

# Novel antibiotic resistance gene in milk

April 27 2017

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Researchers of the University of Bern have identified a new antibiotic resistance gene in bacteria from dairy cows. This gene confers resistance to all beta-lactam antibiotics including the last generation of cephalosporins used against methicillin-resistant *Staphylococcus aureus*. A transfer to *S. aureus* which is likely according to the researchers would jeopardize the use of reserve antibiotics to treat human infections caused by multidrug-resistant bacteria in hospitals.

*Micrococcus caseolyticus* is a harmless bacterium naturally found on the skin of dairy cows which can spread to milk during the milking process. It can also be present in dairy products made from raw milk like e.g. cheese. Researchers of the Institute of Veterinary Bacteriology of the University of Bern have identified a new methicillin [resistance](#) gene in

strains of *M. caseolyticus* isolated from milk. Transfer of the gene to *Staphylococcus aureus*, a bacteria found on the skin and mucosa of animals and humans, would have dramatic consequences for public health. This methicillin resistance gene would turn this bacteria into a hazardous methicillin-resistant *S. aureus* (MRSA), which is known to cause difficult-to-treat infections in hospitals. Acquired methicillin resistance in bacteria is associated with genes *mecA*, *mecB*, or *mecC*. However, none of these genes were present in the *M. caseolyticus* strains – they carried the novel resistance gene *mecD*. This discovery has now been published in *Scientific Reports*.

## The discovery

Over the last years, researchers of Vincent Perreten's group at the Institute of Veterinary Bacteriology in Bern investigated *M. caseolyticus* present in milk of [dairy cows](#) suffering from mastitis. Mastitis is an infection of the udder which is frequently treated with penicillins and cephalosporins, which are [antibiotics](#) of the beta-lactam class like methicillin. These bacteria isolated from milk showed an unusual resistance pattern to beta-lactam antibiotics with a resistance profile resembling that of MRSA, but the known [genes](#) responsible for resistance were missing. "We were intrigued by this novel resistance in *M. caseolyticus* and wanted to know what was behind this resistance," says Vincent Perreten. Bacteria have the extraordinary ability to acquire novel genetic information such as [antibiotic resistance genes](#). Using Next Generation Sequencing (NGS), the researchers rapidly found that the *M. caseolyticus* isolates acquired a novel antibiotic resistance island which contains a new methicillin resistance gene designated *mecD*.

## The new *mecD* gene confers resistance to anti-MRSA cephalosporins

The group of Vincent Perreten demonstrated that the novel methicillin resistance gene *mecD* confers resistance to all classes of  $\beta$ -lactams including anti-MRSA cephalosporins. It was located on a "resistance island" which has been acquired by *M. caseolyticus*. Further experimental investigations of the "resistance island" showed that it also has the potential for integration into the chromosome of *S. aureus*. "It is not excluded that this event may happen in nature, since *S. aureus* and *M. caseolyticus* share the same habitats," says Perreten.

*M. caseolyticus* containing the novel *mecD* gene has been so far mainly found in cattle but in one case it has been isolated from skin infection in a dog indicating that this bacteria has the potential to colonize different animal species.

"So far, we do not have any indication of the presence of *mecD* in humans, but its transfer from *M. caseolyticus* to *S. aureus* would further limit therapeutic options of this nosocomial pathogen." Selection of this gene should be avoided limiting the inadequate use of antibiotics in animals and humans. "It is imperative to keep an eye on the evolution and spread of this novel resistance gene in both human and animal [bacteria](#)," says Perreten.

**More information:** Sybille Schwendener et al. Novel methicillin resistance gene *mecD* in clinical *Micrococcus caseolyticus* strains from bovine and canine sources, *Scientific Reports* (2017). [DOI: 10.1038/srep43797](#)

Provided by University of Bern

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