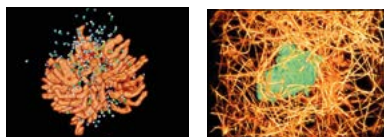


Sciencewatch

COMPILED BY JOHN SWAIN, NORTHEASTERN UNIVERSITY

Super-resolution microscope makes movies

Eric Betzig, of the Janelia Research Campus of the Howard Hughes Medical Institute in Virginia, shared the 2014 Nobel Prize for Chemistry for the invention of super-resolution microscopy. Now, he and his colleagues have taken the technique a step further. They have extended light-sheet microscopy to use ultrathin light sheets from 2D optical lattices to scan plane by plane through a specimen to build up a 3D image at up to 1000 frames



per second. The reduced illumination also has the advantage of causing minimal specimen damage, so cells and small embryos can be filmed as they go about their lives, as the researchers demonstrate

Stills from two of the movies following cell division, left, and cell movement through a matrix.

for 20 biological processes covering four orders of magnitude in space and time.

• Further reading

Bi-Chang Chen *et al.* 2014 *Science* **346** 439. For the movies, visit <http://vimeo.com/album/3098015>.

Long-range tractor beam

A Star Trek-like tractor beam able to stably push or pull semitransparent gold-coated glass spheres over tens of centimetres has been developed by Vladen Shvedov of the Australian National University in Canberra and colleagues. They use a laser beam with a doughnut-shaped profile (with a hole down the middle) to hold the sphere. Then, by adjusting the polarization of the same beam (azimuthal or radial), they can have energy absorbed mainly on the sphere's front side, heating it so that it ejects warm air and is pushed along the beam, or at the rear side, so that the warm air pushes back and the tractor beam exerts a pull. This is the first working long-range tractor beam that both pushes and pulls.

• Further reading

V Shvedov *et al.* 2014 *Nature Photonics* **8** 846.

Oxygen and the boring billion

In the beginning...the Earth had essentially no free oxygen in its atmosphere. The Great Oxygenation Event came around 2000 million years ago, when cyanobacteria produced enough oxygen for it to accumulate, but only in the past 800 million years did an explosion of multicellular animal life take place. The intervening period of not much happening is often called, rather approximately, "the boring billion". Now, Noah Planavsky of Yale University and colleagues have shown that it coincides with a low atmospheric oxygen content, improving previous upper limits by at least an order of magnitude. Looking at the oxidation of chromium isotopes in ancient sediments, they found that oxygen levels were only 0.1% of those today – while associated with the boring billion, this is not boring at all.

Hot solar explosions

Just above the surface of the Sun lies the relatively cool photosphere, at around 6000 K, but it turns out to host some remarkably hot explosions. Using the Interface Region Imaging Spectrograph (IRIS), Hardi Peter of the Max Planck Institute for Solar System Research in Göttingen and colleagues report pockets of plasma heated to almost 100,000 K for a few minutes. Presumably from magnetic reconnection, these explosions have 0.1–1% of the energy of a flare, making the brightest ones an order of magnitude more energetic than the microflares known as "Ellerman bombs". This new finding contributes to an ever more complex view of the photosphere.

• Further reading

H Peter *et al.* 2014 *Science* **346** 1255726.

• Further reading

N J Planavsky *et al.* 2014 *Science* **345** 635.

Hope for a diabetes cure

For the first time, human stem cells have been converted into insulin-producing pancreatic β cells. Douglas Melton of the Harvard Stem Cell Institute and colleagues report on a complex process that over 35 days produces some 200 million β cells, which would be enough, in theory, to treat a human patient. Transplanted into mice, the β cells work, secreting human insulin and improving hyperglycemia in diabetic mice. In human diabetics, these cells might still be destroyed in the person's immune system, like the original β cells, but recipients of transplanted cadaveric human tissue transplants have been insulin-free for five years – a procedure that is limited owing to the scarcity of suitable donor

tissue. While not yet a cure, this is the first example of making functional, transplantable insulin-producing human cells, and of the importance of continuing stem-cell work.

• Further reading

FW Pagliuca *et al.* 2014 *Cell* **159** 428.

Genetic tools on paper

The term "on paper" often means "theoretically", but James Collins of Harvard University, Boston University, and the Howard Hughes Medical Institute in Maryland and colleagues have shown that working biological circuits can be printed on paper. They produced cell-free gene networks made from off-the-shelf parts and freeze-dried onto paper. When rehydrated, these worked as diagnostic devices with a colorimetric output, capable of detecting glucose and distinguishing RNA fragments from two related species of the Ebola virus.

• Further reading

K Pardee *et al.* 2014 *Cell* **159** 1.

Oxygen – less space is more

An oxygen cylinder holds more gas if filled first with a sponge-like powder. Jared DeCoste of Leidos, Inc. in Maryland and colleagues searched among 10,000 metal-organic frameworks using a Monte Carlo simulation, and found two that increase the capacity of an empty cylinder by 89% and 114% at a pressure of 140 bar. This should allow for smaller, lighter oxygen tanks that require lower pressures, and has implications for divers, fighter pilots, astronauts, and anyone who needs medical oxygen.

• Further reading

J B DeCoste 2014 *Angew. Chem. Int. Ed.* **53** 1.

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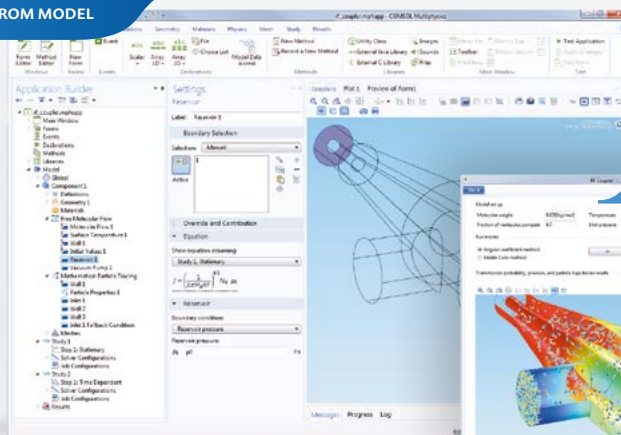
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