

## BOOKS &amp; ARTS

## Leading the fight against smallpox

Donald Henderson directed the World Health Organization's effort to eradicate the variola virus. His memoir is a lesson in managing complex projects and personalities, says **John Carmody**.

**Smallpox: The Death of a Disease**

by D. A. Henderson

Prometheus Books: 2009. 334 pp.

\$27.98, £23.50

On 8 May 1980 the World Health Assembly declared that "the world and all its peoples have won freedom from smallpox". The assembly went on to express "its deep gratitude to all nations and individuals" who contributed to the success of its global vaccination programme, initiated in 1958.

One of those individuals was Donald Henderson, who directed the eradication campaign during its intensified period between 1967 and 1977. In *Smallpox: the Death of a Disease*, he recalls the personalities, politics and battles behind that resolution. Henderson skewers the declaration's self-congratulatory tone, quoting from Robert Burton's *The Anatomy of Melancholy* (1621): "When a thing has once been done, people think it easy; when the road is made, they forget how rough the way used to be." Moreover, after success they forget their former indifference in their zeal to claim a share of the credit.

The origins of the smallpox variola virus, around 12,000 years ago, are obscure. But its influence on world history has been profound — it has killed rulers in ancient Egypt, China, Japan, Africa and Europe. Its threat was challenged in 1798 by physician Edward Jenner's discovery that infection with the related cowpox virus conferred immunity to smallpox. But outside Europe, access to this vaccine was limited early on owing to its instability.

The geographical disparities in the incidence of smallpox were highlighted in 1947 in the *Weekly Epidemiological Record* published by the fledgling World Health Organization (WHO), which reported that smallpox incidence was increasing in Africa, Asia and the Americas, although declining in Europe. The World Health Assembly (WHA) in 1948 established a study group on the disease at its first formal meeting. At its eleventh meeting, the Soviet Union requested that the WHO "investigate the means of ensuring the worldwide eradication of smallpox" and "encourage" the production of adequate stocks of vaccine. But progress was desultory.

**"Smallpox continues to hover as a dark and ominous cloud... It cannot be forgotten nor ignored."**



Field workers had a vital role in the global campaign to eliminate smallpox.

Then, in 1965, the 18th WHA resolved that global eradication of smallpox was a major objective of the WHO. This was mainly because of altered policy in the United States — its government did not want to seem weak in those cold-war years, and the expansion of air travel increased the risk of the disease's spread. Henderson was appointed as director of that global effort. Taking up his place in medical history, Henderson moved to Geneva, Switzerland, from his post as chief of the surveillance section of the Communicable Diseases Center (now the Centers for Disease Control and Prevention) in Atlanta, Georgia.

His easy narrative is convincing, in part because of his central role but especially because of his generosity towards the numerous other participants — he portrays the 'front-line troops' in the field as being even more important than those at WHO headquarters. His magnanimity makes his criticisms all the more trenchant and cogent.

Anyone can be blinkered to the real problems of the world when they observe them from a comfortable office in a prosperous society — and that is true of governments as

well as individuals. Henderson's accounts of inefficiencies and hostility are dispiriting: the failure of one government to admit that a locally made vaccine was useless and thus dangerous; the insistence by another that home-manufactured vaccines must be exported to distribute that nation's aid, adding costs, delays and interruptions to the work; and the arrogance and obstruction of individual health officials.

The achievement — with dizzying statistics of the hundreds of millions of doses of vaccine that were distributed — becomes all the more admirable when Henderson describes the physical obstacles that were overcome. His relationships with people across many nationalities and backgrounds were a crucial factor. The imaginative recruitment of schoolchildren, for example, is particularly striking: they tend to know the goings-on in their communities and, unlike officials, can be relied on to say what is really happening.

There is a second act to Henderson's drama that is linked to the power politics that prevailed at the end of the cold war. In May 1980, the WHA urged "the discontinuation of smallpox vaccination" and resolved that no more than four WHO collaborating centres should hold and handle stocks of smallpox virus. This raised the question of which countries should hold

this potential bioweapon, one being the United States. Yet, in accord with the WHO resolution, the majority of the US population by this time had no immunity to smallpox. By then, Henderson had returned to the United States as a senior academic and later became adviser to President George H. W. Bush. Regrettably, here he is the epitome of discretion. He names few people, but does reveal his experience of the chilling intransigence and medical ignorance shown by the Pentagon in its negotiations with him over biological warfare policies.

Like all good stories, *Smallpox* recounts the

deeds of heroes and villains, fools and sages. Henderson ends by declaring his pride in having been at the WHO at this crucial time. A better conclusion would have been the close of the penultimate chapter, in which his delight is tempered with a dash of reality: “smallpox continues to hover as a dark and ominous cloud as it has throughout the course of mankind’s history. It cannot be forgotten nor ignored”.

■ **John Carmody** is a medical scientist at the University of Sydney, NSW 2006, Australia, who writes and broadcasts scientific history. e-mail: [jcarmody@med.usyd.edu.au](mailto:jcarmody@med.usyd.edu.au)

decision-making. But when systems are stressed, other modes come into play. Cooperative relations emerge between front-line practitioners and senior officials; ranks fade as everyone focuses on fixing the problem and ensuring the mission’s success. The organization responds to emergency situations that threaten major system failure with pre-planned procedures that are rehearsed and updated. Thus high-reliability organizations are highly self-conscious about learning, in order to respond to unexpected, non-routine events.

The Columbia Accident Investigation Board recommended that NASA adopt elements of high-reliability theory, although it observed that “neither High Reliability Theory nor Normal Accident Theory is entirely appropriate”. But the histories of *Challenger* and *Columbia* show that NASA has not fully integrated learning into its organization. After *Challenger*, there was a greater willingness to communicate problems up the management chain and clear lines of authority and accountability were created. But they blurred over the years as a result of budgetary and organizational turmoil.

Only minor errors of interpretation or omission creep in to Mahler’s analysis. For example, the congressional direction to use commercial software — when no suitable product existed — isn’t mentioned in her discussion of NASA’s difficulty in implementing a financial reporting system for project managers. This omission could lead readers to conclude that difficulties were solely due to NASA’s shortcomings. But imposed requirements also contributed to decisions made.

Budget and schedule pressures came from Congress and the White House. And political

pressures from congressional supporters influenced the creation of specialist ‘lead centres’, rivalries between which may have hindered communications. Thus it is not always obvious what lessons are being taught and by whom. If an organization is struggling to survive or to do too much with too little, the attention required for mission success may falter. As Mahler says, “NASA did learn in some cases, at some times, about some things.” Unfortunately, in spaceflight, especially human spaceflight, that isn’t good enough.

■ **Scott Pace** is professor of the practice of international affairs and director of the Space Policy Institute at George Washington University, Washington DC 20052, USA. e-mail: [space1@gwu.edu](mailto:space1@gwu.edu)

## Space for improvement at NASA

### Organizational Learning at NASA: The Challenger and Columbia Accidents

by Julianne G. Mahler with Maureen Hogan Casamayou

Georgetown University Press: 2009. 256 pp. \$29.95

Mark Twain once said that “History doesn’t repeat itself, but it does rhyme.” Julianne Mahler, a political scientist at George Mason University in Fairfax, Virginia, makes a case for this observation in her examination of NASA’s organizational responses to the losses of the space shuttles *Challenger* in 1986 and *Columbia* in 2003. She asks what NASA learned from the first accident, how that changed it and whether those changes were in effect when the second accident occurred. Given the high-risk nature of human space flight, was NASA a ‘learning organization’?

*Organizational Learning at NASA* doesn’t add to the extensive official record. But the book is a clear and insightful discussion of the factors that contributed to both accidents.

Mahler analyses information-processing structures, relations with contractors, political and budgetary pressures and organizational culture, including rivalries between NASA field centres. These four factors were cited as contributing causes to the shuttle failures through defects in mission management, safety monitoring and responses to schedule and budget pressures.

The book contrasts prescriptions from two organizational theories: ‘normal accident’ and

‘high reliability’. The former states that some accidents are unavoidable in complex systems that are tightly coupled, such as nuclear power stations. Unexpected interactions among such a system’s components can escalate a small problem into a major failure more quickly than human operators can respond. Thus a tension arises between the need for both centralized control, to ensure safe operations, and decentralized authority, to generate creative solutions to unexpected problems. These two goals conflict; yet society requires that complex systems such as air-traffic control operate safely. With great effort this can be achieved and centralization and decentralization can coexist; these are called high-reliability organizations.

High-reliability organizations seem ideal for managing a space mission. Their organization is hierarchical and centralized for routine



The *Challenger* tragedy forced NASA to change its organizational culture.