless his reputation for quality was well-established.

This efficiency problem was related to another broader question: that is the rise of a national market and the local nature of rules and their enforcement. Different municipal laboratories used different methods of analysis, and the question arose of how to prevent food rejected in one city being accepted in another. The solution consisted in establishing an official view on methods of analysis valid for all the municipal laboratories; but this could only be done if these laboratories were submitted to state rather than municipal rules. This is to say that the creation of a national market for food was inseparable from that of national regulatory institutions. This was different for other goods, for example, manufactured products; not because they were "naturally" standardized (despite

[14] Girard, *Documents concernant les falsifications*.
[15] Hogg, "De l'organisation des inspections."

the common impression this was hardly the case), but, first, because contractual litigation did not enter the public sphere (criminal, administrative rules) as it did for food and drink and, secondly, because foodstuffs and beverages were required not to be "standardized" but "normalized," that is to have some stable characteristics (fixed in advance). Quality stabilization for manufactures was the result of a complex negotiation at both contractual and market institutional (professional association, chamber of commerce, law courts) levels, while for foodstuffs administrative and criminal sets of rules intervened and added to these other levels.

On the supply side, economic agents mobilized different definitions of food quality and adulteration in order to gain a legal-institutional organization of the market, and thus the legal exclusion of a part of the competition. This is not to say that economic lobbies completely controlled the market rules. The related issues would have been impossible to reach without the role that food security played in the public debate of the time. The hygienist movement made an important contribution. Indeed, under the Third Republic, the influence of scientists increased in the National Assembly and hygiene became an issue throughout the political spectrum.

Moreover, the way economic groups intervened in the public sphere and in the organization of expertise was closely linked to the broader institutional and political organization. Under the Third Republic, several scientists were elected and this was quite different from the preceding Second Empire, when, often excluded from political activity, scientists mobilized their knowledge as a clear political weapon. This also helps to explain the very complex attitude that scientists had with regard to business. It is commonplace to stress that French scientists criticized "capitalism" and its prioritization of profits. This attitude was indeed quite widespread and became particularly evident during the major sanitary crisis (trichinosis, tuberculosis) of that time, as well as in the public debates about wine adulteration.

However important, these attitudes were not the only ones and a majority of scientists (for instance, as a member of a consultative board or as an elected Deputy) considered that science and business had to walk hand in hand in order to find the most appropriate rules; that is rules balancing profits with trade transparency and health security. Some of these scientists were also members of economic associations (chambers of commerce, winegrowers unions, etc.) and, because of that, they were constantly accused of collusion by their colleagues.

Scientists' varied attitudes to business are reflected in the debate about methods of analysis. For example, the addition of plaster in wine (beyond two grams per litre) had been forbidden in 1880, but, because of the protests of Midi winegrowers and traders (those most concerned), the application of this rule was

delayed. In 1886, the Ministry of Agriculture requested experts to assess the "real impact" of plaster on health. This Commission focused, not on this problem, but on the question of how to measure the quantity of plaster in wine.

Two different procedures and instruments were available on the market: one patented by Pasteur the other by Berthelot and Fleurieu. Unfortunately, these different methods gave different results and, if the Pasteur method had been in use, most of the concerned wine would have been considered as "legal," while the second method would have led to its interdiction.[16] This raised the basic problem (that in our own time still lingers with doping tests) of the measures and the instruments of expertise. The scientists developed different measures but were unable to agree upon a means of choosing one method or another. From this point of view scientific uncertainty and political mediation were constant components of market regulation via expertise.

In other cases, traditional organoleptic analysis (tasting wine, smelling milk) of food professionals was set in opposition to chemical expertise. This mirrored the problem of quality measures for foodstuffs and drink: food traders stressed that, as these items were not standardized products, it was possible to conclude about adulteration only on the grounds of chemical analysis. For example, how could one demonstrate that an excess of water in wine (or in milk) was due to the producer rather than to "nature"? For their part, scientists sought to list the main components and acceptable values for every product. This supposed the possibility of establishing a correspondence between the standardization of products and of expertise; unfortunately, for most of our period, this was more a project than a reality.

Organoleptic expertise was based on the experience and professional skill of food traders and wine merchants. However, such professional skill met increasing difficulties when confronted at the end of the nineteenth century with the wide use of organic chemistry. When they were defendants in a trial, traders maintained they were not scientists and, as such, could not identify artificial substances in wine or other "natural" products. But, at the same time, they argued that "natural" products such as wine could not be evaluated only by chemical analysis. Scientists might confuse bad vintages with adulterated products. On these grounds, traders and professional associations criticized the stance of the Paris laboratory in identifying upper and lower limits for several components of wine beyond which adulteration was presumed.[17]

Because of such criticisms, the Ministry of the Interior asked the Director of the laboratory, Charles Girard, and the Prefect for a detailed report. In this

[16] [Anon.], "Analyse chimique des vins."
[17] AN F 12 7417, "Feuilles d'analyse du laboratoire de Paris." (janvier 1884)

Girard denied the fact that the laboratory made use only of chemical analysis for wine, pointing out that tasting (dégustation) was also used, particularly for the top rank wines. His concern was not just with food safety but also with adulteration. He displayed a contempt for the profit motive of capitalist food industry and advocated the disclosure of detailed information about the composition of foods. Here we need to make a distinction between two different phases in product quality: ex-ante (information on labels or in contracts) and ex-post (laboratory analysis). Girard entered the ex-ante debate but he and his laboratory were responsible only for ex-post problems of evaluating already sold products. His attitudes gave traders a solid basis for their complaints and led the debate on to the legal value of expertise. As the Prefect explained in his report, the laboratory was just a simple source of information and its analyses constituted only indices of presumption, not clear evidence for legal judgements.[18] As to the judges: this did not imply that they had to acquire scientific training or competence. Expertise expressed technical concerns but also contained a conclusion expressed in legal terms: adulterated wine or milk. After that the judge had to attribute responsibility, and here expert analysis was only one element among many because it could not say anything about who had adulterated the product.

Despite attempts to defuse the debate, criticisms did not stop and even increased, to the extent that some judges in the 1890s raised doubts about using laboratory analyses, even as simple indices.[19] This was so because the chemical analysis of foodstuffs and wine still faced serious difficulties in the accuracy and stability of its observations. For example, the watering down of wine cannot be detected if the added water is below 20 per cent of the volume.[20]

In 1896 a special Commission was set up at the Ministry of Finance. It was charged with an attempt to identify standard criteria for analyzing wines and alcohol generally. It was not by chance that this Commission was formed only of scientists, with no representative of the business associations.[21] This was an attempt made by civil servants both to reduce contestation and to coordinate different branches of the administration (that is municipal as well as different ministry laboratories). Science was supposed to be the strong unifying and legitimising factor.

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[18] AN F 12 7417, "Préfecture de Police au Ministre du Commerce." (9 mars 1883)
[19] AN BB 18 6025, "Lettre du Préfet de Paris au Ministre de l'Intérieur." (18 mars 1895)
[20] *Ibid.*
[21] AN F 12 7417***(not 68 etc.), "Décret du Président de la République sur la Constitution d'une Commission d'Expert auprès du Ministère des Finances." (25 september 1883)

The Commission indicated the most appropriate methods of analysis but it added that administrative expertise as practised in municipal and fiscal laboratories was only one piece of evidence, among others, in a judicial trial. Guilt could only be attributed on the grounds of several concomitant factors (letters, accounts, testimonies). These suggestions left unsolved the problem of the institutional setting in which the standardization of expertise had to be placed: should municipalities be left in charge of these services? How were local and central institutions to be coordinated?

These questions deeply affected not only the economic dynamics but also the institutional equilibrium of the Third Republic and in particular the relationship between municipalities and the central state. The tensions were such that the Commission's recommendations were not translated into rules until, at the beginning of the twentieth century, a new general law on fraud and falsification laid out a basis for expertise. This general law on food adulteration of 1905 was followed in July 1906 by a Ministerial Decree confirming the creation of a new Service for the Repression of Frauds at the Ministry of Agriculture. The decree detailed the organization of laboratories and their methods of analysis. Still the relationship between these new central laboratories and the previous municipal laboratories had to be clarified: should the municipal laboratories be curtailed, and, if not, should they be dependant on the Ministry of Agriculture?

A circular issued by this Ministry stated that municipal laboratories could survive only by agreement and, then, under the control of the Minister of Agriculture.[22] This meant that, unlike in the first years of the Third Republic, now the balance of power had shifted from municipalities towards the central government. The reform was not without its problems; the Paris laboratory, in particular, refused to submit to the Service of Repression of Fraud and contested the value of its selected methods of analysis. The result was that the Ministry denied the laboratory official status and the courts refused to take its analyses into consideration.[23]

Of course this issue only concerned administrative law expertise. Other forms of expertise were available in different contexts. In particular, judicial contre-expertise in law courts could not be standardized nor practised by officials but only by "assermentés" experts who were free to choose their methods. This was so because officials were considered as "involved parties"

[22] AN BB 18 6055, "Note interne du Ministère de la Justice." (no date).

[23] Décrets du 19 mars 1907 (*Journal Officiel*, 7 avril 1907) et du 13 juin 1907 (*Journal Officiel* du 20 juin 1907); AN BB 18 6031, "Rapport du Procureur Général de la Cour de Cassation au Ministre de la Justice." (27 avril 1909)

and also because, precisely because experts could not be chosen from among state officials, they could not impose any methods.

Last but not least, private product expertise was developed in order to satisfy the increasing needs of business to control product or semi-product quality to avoid litigation. This development also responded to the evolution of contractual responsibilities. At the turn of the century, the legal invention of the consumer went along with that of the "professional." The rights of the former where protected when challenging the quality of a product or even when the purchase of an adulterated product was the result of ignorance. In both cases it was the responsibility of the professional to take care to evaluate the product, applying expertise where necessary. Here analyses mostly acted as a check on negligence rather than as proof of a guilty action, because, for that, further official expertise was required.

London

The situation in England and Wales was similar in some ways to Paris and different in other important respects. Laboratory expertise was fragmented and of uncertain authority. First, there were local authorities in London and in some of the larger industrial cities such as Manchester and Liverpool that took it upon themselves to establish means of detecting food frauds from the middle of the nineteenth century onwards. It is important to note that these initiatives were limited in scope: (a) at first to microscopic and physical analysis, (b) to the most adulterated foods, such as milk, and (c) with little or no impact upon small towns and rural areas until the end of the century. Second, laboratories were set up in the 1870s and 1880s by some of the larger food companies, although their work was more concerned with the quality of supplies to their factories than with protection for the consumer. In 1881 in London, the Aylesbury Dairy Co., for instance, began taking 10-20,000 samples of milk a year and gradually they built up the world's largest database of information about dairy products. Third, the official laboratory was in Somerset House, London, and was known variously as the Board of Inland Revenue Chemical Laboratory (1849-1894), the Government Laboratory (1884-1911), and the Government Chemist's Department (1911-1959). For our present purposes, this laboratory derived its power from the 1875 Sale of Food and Drugs Act and acted as a chemical Court of Appeal, sitting in judgment upon the efforts of local authority analysts. There had been previous Acts in 1860 and 1872 that had been ineffective.

Analysts could be appointed under the 1860 Act, but at the local level this was not compulsory until 1899.[24] Their professional interests were looked after by the Society of Public Analysts (SPA), which from the outset developed into a focus of opposition to Somerset House. A trader convicted of food fraud could appeal and the Government Laboratory was the final arbiter. They frequently overturned the results of Local Authority analysts and this led to a great deal of friction. In the case of milk, for instance, it was in as many as a half of cases that Somerset House prevailed.[25] The SPA accused government scientists of being unqualified and of using inappropriate methods of analysis. Disputes frequently spilled over into the trade press and sometimes even into popular newspapers. The editor of *Food and Sanitation*, for instance, praised the approach adopted in Paris but was bitterly critical of Somerset House. In 1894 he spoke of the "wretched, ignorant, and utterly untrustworthy system of food analysis at Somerset House". It was a "poor, bungling department struggling to perform work for which it has not got the skill or knowledge". In his opinion, "scientifically the Somerset House chemists are dead, and there exists no shadow of an excuse for their remaining unburied."[26]

There were in essence two problems here, equally relevant in both Paris and London: definitions of the "natural," and the "knowability" of the world through laboratory science. First, food is, of course, organic and therefore variable in its qualities through both time and space. But eliminating fraudulent foodstuffs by defining the compositional characteristics found in the "genuine" article proved to be exceptionally difficult in our study period. There are seasonal variations, and also differences from district to district, and sometimes even from field to field. Anyone familiar with the wonderful complexities of wine vintages knows this from subtle differences in taste that are the result, not just of the grapes used and the methods of fermentation and storage, but also of soil and micro-climate. With milk, there were attempts on both sides of the Channel to state the acceptable constituents. In Paris in 1897 a Municipal Commission concluded that this should be 3.0 per cent butterfat and 8.5 per cent solids non fat, the same as the British Sale of Milk Regulations in 1901.[27] The neat congruence is deceptive, however, because the previous decade had seen heated debates about "genuine" milk and what it was reasonable to ask of farmers. In London, participants included (a) the dairy lobby, who pointed to seasonal alternations of rich and "thin" milk; (b) local authority public analysts, who wanted a high

[24] Dyer and Mitchell, *The Society of Public Analysts*, 2, 16-17.
[25] French and Phillips, *Cheated Not Poisoned?*, 45.
[26] *Food & Sanitation*, 27 January 1894, 25.
[27] Budin, *Commission municipale d'étude*.

standard; and (c) Somerset House, who, without consultation, implemented a low standard. It was only with detailed empirical agronomic research in the early twentieth century that it was possible to put this issue on the sounder footing of observed regularities.

Second, food science matured in the second half of the nineteenth century with developments in organic chemistry. There had been delays earlier because of the difficulty of dealing with organic materials in a precise manner. Accuracy was important for deriving quality standards but, in the case of milk, use of the "lactometer" from about 1800 proved to be most unsatisfactory. The instrument was a modified hydrometer that floated in a milk sample, and the specific gravity (weight per volume) inferred from the volume of displacement was an indication of whether the milk had been tampered with by watering, or was whole and therefore natural. In reality lactometers were far from fool-proof. For instance, cream decreases the density of milk and a sample's specific gravity can therefore readily be manipulated by skimming part of the cream to raise the density and then adding water to reduce it back to the original reading.

The application of chemical techniques to food analysis increased from the 1870s. However, there was fierce rivalry between the proponents of different techniques and significant scientific disagreements emerged about the validity of the methods and their results.

Building a scientific consensus about "genuine" food and about the methods of detecting fraud was achieved in four ways. First, food chemistry came to be increasingly dominated by industrial interests. It was they who invested the most in testing and in the creation of industrial-scale databases of observations under all possible conditions. Quantification and standardized laboratory protocols were intended to establish "technologies of trust" in controversial areas. Thus the series of daily milk samples established a number of features of cow biology that had not previously been understood. First, genuine milk was discovered to be highly variable in its constituents due to a wide range of factors. Second, the early, rather simplistic, focus on butter fat had distorted the industry's understanding of genuine milk and encouraged farmers to engineer a regression to an annual mean for that ingredient, to the neglect of other elements.

Corporate capitals and initiatives were dominant. In the year 1924, the London laboratories of the United Dairies examined seven times more samples of milk and cream than all of the local authorities in England and Wales put together.[28] Henry Droop Richmond, who was Analyst to the Aylesbury Dairy Company for twenty years, in his laboratories alone processed 330,000 samples.

[28] Maggs, "The organization of United Dairies (Ltd)."

Along with Express Dairies, the Cooperative Wholesale Society, and a number of others, these companies dominated research. Few textbooks were available at the turn of the century and Richmond led the field, in Britain at least, with his *The Laboratory Book of Dairy Analysis* (three editions: 1905, 1912, 1925) and his *Dairy Chemistry* (five editions: 1899, 1914, 1920, 1942, 1953), the latter of which was described as "*the* reference book" for all analysts.[29]

Second, methods of testing and laboratory expertise were increasingly geared to the expense and timeliness of techniques of analysis. This was more important than the ultimate degree of precision that could be achieved. For milk, the Babcock technique was a favourite in the 1890s, where sulphuric acid was used to dissolve everything in the milk except the fat. The mixture was then rapidly rotated in a centrifuge to separate the fat and a percentage figure could be read off on the graduated neck of the special bottle provided. The time whirling the samples tied up the expensive equipment, however, and the Gerber acido-butyrometry method eventually triumphed because of the convenience of its apparatus.[30]

Third, both industrial and state chemistry came to rely upon impartial third parties to provide a gloss of objectivity to their work. In 1900 the newly established National Physical Laboratory (NPL) was called in to guarantee the accuracy of Gerber bottles and subsequently they became pre-eminent in the standardization of equipment and techniques generally. The bottles soon were an important element in the income stream of the NPL and may therefore be fairly said to have had a central role in its early years. Gerber bottles were vital to the dairy industry, not only to monitor quality and reduce adulteration but also to reassure farmers who sold their milk to butter factories that they were being paid sufficient for the fat content of their milk.[31]

Fourth, deployment of the law was crucial.[32] In fact, it was through the application of the anti-adulteration laws that scientific expertise was most severely tested. As Porter observes, "courts have been particularly stubborn in believing that science should mean the straightforward application of general laws to particular circumstances".[33] Golan shows how this attitude evolved, with particular reference to expert testimony in the Anglo-Saxon common law tradition.[34] But scientific expertise is in reality more complex and less certain

[29] Hughes, "Pure Food For The People," 24.
[30] Atkins, "Laboratories, Laws and The Career of a Commodity."
[31] National Physical Laboratory, *Regulations*.
[32] For an account of French law-related laboratory work, see Dumoulin, "La médecine légale;" Edmond, *Expertise*, 65–77.
[33] Porter, *Trust In Numbers*, 195.
[34] Golan, *Laws of Men*.

than the expectations of the law, with the result that "the testimony of real living scientists often holds up rather badly in the adversarial courtroom situation" and "research done according to the standards of scientists is often not impersonal and law-like enough to stand up to political and judicial scrutiny."[35] As a result, the science of food analysis had to adjust to the requirements of the law and lawyers if convictions were to be obtained and adulteration eliminated. Laboratories had to be run with reference to methods of analysis known to be acceptable to the courts, and at levels of efficiency in the processing of samples and the reporting of results that would stand up in court. Local authority inspectors had to become authoritative and personable "experts," who could "perform" convincingly in the courtroom, and behind whom there was an administrative and scientific weight that was beyond question.

The gradual accumulation of case law after the Sale of Food and Drugs Acts of 1860, 1872, 1875, 1879, 1899 and 1928, and the issue by successive governments of regulations and explanatory circulars, fostered a changing understanding of the thresholds of legality with regard to food. However, the law was unable to eliminate the fuzziness of science. On the contrary, it revealed, in its pedantic reverence of the statutory text, uncertainties that no-one, from farmer to retailer to scientist, had ever foreseen. It also created injustice by convicting innocent parties and acquitting the guilty; it undermined informal trust that had existed in the trade for decades and encouraged the substitution of complex contractual obligations; and the legal profession flourished on a rash of milk cases (Table 1) that eventually, by their sheer number and high profile, led to political consequences.

Table 1. Issues in milk litigation in Britain, 1870-1914

• Warranty - written undertaking that milk would be whole and untampered with.
• Appeal to the cow—poor milk legal if shown to be unadulterated.
• Grigg v. Smith (1917) - no need for milk to be the outcome of an entire or uninterrupted milking

By 1914 much of the heat had gone out of the dispute between the SPA and what by now was called the Government Chemist's Laboratory. This was because the methodology of milk analysis was broadly agreed upon and the

[35] Bauman, *Modernity and Ambivalence*, 9.

controversy had shifted to the courts and the politics were now between farmers' representatives and the legislators.

Conclusion

What then is expertise and how was it deployed in our case studies? We suggest that expertise in the regulatory situations under scrutiny was a set of constructions of goal-orientated knowledge that were deployed in laboratories, in courts and in the corridors of power, in order to achieve the insertion of rational ordering and standardization of the food supply. This is not to deny a distributed expertise among members of the public and even among the actors responsible for adulteration, but historians have generally found these more difficult to study because of dearth of relevant source material.[36]

The process of urbanization was connected to the rise of national markets in both countries, and also with the number of intermediaries and the complexity of the supply chain. Together with the entry of chemistry into agribusiness production, this raised serious information asymmetry problems, and sometimes it even challenged already established agreements on the definition of product quality. This situation of generalized uncertainty fuelled attempts made by economic lobbies to conquer market share by turning legal rules and market institutions to their own profitable advantage. This was mostly done by influencing official definitions of the quality/adulteration of a given product, which, in turn, made possible the exclusion of some of their competitors from the market. Although the legislative and regulatory frameworks were somewhat different between France and England, in both countries the evidence seems to suggest that commercial interests were dominant.

It was in this context that the question of product expertise arose. In London, as in Paris, different interests of economic association, as well as a lack of coordination with organs of the central state, encouraged municipalities to offer their own services for food inspection and analysis. In France, this fitted with the broader tendency in the first years of the Third Republic of decentralizing powers to municipalities. Municipal laboratories came to supply this service to both the public, and to official and private contractors. As such, public expertise was submitted to the same critique as private transactions, and organoleptic expertise was opposed to chemical analysis. This tension was between two criteria of product evaluation, two notions of the law (one close to administrative-police rules the second to judicial law) and, last but not least, to

[36] But see Hierholzer, "The 'War Against Food Adulteration'."

two different forms of intersection between economics and the law. Scientific analysis led to macro forms of regulation, while organoleptic expertise was much more anchored to micro contractual arrangements.

In France, unlike other European countries (for example Great Britain or Germany) these confrontations were solved by the victory of standardized expertise over the organoleptic, and the state took over the power of municipalities with regard to food control. This process went along with the evolution of food security and food quality rules from civil and/or penal versus administrative penal rules. This was part of a broader transformation (to which it contributed too) of the Third Republic from local to highly centralized forms of power.

In contrast, in Britain, centralization was much less pronounced than in France and, more important, was different in character. Product quality was increasingly linked in our period to a series of centrally defined rules that were negotiated by civil servants and representatives of the food industry. These were empowered by a combination of laws and official regulations, which were then tested and enforced by the courts, starting at the local level in the magistrate's courts and, in a small number of cases, appealed to the High Court. As a result, commercial and administrative rules and legal debate were inevitably bound together; but it is important to repeat and emphasise the contestation that was built in to such a system. Because of disagreements between experts of the same background and between the expertises of traders, scientists, administrators and lawyers, our period has a rich literature and series of case law precedents to draw upon for research. There were also differences across space within jurisdictions, especially in the administratively more diverse English system of governance.

It is our contention that further comparative research is required on food quality in order to understand, not only these varied and contingent histories, but also the common principles that underlie the European experience.[37] Many countries followed the approaches of Britain or France but even those that created their own notions of quality had much in common as a result of the standardizing power of laboratory expertise.

WORKS CITED

[37] For an idea of the methodological basis upon which such comparison can be made, see the thorough and informative treatment of agricultural chemistry in France and Germany in this period by Jas, *Au carrefour de la chimie et de l'agriculture*.

Primary sources

Archives Nationales, Paris (AN)
F 12 (Ministry of Industry and Trade) 6873: Alcohols and wines.
F 12 7417: Laboratoire municipal de Paris.
BB 18 (Ministry of Justice, Criminal division) 6025: Plastered wines.
BB 18 6031: Appellations d'origine.
BB 18 6055: Law of 1905.

Journal Officiel

Food and Sanitation

[Anon.] "Analyse chimique des vins du département de la Gironde, vins rouges de la récolte de 1888 et vins blancs de la récolte de 1887." *Bulletin du ministère de l'Agriculture* 6 (1889): 510–530.

Accum, Friedrich. *A Treatise on Adulteration of Food and Culinary Poisons (..).and the Methods of Detecting Them.* London: Longmans, 1820.

Budin, Pierre. *Commission municipale d'étude de l'alimentation par le lait. Rapport général*. Paris: Imprimerie municipale, 1897.

Chevallier, Alphonse. *Dictionnaire des altérations et falsifications des substances alimentaires, médicamenteuses et commerciales*. Paris: Béchet, 1850.

Du Mesnil, Octave. *Bureaux municipaux d'hygiène. Rapport sur leur mode d'organisation et de fonctionnement*. [Offprint of *Recueil des travaux du Comité consultatif*, vol. XVI.] Paris: Imprimerie Nationale, 1886.

Girard, Charles. *Documents sur les falsifications des matières alimentaires et sur les travaux du laboratoire municipal.* Deuxième rapport pour la Préfecture de Police. Paris: G. Masson, 1887.

Hassall, Arthur. *Food and its adulterations: comprising reports of the Analytical Sanitary Commission of `The Lancet' for the years 1851-1854.* London: Longmans, 1855.

Hogg, Dr. "De l'organisation de l'inspection des substances alimentaires." *Revue d'Hygiène et de Police Sanitaire* (1881): 431–450.

National Physical Laboratory. *Regulations for the Examination of Lister-Gerber and Other Similar Milk Testing Apparatus*. [Teddington: National Physical Laboratory], 1903.

Secondary sources

Atkins, Peter J. "Laboratories, Laws and The Career of a Commodity." *Environment & Planning D: Society & Space* 25 (2007): forthcoming.

Atkins, Peter J., Peter Lummel and Derek J. Oddy (eds). *Food and the City in Europe since 1800*. Aldershot: Ashgate, 2007.

Bauman, Zygmunt. *Modernity and Ambivalence.* Ithaca, NY: Cornell University Press, 1991.

Beck, Ulrich. *Risk Society: Towards A New Modernity*. London: Sage, 1992.

Beck, Ulrich. *World Risk Society.* Cambridge: Polity Press, 1999.

Burnett, John. *Plenty and Want: A Social History of Diet in England from 1815 to the Present Day.* London: Nelson, 1966.

Callon, Michel, Pierre Lascoumes and Yannick Barthe. *Agir dans un monde incertain: essai sur la démocratie technique*. Paris: Le Seuil, 2001.

Callon, Michel and Arie Rip. "Humains, non-humains: morale d'une coexistence." *La terre outragée: les experts sont formels!* edited by Jacques Theys and Bernard Kalaora: 140–156. Paris: Éditions Autrement, 1992.

Collins, Harry M. and Robert J. Evans. "The Third Wave of Science Studies: Studies of Expertise and Experience." *Social Studies of Science* 32 (2002): 235–296.

—. "King Canute Meets the Beach Boys: Responses to the Third Wave." *Social Studies of Science* 33 (2003): 435–452.

Crease, Robert and Evan Selinger (eds). *The Philosophy of Expertise*. New York, NY: Columbia University Press, 2006.

Dumoulin, Laurence. "La médecine légale aux fondements de l'expertise judiciaire: de l'activité de médecin légiste à la profession d'expert." In Special issue "Homo criminalis: pratiques et doctrines médico-légales (XVIe-XXe siècles)," edited by Vincent Barras and Michel Porret. *Équinoxes* 22 (1999): 65–77.

Dyer, Bernard and Mitchell, Charles A. *The Society of Public Analysts and Other Analytical Chemists: some reminiscences of its first fifty years and a review of its activities.* Cambridge: Heffer, 1932.

Edmond, Gary (ed). *Expertise in Regulation And Law*. Aldershot: Ashgate, 2004.

Ericsson, Karl A., Neil Charness, Paul J. Feltovich, and Hoffman, Robert R. (eds). *The Cambridge Handbook of Expertise and Expert Performance*. Cambridge: Cambridge University Press, 2006.

French, Michael and Jim Phillips. *Cheated Not Poisoned? Food Regulation in the United Kingdom, 1875-1938*. Manchester: Manchester University Press, 2000.

Golan, Tal. *Laws of Men and Laws of Nature: The History of Scientific Expert Testimony in England and America*. Cambridge, MA: Harvard University Press, 2004.

Gorman, Michael. "Levels of Expertise and Trading Zones." *Social Studies of Science* 32 (2002): 933–938.

Hierholzer, Vera. "The 'war against food adulteration': municipal food monitoring and citizen self-help associations in Germany, 1870s–1880s." In *Food and The City in Europe*, edited by Peter Atkins *et al*., 2007 (forthcoming).

Hughes, E. B. "Pure Food For The People: The Manufacturers' Contribution." In *Pure Food and Pure Food Legislation: Papers of the 1960 Centenary Conference*, edited by A. J. Amos: 21–39. London: Butterworths, 1960.

Ingold, Alice. *Négocier la ville: projet urbain, société et fascisme à Milan*. Paris: Éditions de l'École des Hautes Études en Sciences Sociales, 2000.

Jas, Nathalie. *Au carrefour de la chimie et de l'agriculture: les sciences agronomiques en France et en Allemagne, 1850-1914*. Paris: Éditions des archives contemporaines, 2000.

Jasanoff, Sheila. "Breaking the Waves in Science Studies." *Social Studies of Science* 33 (2003): 389-400.

Long, William F. "Dickens and The Adulteration of Food." *The Dickensian* 84 (1988): 160–70.

MacLeod, Roy (ed). *Government and expertise: specialists, administrators and professionals, 1860-1919*. Cambridge: Cambridge University Press, 1988.

Maggs, Joseph H. "The organization of United Dairies (Ltd)." In *Proceedings of the World's Dairy Congress, Washington DC, October 2, 3, Philadelphia PA, October 4, Syracuse NY, October 5, 6, 8, 9, 10, 1923*, edited by L. A. Rogers and K. D. Lenoir (eds): 235–41. Vol. 1. Washington, DC: Government Printing Office, 1924.

Mythen, Gabriel. *Ulrich Beck: A Critical Introduction To The Risk Society*. London: Pluto Press, 2004.

Oddy, Derek J. "Food Quality in London and The Rise of the Public Analyst, 1870–1939." In *Food and The City in Europe*, edited by Peter Atkins *et al*., 2007 (forthcoming).

Porter, Theodore M. *Trust In Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton, NJ: Princeton University Press, 1995.

Rip, Arie. "Constructing Expertise In A Third Wave of Science Studies?" *Social Studies of Science* 33 (2003): 419–434.

Scholliers, Peter. "Food Fraud and The Big City: Brussels' Responses to Food Anxieties in The Nineteenth Century." In *Food and The City in Europe*, edited by Peter Atkins *et al*., 2007 (forthcoming).

Stanziani, Alessandro. *Histoire de la qualité alimentaire, 1870-1914*. Paris: Le Seuil, 2005.

Stanziani, Alessandro. "Municipal Laboratories and the Analyses of Foodstuffs in France under the Third Republic: A Case Study of the Paris Municipal

Laboratory, 1878–1907." In *Food and The City in Europe*, edited by Peter Atkins *et al*., 2007 (forthcoming).

Wynne, Bryan. "Seasick On The Third Wave? Subverting The Hegemony of Propositionalism." *Social Studies of Science* 33 (2003): 401–417.