

Microwaves to improve drug delivery

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A team of Swinburne researchers has shown that low-temperature microwaves can be used to open up pores in bacterial cells, which could lead to significant improvements in the design of drug delivery systems.

The study, co-authored by Dean of Swinburne's Faculty of Life and Social Sciences Professor Russell Crawford, has been published in *Applied and Environmental Microbiology* and highlighted by *Microbes*, both publications of the American Society of Microbiology.

According to Professor Crawford the research conducted by the faculty's Nano-BioTech Group showed that, when exposed to an 18 GHz radiofrequency electromagnetic field, E. coli cells ingested sugar molecules from the solution surrounding them.

"This showed us that the microwave treatment was opening up <u>pores</u> in the <u>bacterial cells</u>, allowing sugar molecules to cross the cellular membrane."

Scientists have long debated whether microwave frequency exposure can affect bacterial cells independent of microwave-associated temperature increases.

By conducting the experiments at lower peak temperatures – between 20 and 40 degrees – the researchers were able show that it was a specific bioeffect caused by the electromagnetic field exposure, rather than high temperatures, which caused changes to the bacterial cells.



This also meant that the researchers were able to induce pores in the bacterial cells without causing any heat damage. According to Professor Crawford, this has great potential for research and medical applications.

"For instance, the pore-forming effect could help doctors deliver antibiotics to infection sites, such as open wounds or surfaces around medical implants," he said.

"By focusing microwave treatment on the site, this would open up pores in the bacterial cells allowing the drugs to enter. And because the microwave treatment would be done at a <u>low temperature</u> it wouldn't damage any of the patient's surrounding cells."

While work still needs to be done to incorporate the researchers' findings into a <u>drug delivery</u> system, discovery of the novel pore-forming effect is a significant first step.

More information: The paper, <u>Specific Electromagnetic Effects of</u> <u>Microwave Radiation on Escherichia coli</u>, was authored by Yury Shamis, Dr. Alex Taube, Dr Natasa Mitik-Dineva, Professor Russell Crawford and Professor Elena Ivanova from Swinburne University of Technology and Professor Rodney Croft from the University of Wollongong.

Provided by Swinburne University of Technology

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