## The natural history of an infectious disease: MacFarlane Burnet's contribution to the epidemiology of poliomyelitis

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**To the Editor:** In *Natural history of infectious disease*,[1] Macfarlane Burnet emphasised that poliomyelitis was the one infective disease of advanced countries that had failed to respond to improvements in the standard of living, leading to epidemics in the first half of the 20th century that increasingly involved young adults, who developed severe paralyses. There was also an abnormally high death rate among young adults. However, in tropical countries where the poliovirus was endemic, the virus spread among infants "with a minimal number of paralytic cases". Burnet therefore defined a "safe" period in the first year of life, when infection was not likely to lead to paralysis.

Burnet also described the features of the "so-called 'virgin soil' epidemics" that occurred in remote islands and Arctic communities. In these places, the population had not been exposed to the virus in infancy, but the "brunt of the disease was borne … by adolescents and young adults". In an Eskimo community, the paralysis rate was 40% and the mortality rate 14% of the whole population.[1]

When, in 1988, the World Health Organization decided to eliminate the poliovirus using the oral, live attenuated virus Sabin vaccine, it apparently ignored Burnet's observations, concluding that polio was in fact a serious disease in tropical countries. As a result of the vaccination program, the wild virus was eliminated from Africa, except in Nigeria.[2] However, re-infection has occurred in several African countries, leading to epidemics since 1993 in which young adults have become severely paralysed and the mortality rate has been high,[3] because the population's first contact with the wild virus has no longer occurred in infancy.

Burnet predicted that young adults aged between 15 and 25 years would be the main group affected in any polio epidemic.[1] He based his observations on the natural history of the disease. The current approach to the epidemiology of polio infection has, however, relied on mathematical models and molecular biology. Both of these approaches have failed to predict that epidemics would occur.[4,5] In fact, Anderson and May claimed that the decision to advocate vaccination was justified — that "programmes of mass immunization against poliomyelitis in developing countries are unlikely to do harm".[4]

Nearly 40 years earlier, Burnet wrote:

> Any escape into circulation that was not immediately dealt with could grow into the almost unimaginable catastrophe of a 'virgin-soil' epidemic of poliomyelitis involving all the populous regions of the world.
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> […]
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> The great epidemics represented the entry of virulent strains into popula-

tions containing a high proportion of older children and adults who had escaped natural immunisation infection.[6]

The loss of naturally acquired immunity to the wild virus as the result of oral vaccination could have disastrous results. While it is now too late to stop vaccination, it should be extended to young adults as well as children, because current epidemics are affecting this age group, as Burnet predicted.[1]

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5 Zinkernagel RM. Maternal antibodies, childhood infections and autoimmune diseases. *N Engl J Med* 2001; 345: 1331-1335.
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