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Experimental studies of airborne pathogens in indoor environments

JAKOB LÖNDAHL, AEROSOL TECHNOLOGY, LUND UNIVERSITY



Aerosol people from Lund University





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Research group airborne pathogens

Jakob Löndahl, *docent aerosolteknologi*

Malin Alsved, *postdok aerosolteknologi*

Sara Thuresson, *doktorand aerosolteknologi*

Patrik Medstrand, *professor virologi*

Carl-Johan Fraenkel, *med. dr., infektionsöverläkare*

Sviataslau Sasinovich, *postdoc, klinisk virologi*

Anders Widell, *docent, överläkare klinisk mikrobiologi*

Erik Sennerby, *med. dr., ST-läkare klinisk mikrobiologi*

Josefine Thylefors, *sjuusköterska vårdhygien*

Blenda Böttiger, *docent, överläkare klinisk mikrobiologi*

Jonathan Soldemyr, *M.Sc.*



T H E
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O S H E R
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F O U N D A T I O N



Forskningsrådet för
hälsa, arbetsliv och välfärd

Experimental works at a glance

- Measurements of airborne viruses in indoor environments (hospitals), 2016-present
- Sampling of bacteria in hospital operating theatres (2013-2018)
- Laboratory characterization of airborne virus
- Measurement of inhaled particle deposition (2004-present) and dose estimates to respiratory tract
- Development of new sampling techniques for bioaerosols
- Sampling of airborne biological material (e.g. allergens)

1. Emission



Sneeze and cough
Talk and breathing
Skin
Textiles
Flushing toilets

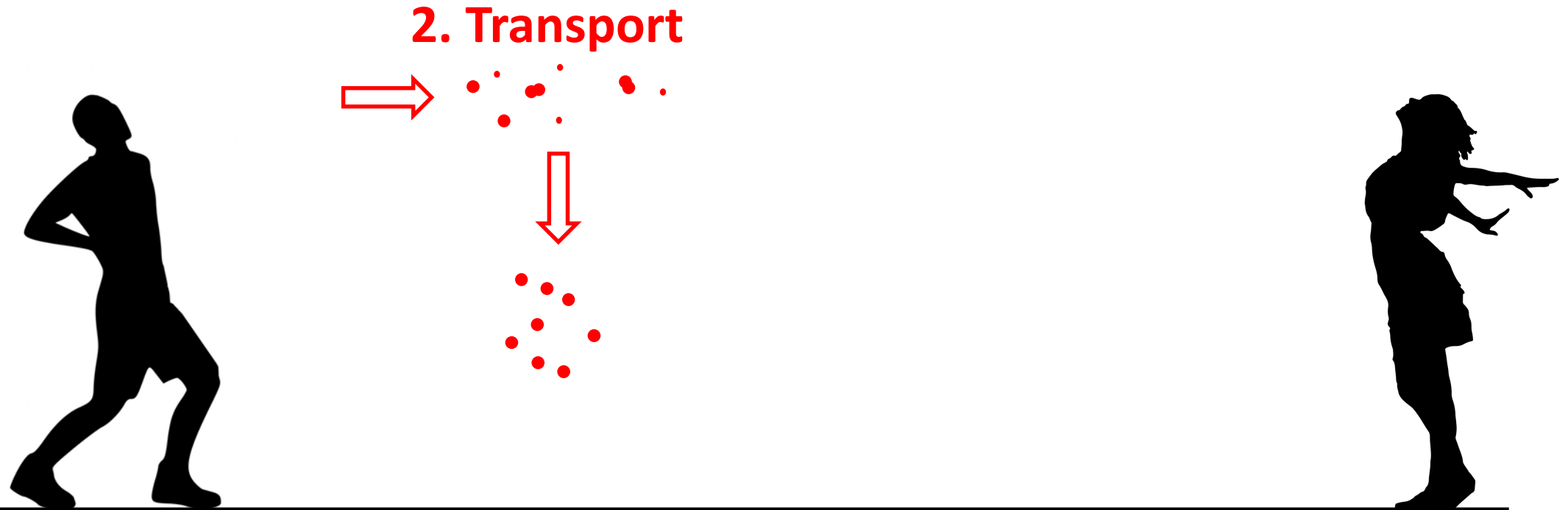


Alsved et al., 2020, *Aerosol Science and Technology*

Alsved et al., 2019, *Aerosol Science and Technology*

Transport: Deposition, dilution, evaporation, coagulation

Particle size and relative humidity (note that particle size is different from size of infectious agent)



Alsved, Fraenkel et al., 2020, *Clinical Infectious Diseases*

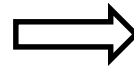
Alsved et al., 2018, *Journal of Hospital Infections*

Santl-Temkiv et al., 2017, *Environmental Science and Technology*

Atmosphere is a stressful environment

Temperature, humidity, radiation, nutrition

3. Viability

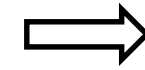


Alsved, Holm et al., 2018, *Frontiers in Microbiology*

Alsved et al., 2020, *Scientific Reports*

Inhalability and respiratory tract deposition

Determined by particle size, hygroscopicity, breathing flow and lung properties



4. Deposition



Jakobsson et al., 2018, *Journal of Applied Physiology*

Rissler et al., 2017, *Particle Fibre and Toxicology*

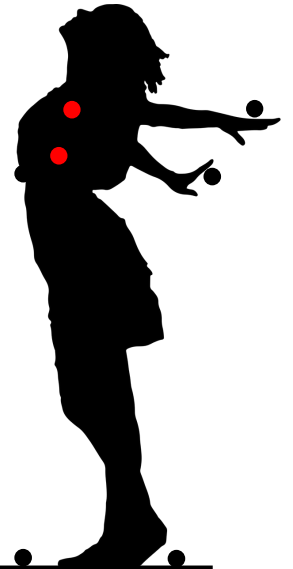
Does the pathogen reach areas for replication?

Location of deposition, clearance and translocation

Not only respiratory disease transmit through air



5. Target

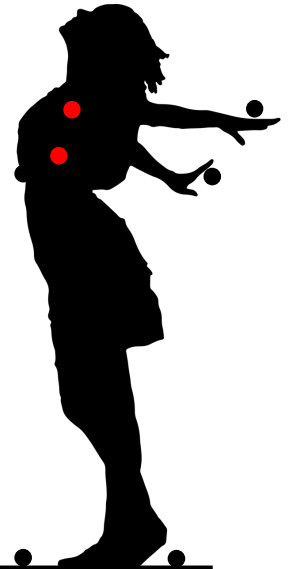


Is the inhaled amount of pathogen sufficient?

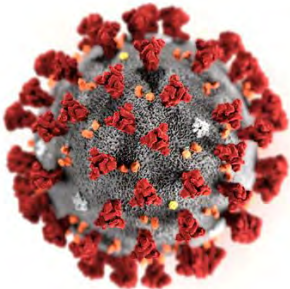
Exposure time, exposure concentration and ventilation rate



6. Dose



Sampling SARS-CoV-2



Nanometer



Condensation (BioSpot)



Cyclone (Coriolis μ)



Filter (Sartorius)



Impaction (NGI)

Sampling SARS-CoV-2







- Safety
- Ethical permission
- Lab permission
- Method for virus analysis?



Results SARS-CoV-2



Exhaled respiratory particles during singing and talking

M. Alsvéd^a , A. Matamis^b , R. Bohlin^c, M. Richter^b , P.-E. Bengtsson^b , C.-J. Fraenkel^d , P. Medstrand^e , and J. Löndahl^a 