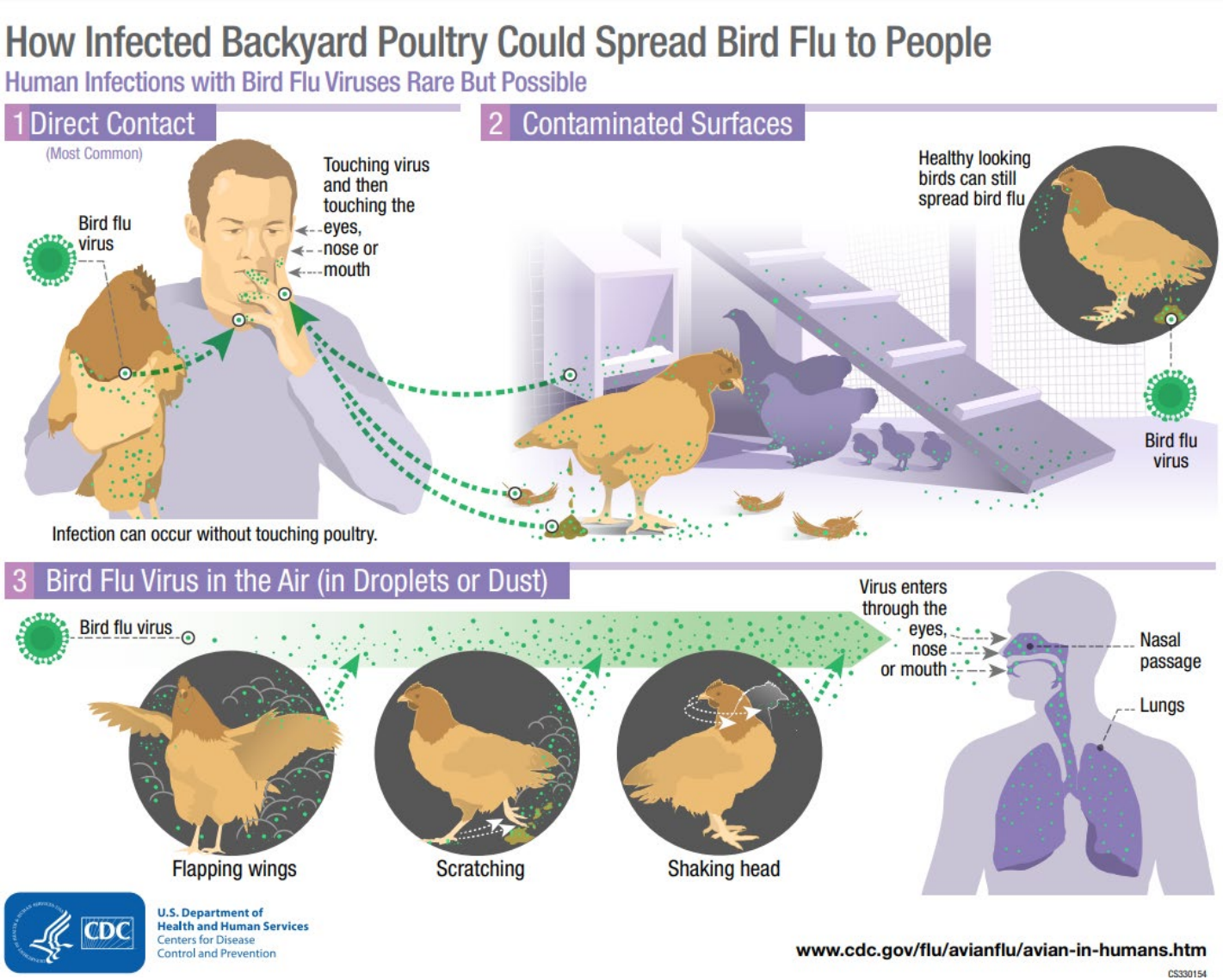
Understanding airborne transmission of viruses

Tarja Sironen

University of Helsinki



From the preprint by the Team Koopmans and Sikkema (doi.org/10.1101/2023.05.12.540493):

High number of HPAI H5 Virus Infections and Antibodies in Wild Carnivores in the Netherlands, 2020-2022
- Increase in prevalence from 0.8% to 10%

The new variant of H5N1 flu had been spreading among mink. Credit: Ole Jensen/Getty

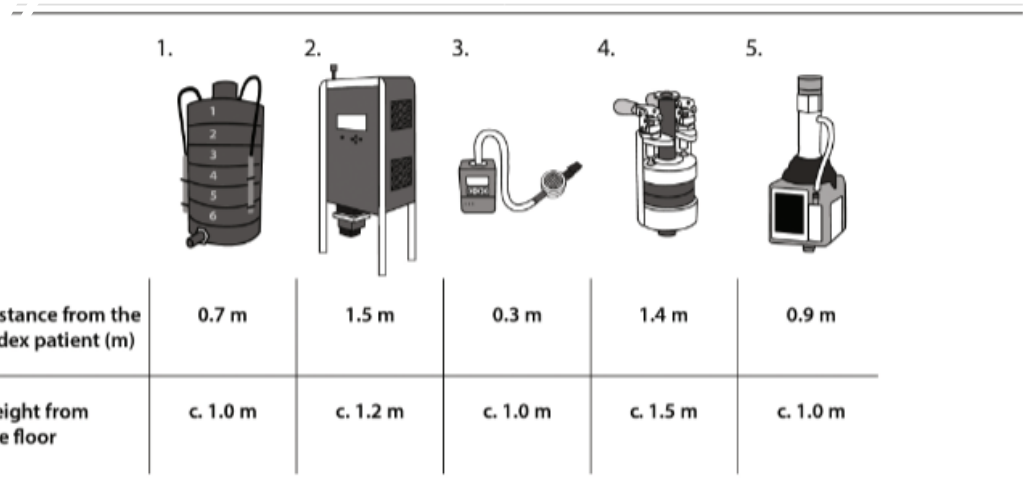
Earlier studies and lessons learned

Virus RNA was frequently found in air and surfaces, but no viable virus was found

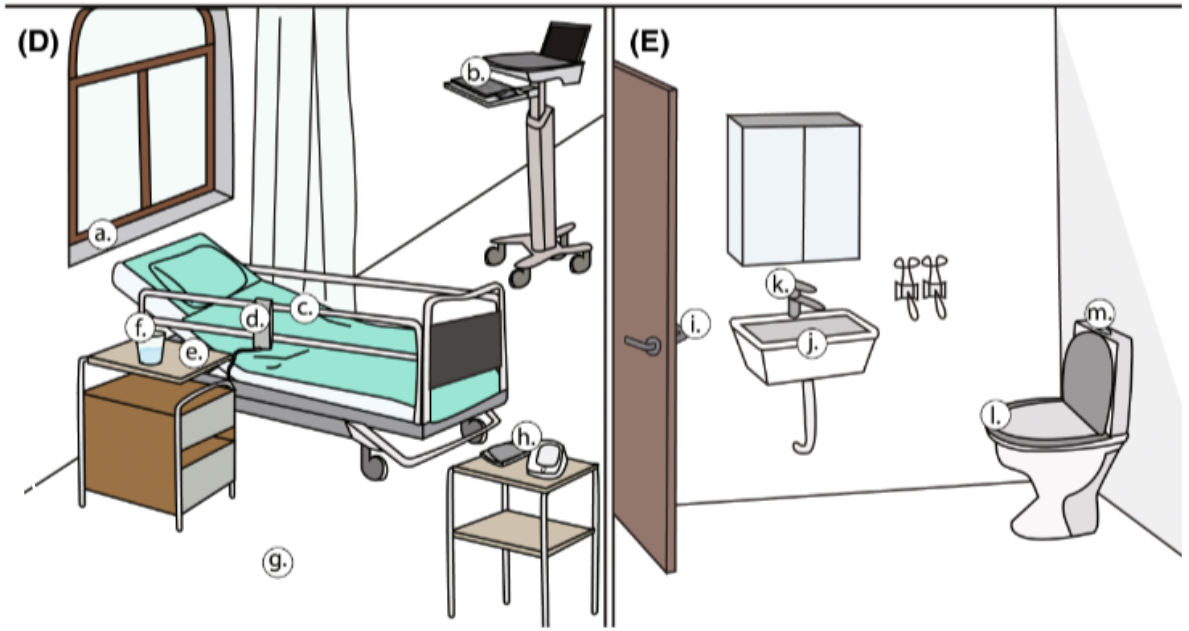
doi: 10.1111/ina.13118

Showing the presence of viable virus is important in understanding infectious disease transmission but also extremely challenging

Great need for methodology development



	1.	2.	3.	4.	5.
Distance from the index patient (m)	0.7 m	1.5 m	0.3 m	1.4 m	0.9 m
Height from the floor	c. 1.0 m	c. 1.2 m	c. 1.0 m	c. 1.5 m	c. 1.0 m



Animal models – main findings

Both UK and Omicron strains infect mink with visible signs of disease

Mink seroconvert faster than humans but otherwise similar symptomology

Infects also mink brain --> possible animal model for long covid!

Transmit virus with relative ease

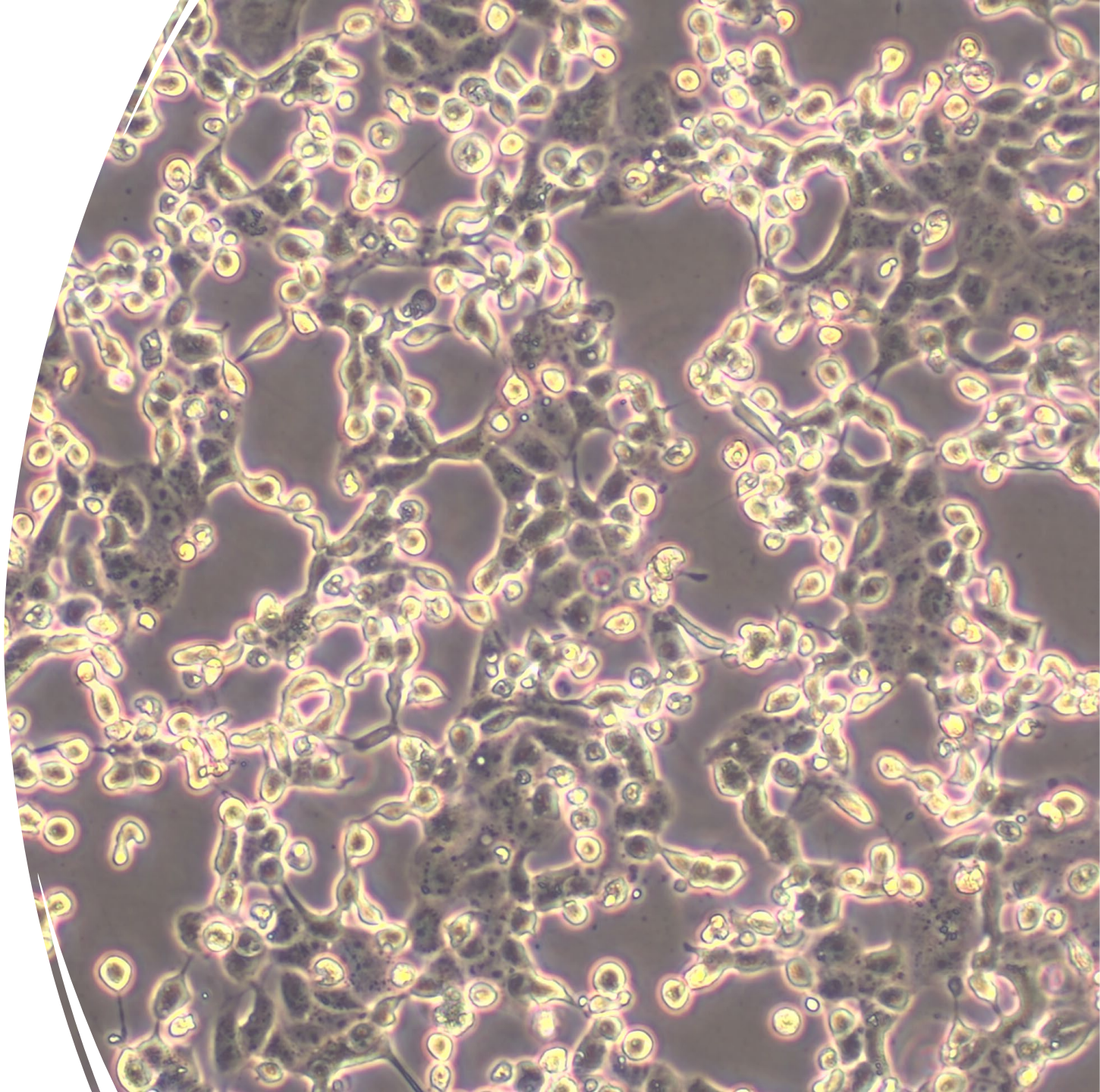
No mink specific mutations in virus in such short time

Environmental sampling

- Culture SARS-CoV-2 viruses collected from air and surfaces
- Sampling in a laboratory room with SARS-CoV-2 (omicron) infected mink
- Viable viruses were cultured from multiple air samples but only one surface sample
  - Most surface samples PCR positive

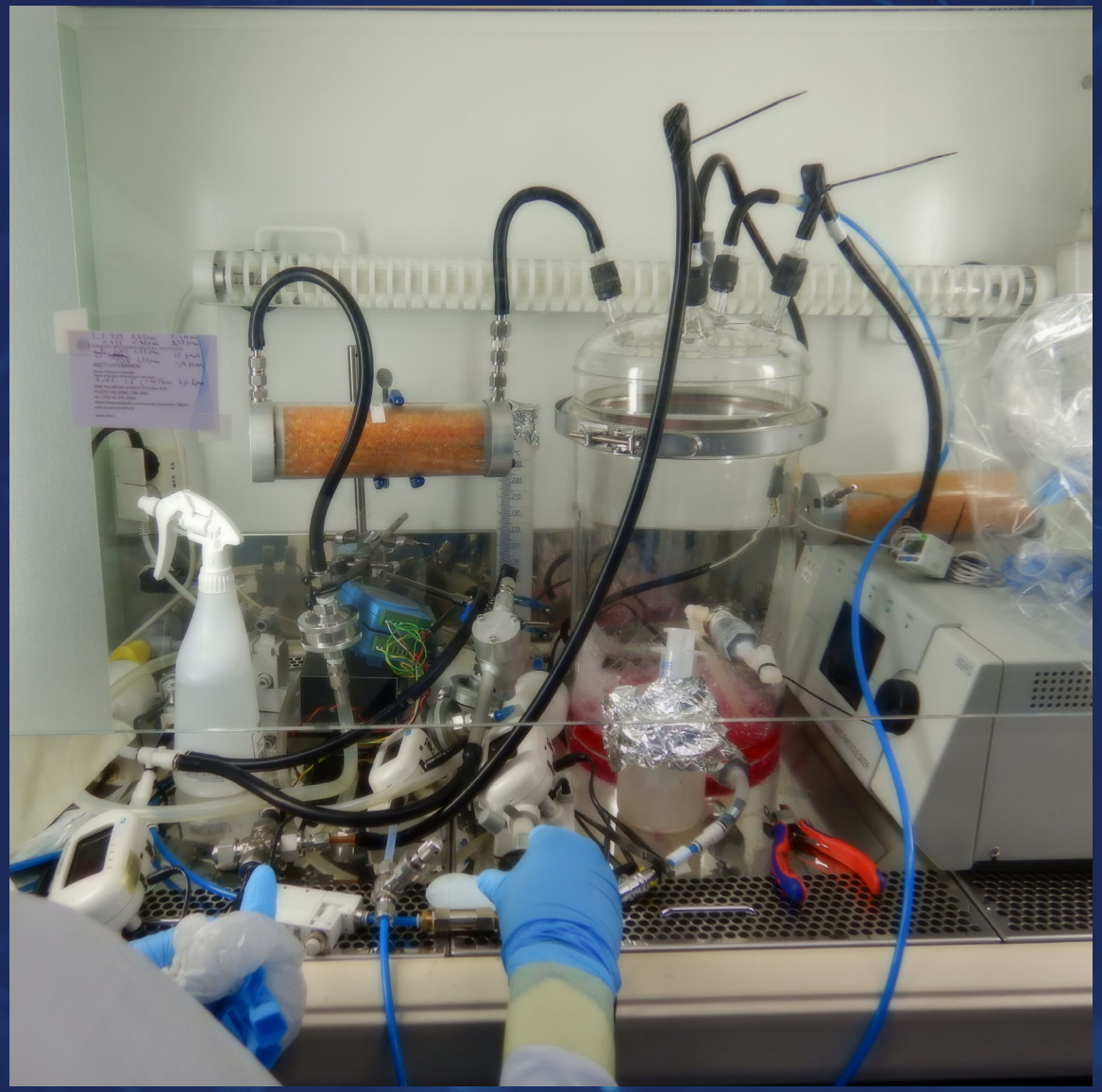
➢ **Viruses are found more often on surfaces, but remain more infectious in aerosols**

  ➢ (logical since animal to culture time much shorter in the air than on surfaces)

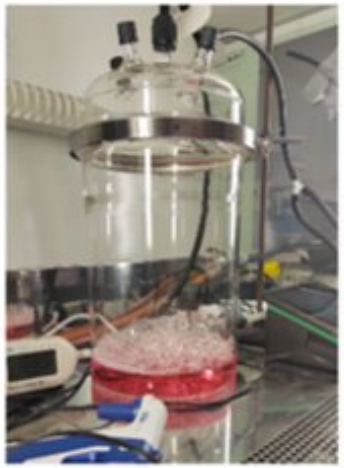


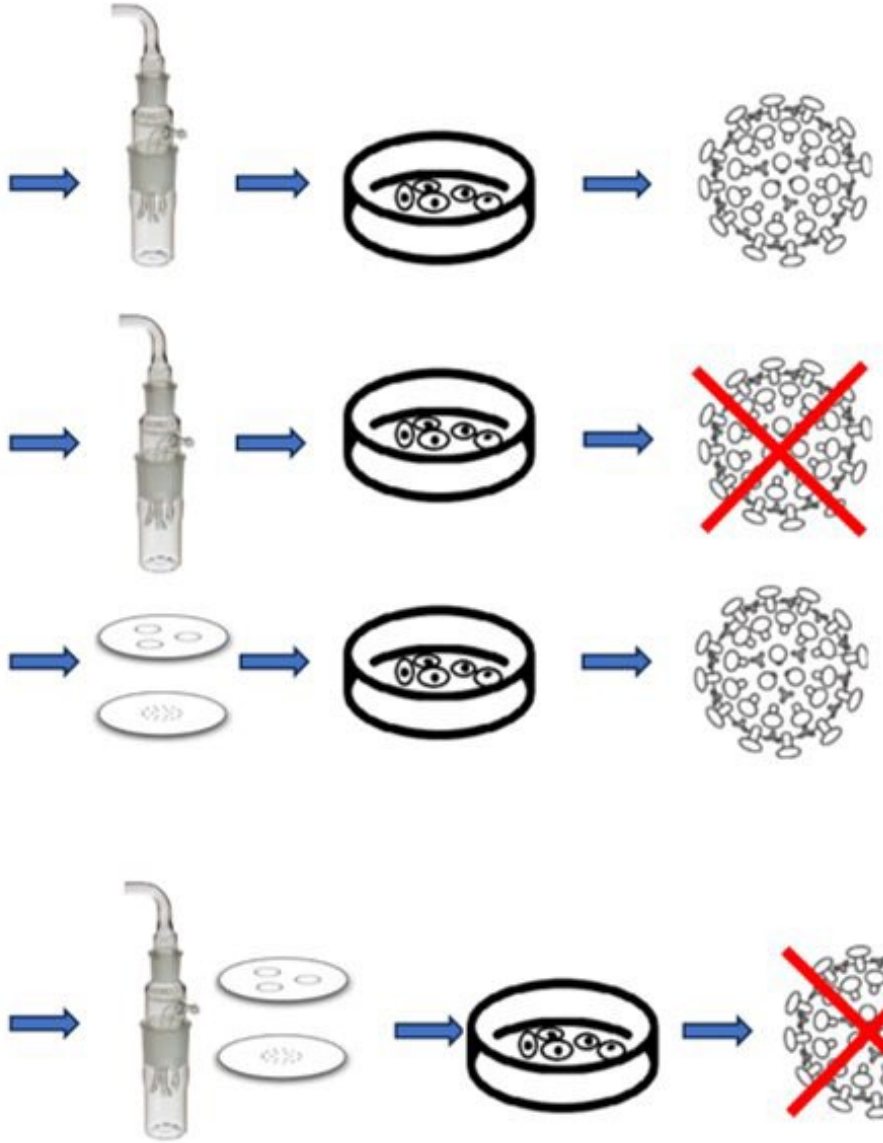
Viable virus in the air

- Developing methodology for detecting viable viruses from air
- Test done with different respiratory viruses (influenza, RSV, seasonal corona) in laboratory conditions
- Viruses aerosolized in a glass chamber using an atomizer/nebulizer
- Virus-containing aerosols are subjected to specific conditions in the chamber and then collected using a BioSampler
- Variables
  - Room humidity
  - Storage time
  - Storage temperature



- Virus samples generally tolerate transport poorly
- Aerosol generating system mechanically hard on viruses?
- Only very small amounts captured of the whole





Future perspectives

- Technological development needed
- RNA copy number versus infectious dose
- What key questions to be tested in animal models
- Response to new threats?

Thank you to everyone in E3!