

# Introduction

Nineteenth-century Britain witnessed an enormous growth in the scope and size of central government. The same period saw major scientific advances, huge industrial development based on coal and steam power, and new medical understanding and procedures. To what extent are these great changes connected? This book brings together perspectives from the history of science and the history of the state to explore this question, and to focus on the influence of scientific, engineering, and medical expertise on national policy and administration.

While both politics and expert advice may represent the “art of the possible,”<sup>1</sup> their objectives, values, and practices are often in tension. As the state responded to the military, social, economic, and environmental challenges of the nineteenth century, the practitioners of science, engineering, and medicine, almost entirely men, were drawn into close involvement and contestation with the politicians.<sup>2</sup>

Several sets of questions arise: What were the social and political imperatives, and the scientific, engineering, and medical developments in this period that drove or offered opportunities for the government or Parliament to seek expert advice? How did the practitioners of science, engineering, and medicine achieve authority and influence with the British government and Parliament? What were the most significant political and cultural constraints within which they had to operate? To what extent was advice sought from individuals or from institutions? What were the roles in which individuals

acted? How were they appointed, employed, and remunerated, or otherwise recognized? How did individual personal qualities, networks, and relationships influence their appointment, and the structures and modes of providing advice? Standing back, looking over the course of the nineteenth century, what factors shaped the system of advice that developed? How different was the system at the end of the nineteenth century, leading up to World War I, compared to its nature at the beginning?

The intent of this book is to take a broad approach, across both military and civil policy areas. That allows connections to be made and trends perceived across an entire century, with glances back to eighteenth-century roots and glimpses forward to the twentieth century. It means that nuances and detail will be lost in individual policy domains. I have left a trail of references to enable anyone to explore particular aspects in more depth, and can only regret any omissions of work that other scholars might have expected to see acknowledged.

### SCIENTIFIC ADVICE AND THE STATE

In twenty-first-century Britain, scientific advice to government is highly organized, integrated across government departments, and led by a chief scientific adviser who reports to the prime minister. Each individual government department has a chief scientist, formally a civil servant, who acts as the broker of advice within that department. Some of these may be engineers or social scientists, and there is a chief medical officer at the Department of Health. The beginning of the nineteenth century reveals a very different picture. The word *scientist* was not coined until 1833,<sup>3</sup> and was barely used in Britain until the twentieth century. Likewise, the terms *expert* and *expertise* did not come into colloquial use until the 1860s.<sup>4</sup> The meanings of *science*, *scientific advice*, and *expertise* will be treated here in a fluid manner.<sup>5</sup> They will often encompass as a shorthand both engineering and medicine, although the specialties will be distinguished where appropriate. What counts as *scientific advice* or *technical expertise* to inform policy and its implementation is as much determined by who is prepared to listen and confer validity on it, as it is by who claims to offer it, and by the actual basis of such claims. From the point of view of practical politics, *expert advice* is a combination of what its protagonists claim it to be and what its recipients accept as valid.

The men of science, or savants, of the day were those who derived their knowledge of the natural world from experience, observation, and experiment, and include those who sought to understand human behavior and society in an analogous manner. They encompass mathematicians, natural philosophers, physicists, chemists, geologists, natural historians, biologists, and statisticians.<sup>6</sup> Engineering, growing out of practical and artisanal skills

and knowledge, developed further as mathematics and the theoretical understanding brought by physics and chemistry offered greater rigor and further opportunities for innovation. The medical profession, a career with a status rather below that of the law and the church at the turn of the nineteenth century, became increasingly scientific, suffering constant tensions between its different elements, and between medical practitioners and the advocates of new scientific research. The developing social sciences are not treated in detail here.<sup>7</sup> The “state” is envisaged as the whole system of institutions and processes that constitute the direction and management of Britain as an entity, national and local. Britain emerged from the eighteenth century as a “fiscal-military” state.<sup>8</sup> It had powers to raise money to finance wars that enabled it to increase its colonial possessions, and to control trade and commerce that allowed it to benefit from those conquests. In 1811, during the Napoleonic Wars, one half of all government expenditure, £43 million out of £85 million, was spent on the navy, army, and Board of Ordnance.<sup>9</sup> This fiscal-military state of the late eighteenth century, with its aristocratic ethos, evolved into the liberal but more centralized and bureaucratic state of the nineteenth century, now rooted in free trade.<sup>10</sup> The emphasis of this book is on advice to the executive and the legislature—in other words, to government and Parliament, alongside the civil service and the military, and in the context of other institutions such as private corporations, charities, and social and professional associations. This complexity makes the concept of a single identifiable “state” problematic. The responsibilities and powers of different public bodies were less coordinated at the beginning of the nineteenth century than they were at the end. Courts, towns, parishes, and other local bodies had substantial autonomy, and there were strong political pressures tending to favor local over central control. This tension between the local and central elements of the state runs throughout this book. There were also differences, many of which still exist, between England and Wales, Scotland, and Ireland. Ireland only became part of the United Kingdom in 1801, with representation in Parliament at Westminster.

### DRAWING BOUNDARIES

Some boundaries must be drawn. Policies on primarily social issues such as education, crime, policing, prisons, and labor relations are not addressed here in any detail.<sup>11</sup>

This book does not tackle government support for the scientific research community nor government furtherance of scientific, technical, or medical education. Throughout the nineteenth century, many people within the scientific community lobbied for funding from the state for the systematic support of scientific research and of individual researchers, without great success.<sup>12</sup> British governments left fundamental scientific research to private initiative,

but encouraged practically oriented science where it offered benefits to the state. The scientific community was split on this. Although many sought the endowment of research by government, others considered it best done by private means, as they would retain independence. Men of science also lobbied for parliamentary legislation and money to improve scientific and technological education, with somewhat more success. Both these dimensions have been extensively investigated, through numerous case studies and broader assessments.<sup>13</sup> By contrast, this is a book about science for policy, not policy for science, although the two are inevitably linked. It is the technical content and relevance of advice that is emphasized.

There are many individual studies of the nature and impact of scientific advice on particular policy areas. But although there has been recent research in specific domains, relating to both civil and military policies and practices, there is little synoptic overview.<sup>14</sup> Such a synthesis is attempted here. Nevertheless, the emphasis is on Britain's domestic policies rather than on its colonies and extending empire. They would deserve a volume to themselves. But it seems likely that the manifest usefulness of the scientific experts in colonial expansion reinforced their authority in domestic affairs too.<sup>15</sup>

I have taken a policy-led approach to writing this account. Two introductory chapters, presenting context on the state of science and scientific institutions in the early nineteenth century, are followed by twelve chapters on different policy areas. Within each chapter the treatment is for the most part chronological. The consequence of this approach is that common issues recur with different emphases in different domains. I start with two chapters on military policy. That is partly because the fiscal-military state of the late eighteenth century already had a strong demand for scientific and technical expertise but also because the factors affecting military policy prove to be distinct from those affecting civil policy. The ten following chapters address these civil policy areas, concentrating on social and industrial issues. While some analysis is offered in individual chapters, they are primarily descriptive of what occurred, highlighting the research evidence. The final chapter seeks to bring out the key themes arising from these narratives, and sets out my overall analysis and conclusions.

In considering the existing literature on these various policy areas, it becomes evident that historians have taken different approaches depending on the topic.<sup>16</sup> For example, with respect to the military and to transport systems, there is much focus on technological developments connected to the state. In public health, by contrast, theories of disease interact with disputes about appropriate local and central state relationships. In the area of utilities, such as gas provision, economic issues and the role of the private sector may be stressed over the provision of technical expertise. Studies have also been

made from the point of view of the legal system—for example, in the case of river pollution seen from the perspective of the nuisance laws. I do not engage critically with these contrasting approaches, but my method of building this account upward from the Parliamentary Papers (described below) enables me to some extent to cut across these differences.

### THE EVIDENCE BASE

The main thesis of this book is that the expanding administrative system of the state at the central level, across multiple policy areas, was piecemeal and pragmatic, in contested interaction with several major constraints. Throughout the nineteenth century, the driving force was the development of scientific, engineering, and medical knowledge, expertise and authority, in conjunction with the increasing range and impact of social and political pressures for action on issues to which technical advice could be relevant. In the civil policy areas, the constraints are rooted in the liberal culture that prevailed during the nineteenth century, almost regardless of party politics.<sup>17</sup> Four overarching principles and beliefs, widely held throughout nineteenth-century society, emerge from the evidence presented here to set the primary constraints within which politics and expertise were contested. They are the sanctity of private property, the *laissez-faire* approach to capitalist private industry,<sup>18</sup> the emphasis on individual freedom and responsibility, and the importance of local government. These political forces will be met repeatedly as the chapters unfold.

I take as my starting point the deliberations and actions of central government and Parliament, the executive and the legislature. In legislative terms, Parliament can pass public acts, which change the general law, as well as private acts, also known as local and personal acts, which affect the powers of individual groups such as local authorities or private companies. These might encompass services such as public health provision in specific towns, or the development of individual railways. Local authorities could also acquire powers under public acts. They could incorporate clauses from public clauses acts—for example, to provide gas services or to acquire land, and adopt permissive clauses or general powers, such as making bylaws, under specific public acts.

This book focuses on central government and administration, and hence on public acts affecting the nation as a whole, or at least England and Wales. The scrutiny of public bills by select committees of Parliament prior to legislation was thorough, generally involved a range of expert advice, and had parliamentary confidence. Private bills, by contrast, received no independent expert evidence on technical aspects.<sup>19</sup> Instead, they were contested by affected local interests, who might commission experts to bolster their opposing cases. Most reports on private bills were unpublished.<sup>20</sup> The nature and operation of

private acts inevitably informed national discussion and legislation, especially in areas such as infrastructure, transport, and public health.<sup>21</sup> The endemic tension between the local and the national led to iterative processes throughout the century, in which both national and local systems of government and administration evolved together. While acknowledging that, I concentrate here on the national perspective.

The reports of select committees on public bills, of royal commissions, of boards and commissioners, and of committees of central government departments, form the primary evidence base for this book. These reports were generally published, and in the case of select committee and royal commission reports in particular, they contain effectively verbatim transcripts of all the oral evidence. Allowing for the fact that these are constrained by formal processes, they nevertheless enable the authentic voices of parliamentarians and experts to be heard. It is this national level that is the major locus of diverse and independent scientific advice even if, in some policy areas such as public health, local initiatives preceded and strongly influenced later central government action. A detailed analysis of expert advice to committees scrutinizing local bills, and to local authorities themselves, would make an interesting complement to this study.

I have consulted more than seven hundred Parliamentary Papers, and list those I have referenced in a separate bibliography at the end of the book. These include reports of committees and commissions, and the evidence presented to them, as well as administrative papers. In making such extensive use of government publications, published and often sold in the “blue books” that avalanched out of the government’s printers, I am following the lead of so many members of the Victorian public.<sup>22</sup> These publications were widely read and quoted, in newspapers, periodicals, and by private individuals, as were parliamentary speeches, captured also in *Hansard*. They were a means of informing the public and stimulating debate, as well as of influencing legislation or of improving administration, and for parking politically difficult problems.

Select committees and royal commissions prove particularly important.<sup>23</sup> Select committees, of either the House of Commons or the House of Lords, are established by Parliament. Their membership consists solely of parliamentarians, and their role is to scrutinise bills, or other matters that Parliament considers important. Witnesses, including technical experts, can be invited to give evidence under questioning, and the committee presents this evidence and its report to Parliament. Royal commissions, by contrast, are tools of government designed to explore particular issues in detail, often over many months or even years. Their purposes may include making recommendations on legislative or administrative changes, or kicking difficult issues into the long grass. The memberships of committees and commissions are chosen under political

pressures to advance particular agendas. Those invited to give evidence may be selected to put forward specific views, or to buttress arguments that members wish to advance. Equally, witnesses to committees and commissions would know that they could put their views on the record to quote them later with the authority of a parliamentary paper. Their views would need to be acceptable, or at least to represent substantial and unavoidable opinion, if they were to be heard at all. Radical views threatening the political order would find purchase difficult. It is unsurprising to find that so many influential advisers were moderate in their politics, broadly sharing the agenda of the ruling class. The radical socialists, Chartists, and trade unionists, with limited representation in Parliament, had to make their views known through other means such as pamphlets, protests, and strikes.

The treatment here is in the British context rather than by comparison with other countries, although reference is made at times to international issues and constraints. The position of the scientific community in Britain, in relation to government, was different to that in places such as France, Germany, and the United States, as the political systems were so distinct. Compared to forms of the state in, for example, autocratic Prussia and revolutionary “statist” France, Britain was more politically liberal and less centralized.<sup>24</sup> The revolutionary upheavals on the continent and in the United States, the formation of countries such as Italy and Germany in the second half of the century, and the different national scientific cultures, give unique contexts to policymaking. Educational institutions were predominantly private in Britain, unlike the case in France and Germany. Many influential members of the British governing class shared a broad scientific interest and outlook, exemplified by their membership of the independent Royal Society of London for Improving Natural Knowledge (see chapter 2). There was therefore a receptive culture toward scientific expertise in general, which lasted throughout the nineteenth century under a stable political culture that avoided revolution. In France, the Académie des Sciences and the major educational institutions were part of the state.<sup>25</sup> Scientific figures were prominent advisers to King Louis XVI prior to the French Revolution. They were also members of the elite under Napoleon Bonaparte, either in government or as trusted advisers, but within a highly centralized system that persisted.<sup>26</sup> Later still, during the various French political upheavals, some became ministers. It has been argued that scientists in Germany, who tended to come from lower social backgrounds than in France or Britain,<sup>27</sup> had little influence on government before the end of the nineteenth century,<sup>28</sup> although advice was provided within individual cities and states. German universities, and later research institutes, had a research orientation tied to the emerging state.<sup>29</sup> Academic science, rather than applied research, was much later to take off in the United States compared to Europe.

The importance of individual states in the United States, with some similarities to the federal system in Germany, colors the context within which advice could be offered and influential. Comparative studies have been made in some policy areas, such as public health,<sup>30</sup> and in terms of approaches to higher education and scientific research.<sup>31</sup> A broader comparative analysis of how different countries accessed and used scientific advice for military and civil policy would be of great interest, but is not attempted here. Britain's unique features are examined in their own context.

### GOVERNMENT GROWTH

The period chosen for this study is broadly from the end of the Napoleonic Wars (1803–1815) to the end of the century, with glances back to eighteenth-century roots and glimpses forward to the twentieth century. That choice follows from analysis that has identified three broad phases of government growth in the nineteenth century. These provide useful markers when reading the subsequent chapters, even if the growth looks in many respects more like a continuum.<sup>32</sup>

The first period runs from around 1815 to the Reform Act 1832. This overlaps with the presidency of Joseph Banks at the Royal Society until 1820, a time during which elite science was primarily the domain of gentlemen of independent means, like Banks.

The second period runs from the 1830s until around 1870. From the 1830s, reflecting a widespread move for reform, there was a dramatic increase in the number of parliamentary select committees, royal commissions, and consequential legislation across many areas of social policy. In addition, the line between political minister and permanent official became more distinct after 1830 than before.<sup>33</sup> This mid-century period, straddling the Crimean War (1853–1856), saw the founding of the British Association for the Advancement of Science,<sup>34</sup> a reformed Royal Society,<sup>35</sup> consolidation in the medical community, and the formation of the Social Science Association.<sup>36</sup> The men of science and other experts became increasingly involved with the reforming activities of government, with regulation, and with a civil service that was starting to become professionalized. The later mid-century years, after the initial burst of reform in the 1830s and 1840s, are sometimes known as the “age of equipoise.” From 1852 and the coalition government of the fourth Earl of Aberdeen to the 1860s, there was a period of relative social calm and balance.<sup>37</sup>

The third period runs from the 1870s until the end of Queen Victoria's reign in 1901. The Reform Act 1867, brought in by the Conservative fourteenth Earl of Derby and Benjamin Disraeli, roughly doubled the electorate. It heralded William Gladstone's first Liberal government and a further burst of royal commissions and legislative activity in social policy. Legislation from



around 1870, by both Liberal and Conservative governments, appears more consolidating than that of previous decades when so many major changes were introduced. The civil service became larger, more bureaucratic, and more capable. Gladstone's government of 1884 completed the electoral legislation of the nineteenth century by bringing in the Representation of the People Act 1884, which increased the franchise to the majority of men but still excluded women.

As the nature and organization of the state changed, so did the manner in which members of the scientific community projected and justified their activities in the public domain, especially to government.<sup>38</sup> Through much of the century, most scientific research was seen to be private and voluntary, independent of the state in the manner of private businesses. Exceptions were areas of direct relevance to state interests, such as navigation, surveying, and mapping, for domestic benefit and colonial expansion, and the armed forces. From the 1840s to the 1870s there was a move by a vocal minority of practitioners to create a professional scientific community and to establish cultural authority for a naturalistic approach to science separate from religious or other traditional authorities. Left to their own researches, the men of science would, they argued, make new discoveries that would lead to countless applications to benefit society. Science, which was a marginal activity in the early part of the nineteenth century, had become a part of general intellectual culture by mid-century. That created its tensions, in particular with respect to arguments about who could speak with scientific authority.<sup>39</sup>

From the 1870s, when the British government still neither funded fundamental scientific research to any significant extent, nor wholeheartedly supported science and technology education, the rhetoric of the scientific community changed. That coincided with a growing and separate scientific culture among its practitioners.<sup>40</sup> Now, with scientific knowledge increasingly specialized, the arguments of those promoting science shifted toward science in the service of the state, emphasising military security and economic growth.

The organization of political parties, of government, and of public institutions had developed further by this point. The political parties were establishing policymaking capabilities, changing the relationship of the government and Parliament to individuals or organizations that sought to influence policy. The civil service directly employed an increasing number of staff with technical knowledge, although political nomination was still the normal route into the civil service in the 1850s.<sup>41</sup> Change was accentuated by the Northcote-Trevelyan Report of 1854,<sup>42</sup> leading to examinations and open competition, but that took several decades to embed. The concept of the neutral civil servant slowly crystallized by the late century, consigning the operations of the likes of Edwin Chadwick and John Simon to the past.<sup>43</sup> In these last decades

more formal structures, a larger government, and the growth of professional scientific, engineering, and medical disciplines and roles laid the foundation for the organizational and institutional changes in relation to science that took place in the early years of the twentieth century.

This book is a study of the interaction of scientific expertise with politics and administration. While technical advice might on the face of it seem paramount in policy areas such as weights and measures, vaccination, or the railways, in reality, questions including the extent of local determination or central control, individual rights, religious beliefs, and economic values set the social and political context within which technical aspects were debated and contested. I aim to examine the interconnections and mutual influences, to bring them to view, and to expose some of the underlying contingencies. Things happened as they did, but they might have been different. Many of these possible counterfactuals are concerned with the personal characteristics of individual advisers and the fortunes of politics, as ministers moved and governments changed or fell at unpredictable moments. Complex interactions of different scientific, commercial, religious, political, and personal interests and beliefs shaped the outcomes in each policy area. But exactly what happened when is contingent on many factors. I have attempted to bring these contingencies to light, and to place them in the context of broader trends across the nineteenth century.