

Press Release

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FUNGUS PROMOTES CARIES FORMATION

THE INTERPLAY OF DIFFERENT PATHOGENS IS DECISIVE FOR THEIR EFFECT

Streptococcus mutans is believed to be the most important cause of caries. But it looks as if this bacterium is not responsible for lesions in teeth by itself. Scientists of the Helmholtz Centre for Infection Research (HZI) in Braunschweig (Germany) recently showed that the development of caries is triggered by a complex interplay of different pathogens. The researchers published their results in the "ISME Journal".



HZI/Rohde&Sztajer

Links: Nahaufnahme eines Biofilms bestehend aus zwei humanen Krankheitserregern, dem Pilz *Candida albicans* und dem Karies fördernden Bakterium *Streptococcus mutans*. Die Produktion von extrazellulären polymeren Substanzen (EPS) des Bakteriums, die Karies auslösen können, wird durch den Pilz gestoppt. Rechts: *S. mutans* Zellen fluoreszieren grün. Sie tragen ein Gen für das grün fluoreszierende Protein und sind mit dem Promotor des Quorum-Sensing gesteuerten alternativen sigma-factor *SigX* verbunden. Das Quorum-Sensing

Streptococcus mutans, a bacterium, is present in the saliva of most humans and plays a major role in the formation of caries. According to a long-held belief, this germ, acting by itself, is responsible for caries formation. However, recent studies show multiple pathogens are involved in this process. Many of these live in the sticky substance produced by *Streptococcus mutans* in order to be able to adhere to the teeth. One of these germs is the yeast fungus called *Candida albicans*.

"We looked closely at the interplay between *Streptococcus mutans* and *Candida albicans* and noticed that the virulence of the bacterium changes if the fungus is present," says Prof Irene Wagner-Döbler, head of the "Microbial Communication" research group at the HZI. The bacterium becomes more harmful in the presence of the yeast.

Since micro-organisms lack mouths and ears, they cannot communicate with each other by sound, but rather use chemical signals for this purpose. They release molecules and recognise molecules of other micro-organisms in their vicinity. If the concentration of certain signalling substances is sufficiently high, the so-called quorum sensing system becomes activated.

This means that the fungus produces and releases signalling molecules, which are taken up by bacteria if they exceed a certain threshold concentration and can elicit various metabolic reactions. "One of these responses is the activation of genes in *Streptococcus mutans* that lead to the production of antibiotics of this cell," says Dr Helena Sztajer, principal author of the study. By this means, *S. mutans* can successfully fight other bacteria and gain a competitive advantage.

In addition, the bacterium can take up genetic material from other organisms more easily in the presence of the yeast. "This allows the bacterium to assume new properties, such as resistance to antibiotics," says Wagner-Döbler. Moreover, the fungus suppresses the production of sticky substances, which are an important requisite for the adhesion of *S. mutans* and other bacteria on the tooth. Studies in humans will have to show if this promotes the formation of caries. It is clear though that the interplay between a pathogen and another micro-organism can totally change the harmfulness (virulence) of the pathogen - turning Dr Jekyll into Mr Hyde.

The scientists' results have a bearing beyond caries, because they confirm a new perspective in the study of diseases. While the search for a cause of a disease used to focus on a single pathogen only, the results of the HZI researchers support the hypothesis that the interplay between many different micro-organisms plays a role in disease. "The organisms act in concert, much like an orchestra," says Wagner-Döbler.

The **Helmholtz Centre for Infection Research** contributes to the achievement of the goals of the Helmholtz Association of German Research Centres and to the successful implementation of the research strategy of the German Federal Government. The goal is to meet the challenges in infection research and make a contribution to public health with new strategies for the prevention and therapy of infectious diseases. www.helmholtz-hzi.de