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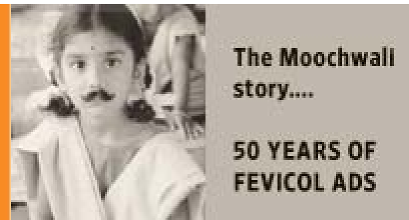

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Nanoparticles may lead to irreparable damage

The medically used wonders can damage cells without crossing the protective cellular barriers, says report

Seema Singh

Bangalore: The variety of nanoparticles that are being developed as the all-purpose delivery system for drugs and diagnostics may be ultra small in size, but could cause long-lasting damage to the body, even to the DNA.

Listen to an interview with Rajiv Saxena, a professor of Immunology at JNU who has got a grant to study nanoparticles. here

Reporting in Friday's issue of *Nature Nanotechnology,* a team of UK researchers say that medically used nanoparticles can damage the cell's DNA without even crossing the protective cellular barriers.

Even as several metal and polymer-based nanoparticles wriggle their way into our lives—in paints, sunscreens, tyres, anti-crease, anti-bacterial clothes, medicines, medical imaging—some organs in the body such as the skin, placenta, lungs and the gastrointestinal tract have been traditionally considered as barriers to many nanomaterials.

But the present study, led by Charles Patrick Case and Gevdeep Bhabra from Bristol Implant Research Centre in Bristol, shows that even if the nanoparticles don't cross the barrier, they can damage the DNA through intercellular signalling, which is akin to a relay effect.

There have been several studies showing the toxicity of nanoparticles, but this study is different because it shows a novel indirect mechanism where a mediator such as the ATP (the powerhouse of the cell) is activated, which, in turn, generates a chain of cellular events, says Rajiv K. Saxena, professor of immunology at the Jawaharlal Nehru University in New Delhi. "The important point is that now we have to consider not only direct impacts, but even the indirect ones."

To study the impact in the lab, scientists grew a multilayer of human cells to mimic a specialized protective barrier. They used this barrier to examine the indirect effects of cobalt-chromium nanoparticles—which are generated from wear and tear of bone implants that follow joint replacement surgeries and are also the most popularly used nanoparticles in magnetic scans—on the cells that were lying behind this barrier.

The amount of DNA damage in the cells behind the protective barrier was similar to the DNA damage caused by direct exposure to the nanoparticles.

“We are not saying that this is the model of what goes on in the body...but since nanotechnology is an extremely exciting technology with huge advantages to the mankind, we need to understand the way nanomaterials interact with the body,” Case said in a press briefing on Thursday.

He and his colleagues showed that the nanoparticles did not pass through the barrier to cause the DNA damage, but, in fact, generated signalling molecules within the barrier cells that were then transmitted to the cells behind the barrier.

Recalling one of his earlier studies while serving in the US Environmental Protection Agency, Saxena says when carbon nanotubes were inserted in the lungs, researchers found their impact in the heart overnight. “Maybe the tiny particles crossed the lung wall or maybe such (as shown in the present study) signalling effects were at work, we don’t know.”

Experts say the study of nanoparticle toxicity is such a new field that there isn’t even a consensus on the extent of the harm caused.

But soon these nanoparticles will pervade the environment, says Saxena, who is studying the impact of carbon nanotubes on human health in India under a grant from the Rs1,000 crore Nano Mission. His initial work on the impact of carbon nanotubes on red blood cells and the lungs shows that these micro entities induce anaemia in the human system.

Still, the biomedical world is pinning high hopes on this technology, the latest success story, though in animal models, being its effective use in delivering erection drugs in the form of a topical application, which, one day, could replace oral erectile dysfunction drugs.

“Side effects are bound to occur,” says K.S. Narayan at the Jawaharlal Nehru Centre for Advanced Scientific Research at Bangalore, who works on molecular electronic devices. “But researchers should also highlight the way forward and the possible solution,” he says, adding that the cobalt-chromium particle used in imaging can be made safer by robust capping so that their magnetic properties remain intact.

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