Abstractions

FIRST AUTHOR

Have you ever noticed that when you buy, say, a red convertible, every other car on the road suddenly seems to be a red convertible? According to findings by Marius Peelen and his colleagues in the psychology department of Princeton University in New Jersey, neural mechanisms in the visual cortex are responsible for the phenomenon. When the researchers tested neural responses in the visual cortices of volunteers who had been instructed to look for certain objects in photographs that flashed up on a screen, they discovered that people are extremely adept at spotting objects of interest, even in situations in which the items are difficult to find (see page 94). He tells *Nature* why.

How did you conduct your experiment?

We tested neural activity in volunteers' visual cortices during two tasks using functional magnetic resonance imaging. In the first task, the volunteers were shown isolated images of cars and people; in the second, they were asked to try to spot a car or person during brief viewings of complex real-life photos. Their visual-system responses were very similar in both situations. This tells us that the visual cortex can filter out, or ignore, irrelevant visual information.

What was the most striking result?

We flashed four photos up on the screen simultaneously and told volunteers to look for cars or people in two of the photos, and to ignore the other two. But the volunteers' cortical activity was high regardless of whether the specified objects were in the photos that they were supposed to be watching or in those they had been told to ignore. Thus, they visually registered the cars or people in photos they were trying to ignore, even though they didn't consciously realize it.

What does this mean for real-life situations?

That you can quickly detect things you are looking for by biasing the processing of a scene in favour of those objects. For example, after buying a red convertible, you may select items in a scene that are similar to your new interest, red convertibles. Looking for someone in a crowd may follow the same basic mechanism. Knowing what you are looking for primes the visual system in favour of objects similar to your 'search template'.

Is there a downside to this phenomenon?

It might result in your missing useful things that you are not actively searching for. For example, you might walk up and down supermarket aisles looking for sugar until you find it. Then, if you also want coffee, you might have to check all the aisles again, even though you may have passed the coffee minutes earlier. ■

MAKING THE PAPER

Juan Carlos Izpisúa Belmonte

Healthy cells derived from diseased ones offer treatment hope.

In 2006, scientists in Japan rocked the biomedical world when their manipulations prompted mouse skin cells to revert to an embryonic-like state, from which they could potentially be turned into any type of body cell. The cells were dubbed induced pluripotent stem (iPS) cells, and the following year two groups successfully generated human iPS cells. These could obviate the need to destroy human embryos to generate stem cells, and may offer a new way to treat human diseases using a patient's own cells.

A group of scientists led by Juan Carlos Izpisúa Belmonte, a developmental biologist at the Salk Institute for Biological Studies in La Jolla, California, wasted no time in testing whether iPS cells could one day replace diseased cells in patients with Fanconi anaemia. This inherited blood disorder results from mutations in any of 13 known genes, the products of which maintain genetic stability. It can lead to bone-marrow failure, cancer and other problems. As a first step, the team has demonstrated that a patient's skin cells can be turned into disease-free blood-cell progenitors that could potentially be transplanted into humans.

Izpisúa Belmonte's previous research, which focused on understanding how some animals — such as frogs and salamanders — are able to regenerate limbs, fuelled his foray into human stem-cell research. To negotiate this new territory, he partnered with basic scientists and clinicians in Spain, Italy and California. "For someone with my background to help to produce this type of focused regenerative-medicine study speaks to the importance of collaboration in science," he says.

The team's first task was to turn skin cells from a patient with Fanconi anaemia into iPS cells. The researchers used viruses to introduce four 'reprogramming' genes into the cells, but repeated efforts with the Fanconi anaemia cells didn't work. One team member pointed out that the cells might have too many abnormalities to be successfully reprogrammed. "We realized that we had to correct the genetic defects first," says Izpisúa Belmonte. To do so, they used viral vectors to introduce corrected versions of two of the Fanconi anaemia genes into cells.

Once the genetic defects had been corrected, the group was able to generate iPS cells. Turning these cells into progenitors of healthy blood cells was relatively straightforward. However, it did take several attempts to work out the experimental details, because there was no well-established protocol. Eventually, though, the group succeeded — creating the first patient-specific, disease-corrected cells (see page 53).

"We cured a cell, but we haven't cured a patient," says Izpisúa Belmonte, calling this work a "proof of principle". One crucial hurdle remains. Introducing foreign genes — such as those used to reprogram skin cells — can cause tumours to form, a particularly troublesome side effect for the already tumour-prone individuals with Fanconi anaemia. "Before this technology can be brought into the clinic, we will have to be able to generate cells that do not produce tumours," says Izpisúa Belmonte, "or find a way to readily kill any potentially tumorigenic cell before transplanting them into patients."

But he remains cautiously optimistic that it can be done. "Just a few years ago, the ability to reprogram mature cells caused the entire community to change its perspective, so you never know where the science will lead," he says. ■

FROM THE BLOGOSPHERE

Throw away those chemistry lab-course 'cookbooks', says Aaron Finke, guest blogger at The Sceptical Chymist (http://tinyurl.com/lvjw5q).

A graduate student in organic chemistry at the University of Illinois in Urbana-Champaign, Finke recently oversaw an organic chemistry lab course attended primarily by students aiming to study medical or veterinary science. The absurdity of having students perform basic extractions, chromatography and syntheses was not lost on Finke: "It is highly unlikely they will actually use the specific skills implemented in the course, unless they plan on distilling their own whiskey!" Furthermore, the course failed to deliver what students should be learning — the process of scientific inquiry, how scientific knowledge is validated and exposure to modern chemistry instrumentation such as nuclear magnetic resonance (NMR) and mass spectroscopy.

One commenter on the the post reported learning how to gather NMR and mass-spectroscopy data on an organic chemistry course, so the tide may be turning. In his next post, Finke will explore how some educators are looking to make such courses more relevant. ■

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