

Preventing antibiotic resistance in hospital textiles

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New research explores strategies to develop new technologies for fighting antibacterial resistance.

"Antibiotic resistance threatens a return to the pre-antibiotic era". The World Health Organisation uses this strong expression when referring to a phenomenon that is rapidly spreading: the increasing resistance of microorganisms to antimicrobial medicines, such as antibiotics. WHO estimates indicate that the excess mortality due to resistant bacterial [hospital infections](#) exceeds 25,000 every year, in Europe. "Nowadays, if you acquire an infection in a hospital, it is extremely rare for the

infecting bacterium to not be resistant to multiple antibiotics," says Australian microbiologist Harold Stokes, research director at the institute, University of Technology, Sydney (UTS).

The trouble is that antibacterial resistance is not fully understood. Recent research has shed some light into the resistance mechanism. Jordi Garcia-Ojalvo and Pau Rué, researchers previously based at the Polytechnical University of Catalonia, in Barcelona, Spain, where they were members of a team that developed a 2-D model of the biofilms formed by *Bacillus subtilis*, a soil bacterium which forms spores to tolerate extreme environmental conditions. "When the colony of bacteria is under stress," says Rué, "wrinkle structures in the biofilm conveying resistance to the colony are formed."

The formation of these structures is initiated by massive spatially self-organised cell death, they observed. "With our simulation, we demonstrated that these patterns result from interaction between extracellular matrix production and cell death," Rué tells youris.com, adding: "without a matrix, cells die all together, no wrinkles are formed and no resistance occurs." This finding could therefore help understand how bacteria develop resistance to external agents.

There are many attempts to tackle bacteria resistance. One team focuses on developing antibacterial textiles, for example. Bulgarian born chemist Tzanko Tzanov, also from the Polytechnical University of Catalonia, has developed a technology to make sanitary fabric aseptic. This strategy is based on the use of a combination of zinc nanoparticles, enzymes and ultrasounds. The research is part of EU-funded SONO Project, aimed at the development of a sonochemical process for the production of medical antibacterial textiles.

Like silver, zinc has a strong antiseptic effect. While the fabric is immersed in the water, ultrasounds cause bubbles containing zinc oxyde

nanoparticle to explode and the particles to be embedded in the textile. "We use enzymes that improve the adherence of the particles, and biopolymers that improve the antibacterial effect," explains Tzanov. "The combination of biopolymers, nanoparticles and enzymes results in an extraordinary adherence – which resists 70 high temperature laundry cycles – and in a better antimicrobial effect." The idea is to produce hospital gowns or linen to help prevent the spreading of [resistant bacteria](#).

Some experts believe this approach could have some use, as long as it is limited to hospitals. "This technology needs to be evidence-based studied to see how effective it really is, but it may help to reduce the microbial load in a hospital," says Harold Stokes.

According to the Australian microbiologist, the risk of using these antimicrobial agents outside a nosocomial environment is high. "There are several examples where the broad use of antibiotics has favoured a large increase in resistant genes in bacteria. Horizontal gene transfer, by which bacteria are able to transfer genetic material to an entire population, favours the spread of resistant genes to many pathogenic bacteria. My concern is that the wholesale spreading of this technology for use for non-medical purposes might foster resistance. Antibiotics and antimicrobials should only be used in a hospital context. The same applies to this technology."

Other experts have further reservations, despite the quality of the results. "The antimicrobial results of this technology are good," says Annalisa Pantosti, an expert of microbial resistance from the Italian National Health Institute ISS, in Rome. "Yet, I have doubts on its actual efficacy for the nosocomial infections," she tells youris.com, "In a hospital, the transfer of bacteria may occur because of the hands of the staff, for not properly sterilized medical devices, or for infection of chirurgical sites during the operations." She believes current protocols provide for

disposable gowns and masks, and therefore such textiles cannot help much. She concludes: "Consider that the WHO emphasises that the single intervention that can significantly lower nosocomial infections is very simple: washing hands."

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