Living and dying with viruses

Viral Fitness: The Next SARS and West Nile in the Making

by Jaap Goudsmit

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Reviewed by Cormac Sheridan

For the author of *Viral Fitness*, everything in the world of viruses, as well as humans, changed following the attacks on the World Trade Center on September 11, 2001. Jaap Goudsmit was an eyewitness to the atrocities. He was in New York for a meeting of the International AIDS Vaccine Initiative (IAVI) that took place on William Street, just three blocks from the Twin Towers. As the scale of the disaster unfolded, that meeting was hastily abandoned, and its participants joined the thousands of New Yorkers making their way uptown to safety. Goudsmit takes the events of that day as the starting point for this book: "From that day on," he writes, "nothing has been unthinkable anymore, not even an attack with smallpox or Ebola."

However, what follows is not a speculative tract on which virus-based bioweapons may or may not be in development in terrorist-funded labs. *Viral Fitness* is, in essence, an historical and geographical guide to the emergence of recent viral threats to humans and a thoughtful essay on what might next be in store. The latter aspect of the book, inevitably, relies on a significant degree of speculation. However, it is of the informed variety, rooted in a thorough understanding of the evolution, biology and epidemiology of viruses and of the principal factors underpinning their potential to become human pathogens.

According to Goudsmit, humans have never been under such threat from viruses as today. Following the spread of human immunodeficiency virus (HIV) during the 1980s, a slew of exotic viral pathogens has caused human fatalities in unexpected places: mosquito-borne West Nile virus is spreading across the North American continent, following its initial emergence in New York; the Hendra virus has killed a horse trainer in Australia; the Nipah virus has caused encephalitis in Malaysia; an aggressive strain of Hantavirus has led to deaths among the Navajo population of the Four Corners region of the American southwest; and a new coronavirus has emerged in Guangdong Province in China, leading to worldwide alerts about the spread of sudden acute respiratory syndrome (SARS) two years ago.

In addition, fears of another highly virulent influenza pandemic, on a scale similar to the fatal outbreaks of 1918, 1957 or 1968, continue to

grow, although recent outbreaks of avian flu in Hong Kong, Thailand and several other countries have so far been contained by drastic poultry culls and other measures. According to Goudsmit, "All the ingredients are in place for the next killer virus" in his own country, the Netherlands. The high densities of pigs, chickens and humans living in close proximity increase the likelihood of a lethal avian strain emerging that could spread from person to person.

Early on, Goudsmit dispels the notion that individual viruses are associated with particular species, and he emphasizes their unique ability to mix and match DNA from multiple sources. "Viruses surf the living world in order to survive," he writes. They are intimately associated with the molecular machinery of their living hosts, for, literally, good and ill.

Viruses that are long adapted to a particular species rarely cause trouble. Although influenza virus is a common human pathogen, its natural host is the wild duck, which is not affected by infection. A gene encoded by a human endogenous retrovirus, HERV-W, expresses the syncytin protein that is essential for placenta formation and protection against maternal immunological attack during pregnancy.

It is when viruses colonize a new host that problems arise, as fitter strains, better able to withstand the change in conditions, evolve and cause disease. Human activities and unstoppable population growth are the root causes underlying the emergence of many new viral pathogens, according to Goudsmit. HIV, he suggests, may have taken a foothold in humans because of pressures on a harmless forbear, simian immunodeficiency virus (SIV), brought about by the decline of its natural host, the chimpanzee, through habitat destruction. Increasing urbanization combined with poor sanitation have contributed to a sharp rise in dengue fever virus infections during the past 50 years. Even perturbations in large-scale oceanic cycles, presumably brought about by climate change, can ultimately influence the prevalence of viruses, particularly those borne by mosquitoes and rodents.

Although *Viral Fitness* is quite a brief volume, its scope is wide-ranging and ambitious. Jaap Goudsmit, an internationally recognized AIDS expert and chief scientific officer of the Dutch biotechnology firm Crucell, has read widely and deeply, and well beyond his immediate field. He makes an arresting connection between the cause of the Irish potato famine and earlier efforts to breed virus-resistant crop varieties. He also writes authoritatively on bacteriophages and their contribution to microbial ecology and pathogenicity.

If this reader has one caveat, it is that both the language and style seem a little loose at times. The book has an excess of anthropomorphic references: for example, under the entry for "viruses" in the index, there is a sub-heading entitled "and care for the host"; elsewhere, Goudsmit writes that "viruses feel more at home in water" than in other environments. It would be ungenerous to criticize a non-native speaker for such shortcomings. A translator is credited for his work on an early draft, but not for the published volume. Perhaps Goudsmit's publisher could have made greater efforts to ensure that his ideas were rendered in English with more clarity. That said, this is a welcome and timely book for any reader seeking to place mainstream media coverage of this important subject in a wider context.

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