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The Era of Biomedicine: Science, Medicine, and Public Health in Britain and France after the Second World War

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The relationship between medicine and the study of life is as old as medicine itself. Nevertheless, historians have highlighted the great transformation that took place in the nineteenth century when first physiology and then bacteriology became important resources for the classification, diagnosis, and treatment of human diseases.¹ In that period, significant links developed between the sites specializing in biological experimentation (i.e. laboratories) on the one hand, and the places of healing (i.e. hospitals, dispensaries) and public health offices on the other. Together, they helped to fashion modern, professional medicine.² However, many historical studies have also argued that this mobilization of biological knowledge exerted a limited impact on medical practice in general, and clinical practice in particular.³

The well-documented history of bacteriology is emblematic of these conflicting trends. While one may point out the importance of widely circulated and celebrated innovations, such as bacteriological cultures and diagnoses, or a few but impressive therapeutic agents like diphtheria antitoxin, bacteriology itself did not have a radical impact on early-twentieth-century public health.⁴ The history of tuberculosis in industrial Europe is a powerful—and often mentioned—illustration of this. The bacteriological trajectory of tuberculosis is not only remembered because of the success of animal modelling, which led to the identification of Koch's bacillus, or because of the effectiveness of X-rays, which enabled the early detection of tubercular lesions. It is also marked by the failure of Koch's tuberculin as a miracle drug, by the controversies surrounding the efficacy of BCG vaccination and the Lübeck affair, by the uncertainties about the combined roles of heredity and infection in the aetiology of the disease, as well as by the enduring domination of public hygiene and palliative care in sanatoria.⁵ It is only after the beginning of the antibiotic era, in the late 1940s and early 1950s, that decisive improvements in the control of the white plague could be attributed to the conjunction of chemical and bacteriological work conducted both in academic and industrial laboratories.⁶ Generalizing from the example of tuberculosis, one can therefore argue that biomedicine was only truly "invented" after the Second World War.

The transformation of biology and medicine, and their convergence after 1945, is far from being uncharted territory for historians.⁷ Several studies have revealed a step change in the scale of investment in research, a new role for the state as scientific entrepreneur, an increasingly fundamental level of investigation in biology and medicine, and a closer relationship between the laboratory and the clinic. They have also described the culture of the therapeutic miracle that has pervaded scientific and medical communities, and inspired the search for magic bullets against tuberculosis, cancer, and cardiovascular diseases.⁸ In fact, the links between these changes have been such that the period 1945–1975 could be described as one of a new system of

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relations between science, technology and medicine, or as a new “way of knowing”.⁹

That the post-war period saw the growth of biomedical complexes characterized by the intensification of research in the life sciences, the hunt for novel molecules, and a new alliance between biologists and the state, should not obscure the fact that it also saw renewed tensions and local variations, which challenge any description of it as the culmination of a uniform trend. Firstly, there have been tensions between three different kinds of medicine: experimental medicine, clinical medicine, and social medicine. Although biomedicine has, above all, been dominated by experimental medicine, other sets of practices have persisted alongside those employed by the experimenter, including molecular modelling and analysis, and biomedical scientists have developed complex relationships with hospital clinicians and public health officials, which have varied from arms-length distance, to mutual inter-dependence, and—more rarely—to outright collaboration.

Then, of course, there have been variations due to different local and national contexts. Whether these have affected the status of medical goods and services, the relationship between health professionals and the state, the evolution of scientific disciplines and medical specialties, the hierarchy between them, the regulation of the pharmaceutical industry and the medical market, or simply what is meant by “social”, these different contexts have influenced the evolution and nature of biomedical complexes. Even within the relatively homogeneous scientific landscape of post-war Europe, one might therefore expect national differences to have played a role that has been all the more important in that, in the decades after the war, the management of life and health became a matter for the state, exceeding in scale and scope the demographic concerns of earlier governments.

However, as Anne Hardy and Tilli Tansey have rightly pointed out, “there is no satisfactory general overview of the history of western medicine after 1945”,¹⁰ particularly concerning the changing relationship between laboratories, clinical settings, and public health authorities, and taking into account the different countries that have contributed to the western medical tradition. The purpose of the following collection is therefore to examine further this changing relationship, as well as encourage the study of biomedicine in different national contexts.

The first choice we made in preparing this issue was to concentrate on post-war clinical and public health research, in order to examine the forces and influences that fashioned western medicine in the “era of biomedicine”. Biological research and laboratory investigations have been the subject of much historical work in science and medicine after 1945, most notably in relation to the so-called “molecularization” that led biologists to relocate life and its most basic processes at the level of macromolecular structures, more especially DNA and genes. Historians of molecular biology and its parent disciplines, biochemistry, genetics, and virology, have stressed the critical role that the development of new tools and instrumental practices—such as the use of the ultracentrifuge, electron microscope, and electrophoresis—have played in this transformation.¹¹ These studies have also shown how the “molecular vision” of life was linked to the political and cultural aspects of the Cold War, its emphasis on information and control, and its permanent state of scientific mobilization in preparation for war.¹² Hence, between 1945 and 1965, biological experimentation changed radically, even if important fields like embryology and developmental studies proved much more difficult to attach to the molecular bandwagon than geneticists and biochemists had hoped.

These developments in the life sciences were not without their consequences for, and echoes in, medicine. The most obvious was the incorporation of new entities, ranging from enzymes to cancer viruses and inbred strains of mice, in the aetiological characterization of diseases. Despite such advances, the direct impact of molecular biology on medical practice remained confined to new explanatory models and diagnostic tools. The most significant displacements were more indirect, resulting from the complex interaction between the molecularization of the life sciences and the molecularization of medical intervention, i.e. the transformation of therapeutic targets and the generalization of a chemotherapeutic model of treatment, a situation influenced as well as exemplified by the post-war history of cancer.¹³ This aspect of “biomedicine”, in particular the

relationship between the misnamed “therapeutic revolution”—too readily attributed to the changing scale, organization, and targets of pharmaceutical research—and clinical and social medicine, which this issue touches upon, largely remains to be explored.¹⁴

The second principle guiding our selection was the particular interest of comparing Britain with France, for the history of these two countries’ biomedical complexes has many similar features, such as the relative underdevelopment of certain fields in the inter-war years, followed by a process of catching up after the Second World War.¹⁵ Yet the differences between Britain and France, not least their different systems of health care, might be significant enough to lead to distinct but nevertheless related biomedical practices, partly because none of the developments described above took place in isolation. However, exchanges were less a matter of direct, bilateral “crossed history”, than of intricate circulation, with the American biomedical complex as third party, functioning at once as a model, competitor, and provider of means—cognitive and financial, as well as instrumental—which reflected the economic, political and scientific hegemony of the United States.¹⁶

The very word “biomedicine”, its emergence and subsequent uses, is a testimony to these differences. The prominence acquired by the term between 1945 and 1975 coincided with the appearance of a new system of medical innovation in relation to biology and health policy. However, this system was far from homogeneous, and the meaning of biomedicine has been deeply influenced by the different scientific and national cultures that have shaped western medicine since the late nineteenth century. In Britain, the word biomedicine first appeared in Dorland’s 1923 *Medical dictionary*, and meant “clinical medicine based on the principles of physiology and biochemistry”.¹⁷ Although in the inter-war years the term was used only sporadically, it is significant that its invention coincided with the Medical Research Council’s move away from public health concerns, towards biological research.¹⁸ In this period, the “biomedical” work of the Council consisted in establishing a number of research units, mostly within the London teaching hospitals, where it promoted a distinct research style inspired by the Cambridge School of Physiology with the aim of making British clinical medicine more scientific.¹⁹ By contrast, in the French context, the word biomedicine appeared only in the 1960s, when it was used mainly by science policy makers and state administrators. Paradoxically, the term was not employed by the biologists involved in the post-war development of state-funded research agencies (the Centre National de la Recherche Scientifique (CNRS), or the Institut National d’Hygiene (INH), later Institut National de Santé et de la Recherche Médicale (INSERM), the French equivalent of the Medical Research Council [MRC]). On the contrary, they pleaded for a “de-medicalization” of disciplines such as bacteriology, immunology and virology, whose expansion had, according to them, been hampered by the influence of “medical mandarins”, and their disciplinary agenda led them to reject the very idea of “biomedicine”.²⁰ As for clinicians, they preferred the term “medical research” (“*recherche médicale*”) to describe what they saw as a domain based first and foremost on clinical expertise, even if it was influenced by advances made in the life sciences.²¹

The fate of “biomedicine” as a word is a marker of the specific, and yet parallel, changes that affected the relationship between science, medicine and public health in Britain and France. Although direct comparisons between the two countries are relatively rare,²² the historiography has tended to reinforce the idea of their distinct patterns of evolution. Thus, it has become commonplace to oppose the “nationalization” of the medical profession and the central planning of health services under the National Health Service (NHS) to the policy of *laissez-faire* and professional governance that prevailed with the Sécurité Sociale, even if in both cases the creation of a national health system allowed access to care to the vast majority of the population, and provided the basis upon which hospitals became the main site for—often high-tech—medical intervention.²³ Similarly, the expansion of biological and medical research followed different paths in the two countries: while the French favoured a model of full-time research under the umbrella of government agencies (the CNRS, INH and later INSERM), the British built on an older and stronger tradition of university-based research.²⁴ Furthermore, increasing post-war investments in experimental medicine had the

effect of perpetuating long-established disciplinary hierarchies, in Britain with the growth of genetics and biochemistry, and in France with the expansion of the “pasteurian” sciences, namely bacteriology, virology and immunology, which after the Second World War came under the influence of fundamental molecular biology.²⁵ Last but not least, the extensive use of medical statistics in Britain, where it was nurtured by a strong public health administration, contributed to clinical investigations of therapeutic efficacy and regulation of research practices, which came together in the controlled drug trial, an example rarely imitated before the late 1970s by the case-loving French clinicians. These observations drawn from the historiography help to highlight the legitimacy and significance of a comparison between Britain and France, particularly in view of the need to examine further the link between science, medicine and public health in the era of biomedicine.

However, a major paradox resulting from our comparison is that, despite these differences, French and British biologists and clinicians considered American biomedicine in much the same way, i.e. as a reference point, a resource, and a challenge. The American biomedical model is a “ghost” haunting European biomedical research.²⁶ Its pervading influence is evident in the reorientation of the circulation of people, tools and results from a trans-European to a trans-Atlantic direction, and by the realignment of research practices in western medicine in the years following the war.²⁷ It is therefore not a complete surprise if the most significant conclusions to emerge from our comparative exercise stress the similarities between Britain and France, for the rise of biomedicine led to profound changes, which blur the contrasts that have usually been drawn when thinking about the two sides of the “medical Channel”.

The most striking similarity, considering the strength of the British tradition in social medicine, was the re-definition of “public health” as essentially hospital- and drug-based, or in other words as curative rather than preventive medicine. The papers by John Stewart and Luc Berlivet show how this convergence emerged out of two different public health systems, the first in Britain, the second in France. The creation of the British NHS in the period of the “classic” welfare state—that is, from the end of the Second World War to the economic crises of the mid-1970s—produced many new research opportunities.²⁸ Stewart’s paper goes on to argue that, important as these opportunities and the resulting achievements were, there were also considerable constraints, which affected not only the NHS, but also the MRC operating within it. The opportunities were in many respects obvious enough—universal health care for British citizens, which was comprehensive, free at the point of delivery, and accompanied by steadily rising expenditures. However, the creation of the NHS has been problematic for those with aspirations to a form of medicine that takes into account the socio-economic environment, emphasizing prevention rather than cure, and thus overall seeks to deal with health in an integrated rather than molecular manner. The reasons for this were firstly, financial, since Britain’s commitment to social medicine was limited even by European standards; secondly, structural, since in the process of policy formation key influence was handed over to the medical profession, thus empowering actors who were largely wedded to the biomedical model, and paid relatively little attention to environmental factors; and thirdly, political, since although all the major parties were in favour of the NHS in some form or another, in matters of health policy strategy politicians were not only prepared to cede power to the medical profession, they also conferred a relatively low status upon the Ministry of Health. All this resulted in a system in which the emphasis was on curative medicine/biomedicine (particularly in a hospital environment) at the expense of the interrelated and overlapping fields of preventive medicine/social medicine/public health/integrated and proactive primary care. Thus, the public health sector and the local authorities experienced a significant loss of power. Social medicine in particular was discouraged as a discipline, and eventually declined into a version of medical statistics.²⁹

On this point, Berlivet’s paper converges and intersects with Stewart’s. Berlivet analyses how the rise of biomedicine impacted on French public health research after the Second World War. In France, the rise of biomedicine did not depend upon, or lead to, displacements of concepts, instruments or people; on the contrary. As in the case of Britain, it was a matter of intellectual and institutional competition between various forms of health-related enquiries. The INH, established by the Vichy regime but later maintained and expanded by the political and scientific elites of the Fourth and Fifth Republics, was initially set up to monitor

the health of the French population.³⁰ This institutional configuration allowed for the development of a wide range of investigations, characterized by an emphasis on the social dimension of disease. However, in the 1950s and 1960s, changes in the approach to medical research prompted a transformation of the INH into an institute of biomedicine, a trend that accelerated after it was renamed the Institut National de Santé et de la Recherche Médicale (INSERM) in 1964. The social and population approach to public health previously adopted by the INH, and reflected in its large surveys of infectious diseases and later chronic illnesses—cancer and respiratory disorders among them—was gradually marginalized. At the same time, the rise of biomedicine encouraged a different kind of population-based research. A group of medical statisticians built on their links with some influential clinicians and experimenters to promote a version of epidemiology that concentrated mainly on clinical trial methodology and on the inferential analysis of complex aetiologies like cancer and cardiovascular diseases, thus advancing a form of “experimental” medicine typical of the era of biomedicine, but not biological in essence.

The last two papers deal with yet another similarity that emerges from this comparison, namely the common rise of the clinical trial as a privileged form of, and site for, therapeutic evaluation. The history of clinical trials has begun to move away from the once overarching concern with methodological innovation and the problematic emergence of statistics as a legitimate form of evidence in medicine. Recent work on the British aspect of the story has focused on the peculiar history of statistical studies and clinical research conducted under the aegis of the MRC.³¹ The Second World War and post-war reconstruction, not least with the launch of the NHS in 1948, provided the MRC with scope and opportunity to expand its activities significantly and venture into new areas such as cancer, which had previously been dominated by other bodies,³² as well as consolidate its role in more traditional fields of study, such as tuberculosis. In this connection, the MRC trials of streptomycin for the treatment of tuberculosis are usually seen as a highpoint in the history of modern biomedicine. These trials helped to establish the Randomized Controlled Trial (RCT) as a gold standard in clinical research.³³ By contrast, the historiography on the American route to controlled trials has been less interested in randomization and trial design than in clinical work, organizational change, and drug regulation.³⁴ The 1962 Kefauver–Harris amendments to the Food and Drug Act, which provided the Food and Drug Agency (FDA) with a mandate to enforce investigations of both toxicity and efficacy when examining drug marketing applications, deeply altered clinical and pharmaceutical research, since “controlled trials” were made a legal requirement. These amendments were supported by an alliance of American public health administrators and clinical reformers working in prominent teaching hospitals, such as those at Harvard and Johns Hopkins, who had long been searching for instruments of medical evaluation that would at once make clinical practice more “rational”, and the average practitioner less dependent on the claims of the pharmaceutical industry.³⁵

Parallel studies of the “trial culture” in post-war medicine have concentrated on the generalization of the RCT in cancer chemotherapy.³⁶ Although the roots of this evolution remain equivocal, the industrial origins of cancer chemotherapy as well as the political context of the American war on cancer have played a crucial role in the success of the RCT. Clinical investigations of chemotherapeutic treatments were developed by the National Cancer Institute in association with a mass-screening enterprise, which adopted a high-throughput approach, and the use of standard molecules, animal models, and therapeutic protocols.³⁷ In this context, clinical trials were a means of alignment and control over heterogeneous local practices. They played an important part in scaling-up activities and achieving statistical significance, but unexpectedly resulted in a blurring of the boundaries between the biological modelling of cancer causation and the therapeutic combination of surgery, radiotherapy, and drugs. In addition, clinical trials seemed particularly well suited to the production of evidence in cases where efficacy was not a matter of cure but rather a question of survival time, and to the evaluation of palliative forms of medical intervention, as in the case of cancer.

If the 1947 streptomycin trials are well remembered, it is less well known that the MRC Tuberculosis Research Unit that oversaw these trials also organized clinical trials on the treatment of lung cancer, which

were far less successful in that they produced less clear-cut evidence than their predecessors. In their paper, Helen Valier and Carsten Timmermann look at both sets of trials, comparing the (often similar) problems the MRC researchers encountered when organizing the different studies, and the various ways in which they dealt with these. In contrast to the TB trials, lung cancer trials proved a poor instrument of investigation, as the assessment of the effectiveness of combined radiotherapy and surgery in relation to various radiotherapy regimes delivered inconclusive results, which merely confirmed the status lung tumours acquired in the 1960s as “untreatable” cancers because of the constant comparison made with the highly visible and successful example of childhood leukaemia. The value of the MRC researchers’ attempts was therefore—Valier and Timmermann argue—less in the knowledge produced, than in their organizational significance. This distinction confirms Löwy’s observations on the palliative function of the trials, as well as her vision of a biomedical world divided into two domains, the first a biological realm where research entities are easy to control and manipulate, the second a clinical realm where cure is difficult to achieve and research messy. Thus the post-war MRC trials participated in the transformation of clinical research into a collective enterprise that relied on sophisticated forms of co-ordination and division of labour, a development mirroring the hospital-based organization of the NHS.

The “resistance” (a term invented by professional statisticians) of the French *grands cliniciens* towards medical statistics is a common trope in the history of French medicine, often linked to Claude Bernard’s famous plea against the use of percentage and computation in both experimental and clinical medicine.³⁸ Examining the clinical research programme on leukaemia carried out under the leadership of Jean Bernard at the Saint-Louis Hospital in Paris, Christelle Rigal’s paper shows us how in some circles of the medical elite such disdain for numbers had by the 1960s become unacceptable. The internationalization of leukaemia research was an important element in this transformation. Rigal’s study reveals the “biomedical triangle” referred to earlier, describing as it does the development of international studies launched by the American National Cancer Institute, which tested molecules of American origin, but repeatedly mobilized a methodology that was attributed to British inferential statistics. Local tinkering led to a combination of RCTs and alternative designs that included historical controls, as well non-randomized trials, a situation far from specific to France.³⁹ Specificity was not absent, however. Unlike its American counterpart, French “clinical biomedicine” was not based on a pharmaceutical culture of industrial standardization, but in a way similar to Britain, Rigal argues, on an administrative culture of state planning.

What message can historians of twentieth-century medicine take from this selection of articles? Our first conclusion is that it is worth embedding biomedicine within the broader context of different post-war national health systems, and vice-versa, and looking more precisely at the articulation as well as tensions between the three forms of medicine, experimental, clinical, and social, which make up the western medical tradition. The second conclusion is that—contrary to what one might expect—in the era of biomedicine, individual national patterns have had a relatively limited influence. The moral and political economy of the post-war period stimulated the rapid internationalization of biological research. This, in turn, resulted in similar challenges for different national scientific communities, if not similar practices, with the consequence that analogous responses were worked out when “experimentalizing” clinical or public health research. Our third and last conclusion is simply that recognizing this complex history may be helpful in making the current wave of “biomedicalization” less radical and unexpected than social analysts are tempted to assume.⁴⁰

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¹W F Bynum, *Science and the practice of medicine in the nineteenth century*, Cambridge University Press, 1994; *idem*, 'The rise of science in medicine, 1850–1913', in W F Bynum, Anne Hardy, Stephen Jacyna, Christopher Lawrence, and E M Tansey, *The western medical tradition 1800 to 2000*, Cambridge University Press, 2006, pp. 103–230.

²The development of medicine as a modern profession has been discussed most thoroughly in relation to the United States and Germany; on the American example, see John Harley Warner, *The therapeutic perspective: medical knowledge, practice, and professional identity in America, 1820–1885*, Cambridge, MA, Harvard University Press, 1984; on Germany, see Charles E McClelland, *The German experience of professionalization: modern learned professions and their organizations from the early nineteenth century to the Hitler era*, Cambridge University Press, 1991; on France: Matthew Ramsay, 'The politics of professional monopoly in nineteenth-century medicine: the French model and its rivals', in Gerald L Geison (ed.), *Professions and the French state, 1700–1900*, Philadelphia, University of Pennsylvania Press, 1984; on Britain: Ivan Waddington, *The medical profession in the industrial revolution*, Dublin, Gill and Macmillan, 1984.

³For historical overviews of clinical research, see Christopher C Booth, 'Clinical research', in W F Bynum and Roy Porter (eds), *Companion encyclopedia of the history of medicine*, London and New York, Routledge, 1990, vol. 1, pp. 205–9; Christiane Sinding, *Le clinicien et le chercheur: des grandes maladies de carence à la médecine moléculaire*, Paris, PUF, 1991; Christopher Lawrence, 'Clinical research', in John Krige and Dominique Pestre (eds), *Science in the twentieth century*, Amsterdam, Harwood Academic, 1997, pp. 439–59. See also Christopher Lawrence and George Weisz (eds), *Greater than the parts: holism in medicine, 1920–1950*, Oxford University Press, 1998.

⁴For an introduction to the debates about the impact of medical science on public health, see Thomas McKeown, *The role of medicine: dream, mirage, or nemesis?*, London, Nuffield Provincial Hospitals Trust, 1976; Paul Weindling, 'From infectious to chronic diseases: changing patterns of sickness in the nineteenth and twentieth centuries', in Andrew Wear (ed.), *Medicine in society; historical essays*, Cambridge University Press, 1992, pp. 303–16; Anne Hardy, 'On the cusp: epidemiology and bacteriology at the Local Government Board, 1890–1905', *Med. Hist.*, 1998, **42**: 328–46.

⁵Christoph Gradmann, *Krankheit im Labor: Robert Koch und die medizinische Bakteriologie*, Göttingen, Wallstein, 2005; Christian Bonah, Etienne Lepicard and Volcker Roelcke, *La médecine expérimentale au tribunal*, Paris, Editions des Archives Contemporaines, 2003; Jean-Paul Gaudillière and Ilana Löwy (eds), *Heredity and infection: a history of disease transmission*, London, Routledge, 1998; Michael Worboys and Flurin Condrau (eds), *Tuberculosis then and now: interdisciplinary perspectives on a post-modern plague*, forthcoming.

⁶In addition to Worboys and Condrau (eds), op. cit., note 5 above, see John E Lesch, *The first miracle drugs: how the sulfa drugs transformed medicine*, Oxford University Press, 2007; Jean-Paul Gaudillière, 'The invention of screening: Bayer, Rhône-Poulenc und die Geburt von Tuberkulose Therapie nach dem zweiten Weltkrieg', *Medizinisches Historisches Journal*, forthcoming.

⁷On biological and medical research after 1945, see Jean-Paul Gaudillière, *Inventer la biomédecine: la France, l'Amérique et la production des savoirs du vivant (1945–1965)*, Paris, La Découverte, 2002 (English translation forthcoming from Yale University Press); Peter Keating and Alberto Cambrosio, *Biomedical platforms: realigning the normal and the pathological in late-twentieth-century medicine*, Cambridge, MA, MIT Press, 2003; Ilana Löwy, *Between bench and bedside: science, healing and interleukine-2 in a cancer ward*, Cambridge, MA,

Harvard University Press, 1996; Roger Cooter and John Pickstone (eds), *Medicine in the twentieth century*, Amsterdam, Harwood Academic Publishers, 2000; Paul Starr, *The social transformation of American medicine: the rise of a sovereign profession and the making of a vast industry*, New York, Basic Books, 1982. See also Anne Hardy and E M Tansey, 'Medical enterprise and global response, 1945–2000', in Bynum, *et al.*, *The western medical tradition*, op. cit., note 1 above, pp. 405–533.

⁸See, for example, David Cantor, 'Cortisone and the politics of drama, 1949–1955', in John V Pickstone (ed.), *Medical innovations in historical perspective*, Basingstoke, Macmillan, 1992, pp. 163–84; James Le Fanu, *The rise and fall of modern medicine*, London, Abacus, 1999; Toine Pieters, *Interferon: the science and selling of a miracle drug*, Abingdon and New York, Routledge, 2005; Lesch, op. cit., note 6 above; Robert Bud, *Penicillin: triumph and tragedy*, Oxford University Press, 2007; Viviane Quirke, 'From evidence to market: Alfred Spinks's 1953 survey of new fields of pharmacological research, and the origins of ICI's cardiovascular programme', in Virginia Berridge and Kelly Loughlin (eds), *Medicine, the market and the mass media: producing health in the twentieth century*, London and New York, Routledge, 2005, pp. 146–71; Viviane Quirke, 'Putting theory into practice: James Black, receptor theory and the development of the beta-blockers at ICI, 1958–1978', *Med. Hist.*, 2006, **50**: 69–92.

⁹John V Pickstone, *Ways of knowing: a new history of science, technology and medicine*, Manchester University Press, 2000.

¹⁰Anne Hardy and E M Tansey, 'Bibliographical essays', in Bynum, *et al.*, *The western medical tradition*, op. cit., note 2 above, pp. 537–64, on p. 555.

¹¹Robert E Kohler, *Partners in science: foundations and natural scientists, 1900–1945*, University of Chicago Press, 1991; Lily E Kay, *The molecular vision of life: Caltech, the Rockefeller Foundation, and the rise of the new biology*, Oxford and New York, Oxford University Press, 1993; Nicolas Rasmussen, *Picture control: the electron microscope and the transformation of biology in America, 1900–1960*, Stanford University Press, 1997; Pnina G Abir-Am, 'The molecular transformation of twentieth-century biology', in Krige and Pestre (eds), op. cit., note 3 above, pp. 495–523; Angela N H Creager, *The life of a virus: tobacco mosaic virus as an experimental model, 1930–1965*, University of Chicago Press, 2002; Soraya de Chadarevian, *Designs for life: molecular biology after World War II*, Cambridge University Press, 2002; Gaudillière, op. cit., note 7 above.

¹²Lily E Kay, *Who wrote the book of life? A history of the genetic code*, Stanford University Press, 2000.

¹³In addition to above mentioned works, see the collection of essays gathered by David Cantor in the special issue of the *Bulletin of the History of Medicine* (2007, **81** [1]) on cancer after the Second World War.

¹⁴The relationship between drug companies and clinicians has begun to receive special attention from historians. See Nicolas Rasmussen, 'The drug industry and clinical research in interwar America: three types of physician collaborator', *Bull. Hist. Med.*, 2005, **79**: 50–80; Jeremy A Greene, *Prescribing by numbers: drugs and the definition of disease*, Baltimore, Johns Hopkins University Press, 2007; Viviane Quirke, *Collaboration in the pharmaceutical industry: changing relationships in Britain and France, 1935–1965*, Abingdon and New York, Routledge, 2008, pp. 241–2.

¹⁵For a comparative study of the development of biochemistry, see Robert E Kohler, *From medical chemistry to biochemistry: the making of a biomedical discipline*, Cambridge University Press, 1982. Regarding French and British medical sciences and the pharmaceutical industry, see Quirke, op. cit., note 14 above. Concerning medicine and the life sciences in France, in addition to already mentioned works, see Claude Debru, Jean Gayon, and Jean-François Picard (eds), *Les sciences biologiques et médicales en France, 1920–1950*, Paris, CNRS Editions, 1994; in Britain: Steve Sturdy, 'Medical chemistry and clinical medicine: academics and the scientisation of medical practice in Britain, 1900–1925', in Ilana Löwy, Olga Amsterdamska, John Pickstone and Patrice Pinell (eds), *Medicine and change: historical and sociological studies of medical innovation*, Montrouge, John Libbey

Eurotext, and Paris, INSERM, 1993, pp. 371–93; Soraya de Chadarevian and Harmke Kaminga (eds), *Molecularizing biology and medicine: new practices and alliances, 1910s–1970s*, Amsterdam, Harwood Academic Publishers, 1997.

¹⁶John Krige, *American hegemony and the postwar reconstruction of science in Europe*, Cambridge, MA, MIT Press, 2006; in relation to the pharmaceutical industry, see Viviane Quirke, ‘Anglo-American relations and the co-production of American hegemony in pharmaceuticals’, in Hubert Bonin and Ferry de Goey (eds), *American firms in Europe*, Geneva, Droz, forthcoming, pp. 306–26.

¹⁷Keating and Cambrosio, op. cit., note 7 above, p. 52.

¹⁸Joan Austoker, ‘Walter Morley Fletcher and the origins of a basic biomedical research policy’, in Joan Austoker and Linda Bryder (eds), *Historical perspectives on the role of the MRC: essays in the history of the Medical Research Council of the United Kingdom and its predecessor, the Medical Research Committee, 1913–53*, Oxford University Press, 1989, pp. 23–33, and other contributions in this volume.

¹⁹On the MRC's contribution to British clinical research, see especially Booth, op. cit., note 3 above, pp. 205–9.

²⁰Gaudillière, op. cit., note 7 above, ch. 8, pp. 292–317.

²¹Jean-François Picard, ‘Poussée scientifique ou demande de médecins? La recherche médicale en France de l'Institut National d'Hygiène à l'INSERM: contributions à l'histoire de la recherche médicale en France au XXème siècle’, *Sciences Sociales et Santé*, 1992, **10**: 47–106; *idem*, ‘De la médecine expérimentale (1865) à l'INSERM (1964)’, in Debru, *et al.* (eds), op. cit., note 15 above, pp. 329–43, on p. 342.

²²These have mainly dealt with the pharmaceutical industry, for example, Leigh M Hancher, *Regulating for competition: government, law and the pharmaceutical industry in the United Kingdom and France*, Oxford, Clarendon, 1990; Lacy G Thomas, ‘Implicit industrial policy: the triumph of Britain and the failure of France in global pharmaceuticals’, *Industrial and Corporate Change*, 1994, **3**: 451–89; Quirke, op. cit., note 14 above.

²³Cooter and Pickstone (eds), op. cit., note 7 above.

²⁴Jean-François Picard, *La république des savants: la recherche française et le CNRS*, Paris, Flammarion, 1990; Picard, ‘Poussée scientifique’, op. cit., note 21 above; Michael Sanderson, *The universities and British industry, 1850–1970*, London, Routledge and Kegan Paul, 1972; Quirke, op. cit., note 14 above, Part III; Clive Field and John Pickstone, *A centre of intelligence: the development of science, technology and medicine in Manchester and its university*, Manchester, John Rylands University Library of Manchester, 1992; Arthur W Chapman, *The story of a modern university: a history of the University of Sheffield*, London, Oxford University Press, 1995; Jack Morrell, *Science at Oxford, 1914–1939: transforming an arts university*, Oxford, Clarendon Press, 1997; Mark Weatherall, *Gentlemen, scientists and doctors: medicine at Cambridge, 1800–1940*, Woodbridge, Boydell Press, 2000.

²⁵See, for example, Michel Morange, *Histoire de la biologie moléculaire*, Paris, La Découverte, 1994, especially ch. 14 on the French school of molecular biology, and Gaudillière, op. cit., note 7 above, chs 7 and 8.

²⁶For a general description of the transformation of US medicine after 1945, see Starr, op. cit., note 7 above.

²⁷For an example, see Jean-Paul Gaudillière, ‘Paris–New York roundtrip: transatlantic crossings and the reconstruction of the biological sciences in post-war France’, *Stud. Hist. Philos. Biolog. Biomed. Sci.*, 2002, **33**: 389–417. For a tri-partite comparison in relation to molecular biology, see Pnina G Abir-Am, ‘Molecular biology in the context of British, French, and American cultures’, *Inter. Soc. Sci. J.*, 2001, **168**: 187–99.

²⁸For an overview of the origins and development of the NHS, see Charles Webster, *The National Health Service: a political history*, Oxford University Press, 1998. See also Rudolf Klein, *The new politics of the NHS*, 3rd ed., London, Longman, 1995; Geoffrey Rivett, *From cradle to grave: fifty years of the NHS*, London, King's Fund, 1998.

²⁹Dorothy Porter (ed.), *Health, civilization and the state: a history of public health from ancient to modern times*, London, Routledge, 1999. See also Virginia Berridge, *Health and society in Britain since 1939*, Cambridge University Press, 1999; Anne Hardy, *Health and medicine in Britain since 1860*, Basingstoke, Macmillan, 2000.

³⁰Jean-François Picard, 'Aux origines de l'INSERM: André Chevallier et l'Institut National d'Hygiène et l'INSERM', *Sciences Sociales et Santé*, 2003, **21**: 5–26.

³¹For a British history of clinical trials, see J Rosser Matthews, 'Major Greenwood versus Almroth Wright: contrasting visions of "scientific" medicine in Edwardian Britain', *Bull. Hist. Med.*, 1995, **69**: pp. 30–43; *idem*, *Quantification and the quest for medical certainty*, Princeton University Press, 1995; A Yoshioka, 'Use of randomisation in the Medical Research Council's clinical trial of streptomycin in pulmonary tuberculosis in the 1940s', *Br. med. J.*, 1998, **317**: 1220–3; Eileen Magnello and Anne Hardy (eds), *The road to medical statistics*, Amsterdam and New York, Rodopi, 2002; Iain Chalmers and Mike Clarke, 'The 1944 patulin trial: the first properly conducted multicentre trial conducted under the aegis of the British Medical Research Council', *Inter. J. Epidemiol.*, 2004, **33**: 253–60.

³²On cancer research, see, for example, Joan Austoker, *A history of the Imperial Cancer Research Fund, 1902–1986*, Oxford University Press, 1988.

³³Harry M Marks, *The progress of experiment: science and therapeutic reform in the United States, 1900–1990*, Cambridge University Press, 1997; Stefan Timmermans and Marc Berg, *The gold standard: the challenge of evidence-based medicine and standardization in health care*, Philadelphia, PA, Temple University Press, 2003.

³⁴Marks, *op. cit.*, note 33 above; Arthur A Daemrich, *Pharmacopolitics: drug regulation in the United States and Germany*, Chapel Hill, University of North Carolina Press, 2004.

³⁵Daemrich, *op. cit.*, note 34 above, ch. 2; Marks, *op. cit.*, note 33 above, ch. 8.

³⁶Löwy, *op. cit.*, note 7 above; Peter Keating and Alberto Cambrosio, 'From screening to clinical research: the cure of leukemia and the early development of the cooperative oncology groups, 1955–1966', *Bull. Hist. Med.*, 2002, **76**: 299–334. See also Peter Keating and Alberto Cambrosio, 'Cancer clinical trials: the emergence and development of a new style of practice', *Bull. Hist. Med.*, 2007, **81**: 197–223, on p. 199.

³⁷R F Bud, 'Strategy in American cancer research after World War Two: a case study', *Soc. Stud. Sci.*, 1978, **8**: 425–59; Ilana Löwy and Jean-Paul Gaudillière, 'Disciplining cancer: mice and the practice of genetic purity', in Jean-Paul Gaudillière and Ilana Löwy (eds), *The invisible industrialist: manufactures and the production of scientific knowledge*, Basingstoke, Macmillan, 1998, pp. 209–49.

³⁸Jean-Paul Gaudillière, *La médecine et les sciences, XIXè–XXè siècles*, Paris, La Découverte, 2006, pp. 48–65, 89–92.

³⁹Keating and Cambrosio, 'From screening to clinical research', *op. cit.*, note 36 above.

⁴⁰Adele E Clarke, Janet K Shim, Laura Mamo, Jennifer R Fosket, and Jennifer R Fishman, 'Biomedicalization: technoscientific transformations of health, illness and U.S. biomedicine', *Am. Sociol. Rev.*, 2003, **68**: 161–94.

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