Science and the nation: towards new histories of twentieth-century Britain*

David Edgerton

Imperial College London

Abstract

This article examines the technocratic and militaristic critiques of twentieth-century Britain, arguing that they often take the form of ‘anti-histories’ of British science and technology and of preparedness for war. Such critiques have been central in conventional accounts of Britain and its national identity. This article calls, instead, for a post-declinist and post-welfarist account of twentieth-century Britain, re-examining four clichéd visions of key aspects of the historiography of twentieth-century Britain: ‘inter-war disarmament’, the ‘rise of the welfare state’, the ‘two cultures’ and the ‘White Heat’. Giving due emphasis to the history of the British ‘warfare state’, and the overlapping research enterprise, will not merely add to our existing picture but profoundly change it.

It is an honour to fill this chair, once held by Rupert Hall, renamed for Hans Rausing. There are three Hans Rausing chairs in the history of science – here in London, in Cambridge and in Uppsala. There are brilliant precedents for such multiple international recognition, but there is a surprising one at Imperial College. During the Great War a chair was named for Sir Basil Zaharoff, with parallel chairs in Paris and St. Petersburg. Although hardly known today, Sir Basil was infamous in the inter-war years: he was the ‘munitions king’, the ‘mystery man of Europe’, the original ‘merchant of death’, a key figure in the ‘secret international’. He sold armaments for Vickers. The chairs were in aviation.¹

The themes linked with ‘Zaharoff’ – clichés like ‘merchants of death’, the arms industry, the key state science of aeronautical engineering, the complex interplay between the national and the international, and even notoriety – will be among those discussed in this article. Some even have something to do with my first arrival at Imperial. In November 1979, as

* This article is the text of David Edgerton’s inaugural lecture as Hans Rausing Professor, delivered at Imperial College London on 15 Oct. 2002. The rector of Imperial College, Sir Richard Sykes, was in the chair, and the vote of thanks was given by Professor Dorothy Wedderburn.

¹ The Zaharoff chair has been left vacant since the early 1990s, at the suggestion of the then head of the aeronautics department, and later deputy rector, Peter Beamant. I am grateful to Professor Beamant for this information.
an undergraduate, I was listening to the radio news just before going out to see an Italian film, *Investigation of a Citizen Above Suspicion*. It was reported that Professor Sir Anthony Blunt of the Courtauld Institute had just been exposed in parliament by the new prime minister, Margaret Thatcher. He was the ‘fourth man’. The coincidence stimulated my interest, and I read the papers avidly. There was a good deal of comment which suggested some affinity between public schools, Cambridge, the arts, homosexuality, communism and espionage. This effete and disloyal ‘Homintern’ – the homosexual international – contrasted of course with the right-wing, provincial, patriotic politics of the scientist Mrs. Thatcher. This binary opposition, like so many others central to the understanding of ‘Englishness’, was of course nonsense, but of clear ideological significance.

Of the many articles I read at the time only one sticks in my mind. Anthony Howard, in *The Listener*, debunked the image by pointing to the strong connections between communism and natural science in nineteen-thirties Cambridge. Both had a distinctly heterosexual temper – well embodied in the figure of J. D. Bernal. Howard referred to a recent book by an American historian, Gary Werskey, called *The Visible College*, a collective biography of socialist scientists of the nineteen-thirties. The book’s subjects were Bernal, Joseph Needham, Lancelot Hogben, J. B. S. Haldane and Imperial College’s own Hyman Levy, a mathematician/aeronautical engineer. *The Visible College* was much more than a series of biographies – it put science into the history of British socialism, and into British national history too. Gary Werskey put science into history quite differently from my first teachers of history, Margaret Gowing and Allan Chapman. When some two years later I was told that Gary, who was at Imperial College, had a Ph.D. studentship to study the World Federation of Scientific Workers, a communist front organization, I jumped at the chance of working with him.

Gary started me off by getting me to read two books, *Late Capitalism* – how odd that now sounds – by the Belgian Marxist Ernest Mandel, and Keith Middlemas’s *Politics of Industrial Society*. The latter was for me a revelatory account of British history in the mid twentieth century – a theoretically interesting and historically dense answer by a conservative historian to a European question: why was Britain so stable in the twentieth century compared with its continental European analogues? Middlemas’s answer was quite distinctive in that he was putting the *state* into British twentieth-century history. At the time the issue of the state was an extremely lively one, not least among the industrial sociologists with whom I worked at Imperial, and the political scientists I was close to at the London School of Economics.

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The Visible College and the Politics of Industrial Society were brilliant expressions of powerful underlying arguments about twentieth-century Britain. The Visible College was the first critical examination of British, left-wing, scientific intellectuals, but the idea that technocracy was a left-wing phenomenon was a commonplace of British political and intellectual history. Middlemas’s book was a particularly rich variant of the idea that central to British state development in the twentieth century were the politics of labour and the creation of the welfare state.

In my own work I have tried to put two systematically missing elements into the historiography of twentieth-century Britain: the military and its associated civilian apparatus – the warfare state for short; and the non-academic and non-socialist parts of the British research enterprise.4 A key part of my story is the significant overlap between the warfare state and British research, and thus my work has in part been about putting the state into the history of science and technology, to produce a new account of science and the nation. Doing this has meant understanding and challenging powerful traditions which influentially denied that there was ever anything like a British warfare state, and denied there could have been a powerful British research effort outside elite universities. These traditions were driven by what I call the technocratic and militaristic critiques of twentieth-century Britain. The latter were often combined, most ably and most influentially in the work of Correlli Barnett. The histories of twentieth-century British militarism and technocracy have typically been what I will call ‘anti-histories’ – explanations of why both were weak, rather than accounts of actual British militarism or technocracy. These anti-histories are closely linked to the ‘declinism’ and ‘inverted whiggism’ that have so affected thinking about Britain in the twentieth century, not only about its economic performance but also about its very ‘national identity’.

I want to sketch elements of what a post-declinist and post-welfarist account of twentieth-century Britain might look like. In this story Imperial College will have a larger place than it currently has, perhaps not surprisingly because, as Mats Fridlund pointed out to me, its motto is ‘Knowledge is the adornment and protection of the state’. Significantly, Imperial College has been seen as somehow atypical, a foreign institution transplanted into South Kensington – it was after all known as the ‘London Charlottenberg’ after the Berlin-Charlottenberg Technische Hochschule and later as the British M.I.T.

For many continental intellectuals the intertwining of the state and knowledge has been obvious. For many British intellectuals that was

precisely the problem with Europe. According to Rob Iliffe, the early Royal Society saw the trading, Protestant English gentlemen as better-suited to science than continental wits and priests. Later, French savants were seen as having been corrupted by a powerful state in which they were key players; the German professoriate as having ‘prostituted’ itself to Prussian militarism. Militarism was itself seen as a continental affliction, which did not affect free-trading maritime Britons.

In recent decades the view that research flourished best in a free-trading world with minimal state funding and control has hardly been popular in the British scientific community. Indeed the general view among intellectuals has long been that Britain should have been more like Europe. Pre-1914 Germany has for some time been a favourite model. The British problem was that there was no mutual constitution of state power and science. For British technocrats it has usually been a cause of lament that science and power have not been more closely allied. That is one of the reasons why British science-power links are so rarely studied.

Of course, that British image of the continental savant or professor may not be an especially good starting point for their study, as Andrew Mendelsohn would argue. But asking ‘continental’ questions about nineteenth-century British science is certainly productive. For example, Andrew Warwick sees, with continental eyes, the University of Cambridge as an, admittedly somewhat sporty and clerical, *Ecole Polytechnique*. In asking continental questions, we will often discover a Britain more like Europe and our image of Europe than we imagine. For the twentieth century, militarism and technocracy are terms of art in the historiography of Europe, but nearly absent in the study of Britain. In British variants (in, for example, the form of ‘liberal militarism’), they do exist, and indeed are extremely important. There have also been many powerful British technocrats, several of them of the right. That Britain did not have continental-style conscription does not mean it had weak armed forces; that the state did not have an *Ecole Polytechnique* does not mean it did not have élite technical corps closely allied to the state.

I want to address four central clichés in the historiography of twentieth-century Britain which particularly affect our understanding of both the warfare state and British research and development: ‘inter-war disarmament’; the ‘rise of the welfare state’ in the nineteen-forties; the ‘two cultures’; and the ‘White Heat’. I shall also consider ‘boffins’, ‘good at inventing but bad at developing’, and ‘on tap but not on top’.

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Central to the belief that twentieth-century Britain has been an anti-military nation is the idea that Britain had unilaterally disarmed in the nineteen-twenties and early nineteen-thirties. This, ideologically extremely significant, argument, repeated and ingeniously defended by historians, is surprisingly weak. In real terms inter-war arms spending remained at around the levels of the Edwardian arms race and thus significantly higher than in the late nineteenth century. In the nineteen-twenties and early nineteen-thirties the new air force grew and created an aircraft industry as large as any in the world. Multilateral disarmament did reduce the Navy and its spending but it remained the largest in the world. This was not a hangover from the past: the Royal Navy out-built all other navies in the inter-war years, and was clearly technologically progressive, boasting not only the two most modern large battleships in the world but also greater strength in aircraft carriers (in numbers and tonnage) than any other power.

It is difficult to find people in inter-war Britain who objected to technologically progressive naval and armed forces. But there is one genuine technological reactionary who did just this. Captain Bernard Acworth was a submariner and ornithologist who in retirement campaigned against Darwinism, aviation, the oil-firing of warships, and large battleships. He was a critic of ‘modern science’ and ‘research’, in his view ‘the modernist title for what was once called engineering’. He lamented that the Navy of 1930 reflected ‘the cloven hoof of scientific research’. Acworth was right that the Navy, and indeed the forces in general, had a huge research corps; it amounted to several hundred ‘boffins’. This was ‘big science’, and the biggest facilities of all were the research department at Woolwich and the aeronautical establishment at Farnborough. Well before rearmament Britain’s armed forces had creative research and experimental facilities to match their great strength in modern weaponry: out of the state research corps came many new weapons, including radar, A.S.D.I.C. (sonar) and to some extent the jet engine too.

Imperial College graduates were important in this research corps. Up to 1937 only the air force and the Navy had directors of scientific research, and three of the four were from Imperial. Indeed, Imperial was second only to Cambridge in supplying the senior personnel of the research corps. For example, Imperial men had key roles in air defence research. Major Tucker of the Air Defence Experimental Establishment, which long preceded radar, convinced the government to build a network of gigantic concrete acoustic mirrors to detect incoming aircraft, a project scrapped in 1935, but not before some of these extraordinary structures were built. Radar, which came out of other establishments, was developed instead. A key midwife was the R.A.F.’s senior scientific and technical

8 Capt. B. Acworth, The Navies of Today and Tomorrow: a Study of the Naval Crisis from Within (1930).
adviser, Sir Henry Tizard, the rector of Imperial, who chaired an influential scientific committee on air defence. It was an Imperial graduate, Herbert Wimperis, who, as director of scientific research, brought Tizard’s committee together; A. P. Rowe, also of Imperial, was its secretary. The links between the rectors of the college and the forces have been close. For about forty-four out of Imperial’s ninety-five years of existence its rectors have been men who had important military positions in peacetime.\(^9\)

It is very difficult to find a work of history which does not describe the British state of the nineteen-forties as a ‘benign state’, a ‘social-democratic state’, and most common of all the ‘welfare state’, my second cliché. The emblematic figure for the war years is the trade unionist Ernest Bevin, and in nearly all economic and social accounts of the war his ministry of labour is given a key role. The argument is that in war the financial budget, and with it treasury control, yielded to the manpower budget, and thus gave the ministry of labour power. In the dominant social democratic historiography of this period it is labour, and the Labour party, which are in the ascendant during the war, and it is this which leads to wartime production miracles and innovations in social policy. It also leads, of course, to that great reforming Labour administration of 1945–51, with its programme of nationalization of industry and the creation not only of the National Health Service but of what came to be called, by the nineteen-fifties, the ‘welfare state’.

Systematically missing from these accounts was the gigantic, military-civilian warfare state apparatus. This was an extension of the inter-war structures, built up and kept at a much greater scale after the war. Surprising as it may seem, the most significant increase in state expenditure, and indeed state employment, between the nineteen-thirties and the late nineteen-forties was in the warfare state, not the welfare state. This is even more the case after the rearmament of the early nineteen-fifties. The post-war Labour government built hardly any hospitals or schools, but it did build vast new military research laboratories. Indeed the ‘welfareness’ of British state spending did not return to early nineteen-thirties levels until 1970, at the end of the second post-war Labour government.

During the war the warfare state transformed large parts of British industry – it financed the building of a vast network of new arms factories, which employed around 1.6 million workers. The Labour government created out of the wartime warfare state a peacetime machine of great significance. This warfare state had various ministries concerned with the forces, and also an industrial and research ministry, known first as the

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\(^9\) They are Surgeon-General Sir Alfred Keogh (1910–22), pre-Great War head of the Royal Army Medical Corps; Lt.-Col. Sir Henry Tizard (1929–42), already mentioned; Air Marshal Sir Roderic Hill (1948–54), a career air force officer who had been director-general of technical development; Lord Penney (1967–73), head of the nuclear bomb project; and Lord Oxburgh (1993–2000), former chief scientific adviser to the ministry of defence, a post in effect held by Tizard in the late 1940s.
ministry of supply, then the ministry of aviation, and then the ministry of technology. All these labels are misleading, for these ministries were at the core not only of military technological but also of civil technological policy. Labour’s ministry of supply produced and developed arms on a large scale, including the full ABC of weapons of mass destruction, as they were even then called: atomic, biological and chemical weapons. It also developed heavy industry, atomic energy, jet engines, penicillin and much else besides.

We need then an alternative emblematic wartime minister to Bevin, not because Bevin and labour were not important, but because power lay elsewhere and had different sources. Sir John Anderson is a good alternative. Anderson had been a remarkably successful civil servant – in Ireland, and later as permanent secretary at the home office; he went on to become governor of Bengal, an important and sensitive post. He was a senior securocrat. His first ministerial post, just before the war, gave him responsibility for air raid precautions (a matter of ensuring civil obedience as much as civil defence). In the war he was lord president of the council 1940–3, in which capacity he acted as a kind of prime minister for the civilian side of the war, and from 1943 he was chancellor of the exchequer. It was in both these capacities that Anderson, not Bevin, had control over the allocation of labour. Anderson also had a key role from early in the war in atomic bomb matters, and became a kind of semi-ministerial director of the bomb project under the Labour government (despite being by then a Conservative M.P.). Anderson was a brilliant product of the administrative class of the civil service, but unusually for that class had trained in chemistry at Edinburgh and Leipzig, working, as it happens, on uranium.

Anderson stands for an alternative image of the British state more generally. The pre-war state produced not only Anderson, but many great administrators and planners of war production and research and development, for example the pre-war procurement officers Engineer Vice-Admiral Sir Harold Brown, wartime controller-general of the ministry of supply, and Air Marshal Sir Wilfrid Freeman, wartime chief executive of the ministry of aircraft production. Members of the peacetime state research corps also had important roles, for example Imperial men like A. P. Rowe, head of Telecommunications Research Establishment, the

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10 Sir James Grigg, another member of the administrative class to be made a minister, became secretary of state for war. He had a degree in mathematics. Indeed Anderson and Grigg were just two of four state servants who became ministers just before or during the war. The other two were naval men, with technical experience – Lords Hankey and Chatfield. Hankey was a former artillery officer in the Marines, and secretary of the Cabinet until 1938; Chatfield had been the Navy’s senior procurement officer, as well as First Sea Lord. We could add a 5th technical man, Sir John Reith, if we count the B.B.C. as state employment. Reith, the creator of the B.B.C., was an engineer. (Incidentally, Sir John Birt is also an engineer.)
great radar laboratory.\textsuperscript{11} External expertise came from many sources, but especially industry, with particularly important inputs from the arms industry. Commander Sir Charles Craven of Vickers, second only to Zaharoff as a notorious ‘merchant of death’ in the nineteen-thirties, had a crucial role in the ministry of aircraft production; the leader of the British bomb project was Sir Wallace Akers, a director of I.C.I.

The role of academics within the wartime state machine has been exaggerated, as it has generally been in the history of science and technology. The names of Blackett, Bernal and Zuckerman, scientists of great academic distinction and of very broad interests, ranging in politics from the hard left to the centre, appear rather too often in British accounts of ‘science and war’, without sufficient recognition of the limited nature of their roles as ‘operational researchers’. They had no role in the management of wartime research and development, nor did their schemes for the planning of science have much impact on what the state actually did.

The academy was, however, deeply affected by the warfare state. During the war the great majority of academics, including scientists and engineers, stayed in post teaching. Around seventy-five per cent of Imperial staff stayed. Wartime Britain maintained an almost peacetime complement of male science and engineering undergraduates, in contrast to the arts where male arts students had their studies interrupted or delayed until peacetime. After the war, university science and technology got a huge boost, such that by the nineteen-sixties a majority of British male students were to graduate in either science or engineering. The warfare (and industrial) state, rather than the welfare state, drove university development, for graduation in medicine for the N.H.S., or in the arts, a traditional preparation for teaching, expanded much less. One can see traces of the warfare state in a remarkable but barely known change in the student population. Although the war years saw a slight feminization of science and engineering students, after the war the proportion of women fell strongly, such that it was lower than it had been in the inter-war years. Indeed it did not return to nineteen-twenties levels until the nineteen-sixties. The warfare state, and industry, wanted male scientists and engineers, and from those branches of science and engineering where men were particularly dominant.

Helping to organize the recruitment and placement of the new science and engineering graduates, from the war into the nineteen-fifties, was the former Cambridge science don and novelist, Sir Charles Snow, as C. P. Snow used to be referred to. He became a major public figure and even today his name, and his concept of the ‘two cultures’, my third

\textsuperscript{11} Other Imperial College figures include N. E. Rowe, who was the first civilian director of technical development for aircraft, and Harold Roxbee-Cox, director of special projects at the ministry of aircraft production, responsible for jet engines.
 cliché, are still commonplaces. The *Two Cultures*, published in 1959, is still in print, and in many languages. Snow articulated with enormous success deep and enduring beliefs about the place of science in British life, both among scientists and engineers, and public intellectuals more generally, including those trained in the arts. However, in private the experts on scientific matters treated Snow with contempt. Otto Clarke, a civil servant with a mathematics degree, the father of Charles Clarke, the current Labour secretary of state for education, was scathing about Snow’s views: ‘If he tells us that we should be moving in that direction’, he would say, ‘turn smartly round and go the opposite way – we are more likely to be right’. That was the recollection of Sir Solly Zuckerman, chairman of a committee considering ‘scientific manpower’ in the nineteen-fifties on which Snow sat, and Zuckerman plainly agreed with Clarke.

Most public comment, then and since, has been respectful, with one famous exception. The, extremely rude, condemnation of Snow by the literary critic F. R. Leavis in the early nineteen-sixties has had rather a bad press. It is seen as being in poor taste, and as exemplifying Snow’s distinction between the literary and the scientific. Leavis’s concern was that a ‘nullity’ like Snow should be taken for a sage. In his view Snow’s significance lay only in that he was taken seriously. Leavis understood Snow as someone who affected to speak from science, with the authority of science, and for science, but who was actually talking nonsense, about literature and science.

Snow’s argument was that there existed an unbridgeable gulf between ‘science’ and the ‘arts’, and that in Britain ‘science’ was in an inferior position, the ‘Natural Luddites’ ruled. Yet Snow’s own career, and the extraordinary success of his arguments, refute his own thesis. It was by virtue of being a scientist and a supposed expert on science and scientists (and not a novelist) that Snow was a civil service commissioner, a member of the board of English Electric (a great arms firm) and, as Lord Snow, a junior minister in the ministry of technology. In a culture as dominated by novelists as Snow imagined, he would hardly have been noticed and would be remembered only like some Feuerbach or Dühring, as the unfortunate victim of an enlightening drubbing by a greater mind. It is Snow that makes Leavis famous for most people.


13 F. R. Leavis, *Two Cultures? The Significance of C. P. Snow*, with an essay by Michael Yudkin (1962).

14 In 2002, the 40th anniversary of the Richmond Lecture was marked in the *Guardian* by a pro-Snow piece, arguing his rightness, even in 2002 (see M. Kettle, ‘Two cultures still’, *Guardian*, 2 Feb. 2002). It was noted in *Prospect* by a ‘plague on both their houses’ reflection, which again misses the significance of Snow (see G. Wheatcroft, ‘Two cultures at forty’, *Prospect*, May 2002, pp. 62–4).
What is wrong with the *Two Cultures*? Paradoxically, perversely, although he was a propagandist for science, Snow ends up, like his predecessors and followers, by taking science and technology *out* of British history. Snow’s *Two Cultures* is exemplary of declinist anti-histories of British science and technology. He emphasizes the weakness, indeed argues for the increasing weakness, of science and technology; the active agency in British history was the traditional culture of ‘novelists’. Snow’s anti-historical method, if method it is, has proved influential. For example, the history of the research corps is left out of most accounts of the British civil service. There is nothing unusual in leaving technicians out of accounts of imperial élites – Serafina Cuomo points out that this is true of antiquity.\(^\text{15}\) And yet, in the case of the British state élite, they are not left out because they are beneath the notice of arts-trained historians, nor because they are insignificant within the state. For most studies of the British civil service *lament* their lowly place, indeed see this as a key problem with the British state. This view was powerfully endorsed by the Fulton report of the late nineteen-sixties (Fulton was a philosopher) and by Peter Hennessy (a historian) in his celebrated history *Whitehall*.\(^\text{16}\)

If we put the research corps in we get a very different picture of the state, as I have already suggested. Before the war the research corps was just a little smaller than the élite administrative class; together they represented the great bulk of university graduates in state service. After the war the research corps was bigger than the administrative class. In the research-intensive ministries (like supply, aviation, technology) the numbers of administrators and specialists in the most senior positions were comparable. Furthermore, the concentration of the research corps in these ministries meant that the chains of command rarely went through administrators. Scientists were hardly just on tap in these ministries. Just as significantly, the research corps had grown in power by comparison with other specialists. If in the inter-war years the director of naval construction was the greatest technical officer of the British state, after the war this role was surely filled by the senior members of the research corps, notably the ‘nuclear knights’, with Imperial’s Lord Penney key among them. The research corps also provided personnel for senior posts previously reserved for other specialists, including some previously held by military officers.

‘Two cultures’ thinking has had the same sort of effect in histories of business. For example, it has been influentially claimed that non-scientific gentlemen ran British businesses of the twentieth century; beneath them were the scientific players. Many studies of British firms complained of their lack of investment in research and development (R&D). These


histories implicitly and explicitly underestimated the number of scientific gentlemen running major firms, and the actual R&D effort of British firms – as, for example, Sally Horrocks and I showed for the inter-war years.\(^\text{17}\) Essentially, by the nineteen-thirties nearly every large manufacturing firm was doing R&D, and of course this effort increased hugely after the war. There is no doubt that into the nineteen-sixties British businesses led the world, with the obvious and huge exception of the U.S.A., in R&D.

The ‘two cultures’ images of the state, of business, with implicit comparisons often with Germany, are generally very far from being based on anything that scientists would recognize as a scientific analysis. Even the British twentieth-century novel is more scientific than any reader of Snow would believe possible. There have been a remarkable number of novelists with backgrounds in science and engineering who wrote about technical people, many more insightfully than Snow. Imperial College produced H. G. Wells. Of the others (omitting the medics such as Conan Doyle or J. G. Ballard) we might note Eric Ambler, who transformed the detective story in the nineteen-thirties, Neville Shute, Nigel Balchin, a wartime civil servant whose *Small Back Room* was made into a wonderful film, and William Cooper, a pioneer of the provincial middle-class novel. Cooper’s last novel featured a Prince Consort College, a geologist rector, and the teaching of humanities to scientists.\(^\text{18}\)

And so to the fourth cliché, ‘White Heat’. One of the most familiar terms in the history of British politics, it is derived from one of the best-known speeches, Harold Wilson’s first Labour party conference address as leader of his party. Wilson brilliantly placed Labour as the party of technocratic modernization: Labour would forge a new Britain that would succeed in the ‘scientific revolution’. Yet, the White Heat was not what it seemed. The nineteen-sixties saw the scaling back of *techno-nationalist* projects, notably in aviation, and to some extent in nuclear matters too. There was also an awareness that a core *techno-declinist* assumption – that the progress of a nation was dependent on *national* research and development – did not hold. The declinist account of Britain which had inspired the White Heat did not stand up to the expert, even scientific, analysis it itself generated.

The great institutional embodiment of the White Heat was the ministry of technology, created in 1964 with C. P. Snow as a (disastrous) junior minister. In 1967 Anthony Wedgwood Benn, the second minister of technology, chose to come to Imperial College to give an important lecture outlining the future policies of his ministry. R&D spending was to shift from defence to civilian, from civil aerospace and civil nuclear power to other sectors, and it was to shift from government laboratories


to the private sector. Similarly, support for industry would shift from defence to civil, and from aerospace and nuclear power to other sectors. In other words, the state research corps, and the great state-funded projects, were under threat. There was also a shift from emphasizing innovation as a key problem of British industry. As Benn put it in 1970:

Technology is so closely linked in the public mind with Harold Wilson’s famous 1963 Scarborough speech that most people have forgotten that a grandiose adherence to technology characterised the Macmillan government’s thinking. The Scarborough speech broke away from this romantic attitude: it was an industrial speech, and Labour’s Mintech duly evolved into an industrial department. . . . In Mintech it was quickly recognised that it was not technology that Britain lacked but a strong industrial organisation, good management, real attention to application. Benn and Mintech were doing evidenced-based policy. The most straightforward analysis of the newly emerging data on research and development and on economic performance yielded the uncomfortable conclusion that Britain did a great deal of R&D and yet had a relatively low rate of economic growth. R&D is mostly ‘development’, suggesting then that Britain, if not necessarily ‘good at development’, was spending a lot on it. Bruce Williams, soon to be Mintech’s economic adviser reflected:

Think how often it is argued in Britain that growth is held down by a failure to spend on research and development as high a percentage of national product as do the Americans. In France (and Germany and Australia) the argument tends to be that growth is held down by a failure to spend as high a percentage as the British. The point was taken up. Indeed Otto Clarke, now permanent secretary at the ministry of technology, argued for tests ‘of popularly held theories which are almost invariably wrong. The recent demonstration for example, that there is no discernable relationship between R&D expenditure and economic growth, has been of first-class importance in getting the Department’s thinking on better lines’. Benn himself made clear there was no ‘automatic correlation between the amount spent on research and the rate of economic growth’, and no correlation either between civil R&D expenditure and growth.

This might be the kind of thing one expects from politicians and economists. When I, along with others, notably Terence Kealey, was

23 Benn, Government’s Policy, p. 2.
pointing out this lack of correlation in the nineteen-nineties, I had prepared a line of defence for use in Imperial, to which, I am delighted to say, I have never had to resort. I will reveal it today: some of the greatest figures in the history of the College were of like mind. The electrical engineer Sir Willis Jackson (Lord Jackson of Burnley) made the point in a number of speeches in the period 1967–8, including his presidential address to the British Association for the Advancement of Science. So did Patrick Blackett, president of the Royal Society, and from 1964 the influential scientific adviser to the ministry of technology. Sir Henry Tizard had anticipated both. In his presidential address to the British Association in 1948, he asked: ‘to what then shall we attribute the relative decline [of Britain as a great power]? Shall we argue that a main cause was that research was on too small a scale?’ He preferred other reasons, noting that Sweden and Switzerland had strong technology, but no great strength in research. His view was that ‘it is not the general expansion of research in this country that is of first importance for the restoration of its industrial health, and certainly not the expansion of government research remote from the everyday problems of industry. What is of first importance is to apply what is already known’.

The lack of positive correlation of national R&D with national rates of economic growth is not some British aberration but a product of an international world. Even in the era of high techno-nationalism most technologies were imported; the world shares technologies – the Tetra Pak went from Sweden to the world. The assumption that there should be a positive relationship between national research and national growth is a particular instance of the techno-nationalism which so affects our understanding of the role of science and technology, as Kirsty Hughes and I found in our studies of British and Scottish science policy in the nineteen-eighties and nineties.

This techno-nationalism has also affected historical accounts. The assumption that Britain must have under-invested in research over the last 150 years because it has grown relatively slowly, is deeply ingrained in the literature (despite the analyses of forty years ago), even in the work of academics who specialize in the field.

Techno-nationalism also leads to confusion between the national state-funded and the significant. But in the Edwardian period, and for years thereafter, much of the research effort was neither national nor state-funded. The great civic universities were civic and international – think of Manchester or the London colleges. Philanthropy was at least as important as the state, perhaps much more so, in developing research. At

24 See London, Imperial College Archives, Jackson Papers, A/20/3; A/20/6; A/22/1.
Imperial the contributions of the ‘Rand Lords’, for example Sir Alfred Beit, were very important; in the case of St. Mary’s, Sir Almroth Wright’s large laboratory was supported by fees and philanthropy. It was in this laboratory that Sir Alexander Fleming worked. We will know a lot more about all this in two books arising from the centre for the history of science, technology and medicine, Elsbeth Heaman’s history of St. Mary’s and Hannah Gay’s history of the old Imperial College, which will be ready for Imperial’s centenary in 2007.27

Techno-nationalism also fails to capture the significance and nature of the process of nationalization. There clearly was a connection between trade policy and research policy in earlier times, as Lisbet Koerner has so elegantly shown for mercantilist eighteenth-century Sweden.28 It also became the case in the twentieth century. Here is George Orwell attacking naïve internationalism, in 1944:

Reading recently a batch of rather shallowly optimistic ‘progressive’ books, I was struck by the automatic way people go on repeating certain phrases which were fashionable before 1914. Two great favourites are the ‘abolition of distance’ and the ‘disappearance of frontiers’. I do not know how often I have met with statements that ‘the aeroplane and the radio have abolished distance’ and ‘all parts of the world are now interdependent’. Actually, the effect of modern inventions has been to increase nationalism, to make travel enormously more difficult, to cut down the means of communication between one country and another, and to make various parts of the world less, not more dependent on one another for food and manufactured goods.29

Orwell had a point.

Autarky and militarism have been profoundly important to the research enterprise in the twentieth century, and not just in the ‘deviant’ cases of mid century – the U.S.S.R., Nazi Germany, Italy and Japan. By the nineteen-fifties the militarization and nationalization of the economy had become crucial to the development of the research enterprise in Britain too. Aviation and nuclear power, to take just two examples, were not just products of capitalism, industrialism, imperialism, or even militarism or the ‘cold war’, but of a particular conjunction of national rivalries between strong nation-states.

The significance of the national context has not been obvious from the scientists’ own accounts, even those which address these issues. Let me take two post-war texts called Science and the Nation. The first is a programme for national science produced by the Association of Scientific Workers in 1947 under Blackett’s presidency.30 It did not address the huge military programmes being pursued by the government. The second

dates from a decade later – Sir Edward Appleton gave the same title to his Reith Lectures of 1956. He felt he had to explain his title, since science was obviously international. Although principally concerned with state support he omitted the military, at a time when they took eighty per cent of government, and perhaps forty per cent of all expenditure in industry on R&D.\(^{31}\) The military are, in very deep ways, written out of histories of science, technology and medicine, which are assumed to be profoundly civilian and international, and to have the power to internationalize and civilianize, and give the world perpetual peace.

The Austrian novelist Robert Musil, who had scientific training, wrote the causes dearest to our hearts – the nation, peace, humanity, character, and similarly sacred objectives – sprout on their backs the cheapest flora of the mind. This would make ours a topsy-turvy world, unless we assume that the more significant the subject, the more innately it may be discussed, in which case the world is turned right side up again.\(^{32}\)

I wonder why he did not add ‘science’. The public culture around science and technology is, I think, a prime example. It is dominated by a plagiarism of the passé, and the discredited, but much still passes for insightful futurism. When we want to discuss science and the nation we reach for the clichés, and forget the more serious analysis. The continued significance of Snow is a case in point; the collective amnesia about the White Heat another. When we discuss science and technology more generally we invoke, as we have done for more than 100 years, the lag of moral development behind science and technology, the idea that the rate of change is ever-increasing, that the world is getting smaller, that we live in a global village and so on. We need to understand the endless repetitions, the obliteration of history, the perpetual fake novelty of so much commentary. We could reflect that it has hardly changed in a century, when science and technology have changed so much. To the historian the millennium dome, far from being futuristic, evokes the past – 1951 to be precise, and the Festival of Britain. The millennium dome was one dome of discovery and twelve Skylons (not my joke – I’ve plagiarized it from, I think, Will Self). As the Uruguayan writer and engineer Lautréamont quipped, progress implies plagiarism, but, we might add, not all plagiarism is progressive.

Our understanding of science and technology in twentieth-century Britain is only now achieving the radical cumulativeness of some branches of knowledge, and the informed debate between interesting positions characteristic of others. Much of this work is being done by people, like myself, who have passed through the centre for the history of science, technology and medicine in Manchester, until recently directed by John

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Pickstone. We are moving from anti-history to history; from a historiography which explains why Britain was militarily, economically and technologically weak, to one in which we ask historical questions about British military agencies, the state research corps, major businesses, and science and technology generally; one where we ask the same sort of historical questions we might ask about German, Soviet or American science.

Putting the warfare state and the history of science and technology into the history of twentieth-century Britain will, I hope, change what we take the history of twentieth-century Britain to be. Post-declinist and post-welfarist histories of Britain will be different, not merely because they include the warfare state and the research enterprise, but because that very inclusion will involve surprisingly important changes in our understanding of key elements of British history. We will not have new histories of the warfare state or science contextualized within existing British histories, but within new ones. For the anti-histories of both were already powerfully linked to influential general accounts of British history in which British was essentially, say, free-trading, welfarist, aristocratic, imperial, anti-European, financial and so on. In these accounts British militarism, science and technology, and the modernizing state disappeared into explanations of their weakness. These accounts themselves drew strength from the anti-histories of science, technology and the military. To get a flavour of these connections let me quote Perry Anderson: the British state, he maintained,

constructed to contain social conflict at home and police an empire abroad, has proved impotent to redress economic decline. The night-watchman state acquired traits of the welfare officer, but never of the engineer. Sustained and structural intervention in the economy was the one task for which its organic liberalism was entirely ill-suited. 33

In the new accounts, the prevalence of such analyses testifies to the ubiquity of the technocratic and militaristic critiques; it provides evidence not for the weakness of technocracy and militarism, but of their ideological power. And that ideological power is still very strong, influencing a whole new generation of cultural historians of ‘national identity’ who still write as if Britain was all welfare, empire, decline.

It will be obvious by now that I think we should pay attention to the discordant voices who took a different view, even for their own very particular reasons. I have mentioned a few, including the submariner Bernard Acworth, F. R. Leavis, George Orwell, and Tizard and Blackett. They can provide a historiography from below which will help us to understand the history of science and technology. We should also include E. P. Thompson, a pioneer of history from below. In a famous 1965

article on the ‘peculiarities of the English’ he maintained that science and political economy were central to British culture, to British national identity. He also insisted that post-war Britain played a key role in a European cold war, in which there was a powerful British military–industrial ‘Thing’ which was obscured in ‘declinist’ analyses from left, centre and right.  

Times change. There has been a decoupling of science and nation; an extraordinary de-nationalization of the research enterprise. The state research corps is hardly what it was; national enterprises are no longer so national. The politics of declinism have not outlived the election of New Labour. The welfare state is not so secure; the warfare state is under the control of another power. The proportion of women in universities, even studying science and technology, has greatly exceeded the peaks of the nineteen–twenties. Universities, despite enormous national constraints, have become more international, and at Imperial we have witnessed the return of very generous private philanthropy. Our Centre exemplifies these trends. Let me mention the case of a Ph.D. student whose family emigrated from Germany to Sweden in the eighteenth century, to Colombia in the nineteenth, who came to study the work of a theoretical physicist born in British India who spent most of his career at Imperial and who created a multinational institute in Trieste, an especially international border city. The physicist was the Nobel Laureate Abdus Salam. In such a milieu, and in such historical circumstances, it becomes easier to see British history in European and in world perspectives.  

Times change, and for me this inaugural lecture marks an end as much as a beginning – for much of what I have said will be found in my forthcoming book on the warfare state. It marks the end of the end of a project begun here at Imperial, in very different circumstances. I am already working on another project on ‘The uses of things’ in the twentieth century; a history of things in use, of their design, manufacture, maintenance and repair, not just their innovation. It will take me away from British history to world history, from armaments to the ubiquitous technologies of everyday life, and from the world of Zaharoff to the world of Rausing.  

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36 Edgerton, Warfare State.  