

New technology traces resistance gene quickly

8 December 2015, by Heidi Kornholt



A new resistance gene has been found in coli bacteria among pigs, broiler meat and humans in China. Bacteria with the same resistance gene have now also been found in Denmark, according to a new Danish study. The National Food Institute, Technical University of Denmark, and Statens Serum Institut have been able to quickly create an overview of the situation in Denmark because many bacteria have had their DNA-profile mapped with the help of whole genome sequencing.

A new resistance gene, *mcr-1*, has been found in coli [bacteria](#) among pigs, broiler meat and humans in China according to a scientific article in renowned journal *The Lancet* on 18 November 2015.

The gene leads to resistance to colistin - antimicrobials of the type polymyxin, which are the last available option to treat infections with multiresistant so-called [gram negative bacteria](#) such as fx E-coli and klebsiella.

Technology platform at DTU

Since 2009 the National Food Institute and DTU

Systems Biology have built up computer facilities which are able to quickly map a bacteria's genome – its DNA – and compare the results with bacterial findings from around the world. Many bacterial findings in Denmark have had their DNA profile mapped with the help of whole [genome sequencing](#).

When the [resistance gene](#), *mcr-1*, was made available to researchers on 23 November 2015, the National Food Institute in cooperation with Statens Serum Institut was able to quickly create an overview of the situation in Denmark for the Danish authorities.

Unlike previously when it was necessary to collect bacterial samples, set up new detection methods and carry out analysis, researchers can these days get an overview of the situation within hours thereby saving months of work.

The approximately 3000 gram negative coli- og salmonella bacteria, which have previously been mapped using whole genome sequencing, have been reexamined to see whether *mcr-1* is present. Results show that *mcr-1* was found in one patient, who suffered from a blood infection in 2015 and in five food samples that have been imported from 2012-2014. All the bacteria are multiresistant ESBL bacteria containing the *mcr-1* gene, which can further complicate treatment.

Global databases

The National Food Institute is working to develop global databases in order to further the intelligent use of whole genome sequencing data.

This work takes place in the network Global Microbial Identifier and the EU project [COMPARE](#). Both have the aim of creating a global system of databases for whole genome sequencing. These databases will be used to identify and diagnose disease-causing microorganisms and infectious

diseases. They will also make it possible to compare data with information on outbreaks and emerging disease-causing microorganisms.

The National Food Institute also performs the role of WHO Collaborating Centre and EU reference laboratory for antimicrobial resistance. As such, the reference laboratory is planning in agreement with the European Commission to examine the prevalence of mcr-1 in cooperation with national veterinary and food laboratories in the EU.

Facts about antimicrobial resistance

Treatment with antimicrobials is intended to kill [pathogenic bacteria](#). Unfortunately, antimicrobials also cause the bacteria to protect themselves by developing resistance to the type of antimicrobials that are used to treat them which causes the antimicrobials to lose their effectiveness. Resistant bacteria can be transmitted between humans, and bacteria can infect each other with resistance. However, [resistant bacteria](#) are poor at surviving if antimicrobials are not present. Therefore, it is important to have an overall focus on using as few antimicrobials as possible for the treatment of both animals and humans.

Bacteria that are resistant to several types of antimicrobials are called multiresistant.

Bacteria know no borders, therefore [antimicrobial resistance](#) in one country can cause problems outside of its borders. As such the use of antimicrobials in both animals and humans is a global problem.

Not all antimicrobials are the same. Some are narrow spectrum and affect only individual groups of bacteria. They are used when you know which bacteria are causing the disease. Others are broad spectrum and affect numerous groups of bacteria at the same time. They can therefore be used to treat a disease before knowing which bacteria is the cause. However, they often also kill useful and [harmless bacteria](#) such as bacteria from the intestine, which may lead to the emergence of resistant bacteria.

Not all antimicrobials are equally important in the

treatment of humans. WHO has declared a number of antimicrobials to be 'critically important', because they are the only or one of only a few [antimicrobials](#), which can be used to treat serious or life-threatening infections in humans. These types include carbapenems, third and fourth generation cephalosporins, fluoroquinolones and macrolides.

More information: Yi-Yun Liu et al. Emergence of plasmid-mediated colistin resistance mechanism MCR-1 in animals and human beings in China: a microbiological and molecular biological study, *The Lancet Infectious Diseases* (2015). [DOI: 10.1016/S1473-3099\(15\)00424-7](#)

Provided by Technical University of Denmark

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