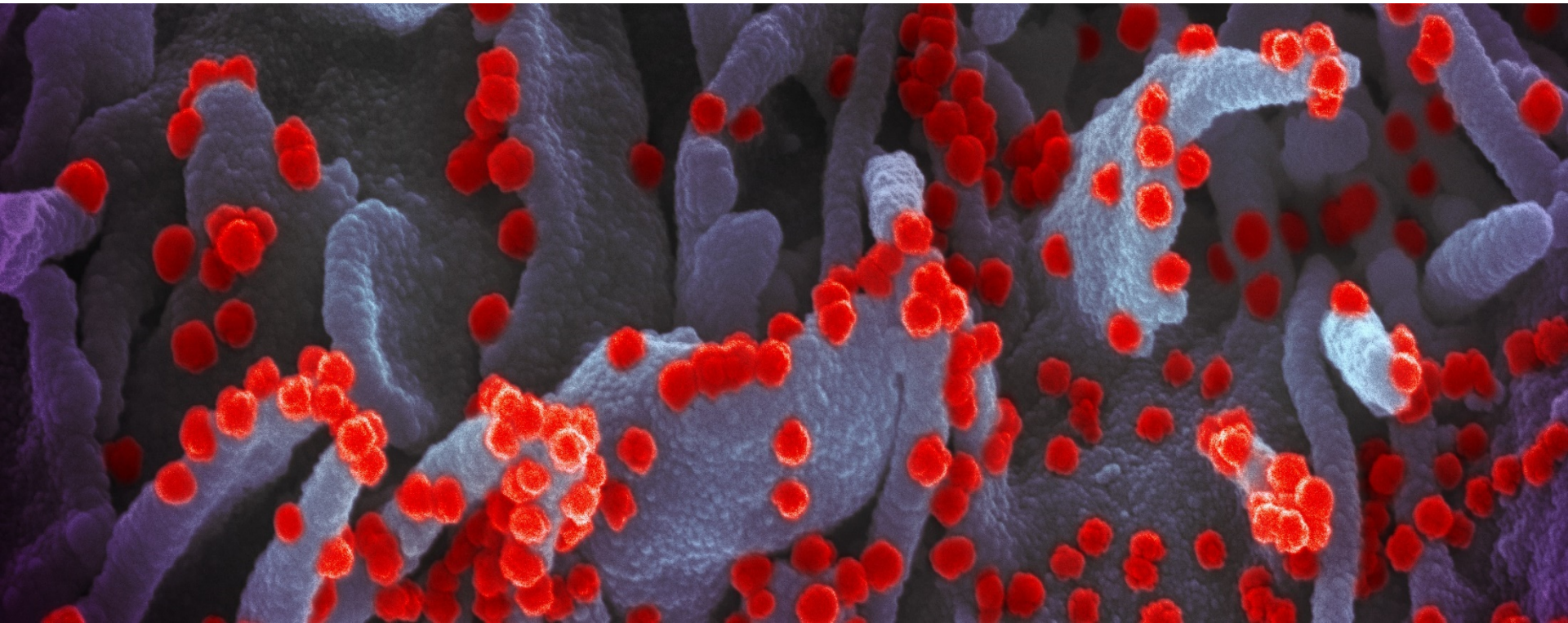


Impact of environmental conditions on the infectivity of SARS-CoV-2 in aerosols

Emmie de Wit
Rocky Mountain Laboratories
NIAID, NIH



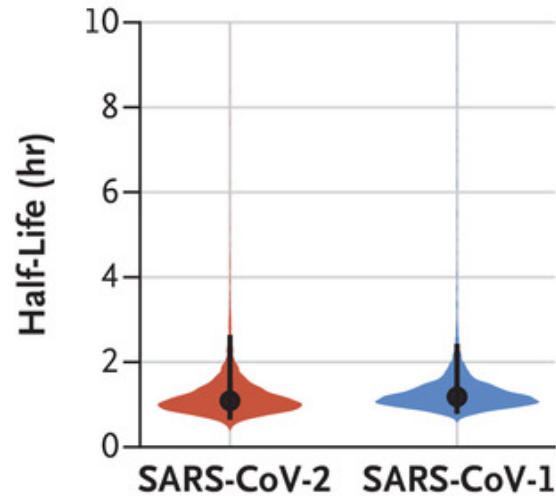
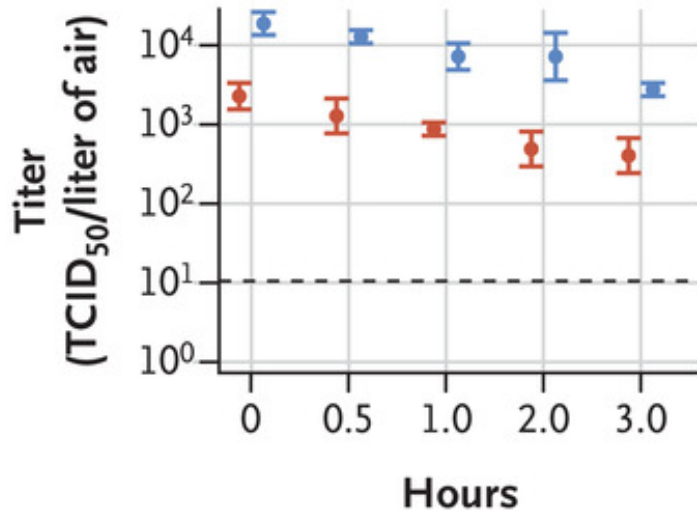
Goldberg drum: measuring the stability in aerosols by keeping them suspended



SARS-CoV-2 stability in aerosols - 1

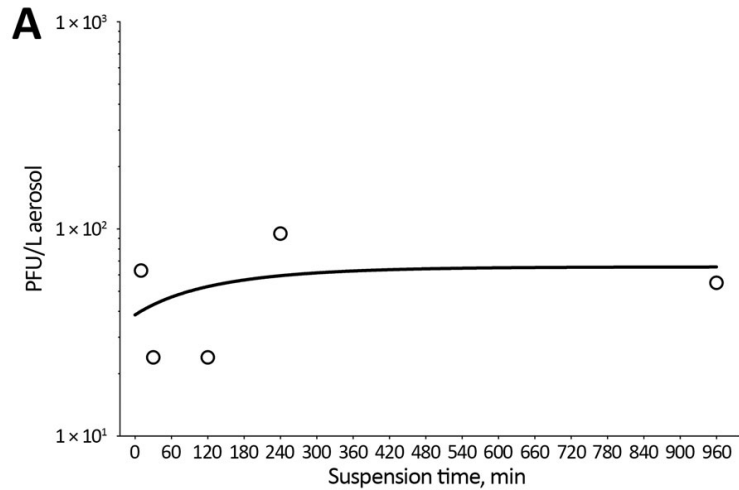
van Doremalen et al., NEJM 2020

21-23°C; 65% RH



SARS-CoV-2 half-life in aerosols: 1.1 hrs

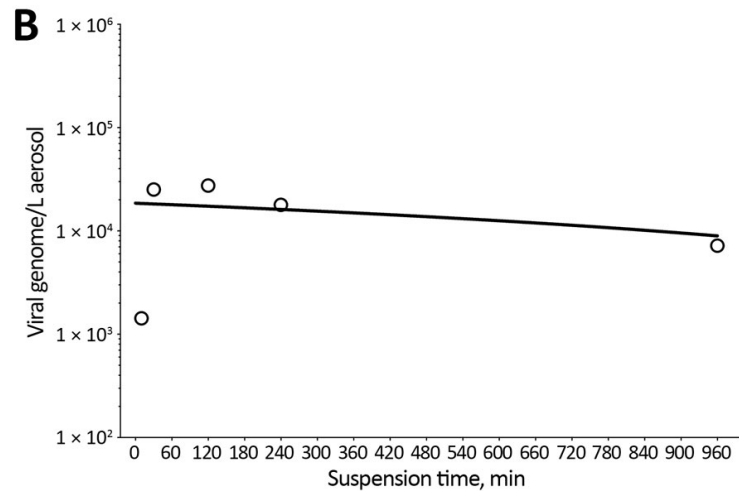
SARS-CoV-2 stability in aerosols - 2



Fears et al., JID 2020

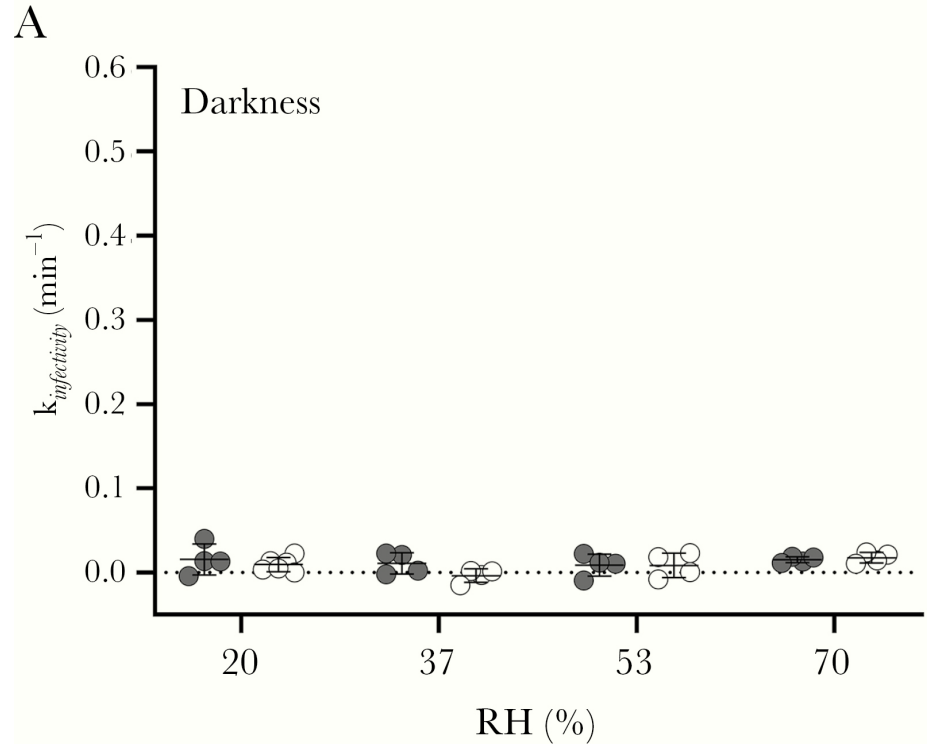
23°C; 53% RH

N=1



**SARS-CoV-2 half-life in aerosols
could not be calculated**

SARS-CoV-2 stability in aerosols: effect of relative humidity

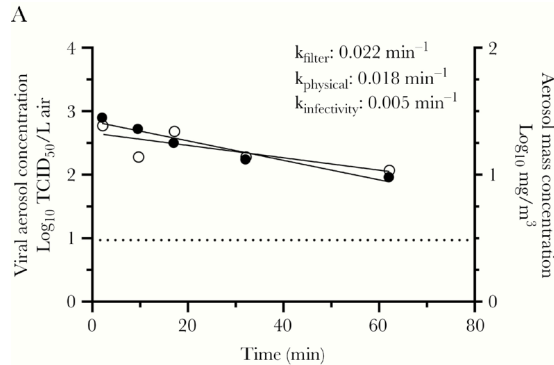


Schuit et al. JID 2020
20°C

**SARS-CoV-2 half-life in
aerosols: 55 minutes**

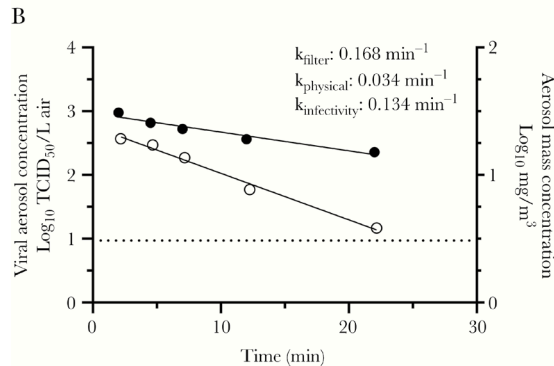
SARS-CoV-2 stability in aerosols: rapid inactivation in simulated sunlight

darkness

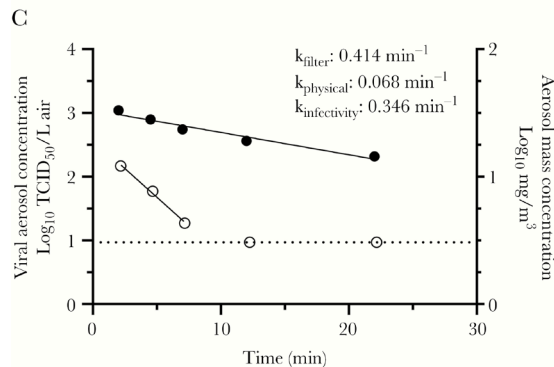


Schuit et al., JID 2020
20°C

March 7/
October 4
40°N



June 21
40°N

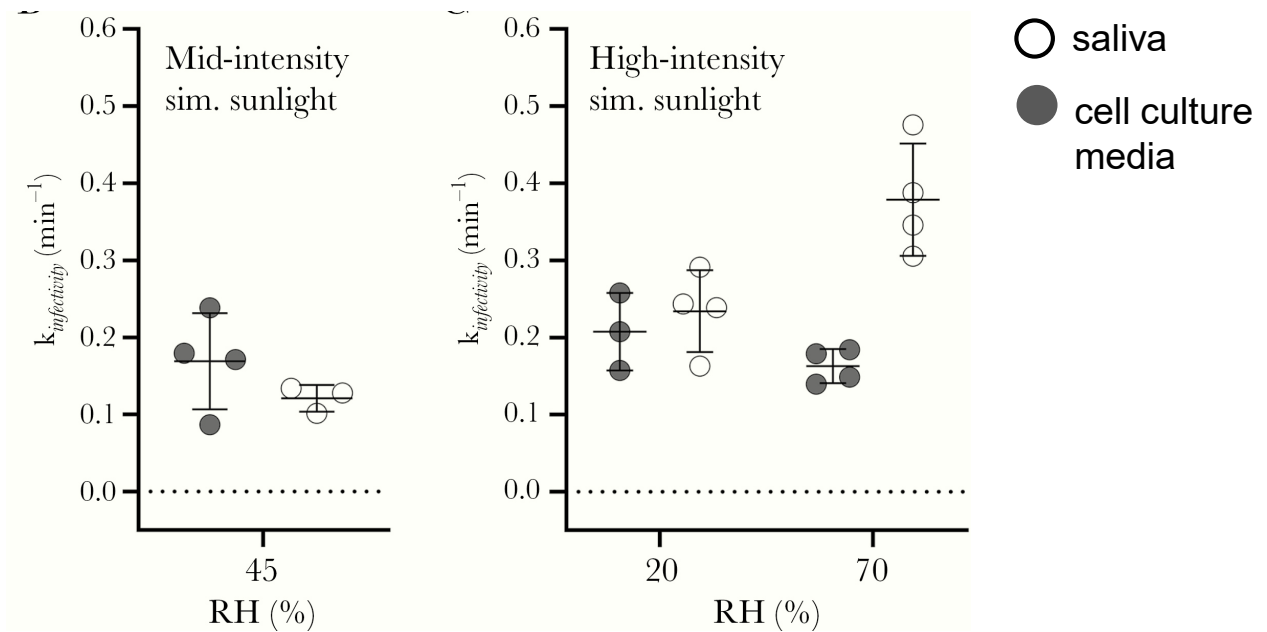


Half-life of SARS-CoV-2 in aerosols exposed to sunlight is <6 minutes

Human aerosols are not made of cell culture media: How about the micro-environment?

Schuit et al., JID 2020

20°C

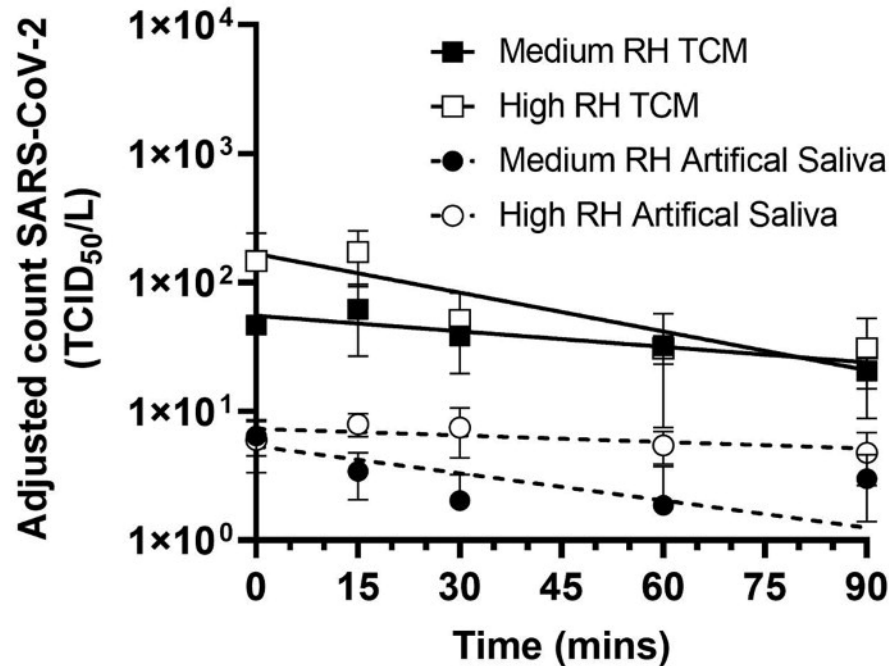


**SARS-CoV-2 is less stable
in aerosols made from
simulated saliva than cell
culture media**

Human aerosols are not made of cell culture media: How about the micro-environment?

Smither et al., EMI 2020

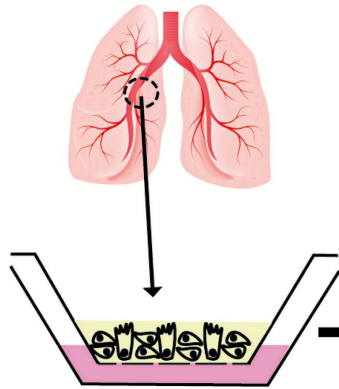
19-22°C



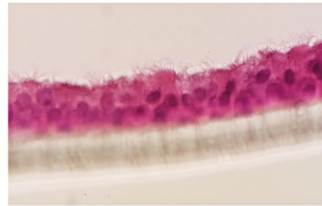
SARS-CoV-2 stability in artificial saliva depends on humidity

Stability in aerosols: how about the micro-environment?

A Seed harvested lung cells
on Transwell

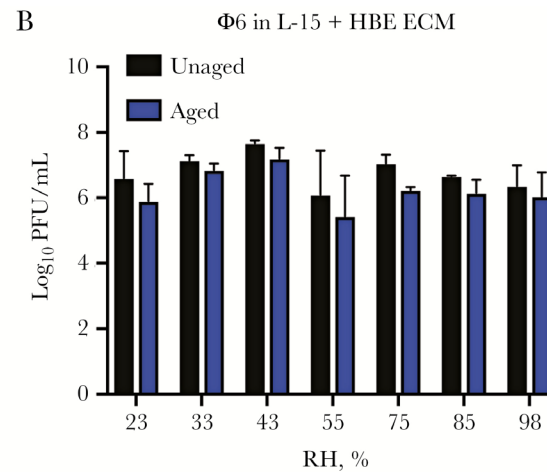
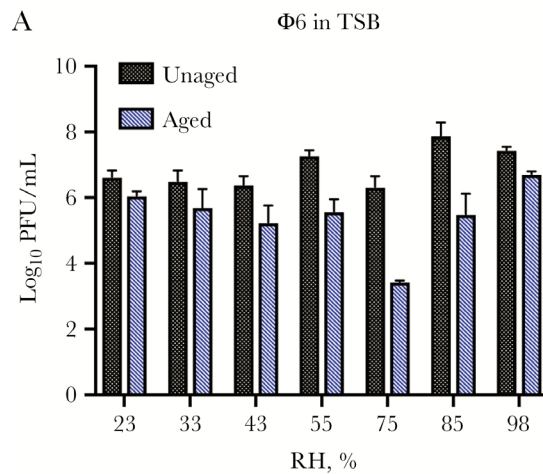


Cell differentiation



Remove ECM and supplement
to virus grown in tissue culture

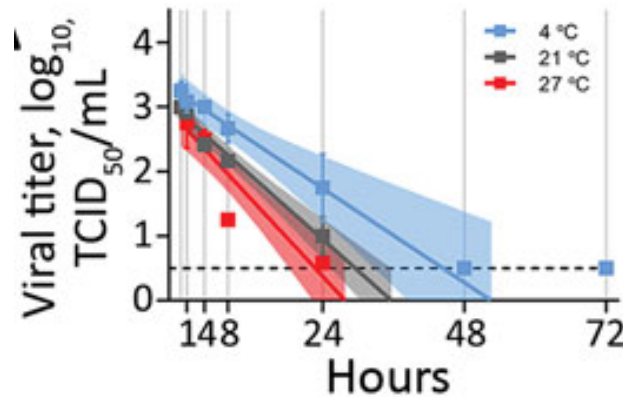
Kormuth et al, JID 2018



**$\Phi 6$ is more stable in
aerosols containing
mucus components**

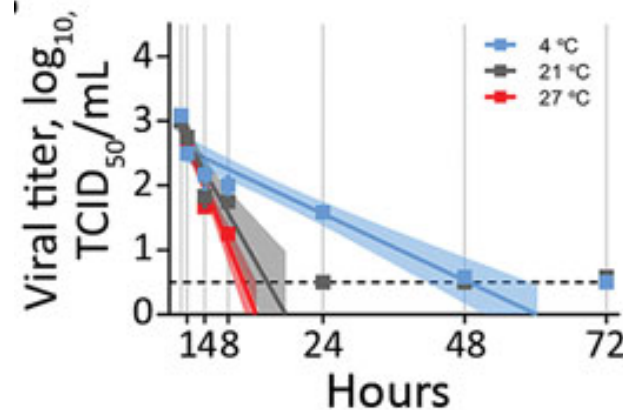
SARS-CoV-2 stability in respiratory secretions: reduced half-life in nasal mucus and sputum

Liquid nasal mucus*



Matson et al, EID 2018

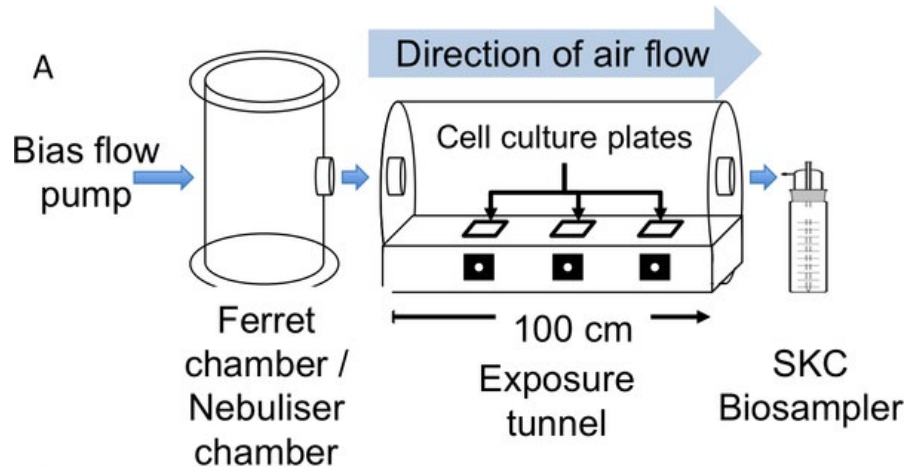
Liquid sputum*



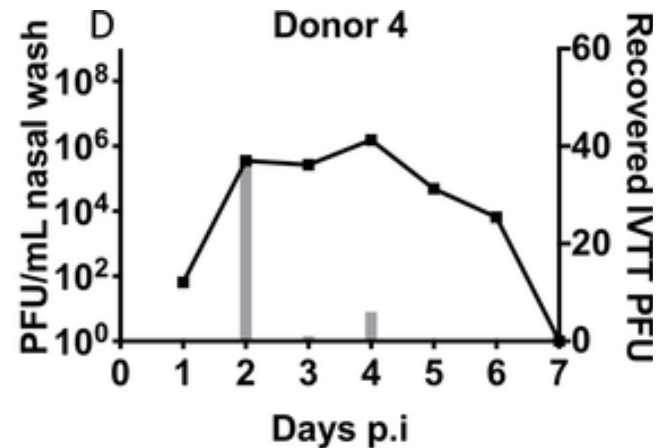
Half-life in mucus or sputum on surfaces is about ½ of that in cell culture medium

*pooled human nasal mucus/sputum

SARS-CoV-2 stability in the micro-environment: does the micro-environment change during infection?



Singanayagam et al.,
PLOS Path 2020



**Presence of infectious virus
in nasal cavity \neq infectious
virus in aerosols**

Summary

Known

- **SARS-CoV-2 infectivity declines slowly in aerosols at room temperature**
- **Small effect of relative humidity on infectivity in aerosols, with higher humidity resulting in lower infectivity**
- **Sunlight rapidly inactivates SARS-CoV-2 in aerosols**

Unknown

- **Effect of low temperatures on stability in aerosols (likely increases stability)**
- **Stability in aerosols made of relevant liquid (i.e. respiratory secretions)**
- **Changes in aerosol composition during disease could affect stability of SARS-CoV-2 in those aerosols**