ETH zürich

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Raising hope for men with erectile dysfunction

From blue pill to blue light

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Taking men's concerns seriously: ETH biotechnologists are developing a bio-tech solution for erectile dysfunction that consists of a gene construct and a blue light.

Erectile dysfunction is a taboo subject among men. No one likes to talk about it. But the fact is that as men age, an increasing number will suffer from erectile dysfunction. From the age of 30, the number of men who have unsatisfactory erections or none at all increases. In the over-60 age group, more than half of all men have been affected by erectile dysfunction.

The main causes include cardiovascular disease, diabetes, hormonal imbalance, neurological disease and the side-effects of medication. Even spinal paralysis can result in patients no longer being able to have erections.

Some men reach for the 'blue pills' to deal with erectile dysfunction. However, Viagra helps only to prolong an erection; it does not actually trigger it. To 'get it up', researchers led by Martin Fussenegger, professor of Biotechnology and Bioengineering at the Department of Biosystems (D-BSSE) in Basel, have now developed a novel biotechnological solution: a gene therapy that triggers reliable erections.

Erection without sexual stimulation

A gene construct that reacts to blue light is injected into the erectile tissue of the penis. As soon as it is exposed to the light, a precursor molecule (guanosine triphosphate or GTP) is converted into the second messenger cyclic guanosine monophosphate (cGMP), which exists naturally in a number of human organs. This allows voltage-dependent calcium channels to close, thereby reducing calcium levels in the cells, which in turn relaxes muscle cells and increases blood flow to the erectile tissue. And so the penis becomes stiff. An enzyme then slowly breaks down cGMP so that the erection wears off with time. The 'blue pill' blocks this enzyme and intensifies and prolongs the erection, but it cannot trigger one.

Thanks to the gene construct, the production of cGMP is not stimulated by sexual arousal but by exposure of the erectile tissue to blue light. "In this way, we circumvent the usual sexual stimulation that triggers a cascade of signals in the body and ultimately leads to an erection," says Fussenegger. With erectile dysfunction, normal sexual stimulation does not lead to an erection.

Animal testing successful

The researchers tested their new development in male rats by injecting the gene construct into the erectile tissue – with good results. In most cases, the blue light acted like a switch that allowed the rats' erection to be 'turned on'. For some of the animals, the stimulation even led to ejaculation.

"The system of an erection is very similar across all mammals," says Fussenegger. He is therefore convinced that the gene construct will also work in humans. Apparently, it appeared very early in evolutionary history and has been preserved. "Even Viagra works on rats. It prolongs the erection's intensity, just as it does in humans."

Great need among sufferers

The ETH professor does not anticipate many side-effects from this type of gene therapy. "Injection of a gene construct should not be a barrier to potential users, as injections in the erectile tissue are already a standard treatment for erectile dysfunction these days," says Fussenegger. The erectile tissue is largely insensitive to pain; it is also for the most part detached from normal blood circulation, so the probability that the gene construct could reach other parts of the body is very low. In addition, cGMP breaks down relatively quickly. As Viagra prolongs the erection, any possible gene therapy could be supplemented by this medication.

An artificially induced erection would satisfy a great need among patients suffering from erectile dysfunction, says Fussenegger. "Several doctors have confirmed this to me," says the ETH professor. In addition, not all sufferers are allowed to take Viagra; for instance, those with known heart disease.

ETH researchers in Basel worked on this gene construct for four years and for the time being it exists only as a prototype; tests in humans have yet to be conducted. However, Fussenegger expects that the principle will become established with humans too, since the system is very easy and inexpensive to use. "Before it can be used as a treatment, it requires highly expensive clinical tests. We are actively looking for partners to put our technology into clinical practice."

Further Information

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