GENE EDITING: THE TINY ENZYMES WITH GREAT POTENTIAL

Unusually small enzymes from extra-large viruses allow the CRISPR–Cas gene-editing system to slip into cells and target a broad range of genetic sequences — a finding that could help in manipulating genomes more easily than before.

The CRISPR–Cas complex used in labs worldwide originated in bacteria. It serves as a bacterial immune mechanism, recognizing viral DNA and directing Cas enzymes to cut it. A variation on the standard CRISPR–Cas system is found in the ‘Biggiephages’, a class of virus that infects bacteria. These viruses have extra-large genomes, but their Cas enzymes are about half the size of those in other CRISPR–Cas systems.

Jennifer Doudna at the University of California, Berkeley, and her colleagues found that the Biggiephage Cas enzymes can be programmed to target a wider range of DNA sequences than can conventional Cas proteins. They can also be delivered into cells easily — a boon for CRISPR-based therapies, because getting the gene-editing machinery to where it’s needed in the body is a major challenge.

The enzymes, which can edit genes in human and plant cells, are a powerful addition to the CRISPR–Cas toolbox, the researchers say.

Science 369, 333–337 (2020)

HOW PIGS CAN BREATHE NEW LIFE INTO HUMAN LUNGS

Damaged human lungs could be rejuvenated to allow for transplantation into people if the organs were hooked up to a pig’s circulatory system.

Matthew Bacchetta at Vanderbilt University in Nashville, Tennessee, Gordana Vunjak-Novakovic at Columbia University in New York City and their colleagues collected five human lungs that had been deemed unsuitable for transplant because of acute damage. The researchers also gave immunosuppressant drugs and a component of cobra venom to five pigs to prevent the animals’ immune systems from attacking the human lungs after they were linked together.

Next, the team connected the lungs’ blood vessels to the pigs’ jugular veins and allowed their blood to intermix for 24 hours. When the researchers examined the human lungs afterwards, they found that the organs’ structure and function had improved enough to make them suitable for transplant. They have not yet performed human trials.

Using this method to increase the number of healthy lungs available could cut the length of time people wait for transplants, the authors say.

Nature Med. 26, 1102–1113 (2020)

DEEP DYE MAKES FROGS MASTERS OF DISGUISE

The vivid blue-green hue of hundreds of frog species allows the animals to ‘disappear’ amid green foliage — thanks to a molecular trick that arose multiple times in amphibian history.

Green vertebrates are generally thought to get their coloration from pigment-bearing cells in their skin. But many tree frogs lack these cells. These frogs are green because their translucent bodies show off blood, bones and other internal tissues that are coloured by high levels of the green pigment biliverdin.

To understand the phenomenon’s origins, Carlos Taboada at the University of Buenos Aires and his colleagues extracted lymph and other fluids from the polka-dot tree frog (Boana punctata, pictured). They traced the creatures’ blue-green coloration to a previously unknown protein that binds to and transports biliverdin. The team found similar proteins in the lymph of eight other tree frog species.

The researchers studied the plants where B. punctata rests during the day or perches at night and realized that the frog’s colour and brightness closely match that of the vegetation. The biliverdin-binding protein allowed for evolutionary fine-tuning of the frog’s coloration, causing the creature to ‘vanish’ in the forest.

Proc. Natl Acad. Sci. USA http://doi.org/d35k (2020)

EXTREME ARCTIC WAVES SET TO HIT NEW HEIGHTS

Climate change will swell the highest waves in the Arctic Ocean, endangering people who live and work in coastal areas.

As Earth warms, sea ice melts and wind patterns shift. In the Arctic, loss of sea ice allows winds to build waves higher, especially during autumn storms.

Mercè Casas-Prat and Xiaolan Wang at Environment and Climate Change Canada in Toronto used five climate models to simulate how such changes might affect Arctic waves in the last two decades of this century. They found that in an extreme future scenario in which greenhouse-gas emissions continue to soar, the maximum wave height will increase by up to 6 metres offshore and by up to 3 metres along coastlines. The biggest changes are expected in the Arctic Ocean and the Greenland Sea.

Along the Beaufort Sea’s coastline, the annual chance of damaging extreme waves will rise from the 1 in 20 chance seen towards the end of the twentieth century to between 1 in 5 and 1 in 2 by 2100. Extreme waves are a threat not only to coastal towns, but also to infrastructure, such as the Northstar oil platform (pictured) in the Beaufort Sea.

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