Soviet maps omitted the 'Progress' plant in Stepnogorsk, once the world's largest bioweapons facility.

MILITARY SCIENCE

The USSR's deadly secret

Tim Trevan weighs up an authoritative take on the Soviet Union's vast, covert and costly bioweapons programme.

Two key events in the history of biological weapons occurred in 1972. The Biological and Toxin Weapons Convention was signed, with the United States, Britain and the Soviet Union as depositaries, or administrators. At the same time, in blatant violation of that convention, the Soviets re-energized their bioweapons programme, launched in the aftermath of the First World War. This massive, covert research push was the only biowarfare programme known to have modified pathogens through genetic engineering.

Conducted in great secrecy over two decades, the programme cost billions of rubles and involved up to 65,000 scientists and technicians. Some worked in the military; many others in a network of civilian laboratories under 'legends', or multilayered cover stories. The programme ended only after microbiologist Vladimir Pasechnik defected to Britain in October 1989. Milton Leitenberg and Raymond Zilinskas explore this murky world exhaustively in *The Soviet Biological Weapons Program*.

The book is peerless as a reference on the Soviet bioweapons programme, and highlights areas where not enough is known and worries remain. No page-turner, this is a densely factual, acronym-laden and foot-noted catalogue of open-source and interview material gathered during more than ten years of meticulous research. The notes alone are a major contribution to the field.

Leitenberg and Zilinskas chronicle the decision-making process behind the programme, as well as its achievements and failures. They examine the performance of US and UK intelligence and diplomatic services in failing to uncover what was going on before Pasechnik's defection, and

subsequently in negotiating the Trilateral Accords — the consultations between the Russian Federation, United States and Britain about his allegations.

The book also provides fascinating insight into how vested interests in both the Soviet military and its scientific establishment thwarted the decision to shut down the offensive parts of the programme by the Central Committee in 1989, Mikhail Gorbachev in 1991 and Boris Yeltsin the following year. And it throws some light on the current debates over H5N1 and other dual-use research — work with the potential to be used both for beneficial and malicious means.

In the context of Soviet warfare, the programme had a handful of signal achievements. For example, it created strains of bacteria resistant to multiple antibiotics. It also genetically altered *Bacillus anthracis* (anthrax) to render existing vaccines ineffective. Perhaps most alarmingly, it genetically altered *Legionella pneumophila* (the agent responsible for Legionnaires' disease) to precipitate an immune-system attack on myelin, the main insulating material in the human nervous system. Such attack creates an artificial, rapid-onset disease similar to multiple sclerosis.

According to the authors, the bioweapons programme achieved little in terms of defences against pathogens. They also write that no systems existed to deliver biological warfare to the continental United States, and that work on intercontinental ballistic missile and cruise missile warheads never progressed far — an assessment that may raise eyebrows in the Western intelligence community.

What does this book's depiction of the Soviet genetic-engineering effort teach us about the dangers of new threats, using even more advanced techniques and vastly greater knowledge?

First, it debunks the theory of biological warfare as the 'poor man's nuke', at least as a weapon of mass destruction (as opposed to one of terror or assassination). The

The Soviet Biological Weapons Program: A History

MILTON LEITENBERG
AND RAYMOND A.
ZILINSKAS
Harvard University
Press: 2012. 960 pp.
£40.95, \$55

DAVID HONLU/ZUMA PRESS

Signs hint at the dangers that were once prevalent at the USSR's Progress bioweapons plant.

DAVID HONLU/ZUMA PRESS

programme soaked up staggering amounts of money, expertise, resources and time.

Second, it proves that it is technically very difficult to genetically engineer pathogens to meet all 12 of the criteria for military usefulness, such as being suitable for aerosol delivery and able to survive in stable form in the air. Pleiotropy — the fact that a single gene may affect more than one feature in an organism — often means that efforts to enhance one ‘desirable’ property reduce others. However, advances in genomics may eventually overcome this obstacle.

Third, it shows that there was no national strategy for the programme. As Leitenberg and Zilinskas note, it did not benefit the Soviet Union’s ability to wage war, but it did severely impair economic development in biotechnology by diverting scientific talent. Indeed, there was no stated doctrine of use laying out in what circumstances or how the Soviet armed forces would use bioweapons on the battlefield.

Finally, the book illustrates the impracticality of applying a single-use/dual-use approach to biology. Rather, we should talk of use and misuse. Even the most apparently ‘single-use’ aspect of the Soviet offensive research — the development of antibiotic-resistant pathogens — has potentially large-scale health applications. An attenuated, antibiotic-resistant live vaccine could be injected into patients with a disease and under antibiotic treatment. The antibiotics would attack the disease, but not the vaccine. We should seek not to ring-fence ‘dual-use’ technologies — impossible, in any case — but to discover how to prevent the misuse of biology.

Biopreparat, the ostensibly civilian part of the programme, came about because Soviet military bioweapons experts wanted parity with nuclear experts; at the same time, civilian scientists realized that their research would be funded only if it had weapons applications. As the programme’s scientific champion Yuri Ovchinnikov is reported to have said: “Nobody would give us money for medicine. But offer one weapon and you’ll get full support.”

In other words, because Soviet biologists were underfunded and under-respected, they distorted what they offered to fit military funders’ misinformed biases. Behavioural economists tell us how decisions that are logical at the individual level can result in outcomes that are, at the aggregate level, wildly illogical. Perhaps the Soviet programme, a clear example of this, tells us that behavioural economists should have a role in analysing how to prevent proliferation or create environments conducive to disarmament. ■

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Books in brief

Corporation 2020: Transforming Business for Tomorrow's World
Pavan Sukhdev ISLAND 320 pp. £18.99 (2012)

Business isn't working — so say a rising number of pundits witnessing cyclical patterns of boom and bust. Green economist and former banker Pavan Sukhdev argues that the corporate model needs an overhaul if profits are to be generated in socially equitable, environmentally benign ways. In his nuanced analysis, corporations need to align their aims with society, becoming viable communities, institutes and financial, human and natural capital ‘factories’. His plan for reform focuses on resource taxation, limited leverage, ethical advertising and disclosure of externalities such as pollution.

Hyperactive: The Controversial History of ADHD
Matthew Smith REAKTION BOOKS 208 pp. £25 (2012)

Mild brain damage, sugar, evolutionary hangovers, genes — answers to the question ‘What causes ADHD?’ are mind-bogglingly diverse. But, argues Matthew Smith in the first medical history of attention-deficit hyperactivity disorder, we may need to accept that explanations will be pluralistic and relativistic. Smith addresses biological, social and psychological issues, from an eighteenth-century description of the fidgets to the first cases, the drugs and the diets. With powerful pharmaceuticals involved and US diagnoses running at 9% a year in 5- to 17-year-olds, this is a timely chronicle.

Measurement

Paul Lockhart HARVARD UNIVERSITY PRESS 416 pp. £20 (2012)

This invitation to tackle mathematical questions is infused with the joys of the rarefied reality of maths. Paul Lockhart largely avoids complex formulae and the wilder shores of jargon, opting instead for simple geometric drawings, lucid instructions and honest warnings about the hurdles. Covering size, shape, space and time, Lockhart, a maths teacher, gets through scores of problems, from showing that a cone in a hemisphere occupies half the volume to determining the size of the largest circle that can sit at the bottom of a parabola. Elegant, amusing and challenging.

Tibet Wild: A Naturalist's Journeys on the Roof of the World
George B. Schaller ISLAND 412 pp. £18.99 (2012)

After 50 years of research on endangered species, field biologist George Schaller is still swimming against the tide of change in the wild. This highly personal compilation, part memoir and part research record, celebrates that “raw terrain where lakes are the colour of molten turquoise” — the Tibetan Plateau, particularly the northern plain of the Chang Tang. Woven into vivid accounts of tracking mammals such as snow leopards and chiru, or Tibetan antelope, are Schaller’s tracings of the impacts of climate change and population growth on one of the last animal strongholds.

Mr. Collier's Letter Racks: A Tale of Art and Illusion at the Threshold of the Modern Information Age

Dror Wahrman OXFORD UNIVERSITY PRESS 352 pp. £22.95 (2012)

The technology-driven explosion in cheap print 300 years ago spawned the first information age. As historical sleuth Dror Wahrman relates, a little-known Dutchman commented covertly on the metamorphosis — in *trompe l'oeil* paintings. Edward Collier created ‘snapshots’ of letter racks stuffed with printed speeches and pamphlets — riddled with visual jokes and puzzles that were coded criticisms of the limitations of print and the politics of the day.