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From laboratory expertise to litigation: the municipal laboratory of Paris and the Inland Revenue laboratory in London, 1870-1914. A comparative analysis

During the second half of the 19th century increasing attention was devoted to food adulteration in several European countries and in the USA. National and local rules were adopted and their enforcement raised several problems. To start with, who was most qualified to lead with expertise on food and drink: scientists or food professionals? And which kind of expertise was superior: organoleptic or standardised "scientific" analysis? In turn, these questions are related to the institutional framework in which the laboratories acted. Administrative, police expertise was quite different from judicial expertise, and there were fundamental tensions between local (municipal) and central authorities. In order to explore these questions we will compare the situation of laboratories in Paris and London. Common issues will be identified, mostly based on the increasing use of scientific arguments and tools in public debate.

In France, the creation of municipal laboratories in the first years of the Third Republic was a major step in allotting responsibility for the sanitary management of food markets. Through a study of unexplored archives, the birth and activity of these laboratories is revealed, in particular of the Paris laboratory, which was the first (1878) and, without any doubt, the most important and controversial. We ask whether this institution was 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 also question whether it was supposed to protect public health (and thus the consumer) or to regulate competition (and, thus, the relationship between traders).

In England and Wales the official government laboratory was in London, operated by the Inland Revenue in Somerset House, and designated by the 1875 Sale of Food and Drugs Act. It acted as a chemical Court of Appeal and sat in judgment on the efforts of local authority analysts. Like in France, there was fierce contestation about methods and standards but there was a difference here in that the expertise of the government scientists was regularly called into question by the Society of Public Analysts and by the press.

In order to provide a basis for comparison, we will address three points. First, we explore the designation of experts, the nature of their methods, and the *imprimatur* of their pronouncements. 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 rather 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. However, in the early 20th 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 completely overshadowed the efforts of the central and local state on milk analysis. It was these 'industrial' laboratories who 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.

Overall, our paper indicates that comparative histories of laboratory expertise are valuable in understanding the evolution of food standards, with important additional perspectives on the development of organic chemistry and of the application of the law to issues concerning the 'natural'.

Paris

As we have demonstrated elsewhere¹, food and drink adulteration in 19th century France was an extremely complex phenomenon which testifies to the inner links between market, rules, and institutions in the process of product quality development. In a context marked by urbanization and a growing commercial intermediation, the question of adulteration was linked to several albeit different processes: the use of organic chemistry in foodstuffs and beverage making; watering down; counterfeiting; commercial fraud. Conflicts among economic lobbies led to the adoption of new administrative and legal rules on food adulteration. This was not only a problem of an imperfect market confronted by information asymmetries; economic actors did not share the same quality convention nor the same beliefs and perceptions concerning quality; because of this, buyers and final consumers in particular could solve the problem of quality uncertainty only with access to more information, precisely because this last could be differently interpreted.

On the supply side as well, 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 public debate and discourse at the time. The hygienist movement made an important contribution. Indeed, under the Third Republic, the influence of scientists increased at the National Assembly and hygiene became an issue throughout the political spectrum. In March 1871, Henri Saint-Claire Deville, at the Academy of Science, called for a direct involvement of scientists in public life.² The foundation of the Society for Public and Professional Health (1877), as well as of the *Revue d'Hygiène et de Police Sanitaire* (1879) was part of this same trend.

In the hygienist discourse, the struggle against food adulteration was part of a broader appeal to social reform. Food and drink adulteration was supposed to concern cheap products, that is, those purchased by the low-income classes. Traders' and capitalists' lure of gain was indicated as the source of the problem. At the same time, hygienists strongly criticized judges who, in their opinion, did not condemn fraudsters,³ while some others

¹ Stanziani, A. (2005) *Histoire de la qualité alimentaire, 1870-1914* Paris : Seuil

² Cité in Murard, Zylberman (1996), *L'hygiène dans la République* Paris, Fayard, p. 41.

³ Brouardel, A. (1881) Discussion following a report by J.-A. Pabst, *Revue d'Hygiène et de Police Sanitaire* 1035-1043.

considered the rules to be quite inadequate⁴. Changing the rules or their enforcement, this was a crucial division in the debate; but, whatever the position, the institutions in charge of food expertise and their methods of analysis were under consideration.

The first question to solve was less economic than political: it consisted of allocating responsibility either to the State or to the municipalities for coordinating a pure food and drink campaign. Since the middle of the 19th century, new institutions were in charge of public health: under the Second Republic, a Consultative Committee for Hygiene was created at the ministry of Agriculture and Trade. However, it really developed its activities only during the 1880s; in 1889, its direction was transferred to the Ministry of the Interior, and the Committee was renamed the High Council for Public Health, while the département councils were placed under the control of local Prefects.⁵

By comparison, municipalities were involved earlier in the battle for pure food and drink since they were given powers under the laws of 1855 and 1867, and the decree of 1859. Municipal inspectors could visit pharmacists, drugstores, grocers and foodstuff retailers; they could also make seizures and take samples. The hygienist movement found its favourite field of action in the city in the interaction between “men” and “milieu”. This meshed with a political tendency in the first years of the Third Republic to grant municipalities increased powers. It was in this context that the question of municipal laboratories arose. After the hygienist international conference held in Bruxelles in 1876 had highlighted the role the municipal laboratory played in that town, the hygienist congress in Paris (1878) stressed the need of organizing similar laboratories in the main French towns. This was done in Paris in 1878, Le Havre 1879, Reims 1882, Rouen 1883, Saint-Etienne and Amiens 1884, and Pau 1885.⁶ In these units, doctors acted as statisticians and demographers as well; they were in charge of hygiene, vaccination and food safety problems. This was so, not only because of budgetary constraints, but also because, according to the hygienist credo, prevention had to be “global” in the sense that it should cover food habits, vaccination, housing, and general education.⁷

This approach was criticised after the trichinosis epidemic. A detailed and scientific inspection of foodstuffs was called for in Parliament and in the town councils as well; a bill was submitted to the Chamber and transmitted to the High Council of Hygiene. Article 1 charged a special service at the Ministry of Agriculture and Trade with responsibility for food inspection, while Article 4 gave food inspectors the same status as policemen and Article 8 attributed this same status to chemists employed by these units. At the Council of Hygiene, the Referee strongly supported this bill, as he maintained that the “progress of industrial chemistry, the cupidity of economic actors and especially the insufficiency of the legislation, encouraged the increase of adulteration.” However, in the ensuing debate, the legal and administrative status of food inspectors and analysts was questioned. One solution consisted in granting the inspectors the power not only of seizing suspect products but also of prosecuting. However, this would have required inspectors to have pecuniary responsibilities in case of mistakes, which was incompatible with French public officers’ (fonctionnaires) statutory duties and the clear distinction in France between administrative and judicial powers.⁸

⁴ Société de Médecine Publique, meeting of 7th December 1881, report by Vidal, ‘La nécessité de nouvelles mesures légales pour réprimer la falsification des substances alimentaires’, discussion in: *Revue d’Hygiène et de Police Sanitaire*, 1882, 32-36.

⁵ AN F 8 170, law of 18th December 1848 and decree of 15 February 1849.

⁶ O. Du Mesnil (1886) *Bureaux municipaux d’hygiène. Rapport sur leur mode d’organisation et de fonctionnement*, Paris, imprimerie nationale, extract in *Recueil des Travaux du Comité Consultatif*, 1886, vol. XVI.

⁷ Du Mesnil, *op. cit.*.

⁸ Dr. Hogg (1881) De l’organisation de l’inspection des substances alimentaires, *Revue d’Hygiène et de Police Sanitaire*, 431-450; E. Vidal, same title, *ibid.*, 674-685.

The final resolution of the Council of Hygiene was an appeal to the government to draw up a special interim regulation while waiting for a more general law. The Council also asked for the creation of special laboratories at the level of départements' Councils of Hygiene and suggested granting inspectors the power of judiciary police.⁹ However, these suggestions were crushed by resistance from business representatives in Parliament, the argument being that these special powers would have strongly limited trade. Economic lobbies' representatives also stressed the lack of competence of inspectors in judging of the quality of foodstuffs and drinks.

Several municipalities thus decided to adopt their own rules on food adulteration. In Paris, the organization of a municipal laboratory was first mooted in 1876, in particular to detect artificially coloured wines. However, this was conceived as a form of public control on the markets; as such, services of the municipal laboratory would not have been accessible to the public, only the police. Such a laboratory was agreed upon in 1878; however, this issue raised protest 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; but to do this two legal solutions were available: the laboratory could be accessed not only by the police and the prefecture, but also by 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 (Table 1).

Table 1. Annual budget of the Paris laboratory (francs)

1879	14,000
1880	14,000
1881	129,800
1882	139,800
1883	206,890

Source: Laboratoire municipal de chimie de la ville de Paris, tarifs, *Revue d'Hygiène et de Police Sanitaire*, 1886, 714-716

This progression is mostly explained by increasing public (municipal and state) subsidies. At the same time, public's growing interest in these analyses also granted the laboratory with larger income. The tariffs in 1886 are shown in Table 2.

Table 2. Paris laboratory tariffs in 1886 (francs)

Charge	Products
Free	<ul style="list-style-type: none"> • Out-of-date food products • Watered down wine
5	<ul style="list-style-type: none"> • wine: proportions of alcohol and extracts; proportions of dry extracts • kitchen salt: proportioning of sodium chloride
10	<ul style="list-style-type: none"> • wine: artificial colouring; • milk: density, colour, proportion of butterfat; • potable water: analysis by hydrometric method; • chicory: proportion of ashes; search for foreign matter • meats, vegetables and preserves: microscopic examination, search for metals

⁹ *Ibid.*.

	<ul style="list-style-type: none"> • sugar: prohibited dyes • sweeteners, glucose, honey: microscopic examination and proportioning with polarimeter
20	<ul style="list-style-type: none"> • wine: tasting, proportion of alcohol, extracts, ashes, tartar, sulphates • beer or cider: density of alcohol, ashes, acidity • flour, breads, paté and pastry: proportion of water, ash, gluten, foreign substances • Syrups and jams: proportion of sugar and glucose; dyes • Butter: water content, mixing with margarine and other greases • Coffee and cocoa: constituents, foreign substances
50	pharmaceutical products, beef extracts
100	drinking water
1,000	mineral water

Source: Laboratoire municipal de chimie de la ville de Paris, tarifs, *Revue d'Hygiène et de Police Sanitaire*, 1886, 714-716

The high price for the analysis of mineral water was partly justified by technical constraints, partly by the fact that this product was still considered a "luxury". Unlike mineral water, the high price of the analysis of drinking water was explained by the fact that this analysis was not required by the public but by the municipality.¹⁰ The other tariffs were only partially justified by their cost, the economic reasoning being based on public utility considerations, that is, to grant lower prices for the most demanded (by the public) analyses.

In 1881, the laboratory made 3,958 analyses free of charge and 378 were paid for by private customers. To this, one has to add 2,181 the samples that municipal inspectors had 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 products, wine was the most analyzed product: in 1883 almost half of the analyses (7,444) concerned wine, 5,280 of them were free of charge (that is related to watering down), 283 were paid for by private customers and 1,581 were 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.

These figures confirm that wine adulteration was in part a public order question and in part a contractual matter between traders and retailers; whereas milk adulteration mostly concerned public officials, and the tensions between producers, traders and retailers were informally solved. The reasons for this can be found in the different organization of the wine and milk markets: while milk retailers and producers were under trade control, in the wine market regional differences were coupled with increasing conflicts between winegrowers, traders and retailers. This also helps to explain the results obtained by the municipal laboratory and the reactions to its efforts. In fact, despite the sharp increase in analysis, 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.).¹¹

However, despite their increase in number, these controls were limited as compared to the size of Paris. For wine alone, every day, 16 to 20 inspectors sampled five bistros. This

¹⁰ On this, see *Travaux du Comité d'Hygiène* and **Murard et Zylberman, op. cit. 1996**.

¹¹ Ch. Girard, Préfecture de police, *Documents sur les falsifications des matières alimentaires et sur les travaux du laboratoire municipal*, deuxième rapport, Paris, G. Masson, 1887

means, 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.¹² Overall, the probability that a food or drink retailer was visited was remote and his incentive to renounce fraud was low, unless his reputation for quality was well-established.

One of the main reasons why economic lobbies strongly opposed laboratory analysis, despite the fact that inspection was rare, was the possibility of a negative reputational effect. The debate focused on methods of analysis. Organoleptic expertise was contrasted with chemical analysis, the former being traditionally the most widespread, while the latter had an increasing success at the turn of the century. Organoleptic expertise was based on professional skill of traders and wine merchants but their professional skills met increasing difficulties when confronted with the wide use of organic chemistry in the agro-food business. When they were defendants in a trial, for instance, traders had to admit that they were not scientists and, as such, could not identify artificial substances in wine or other “natural” products. But, at the same time, these same traders argued that it was a mistake to evaluate “natural” products such as wine only by chemical analysis and they claimed that scientists sometimes confused bad vintages with adulterated products. On these grounds, traders and professional associations criticized the Paris laboratory for using upper and lower limits for several components of wine beyond which adulteration was presumed.¹³ They maintained that this was unreasonable because wine is not a standardized product.¹⁴

Because of such criticisms, the Ministry of the Interior asked the Director of the laboratory, C. Girard, and the Prefect for a detailed report. In his report, 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 contempt for the profit motive of capitalist food industry and advocated the disclosure of detailed information about the composition of foods.¹⁵ Here lies the core of the tension between the municipal laboratory and the professional associations: the latter were ready to satisfy hygienist and public opinion by banning dangerous products for health, but the laboratory, and its director in particular, wanted to push information on quality beyond safety problems in order to fight adulteration.

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

¹² Dr. Hogg, (1881) De l'organisation de l'inspection des substances alimentaires, *Revue d'Hygiène et de Police Sanitaire*, 431-450.

¹³ AN F 12 7417, Analysis records of the laboratory of Paris, January 1884.

¹⁴ AN F 12 7417, Syndicat des vins et spiritueux en gros de Paris et du département de la Seine to Ministry of Commerce, 24 September 1881; AN F 12 7417, Chambre de commerce de Paris, *Rapport sur une note du laboratoire municipal défendant son fonctionnement. Rapport présenté à la chambre de commerce le 28 novembre 1883 au nom de la commission des douanes, entrepôts et marchés par J. Jarlaud*, Paris, imprimerie et librairie centrales des chemins de fer, 1883 ; AN F 12 7417, chambre de commerce de Paris au ministre du Commerce, January-March 1883 ; AN F 12 7417, Chambre de commerce d'Angoulême, exportations des eaux-de-vie de France aux Etats-Unis, meeting of 14 September 1882, Angoulême, imprimerie F. Lugeol et C., 1882 ; Chamber of Commerce of Reims, to Ministry of Commerce, 26 March 1883, Chamber of Commerce of Bordeaux, to Ministry of Commerce, 17 January 1883, 21 May 1884, Chamber of Commerce of Beaune to Ministry of Commerce, 11 June 1884, Chambre de Commerce of Reims, 'Documents sur les falsifications des matières alimentaires et sur les travaux du laboratoire municipal, deuxième rapport à M. le préfet de police', 1885, reprinted in *Recueil des travaux du comité consultatif d'hygiène*, vol. XV, 1885, Paris, 1886, meeting of 21 December 1885 report by Dr. Pouchet, Falsification des vins de champagne, 412-417.

¹⁵ AN F 12 7417, Ch. Girard to Prefect of Paris, 18 June 1884.

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.¹⁶

Despite this attempt to defuse the debate, criticisms did not stop and even increased during the following years, to the extent that some judges in the 1890s even raised doubts about using laboratory analysis, even as simple indices.¹⁷ 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 of wine).¹⁸

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.¹⁹ 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 legitimizing factor.

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, accounting, testimonies). These suggestions left unsolved the problem of the institutional setting in which the standardization of expertise had to be placed: could municipalities be left in charge with 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. The 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.²⁰ 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 laboratory of Paris, 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

¹⁶ AN F 12 7417, Préfecture of Police to Ministry of Commerce, 9 March 1883.

¹⁷ AN BB 18 6025, Letter from Prefect of Paris to Ministry of Interior, 18 March 1895.

¹⁸ *Ibid.*

¹⁹ AN F 12 6873, Decree by the Prssident of the Republic on the Constitution of a Commission of Experts attached to the Ministry of Finance.

²⁰ AN BB 18 6055, Internal note, Ministry of Justice, no date.

refused the laboratory official status and the courts refused to take its analyses into consideration.²¹

London

The situation in England and Wales was similar in some ways. 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.²² 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.²³

Analysts were professionalized by the 1875 Act, but their appointment at the local level 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. On appeal, the latter 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 much 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."

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

²¹ Decrees of 19 March 1907 (*JO* of 7 April 1907) and 13 June 1907 (*JO* of 20 June 1907) ; AN BB 18 6031, Rapport du Procureur Général de la Cour de Cassation to Ministry of Justice, 27 April 1909.

²² In 1881 in London, the Aylesbury Dairy Co. began taking 10-20,000 samples of milk a year and gradually they built up the world's largest database.

²³ There had been previous Acts in 1860 and 1872 that had been ineffective.

²⁴ Dyer B, Mitchell C A (1932) *The Society of Public Analysts and Other Analytical Chemists: some reminiscences of its first fifty years and a review of its activities* Cambridge: Heffer, Cambridge.

²⁵ 47 per cent of milk analyses were challenged in the period 1875-88. French, M. & Phillips, J. (2000) *Cheated not poisoned? Food regulation in the United Kingdom, 1875-1938* Manchester: Manchester University Press.

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 1901.²⁶ 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 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.²⁷ 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.

Table 3. Most popular methods of milk fat analysis, 1870-1914

Method	Technique	Date	Comments
Dry extraction	Wanklyn	1871	Fat extracted from dried milk by ether. Underestimated fat.
	Adams coil	1885	Fat absorbed by blotting paper, and then extracted with ether by the Soxhlet method. 0.5% more fat than Wanklyn.
Solvent extraction	Soxhlet	1880	Chemical extraction in ether.
	aerometric		
	Werner-Schmid	1888	Similar to Gottlieb/Röse but used hydrochloric acid to loosen casein from fat.
Wet extraction	Gottlieb/Röse	1898	An accurate method for legal determination employing ammonia, alcohol and ether.
	De Laval	1885	The 'lactocrite'.
	Lister/Babcock	1889	Disadvantage that three centrifugings required.
	Leffmann/Beam	1892	Superseded by Gerber.
Maceration	Gerber	1892/3	Quicker, less manipulation, used less material than Babcock.
	Somerset House (Bell)	1875	For analysis of sour milk.

²⁶ Budin, P. (1897) *Commission municipale d'étude de l'alimentation par le lait, rapport general*.

²⁷ Normal cow's milk has an average specific gravity of 1.032 as against 1.000 for water.

Source: Atkins, P.J. (forthcoming 2006) Laboratories and laws: the anonymous spokesmen for nature.

The application of chemical techniques to food analysis increased from the 1870s. Table 3 lists the main techniques employed to detect milk adulteration, which can be summarized as 'dry extraction' in the 1870s and 1880s, gradually overtaken in the 1880s and 1890s by 'solvent extraction' and 'wet extraction' methods. There was fierce rivalry between the proponents of these 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.²⁸ Thus, 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.²⁹ Henry Droop Richmond, who was Analyst to the Aylesbury Dairy Company for twenty years, in his laboratories alone processed 330,000 samples.³⁰ 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.³¹

Second, methods of testing and laboratory expertise were increasingly geared to 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 Gerber acido-butyrometry method eventually triumphed because of the convenience of its apparatus.

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

²⁸ The observation series of daily milk samples established a number of features of cow biology that had not previously been appreciated. 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.

²⁹ Maggs J H (1924) The organization of United Dairies (Ltd), pp 235-41 in Volume 1, Rogers, L.A. & Lenoir, K.D. (Eds) *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* Washington, DC: Government Printing Office.

³⁰ He found an average composition of 3.75 per cent fat, 4.70 per cent milk sugar, 3.00 per cent casein, 0.40 per cent albumin, 0.75 per cent ash, and 0.06 per cent other constituents.

³¹ Hughes E B (1960), Pure food for the people: the manufacturers' contribution, pp 21-39 in Amos, A.J. (Ed.) *Pure Food and Pure Food Legislation: Papers of the 1960 Centenary Conference* Ed A J Amos London: Butterworths.

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.³²

Fourth, deployment of the law was crucial. In fact, it was through the application of the anti-adulteration laws in Britain and France that scientific expertise was 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 For Bauman, the sovereignty of the modern intellect “is the power to define and to make the definitions stick - everything that eludes unequivocal allocation is an anomaly and a challenge”.³⁴ But science is in reality more complex and less certain than these expectations demand, 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.” 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’, 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 releasing 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 4) that eventually, by their sheer number and high profile, led to political consequences.

Table 4. Issues in milk litigation, 1870-1914

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

Conclusion

³² National Physical Laboratory, 1903 *Regulations for the Examination of Lister-Gerber and Other Similar Milk Testing Apparatus* [National Physical Laboratory, Teddington].

³³ Porter, T.M. (1995) *Trust in Numbers: the Pursuit of Objectivity in Science and Public Life* Princeton, NJ: Princeton University Press.

³⁴ Bauman, Z. (1991) *Modernity and Ambivalence* Ithaca, NY: Cornell University Press.

The process of urbanization went along with the rise of a national market and, therefore, in the number of intermediaries. This phenomenon, together with the entry of chemistry in the agro-business production raised serious information asymmetry problems, and sometimes it even broke agreements on the definition of the quality of products. This situation of generalized uncertainty gave rise to the attempts made by economic lobbies to conquer market share by turning legal rules and market institutions to their profit. This was mostly done by obtaining official definitions of quality and adulteration of a given product which, in turn, made possible to exclude some of their competitors from the market.

It was in this context that the question of product expertise arose. In the absence of a prior agreement between the various parties on quality, recourse to an external 'referee' was required. This could be either a private or a public service. In large communities with "anonymous individuals", self-regulation may encounter the problem of free-riding and enforcement. In such cases, self-certification may be devised more to confer utility on suppliers than to meet consumer preferences. Such imposed quality may exceed that which will meet consumers' preferences while not being justified by externalities; the excessive cost is born by consumers³⁵. Although partially true, this statement can be strongly nuanced by historical experience, first because public services can perfectly fit private interests and, secondly, because social actors and institutions do not necessarily act in response to maximizing theory hypotheses.

In London, as in Paris, different interests of economic association as well as the lack of coordination between central state administrations encouraged municipalities to offer their own services for food inspection and analysis. In France, this issue fitted with the broader tendency in the first years of the Third Republic to decentralize consistent powers to municipalities. Municipal laboratories came supply this service to both public, official and private contractors. However both the appeal to public institutions, and the methods that they could adopt to evaluate products, were themselves not outside but within the political economy of food security. As such, public expertise was submitted to the same critique as private transactions, and organoleptic expertise was opposed to chemical analysis. This last was a way to promote the standardization of the public expertise, which, in turn, constituted a form of legitimating laboratories and public administrations vis-à-vis the public, while facilitating the coordination between scattered public services. Unfortunately, this form of expertise was unable to take into consideration non-standardized products, that is, the great majority of agro-food and drink products at that time.

In contrast, organoleptic expertise took into account product individualities and kept safe a role for traders and economic professionals in product quality. However this was done at the expense of the possibility to mobilize these expertises into a formal procedural legal framework.

To sum up, the opposition between chemical and organoleptic expertises was that between two criteria of product evaluation, two notions of the law (one close to administrative-police rules the second to judicial law) and, least but not the last, to two different forms of intersection between law and economics. Scientific analysis led to macro forms of regulation while organoleptic expertises was much more anchored to micro contractual arrangements. In France, unlike other countries (for example Great Britain or Germany) these confrontations were solved in that way, standardized expertise won upon organoleptic forms of it, while the State took the power of municipalities on food control. This process went along with a passage of food security and food quality rules from civil and/or penal versus administrative

³⁵ Trebilcock, M. (1983) Regulating service quality in professional markets, in Dewees, D. (Ed.) *The regulation of quality: products, services, workplaces and the environment* London: Butterworth.

penal rules. This issue actually took place in a broader transformation (to which it contributed too) of the Third Republic from local versus highly centralized forms of power. On the contrary, 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.

In both countries, the period 1870-1914 saw complex discussions and conflicts about food quality and security and the various forms of the expertise that emerged confirmed that the process of developing product quality and the market mechanisms in general express neither simple psychological choices (neoclassical arguments) nor institutional constraints (neo-institutionalist approach). On the contrary, markets and institutions, consumption and product quality are included in a definite historical legal and cognitive framework. In the short run, rules and actors' perceptions strongly influenced economic action (not in a strongly deterministic fashion, but rather by fixing a set of possibilities). In the middle and long run, these same actions and perceptions contribute to the evolution of both the cognitive and the institutional frameworks.