

Hungry immune guardians are snappier

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Biomedical researchers from the LIMES Institute at the University of Bonn (left in the picture: Professor Michael Hoch) have discovered an immune mechanism which is linked directly to the metabolic status via the insulin signaling pathway. Credit: Frank Homann, University of Bonn

German researchers have discovered an elementary mechanism which regulates vital immune functions in healthy people. In situations of hunger which mean stress for the body's cells, the body releases more antimicrobial peptides in order to protect itself. The scientists will publish their results in the journal *Nature*.

T cells, [B cells](#), antibodies are known as the 'SWAT team' of our [immune system](#) that intervenes when viruses and bacteria make us ill. With 'heavy molecular artillery' they wipe out intruders effectively. However, at the same time the defence systems cause collateral damage in the body's own tissue, which has to be repaired first.

In order for the immune system not to be consistently in a state of red

alert and possibly cause [chronic inflammation](#) this way, there is a second defence system switched in series between body and outside world. This is absolutely necessary because on the barrier tissue such as lungs and skin there are trillions of bacteria. The majority of these microorganisms have been living with our body's cells as good neighbours for millions of years. There's more to come: the complex symbiosis of very different microorganisms supplies us with important natural substances such as vitamin B12.

Good germs, bad germs

At the same time there are always a few mischief-makers among the numerous peaceful bacteria which can make us sick. In this situation, even before the pathogenic germs invade our body, a mechanism is set in motion which acts completely independently of the classic [immune defence](#) systems. The biomedical researchers from the LIMES Institute at the University of Bonn have been able to show in fruit flies but also in human tissue that this natural immune defence system is linked directly to the [metabolic status](#) via the insulin signalling pathway.

If we have not eaten for a while or have to climb many stairs, the energy level of our cells drops and with it the level of insulin. The researchers from Bonn have now discovered that in the case of a low insulin level the FOXO transcription factor is activated. A transcription factor can switch genes on and off. FOXO switches genes for immune defence proteins on when energy is needed. These antimicrobial peptides (AMP) - not to be confused with antibodies - are subsequently jettisoned by the body's cells. They destroy possible pathogens by dissolving their cell walls. 'This happens every minute every day,' the director of studies Prof. Michael Hoch from the LIMES Institute explains. 'What is fascinating about this is that a function of the immune system directly depends on how much and what we eat.' In situations of hunger which mean stress for the body cells, the body releases [antimicrobial peptides](#) as a precaution in order to

protect itself. 'The barrier between body and outside world is apparently fortified in a potentially dangerous situation in which we have too little energy,' Professor Hoch presumes.

Ancient defence mechanism helps us to get old?

FOXO and the antimicrobial peptide genes which it switches on occur in almost all groups of animals. That is why the researchers believe that the direct link between the food supply and the immunological defence probably developed during the early stage of evolution of metazoan organisms.

The research of the Bonn biologists could also be clinically relevant. For a number of common diseases such as type II diabetes or obesity (adiposity) are the result of an increased intake of calories. Furthermore, such diseases are accompanied by increased inflammation of the barrier tissue, a disturbed immune system and an overall reduced life span. 'Our results present new starting points for understanding of these diseases,' Professor Joachim Schultze from the LIMES Institute, who also is involved in the research project, says.

The scientists at LIMES will concentrate next on the relationship between calorie intake and life span. Examinations of nematodes, [fruit flies](#) and mice have shown that a reduced calorie intake can increase life span. Professor Hoch says: 'We now want to find out whether this is due to an foxo-dependent improvement of the barrier functions of the natural immune system.'

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Provided by University of Bonn

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