EM of Viruses: Specimen Prep + Virus ID & Imposters

S.E. Miller[1]

[1] Dept. of Pathology, Center for Electron Microscopy & Nanotechnology, Duke University Medical Center, Durham, NC, USA.

Abstract

Awareness of virus infection is essential for performing electron microscopy of biological samples because they not only cause disease but also can skew results of other observations. Knowledge of normal cell morphology, as well as virus appearance and morphogenesis, are essential in determining their presence. Negative staining is used to examine viruses in fluids, while routine tissue preparation for EM is sufficient to look for them in cells. Viruses come in 2 morphological "flavors": naked or enveloped. Naked ones are icosahedral and range from ~20 to 90 nm, while enveloped ones usually have a soft, pliable membrane around their nucleocapsid (the nucleic acid plus some proteins), and, therefore, are pleomorphic. Most have spikes on their surfaces (which can be ~20 nm, ~8 nm, or short bumps). They may range from ~30 to 400 nm, and some can be long (~1500 nm) and skinny (~80 nm); a few can be even bigger, (~700 nm (Megavirales). Viruses contain either DNA or RNA, not both; most human DNA viruses are produced in cell nuclei, while RNA ones are constructed in the cytoplasm. There are exceptions. Many normal cell organelles and structures can resemble viruses, and care must be taken not to be fooled.

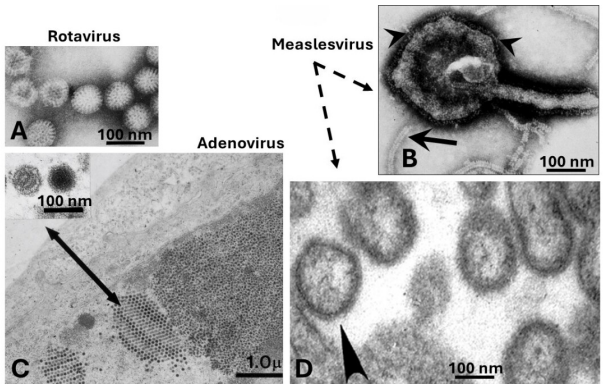

Figure Legend. Examples of virus preparations and virus types: A & B = negative stains; C & D = thin sections. A = naked icosahedral virus. B = enveloped (pleomorphic) virus with spikes (arrowheads) on the outside and helical nucleocapsid (like a phone cord, arrow). C = paracrystalline array of naked DNA virus in the nucleus (arrow). D. extracullar virions (arrowhead) with spikes (dense fuzzy membrane).

References

1. Hayat MA & Miller SE. 1990. Negative Staining. McGraw-Hill Publishing Company, New York
2. Miller SE. 1986. Detection and identification of viruses by electron microscopy. J Electron Microsc Tech 4:265-301. https://doi.org/10.1002/jemt.1060040305