RESEARCH HIGHLIGHTS

Island hoppers

PLoS Biol. **3,** 247 (2005)

It was suspected, from archaeological and linguistic data, that Polynesia was colonized by migrants from Taiwan. A team led by Marie Lin, from the Mackay Memorial Hospital in Taiwan, has now provided genetic evidence that supports this view. By analysing the mitochondrial DNA of living populations, the team showed that Polynesians are more closely linked to aboriginal Taiwanese than to the general Chinese (Han) population.

Whether the Polynesian ancestors migrated quickly or spent time on different islands en route to Polynesia is still a matter for debate. Lin's team plans to address the question by studying other communities, including populations in the Philippines and on Borneo.

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

A. RYMAN/CORBIS

DEVELOPMENTAL BIOLOGY

Your beatin' heart

Genes Dev. **19,** 1624–1634 (2005)

The discovery of a zebrafish (*Danio rerio*) mutant has given insight into how hearts beat.

In the *dead beat* mutant, the muscle cells of the fish's heart ventricles fail to contract. Its discoverers, led by Mark Fishman of Harvard Medical School, Massachusetts, and Wolfgang Rottbauer from Germany's University of Heidelberg, traced the fault to a cell-signalling system that controls blood-vessel development.

The disabled gene encodes an enzyme called PLCγ1, which helps cells to detect a protein involved in vessel growth, known as VEGF. The researchers found that interfering with VEGF signals in rats altered the flow of calcium ions into heart-muscle cells. They suggest that the heart uses such signals to adapt its beat to changes in blood flow.

STEM CELLS

Keeping quiet

J. Cell Biol. **170,** 81–90 (2005)

A signal shown to influence stem-cell proliferation in the ducts of mouse prostates may play a role in the development of prostate cancers.

A team headed by Lynette Wilson of the New York University School of Medicine found that the growth factor TGF-β maintains the quiescent state of stem cells around the ducts near the urethra, while promoting cell proliferation farther away. Removing androgen, which is an important hormone that regulates prostate growth, reverses the pattern. The researchers suggest that shifts in the balance between these molecules may contribute to proliferative diseases, including cancer.

PLASMA PHYSICS

Bright sparks

Phys. Rev. Lett. **94,** 235001 (2005)

Two researchers from the University of Texas at Austin have identified a promising way to amplify laser power using a plasma of ions and electrons. If the technique holds up in experiments, it could be used to build desktop particle accelerators for medical applications and fundamental physics research.

Serguei Kalmykov and Gennady Shvets calculate that a laser beam travelling through a dense plasma will create a wave that focuses the laser light into a train of sharp pulses — each about 10 to 100 times as intense as the initial beam. A similar technique has been tested with low-power lasers and standard gases, but the duo asserts that using a plasma could push the power of the laser pulses to a thousand trillion watts.

MELANOMA

Skin laid bare

J. Cell Biol. doi:10.1083/jcb.200501067 (2005)

The hormone α-MSH activates the production of the tanning pigment melatonin in skin cells called melanocytes. This pigment shields the skin from cancer-causing ultraviolet rays. However, stimulation of the hormone's signalling system also upregulates a gene called *Hif1a* that may help cancers to survive, says a team led by Roser Buscá of the French biomedical research institute INSERM in Paris.

The protein encoded by *Hif1a* controls the expression of several genes involved in different aspects of cancer progression, including the synthesis of blood vessels. The researchers show that MITF, a factor involved in α-MSH signalling, promotes transcription of *Hif1a*. This adds to previous results that have linked MITF to skin cancer.

STRUCTURAL BIOLOGY

Sponge path

Nature Immunol. doi:10.1038/ni1224 (2005)
Nature Immunol. doi:10.1038/ni1225 (2005)

Natural killer T cells, key players in the immune systems of animals, are stimulated by lipids bound to CD1d molecules on the surface of cells. CD1d is a unique member of its family of cell-surface binding molecules, because it is found in both humans and other animals, but there has been much debate over what lipids it binds.

Two independent papers, from teams headed by researchers from the Scripps Research Institute in La Jolla, California, and Cancer Research UK, provide a starting point. They describe the crystal structure of mouse and human CD1d in complex with variants of a lipid extracted from a marine sponge. The bound structure may provide clues that help identify CD1d's other natural targets.

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

NAT. HIST. MUS. LOND.

NEURODEGENERATION

The many faces of p53

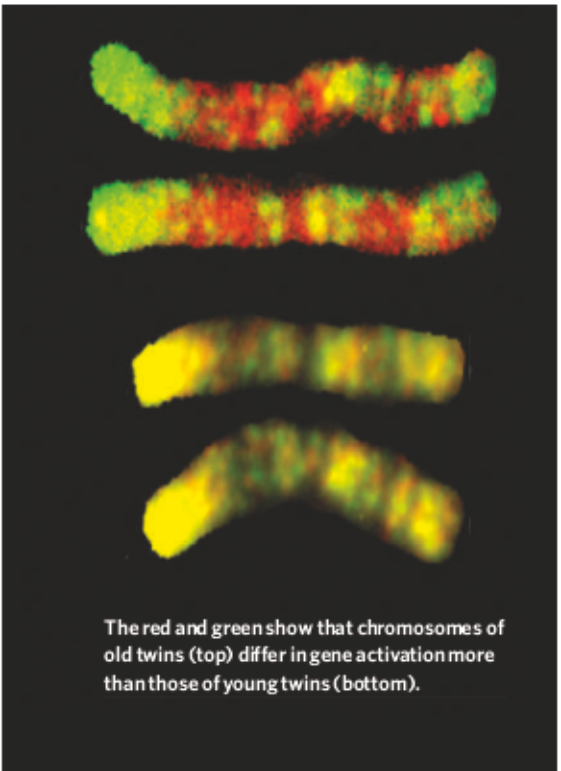
Neuron **47**, 29–41 (2005)

A study of the pathology of Huntington's disease in human patients and a wide range of animal models has uncovered a protein interaction that may be crucial in producing the disease's symptoms.

The work, led by Akira Sawa of Johns Hopkins University School of Medicine in Baltimore, Maryland, shows that abnormal huntingtin protein binds to the regulatory protein p53. This has the effect of raising p53 levels in cells, causing overexpression of certain mitochondrial genes. Ultimately, this leads to the death of brain cells that is characteristic of the disease.

An overabundance of p53 could also underpin diseases such as Parkinson's, but it may be difficult for therapies to target this interaction because low levels of p53 are linked to cancer.

PROC. NAT'L ACAD. SCI. USA



The red and green show that chromosomes of old twins (top) differ in gene activation more than those of young twins (bottom).

EVOLUTION

Quagga taggers

Biol. Lett. doi:10.1098/rsbl.2005.0323 (2005)

The quagga, which went extinct at the end of the nineteenth century, was an African animal with distinctive half-zebra, half-horse coloration (pictured). Twenty years ago, it became the first creature to have its DNA studied from beyond the evolutionary grave. Now, an analysis of genetic material from eight museum specimens has been used to determine its pedigree.

Jennifer Leonard at the Smithsonian Institution in Washington and her colleagues estimate that *Equus quagga* diverged from the plains zebra (*Equus burchelli burchelli*) between 120,000 and 290,000 years ago. This is relatively recent and coincides with a point at which Earth's ice sheets were very large, prompting the authors to suggest that climate change may have driven the split.

ASTRONOMY

What's the point?

Preprint astro-ph/0506607 at http://arxiv.org (2005)

The orbiting Chandra telescope has completed a huge survey of X-ray point sources in a small area of the southern sky. It turned up 589 new objects, to give a grand total of 915 sources in an area measuring a third of a square degree. Most of the sources are objects known as active galactic nuclei. These are thought to be black holes at the centre of galaxies that emit X-rays as they consume matter. The catalogue will help astronomers to learn about the life cycle and properties of these poorly understood objects.

GENETICS

Mistaken identity

Proc. Natl Acad. Sci. USA
doi:10.1073/pnas.0500398102 (2005)

Identical twins have identical DNA, but their genes gradually diverge as they age, says a study of the young and old.

Manel Esteller of the Spanish National Cancer Centre in Madrid and his colleagues examined chromosomes from 40 twin pairs, aged between 3 and 74. They showed that differences in patterns of gene silencing and activation — caused by the addition of chemical groups to the chromosome — accumulate with age. An illustration of their results (left) maps the differences between twins' sequences on to a chromosome structure — stretches that have not diverged look yellow. Although the trend is not surprising, the twin data uniquely trace environmental influences on gene expression.

JOURNAL CLUB

Michael Marder
The University of Texas at Austin

A statistical physicist finds that taking several paths may be the solution for hard problems.

There are some problems for which finding a solution is like searching for a very small needle in a very large haystack. Take the problem of protein folding. A protein chain can adopt so many different configurations, through complex molecular motions, that modern computational models struggle to predict the shape in which it will settle.

Yet progress in making such predictions is not impossible. Recently, I learned that a community of theoretical chemists and applied mathematicians, somewhat disconnected from the statistical physicists with whom I most commonly correspond, have made great steps forward.

In transition-state theory, the problem of moving from an initial state (such as an unfolded protein) to a final one (fully folded) can be viewed as the problem of moving from one valley to another in a complex mountain range. The task is to find the best path between two valleys, and, in particular, to choose a mountain pass that minimizes the height climbed.

Weinan E, Weiqing Ren and Eric Vanden-Eijnden describe their method for predicting rare events in the *Journal of Physical Chemistry B* (109, 6688–6693; 2005). This method uses probability weightings to find not just one path through the mountains, but vast collections of them — some closely related, and others distinct. They apply the technique to predict the rate at which a heated crystal slowly deforms under shear. This is a model problem, but one of such complexity that finding a solution is very impressive.

It almost seems that the communities working to find the likelihood of rare events resemble the solutions they have found, with separate clusters of researchers clambering over nearby but separate mountain passes.