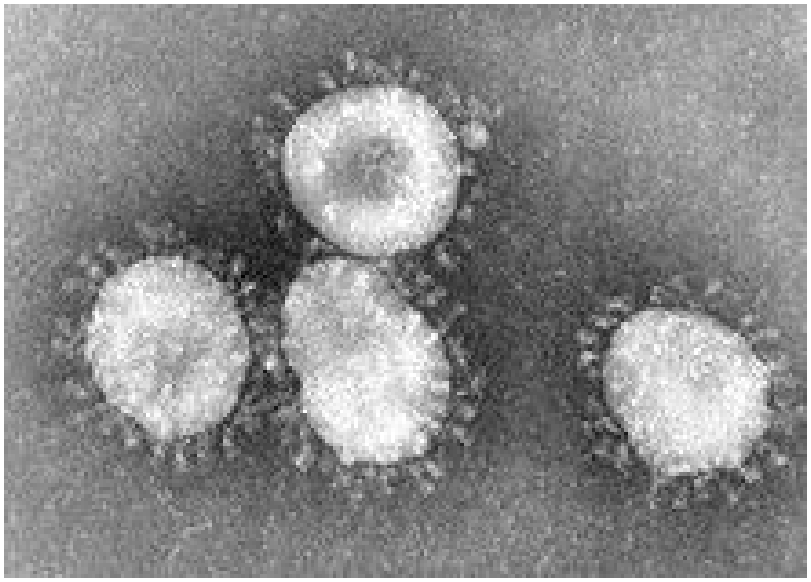
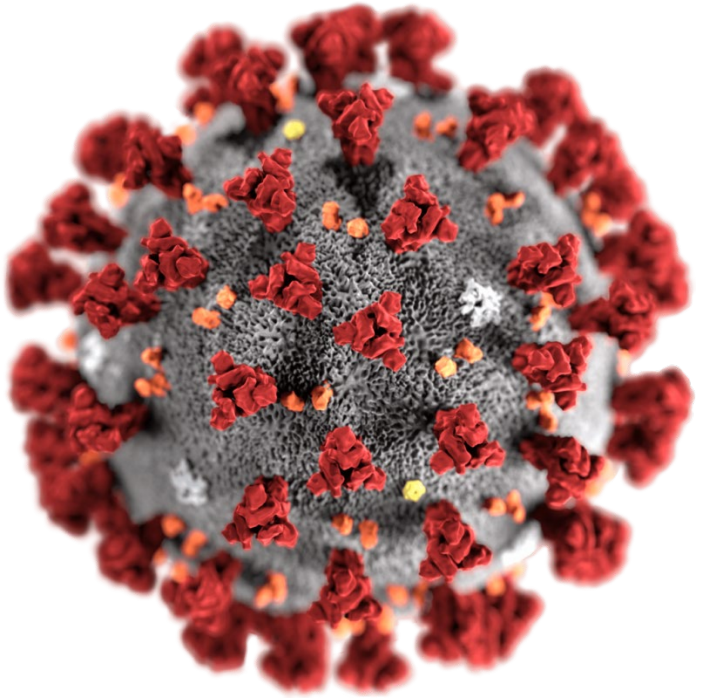
Severe acute respiratory syndrome coronavirus 2 = SARS CoV-2

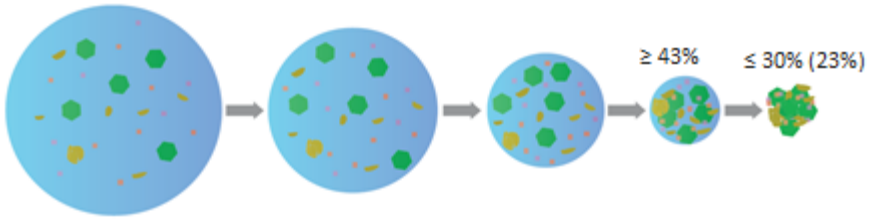




SARS CoV-2 causes COVID-19

Droplets from coughs and sneezes

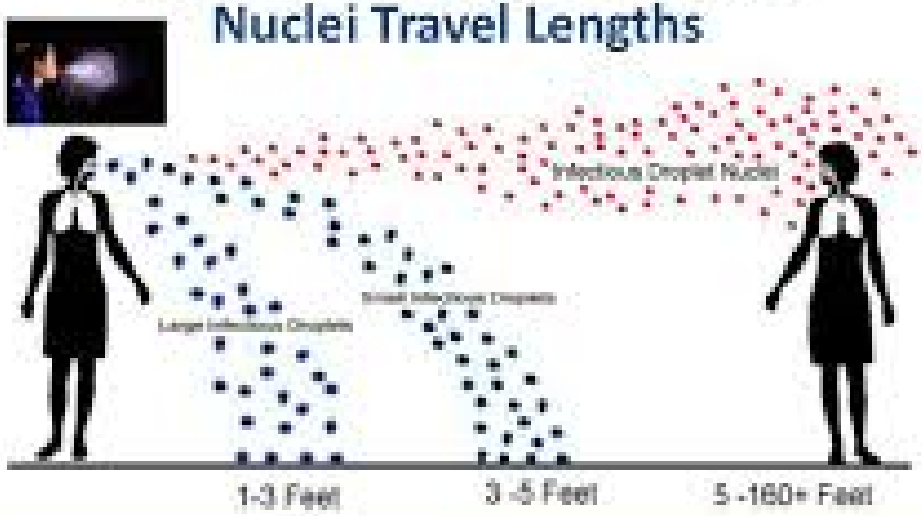
How Airborne Droplet Nuclei are created



Evaporation of a liquid droplet (left) to a droplet nucleus (right). As the liquid evaporates, the nonevaporative content concentrates until a droplet nucleus is obtained.

Airborne viral droplets are coughed, sneezed or expelled by humans. Toilet aerosolization also creates viral droplets.
This illustration shows how the mucus droplets filled with viruses eventually evaporate to create microscopic masses of viruses, salt and protein called Droplet Nuclei. Named and discovered by William F. Wells in 1934, droplet nuclei are the key to understanding airborne infectious disease transmission.

Infectious Droplets & Droplet Nuclei Travel Lengths

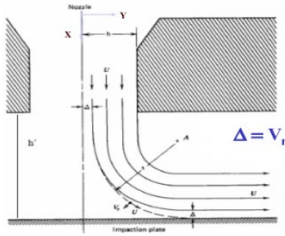


Bioaerosol Samplers:

Bie&Ag

Principle of Collection - Inertial Impaction

Assumptions: the flow velocity is uniform in the jet; the streamlines are arcs of a circle with centers at A



$$V_r = \tau a_r = \frac{\tau U^2}{r}$$

$$\Delta = V_r t = \frac{\tau U^2}{r}\left(\frac{2\pi r}{4U}\right) = \frac{\pi}{2}\tau U$$

$$E_I = \frac{\Delta}{h} = \frac{\pi\tau U}{2h} = \frac{\pi}{2}\mathrm{Stk}$$

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Bioaerosol Samplers:

Bie&Ag

Principle of Collection - Inertial Impaction

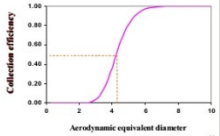
Stk. to characterize inertial impaction:

$$\mathrm{Stk} = \frac{\tau V}{D_j/2} = \frac{\rho_p d_p^2 V C_c}{9\eta D_j}$$

$$d_{50}\sqrt{C_c} = \sqrt{\frac{9\eta D_j \mathrm{Stk}_{50}}{\rho_p V}}$$

The characterization dimension :

- **the radius of the nozzle jet = $D_j/2$ for a circular jet**
- **the jet half-width = W/2 for a rectangular jet**



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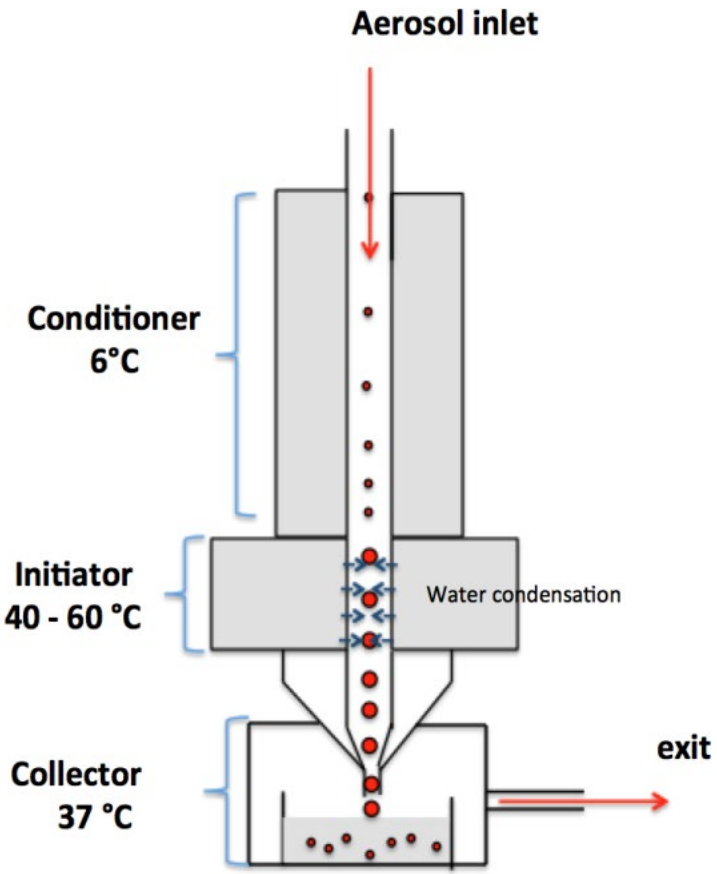
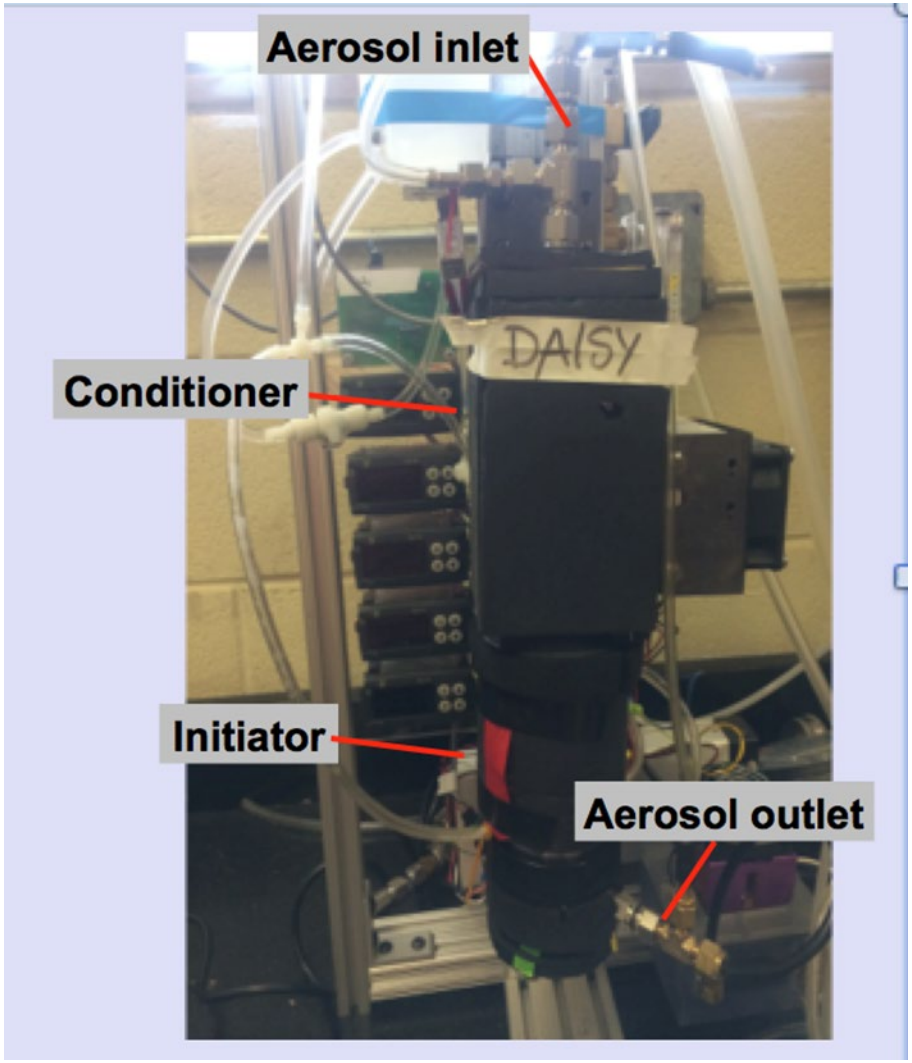
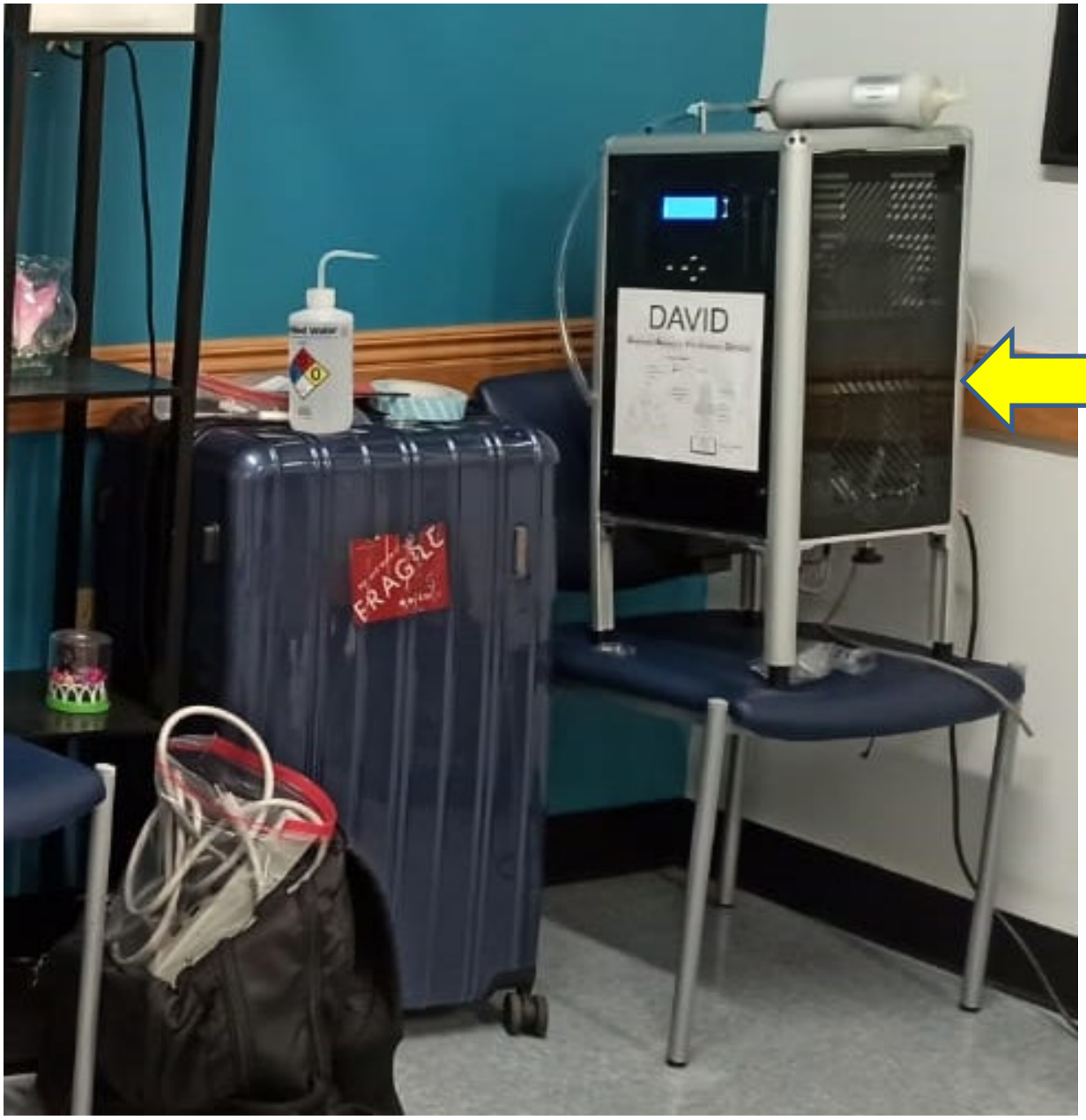
Air Sampler for Virus Aerosols that Operates via a Water Condensation Process





Prototype of a highly efficient (effective) air sampler developed at UF that works well for collecting virus aerosols and maintaining the viability of the collected virus particles.

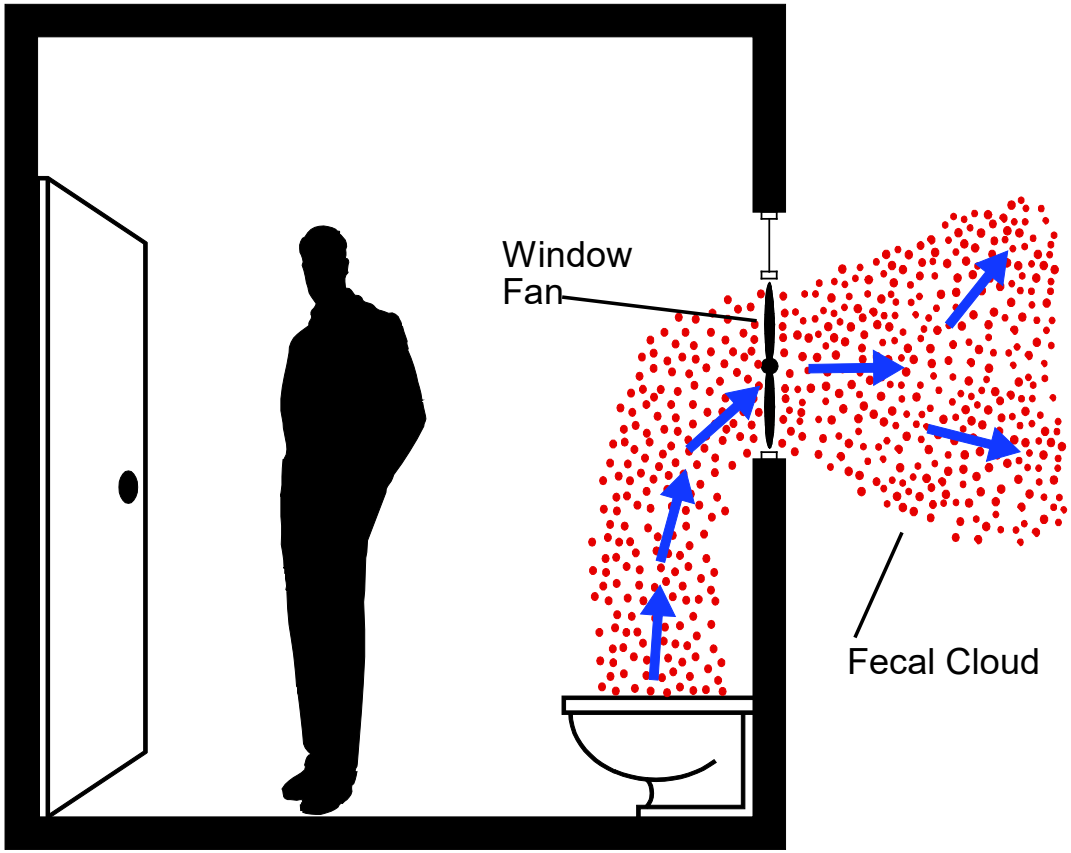


Air sampler (Air sampling in process at a medical clinic).

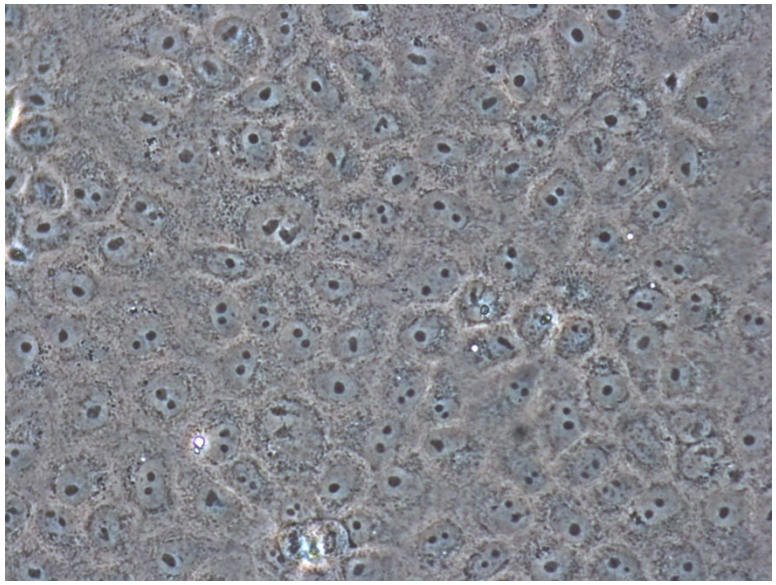
BioSpot-VIVAS™ bioaerosol sampler

Airborne SARS Transmission at Amoy Gardens Apartments 03.19-20.2003

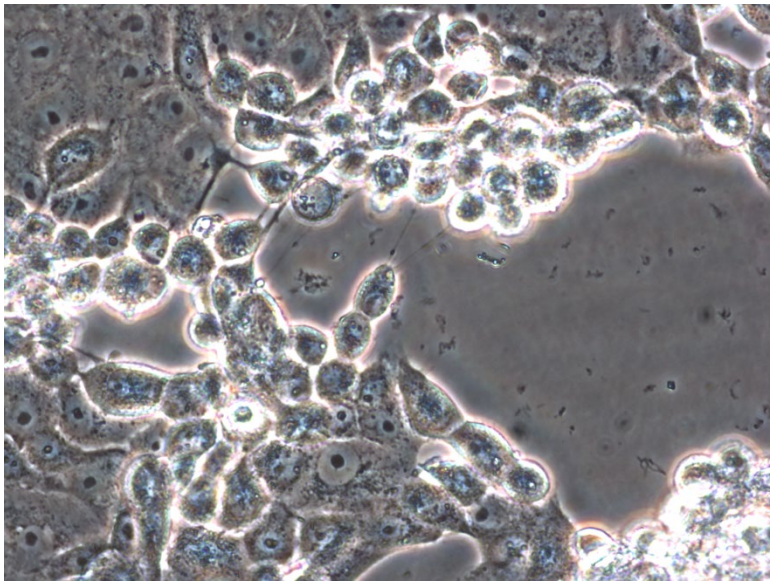
Wang Kaixi was infected by airborne SARS viruses that he breathed in at the Prince of Wales Hospital.
Since SARS produced diarrhea in the majority of patients, he flushed his toilet water likely heavily laced with his SARS thereby aerosolizing his SARS viruses into the most toxic Fecal Cloud ever recorded. His window fan blew his SARS Fecal Cloud(s) outdoors where the wind and rising air currents spread them on to his unsuspecting Amoy Gardens neighbors.



Isolation of coronavirus in cell cultures



Non-infected cells



Coronavirus-infected cells

Workers wearing powered air- purifying respirators (PAPR)

SARS CoV-2 in air sample

Severe acute respiratory syndrome coronavirus 2 isolate SARS-CoV-2/ENV/USA/UF-3/2020, complete genome

GenBank: MT324684.1

FASTA Graphics

Go to:

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LOCUS       MT324684               29889 bp    RNA     linear   VRL 13-APR-2020
DEFINITION  Severe acute respiratory syndrome coronavirus 2 isolate
            SARS-CoV-2/ENV/USA/UF-3/2020, complete genome.
ACCESSION   MT324684
VERSION     MT324684.1
KEYWORDS    .
SOURCE      Severe acute respiratory syndrome coronavirus 2 (SARS-CoV2)
  ORGANISM  Severe acute respiratory syndrome coronavirus 2
            Viruses; Riboviria; Nidovirales; Cornidovirineae; Coronaviridae;
            Orthocoronavirinae; Betacoronavirus; Sarbecovirus.
REFERENCE   1  (bases 1 to 29889)
  AUTHORS   Shankar,S.N., Wu,C.-Y., Clugston,J.R., Elbadry,M.A., Morris,J.G.
            Jr. and Lednicky,J.A.
  TITLE     Genomic sequence of SARS CoV-2 in breathing air
```

SARS CoV-2 affects multiple organ systems

Heart: Nearly 20% of COVID-19 patients have heart damage. About 40% have blood that clots abnormally.

Kidneys: About 30% of hospitalized COVID-19 patients have kidney failure.

Pancreas, liver = also targets of COVID-19. Affects about 50% of patients.

Eyes: up to one-third of hospitalized patients develop conjunctivitis—pink, watery eyes

Brain and central nervous system: 5% to 10% of COVID-19 patients have neurologic signs. Encephalitis, seizures, loss of consciousness, loss of sense of smell, meningitis, and other signs have been reported.

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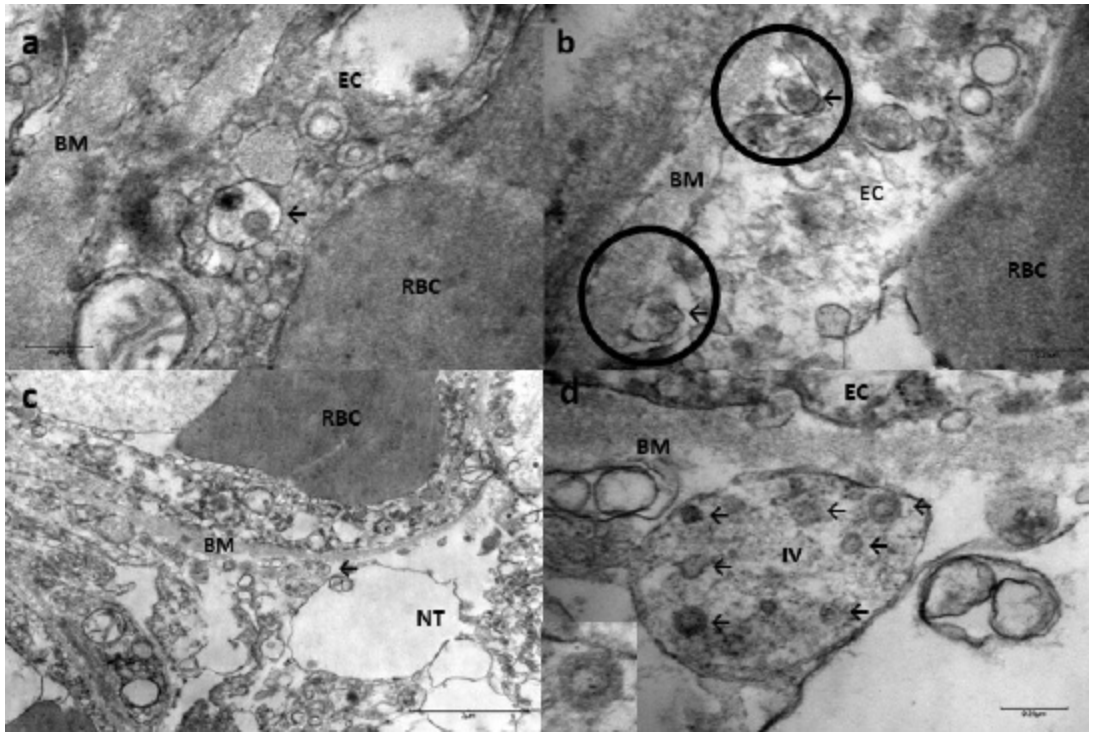
COMMENTARY | Free Access

Central Nervous System Involvement by Severe Acute Respiratory Syndrome Coronavirus -2 (SARS-CoV-2)

Alberto Paniz-Mondolfi, Clare Bryce, Zachary Grimes, Ronald E Gordon, Jason Reidy, John Lednicky, Emilia Mia Sordillo, Mary Fowkes

First published:21 April 2020 | https://doi.org/10.1002/jmv.25915



SARS CoV-2 particles were found in neurons (in frontal lobe sections) and in endothelial cells in brain capillaries.

NOTES: Diagnostic tests for SARS CoV-2

1. Nasal swab specimens: Specimen of choice of RT-PCR tests.
- 30% or higher false NEGATIVE. Why?
- Proper collection of specimen.
- Type of swab. Flocked vs spun.
- Supply shortage.
- Specimen choice should include blood and stool (or rectal swab)?

2. Antibody tests.
- There are > 70 tests available worldwide.
- IMPORTANT: antibodies to coronaviruses tend to be short-lived

29 commercial assays designed to detect antibodies to SARS CoV-2 are on sale in the US, only three of which have been granted the FDA's backing in the form of an emergency use authorization.

- None of these tests, even those with EUAs, have had their accuracy evaluated by the FDA or any other regulatory body.
- Abbott says the IgG test it released in the US last week, when performed at least two weeks after a patient has first exhibited symptoms, has a sensitivity of 100% and specificity of 99.5%.
- Te antibody test sold in the US by Becton Dickinson, developed by BD's partner Biomedomics, has sensitivity of 88.7% and specificity of 90.6%.
- Roche will commercialize its antibody test next month.