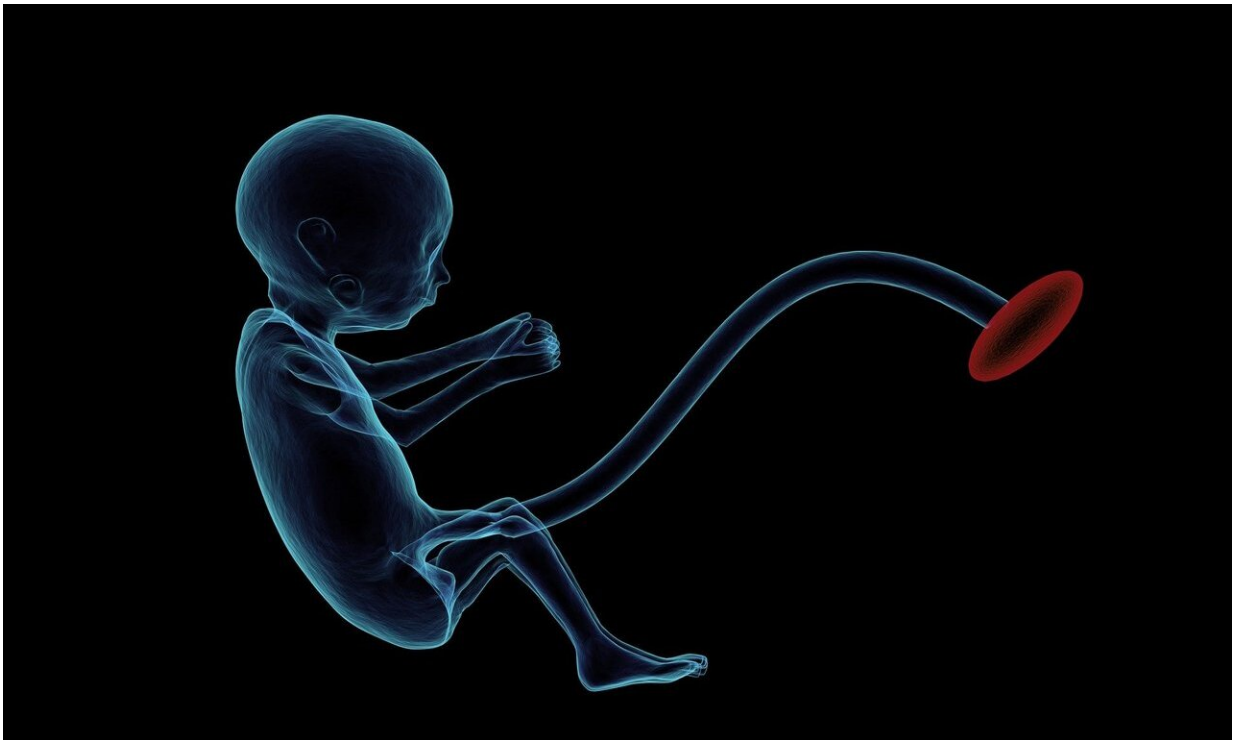


# Nanoparticles can cross the placenta during pregnancy, potentially exposing fetus

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Inhaled nanoparticles—human-made specks so minuscule they can't be seen in conventional microscopes, found in thousands of common products—can cross a natural, protective barrier that normally protects fetuses, according to Rutgers University scientists studying factors that produce low-birth-weight babies.

The scientists reported in the medical journal *Placenta* they were able to track the movement of [nanoparticles](#) made of metal titanium dioxide through the bodies of pregnant rats. After the nanoparticles were inhaled into the lungs of the rodents, some of them escaped this initial barrier. From there, the [particles](#) flowed through the placentas, which generally filter out foreign substances to protect the fetus.

"The particles are small and really hard to find," said Phoebe Stapleton, an author and an assistant professor at Rutgers Ernest Mario School of Pharmacy and a faculty member at Rutgers Environmental and Occupational Health Sciences Institute. "But, using some specialized techniques, we found evidence that the particles can migrate from the lung to the placenta and possibly the fetal tissues after maternal exposure throughout pregnancy. The placenta does not act as a barrier to these particles. Nor do the lungs."

Most nanoparticles are engineered, with few produced naturally. These particles are used in thousands of products, from sunscreens to pharmaceuticals to sports equipment. They are highly valued because they can enhance the effectiveness of drugs and produce sturdy-but-lightweight products.

Nanoparticles are so named because they are less than 100 nanometers wide, meaning they are tens of thousands of times smaller than the diameter of a single human hair. Despite their usefulness, nanoscale materials are poorly understood, with "very little known about the potential effects on [human health](#) and the environment," according to the National Institute of Environmental Health Sciences.

During the experiment, scientists were surprised to also detect titanium dioxide in the "control" group of rats that hadn't been given nanoparticles to inhale. It turns out the food given to the animals contained [titanium dioxide](#). As a result, the researchers were able to

observe the path the metal took through a rat's body.

The research emerged from investigations into the causes of low birth weight in human infants. Newborns weighing less than 5.5 pounds can suffer [adverse health effects](#) as infants and throughout their lives.

According to Stapleton, one theory is mothers who give birth to babies with low birth weights may have inhaled harmful particulates. The resulting inflammation may affect bodily systems, such as [blood flow](#) in the uterus, that could inhibit growth of the fetus.

"Now that we know that the nanoparticles migrate—from the mother's lungs to the placenta and fetal tissues—we can work on answering other questions," Stapleton said. "This detail of transfer will help inform future studies of exposure during pregnancy, fetal [health](#), and the developmental onset of disease."

Other Rutgers authors on the paper included Brian Buckley and Cathleen Doherty at the Environmental and Occupational Health Sciences Institute, and Jeanine D'Errico and Jarett Reyes George at the Ernest Mario School of Pharmacy.

**More information:** J.N. D'Errico et al, Maternal, placental, and fetal distribution of titanium after repeated titanium dioxide nanoparticle inhalation through pregnancy, *Placenta* (2022). [DOI: 10.1016/j.placenta.2022.03.008](#)

Provided by Rutgers University

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