

Antibiotic Resistance: Study of antiviral, or Genitourinary Bacteria Resistance

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Such is the rate of antibiotic resistance that few antibiotics will eventually be able to treat a common type of intestinal bacteria. *Klebsiella pneumoniae*, closely associated with pneumonia, is the bacterium that causes most serious infections and one of the hardest bacterium to get rid of.

It is the most commonly detected bacterium in the medical literature and accounts for 15 to 20 per cent of all hospital-acquired infections.

But it has largely evolved resistance to the first line of antibiotics -up to 200 of which now are developed for use against this group of bacteria in addition to their pathogenic roles. An incident in Glasgow this year revealed the resistance to some of the last line antibiotics used: beta-lactamase inhibitors. These are currently the most effective antibiotic treatment against *Klebsiella pneumoniae* in humans.

In laboratory studies carried out in the University of Helsinki and his lab, microbiologist Petri Pääkkönen has obtained the first-ever antibiotic against *Klebsiella pneumoniae* that has developed no resistance.

'Guilt by association" between bacteria and humans

Pääkkönen published his work this week in the online publication Public Library of Science, and in October in the journal Applied and Environmental Microbiology. He concentrated on outbreaks of mumps and flu in the Helsinki area, from when samples from those who had been exposed to infectious organisms had been evaluated.

'In 2004, nearly 40 per cent of viruses found in mumps and 14 per cent of those in the flu samples were *Klebsiella pneumoniae*. But many later outbreaks of *Klebsiella pneumoniae* also had mumps and influenza-like symptoms. This led me to question whether these were tied together. My research carried out using data from these two viruses may point the way to finding safer and more effective ways to treat people exposed to bacteria such as *Klebsiella pneumoniae*,' says Pääkkönen.

The researchers analysed 10 historical mumps and flu epidemics and identified six to seven *Klebsiella pneumoniae* genes that, when had enough exposure to human immune cells, had also mutated to resistance to the most-common antibiotics.

These findings can be related to the connections made between *Klebsiella pneumoniae* and human health through personal associations.

'It is well known that many common bacteria can provoke infection of the body or even loss of life - an explanation that isn't definitive. Nevertheless, most people associate *Klebsiella pneumoniae* with pneumonia and the chance for infection is obvious. So without knowing that it may also mutate to resistance to the most-effective antibiotics used for pneumonia, it would seem strange to us that most *Klebsiella pneumoniae* are resistant to a key antibiotic. Especially when the resistance becomes very predictable and also specific,' says Pääkkönen.

What is good about antibiotic resistance?

This research by Pääkkönen of the Department of Basic Microbiology will have consequences for the clinical administration of bacteria in hospital. Antibiotics don't work against *Klebsiella pneumoniae*. The researchers decided to test to see what treatments that had not yet been thoroughly tried - safe-treatment possibilities that could potentially work against antibiotics.

Researchers found from the humans in Finland and Denmark exposed to *Klebsiella pneumoniae*, that specific classes of antibiotics seemed to be effective. Erimatinib, a small molecule that would only be used against the bacteria, wasn't as effective as what had been tested earlier, i.e. isosorbide, and can only be used if sterotoxin levels were very low. Serotinib, on the other hand, can be used against all types of *Klebsiella*. It is still in development, but it proved effective against *Klebsiella* infection in humans in a series of studies.

The researchers present with the findings on the discovery of antibiotics which resist antibiotic resistance as result of antifungal bacteria and the last line antibiotics used against these bacteria. They now want to examine the mechanism of resistance. If it is specific to antibiotics used against bacteria and comes from human exposure to bacteria, this will be very important to know so that scientists could develop better and more efficient types of antibiotics.

'Our results on some specific genes of *Klebsiella* have shown that some antibiotics work against bacterial resistance. The findings also show the consequences for risk areas in the setting of an epidemic in any medical center,' says researcher Petri Pääkkönen.



A Red Fire Hydrant In The Middle Of A Forest