A British Institution

The National Physical Laboratory. A History. EDWARD PYATT. Hilger, Bristol, England, 1983 (U.S. distributor, Heyden, Philadelphia). x, 270 pp., illus. $48.

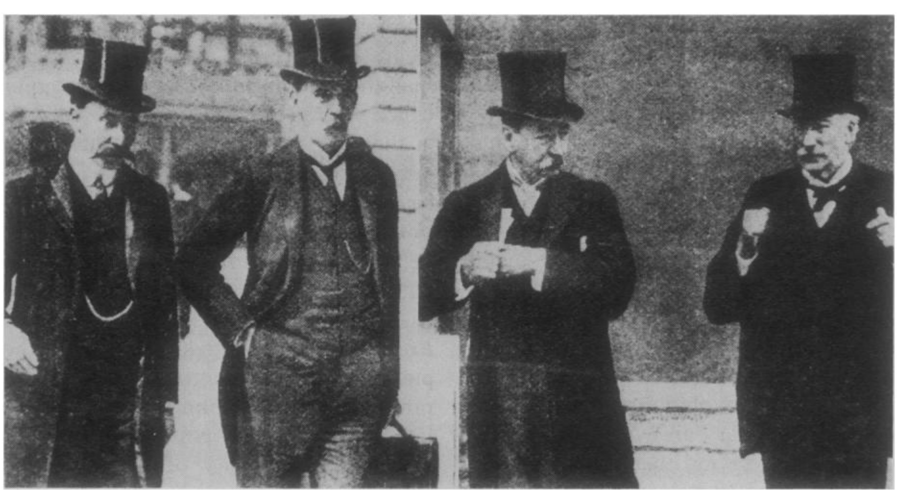
How were the British police of 1908 to ascertain the accuracy of the newly introduced taximeter? What kind of thermometer could the 1921 British team take with them on their assault of Mount Everest? Which lighting design for Buckingham Palace would be most flattering to the debutantes of the 1930's? How was comfort to be improved in the sometimes drafty, sometimes stuffy Debating Room in the new House of Commons? By what means could the Concorde aircraft be weighed? What was the force exerted by a hawfinch in cracking a cherrystone? These are among the more frivolous studies that have been undertaken by the National Physical Laboratory of Teddington, England.

This is not to suggest that the laboratory itself is frivolous. NPL has been one of the most important 20th-century British institutions for scientific research and industrial applications. It has conducted basic research, strengthened national industries, established health and safety standards for the well-being of the British people, and provided numerous services for local and national British government organizations. Its four major tasks have been: to assist with immediate problems of government and industry by advice and experimentation; to conduct longer-range research to open up new technical areas for industry; to test instruments; and to research and maintain physical standards, through the measurement of physical constants and the maintenance and international comparison of primary and secondary standards for time, mass, electrical resistance, and other physical units.

When the new technologies of radio, airplane, medical radiology, and computers became feasible, NPL assisted British industry with their development, for example, by establishing standard unit measurements for radio frequency, conducting theoretical research and wind tunnel experimentation on aircraft flutter and stability, constructing an early prototype automatic electronic computer (Pilot ACE), and studying what constitute safe radiation dosages. NPL made many novel measurements and introduced new equipment such as the current balance for the absolute measurement of physical units. The laboratory also developed practical secondary standards for physical units that could be used with less expense and difficulty throughout British industry. Especially before the Second World War, NPL tested meters, gauges, laboratory equipment, lathes, and other apparatus for industry. For example, the laboratory tested over a million and a half clinical thermometers in 1920. Typical of NPL research projects (too numerous to list in detail) were tests on the physical properties of alloys, of wind forces on bridges, of fatigue resistance of materials under alternating stresses like hot and cold, on color standards for control of the hemoglobin in blood, and on fluid flow around ships and airplanes. In other typical work, NPL examined the relation between the physical properties and atomic stuctures of materials, introduced methods for measuring x-ray dosage, absorption, and scattering, and developed a scientific system for expressing colors in terms of the primaries.

NPL was founded in 1900 in response to a call for a public institution for measurement studies, calibration, and related physical research. As early as 1868 the British Association for the Advancement of Science was calling for government support for the "vigorous prosecution of physical research"—mentioning the potential application of science to defense, telegraphy, meteorology, astronomy, ventilation, sewage handling, and public hygiene. Supporters pointed to the valuable public research that had been done at Kew Observatory since 1842 on magnetic and meteorological phenomena. After the founding in 1883 of the German state-supported Physikalische-Technische Reichsanstalt in Charlottenburg, there were numerous calls in Britain for a national laboratory. The government was sympathetic and granted land, buildings, and a small research fund for a national laboratory to be controlled by the Royal Society.

The laboratory opened in 1902 with a staff of eight to work on projects in mechanics, optics, chemistry, meteorology, terrestrial magnetism, and thermometry. Prior to the First World War the laboratory depended heavily on industrial support in the form of cash, equipment, and facilities. The staff grew to 500 during the war in an attempt to whittle down the disparity between scientific organization and application in Germany and in Britain. This disparity had left Britain at the onset of war in the vulnerable position of importing from Germany most dyestuffs (for uniforms), acetone (for explosives), and optical glass (for range finders), as well as many chemical drugs.



"The Aeronautical Department gets to work." In 1909 the first airplane crossing of the English Channel demonstrated Britain's vulnerability to air attack in case of war and led to the establishment of an Advisory Committee for Aeronautics, presided over by Lord Rayleigh (second left) and chaired by Richard Glazebrook (right), director of the National Physical Laboratory. NPL was charged with conducting research pertinent to the construction of dirigibles and airplanes, and an Aeronautical Division was set up for the purpose. [From *The National Physical Laboratory: A History*]

The laboratory continued to expand between the two wars. But as science became more complex, the control of research activities fell to committees of specialists rather than directly to the Royal Society. The laboratory proved its importance again in the Second World War, through studies on airplane and rocket design, protection of ships from mines, storage of meats in the tropics, meteorological observation from afar, and direction-finding techniques. After the war, the laboratory helped the country's industries to recover. In various reorganizations, some divisions were broken off and assigned to other government institutions, and the laboratory itself was made part of the Department of Industry.

In 1974 the laboratory decided to open a museum to archive and display artifacts and records of its history. Edward Pyatt, a staff member from 1947 until his retirement in 1977, was charged with the task of design and layout of the museum. His connection with that project led to his writing this volume chronicling the history of NPL. Pyatt's extensive experience with both the laboratory and the museum has paid off in the richness of detail in the body of the text, the 128 charts and photographs, and the encyclopedic collection of appendixes on biography, chronology, and organization of NPL, its staff and facilities. Indeed, most scientists and historians would find an hour or two examining the photographs and appendixes both enjoyable and informative.

A much smaller audience would find a careful reading of the entire book worthwhile. The text is little more than a prose catalog of the activities of the laboratory. Most research projects are mentioned in one sentence only, and individual projects are rarely awarded more than a paragraph of coverage. Few readers will find the myriad building and organizational changes of much interest. So much detail is given that the reader never gets the sense of which were the laboratory's major achievements. Nor will the reader gain from this volume, as one would from a work like Herman Lukoff's *From Dits to Bits*, insight into the daily life, the struggle for success, or even the scientific approach of the laboratory. One is simply informed that the laboratory solved certain problems, without being given any picture of the process.

The book is also too inwardly focused. Pyatt portrays NPL as a passive institution, responding to problems brought to it in some mysteriously undefined way. The reader is given no clear picture of the relationship of NPL to other industrial, government, or scientific institutions. On this account, the book fails to demonstrate its (true) claims that NPL is one of the most important 20th-century British scientific institutions and one that mirrors in its own activities the changing organization of British science throughout the century.

Nevertheless, the book does give to the casual scientific reader a good flavor for the range of activities of NPL and should serve as a valuable starting point for a more analytical account of the laboratory.

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Views of the Arms Race

Scientists, the Arms Race and Disarmament. Papers from a symposium, Ajaccio, France, Feb. 1982. JOSEPH ROTBLAT, Ed. Taylor and Francis, London, 1982 (U.S. distributor, Unipub, New York). viii, 324 pp. $24.95.

The major themes of this collection of papers from a Unesco/Pugwash symposium not only are very much in step with the popular attitudes of the moment but are entirely plausible—that the development and amassing of nuclear weapons stockpiles pose major threats to all of human life and that scientists have played a particularly important role in the conduct of this imperfectly contained arms race. Substantial and convincing tabulations of data on the nature of these stockpiles are presented (somewhat repetitiously) in the book. The volume is also valuable for its descriptions of the scientific and research organizations involved in the nuclear arms debate.

Any criticism of the substantive quality of the book would hinge not on such major points but on the subtleties and tone of the analyses of what is best to be done about the Soviet-American nuclear confrontation. It is here that the weaknesses, as well as the strengths, of the Pugwash orientation come to the surface.

The collection can hardly be regarded as a balanced sample of what scientists around the world have been inclined to think or say, or do, about the arms race and disarmament. Arguments for new weapons systems, arguments all too persuasive in Washington at the moment, are much too often caricatured in the book, rather than given a fair hearing and rebutted. The discussion of East-West relations is what one would expect from Pugwash, with the Western representatives feeling free to criticize their own governments more than any others and the representatives of East Germany, the Soviet Union, and other Communist-governed states addressing criticisms only to the policies of the West.

To be fair, there are places where the background assumptions of the authors are put forward clearly enough to engage the debate. Bernard Feld characterizes the old Roman dictum, if you want peace, prepare for war, as "stupid" and "largely responsible for the fall of the Roman Empire" and suggests that Fascism should (and could) have been held back by concerted economic sanctions rather than by bombing campaigns. Most of the authors in the collection might not bring themselves to bet the future of their societies (or the future of international peace) on scientists' general strikes, the possibility of which is referred to several times, or economic sanctions or "peace education," but they too often simply reject out of hand the possibility that current deterrence and missile deployment policies can make any sense at all.

Several chapters in the book are exceptions to the rule, confronting some of the analytical complications of the prevention or moderation of war. An overview of peace research by Bert Röling is particularly good in this regard, showing how the most peace-minded of academics and government officials can entertain some disagreements and doubts about how best to prevent war.

A chapter by Francesco Calogero on the dynamics of the nuclear arms race is similarly valuable for introducing more of the complexities concerning ways in which unnecessary rounds of weapons procurement could have been headed off.

Several chapters are quite insightful and pathbreaking. A chapter by Herbert York and Allen Greb on the evolving role of government science advisers brings to the surface some important trends and possibilities. A catalog by John Ziman of the rationalizations offered by scientists for going ahead with their work, regardless of whether their inventions further stability or the opposite, might be required reading for any young scientist thinking of himself or herself as opposing the arms race.

All in all, one too rarely senses any acceptance in this book of the fundamental arms control distinctions between inputs and outputs advanced by Thomas Schelling and Morton Halperin two decades ago. The goals of arms control must be to reduce the likelihood of war, to reduce the destructiveness of war if it nonetheless occurs, and to reduce the costliness in peacetime of preparation for war. Compared to these, disarmament or formal negotiations with the adversary are only inputs, to be judged desirable when they serve one or more of these outputs and skipped if they do not.

It is not inconceivable that some weapons make war less likely, or make war less destructive if it happens, or even impose fewer costs in peacetime (have we condemned the cruise missile in the past because it is too expensive or because it threatens to be "too cheap"?). But the tone of the book (with valuable exceptions, as noted) is to regard every weapon as bad.

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