

A Cuff Lowering Blood Pressure

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Source: Uni Freiburg, Institut für Mikrosystemtechnik

Stimulating some distinct fibers inside the vagal nerve might be an option for the future of blood pressure treatment.

High blood pressure (HBP) is among the greatest health risks worldwide besides smoking and alcohol consumption. In Germany alone, around 25 percent of the population suffers from arterial hypertension. However, the drugs doctors can prescribe currently will not help around 30 percent of patients in the long term. Chronic high blood pressure leads to damage in other organs – the eyes, kidneys, the heart, and the central nervous system, in particular.

That's why a number of researchers at the [University of Freiburg](#), Germany, teamed up to develop a cuff for the vagal nerve (VN), equipped with 24 electrodes that can lower blood pressure without causing side effects. Mechanoreceptors in the aortic arch relay blood pressure levels through VN-fibers to the brainstem and trigger the baroreflex, thus lowering the BP. The big technological problem, however, lay in the complexity of the VN: until now there was no technique described to localize and stimulate these fibers inside the VN without inadvertent stimulation of non-baroreceptive fibers - causing side effects like bradycardia and bradypnea.

Microsystems engineers Dr. Dennis Plachta and Prof. Thomas Stieglitz from the Laboratory of Biomedical Microtechnology at the Department of Microsystems Engineering (IMTEK) of the University of Freiburg together with neurosurgeons Dr. Mortimer Gierthmühlen and Prof. Josef Zentner from the university's Medical Center developed a device that starts by determining which electrode is closest to the nerve fibers that transmit the blood pressure signal. Then the device uses electro-stimulation to overwrite the information in these fibers with such precision that other bundles of fibers with other functions are not affected. The researchers have named this procedure for individual analysis, selection, and stimulation BaroLoop.

So far the scientists have tested their device on five rats and succeeded in lowering their mean blood pressure by 30 percent, without causing side effects such as a reduced heart rate or a drastic decrease in respiratory rate. The findings of the study, which the researchers call a "proof of concept", have been published in the [Journal of Neural Engineering](#).

Further research will have to deal with the fact, that although the number of synchronously firing baroreceptor fibers is larger in humans and will produce a much higher surface potential, the vagal nerve itself also has a larger diameter. "The distance between the recording electrodes and the barofibers is therefore much higher", says Dr. Plachta, "and makes their detection and selective stimulation challenging. We therefore plan to test our electrode in larger animals like sheep and pig" in order to optimize both recording and stimulation algorithms.

Now that the scientists know that a cuff with electrodes is feasible in principle, they have started to develop a completely implantable system. It might, however, still take quite a while, until the device will enter the market because such a device is classed as an active implant. Thus its requirements have to fulfil the highest level of safety standards according to medical product laws – and such a development might take another decade to get a market approval.

By: Ute Eppinger