Research Brief 207

Particulate matter pollution: A particular problem for the young?

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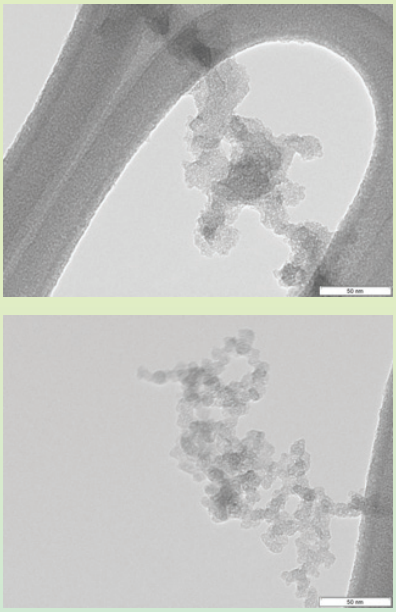
More than a quarter of the United States population is exposed to harmful levels of airborne particulate matter (PM) pollution, which is the made up of soot, dust, and liquid particles, according to the Environmental Protection Agency. Now scientists at the University of California, Davis NIEHS Superfund Research Program have shown that newborns and infants may be more susceptible to harm from PM than adults.

"This study adds to the evidence that young children may be uniquely susceptible to PM," said Ian Kennedy, Ph.D., professor of mechanical and aeronautical engineering and co-author of the study. "Extensive development of the conducting airways happens in the postnatal period. Exacerbation of many airway diseases, such as bronchitis and asthma, has been linked to either acute or chronic exposures to PM in young children."

The researchers exposed 7-day-old rats and adult rats to either filtered air or to a low dose of ultrafine PM for six hours. The dose was below the average level of ultrafine PM in the United States and was approximately the same as the level found in downtown Fresco, Calif.

The neonatal rats were more susceptible to the pollution than the adult rats, as indicated by the very different biological changes they showed following exposure. Those changes in the neonatal rats included significant increases in markers of cytotoxicity (cellular toxicity), as well as changes in gene and protein expression.

The study also shows the need for defined exposure conditions that can be replicated in future studies. Kennedy and colleagues are perfecting a system for generating such conditions. PM in the air is mixed with metals and allergens, making it more difficult to study the health effects of PM itself. In this study, the researchers used an experimental PM they developed that is free of metals and allergens and that can be used to study health effects specific to PM in animal models. In addition, the researchers are able to generate PM that contains either high or low concentrations of polycyclic aromatic hydrocarbons (PAHs), which are potent combustion byproducts.



Transmission electron microscope image of the carbonaceous ultrafine particles that were used in the exposure studies

Photograph courtesy Ian Kennedy

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Superfund Research Program

To learn more about this research, please refer to the following source:

Jackie K.W. Chan, Michelle V. Fanucchi, Donald S. Anderson, Aamir D. Abid, Christopher D. Wallis, Dale A. Dickinson, Benjamin M. Kumfer, Ian M. Kennedy, Anthony S. Wexler, Laura S. Van Winkle.et al. Toxicological Sciences 124(2), 472–486 (2011).

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