

Editorial

Mother Nature's Surprises

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In this modern age of genomics, it is easy to forget that Mother Nature keeps many surprises for us up her sleeve; hubris is only human, after all. A paper in this issue, describing “The peculiar epidemiology of dracunculiasis in Chad,”¹ provides an example. For more than 20 years now, a dedicated battalion of public health workers has been engaged in the international struggle to eradicate Guinea worm disease, endemic in some of the poorest and most isolated communities in some of the least developed countries in Africa.² They have had considerable success. From a score of endemic countries at the outset, there are now only four countries. The annual toll of cases worldwide has been reduced from millions to roughly 500.³

Those health workers who fight it thought that they knew their enemy; *Dracunculus medinensis* is a parasitic nematode alternating between a human host and the tiny crustaceans known as cyclopoids.⁴ It had been selected as a natural loser, an ideal target for global eradication, offering the prospect of success without the risk of a repetition of the malaria débâcle.⁵ The fact that the human is the only definitive mammalian host was a factor in favor. A more powerful argument was the lack of dependence on chemical agents, which would be increasingly likely to cause resistance in the organisms that they aim to control if the eradication struggle were to drag. Even more auspicious was the fact that it had disappeared from a number of countries already—either spontaneously or as a result of efforts to control other diseases.^{4,6}

Now, it seems that, 10 years after the disease was eliminated from Chad, it has returned with a different seasonality, a different geographic distribution, and a different principal host. Now, the principal hosts are dogs. In Uzbekistan in the 1920s, there had been occasional cases among dogs,⁷ but now, the dogs in Chad are suffering a greater prevalence and intensity of infection than the people, and the cases in humans are sporadic and incidental. The worm eradicators could be forgiven for thinking that it might be a different parasite; they sent samples to the Sanger Center in Cambridge, United Kingdom, where genome sequencing confirmed that it was the same species as ever. What seems to have changed is not the organism but its lifecycle, now including a paratenic host.

We need not tell the whole tale here or try to draw specific lessons for Chad's eradication effort. However, there are also more general lessons to be drawn from this tricky turn of the worm as the end draws near.

One general lesson is the risk of making predictions or setting deadlines where epidemiological outcomes are

concerned. The writer's experience with Ghana's Guinea worm eradication program provides a cautionary tale. In 1997, he led a multiagency evaluation of the program,⁸ which concluded that it was generally working well. This evaluation was followed by a decade of stagnation, during which time the annual number of cases hardly changed. Ten years later, he predicted⁹ that Ghana, which then had more than 3,000 cases each year, would require at least another 8 years (i.e., until 2015 or beyond) to eliminate the disease, even if everything went as well as could be hoped. The prediction was part of an argument that global eradication was unlikely before 2019. In the event, Ghana took only 3 years, seeing its last cases in 2010¹⁰ and undermining the whole argument.

Another lesson is the continuing need for research to detect and respond to nature's surprises and continually improve our disease control armamentarium. Research is needed even in the context of diseases that have been almost eradicated. In a world in which crime had been almost eradicated, no one would argue that detectives were redundant. Luckily, those health workers assisting the authorities in Chad's dracunculiasis eradication program have maintained their interest and skill in detective work, which is shown by their paper.¹ Now, they will have to modify the design of their program to protect the paratenic host—apparently fish—and the dogs that seem to be passing the infection on to people. Then, the endemic countries can continue their relentless advance to eradication—unless, of course, there is yet another twist in the tale of this worm.

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