European badgers' gut bacteria may be a powerful ally in the fight against tuberculosis

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What do cattle, European badgers, and gut bacteria have in common? They are all central players in a complex web surrounding a disease that affects multiple species, often with devastating results—tuberculosis. Now, new research funded by Morris Animal Foundation is shedding light on how one player, gut bacteria, may help protect both badgers and cattle from this common, pervasive and deadly illness.

A major outbreak of bovine tuberculosis is significantly impacting agriculture in the United Kingdom. Badgers are known carriers of Mycobacterium bovis (the bacteria that causes tuberculosis in cattle) and are suspected to be a source of disease spread. The use of the human tuberculosis vaccine, Bacillus Calmette-Guerin, in badgers was considered to be a humane and long-term solution to reduce TB spillover from badgers but was falling short on effectiveness.

Dr. Jorge Gutierrez, University of Surrey researcher and lead author of the paper, wanted to know why and wondered if both the reason for this shortfall and its solution could be found in the gut bacteria of badgers.

The team, along with collaborators at the UK's Animal and Plant Health Agency, found gut bacteria from badgers may be decreasing the effectiveness of the BCG vaccine, but at the same time may be killing off *M. bovis*. It's a bad news/good news scenario that may help improve tuberculosis prevention. The team's findings recently were published in *BMC Microbiology*.

Some natural gut bacteria produce substances that can kill off their competitors or make the gut a hostile place for them. Dr. Gutierrez wondered if this might be going on in the badger gut too. His team isolated several types of natural gut bacteria, specifically lactic acid bacteria, from the feces of badgers. They found some of these bacteria kill off the BCG vaccine, which could reduce its effectiveness in this species. But with this finding, there is good news, too.

"As *M. bovis* is often excreted from infected badgers in their feces, we might find a way to use these gut bacteria to kill *M. bovis* instead; a way of naturally reducing contamination of the badgers' environment with the bacteria that cause TB," said Dr. Gutierrez. "We also found the lactic acid from badgers was good at stimulating the badger's immune system, which could be good news for improving the effectiveness of the vaccine."

Current TB intervention measures in the United Kingdom includes controlling cattle movement, limiting cattle contact with wildlife in pastures as well as culling badgers. Keeping cattle away from wildlife is challenging for livestock managers. Also, badgers live locally within a social structure that can be disrupted by culling, leading badgers to travel further, taking the disease with them. An effective vaccine strategy would be optimal for all animals affected by this disease, as well as being an environmentally sound solution

"New long-term, environmentally friendly and sustainable solutions are needed both for the badgers and other animals affected by this disease," said Dr. Gutierrez. "Our findings might explain in part why the BCG vaccine has variable results in badgers but also points to a possible future solution. There's still a lot to learn about the bacteria that make up the natural flora of the badger gut."

"All animals, including humans, contain both beneficial and harmful

bacteria," said Dr. Kelly Diehl, Interim Vice President of Scientific Programs at Morris Animal Foundation. "Unfortunately, harmful bacteria get all the press as these microbes can make us sick or trigger large-scale disease outbreaks. Dr. Gutierrez's work is a superb example of how we might be able to use the beneficial bacteria already living in our bodies in novel ways to help combat diseases such as bovine TB."

More recently, Dr. Gutierrez and his wildlife management collaborator, the Spanish company Ingulados, isolated beneficial gut bacteria from wild boars, another TB reservoir species in parts of mainland Europe. They are exploring its use to naturally and safely help mitigate bovine TB spillover in Spain.

More information: Anna Stedman et al, Lactic acid Bacteria isolated from European badgers (Meles meles) reduce the viability and survival of Bacillus Calmette-Guerin (BCG) vaccine and influence the immune response to BCG in a human macrophage model, *BMC Microbiology* (2018). DOI: 10.1186/s12866-018-1210-z

Provided by Morris Animal Foundation

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