

# Nano World: Nanotube toxicity exams differ

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How toxic carbon nanotubes are on cells apparently depends on what lab tests are used to examine them, experts told UPI's Nano World.

Carbon nanotubes are pipes mere nanometers or billionths of a meter wide. They are the darlings of the nanotech world because they are up to 100 times stronger than steel at one-sixth the weight and possess a bevy of superb electronic properties to boot.

Scientists and the public have also focused on concerns on how toxic carbon nanotubes may be against people and the environment. When inhaled, scientists have found carbon nanotubes can trigger masses of inflamed tissue in mice and rats. However, results from tests on cells have proven confusing, with some indicating carbon nanotubes are highly toxic and others showing no trace of toxicity.

Toxicologists at the Karlsruhe Research Centre in Germany examined the impact of single-walled carbon nanotubes on human lung cells in vitro. One test used a water insoluble salt known as MTT to investigate nanotube impact on the function of mitochondria, the powerhouses of the cell. It found a toxicity of roughly 50 percent. However, a similar test measuring mitochondrial function using a water soluble salt known as WST showed no toxicity.

The researchers investigated other toxicity exams as well. One used INT, a salt that binds to an enzyme released by leaking cells. Another used a dye known as TMRE, which measures how active mitochondria are. Annexin-V is an antibody that latches onto cell membrane proteins

exposed when a cell dies. None of these showed cell toxicity.

The researchers found MTT helps form crystals on the nanotubes, "leading to false results," researcher Jörg Wörle-Knirsch said. He, with researchers Harald Krug and Karin Pulskamp, reported their findings in the journal Nano Letters.

Toxicologist Nancy Monteiro-Riviere at North Carolina State University at Raleigh noted she and her colleagues had similar results. Wörle-Knirsch and Monteiro-Riviere stress toxicity exams of nanomaterials should involve two or more independent systems, as well as suss out which tests could actually serve as reliable standards.

"Usually in vitro tests back up findings of toxicity in animals," particle toxicologist Ken Donaldson at Queens Medical Research Institute in Edinburgh, Scotland. The mismatch between the lack of cell toxicity and the evident animal toxicity could mean the nanotubes are clumping and blocking air spaces, affecting lungs but not cells on a dish, he suggested. Donaldson also suggested tests should examine not whether the nanotubes are damaging cells, but whether they stimulate them instead, to release inflammatory molecules such as cytokines.

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