

Severe air pollution can cause birth defects, deaths

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In a comprehensive study, researchers from Texas A&M University have determined that harmful particulate matter in the atmosphere can produce birth defects and even fatalities during pregnancy using the

animal model.

The team of researchers from Texas A&M's Colleges of Agriculture and Life Sciences and Geosciences, the Texas A&M Health Science Center, and colleagues from the University of California-San Diego has had their findings published in the current issue of *PNAS (Proceedings of the National Academy of Sciences)*.

Using female rats, the team examined the adverse health effects of exposure to fine particulate matter consisting of [ammonium sulfate](#) commonly found in many locations around the world. Large fractions of this substance were detected not only in Asia, but also in Houston (51 percent) and Los Angeles (31 percent).

During winter months in China and India, where severe haze events frequently occur, fine particulate matter levels were especially high at several hundred micrograms per cubic meter, the team concluded.

Air pollution is a century-old problem for much of the world. According to the World Health Organization, 9 out of 10 people worldwide breathe air containing high level of pollutants, and 1 of every 9 global deaths can be attributed to exposure to air pollution, totaling over 7 million premature deaths a year.

Even in the United States, about one third of the population still live under poor air quality conditions, according to a report released by the U. S. Environmental Protection Agency in 2018.

"People typically believe that ammonium sulfate may not be terribly toxic, but our results show large impacts on female pregnant rats," Renyi Zhang, Texas A&M Distinguished Professor of Atmospheric Sciences and the Harold J. Haynes Chair in Geosciences and one of the leading authors, said. "It is unclear yet what is causing these profound effects,

but we speculate that the size of nanoparticles or even the acidity may be the culprit."

Zhang said sulfate is mainly produced from coal burning, which is a major energy source for much of the world in both developed and developing countries. Ammonium is derived from ammonia, which is produced from agricultural, automobile, and animal emissions, "so this certainly represents a major problem worldwide," Zhang said.

"However, our results show that prenatal exposure to air pollution may not dispose offspring to obesity in adulthood," said Guoyao Wu, Texas A&M University Distinguished Professor and another of the lead authors of the study. "Nutrition and lifestyle are likely major factors contributing to the current obesity epidemic worldwide."

Numerous previous studies have shown that air pollution is a serious public health threat throughout the world, with millions of people breathing air that is far less than standards set by the World Health Organization.

In addition, previous studies have shown such pollution to impair metabolic and immune systems in animal offspring, but the team's study shows definitive proof of decreased fetal survival rates, and also shortened gestation rates that can result in smaller body weight, in addition to damage to brains, hearts and other organs in the adult rat models.

The findings present obvious concerns and challenges on a multi-scale level, the team concludes.

"While epidemiological studies have been widely adopted to assess the health effects of air pollution, these tend to yield little insight into adverse outcomes and long-term effects," Zhang said.

"Furthermore, there is an absence of clinical recommendations for prevention and treatment of air [pollution](#)-related health issues. Our study has demonstrated that well-controlled exposure experiments using animal models offer major advantages for future [air pollution](#) control and are promising in the development of therapeutic intervention and treatment procedures."

More information: Guoyao Wu et al, Adverse organogenesis and predisposed long-term metabolic syndrome from prenatal exposure to fine particulate matter, *Proceedings of the National Academy of Sciences* (2019). [DOI: 10.1073/pnas.1902925116](https://doi.org/10.1073/pnas.1902925116)

Provided by Texas A&M University

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