

Using nanomedicine to fight TB

By [Nicklaus Kruger](#)

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Tuberculosis (TB) is one of the world's deadliest infectious diseases. It's massive, it's tricky, and treatment can be exhausting (and toxic). But there may be new hope for TB treatment on the horizon: nanomedicine.



Admire Dube, associate professor of pharmacy, University of the Western Cape

"Nanomedicine is the use of nanotechnology to either diagnose or treat a disease. By creating and manipulating structures in the nanometre size range, we can devise medical solutions that are limited only by our imaginations," says Admire Dube, associate professor of pharmacy at the University of the Western Cape (UWC).

The nanoparticles used in nanomedicine are about 800 times smaller than the thickness of human hair, can be loaded with a variety of types of drugs such as proteins, DNA or even extracts from plants, and can be administered into the human body through swallowing, inhaling, injections or via the skin.

"Typically, nanoparticles are packed with drugs, and can be designed to target only the site of the disease, and release the drug there. Multiple drugs can be loaded in a single or a mixture of nanoparticles, (each containing a single type of drug), can be administered into the body to target disease sites and deliver drugs to those sites," he says.

The power of nanoparticles

Nanoparticles are able to make the drugs more available for infection by protecting them from breakdown prior to reaching the site, where there's a greater uptake of the nanoparticles. With better targeting, patients would need to take less medication for a shorter duration, with fewer side effects and less waste. And (hopefully) treatment would be cheaper.

“Nanomedicine is one of the most exciting applications of nanotechnology and promises to address several of mankind’s healthcare needs.”

There are currently about 50 nanomedicines worldwide which are in use by doctors to treat diseases - most of these for the treatment of cancers. Many researchers believe that nanomedicine could help TB patients enormously as well, and Dube’s research at UWC is focused on just that - examining the application of nanoparticles towards the treatment of TB, especially to achieve immunotherapy, targeted drug delivery and/or access across biological barriers.

“We engineer nanoparticles and use these to deliver high doses of drugs into macrophages,” he explains. “Since these are immune cells, we also engineer the nanoparticles to activate these macrophages (known as immunotherapy) and therefore we can deliver a double, lethal punch to *Mycobacterium tuberculosis*.”

This form of immunotherapy holds great promise: it could prevent the generation of drug-resistant TB strains since the body’s own immune system is used to kill the bacteria. And since nanomedicines can be inhaled, they can be localised in the lungs – the centre of TB infection.

“It’s hoped that these TB-specific nanomedicines will make it to human trials over the next few years, and that they will prove to be safe and effective – and start doing the important work of tackling this debilitating disease,” Dube says.

A better, healthier world

Dube is one of many scientists exploring the potential of nanotechnology for a better world. He first became interested in nanomedicine when he read of the multitude of possibilities offered by nanotechnology for addressing health problems.

“Nanomedicine is a very exciting field from a technological perspective, and opens up many possibilities for innovation to address specific patient health needs. It also provides unique opportunities for scientists from different backgrounds to come and work together to solve medical problems, and such teams usually include pharmacists, medical doctors, biotechnologists, chemists, physicists and material scientists.”

“I have a strong desire to see the development of an effective nanomedicine therapy for persons suffering from tuberculosis in South Africa,” he says. “Nanomedicine offers multiple opportunities to develop such therapies - and really, one’s imagination is the limit.”

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