Of Worms and Men

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During its early development the human embryo may be considered an obligatory parasite, drawing its food and oxygen from the blood of the mother and bypassing all the immunological and other defense mechanisms of the latter. While subsequently leading independent lives, human beings, in turn, become the hosts of many a parasite.

Viruses use the nucleus of human cells to replicate, bacteria and fungi invade the whole system and the skin harbours different flora of microorganisms. The intestinal tract is the organ of predilection for some nematodes. The majority of nematodes are not pathogenic and cause little disturbance or discomfort to the host, for they themselves will die if they kill the host. A notable exception is *Strongyloides stercoralis (S. stercoralis)*, which can and do invade the whole organisms in huge numbers if the immunological status of the host is low. This hyperinvasive syndrome is occasionally encountered long after the host has left the endemic areas because of the unique method of auto-infection of *S. stercoralis*, which can cause parasitism for decades.[1] Physicians should have a high degree of suspicion in order to diagnose and treat this hyperinvasive syndrome in people coming from endemic areas, as the condition is potentially fatal. There is evidence that even if one's immunity is adequate, some of the larvae of *S. stercoralis* can still wander far away from the gastro-intestinal tract.[2]

The genetic predisposing factors in both parasite and man are complex and complicate our understanding of immunologic mechanisms involved in infestations by nematodes.[3] The ways in which some nematodes fool the body defences are slowly coming to light. The parasitic female of *Strongyloides venezuelensis* adheres to the mucosa of the host intestinal mucosa by adhesion molecules secreted from its mouth. Specific antibodies generated against secreted adhesion molecules inhibit the attachment of the worm in the gut.[4] On the same note, IgM and IgG antibodies both protect against larval *S. stercoralis* infection in mice as they recognise different antigens and utilise different killing mechanisms.[5] It is thought that the same mechanisms may be present in men.

Nematodes have infested human being from time immemorial. When coprolites, the desiccated faeces of mummies, are rehydrated, screened, sedimented and analysed, eggs of nematodes have been found.[6] Such eggs have been recovered from coprolites from many archeological sites, in Switzerland,[7] South Africa,[8] northeast Brazil,[9] Peru[10] and the Colorado Plateau.[6] DNA analyses of these coprolites have confirmed that these eggs are from nematodes that infested men.

The genetic analysis of the eggs of nematodes from coprolites is bringing some light on the migration of men across continents and over centuries. Some nematodes have a life cycle which includes a development outside the human body. In the case of *Enterobium vermicularis*, where the development is in the soil, it is expected that the harsh conditions of the arctic and desert regions should have halted the spread of infection in the olden days. The oro-faecal route of infection however, as in pinworm, will continue the infestation in spite of climatic factors. Thus, presence and absence of some types of nematodes will give an indication of the probable route of migration of some nomads or adventurers.[11] The exact ways in which men reached the New World may not be known. However, studies of nematodes do give credence to the different theories of migration to North America across the Bering Straits from Europe, to South America from the islands of the Pacific or to North America from Iceland, Norway or Sweden.

Nematodes seem to have been with us for a long time and will continue to do so for a long time to come. Because of their ingenuity and remarkable ability in adaptation, improvement in sanitation, better education and even the eradication of poverty will simply limit the extent of parasitism but will probably not eradicate them altogether!

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