BOOKS: HISTORY

A Mole Brought to Light

David Holloway

Bombshell. The Secret Story of America's Unknown Atomic Spy Conspiracy. JOSEPH ALBRIGHT and MARCIA KUNSTEL. Times Books, New York, 1997. xvi, 400 pp., + plates. $25 or C$35. ISBN 0-8129-2861-X.

For almost 50 years, atomic espionage has inspired a steady stream of books. Klaus Fuchs, who confessed to the British authorities in 1950 that he had passed significant information to the Soviet Union, has been the subject of a number of studies. Ethel and Julius Rosenberg, executed in 1953 for espionage, have been the focus of intense controversy. The key questions, which maintain the continuing interest in these stories, have been: who passed what information, when, and how? And how much did the Soviet Union learn from these spies?

Interest in atomic espionage has received a boost in recent years. Russian sources have provided new information (and disinformation) about Soviet efforts to learn about U.S. nuclear programs. The U.S. National Security Agency has declassified the Venona translations of Soviet intelligence messages sent from the United States to Moscow during and shortly after World War II and released the small proportion of these messages related to Soviet atomic espionage.

Joseph Albright and Marcia Kunstel, former Moscow correspondents for the Cox Newspapers, have drawn on such new sources to write a book devoted mainly to Theodore Hall, the most important—and indeed the only significant—spy to have been uncovered by recent revelations. Hall, who was born in New York, now lives in Cambridge, England. He has not denied the charge that he passed secret information to the Soviet Union; however, he has not admitted in so many words that he did so, nor has he provided details of his work as a spy. Albright and Kunstel were able to interview Hall at length, and to obtain an oblique confession from him, but they have had to piece together his espionage activities from a variety of good and not-so-good sources.

Hall joined the Manhattan Project in January 1944 at the age of 18. He had completed the coursework for a degree in physics at Harvard, and was assigned to the experimental physics division at Los Alamos, where his first task was to measure the fast-neutron fission cross-section of ^{235}U. In October 1944, with the help of his friend Saville Sax, he made contact with Soviet intelligence in New York and provided a report in which he named key people working at Los Alamos. He was given the covername "Mlad."

In December 1944 Hall met Sax in Albuquerque and gave him a short document outlining the concept of implosion, among other things. This information reached Igor Kurchatov, scientific director of the Soviet atomic project, who wrote on 16 March 1945 that "the implosion method is of great interest, correct in principle." Albright and Kunstel argue correctly that this was the first report of implosion, the key concept in the design of the plutonium bomb, to reach the Soviet Union. But they somewhat exaggerate the importance of Hall's action, for on 7 April Kurchatov wrote an evaluation of information from Klaus Fuchs, which indicates quite clearly that Fuchs had provided much more detailed information than Hall about the methods by which the Americans were planning to achieve implosion.

In May and August 1945, Hall provided further information about the design of the atomic bomb. Here too Hall was a less important source than Fuchs, since, by his own account, he did not have access to the kind of detailed design information that Fuchs gave to the Soviet Union. Albright and Kunstel suggest that in the late 1940s Hall passed information about thermonuclear research and about polonium production, but their evidence for this is much weaker than it is for Hall's activities in 1944–45.

How important was Hall to the Soviet Union? Albright and Kunstel argue that he provided confirmation of the material Fuchs had passed on. Yet the information the two men supplied in 1944 and early 1945 did not lead Stalin to convert the Soviet atomic project into a crash program; it was Hiroshima that marked that turning-point. And although Kurchatov and his colleagues took the American plutonium bomb design, which they had received from Fuchs and Hall, as the basis for their first bomb, they still had to check everything in the material they were given.

This is a readable book, with a great deal of information about Hall's life and background, and the basic argument about Hall's espionage activities is established in a careful and plausible way. The book's main defects are an urge (perhaps understandable) to enhance Hall's importance, and speculation and lack of clarity at some key points. There are also specific points of flawed interpretation. Niels Bohr's views about the need to tell Stalin about the Manhattan Project are badly misrepresented, for example. Nevertheless Albright and Kunstel make good use of the new sources to throw light on the history of atomic espionage.

The author is in the Departments of Political Science and History, Stanford University, Stanford, CA 94305, USA. E-mail: rc.dxh@forsythe.stanford.edu

ALSO NOTEWORTHY

Atomic Spaces. Living on the Manhattan Project. Peter Bacon Hales. University of Illinois Press, Urbana, IL, 1997. viii, 448 pp., illus. $34.95. ISBN 0-252-02296-3.

Drawing on tens of thousands of previously untapped documents that detail everyday life in Oak Ridge, Tennessee; Hanford, Washington; and Los Alamos, New Mexico, during the years 1942 to 1946, Hales reconstructs the social environments in which the first atomic bombs were created. The overwhelming importance of secrecy and security is reflected in this poster from the Hanford Energy Works. Hales' cultural history offers new perspectives on the dawn of the atomic era, and on its continuing consequences.

The identification of Hall as a spy changes our perspective on some of the other characters in the story. David Greenglass, whose evidence formed the basis for the charge brought against the Rosenbergs, emerges from this book as an even more insignificant figure (from the point of view of espionage) than he had already seemed. This makes Julius Rosenberg a very marginal figure in the actual business of atomic espionage, and there is no good evidence that Ethel was involved.

The book leaves many questions unanswered. When did the FBI definitively identify Hall as a spy? Was he debriefed, and given immunity in return for information? Who were the still unidentified Soviet spies "Kvant" and "Pers"? There are enough such questions left to ensure that this will be by no means the last book on Soviet atomic espionage.

MICROBIOLOGY

Tales of Terrible Toxins

Michael Young

The Clostridia: Molecular Biology and Pathogenesis. JULIAN I. ROOD et al., Eds. Academic Press, San Diego, 1997. xviii, 533 pp., illus., + plates. $80. ISBN 0-12-595020-9.

The genus *Clostridium* contains many pathogenic bacteria, including the species responsible for botulism and tetanus, plus a large number of harmless saprophytes. This book, which owes its existence to The First International Meeting on the Molecular Genetics and Pathogenesis of the Clostridia (January 1995), deals almost exclusively with the pathogens.

The pathogenic clostridia do not elaborate either invasins or adhesins, proteins typically associated with a pathogenic lifestyle. Some are probably sheep in wolves' clothing, saprophytes, which produce a range of extracellular hydrolytic enzymes and become opportunistic pathogens only in environments in which they are not normally found. Even without invasins and adhesins, the pathogenic clostridia are truly remarkable for the extraordinary range—and potency—of the toxins they elaborate. This book successfully integrates basic and clinical research dealing with the production, properties, mode of action, and potential uses of clostridial toxins—as well as the diagnosis, etiology and prevention of clostridial toxemias and infections.

The exquisitely potent neurotoxins produced by *Clostridium botulinum* and *Clostridium tetani* are by far the best known clostridial toxins, and several contributions focus on botulism and tetanus. These describe therapeutic strategies for intoxicated individuals, the mode of action and medical uses of tetanus and botulinum neurotoxins, and the genetic basis and molecular biology of toxin production. One of the book's highlights is a consideration of the biochemical interactions between these toxins and their targets, from which much has been learned about the proteins that control the release of neurotransmitters from pre-synaptic vesicles.

Clostridium perfringens wreaked havoc in the trenches during World War I, because soil-contaminated wounds frequently became infected, leading in those days almost inevitably to gas gangrene. This infamy plus its rather well-studied genetics earn it a prominent place in this volume. The physical map of the C. *perfringens* genome was constructed long before that of any other Gram-positive bacterium (*1*). Several chapters are devoted to genetic analysis, genome architecture, and characterization of some of the multiplicity of toxins it produces. Preeminent among these is the hemolytic α-toxin, which is a phospholipase C. The cardinal role played by α-toxin in C. *perfringens* infections has been established in many different ways, most recently by gene replacement methods. This same methodology has undermined somewhat the widely held belief that θ-toxin (perfringolysin O), which closely resembles the thiol-activated cytolysins of other bacteria, also contributes significantly to the pathogenesis of this organism. The importance of the many other C. *perfringens* toxins (β, ε, κ, ι, λ, and μ) in pathogenesis remains to be evaluated critically. Fortunately, gas gangrene is now comparatively rare. Food poisoning, however, is quite commonly caused by enterotoxin-producing strains of C. *perfringens*, and there is currently considerable interest in the mechanism of action of that sporulation-associated protein.

Clostridium difficile, the causative agent of pseudomembranous colitis, is another intensively studied organism. This species has the distinction of producing the two largest known bacterial toxins. These proteins, toxins A and B, closely resemble each other, and the genes that encode them lie in close proximity on the bacterial chromosome. The carboxyl terminal third of both molecules contains multiple repeating units that mediate receptor binding. Another of the book's highlights is a description of the mechanism whereby toxins A and B interfere with the normal functioning of the small GTP-binding protein RhoA by specific glycosylation, which prevents RhoA from regulating cytoskeletal assembly.

The book also discusses other, less well studied, members of the taxonomically diverse clostridia. Among them, *Clostridium spiroforme* produces a binary ι toxin, which interferes with cytoskeletal assembly, and *Clostridium septicum*, which elaborates a pore-forming toxin, shows swarming behavior as part of its pathogenic lifestyle.

In spite of years of study, information about the control of clostridial toxin production is still sparse. Some progress has been made in C. *perfringens*, with the discovery of regulators similar to those that govern the synthesis of virulence factors in other pathogenic organisms. These include the putative proteins PfoR (which specifically activates its cognate for the gene encoding θ-toxin), and VirR (a response regulator) and VirS (a sensor histidine kinase), which are global regulators of toxin production. There is also evidence that a small molecular weight substance can effect intercellular signaling and lead to enhanced toxin production in these bacteria.

One common theme emerging throughout this volume is that many of the clostridial genes encoding toxins are associated with mobile genetic elements: transposons, insertion sequences, plasmids, or bacteriophages (or remnants thereof). Another is that there remains ample scope for more fundamental and applied research on this fascinating and diverse group of organisms.

The toll of tetanus. Sir Charles Bell's portrait (*c.* 1821) of a soldier wounded in the Peninsular War in Spain and suffering from generalized tetanus.

Reference

1. B. Canard and S. T. Cole, *Proc. Natl. Acad. Sci. U.S.A.* **86**, 6676 (1989).

The author is in the Institute of Biological Sciences, University of Wales, Aberstwyth, Ceredigion, Wales SY23 3DA, UK. E-mail: miy@aber.ac.uk