Infectious diseases in the bigger picture

Viewing germs through biological and sociological lenses

Warwick H Anderson
MD, PhD, ARC Laureate Fellow and Professor

Department of History and Centre for Values, Ethics and the Law in Medicine, University of Sydney, Sydney, NSW.

wanderson@usyd.edu.au

doi: 10.5694/mja12.10216

In 1922, Simon Flexner, the director of the Rockefeller Institute in New York City, observed that "each generation receives its particular impression of epidemic diseases". After the influenza pandemic of 1918, the postwar medical generation was trying to "define epidemiology in terms wider than those of the microbic incitants of disease alone", seeking a more complex and biologically informed understanding of patterns of infection.[1] With the development of germ theories in the previous century, epidemiology seemed to have dwindled into microbe hunting, leading to neglect of broader biological, environmental and social influences on disease patterns. This would become a common, and perhaps ritualistic, complaint against the status quo, repeated throughout the 20th century. Each generation of epidemiological reformers fancied itself as contending with facile microbe hunters and germ cultivators. Each new epidemiology offered to restore biological or sociological complexity to the disease calculus.[2]

Historian Erwin Ackerknecht discerned three great divisions in the history of epidemiology.[3] There were those in the 19th century who sought evidence of geographical causes of disease, inquiring into the environmental correlates of outbreaks, the presence of filth and miasma. Others, like pathologist Rudolf Virchow, often liberal in their politics, propounded a sociological interpretation of disease patterns, arguing for the impact of economic inequality. Then came the bacteriologists who linked germs to specific diseases and assiduously tracked these microbes through food, water, the earth and atmosphere, as well as insects and animals, including human bodies. Often, they focused narrowly on these microorganisms, ignoring the larger biological or sociological canvas over which they were scattered.

One of Ackerknecht's students, Charles Rosenberg, elaborated on modes of epidemiological reasoning.[4] Some epidemiologists, he wrote, chose to emphasise configuration, or the structural and relational aspects of disease patterns, while others concentrated on contamination, the technics of transmission of germs. The rise of microbiology did not entirely suppress the configurational impulse. Whether the configuration of choice happened to be biological or sociological, it generally revealed assumptions — about fit and stress, about balance and mismatch — between humans and their milieu. Following the tradition of social medicine, Rosenberg evidently favoured political economy and cultural patterns in explaining outbreaks of diseases such as cholera. Another adherent of social medicine, Paul Farmer, would later accentuate the economic basis of epidemic disease, emphasising how global structural inequalities shape the patterns of disease.[5]

In the 20th century, biomedical scientists and epidemiologists drew mainly from two powerful integrative, or configurational, resources: evolutionary biology and the social sciences. They tried to give ecological or sociological complexity to their models of disease processes, rendering microbiology either a part of general biology or social theory. These two prevailing framing devices, both of them minority interests, bear a distinct resemblance to the geographical and sociological approaches Ackerknecht noted in earlier styles of epidemiological practice. But the older geographical determinism had become more animated, dynamic, and interactive — more ecological — and the older political economy was often overlaid with functionalist sociology and cultural anthropology. Disease ecologists like Macfarlane Burnet turned to evolutionary mechanisms and theories of the host–parasite interaction to gain a more intricate and naturalistic understanding of disease.

> "Each generation of epidemiological reformers fancied itself as contending with facile microbe hunters and germ cultivators"

Burnet, an amateur naturalist, was the leading advocate of disease ecology. In his 1940 book, *Biological aspects of infectious disease*, Burnet showed that "infectious disease can be thought of with profit along ecological lines as the struggle for existence between man and micro-organisms". Accordingly, "conflict between man and his parasites, in a constant environment, would tend to result in a virtual equilibrium, in which both species would survive indefinitely. Man, however, lives in an environment constantly being changed by his own activities, and few of his diseases have attained such an equilibrium".[6] Burnet looked at germs from an evolutionary viewpoint. He examined the impact of war, migration, travel, urbanisation, and financial depression on the interactions of humans and parasites, warning of the dangers of emerging diseases and biological warfare. In our own time, his ecological approach would be applied to explaining health effects of climate change. Generally, these studies favour vivid biological imagery, along with lightly shaded sociological marginalia. Disease ecologists often experience difficulty combining sociological analysis with biological insight — but then, promoters of social medicine rarely make reference to evolutionary theory.

Now that we are disinclined to teach medical scientists any general biology and sociology — let alone history — we should wonder what impression epidemic disease will make on the next generation, and ask whether any Burnet or Farmer could emerge to devise some new frame of analysis, thereby refreshing epidemiology.

Competing interests: No relevant disclosures.

Provenance: Commissioned; not externally peer reviewed.

1 Flexner S. Experimental epidemiology. *J Exp Med* 1922; 36: 9-14.
2 Anderson W. Natural histories of infectious disease: ecological vision in twentieth-century biomedical science. *Osiris* 2004; 19: 39-61.
3 Ackerknecht EH. Anticontagionism between 1821 and 1867. *Bull Hist Med* 1948; 22: 562-593.
4 Rosenberg CE. Explaining epidemics and other studies in the history of medicine. Cambridge: Cambridge University Press, 1992: 293-304.
5 Farmer P. Infections and inequalities: the modern plagues. Berkeley: University of California Press, 2001.
6 Burnet FM. Biological aspects of infectious disease. New York: Cambridge University Press, 1940: 3, 23.