ETH zürich

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GLOBE

FOCUS

GETTING PEOPLE MOVING

How machines are restoring quality of life

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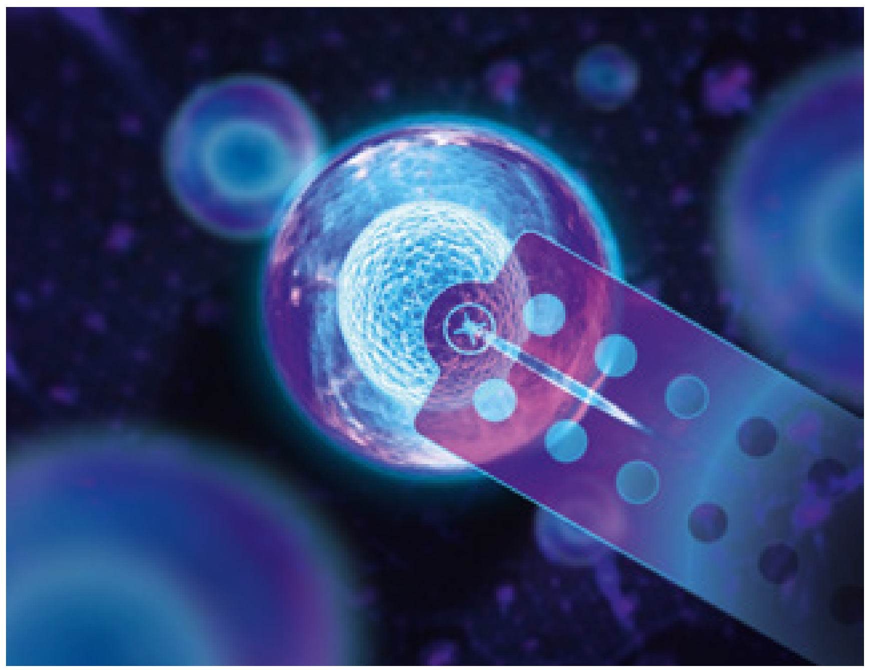
Revolutionary technique

EXTRACTING INDIVIDUAL LIVING CELLS

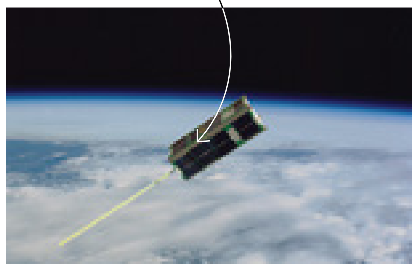
Biologists are increasingly interested in the behaviour of individual cells as opposed to whole groups of cells. Researchers at ETH Zurich have developed a new technique that could revolutionise this sort of single-cell analysis. Using the technique, scientists can prick individual living cells with a tiny syringe and extract their contents. “Our technique is a huge boost to biology research – a new chapter, if you will,” says Julia Vorholt, Professor in the Department of Biology.

Thanks to the new technique, researchers can sample individual cells of a tissue culture directly in the Petri dish, allowing them to study questions such as how a cell affects its neighbouring cells in a cell group. In addition, the microsyringe is so precise that the researchers can specifically target either the contents of the cell nucleus or the fluid surrounding it, cytosol. The researchers can also pinpoint the quantity they extract with extreme precision – accurate to a tenth of a picolitre, which is one ten billionth of a millilitre. To put it into perspective, the volume of a cell is ten to a hundred times larger than that.

The new cell extraction method is based on the FluidFM microinjection system developed at ETH Zurich over the last few years – the smallest syringe in the world. Vorholt and her team then developed the system further to be able to extract cell contents.



The researchers can precisely determine the quantity to be extracted from the cell.



Power electronics

HIGH-SPEED

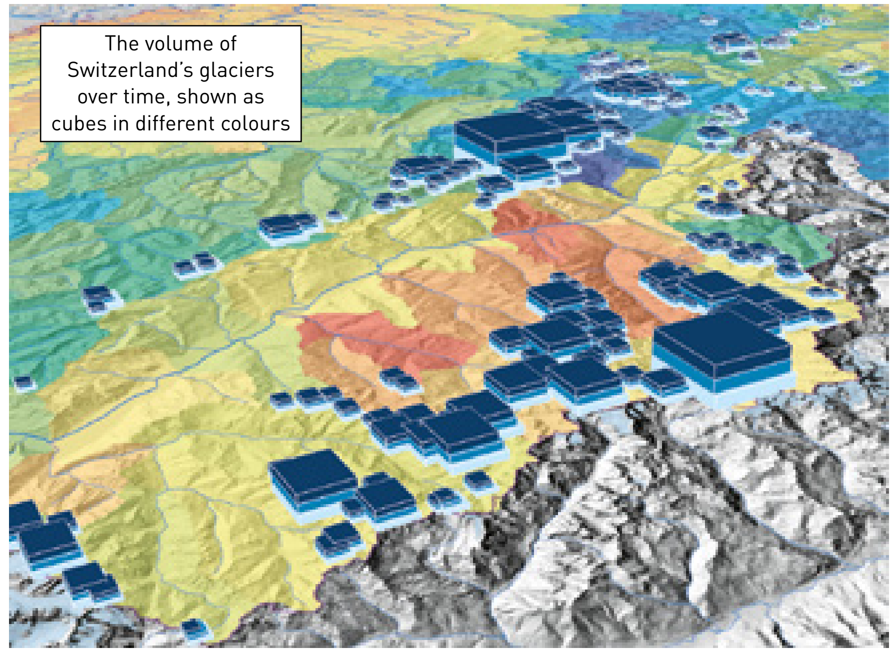
Reaching a dizzying 150,000 revolutions a minute: researchers at ETH Zurich’s Power Electronic Systems Laboratory (PES) headed by Professor Johann Kolar have teamed up with colleagues from ETH spin-off Celeroton to develop an ultrafast, magnetically levitated electric motor for reaction wheels. Because the rotor is magnetically levitated – instead of using conventional ball bearings – the drive system can be significantly reduced in size, making it attractive for use in small satellites.

Epigenetics

OVERCOMING THE SYMPTOMS OF TRAUMA

Traumatic childhood experiences can lead to later behavioural disorders. These symptoms can be reversed in mice, provided that they live in a positive environment in adulthood, as a team of researchers headed by Isabelle Mansuy, Professor for Neuroepigenetics at the University of Zurich and ETH Zurich, has successfully shown. This allowed them to conclude that environmental factors can correct irregularities in behaviour that would otherwise be passed on to the next generation.

Image: ETH Zurich; Rick Kohnert



New Atlas of Switzerland

ONLINE ACCESS TO 3D MAPS

For the first time, ETH Zurich’s Institute of Cartography and Geoinformation is making its multi-award-winning *Atlas of Switzerland* available online free of charge. The previous CD version has been overhauled with a new design for the user interface and menu structure in accordance with the principles of user-centred design. This allows users to call up maps quickly and intuitively, and now in 3D too. Users can download the Windows app for free, and a Mac version is in development.
www.atlasderschweiz.ch

Mountain regions

FLOODS VS. DROUGHT

The Himalayas and Andes feature mountains over 6,000 metres high, plus glaciers, and climate models for the remainder of the century indicate that both regions will experience similar increases in annual mean temperatures. Despite these similarities, the water balance in the two regions is likely to develop differently. People in Nepal can expect to be faced with high water levels, while Chile should be prepared for long periods of drought. These are the findings of researchers from ETH Zurich and the University of Utrecht, who have thoroughly examined the water balance of both mountain regions using measurement data and climate models.

Electrochemical materials

SOLID BATTERIES IMPROVE SAFETY

Lithium-ion batteries can store a lot of energy in an extremely small space, making them the power source of choice for mobile electronics such as mobile phones and laptops, and even e-bikes and electric cars. However, lithium-ion batteries are not without their dangers, and there have been multiple instances of mobile phone batteries exploding, injuring their owners. Now, researchers from ETH Zurich have developed a type of battery that, unlike conventional lithium-ion batteries, relies solely on solid chemical bonds and is non-flammable.

In traditional lithium-ion batteries, the positive and negative terminals – the two electrodes – are made from solid conductive material; the charge then moves between them in a liquid or gel electrolyte. If these batteries are charged incorrectly or left out in the sun, their liquid can ignite. This is in contrast to the solid-state batteries currently being developed in laboratories around the world. In this case, the electrolyte is also made of solid material and cannot catch fire.

Led by Jennifer Rupp, Professor for Electrochemical Materials, ETH researchers have developed just such a battery, using a layer of a compound containing lithium (lithium garnet) as the solid electrolyte. “Thanks to the solid electrolyte, we can operate batteries at a higher temperature and build thin-film batteries,” says Rupp. “These batteries could revolutionise the energy supply of portable electronic devices.”

Image: Atlas of Switzerland