Nanotechnology used to probe effectiveness of antibiotics

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A group of researchers led by scientists from the London Centre for Nanotechnology, in collaboration with a University of Queensland researcher, have discovered a way of using tiny nano-probes to help understand how an antibiotic is effective against bacteria.

Bacteria such as MRSA (commonly known as Golden Staph) are becoming increasingly resistant to antibiotics, posing a major community health problem.

Professor Matt Cooper, the Australian in the team, has this week joined the Institute for Molecular Bioscience at UQ on a $4 million Australia Fellowship.

Through the fellowship, he will establish a research program in the development of antibiotics and antifungals that are active against drug-resistant pathogens, in particular those responsible for hospital-acquired infections.

"In order to attack this problem we need to understand not only the ways in which bacteria develop and exhibit resistance to antibiotics, but also how new antibiotics can work to kill or slow the growth of resistant bacteria," Professor Cooper said.

To study antibiotic action, the London team made nano-probes coated with molecules found in bacterial cell walls from normal bacteria and bacteria resistant to antibiotics.

They then added doses of the "last resort" antibiotic, vancomycin, to the system and found that probes from normal bacteria were stressed and changed shape, whereas probes from resistant bacteria were only weakly affected.

These bent probes could be detected with a laser, indicating that the antibiotic was applying a force to the surface. This allowed the researchers to quickly assess the effectiveness of an antibiotic and propose new ways in which antibiotics may be acting to cause the bacteria to burst and die.

"This advance will help us to understand the mode of action of drugs targeted against resistant bacteria, and could also lead to rapid diagnostic tools and novel methods of investigating antibiotic action," Dr Cooper said.

"There is only a tiny molecular difference between resistant and non-resistant bacteria. We now know that these probes can detect that difference, and can do so within minutes."

The system was able to detect that it is 1,000 times harder for vancomycin to attach to resistant bacteria than to non-resistant bacteria.

The team are now screening other novel antibiotics with the goal of finding a drug

that is able to bind strongly to resistant bacteria and cause substantial structural weaknesses to the cell wall.

University College London researcher Dr Rachel McKendry, who led the team, said the findings had implications for improving the response to the bacteria.

"Investigating both these binding and mechanical influences on the cell's structure could lead to the development of more powerful and effective antibiotics in future," Dr McKendry said.

The research was published late last year in the journal *Nature Nanotechnology*.

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