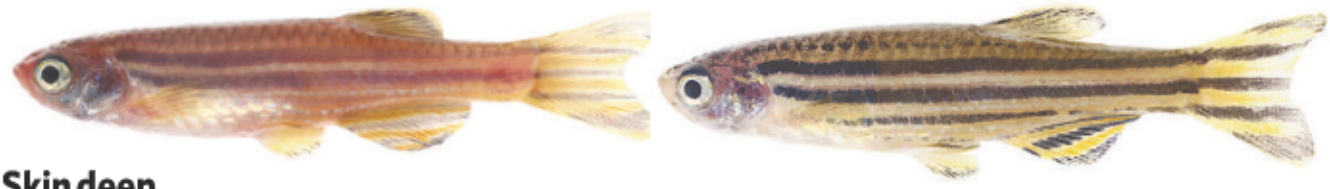
RESEARCH HIGHLIGHTS



SCIENCE

Skin deep

Science **310**, 1782–1786 (2005)

Geneticists say they have identified a gene that plays a role in determining differences in people's skin colour.

Previous studies have identified many gene changes responsible for rare disorders such as albinism. But now, Keith Cheng at the Pennsylvania State University College of Medicine in Hershey and his colleagues have found a gene variation that explains 25–38% of the difference in skin colour between populations of European and African ancestry.

The key clue came from zebrafish (*Danio rerio*) whose skin colour was lighter than normal. Such fish had a mutation causing a shortening of the pigmentation protein Slc24a5. Darker fish had a longer version of the same protein. A single mutation in the human *SLC24A5* gene was found to be shared by people with light skin.

PHOTONICS

Photons learn to crawl

Phys. Rev. Lett. **95**, 253601 (2005)

Slowing down light has become a party trick for physicists. They have previously brought it to a virtual standstill by exploiting exotic optical properties in various media, turning them into 'optical molasses'. An ordinary ruby crystal, for example, will slow light down to about 50 metres per second.

Now Pengfei Wu and Devulapalli Rao of the University of Massachusetts in Boston have shown that the optical properties of the bacterial light-absorbing pigment bacteriorhodopsin, embedded in a thin polymer film, can be manipulated with a laser beam to slow pulses in a second beam to just 0.09 millimetres per second.

Cheap and versatile, these films could have applications in optical technology, such as switching.

BIOTECHNOLOGY

Bumper crop

Nature Biotechnol. doi:10.1038/nbt1173 (2005)

Scientists trying to breed high-yielding crops often find that traits that boost growth are offset by side effects that compromise the plant's yield. A team in Japan reports a way around this problem in rice, and says the findings could be adapted to improve other cereal crops, reducing the need for artificial fertilizers.

Tomoaki Sakamoto of the University of Tokyo and his colleagues screened rice plants for mutations that made the leaves grow at a more erect angle. This should reduce the shade cast on the lower leaves of the plant, increasing photosynthesis. One such mutation improved grain yield when the rice was densely planted, without weakening the plants. The affected gene produces a plant hormone that could be targeted in other crops.

CHEMISTRY

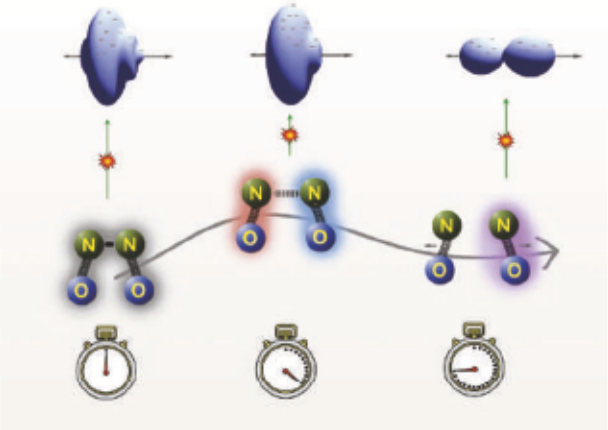
Quick as a flash

Science doi:10.1126/science.1120779 (2005)

Short flashes of laser light lasting mere femtoseconds (10^{-15} seconds) can reveal the progress of chemical reactions by providing snapshots of changing molecules. But the random orientations of these molecules tend to cloud the picture.

Now a team led by Albert Stolow at the National Research Council Canada in Ottawa has used spectroscopic techniques to watch the dissociation of nitric oxide dimers from an individual molecule's point of view, thus removing the randomizing effect.

The observations reveal previously obscure details about how the electron cloud around the molecule changes shape (pictured) during the transformation, offering potential for 'filming' the details of chemical processes.



Firing ultra-short pulses of laser light at nitrogen molecules shows how the electron cloud (top) changes as the two atoms pull apart.

CANCER BIOLOGY

Divide on regardless

Cancer Cell **8**, 479–484 (2005)

Immature cells and stem cells are more likely than specialized cells to go ahead and divide if their chromosomes are entangled, making them naturally more prone to becoming cancerous, say researchers.

Timothy Bestor of Columbia University in New York and his colleagues studied multipotent progenitor cells — which divide to give rise to more specialized cells — in humans and mice. They used a drug to block the action of an enzyme that normally disentangles chromosomes, and found that a greater proportion of progenitor cells pressed on with cell division, compared with similarly treated specialized cells.

Cells that divide regardless produce daughters with damaged and abnormal chromosomes. The research team suggests that such aberrations could help to give rise to cancer stem cells, a subset of tumour cells thought to be the driving force in cancer development.

MICROBIOLOGY

Romping *Rickettsia*

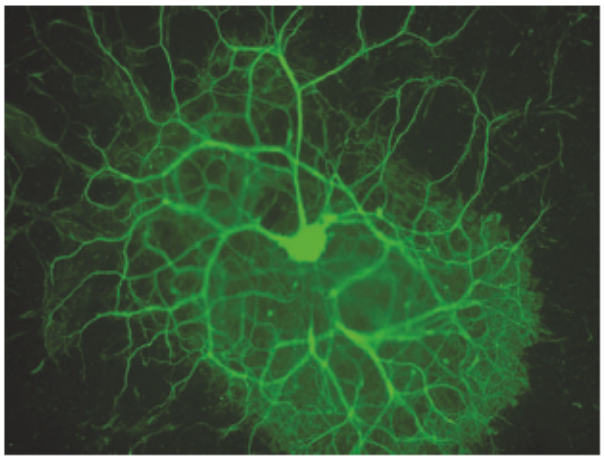
SCIENCE

Cell **123**, 1013–1023 (2005)

The bacterium that causes life-threatening Mediterranean spotted fever uses a molecular stooge to get inside cells, say researchers in France. *Rickettsia conorii* is transmitted by ticks and has been classified as a possible bioterrorism agent. But how it penetrates mammalian host cells has long been a mystery.

Pascale Cossart from the Pasteur Institute in Paris and her colleagues have now identified two key

proteins involved in the process — mammalian Ku70 and bacterial rOmpB. Ku70 is normally found in the nucleus of mammalian cells. But it can also move to the cell membrane, where *Rickettsia*'s rOmpB protein can grab it and use it to invade the cell.



PROC. NATL ACAD. SCI. USA

STEM CELLS

Wired for action

Proc. Natl Acad. Sci. USA **102,** 18638–18643 (2005)

Human embryonic stem cells can form functional adult neurons when implanted into mouse embryo brains. It has been shown before that such cells can form neurons *in vitro* (pictured above) or when transplanted, but not that they could respond to signals within the mouse brain to form electrically connected neurons.

An international team headed by Fred Gage at The Salk Institute for Biological Studies in La Jolla, California, found that, when injected into the mouse brain, human embryonic stem cells specialized to form neurons and supporting glial cells.

The researchers performed electrical recordings on brain slices from these mice and found that the human neurons had similar electrical properties to regular mouse neurons, and transmitted electrical impulses when stimulated.

MEDICINE

Gut feeling

J. Exp. Med. **202,** 1703–1713 (2005)

Carbon monoxide is toxic at high concentrations, but inhaling small quantities of this gas may give relief to patients with diseases of the gut, say researchers.

Cigarette smoke has been known for decades to protect against chronic ulcerative colitis, an inflammation of the gut triggered by intestinal microbes. Now Scott Plevy and his colleagues at the University of Pittsburgh, Pennsylvania, and Harvard Medical School in Boston, Massachusetts, report that the carbon monoxide in the smoke could account for the protective effect.

In mouse studies, they found that inhaling the gas inhibits production of the immune-cell protein IL-12, which drives gut inflammation. Although carbon monoxide is already known to inhibit acute inflammation, this study is the first to show that it can inhibit established chronic inflammation.

CELL BIOLOGY

A light stretch or bend

Nature Chem. Bio. doi:10.1038/nchembio756 (2005)

Protein channels in the cell membranes of neurons open and close in response to chemical neurotransmitters. Now cell biologists have developed a tool that allows exceptional control over this process in channels that respond to the important neurotransmitter glutamate.

Dirk Trauner of the University of California, Berkeley, and his colleagues worked with a compound known to make the channel open. They tethered it to the channel with a molecule that bends or stretches out, depending on the wavelength of light shone on it.

The team showed that bending the linker molecule brings the activating compound closer to the channel, causing it to open. Others may be able to use these new 'light sensitive' channels to re-engineer and explore neurological pathways.

MICROFLUIDICS

Go with the flow

Nature Mater. doi:10.1038/nmat1528 (2005)

Microfluidic systems rely on complex pumps and valves to move tiny quantities of liquids through channels etched into a chip. Luke Lee and his colleagues at the University of California, Berkeley, have developed a way to simplify this set-up.

First, they load the fluid with gold nanoparticles. A low-power laser beam heats the particles at the leading edge of the liquid, which boils and then condenses further up the channel. These fresh droplets coalesce with the bulk of the liquid, effectively dragging it along.

The researchers believe that their approach could be used to make large circuits for manipulating cells and biological molecules.

JOURNAL CLUB

Pier Paolo Pandolfi
Memorial Sloan-Kettering Cancer Center, New York

We must seek to understand the genetics of cancer susceptibility, argues the director of the Molecular and Developmental Biology Laboratories.

What fascinates me, 30 years after the discovery that cancer has a genetic basis, is that we still know little about the inherited genetic variations that affect our risk of developing the disease.

The discovery of genes that are faulty or mutated within cancer cells has already led to dramatic progress in our ability to treat, and effectively cure, some human cancers.

But only now, with so much more genetic data available, are researchers turning their attention to the inheritable traits that influence our susceptibility to cancers. Importantly, these gene variants could become the targets of preventive medicines.

Recently, Kent Hunter from the National Cancer Institute in Bethesda, Maryland, and his colleagues identified a subtle inherited variation, or polymorphism, in a gene known as *SIPA1* that seems to modify the efficiency with which breast tumours spread (Y.-G. Park *Nature Genet.* **37,** 1055–1062; 2005).

As far as I know, this is the first time an inherited polymorphism has been linked to metastasis — the mechanism by which the tumour spreads and seeds other organs.

Not everyone is convinced that understanding the genetics of cancer susceptibility is a critical goal. But, in 1960, sceptics also questioned the relevance of the finding that patients with a rare form of cancer known as chronic myelogenous leukaemia exhibited a chromosomal abnormality.

It took until 1973, when Janet Rowley and her colleagues proved that the abnormality was caused by the interchange of parts of two chromosomes, for people to realize that this 'Philadelphia chromosome' was the first evidence for the genetic basis of human cancer.