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Diesel exhaust inhalation stresses your brain

If the smell of diesel exhaust isn't enough to make you avoid getting a lungful, new research now shows that even a short exposure to the fumes can affect your brain. A study published in the open access journal *Particle and Fibre Toxicology* reveals that an hour of sniffing exhaust induces a stress response in the brain's activity.

Previous studies have already suggested that very small particles, called nanoparticles, breathed in from polluted air can end up in the brain. But this is the first time that scientists have demonstrated that inhalation actually alters brain activity.

Ten volunteers spent one hour in a room filled with either clean air or exhaust from a diesel engine. They were wired up to an electroencephalograph (EEG), a machine that records the electrical signals of the brain, and their brain waves were monitored during the exposure period and for one hour after they left the room.

The researchers found that after about 30 minutes the diesel exhaust began to affect brain activity. The EEG data suggested that the brain displayed a stress response, indicative of changed information processing in the brain cortex, which continued to increase even after the subjects had left the exposure chamber.

The concentration of diesel exhaust that the subjects breathed was set to the highest level that people might encounter in the environment or at work, for example on a busy road or in a garage.

Lead researcher Paul Borm from Zuyd University in The Netherlands said: We believe our findings are due to an effect nanoparticles or soot particles that are major component of diesel exhaust. These may penetrate to the brain and affect brain function. We can only speculate what these effects may mean for the chronic exposure to air pollution encountered in busy cities where the levels of such soot particles can be very high.

One link to understanding the mechanism of this effect is that oxidative stress is one consequence of particles depositing in tissue and oxidative stress has also been implicated in degenerative brain diseases such as Parkinson's and Alzheimer's disease . It is conceivable that the long-term effects of exposure to traffic nanoparticles may interfere with normal brain function and information processing, noted Borm. Further studies are necessary to explore this effect, and to assess the relationship between the amount of exposure to particles and the brain's response and, and investigate the clinical implications of these novel findings.

Studies that expose volunteers to potential toxins or require invasive techniques are limited for ethical reasons. Borm is currently conducting experiments where volunteers inhale artificially generated nanoparticles that are free from the other chemicals that are generated, along with the nanoparticles in diesel exhaust.

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Notes to Editors

1. Exposure to diesel exhaust induces changes in EEG in human volunteers

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Particle and Fibre Toxicology (in press)

During embargo, article available here:

http://www.particleandfibretoxicology.com/imedia/1268934805168856_article.pdf?random=104311

After the embargo, article available at the journal website:

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2. Particle and Fibre Toxicology is an Open Access, peer-reviewed, online journal for new scientific data, hypotheses and reviews on the toxicological effects of particles and fibres; it also advocates the collaboration between disciplines in this multi-disciplinary field.

Particle and Fibre Toxicology is a multi-disciplinary undertaking because of the need to understand the physico-chemistry of the particles, measure the exposure, determine the biological outcomes in terms of human exposure and regulate exposure in the workplace and general environment. In addition, there are diverse scenarios where particles pose a toxicological threat and new potential threats are continuously being introduced. For these reasons the literature has historically been scattered across numerous journals. Particle and Fibre Toxicology will solve this problem by providing a single, identifiable outlet for all of these disciplines and should receive a large number of submissions.

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