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The Emergence of Animal Viruses Explained by Means of an Outer- to Inner-Body Line-Up of the Host Organ Systems

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ABSTRACT

From the host-body outside to the inside epithelial virus transmission becomes replaced by transmission modes that involve the internal organ systems. The virus organ system tropism reflects the wider host environment, in particular the host population ecology. A study of the world main livestock viruses showed that respiratory and enteric viruses are primarily attracted to and emerging in short-cycle poultry and swine production. Ruminants and equines also attract and select for more deep-rooted viruses. The rationale here is that epithelial viruses opportunistically and flexibly adjust to changes in host availability, including when this involves a new host type. The virus may change the level of virulence or, also, jump from enteric to respiratory tract, as observed for myxo- and coronaviruses. Skin viruses transmit at a lower rate. A pox virus may affect all layers of the skin, resulting in slowly healing lesions. A herpesvirus tends to latently establish in peripheral nerves and ganglia and so cause a recurrent venereal or other epithelial infection. Arteriviruses may colonize the proximal genital tract and transmit vertically, which has the effect of enhancing virus-host intimacy. Retroviruses infiltrate also the immune and circulatory systems and as a result tend to become tolerated by the host defenses, as evident from the virus circulation in the bloodstream. Hence, the host environment, the infection-shedding-transmission chain of causation, the virus organ system tropism, and the nature of the virus, all match, mirroring one another. The organ system line-up may thus be applied to capture disease emergence dynamics. By and large, disease emergence is anthropogenic in nature, the result of the increasingly artificial host ecologies. Epithelial viruses adjust to demographically dynamic settings. Instead, deep-rooted viruses tend to incidentally shift to a genetically related, 'yet novel', host species, provoked by ecological perturbance.

Keywords: Disease drivers, Virus organ system tropism, Virus transmission, Disease emergence

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