By Coralie Goetz, Mario Jacques,
François Malouin and Hélène Poirier

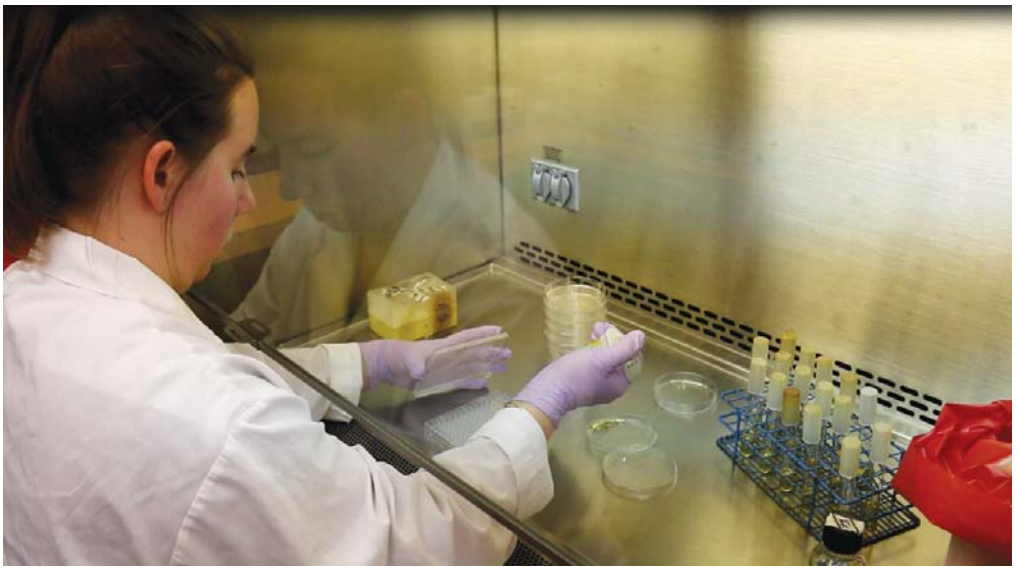
# MATRIX *REVOLUTIONS*

Researchers are examining new avenues to reduce the use of antibiotics to treat mastitis in dairy cows

Researchers from the Université de Montréal and Université de Sherbrooke are working to create new and innovative ways to treat mastitis, particularly staph infections. Their goal is to reduce the use of antibiotics to treat mastitis in dairy cows.

The bacteria that cause mastitis can use various strategies to persist in the mammary gland, and biofilm formation by staphylococcus is one of those. Biofilm is a gelatinous deposit, which is, in reality, a cluster of bacteria embedded in a polymeric matrix comprising polysaccharides, proteins and nucleic acids.

Stuck together in biofilm, they are significantly less susceptible to antibiotics, disinfectants and host immune response compared with free-form bacteria. This contributes to the failure of some antimicrobial treatments for mastitis cases, particularly when staphylococcus aureus is involved. E. coli, streptococcus uberis and coagulase negative staphylococci (CNS) are also able to produce biofilms. The researchers want to determine how new therapeutic strategies can counter these undesirable bacteria.



**RESEARCHERS WANT** to determine how new therapeutic strategies can counter undesirable bacteria that cause mastitis, such as staphylococcus aureus and E. coli.

Knowledge relating to biofilms formed by staphylococci has enabled researchers to develop molecules that specifically target and control biofilm formation. These molecules were developed to be applied in human medicine and, unfortunately, very little are known about their use in veterinary medicine.

At the faculty of veterinary medicine at the Université de Montréal, Mario Jacques, microbiologist and biofilm expert, is determined to discover more about this microscopic and gelatinous matrix. With the help of his colleague, François Malouin from the Université de Sherbrooke, Jacques obtained preliminary results showing the ability of some strains of CNS to inhibit biofilm production by other bacteria responsible for bovine mastitis.

Jacques and Malouin claimed in laboratory cultures, mixing some strains of CNS to other mastitis pathogens induces perturbation in biofilm structure of those pathogens. Knowing this, they developed a hypothesis, which is "could we use this mysterious matrix advantage coming from CNS to fight other bacterial biofilms?"

To verify this hypothesis, Coralie Goetz, originally from France, is devoting her PhD thesis to a project characterizing the CNS mixed biofilms and trying to identify factors produced by CNS that can target biofilm formation. The first objective of the project will be to select strains with high capacity to affect biofilm production. Using microfluidics, a dynamic lab method, which reproduces the environment of the bacteria, the researchers can observe the biofilm formation or destruction in real time. The second objective will be to explain the mode of action responsible for biofilm inhibition. Among other things, it is possible these strains can have an enzymatic activity, such as a proteolytic activity responsible for protein degradation. The researchers already know proteins are important components of CNS biofilm's matrix. The third and final objective will be to identify if these effects are responsible for biofilm inhibition, dispersion or destruction.

The research team aims to define new and innovative therapeutic alternatives to treat mastitis by piercing the secret of the CNS's mode of action. This research supports a reduction in the use of antibiotics for udder health. The researchers hope the development of complementary or alternative treatments in veterinary medicine will allow better control of infectious bovine mastitis pathogens, such as staphylococcus aureus.

**CORALEE GOETZ** is the doctoral student working on this project.

**MARIO JACQUES** is the principal investigator and managing director, Université de Montréal.

**FRANÇOIS MALOUIN** is co-researcher, Université de Sherbrooke.

**HÉLÈNE POIRIER** is the knowledge transfer agent.

*The authors are all from the Canadian Bovine Mastitis and Milk Quality Research Network. This project is supported by a contribution from the Dairy Research Cluster Initiative, which includes Dairy Farmers of Canada, Agriculture and Agri-Food Canada, the Canadian Dairy Network and Canadian Dairy Commission.*