Science and the State

Was it coincidence that the modern state and modern science arose at the same time? This overview of the relations of science and state from the Scientific Revolution to World War II explores this issue, synthesising a range of approaches from history and political theory. John Gascoigne argues the case for an ongoing mutual dependence of the state and science in ways which have promoted the consolidation of both. Drawing on a wide body of scholarship, he shows how the changing functions of the state have brought a wider engagement with science, while the possibilities that science makes available have increased the authority of the state along with its prowess in war. At the end of World War II the alliance between science and state was securely established and, Gascoigne argues, is still firmly embodied in the post-war world.

Emeritus Professor John Gascoigne taught history at the University of New South Wales from 1980 until 2016. This is the sixth of his books with Cambridge University Press, which include *Encountering the Pacific in the Age of the Enlightenment*, which won the NSW Premier's General History Prize in 2014, and *Science in the Service of Empire: Joseph Banks, the British State and the Uses of Science in the Age of Revolution*.

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Science and the State

From the Scientific Revolution to World War II

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For my brother, Robert

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Illustrations

Abbreviations

CNRS	Centre National de la Recherche Scientifique (the National Centre for Scientific Research)
DSIR	Department of Scientific and Industrial Research
KW	Kaiser Wilhelm
MITI	Ministry for International Trade and Industry
NDRC	National Defence Research Council
NIH	National Institutes of Health
NSF	National Science Foundation
ONR	Office of Naval Research
OSRD	Office of Strategic Research and Development

Preface

The rise of science has been linked with a number of major trends in the history of the West: the rise of capitalism, the growth of Protestantism or the impact of exploration and contact with new lands. The object of this book is to examine another possible linkage: the extent to which the formation and consolidation of science was associated with that distinctive feature of Western history, the rise of the state. This is a subject that has received scholarly attention, but which has not been accorded the full-length examination over time that it merits. For the aim of this work is to examine the relationship between the state and science from the age of the Scientific Revolution until the end of World War II. What the book seeks to show is how reciprocal was the linkage between the state and science, with science in some respects strengthening the ideological and institutional reach of the state and, on the other, the ways in which state structures moulded the shape of science through its patronage of particular strands of scientific endeavour.

The work begins with some consideration of the character of both science and the state. Of particular interest here are the characteristics which promoted the formation of the modern state and its entrenchment as a global phenomenon (Chapter 1). This is followed by an examination of the early form of the state in the period of the Renaissance and the extent to which royal and princely patronage offered a basis for partnership between science and the state (Chapter 2). The Renaissance state is then contrasted with the absolutist state that followed it and that provided securer institutional foundations for building an alliance between the state and science (Chapter 3). On the other hand, nonabsolutist states are also shown to have developed different but nonetheless significant forms of linkage between their forms of government and the state (Chapter 4). The old-regime world of the absolutist state was shattered by the age of revolutions and, above all, by the French Revolution, which led to new state structures and ideologies that, in many cases, further entrenched science in the apparatus of government (Chapter 5). By the time of the period from the mid-nineteenth century to World War I, the

state was widening its functions in ways that promoted more recourse by government to scientific advice, with the beginnings of systems of social welfare and public health. This was also the period of 'high imperialism' which meant a greater attention to the uses of science as a device for extending and consolidating imperial rule. (Chapter 6). The period from 1914 to 1945 is, of course, dominated by war, which did much to consummate fully the partnership between science and the state. It was also a period when science came under the sway of totalitarian governments, an experience which underlined the adaptability of scientists to various regimes (Chapter 7). By 1945, both science and the state had spread to much of the globe, taking different forms as it did so. Global expansion also raised issues about the tension between the national and the international dimensions of science (Chapter 8). The integration of science and government, which was brought to pass by the war, makes 1945 a natural ending point for this survey. To reinforce this argument an Epilogue considers some of the major developments that occurred around the globe in the decades immediately after World War II to illustrate how 1945 marked a watershed. Thereafter, there were, of course, significant developments, but they occurred within the context of a consensus that the state had a major role to play as a patron of science. To make this work of manageable size, the method generally followed is to provide case studies of key countries in comparison with each other in the context of the general themes which I have outlined. The result is the omission of other countries that might have been included, but perhaps will be the subject of future studies by others to advance further our understanding of the relations between science and the state.

As a work of synthesis this book is much indebted to many scholars who have written on topics linked to its major themes. My thanks go to Lucy Rhymer at Cambridge University Press for her interest in this project. My thanks, too, to my copy editor, Matthew La Fontaine, for his close attention to my text and to Arnia Van Vuuren for producing a comprehensive index. A one-month fellowship at the Huntington Library, Los Angeles, enabled me to begin work on this book in its pleasant surroundings. Thanks to my family, my children, Robert and Catherine, and my wife, Kate, for their support during the ups and downs of the period when this book was being researched and written.

Chronology

1543	publication of Nicolaus Copernicus' *About the revolutions of the heavenly spheres* and Andreas Vesalius's *About the structure of the human body*
1610	Galileo appointed Mathematician-Philosopher at the court of the Medicis
1626	establishment of the French Royal Garden
1627	publication of Francis Bacon's *New Atlantis*
1633	papal condemnation of Galileo for advancing the Copernican theory
1651	publication of Thomas Hobbes' *Leviathan*
1660	foundation of the Royal Society of London
1666	foundation of the Academy of Sciences of Paris
1687	publication of Isaac Newton's *Mathematical principles of natural philosophy*
1714	British Board of Longitude established
1724/5	foundation of the Saint Petersburg Academy of Science
1736 to 1737, 1735 to 1743 respectively:	Pierre Maupertuis' voyage to Lapland, Charles-Marie de La Condamine's voyage to Peru – both sponsored by Academy of Sciences of Paris in order to determine shape of the earth
1743	foundation of the American Philosophical Society
1744	refounding by Frederick the Great of the Berlin Royal Academy of Sciences
1773	the Royal Gardens at Kew transformed from a royal pleasure garden to a botanical research institute
1774	Spain establishes a royal garden
1793	closure of the Academy of Sciences by the French revolutionary government
1793	foundation of the National Museum of Natural History (replaces the Royal Garden)

1794	foundation of the École Polytechnique
1795	foundation of the French National Institute
1795	foundation of the French Bureau des longitudes
1863	foundation of US National Academy of Sciences
1883	foundation of the British Museum of Natural History
1887	foundation of the German Imperial Physical Technical Institute
1888	foundation of the Paris Pasteur Institute for biological research
1891	foundation of the Berlin Robert Koch Institute for disease control
1900	foundation of the British National Physical Laboratory
1901	foundation of the US Bureau of Standards
1901	foundation of the Rockefeller Institute for Medical Research
1911	foundation of the Kaiser Wilhelm Society for the Promotion of Research
1916	foundation of the US National Research Council
1916	foundation of the British Department of Scientific and Industrial Research (DSIR)
1929	Stalin's 'Great Break'; beginning of purge of the Soviet Academy of Sciences
1939	foundation of French Centre national de la recherche scientifique (CNRS) (the National Centre for Scientific Research)
1940	foundation of the US National Research Defence Committee
1941	foundation of the US Office of Scientific Research and Development
6 Aug 1945	detonation of the atomic bomb over Hiroshima
1945	publication of *Science – the endless frontier*
1946	foundation of US Office of Naval Research
1948	renaming of the Kaiser Wilhelm Society, the Max Planck Institute
1949	detonation of Soviet atomic bomb
1950	formation of the US National Science Foundation (NSF)