Finding the energy for going viral

January 30 2019, by David Bradley

The question of how much energy a virus needs to replicate in its host translates into how likely a single infection is to become an epidemic. Writing in the International Journal of Exergy, Sevgi Eylül Ferahcan, Ayşe Selcen Semercioöz, and Mustafa Özilgen of the Department of Food Engineering, at Yeditepe University, in Istanbul, Turkey, explain how poliovirus is an RNA virus which proliferates in the host's intestines ultimately leading to a crippling disease.

Despite its apparent eradication through extensive worldwide vaccination, there have been major polio epidemics in modern times. In 1988, 350,000 cases were reported. The team has calculated mass, energy, and exergy balances to show that the energy and exergy leeched from a host cell by a single virus are 4.65×10^{-19} and 3.35×10^{-17} kilojoules, respectively. During the 1988 epidemic, a total of 1.627×10^{-9} kJ of energy and 1.174×10^{-7} kJ of exergy was exploited by the multitude of viruses in infecting more than a third of a million people. The energy and exergy are used in the biochemical machinations of replicating the virus and its RNA by exploiting the molecular machinery of the host cells.

These are small numbers in terms of energy and exergy, as such the team argues that it is the almost vanishingly small figures that facilitate the spread of the virus to epidemic levels so readily. It almost makes the disease "going viral" inevitable, the team suggests. As such, it serves as a cautionary tale that we must be ever vigilant as old and new viral diseases emerge or pay the toll in the huge numbers of people that might be afflicted during an epidemic.

More information: Sevgi Eylül Ferahcan et al. Extremely small energy requirement by poliovirus to proliferate itself is the key to an outbreak of an epidemic, *International Journal of Exergy* (2019). DOI: 10.1504/IJEX.2019.097269