Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Electron microscopy of SARS-CoV-2: a challenging task

We read with interest the Correspondence by Zsuzsanna Varga and colleagues[1] on the possible infection of endothelial cells by SARS-CoV-2 using electron microscopic (EM) images as evidence. However, we believe the EM images in the Correspondence do not show coronavirus particles but instead show cross-sections of the rough endoplasmic reticulum (RER). These spherical structures are surrounded by dark dots, which might have been interpreted as spikes on coronavirus particles but are instead ribosomes. The purported particles are free within the cytoplasm, whereas within a coronavirus-infected cell, accumulations of virus particles would be found in membrane-bound areas in the cisternae of the RER–Golgi area, where the spikes would be located on the inside of the cisternal space.[2] In addition, cross-sections through the viral nucleocapsid are not seen in the interior of these structures as would be found with coronavirus particles (figure).

Just recently, there have been two additional reports[3,4] in which structures that can normally be found in the cytoplasm of a cell have been misinterpreted as viral particles.[5] EM can be a powerful tool to show evidence of infection by a virus, but care must be taken when interpreting cytoplasmic structures to correctly identify virus particles.

We declare no competing interests. The findings and conclusions are those of the authors and do not necessarily represent the position of the US Centers for Disease Control and Prevention.

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1 Varga Z, Flammer AJ, Steiger P, et al. Endothelial cell infection and endotheliitis in COVID-19. *Lancet* 2020; **395:** 1417–18.
2 Goldsmith CS, Tatti KM, Ksiazek TG, et al. Ultrastructural characterization of SARS coronavirus. *Emerg Infect Dis* 2004; **10:** 320–26.
3 Su H, Yang M, Wan C, et al. Renal histopathological analysis of 26 postmortem findings of patients with COVID-19 in China. *Kidney Int* 2020; published online April 9. DOI:10.1016/j.kint.2020.04.003.
4 Kissling S, Rotman S, Gerber C, et al. Collapsing glomerulopathy in a COVID-19 patient. *Kidney Int* 2020; published online April 15. DOI:10.1016/j.kint.2020.04.006.
5 Miller SE, Brealey JK. Visualization of putative coronavirus in kidney. *Kidney Int* 2020; published online May 12. DOI:10.1016/j.kint.2020.05.004

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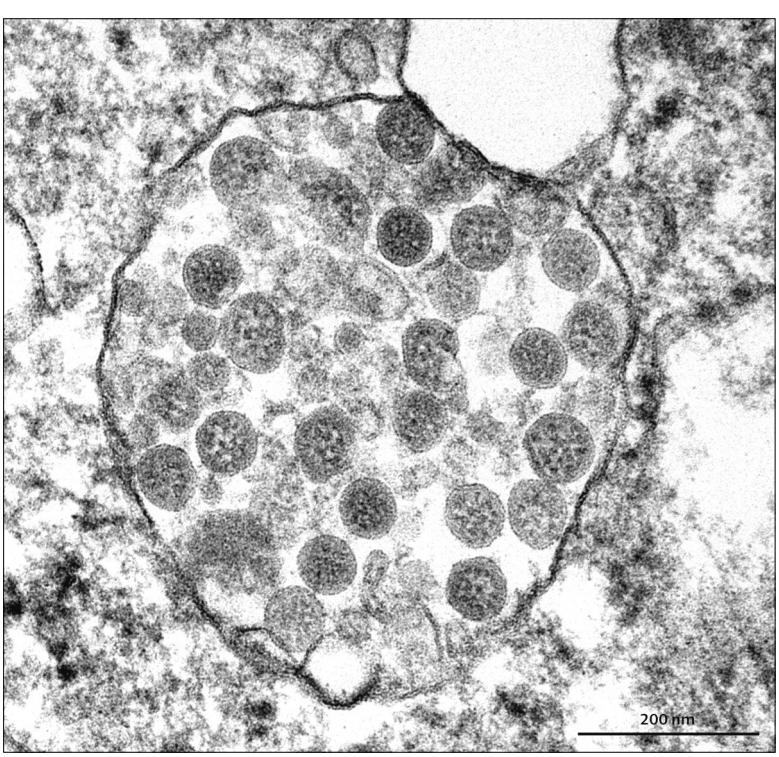

***Figure*: Viral isolate grown in cell culture**
Spherical coronavirus particles with cross-sections through the nucleocapsid, seen as black dots, are clustered within a membrane which separates them from the cytoplasm.