# Working in a Transitional Territory? Chemical Consultants in the United Kingdom, 1870-1914

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An example of the evolving identity of chemistry and the chemical profession can be found in the changing activities of chemical consultants in the United Kingdom, particularly in the period leading up to the First World War. To earn a living, consultants typically took on a number of roles including general analytical work, government appointments such as that of public analyst and industrial consultancy. This latter role involved performing process and product control, advising on chemical practice, and undertaking research, activities which have been highlighted by historians such as James Donnelly, David Edgerton, Sally Horrocks, Robin Mackie and Gerrylynn Roberts.[1] However, during the late nineteenth and early twentieth centuries, the territories occupied by chemical consultants changed as professional borders evolved. Initially the chemical consultants worked independently in their own laboratories providing expertise on various chemical questions for a range of customers. By the end of the period, the specific expertise required by government and industry was beginning to be provided by in-house employees in designated laboratories rather than by independent practitioners.

## Changes in the professional borders of chemistry

This review provides a quantitative examination of the changes in professional borders by using the Open University's "Biographical Database of the British Chemical Community, 1880-1970".[2] At the heart of this project is the "Chemists Database" which includes details of the lives of around 9,000 chemists, assembled from a wide-range of sources such as obituaries, membership records of the three major British chemical institutions, the Chemical Society, the [Royal] Institute of Chemistry and the Society for Chemical Industry, and standard biographical works. A part of this database, containing abbreviated records of around 4,900 individuals, can be viewed on the website: *<http://www.open.ac.uk/ou5/Arts/chemists/>*. The paper is divi-

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ded into two parts. The first half contains a statistical profile of consultants' careers and establishes the percentages of chemists working as independent consultants and presents data on their qualifications, geographical locations and type of employment, exploring how these factors changed over time. In the second half of the paper, having briefly examined the careers of some consultants, their activities will be placed in a wider context and the shifts in the professional boundaries within which they were working is explored.

Although a full understanding of the construction and composition of the "Chemists Database" is unnecessary for the purposes of this paper, a brief explanation of certain aspects is helpful for interpreting the data presented. To study the activities of chemical consultants in the United Kingdom, all chemists selected from the database are those who can be classified as working in the consulting sector. To assess changes occurring in their activities over time, these chemists are divided into two periods, 1877-1886 and 1887-1917. These date ranges are based on the date of entry of each individual to any of the three major British chemical institutions, the membership records of which form the foundation of the database. The start and end dates of the periods arise from changes in the membership criteria of one of the three societies surveyed, namely, the Institute of Chemistry.

Twenty-seven percent of chemists in the British chemical community[3] who joined one of the three societies in the period 1877-1886 were employed as consultants at some point in their careers, with twenty-two percent of the joiners from the second period working in this sector. However, even with this drop, over one fifth of all chemists who joined the three societies in the years leading up to the First World War worked at some point during their careers in the consulting sector. The individuals included in the 27% and 22% form the basis of the data explored in the remainder of this paper. By looking at which chemical institutions they belonged to, their qualifications, geographical locations and employment, it is possible to shed light on who those working as consultants were, and what they did during the course of their careers.

## Profiling Consultants

***Table 1. Membership of Chemical Societies***

| *Institution* | *% of Society Membership working as consultants* | |
|---|---|---|
| | **1877-1886** | **1887-1917** |
| Chemical Society | 43 | 31 |
| Institute of Chemistry | 57 | 39 |
| Society of Chemical Industry | 22 | 19 |

As the data in Table 1 shows, a significant percentage of the membership of all three chemical societies worked as consultants, although (in line with the overall decline in the numbers working in this sector) these percentages were larger for those joining in the first compared to the second period. That the percentages are highest for the Institute of Chemistry (IC) is not surprising. It was consulting and analytical chemists who were instrumental in the foundation of the Institute in 1877, at a time when professional boundaries within the subject were being delineated. The Institute and its remit thus reflected their professional concerns[4]. Membership of the Institute constituted a qualification and for those working in independent consulting practice this provided evidence of their professional skills to potential customers.

Data on the qualification levels attained by consultants is provided in Table 2. As a group, consultants were highly qualified, especially with regards to holding a higher degree – one third of those joining in the first period possessed a doctorate.

***Table 2: Qualifications of Consultants***[5]

| | *All Bachelors* | *All Masters* | *All Doctorates* | *All IC* | *IC & Degree* | *IC Only* |
|---|---|---|---|---|---|---|
| | | | **CONSULTANTS (%)** | | | |
| 1877-1886 | 20 | 7 | 33 | 53 | 20 | 33 |
| 1887-1917 | 36 | 11 | 28 | 52 | 29 | 23 |
| | | | **BRITISH CHEMICAL COMMUNITY (%)** | | | |
| 1877-1866 | 27 | 5 | 25 | 39 | 16 | 23 |
| 1887-1917 | 44 | 12 | 19 | 39 | 24 | 14 |

Comparing consultants with the wider British Chemical Community, Table 2 shows that whilst members of the British Chemical Community were more likely to hold a Bachelors' degree, consultants were more likely to have obtained a doctorate. Again the importance of qualification through the Institute of Chemistry is clear: 53% & 52% of consultants joining in the first and second periods, compared to 39% (for both periods) of the wider community were members[6]. In fact, for joiners in the first period 33% of consultants compared to 23% of the wider community held only the Institute of Chemistry certification as a qualification. This is not unexpected. A key objective for the consulting and analytical chemists, who were instrumental in establishing the Institute of Chemistry, and subsequently creating its examinations system, was to demonstrate professional competency. Many practitioners who had developed their chemical and analytical skills

through a combination of apprenticeship, employment as an analytical assistant and unexamined studies at a range of institutions became members of the Institute for this reason.

***Table 3. Geographical Locations***

| *Location* | *1877-1886 (%)* | *1887-1917 (%)* |
|---|---|---|
| London | 27 | 22 |
| South-East | 8 | 7 |
| South-West | 6 | 3 |
| W Midlands | 5 | 4 |
| E Midlands | 2 | 2 |
| East Anglia | 1 | 1 |
| Yorkshire | 6 | 5 |
| North-West | 11 | 10 |
| North | 3 | 2 |
| Wales | 3 | 2 |
| Scotland | 6 | 5 |
| N Ireland | 1 | - |
| Irish Republic | 3 | 1 |
| UK & Ireland General[7] | 7 | 6 |
| Overseas | 9 | 26 |
| Unknown | 3 | 4 |

As table 3 illustrates,[8] consultants worked in a range of locations throughout the United Kingdom and also overseas during the course of their careers. London was however the dominant location for consultants within the UK. Of consultants joining one of the three societies in the period up to 1886, 27% spent part of their careers in London, with 8% based in the South East. Although it was founded as a national organisation, this partly reflects the Institute's metropolitan focus. However it also reflects the needs of the types of firms located in this area. These were often highly specialised businesses in a range of manufacturing industries such as dyestuffs, pharmaceuticals and metals. Crucially, the expertise provided by consultants was especially suited to these firms' requirements. Similar figures apply to those joining during the years 1887-1917, with 22% of consultants based in London and 7% in the South East. However consultants were not solely London based: for those joining in the years 1877-1886, 11% worked in the North West, again reflecting the concentration of industry there, while 9% spent part of their careers overseas. Many of these individuals worked in more than one region

during their working lives. The flexible nature of the independent practitioner's work facilitated holding multiple appointments and made it easier to take up employment in additional or new locations. In general, similar figures apply for those joining in the second period, with the exception of the high 26% working overseas. The flexibility of consulting work no doubt facilitated overseas employment in this sector, particularly in the Dominions and British colonies. However it is interesting to note that amongst the wider British chemical community overseas employment also peaked at 31% for those joining the three societies between 1887 and 1917.[9]

Consultants were not only geographically mobile; they were also occupationally versatile, working additionally in academia, industry, government and other sectors.[10]

***Table 4. Number of Employment Sectors***[11]

| *Number of Employment Sectors* | *1877-1886 (%)* | *1887-1917 (%)* |
|---|---|---|
| 1 | 16 | 21 |
| 2 | 46 | 49 |
| 3 | 31 | 25 |
| 4+ | 7 | 6 |

For the majority of consultants, their work in the consulting field was part of a multi-sector career, something which reflected the numerous applications and flexibility of chemical skills. 84% of those joining in 1877-1886 and 80% of those joining in 1887-1917 worked in at least two sectors, with 38% and 31% in three or more. Work in consulting was most commonly combined with employment in industry (22% and 31% respectively) or academia (16% and 8%), with 9% and 10% working in all three sectors during the two periods of joining. While the overall percentage of those working in the consulting sector decreased from 27% to 22% over the two periods, more consultants who joined in the years 1887-1917 worked only in this field (21% compared to 16%). This perhaps reflects the continued importance of the private consulting practice. For example, although he had worked in government and industry as part of his training, Horatio Ballantyne (1871-1956), after appearing as an expert witness in the Welsbach Incandescent Gas Light Co. patent infringement case, set up as a consulting chemist in London in 1896 and established a reputation as an authority on chemical processes patent law.[12]

However, it is the 22% rising to 31% of chemists that worked in both the consulting and industrial sectors whose careers are the most striking. Consultants'

increasing involvement with industry reflects the growing employment of chemists from the wider British chemical community in this sector. 64% of chemists joining the three societies in the period 1877 to 1886 worked in industry, a figure which is already greater than many might expect given the common perception that Britain's failure to apply science to industry was one cause of industrial decline. Furthermore the percentage working in industry rose to 72% for those joining in the period 1887-1917. Although not to the same extent as in industry, consultants were also finding more work within government laboratories. Those working in both the consulting and government sectors rose from 4.5% to 7% across the two periods of joining. In the wider British Chemical Community, government employment grew from 13% to 16% over the same time-scale.

## Consultants' Careers

From the data previously presented it is clear that the role of consultants within the chemical community in the years leading up to the First World War was changing as the specific expertise required by government and industry began to be provided by in-house employees rather than by independent practitioners. This will be examined further by looking briefly at the careers of some individual consultants, exploring their links with industry and placing their activities in the wider context of the developing provision of in-house chemical expertise within the firm.

Frequently, the model adopted in Germany and the USA in the late-nineteenth century, where large firms often built up teams of scientific and technical experts who carried out research and tested processes within the organisation, is presented as the norm for industrial activity.[13] However, as in other areas of firm development, British firms may have preferred to rely on external solutions and buy expertise in an open market. That at least one-fifth of chemists joining the three societies worked in the consulting sector in the period up to the First World War suggests that there was significant demand for such individuals. Consulting chemists provided a range of chemical services for firms which included performing process and product control, analysing samples, advising on chemical practice, testing new products and undertaking research.[14]

As David Edgerton and Sally Horrocks have highlighted "many firms employed consultants for both analytical testing and R & D of new products before establishing their own in-house facilities".[15] This applied to William Chattaway's work for the chocolate manufacturers Cadbury Brothers. He performed analyses and

visited Cadburys' works in a consultative capacity for four years up to 1902.[16] In the previous year, 1901, Nathaniel Parr Booth, who had previously worked as a junior analyst under Chattaway, was appointed as Cadbury's first chemist.[17] Chattaway's main employment was as Superintendent of the Drug Trade at Apothecaries' Hall, Blackfriars, London, from where he operated a consultancy practice. Providing expertise for Cadburys was just one aspect of this practice. In a designated laboratory containing equipment including a polarimeter, refractometer and microscope, in addition to basic glassware, balances and burners,[18] chemical analyses and research were performed for customers as diverse as the General Post Office, the Crown Agents for the Colonies and a toothpaste inventor called Mr A. G. England.[19] Chattaway also held government appointments which contributed to his consultancy practice – he was public analyst for both the London Borough of Hammersmith and the town of Colchester in Essex. Later on, the Hall analytical laboratory provided drug standardisation services for a range of pharmaceutical firms before they established in-house laboratories which were licensed for animal testing. From 1909, the drugs digitalis, squill, strophanthus, cannabis indica and ergot were physiologically standardised in the Hall analytical laboratory for firms which included Boots, British Drug Houses and Allen & Hanburys.[20]

The utilisation of outside expertise to provide process and product control, as well as advice on chemical practice, can be seen in a range of sectors within the chemical and related industries. As Sally Horrocks has highlighted in her PhD thesis, the biscuit manufacturers, Huntley and Palmers, provide another example of consulting activity being a precursor to employing in-house chemical expertise. Huntley & Palmers consulted various local chemists prior to creating a full-time post in 1907. For example, John Cuthbert Welch, while employed at the nearby brewery H & G Symonds in Reading, advised on the supply of manufacturing equipment to the biscuit manufacturers.[21] Other consulting chemists provided chemical services for firms through established laboratory practices. For example, Alexander Norman Tate owned an analytical and consulting practice in Liverpool, A Norman Tate & Co, which specialised in the analysis of oils, waxes and fats for W H Lever and other soap and food manufacturers.[22] As had occurred with Cadburys and Huntley & Palmers, the use of consultants here was again a precursor to the employment of in-house chemists. Although it requires more investigation than is possible in this paper, perhaps we can see this employment of chemical consultants as a transitional stage before in-house research laboratories with research chemists came to be widely adopted in Britain in the first half of the twentieth century.

## Shifting Boundaries

That this stage was transitional can be seen when we look at the prominence of consulting in the chemical career over a longer period. Although the overall proportion of chemists employed in consulting who joined the three societies in the periods 1877-1886 and 1887-1917 remained high, we have already seen that there was a decline in the percentage working in this sector between the first and second periods, from 27% to 22%. Taking entrants to the three institutions over the entire duration of the database, this decline accelerated sharply after the First World War.

***Table 5***
***Percentage of Consultants in the British Chemical Community***

| | *1877-1886* | *1887-1917* | *1918-1943* | *1944-1956* | *1957-1970* |
|---|---|---|---|---|---|
| **% Consultants** | 27 | 22 | 14 | 11 | 10 |

As more chemists were employed within firms, the consultant's role moved away from supplying chemical skills from the outside to that of providing expertise from within. As the data in Table 5 shows, the percentage working in consulting declined sharply from 22% to 14% between the second and third periods. The function of the consulting role within the chemical career also changed. A new type of consultant emerged – the individual who turned to consultancy after retirement, perhaps early, from a long industrial or institutionally-based career.[23] This is illustrated by the career of John Frederick Briggs (1871-1963), Chief Chemist to the British Cellulose & Chemical Manufacturing Co from 1916, (British Celanese Ltd from 1925). He remained with this firm until his retirement, but continued with them as a consultant until shortly before his death in 1963.[24]

With around one-quarter of all chemists who joined the three chemical societies in the years leading up to the First World War working as consultants, the significance of consulting as part of the chemical career at this point must not be undervalued. Such work was particularly important with regard to the contributions it made to British industry. Although services such as performing process and product control, advising on chemical practice, and undertaking research took place outside of the firm and thus were often hidden from view, they should not be overlooked. Given the prominence of the consultant in the chemical career at this time, perhaps the period traditionally associated with British industrial

decline, can now be seen in a different light. Instead of concentrating on a perceived absence of the industrial research model adopted in Germany and the USA, we can see it as a stage where the consultant's role was prominent, with chemical expertise provided externally for UK firms by independent practitioners.

However the territory that consultants occupied at this point was only transitory. As the data in Table 5 illustrates, the percentage of chemists working in the consulting sector declined sharply amongst those joining the three societies after the First World War. Increasingly the specific expertise required in government and industry was beginning to be provided by in-house employees rather than by independent practitioners. The nature of consulting was also changing to a role pursued at the end of a career, rather than at its centre. These differences had roots both within the changing relationship of chemistry with other disciplines and the developments taking place within the chemical and allied industries, factors which provide plenty scope for further investigation. As chemistry's identity evolved the dynamic and versatile contributions made by consultants to the economy were transformed.

## Notes

[1] David Edgerton and Sally Horrocks, "British Industrial Research and Development before 1945," *Economic History Review* 47 (1994): 213-38; James Donnelly, "Structural Locations for Chemists in the British Alkali Industry, 1850-1910," in *The Chemical Industry in Europe, 1850-1914: Industrial Growth, Pollution and Professionalization,* eds. Ernst Homburg, Anthony Travis and Harm Schröter (Dordrecht: Kluwer, 1998), 203-19; Robin L. Mackie and Gerrylynn K. Roberts, "Career Patterns in the British Chemical Profession during the Twentieth Century," in *Origins of the Modern Career,* eds. David Mitch, John Brown and Marco van Leeuwen (Aldershot: Ashgate, 2004), 317-36.

[2] Robin L. Mackie and Gerrylynn K. Roberts, "Biographical Database of the British Chemical Community, 1880-1970," *http://www.open.ac.uk/ou5/Arts/chemists/*

[3] By virtue of the sources from which it is constructed, the complete database does contain individuals who spent their entire education and career overseas and had no link to the UK other than society membership. To eliminate such individuals, the chemists referred to in this paper are a group we have defined as "British" by virtue of factors such as employment or education in the UK. This group is referred to in this paper as the British Chemical Community. For an investigation of the entire database and its overseas constituents see G.K. Roberts and A.E. Simmons, "The Overseas Dimensions of British Chemical Societies, c.1890-c.1950," *Historia Scientiarum* 16 (3), March 2007, 224-43.

[4] Colin A. Russell, Noel G. Coley and Gerrylynn K. Roberts, *Chemists by Profession: The Origins and Rise of the Royal Institute of Chemistry* (Milton Keynes: Open University Press, 1977), 135-57.

[5] Data is given as a percentage of those for whom we have information on their education. "All" refers to all individuals in the categories of "Consultants" and "British Chemical Community" who held a bachelors, masters, doctorate etc.

[6] The figures are different from table 1 because table 2 reports the percentage of the 27% and 22% of consultants who joined the Institute, whilst table 1 reports the percentage of the entire IC membership who worked as consultants.
[7] This figure represents the chemists who we know were working in the UK and Ireland but for whom we have no exact geographical location.
[8] The percentages in table 3 have been normalised to 100%.
[9] For those joining between 1877 and 1886 the figure is 13%.
[10] The "other" category includes a wide range of employment fields, such as medicine, military service, finance, the law and administration.
[11] Data is given as a percentage of those for whom we have information on their careers.
[12] *Journal of the Royal Institute of Chemistry* 80 (1956): 245-46; *Chemistry & Industry*, 6 Jan 1933, 5.
[13] A.D. Chandler, *Shaping the Industrial Century: The Remarkable Story of the Evolution of the Modern Chemical and Pharmaceutical Industries* (Cambridge, Mass.; London: Harvard University Press, 2005), 114-43.
[14] Mackie and Roberts, "Career Patterns."
[15] Edgerton and Horrocks, "British Industrial Research," 220.
[16] Apothecaries' Hall Archive, Society of Apothecaries, London: Management Committee Minutes (hereafter MCM), 19 May 1902 and 25 November 1902.
[17] S.M. Horrocks, "Consuming Science: Science, Technology and Food in Britain, 1870-1939," PhD Thesis, University of Manchester (1993): 107-8.
[18] Apothecaries' Hall Archive, E/7 Loose Papers, Box 4, Inventory of Analytical Plant and Apparatus.
[19] Apothecaries' Hall Archive, E/7 Loose Papers, Box 5, Papers re contract for manufacturing England's patent toothpaste. For General Post Office: MCM 15, 22, 29 November 1904. There are numerous references to work performed for the Crown Agents, see A.E. Simmons, "The Chemical and Pharmaceutical Trading Activities of the Society of Apothecaries, 1822-1922," PhD Thesis, The Open University (2004): 211-16.
[20] Simmons, "The Chemical and Pharmaceutical Trading Activities," 242-46.
[21] Horrocks, "Consuming Science," 87, 89; Entry for J.C. Welch in Mackie and Roberts, "Biographical Database."
[22] *Journal of the Society of Chemical Industry* 9 (1892), 594; *Proceedings of the Institute of Chemistry* (1892), ii, 24-6; *DNB*.
[23] J.A. Radley, "Why Consultancy?" *Chemistry in Britain* 3 (1967): 250–52.
[24] *Journal of the Royal Institute of Chemistry*, November 1963, 400; *Chemistry & Industry*, 23 November 1963, 1869-70.