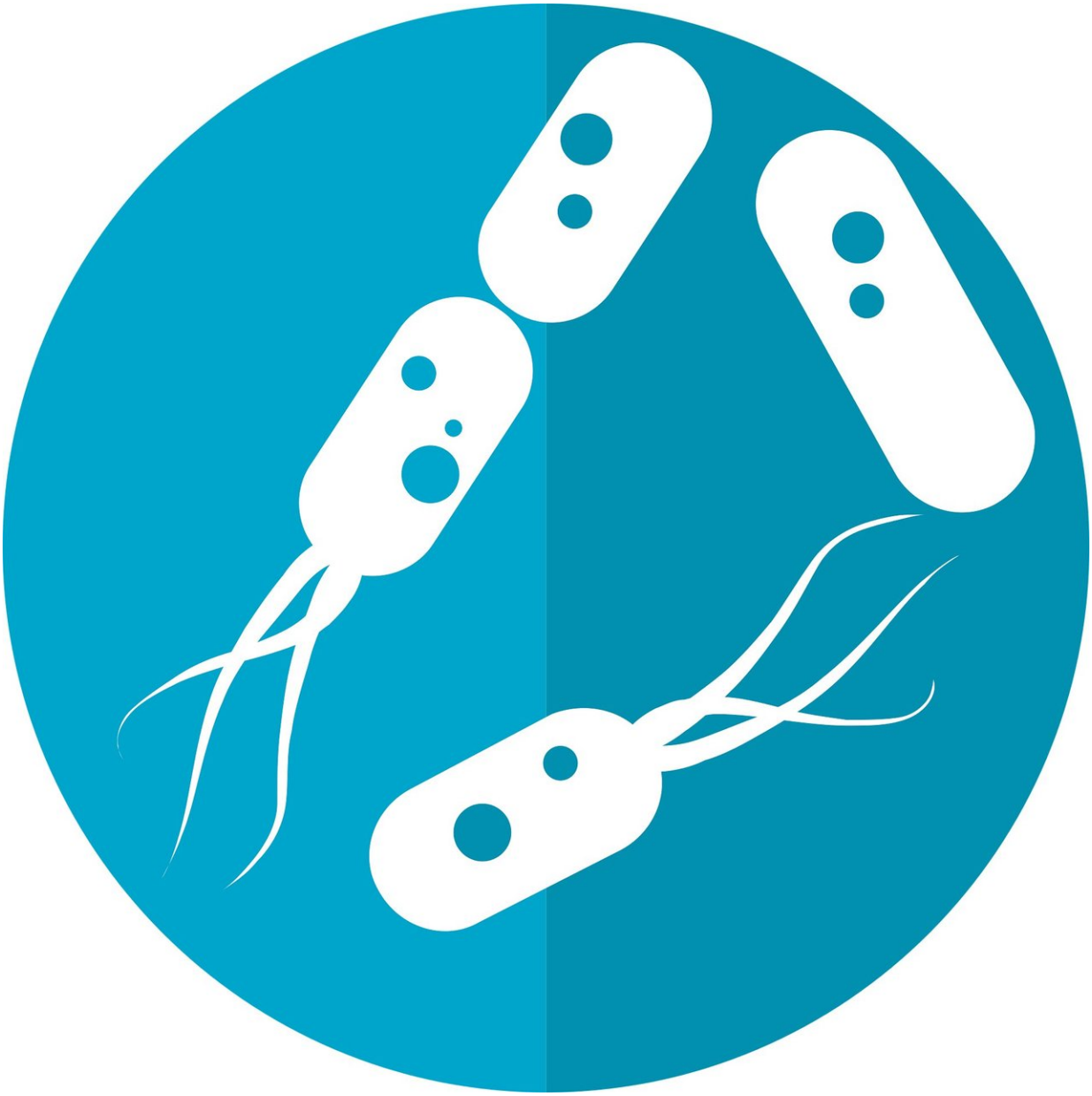
# Edible antibodies to treat and prevent gastrointestinal disorders

April 1 2019



Credit: CC0 Public Domain

Therapeutic antibodies are increasingly being used in the clinic for the treatment of diseases. Yet, oral to gut targeting of antibodies remains a challenge due to their inability to survive digestion and reach gastrointestinal tissues. Now, scientists have developed a new antibody technology that combines the advantages of antibody-based therapies with the convenience of oral drug administration.

Importantly, these antibodies are manufactured using yeast in a straightforward food manufacturing process. This work was published in the journal *Nature Biotechnology* and is the result of an ongoing collaborative effort between Nico Callewaert (VIB-UGent Center for Medical Biotechnology), Ann Depicker (VIB-UGent Center for Plant Systems Biology), Henri De Greve (VIB-VUB Center for Structural Biology) and Eric Cox (UGent Faculty of Veterinary Medicine). The antibody technology may have applications in fighting veterinary and human gut infections, treating inflammatory and metabolic disorders, and the development of microbiome-altering food supplements.

Conventional therapeutic antibodies are injected into the bloodstream for treatment or prevention of a multitude of diseases, including infectious diseases, cancer and inflammation. While widely applicable, these antibody-based therapies are not designed for oral ingestion for targets in the gut, as the digestive environment of gastrointestinal tract may break it down. In addition to avoiding needles, local delivery of antibodies rather than systemic administration can be preferred to minimize or even avoid systemic side effects. That's why scientists are working on technologies that protect antibodies during gastric passage to deliver them intact to the target site in the gut.

Now, research by Vikram Virdi, postdoc in the lab of Nico Callewaert (VIB-UGent) and Ann Depicker (VIB-UGent), makes oral to gut delivery of antibodies possible. The scientists engineered an antibody format that is simple but robust enough to survive the harsh environment in the gut. What is more, the team also developed a manufacturing process that uses either soybean seeds or yeast cells to produce these antibodies. By using existing food-processing technology, they could eliminate the need for expensive purification processes. The result is an easily manufactured powder with antibodies that can be added to food and ingested orally, requiring no encapsulation.

In collaboration with the group of Eric Cox (UGent), the scientists obtained proof-of-concept with the technology in one of the target species, young piglets susceptible to a diarrhea-causing infection. Post-weaning diarrhea caused by enterotoxigenic Escherichia coli (ETEC) is an economically important disease in pig production worldwide. At the moment, the only thing that helps against this infection is the use of antibiotics, which is a risk factor for the well-known problems of antibiotic resistance and potential transmission of resistant bacteria between animals and humans. This is a huge conundrum for pig producers, who want to overcome ETEC crises in the face of strict regulatory limitations on the use of antibiotics for livestock. The new antibody-based approach appears to be an effective and safe alternative. "The piglets that were provided food supplemented with the new antibodies were protected against infection by ETEC in a pilot study," Vikram Virdi says. Given these results, the team is looking to further develop the antibodies as veterinary product.

Yet according to Nico Callewaert, who led the yeast work, the applications go much further. "Since the human and pig guts are strikingly similar, the lab is already exploring this technology for preventing and treating human gut infections and reducing symptoms in gastric diseases such as Crohn's disease and ulcerative colitis. One of the

key contributions may be in humanitarian projects, for example, during post-disaster situations to combat outbreaks of gut diseases such as cholera caused diarrhea." Overall, the versatility of this new technology creates novel product opportunities for use in food and feed additives, nutraceuticals, biopharmaceuticals and microbiome optimization.

**More information:** Yeast-secreted, dried and food-admixed monomeric IgA prevents gastrointestinal infection in a piglet model, *Nature Biotechnology* (2019). DOI: 10.1038/s41587-019-0070-x , www.nature.com/articles/s41587-019-0070-x

Provided by VIB (the Flanders Institute for Biotechnology)