



Dr John Colreavy showing a tile with light-activated surface that eliminates bacteria. The tile surface can remove a model pollutant such as the orange dye shown here within 20 minutes.

Can we kill the hospital bugs?

Ronan White, Terenure College, Dublin



Dr John Colreavy
Healthcare-acquired
infections (called HCAI)
are caused by hospital
bugs. This is not a
problem for most
healthy individuals.
However, if your
system is already
challenged by an
illness, or if you are
recovering from an
illness, these bugs can
be very serious or even
fatal.

The problem is that the bugs have developed their own defences against our best defences.

In 1896 a French medical student Ernest Duchesne first observed the effect of mould on common bacteria. The importance of this was not realised until Alexander Fleming discovered in 1928 that the blue-mould, *Penicillium notatum*, could destroy common disease-causing bacteria such as *Staphylococcus*. Still, the world had to wait until the 1940s for the production of antibiotics, using these discoveries to

eliminate life-threatening infections caused by disease.

Now the problem is that while nature provided the solution, nature is also providing the threat as bacteria learn to adapt to antibiotics. You probably heard of MRSA – or methicillin-resistant *staphylococcus aureus*. It is a bacterium responsible for several difficult-to-treat infections in humans.

Scientists in the CREST Centre in DIT wanted to find a solution to MRSA so they went back to nature to find something that confuses nature's own defences.

Titanium dioxide is the pigment that is used in all white paints and what makes toothpaste white. The CREST team discovered that when titanium dioxide crystals are synthesised in the laboratory, the crystals are sensitive to visible light.

The importance of this sensitivity is that the moisture in the air is converted to very reactive species known as radicals in the presence of the crystal. These radicals are familiar to us as we have used hydrogen peroxide to bleach hair for generations. The usefulness of these radicals is that they

break down organic matter, just like a catalytic convertor breaks down chemicals in car exhaust systems.

The CREST scientists wondered whether their crystals could covert the normal moisture in the atmosphere to destroy bacteria on surfaces. The 'light bulb moment' came when the team performed an experiment which mimicked the very first observation by Ernest Duchesne in 1896 and used the same bacteria used by Fleming in 1928 in his discovery of penicillin and they found that it worked.

The beauty of the solution is that bacteria have no mechanisms to develop a defence against the surface which simply breaks open any carbon bonds in contact. As all life forms are carbon-based, they have no defence. The end products are harmless carbon dioxide and water and all by simply using light.

Dr Colreavy, who is passionate about all music from opera to Irish traditional, also enjoys hillwalking. He has been a technologist in the field of surface coatings technology for over 27 years.