# Chopping and changing in the microbial world: How mycoplasmas stay alive

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Mycoplasmas regularly change their surface proteins to confuse the immune systems of the humans and animals they invade. Recent work in the group of Renate Rosengarten and Rohini Chopra-Dewasthaly at the University of Veterinary Medicine Vienna has revealed surprising new details of the way they do so and at the same time raised important evolutionary questions. The results are published as the cover article in the September issue of the *Journal of Bacteriology*.

Mycoplasmas are responsible for a variety of important diseases, including atypical pneumonia in humans and mastitis in cows, sheep and goats, which results in loss of milk production. Mycoplasmal mastitis represents a particular problem in the dairy industry and is thus a subject of intense study. One of the most important mastitis agents in sheep and goats is *Mycoplasma agalactiae*, which has been under investigation by the group of Renate Rosengarten and Rohini Chopra-Dewasthaly at the Institute of Bacteriology, Mycology and Hygiene at the University of Veterinary Medicine, Vienna (Vetmeduni Vienna).

Mycoplasmas possess the smallest genomes of any organism able to replicating itself. They thus represent ideal starting points for constructing synthetic genomes in the quest for a minimal genome. While several genes appear dispensable when mycoplasmas are grown under ideal conditions in the laboratory, most of the genes are thought to be essential for survival when mycoplasmas are attached to host cells and interact with the host's immune system. One such group of mycoplasma genes encodes the highly variable proteins located on the mycoplasma

membrane surface, which compensate for the lack of a protective cell wall and enable the organisms to avoid the host's defence mechanisms during infection.

The mycoplasma researchers at the vetmeduni have previously identified these variable surface protein genes in *Mycoplasma agalactiae* and described precisely how they are switched ON and OFF. It turns out that the so-called phase variation is caused by alterations in the order of short DNA sequences under the control of a special enzyme, a recombinase. Knocking-out the gene encoding the recombinase results in "phase-locked mutants", i.e. mycoplasmas that can no longer vary their surface proteins.

Stefan Czurda, a doctoral student in the group of Renate Rosengarten and Rohini Chopra-Dewasthaly, has now succeeded in identifying the exact positions where the recombinase acts. There are sites where the recombinase "cuts" the DNA to enable the surface protein genes to be reshuffled and additional, adjacent signals that are required for the enzyme to work efficiently. By means of a novel detection system, he has shown that the recombinase is also capable of removing parts of the DNA, including the signal that controls the production of the variable surface proteins. This would presumably make the affected mycoplasma cells less able to survive in a host.

Despite their small genomes, mycoplasmas are highly successful infectious agents. The fact that *Mycoplasma agalactiae* nevertheless has a system that may regularly lead to the loss of some of its precious and limited DNA shows clearly the importance of its ability to vary its surface proteins. According to the mycoplasma researchers at the Vetmeduni Vienna, the potential loss of genetic information seems to be the price that Mycoplasma agalactiae pays for maintaining the ability to change its surface proteins.

**More information:** The paper Xer1-Mediated Site-Specific DNA Inversions and Excisions in Mycoplasma agalactiae by Stefan Czurda, Wolfgang Jechlinger, Renate Rosengarten and Rohini Chopra-Dewasthaly is published in the September issue of the *Journal of Bacteriology* (Vol. 192, issue 17).

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