Willkommen
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Bienvenue

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COVID-19, Face Masks and how Nanotechnology can provide solutions

Dr. Peter Wick,
Head of Particles-Biology Interaction, Head of Contactpointnano and Member of National COVID-19 Science Task Force

New ‘controlled’ normality

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The overall aim of each pandemic crisis is to stop the propagation and extinct the disease

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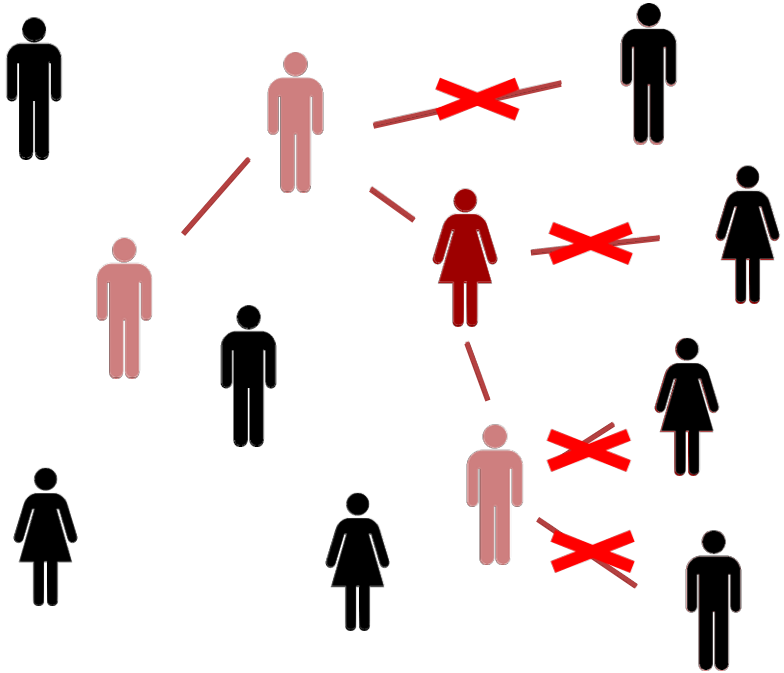
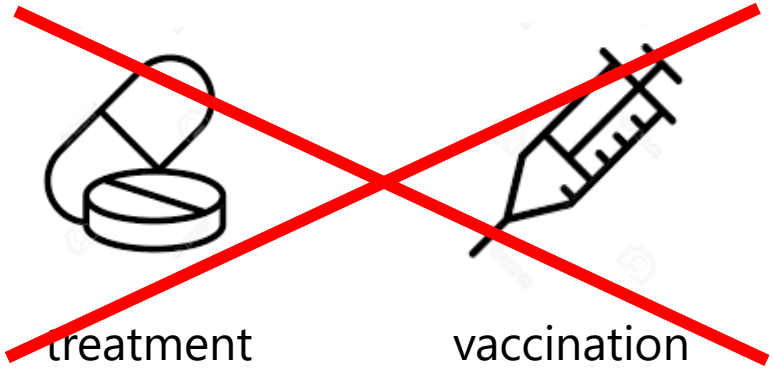


In the case of COVID-19 pandemic



We can only relay on non-pharmaceutical measures

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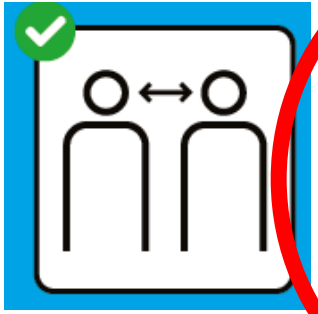
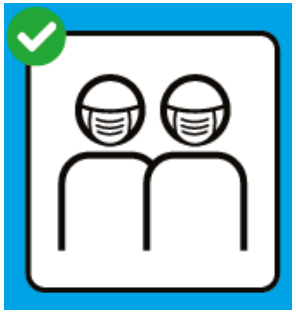
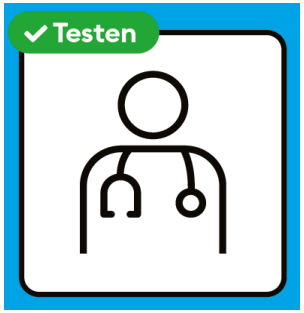
Hygiene

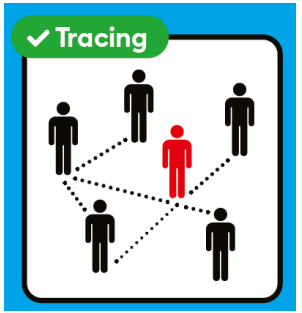


Distance



Protection





What protects against COVID-19 infection or transmission?

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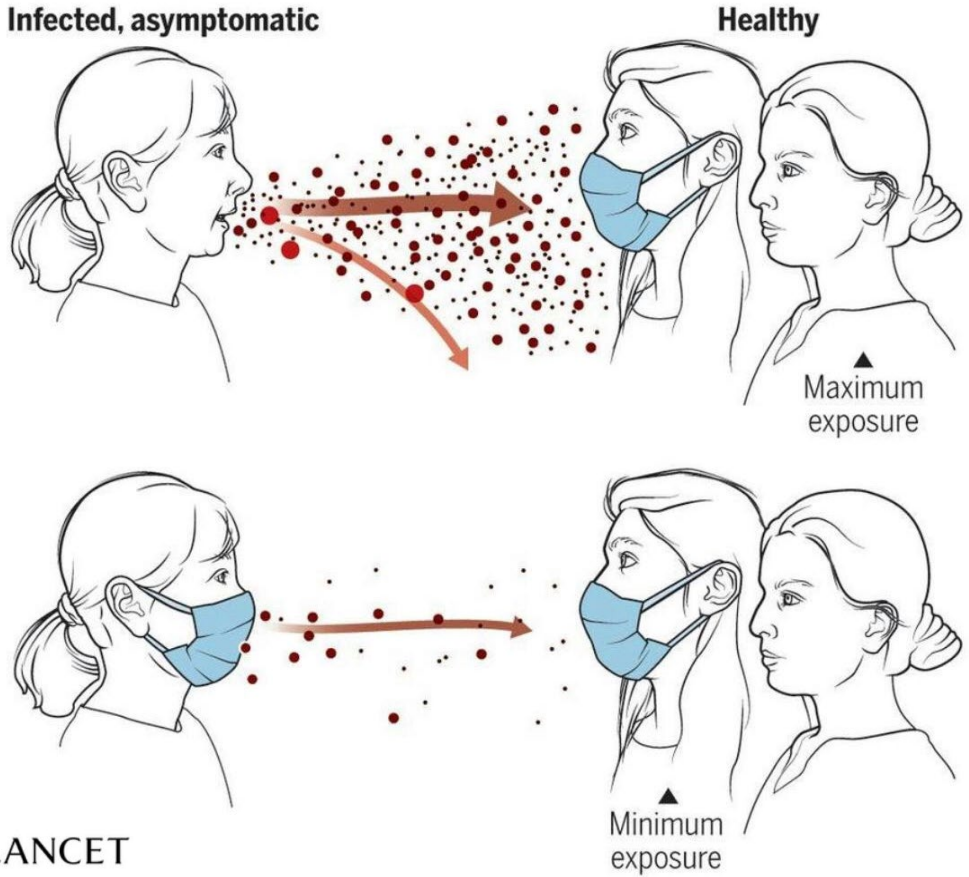

Chu DK, Akl EA, Duda S, et al.
Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. *Lancet* 2020. Published online June 1.

Mask types

Filtering face piece (FFP)
EN 149
EU/2016/425, SR 930.115
(PSA-Verordnung)

FFP1, FFP2, FFP3, N95
High filtration efficiency

Surgical masks
EN 14683
EU/2017/745, SR 812.213
(Medizinprodukteverordnung)

Type I, Type II, Type IIR
Source control

Each crisis has its opportunities

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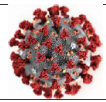
During the shortage of face masks: new face mask concepts were developed

Community mask
«non-medical mask»

https://www.schoeller-textiles.com/de/news

Swiss National COVID-19 Science Task Force (NCS-TF)



Type of document: suggestion and recommendation paper	
In response to request from: Lukas Bruhin, via Matrin Ackermann und Matthias Egger	**Date of request:** 11/04/2020
Expert groups involved: Sub task IPC; S. Tschudin Sutter, P. Wick, R. Rossi, A. Mortensen and ReMask Expert group	**Date of response:** 21/04/2020, finalized 25/04/2020
Contact persons: Peter Wick (peter.wick@empa.ch), René Rossi (rene.rossi@empa.ch)	
Comment on planned updates : none planned as of writing	

Title: - Recommendations for minimal specifications for the community masks for Swiss manufacturers

Summary of request/problem

On request of the Swiss governmental Krisenstab, the "ReMask" Expert group has formulated a recommendation for test methods and minimal specifications for community masks. 22.04.2020 these minimal specifications have been discussed and agreed upon with the Krisenstab and the Task Force VBS.

This document complements the document dated 14.4.20. and has received from the Krisenstab (L. Bruhin per 22.04.2020) the permission to be published .

Executive summary:

Recommended specifications for Community masks:

Community masks , mostly aimed at source control, should offer a sufficient protection against liquid droplets of different sizes produced during coughing or sneezing and aerosols (particle size down to 1 micrometer). They should have a sufficient air permeability to minimize breathing hindrance and different fitting sizes for adults and children to guarantee an adequate face coverage.

In brief:

Air permeability < 60 Pa/cm^2 according to to ISO 9237

HelloMask: a transparent medical face mask

A collaboration project between Empa and EPFL

A snorkel mask modified with a 3D-printed adapter to be used with medical-grade filters

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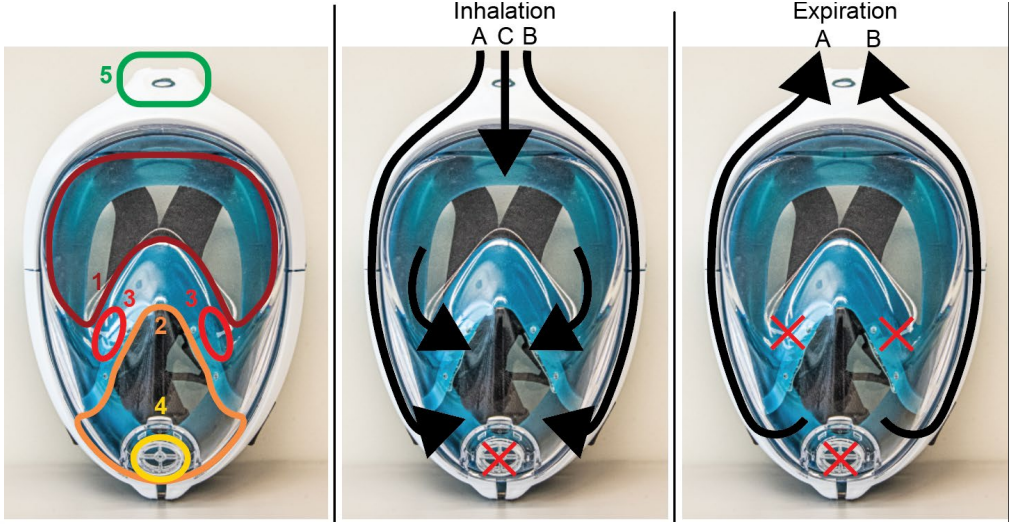

Courtesy of Prof J. Wang ETH / Empa

Nanotechnology an enabler for new antiviral concepts

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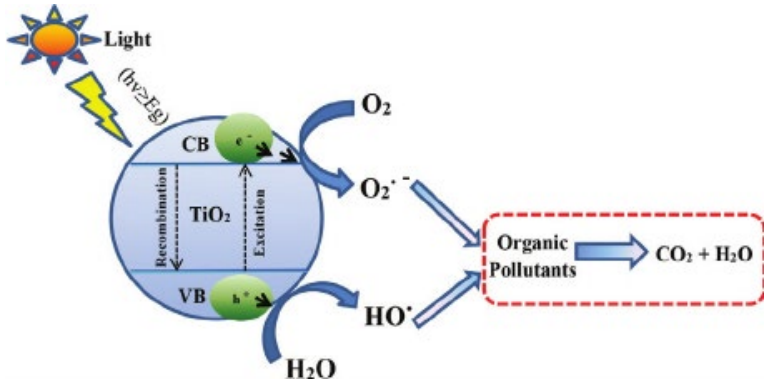

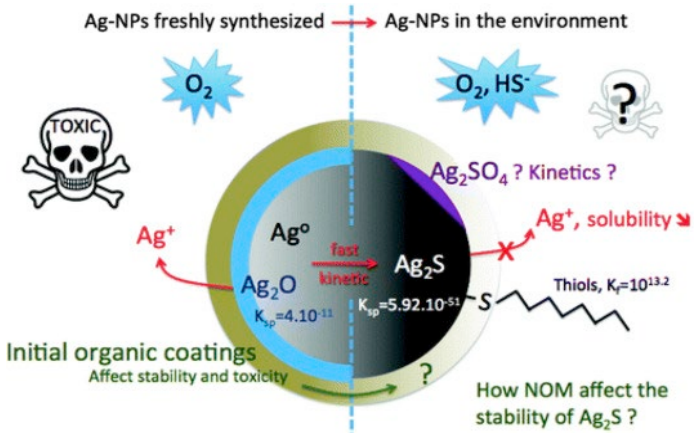

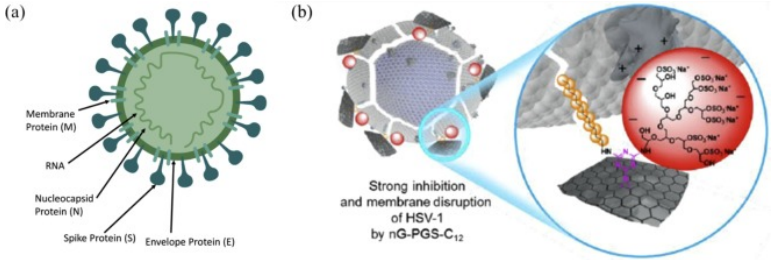

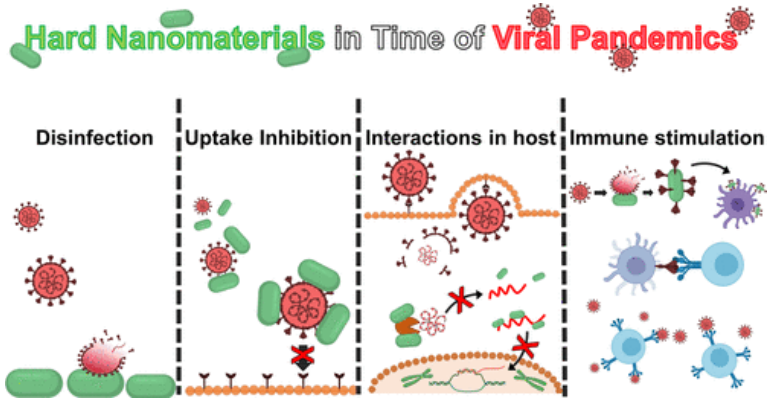

McShan et al 2014, J Food and Drug Analysis; Reina et al 2020, ACSNano; Palmieri and Papi Nanotoday 2020

Risk / benefit analysis

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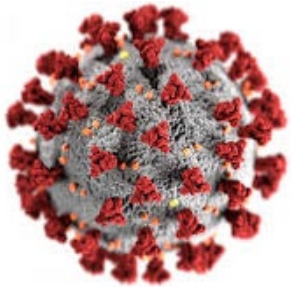
RISK

- potential exposure of released nanomaterials
- hygiene

BENEFIT

- Improved protection properties
- Reusability
- Comfort



https://www.schoeller-textiles.com/de/news

Risk = Exposure x Hazard

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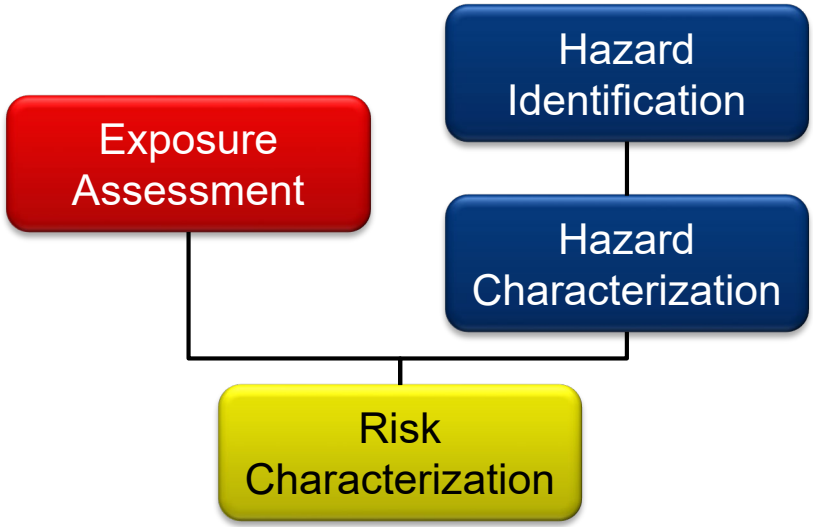
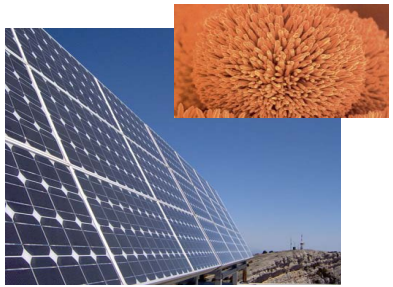
- Contribute to a safe development of nanotechnology
- Analyze possible adverse effects on humans and the environment as early as possible





Exposure routes of nanomaterials in healthy human beings

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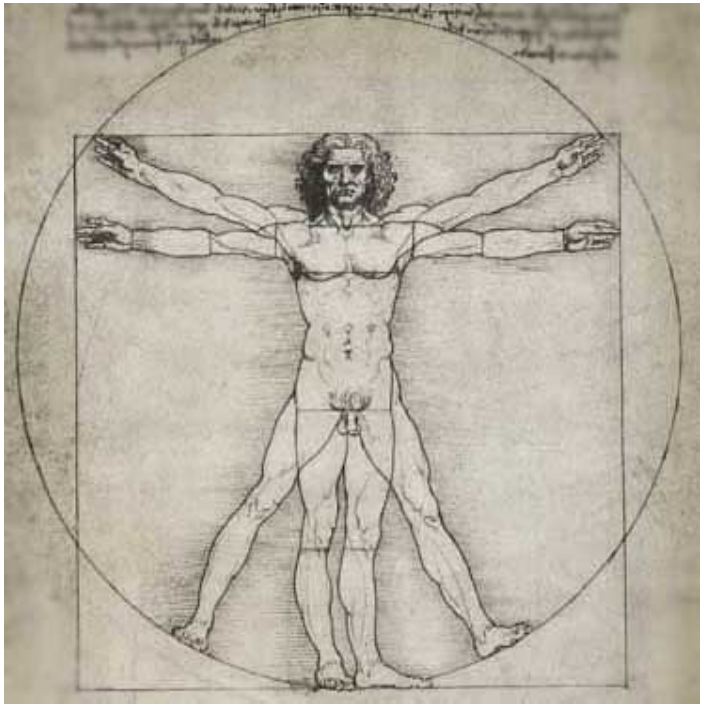
lung:
140 m^2
air / blood barrier
very thin < 2 µm

gastrointestinal tract:
surface: 2000m^2, pH 2,
intestinal mucosa thick;
distance to blood vessels **big**

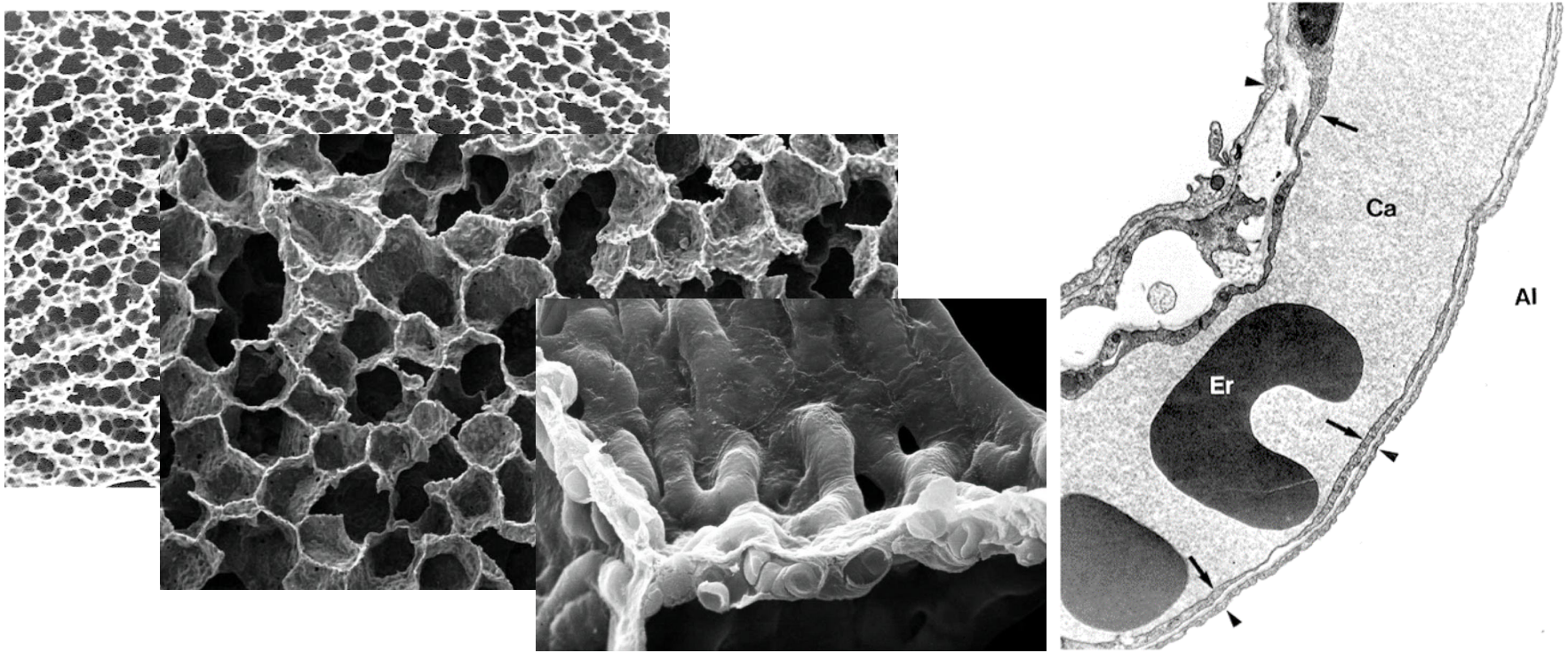


injection:
efficient distribution in the body (4 - 5l cardiac output per minute)

skin:
1.8 m^2
barrier **very thick**, epidermis, horny skin

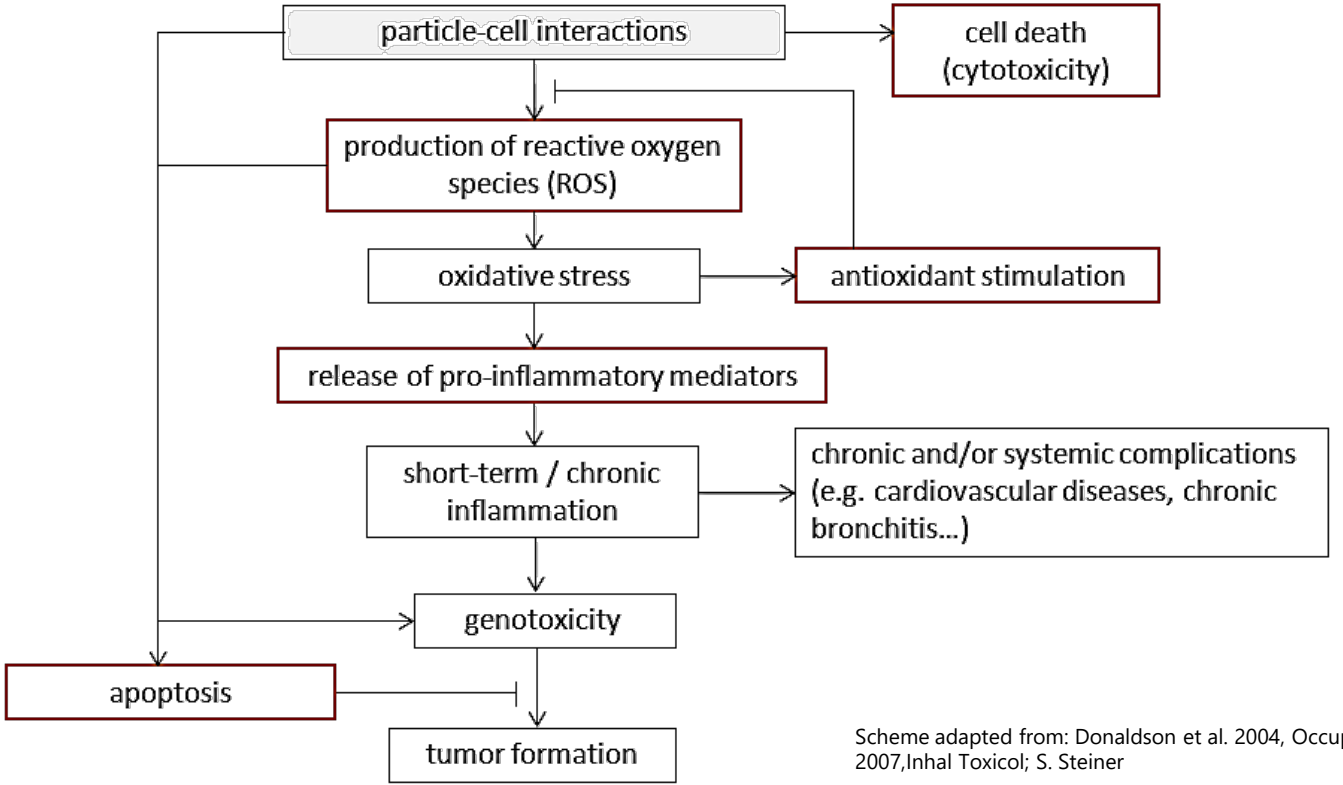
hair follicle	20/cm^2
respiratory glands	150/cm^2
sebaceous glands	15/cm^2

Lung tissue in electron microscopy



E.R. Weibel / P. Gehr University of Bern

Oxidative stress paradigme for ENMs



Scheme adapted from: Donaldson et al. 2004, Occup Environ Med; Schins, Knaapen 2007,Inhal Toxicol; S. Steiner

Until today, case-by-case analysis

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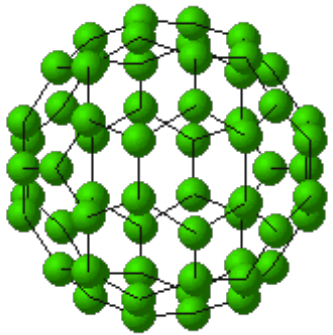
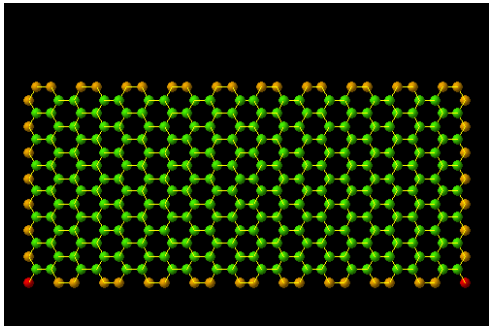
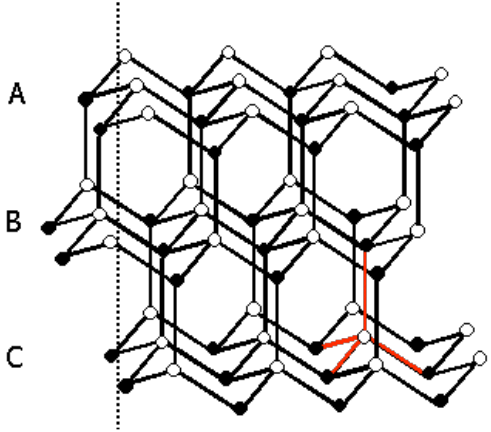
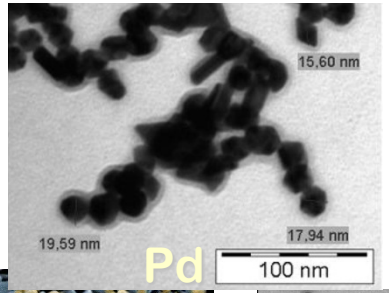
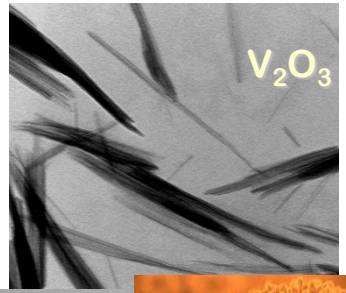


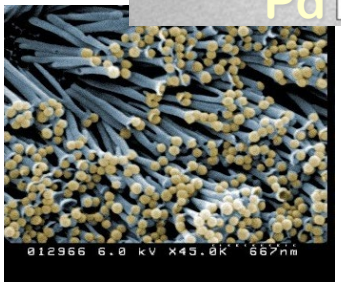


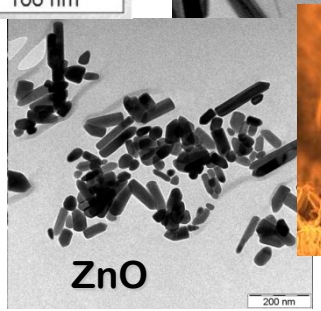


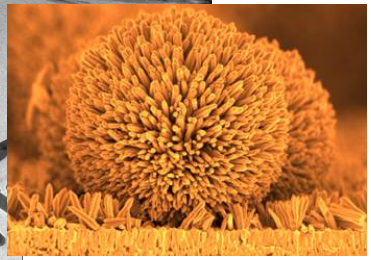
and others…





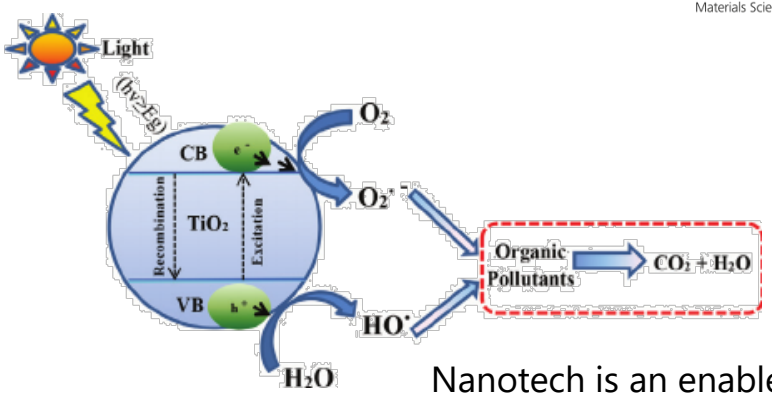




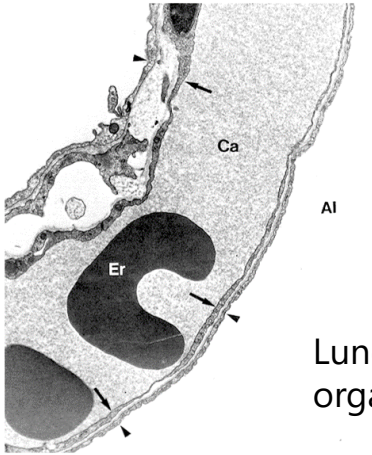


Summary

Community mask
«non-medical mask»



Nanotech is an enabler



Lung is the most sensitive
organ for aerosol particles

Careful risk / benefit analysis

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The national **contactpointnano.ch**

Safe handling of nanomaterials, regulation and knowledge transfer

Website: www.contactpointnano.ch

Email: contactpointnano@empa.ch

https://ncs-tf.ch/

https://bag-coronavirus.ch/downloads/