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Helium-ion microscopy reveals an intra-cytoplasmic route suitable for SARS-CoV-2 cell-to-cell transmission[1] ANTONIO MEROLLI, LEILA KASAEI, LEONARD FELDMAN, Rutgers University - Department of Physicsc and Astronomy — The usual picture of SARS-CoV-2 transmission is extracytoplasmic. Virions (the basic virus complex when outside the cell) enter the host cell by docking their spike glycoproteins to the Angiotensin Converting Enzyme 2 (ACE2) on the host cell membrane. Newly replicated virions are then released outside the host cell to propagate the infection via the ACE2 docking mechanism. Antibodies may attack these extra-cellular virions, thus providing immunity. We used scanning Helium-ion microscopy to study the virion propagation in-vitro in a culture of Vero E6 cells prepared at the PHRI RU-Newark (Dr. Selvakumar Subbian). The unprecedented resolution of HeIM and its capacity to scan a large number of samples, showed the presence of: 1)-long tunneling nanotubes (TNT) that connect two or more cells; 2)-multiple cell fusion events; 3)- abundant extracellular vesicles (EV). TNT and cell fusion events are not significantly present in uninfected samples. These three ultrastructural features (TNT; cell fusion; EV) provide an intra-cytoplasmic modality to connect SARS-CoV-2 infected cells, and this may act as an alternative route of viral transmission. This finding may explain the ability of SARS- CoV-2 to survive the immune surveillance and the observation of the breakthrough infections.

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