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The human lung and its susceptibility against combustion-generated and manmade nanoparticles

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Mentors

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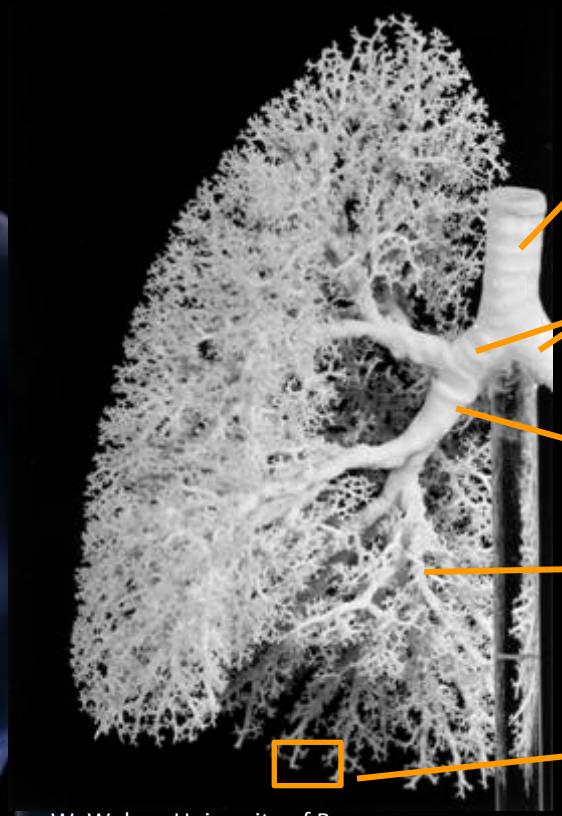
Prof. em. Ewald Weibel

Prof. Matthias Ochs

The human lung structure

Conducting airways

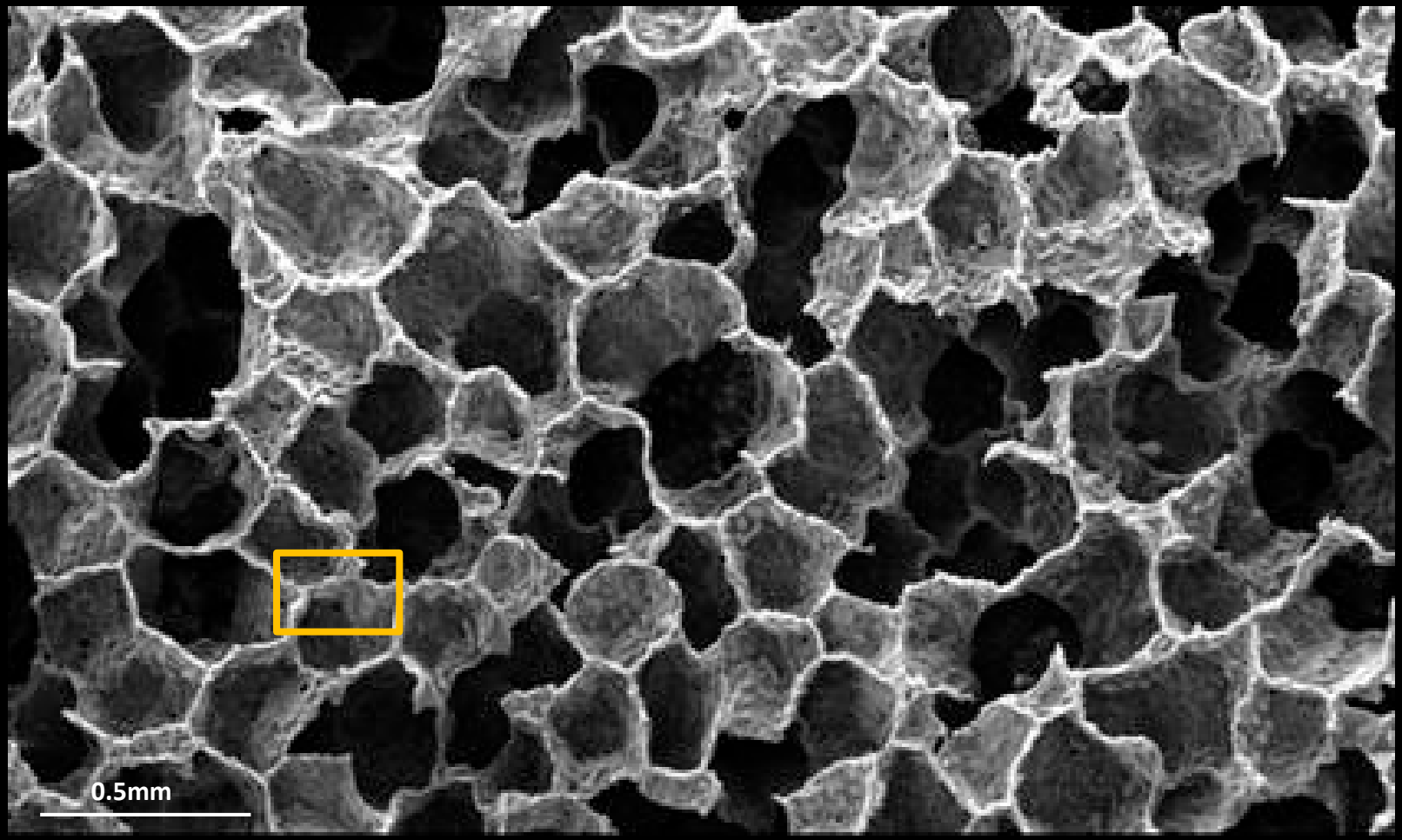
Lungs and Breathing - 3D Medical Animation || ABP ©



W. Weber, University of Bern

The human lung structure

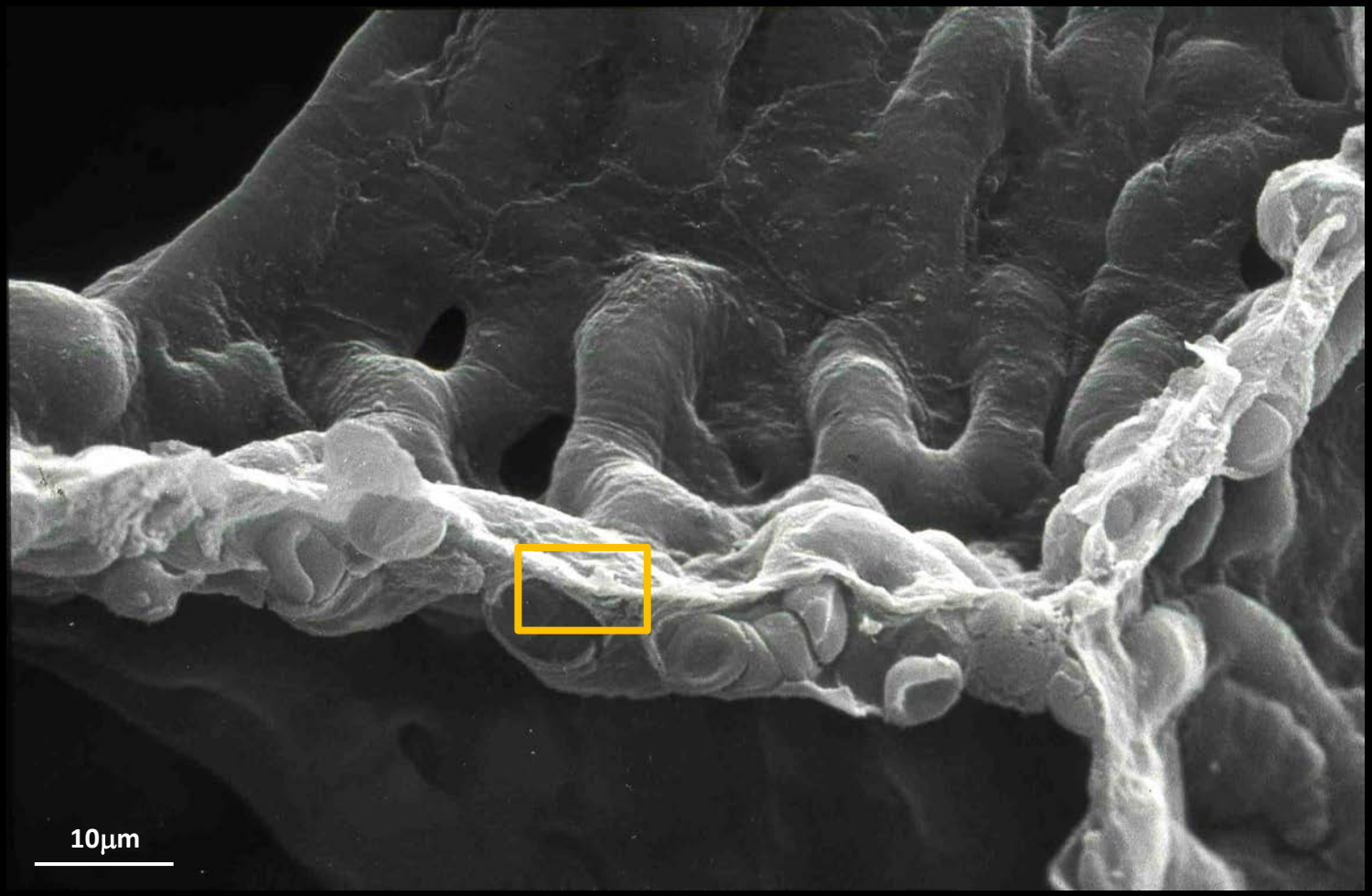
Interalveolar septa



P. Gehr, University of Bern

The human lung structure

Interalveolar septa

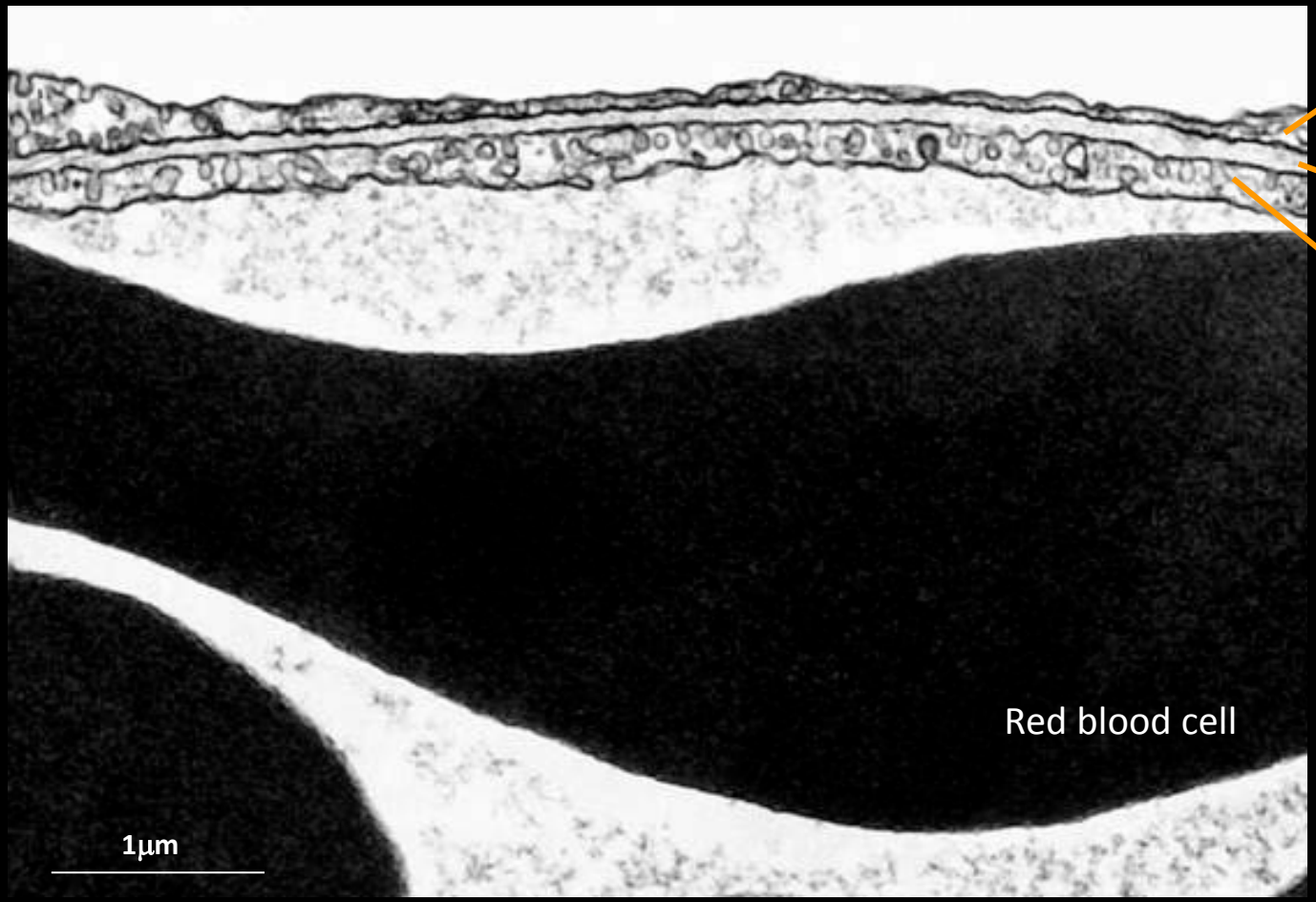


E. Weibel, University of Bern

The human lung structure

Air-blood tissue barrier

Alveolus (Air)



Capillary

P. Gehr
University of Bern

The human lung structure

Some numbers

500 millions alveoli

Surface 140 m²

Capillary volume

210cm³

Air-blood tissue barrier

Mean arithmetic thickness of 2.2 µm

Gehr et al. Resp Physiol (1978); Ochs and Weibel. Fishman´s Pulmonary Diseases and Disorders, New York (2008)

Inhalation of particles / aerosols

http://www.theguardian.com/uk/2013/jan/27/diesel-engine-fumes-worse-petrol

http://www.stern.de/gesundheit/allergie/erkrankungen/

http://www.dguv.de/ifa/Fachinfos/Nanopartikel-am-Arbeitsplatz/

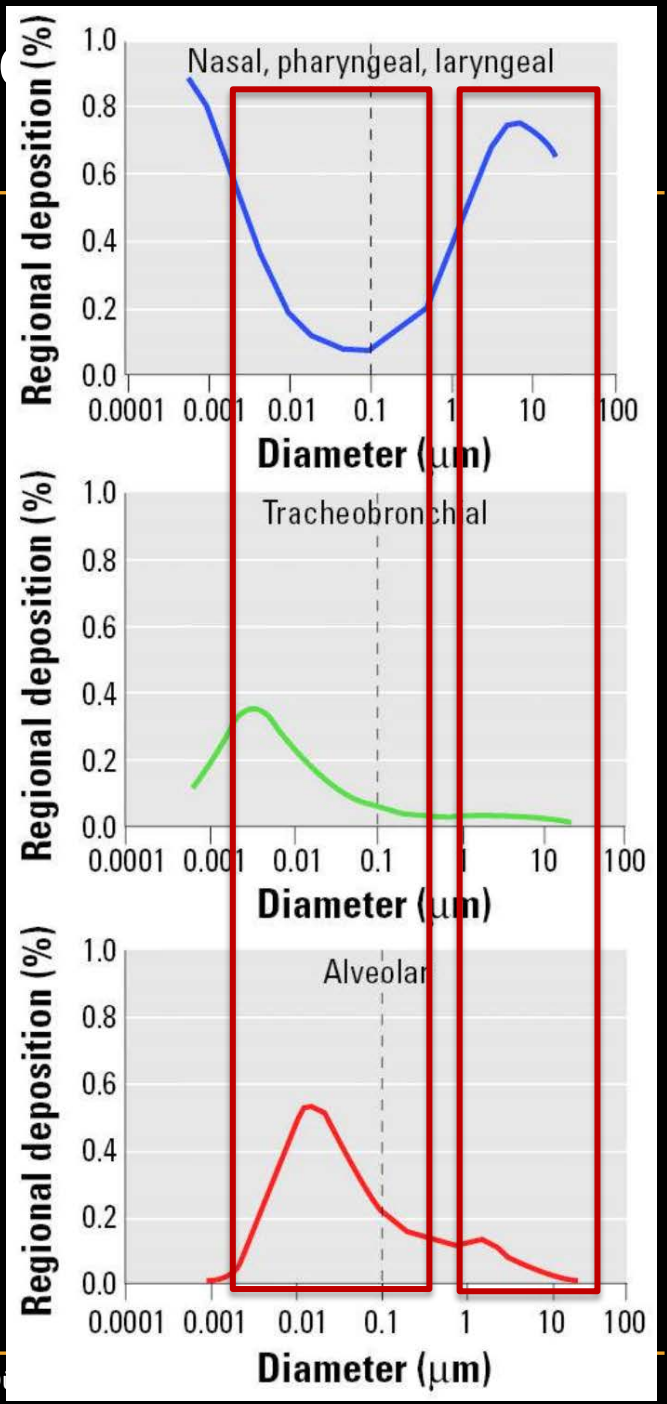
http://www.spiegel.de/gesundheit/diagnose/

http://www.netdoktor.de/Krankheiten/Asthma/Therapie/

Inhalation of particles / aer

Predicted fractional deposition

Oberdörster et al.
Environ Health Perspect (2005)

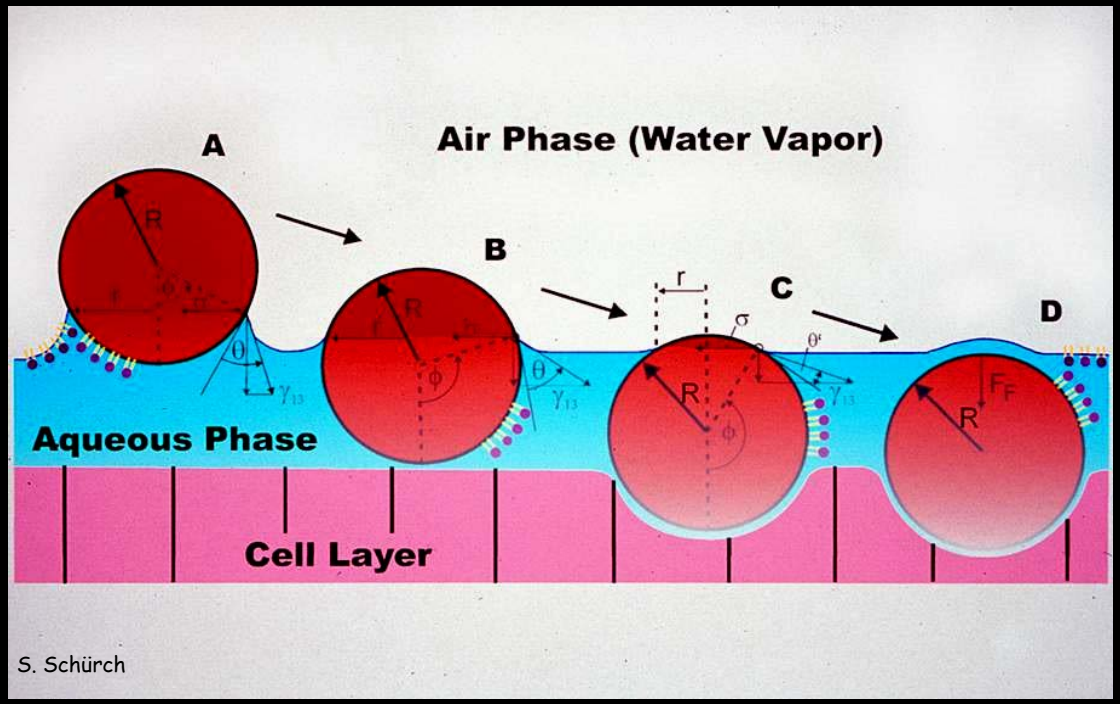


Inhalation of particles / aerosols

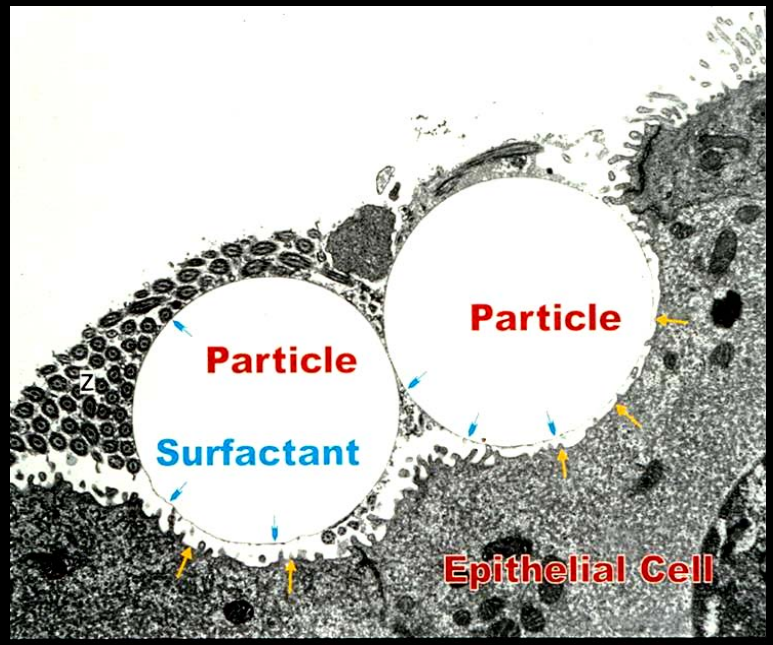
Predicted fractional deposition

Inhalation of particles / aerosols

Interaction with mucus and surfactant



S. Schürch

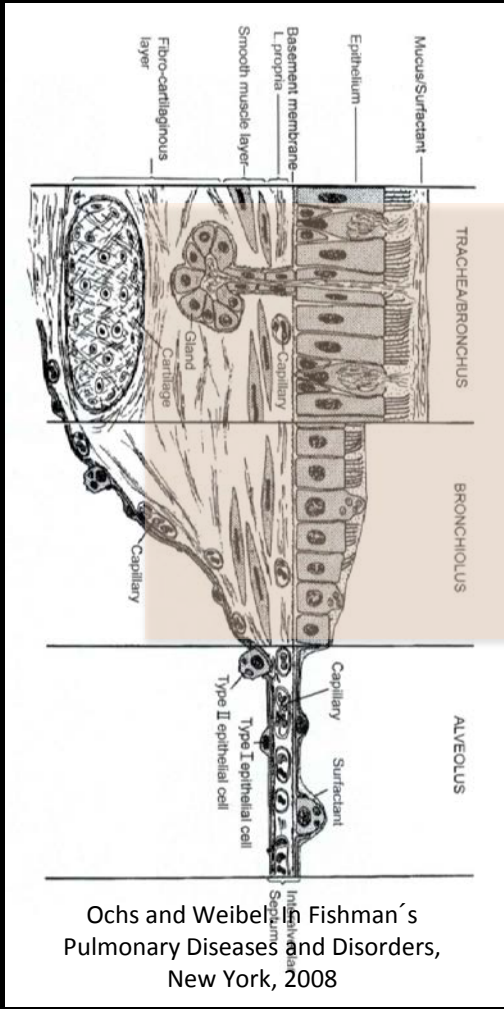


Indentations

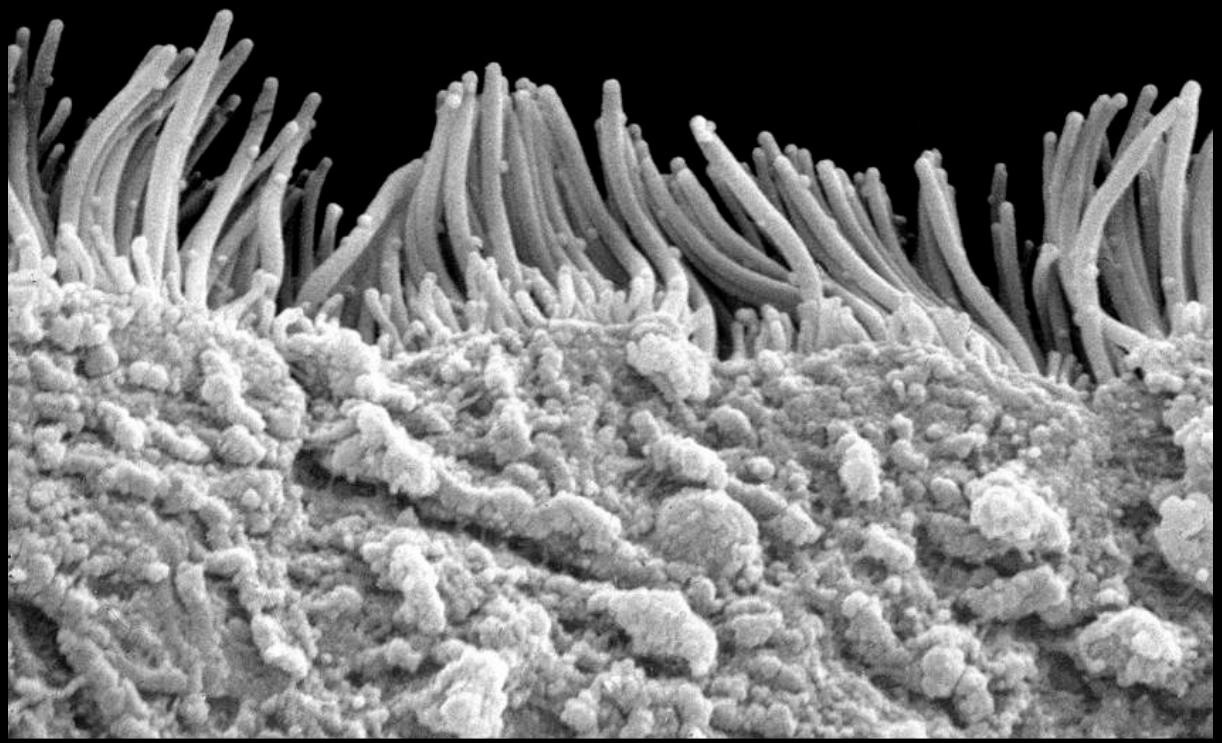
P. Gehr, University Bern

The human lung structure

Mucociliary clearance



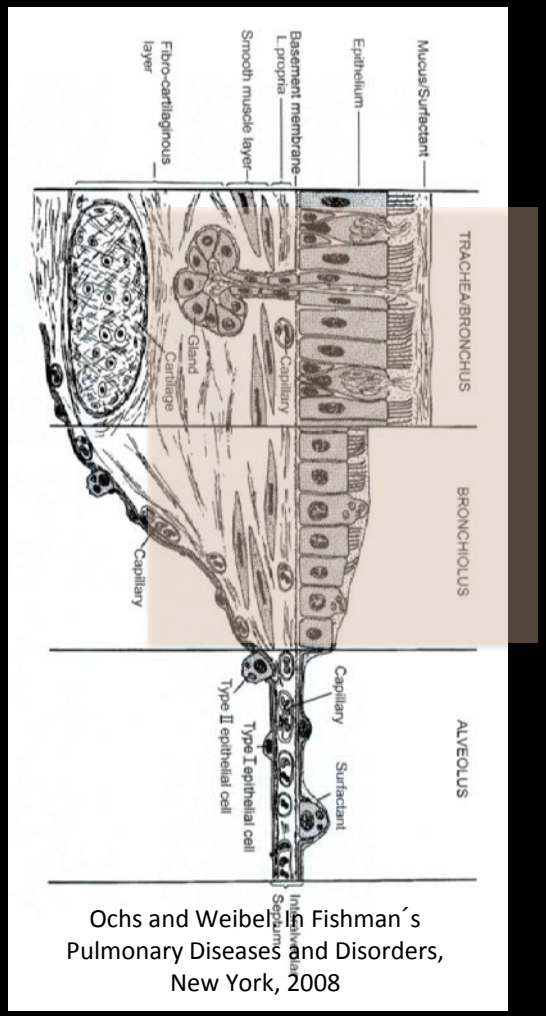
Ochs and Weibel. In Fishman´s Pulmonary Diseases and Disorders, New York, 2008



P. Gehr, University Bern

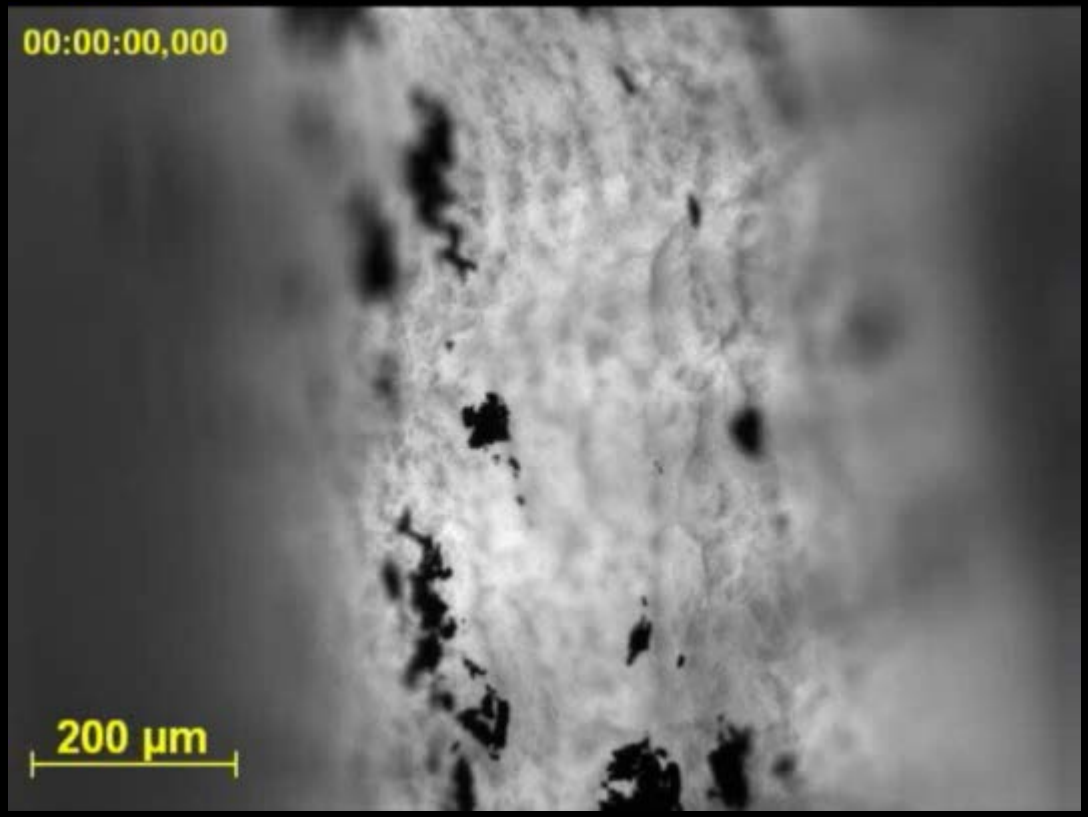
The human lung structure

Mucociliary clearance



Ochs and Weibel in Fishman´s Pulmonary Diseases and Disorders, New York, 2008

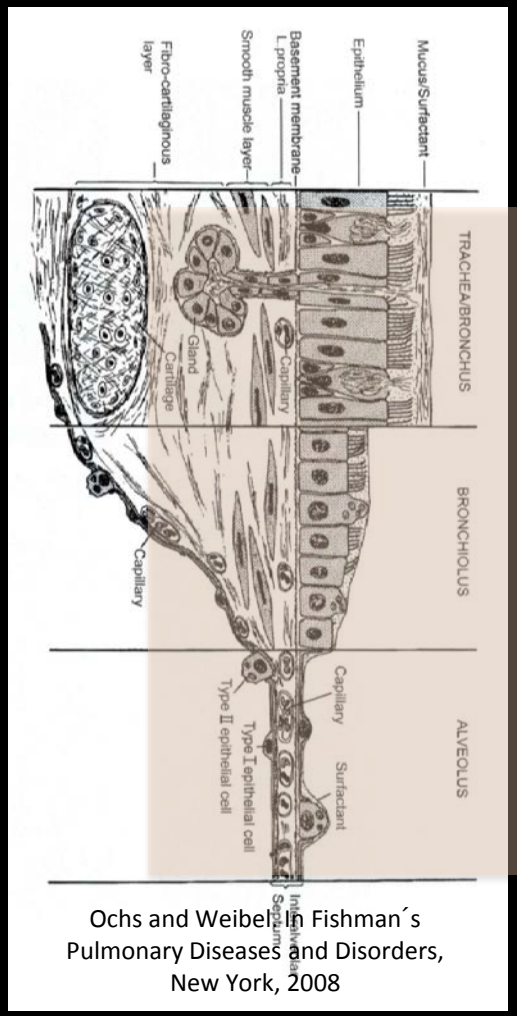
Embryonic Chicken Trachea –
Mucociliary clearance of carbon particles



Henning et al. AAPS PharmSciTech (2008)

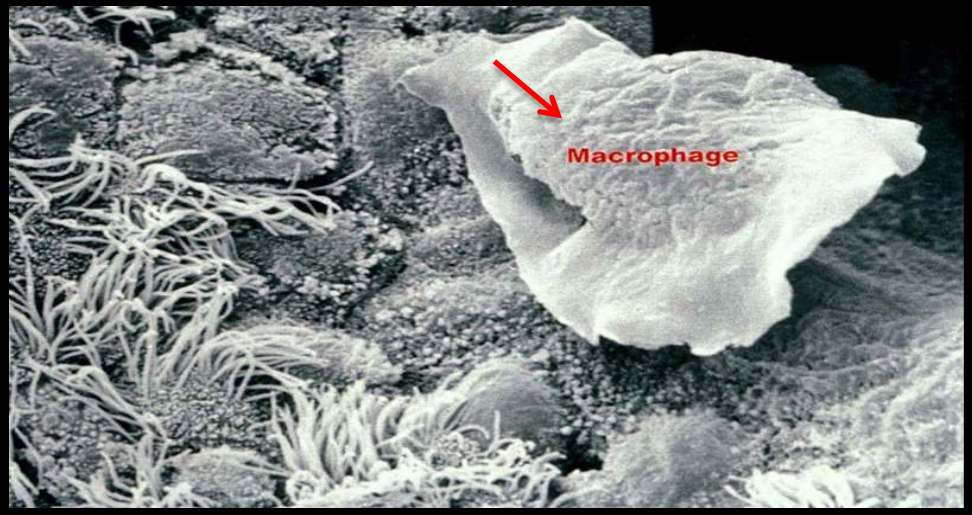
The human lung structure

Immune system in the lung



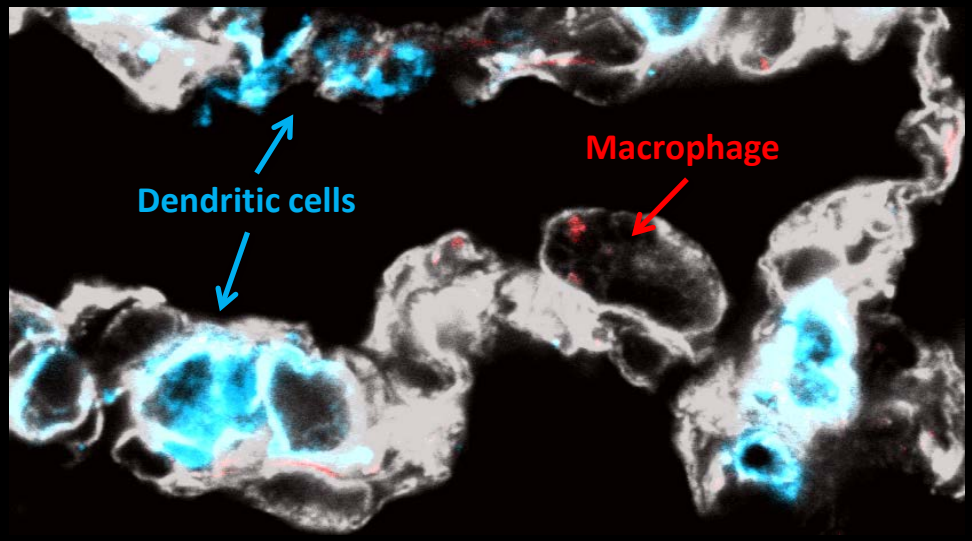
Ochs and Weibel in Fishman´s Pulmonary Diseases and Disorders, New York, 2008

Human lung



P. Gehr,University of Bern

Mouse lung

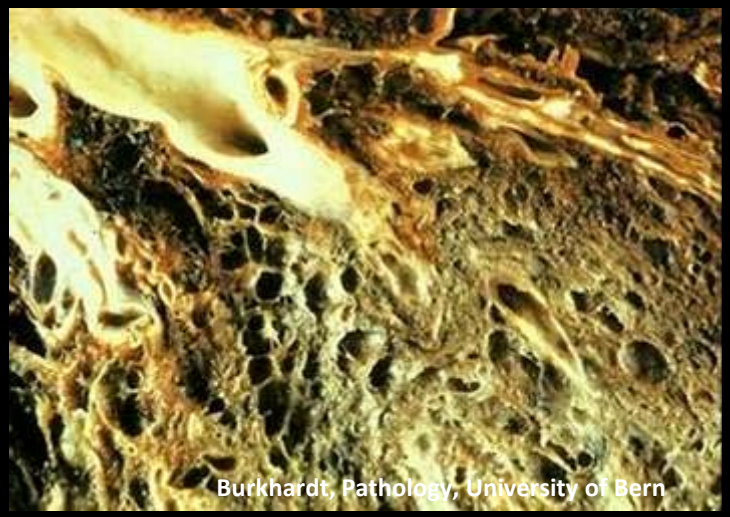


F. Blank, University of Bern

The human lung structure

Immune system in the lung

Healthy and diseased lung

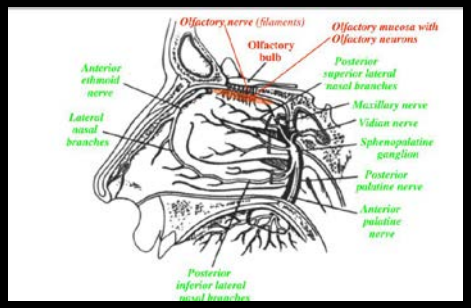


Inhalation of parti

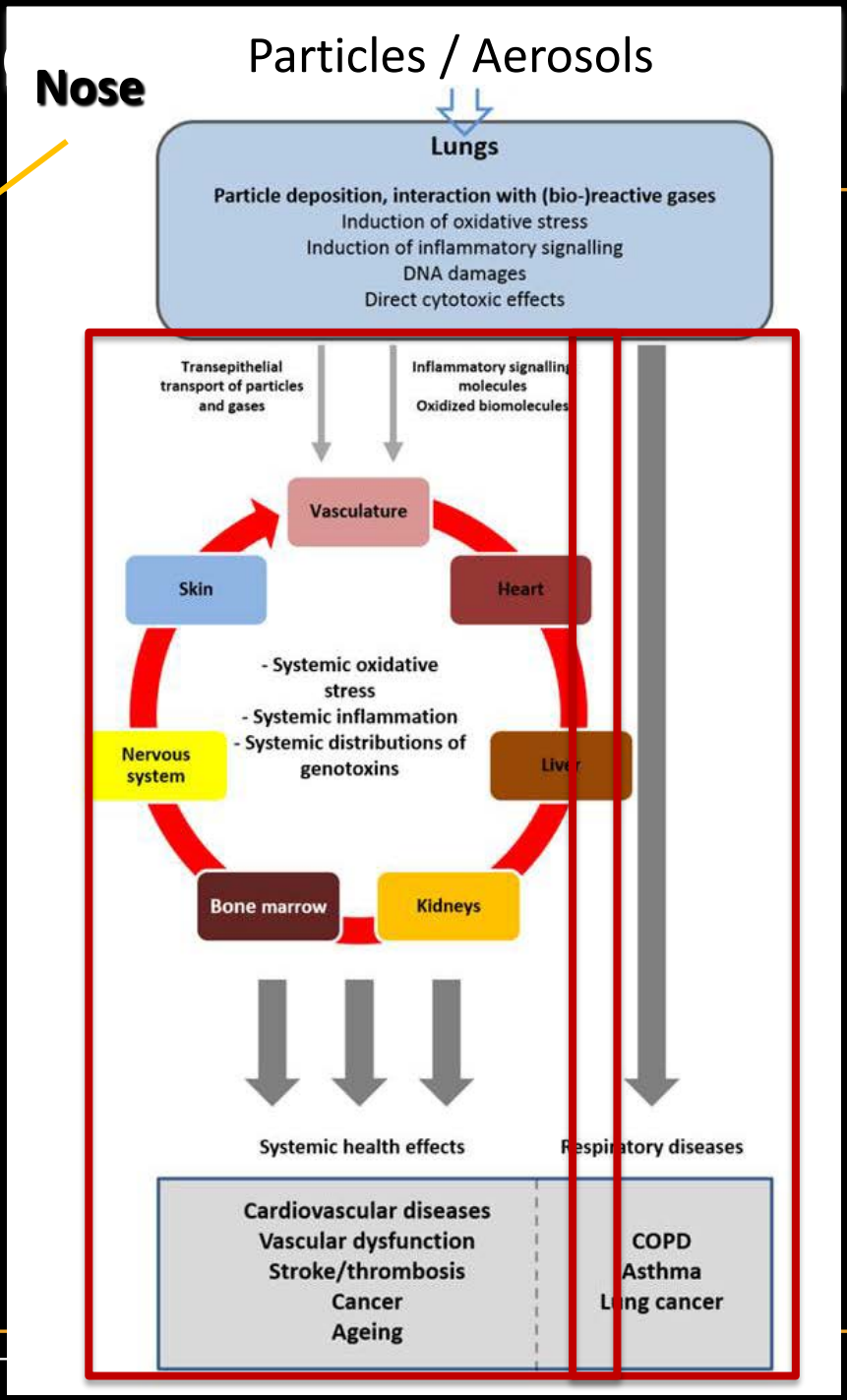
Adverse effects

Nose

Brain



Oberdörster et al.
J Nanosci Nanotechnol 2009



Steiner et al. Arch Tox 2016

Adverse effects

Diesel exhaust

International Agency for Research on Cancer

World Health Organization

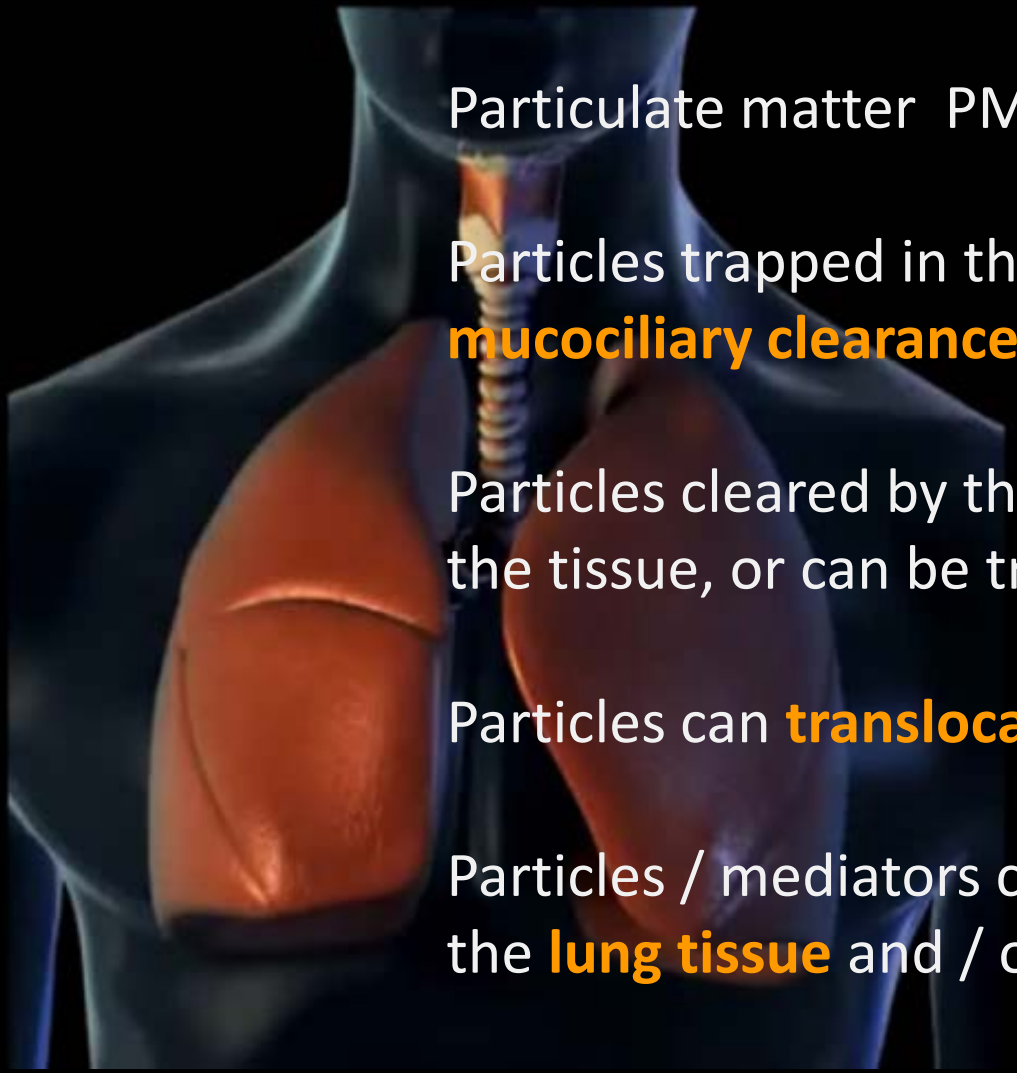
PRESS RELEASE
N° 213

12 June 2012

IARC: DIESEL ENGINE EXHAUST CARCINOGENIC

Lyon, France, June 12, 2012 -- After a week-long meeting of international experts, the International Agency for Research on Cancer (IARC), which is part of the World Health Organization (WHO), today classified diesel engine exhaust as **carcinogenic to humans (Group 1)**, based on sufficient evidence that exposure is associated with an increased risk for lung cancer.

Conclusions



Particulate matter PM_{10} can **enter the lung**

Particles trapped in the mucus are cleared by **mucociliary clearance**

Particles cleared by the **immune system** retain in the tissue, or can be transported to lymph tissue

Particles can **translocate** into the **blood circulation**

Particles / mediators can induce **adverse effects** in the **lung tissue** and / or in **secondary organs**

Acknowledgments

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