BIOMATERIALS

# CRISPR turns gels into biological watchdogs

*Gene-editing tool used to trigger smart materials that can deliver drugs and sense biological signals.*

BY EWEN CALLAWAY

Is there anything CRISPR can't do? Scientists have wielded the gene-editing tool to make scores of genetically modified organisms, as well as to track animal development, detect diseases and control pests. Now, they have found yet another application for it: using CRISPR to create smart materials that change their form on command.

The shape-shifting materials could be used to deliver small molecules, and to create sentinels for almost any biological signal, researchers reported on 22 August (M. A. English *et al. Science* **365**, 780–785; 2019). The study was led by James Collins, a bioengineer at the Massachusetts Institute of Technology in Cambridge.

Collins's team worked with water-filled polymers that are held together by strands of DNA, known as DNA hydrogels. To alter the properties of these materials, Collins and his team turned to a form of CRISPR that uses a DNA-snipping enzyme called Cas12a. (The gene editor CRISPR–Cas9 uses the Cas9 enzyme to snip a DNA sequence at the desired point.) The Cas12a enzyme can be programmed to recognize a specific DNA sequence. The enzyme cuts its target DNA strand, then severs single strands of DNA nearby.

This property allowed the researchers to build a series of CRISPR-controlled hydrogels containing a target DNA sequence and single strands of DNA, which break up after Cas12a recognizes the target sequence in a stimulus. The break-up of the single DNA strands triggers the hydrogels to change shape or, in some cases, completely dissolve, releasing a payload (see 'CRISPR-controlled gel').

## SMART OBJECTIVES

The team created hydrogels programmed to release enzymes, small molecules and even human cells — for instance, as part of a therapy — in response to stimuli. Collins hopes that the gels could be used to make smart therapeutics that release, for example, cancer drugs in the presence of a tumour, or antibiotics around an infection.

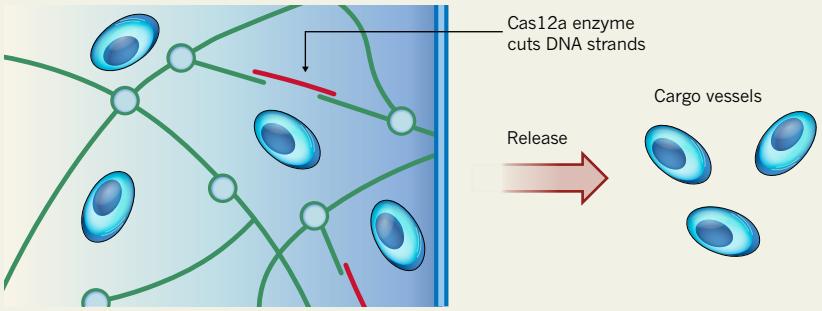
The researchers also integrated CRISPR-controlled hydrogels into electronic circuits. In one approach, they placed hydrogels inside a small chip-like device called a microfluidic chamber that was linked to an electronic circuit. The circuit switched off in response to the detection of genetic material from pathogens including the Ebola virus and methicillin-resistant *Staphylococcus aureus* (MRSA). The team even used the hydrogels to develop a prototype diagnostic tool that sends a wireless signal when it recognizes genetic material from Ebola in lab samples.

Dan Luo, a bioengineer at Cornell University in Ithaca, New York, says that the CRISPR hydrogels are an improvement on other responsive hydrogels because scientists can easily determine what triggers a change in the material.

"We're in the CRISPR age right now," Collins says. "It's taken over biology and biotechnology. We've shown that it can make inroads into materials and bio-materials." ■

### CRISPR-CONTROLLED GEL

Researchers have created a smart hydrogel material that is held together by DNA. The CRISPR–Cas12a protein cuts the DNA strands, changing the gel's shape, which can be controlled to release drugs, particles or even switch an electronic circuit.




DENMARK

# Geologist's sacking prompts outcry

*Tenured professor dismissed from University of Copenhagen.*

BY QUIRIN SCHIERMEIER

For the second time in three years, geoscientists are protesting against the dismissal of a geologist from the University of Copenhagen.

The management of the university's science faculty dismissed Irina Artemieva, a tenured professor and internationally esteemed specialist in lithospheric geophysics, on 29 July — saying that she has repeatedly failed to fulfil various administrative and teaching duties. They allege that she has failed to use the appropriate calendar to plan holidays; travelled to conferences without approval; and caused inconvenience to examination and teaching schedules. "Your actions and behaviour have had a negative impact on the performance of your duties relating to teaching and research activities in overall terms," the faculty told Artemieva in the July letter informing her of her dismissal.

Artemieva denies the accusations, and defended herself in a 128-page document sent to the faculty of science after the management informed her in May that it was contemplating her dismissal. She says that all her external work activities, including field trips, conference attendance and editorial work, are standard professional undertakings that she has documented as required by the university's rules.

An international group of 32 geoscientists says that the university's action is problematic because the reasons given do not warrant the dismissal of a tenured professor, by international academic standards. This — combined