A test for everything

Sometimes scientists come up with something that sounds almost too good to be true. Like CRISPR-Cas, for example. The biochemist Daan Swarts now has something similar. His test can detect any DNA sequence you can imagine. Now he has received a Proof of Concept grant from the European Research Council to develop the test further. Text Roelof Kleis ◆ Illustration Shutterstock

The test is based on a bacterial immune system that was first discovered three years ago. That system, which is called SPARTA, is very good at recognizing specific foreign DNA sequences that penetrate the bacterial cell, says Swarts, 'for example, the DNA of a virus or a plasmid, a circular piece of DNA. The SPARTA system recognizes the infection and takes action accordingly.'

'Like CRISPR-Cas, SPARTA uses a piece of RNA as a guide to track down the foreign DNA,' continues Swarts. 'In this case, it's a strand of 21 nucleotides, a sequence of genetic letters. That lets the system recognize the associated foreign DNA.'

Instead of cutting the DNA at that point (as a lot of CRISPR-Cas systems do), SPARTA then breaks down NAD+, a molecule that is important in producing the cell's energy. The cell then dies.

Choose your own DNA

'That might seem a pretty worthless immune system for the infected bacterium,' says Swarts, 'but it does prevent the virus from spreading. And that protects the bacterial population.'

The way the system works got Swarts and his colleagues thinking. 'You can easily reprogram the system to detect a DNA sequence of your own choosing, for example one from a pathogenic bacterium or virus or mutated DNA. The guide strand is only 21 letters long, making it easy to synthesize.'

In bacteria, the cell's death is evidence of the virus being detected. Swarts: 'But for diagnostic purposes, you want to detect the DNA in a test tube containing a blood sample or saliva. Instead of breaking down NAD+ we use a chemical analogue that fluoresces when broken down. You can easily measure that signal using a device you attach to your mobile phone.'

Swarts knows it works in the lab. Now that he has this grant, he can set a postdoc to work for a year to develop the concept into an application that uses real samples. 'The grant helps you progress onto a partnership with companies or more applied funding. In fact, the postdoc will be spending one day a week on business development, for example in the form of a collaboration or our own start-up. All options are open at this point.'

Patent

In view of this, a patent application was been submitted for the new method before the details were published. Swarts: 'Without that protection, you run the risk no one will want to invest money in further development. I am also talking to businesses. It's a new experience for me and I'm learning a lot. This should offer new opportunities for collaboration and funding, and will also help turn this fundamental research into a genuine application.'