

# Deadly bacterial infection in pigs deciphered

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Prof. Dr. Horst Posthaus Institute of Animal Pathology (ITPA), University of Bern. Credit: Conrad von Schubert

The *Clostridium perfringens* bacterium is part of the large *Clostridium* genus which can cause various fatal illnesses in animals and humans. *Clostridium* infections are widespread. These bacteria are dangerous because they produce extremely strong poisons (toxins) which cause

targeted damage to the host's cells. Dreaded diseases caused by *Clostridium* include botulism, tetanus, gas gangrene and intestinal infections, for example.

Horst Posthaus's group in the Institute of Animal Pathology at the University of Bern is researching an intestinal infection in pigs which is caused by *Clostridium perfringens*. 10 years ago, they were already able to demonstrate that the toxin produced by the bacteria, the so-called beta toxin, kills [vascular cells](#) and thus causes bleeding in the piglet's intestine. Until now, however, it was unclear why the toxin attacked specifically these [cells](#) and not others. Julia Bruggisser, biochemist and doctoral student at the Institute of Animal Pathology, has now succeeded in solving the puzzle of this mechanism in an interdisciplinary collaboration between three faculties. The findings from the study have been published in the specialist journal *Cell Host & Microbe*.

## **A key molecule**

Around five years ago, lab technician Marianne Wyder from the Institute of Animal Pathology came across a molecule called Platelet-Endothelial Cell Adhesion Molecule-1 (PECAM-1 or even CD31 for short). It is located on the surface of various cells and plays a central role in intestinal bleeding in piglets. The actual role of the CD31 molecule is to regulate the interaction between inflammatory cells and the blood vessels. It predominantly occurs on cells which are located on the inside of [blood vessels](#) (so-called [endothelial cells](#)).

During experiments, it was noticed that CD31 and the beta toxin are distributed almost identically on these cells. "Our project resulted from this initial observation," says Horst Posthaus. Julia Bruggisser from the Institute of Animal Pathology discovered that the toxin released by the bacteria in the intestine attaches to the CD31. Since the beta toxin numbers among the pore-forming toxins, it thus perforates the cell

membrane and kills the endothelial cells. This results in damage to the vessels and bleeding in the intestine.

Collaboration between multiple research groups at the University of Bern was essential for the success of the project. "For my research, I work in three laboratories at the university. Although it's challenging, I learn a lot and above all, it's fun," says Julia Bruggisser. In addition to animal pathology, she also works with groups headed by Britta Engelhardt (Theodor-Kocher Institute) and Christoph von Ballmoos (Department of Chemistry and Biochemistry). "They had the right questions and ideas. We were able to bring our know-how concerning CD31 and methods and reagents which we had developed into the study," says Britta Engelhardt. "It came together perfectly," adds Christoph von Ballmoos.

## **Better prophylaxis and medications**

The discovery makes it possible to develop better vaccines in order to prevent the fatal disease in pigs. "But we also want to investigate whether the attachment of beta [toxin](#) to CD31 on the endothelial cells also allows for the development of new forms of therapy, for vascular disease in humans, for example. We have already started more collaborations within the University of Bern to this end," says Horst Posthaus.

**More information:** Julia Bruggisser et al. CD31 (PECAM-1) Serves as the Endothelial Cell-Specific Receptor of *Clostridium perfringens*  $\beta$ -Toxin, *Cell Host & Microbe* (2020). [DOI: 10.1016/j.chom.2020.05.003](https://doi.org/10.1016/j.chom.2020.05.003)

Provided by University of Bern

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