



Scientists Eradicate Gout in Mice

Researchers from the Swiss natural science and engineering university ETH Zurich have developed a self-regulating biological gene network that they believe will make gout and kidney stones a thing of the past.

As humans evolved, we lost an enzyme that helps control levels of uric acid in the body. The enzyme, urate oxidase, is still present in most mammals, working to keep their uric acid in check. Uric acid is a chemical created when the body breaks down purines. Purines are natural substances found in all cells and almost all foods.

In the right quantity, uric acid is a powerful anti-oxidant and an important part of the detoxification process. But when blood levels get too high (over 6.8 mg/dl), the excess uric acid crystallizes into needle sharp crystals in the joints and tissues surrounding the joints, causing a painful form of arthritis known as gout. Excess uric acid can also be deposited in the kidneys as kidney stones.

Determined to reconstruct a system to keep uric acid in check in humans, the ETH researchers put together a biological network of genes they call UREX. The network has three components: a uric acid sensor that constantly monitors uric acid levels, a genetic circuit, and a component that releases urate oxidase into the blood.

The three components are programmed to perform certain functions both independently and in synch with each other, without any outside assistance. When the sensor detects high concentrations of uric acid, it automatically relays that information to the genetic circuit, which triggers the third component to release urate oxidase to lower uric acid levels to a healthy balance.

Amazingly, the gene network is contained in a single cell. Roughly two million of these cells are enclosed in a tiny implantable porous gelatin capsule for protection against an immune system attack. The implant can be removed at any time with no consequence.

ETH Zurich Professor Martin Fussenegger says the "molecular prosthesis" is a prime example of what can be achieved using synthetic biology. "Many medical problems are solved by introducing chemical substances [like gout medication] into the body from outside," he explains, "In our method, we repair a defective metabolic pathway and help the body to treat itself in the best possible way."

UREX has been successfully tested in mice, and the research team has filed a patent application for the gene network. Other partners are now responsible for bringing UREX to market. Fussenegger is confident that UREX will successfully complete the necessary testing in the near future, clearing the way for a finished product to hit the world market - a major development with potential to bring relief to millions of gout sufferers around the world who now rely on gout medication.

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