ALTRUISM IN BACTERIA

A sister system to the better-known, Nobel prize-winning CRISPR-Cas9 system is displaying even more impressive capacities: the CRISPR-Cas type 3 system can actually cut RNA, which suggests promising opportunities for diagnostics. At the beginning of February, microbiologist Raymond Staals published an article about it in *Science*.

The Cas9 system came to fame as a useful molecular tool for cutting and pasting DNA with great precision. Researchers discovered the system in bacteria in 2012. The benefit to bacteria lies in the way the system helps them resist viruses because it recognizes the viruses and shreds them .

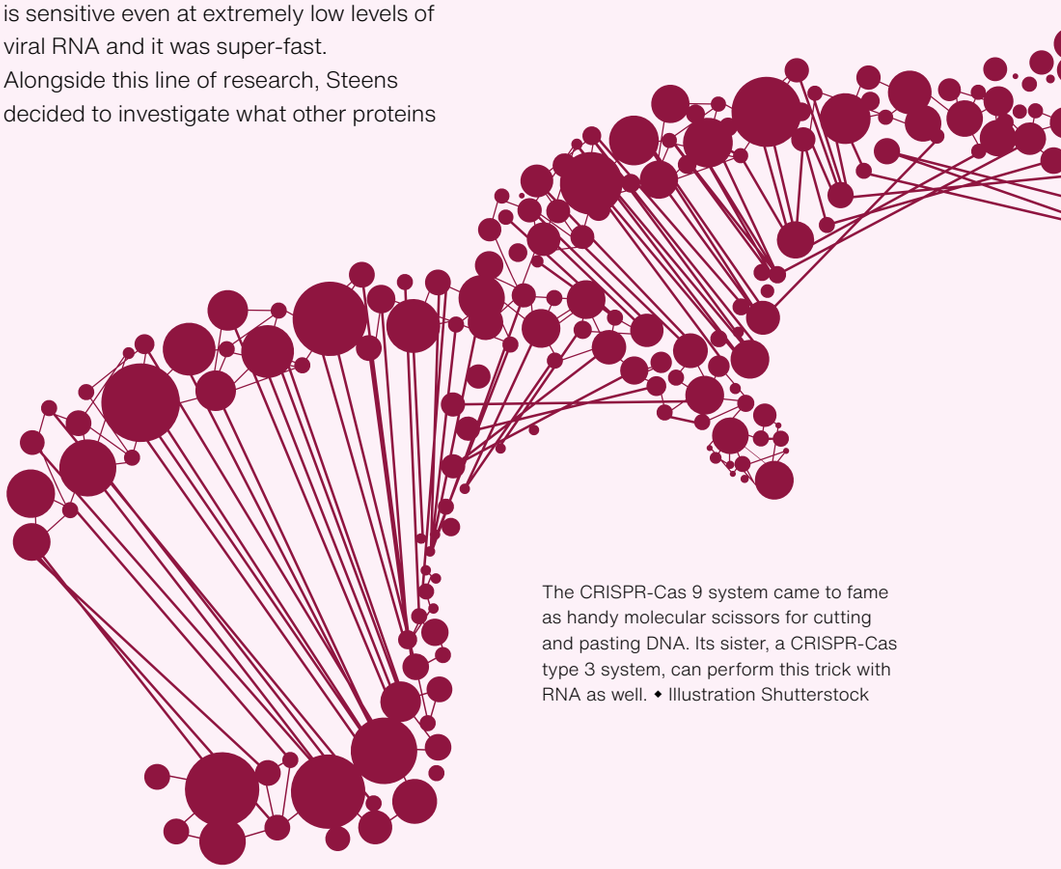
The sister system, a CRISPR-Cas type 3 system, does the same trick with RNA, the mobile copy of DNA. ‘Cutting the RNA is actually a rather illogical strategy on the cell’s part,’ says Staals, ‘because a virus keep on making new RNA from the DNA.’ Staals and his colleagues discovered that bacteria produce many signalling molecules simultaneously, activating a particular protein group with a common characteristic: they destroy critical biomolecules such as DNA, RNA and proteins in the invading virus, but also in the bacterium itself. ‘The bacterium commits suicide,’ Staals explains.

The bacterium prevents itself from becoming a virus factory for further proliferation

This discovery brought a significant insight. It appears that researchers have in fact misunderstood CRISPR-Cas all these years. ‘It does not kill the virus, it kills the bacterium itself. In this way, the bacterium prevents itself from becoming a virus factory for further proliferation. It’s a kind of altruism on the part of the bacteria cells.’ To date, CRISPR-Cas9 appears to be the exception to this general rule, as type 9 doesn’t trigger a suicide mechanism.

Specific and sensitive

PhD candidate Jurre Steens, the lead author of the study, discovered that this system can also be used in diagnostics. The system gives off a signal after identifying a specific piece of virus RNA. The researchers tested it on Covid-19 and the results were unprecedentedly positive: the COVID RNA fragment is recognized more accurately than in other diagnostic tests. It is sensitive even at extremely low levels of viral RNA and it was super-fast.
Alongside this line of research, Steens decided to investigate what other proteins may be activated with the bacteria’s own molecules from the CRISPR-Cas type 3 system. Something extraordinary occurred in one of these proteins. He added the signalling molecule to a test tube with the protein, which changed into a milky fluid within seconds. ‘We didn’t expect that.’ A chain reaction produced a large protein complex, which, in turn, activated a different protein that cut up a lot of molecules in the cell. ‘We jokingly called it “Destroyer of Worlds” in the lab. But don’t worry, the cell has a smart feedback system to halt these destroyers in time.’ And this system bears a striking resemblance to apoptosis, a cellular process that plays an instrumental role in clearing up cancer cells. ‘Who knows how it might contribute to that,’ Staals concludes. TANJA SPEEK



The CRISPR-Cas 9 system came to fame as handy molecular scissors for cutting and pasting DNA. Its sister, a CRISPR-Cas type 3 system, can perform this trick with RNA as well. ◆ Illustration Shutterstock