

Indoor Contaminants on $PM_{2.5}$ and Long-term Health Issues

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PROBLEM

Do synthetic chemicals found on dust particles lead to chronic disease development in building inhabitants?

BACKGROUND

Cases of allergies and asthma caused by indoor fine particulate matter ($PM_{2.5}$) has become an epidemic. There are clear dose-risk relationships between $PM_{2.5}$ concentrations of specific protein allergens and chemicals and these health issues.

While we have learned to live with poor conditions in buildings, we really do not know the long-term health effects of the indoor air we breathe. Considering a majority of people spend 90% of their lives indoors this should be of concern.

Synthetic chemicals that are aerosolized with indoor $PM_{2.5}$ may be associated with the development of specific diseases in people who are continually exposed. Small particle inhalation exposure is not well established.

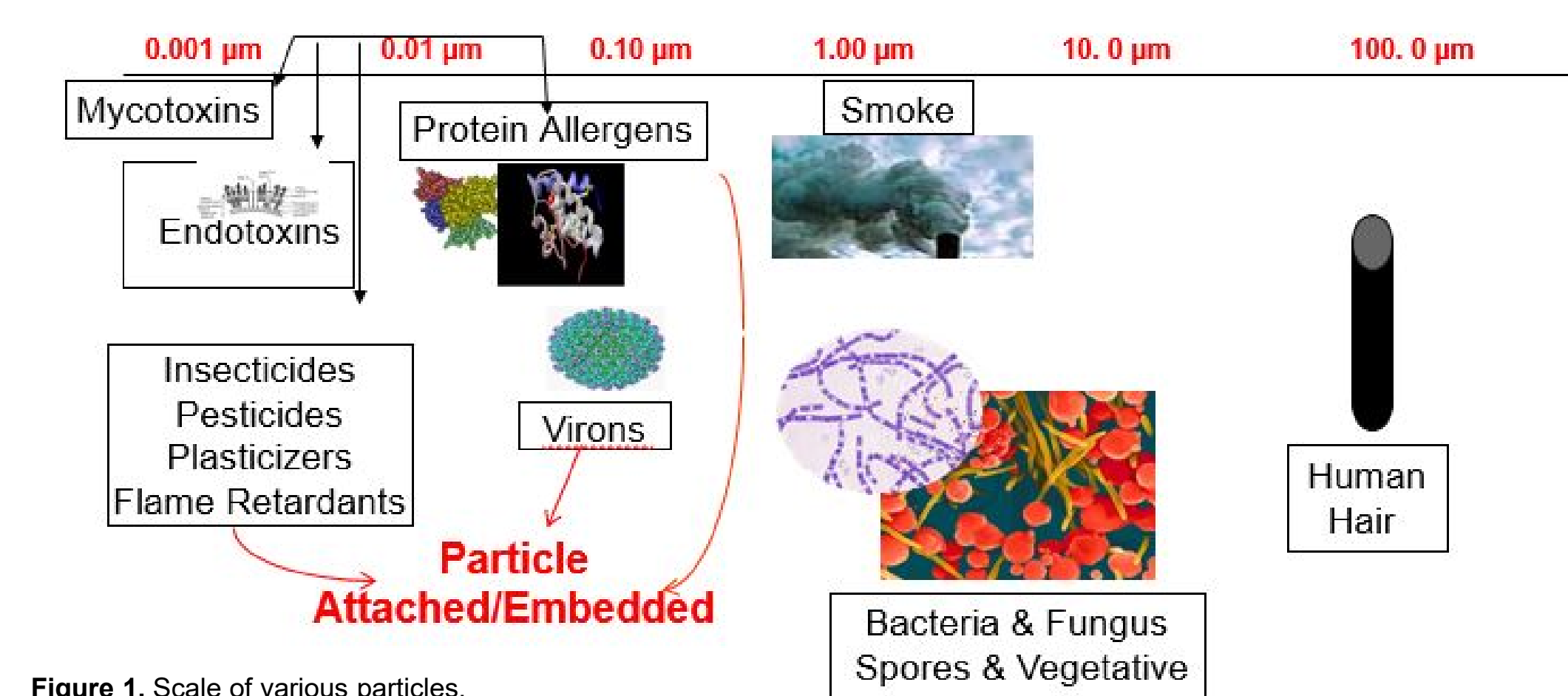


Figure 1. Scale of various particles.

HYPOTHESIS

Micron-sized indoor particles carrying chemicals like insecticides, pesticides, plasticizers, and flame retardants can cause serious diseases when over time when they are inhaled and accumulate in a person's body tissue.

THE STUDY

Chronic health issues like premature births, low birth weight, low sperm counts in males, certain forms of leukemia, infant microcephaly and others are statistically associated with specific, indoor $PM_{2.5}$ concentrations containing synthetic chemicals such as plasticizers, fire retardants, insecticides, and pesticides found in indoor dust samples. While these are nonvolatile by design, we do not know the effects of long-term exposure.

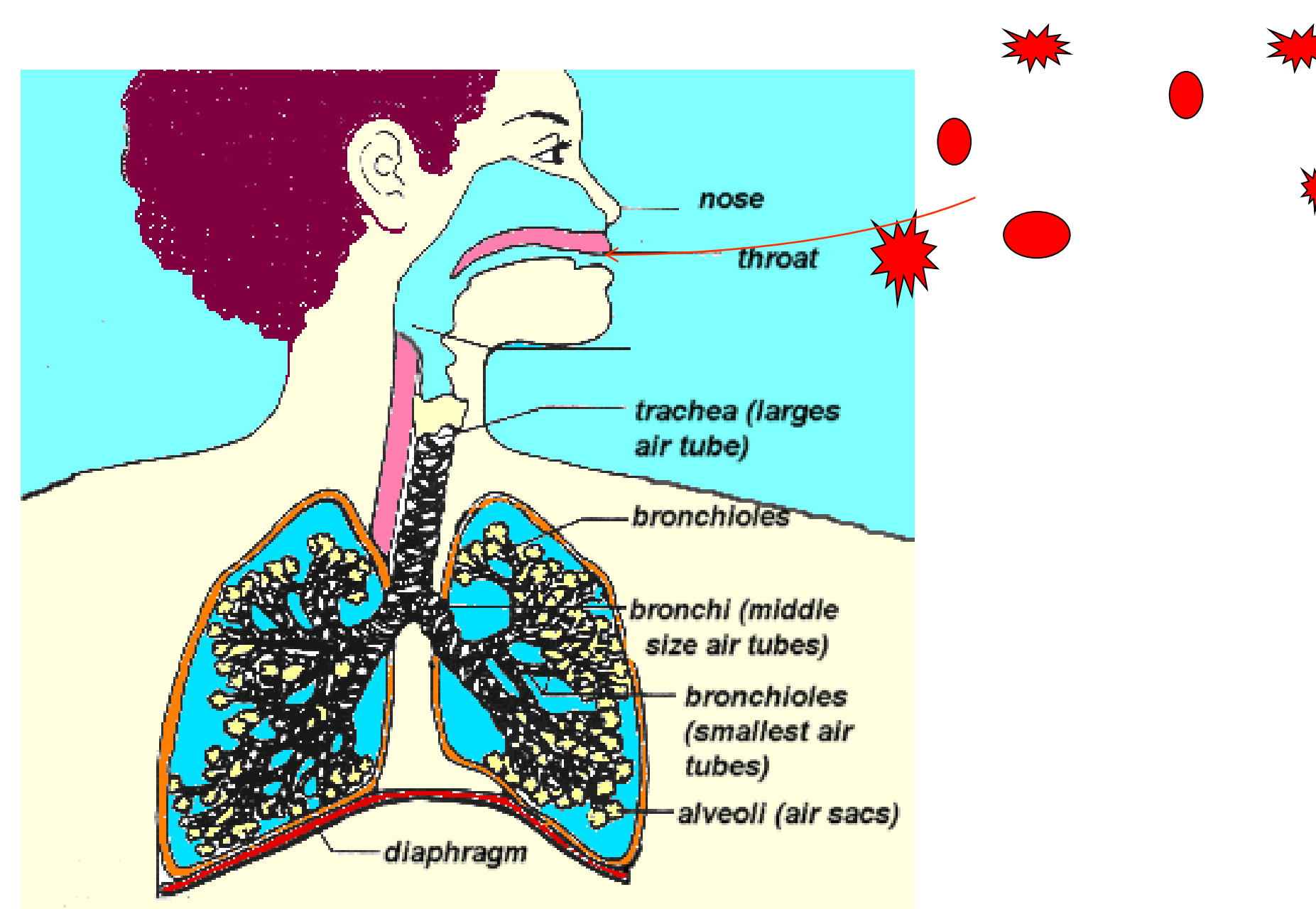
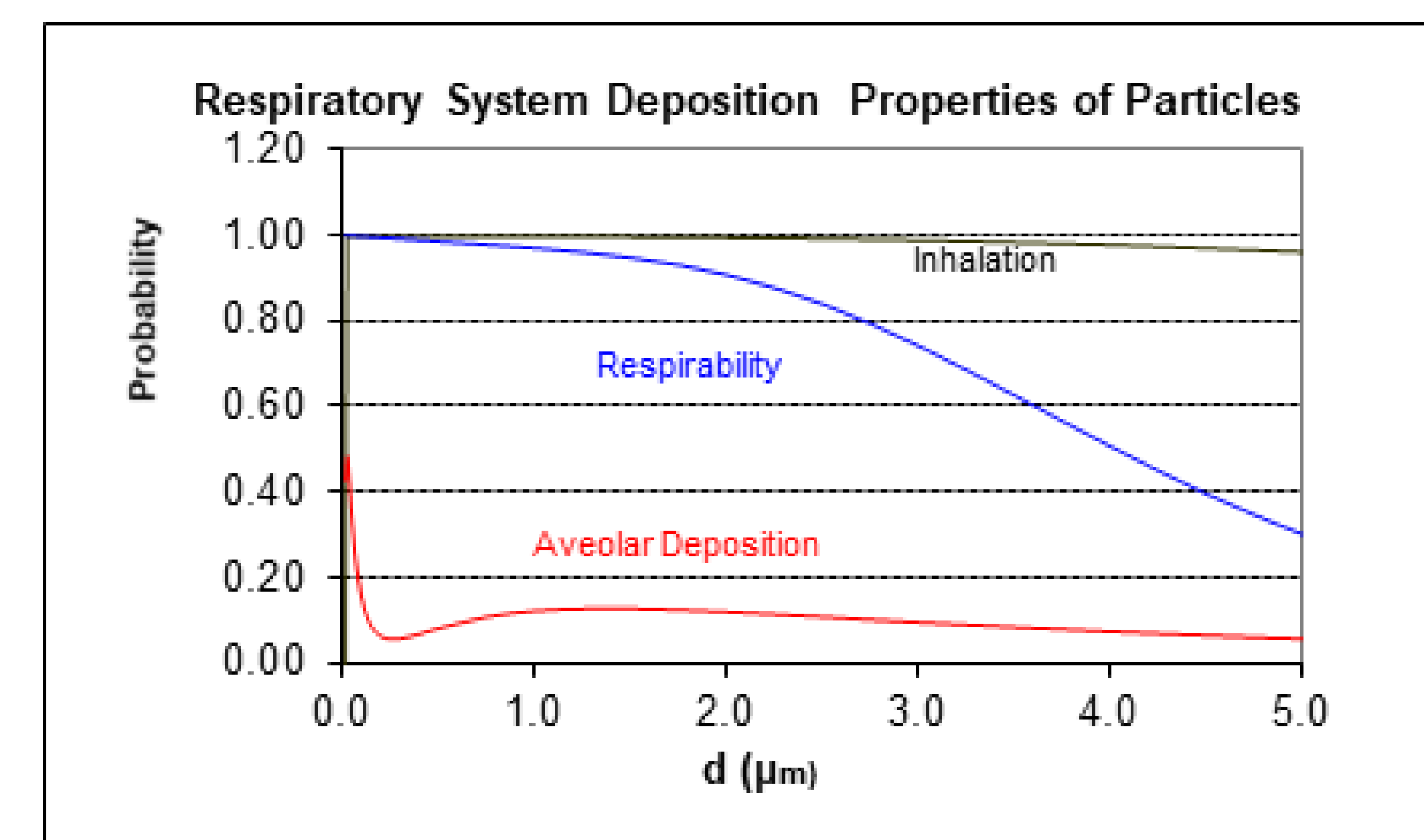


Figure 2. Pathway through the respiratory system.

There are several parts to this study:

- 1) Examining how particles of a certain size travel through the respiratory system and their effects.
- 2) Conducting a literature review to see what is known about contaminants attached to dust particles and their effects.
- 3) Analyzing dust particle samples for specific contaminants.
- 4) Observing how particulate matter is aerosolized by various activities.

FINDINGS FROM SAMPLES



- Many significant indoor contaminants are carried on micron-size dust particles.
- Particle size distribution of contaminant carrier particles is critical for risk assessment.
- Aerosolization varies significantly with particle type and size. Re-suspension can be quantified.
- Quantification of risk of inhalation or transdermal exposure requires advances in rapid, particle size distribution determination and size segregation of bulk samples and increased analytical sensitivity in contaminant.

FUTURE WORK

The team will continue with the literature review.

We will be using a school building as a living laboratory to see how particles become aerosolized due to movement of occupants and HVAC systems operations. We will do this by monitoring PM and CO₂ levels.

ACKNOWLEDGEMENTS

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