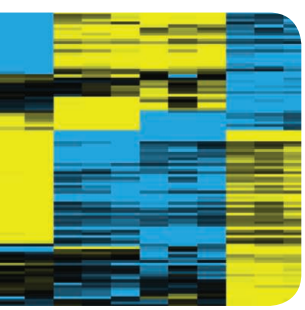
EDITED BY STELLA HURTLEY

## A Measure of Metal-Oxide Interfaces

The rate of a catalytic reaction can sometimes be enhanced by using a different metal oxide as the support for adsorbed metal nanoparticles. Such enhancement is often attributed to more active sites at the metal-oxide interface, but it can be difficult to quantify this effect. **Cargnello *et al.*** (p. 771, published online 18 July) synthesized monodisperse nanoparticles of nickel, platinum, and palladium and dispersed them on high-surface-area ceria or alumina supports. High-resolution transmission electron microscopy enabled a detailed analysis of interfacial site structure, which showed that the rate of CO oxidation on ceria was indeed enhanced greatly at interface sites.

## Allergy Induction

Proteinases found in fungi and other allergens elicit allergic inflammation, but how they do so is far from clear. It is also unclear how pattern recognition receptors, which detect invading microbes, drive allergic inflammation. **Millien *et al.*** (p. 792) shed light on this puzzle by showing that, in mice, induction of allergic inflammation requires proteinase-dependent cleavage of the clotting factor fibrinogen, leading to generation of a ligand that activates the pattern-recognition receptor, Toll-like receptor 4 (TLR4). Cleaved fibrinogen signals through TLR4 to activate the innate immune system and recruit cells to the airway, which drives both allergic responses and antifungal immunity.



## Food as Reward

Why does ice cream taste so good? High-fat foods activate a reward circuit in the brain involving dopamine, a neurotransmitter that regulates pleasure. Overconsumption of high-fat foods is thought to dampen this dopamine-induced reward sensation, leading to compensatory consumption of even more high-fat foods. The mechanisms by which dietary fat in the gut "talks" to the dopamine reward circuit are unclear. **Tellez *et al.*** (p. 800) suggest that an intestinal lipid messenger called oleoylethanolamine (OEA) may play a role—at least in mice. Mice on a high-fat diet had unusually low levels of intestinal OEA and exhibited deficient dopaminergic responses to gut stimulation with high-fat lipids. Infusion of OEA into these mice restored the dopaminergic response, and mice that had been accustomed to a high-fat diet began to eat more low-fat foods.

## Draining Through Ice

Water formed by surface melting of the Greenland Ice Sheet is transferred rapidly to the underlying bedrock, but how the water is then dispersed is less clear. This question is important because how the ice-rock interface is lubricated affects how fast the ice sheet moves. Existing conceptual models are based on observations of mountain glaciers, but **Meierbachtol *et al.*** (p. 777; see the Perspective by **Lüthi**) now show that those ideas may not be applicable to the Greenland Ice Sheet. Measuring water pressures in a transect of 23 boreholes revealed that drainage structures differ between the edge, where large melt channels form, and further inland, where more distributed pathways are found.

## A Single-Photon Gate

A long-standing goal in optics is to produce an all-optical transistor, in which the transmission of a light beam can be controlled by a single photon. Using a system in which a cloud of cesium atoms is coupled to an optical cavity, **Chen *et al.*** (p. 768, published online 4 July; see the Perspective by **Volz and Rauschenbeutel**) were able to control transmission through the optical cavity by exciting the atomic ensemble using a "gate" laser pulse. Just one gate photon stored was sufficient to detune the system and switch the transmission of source photons through the cavity.

## Bringing Down the Andes

Mountain ranges, like the Andes in South America, have a number of forces acting on them that control their elevation. High rates of precipitation can induce rapid incision of canyons, but tectonic forces from deep within the mountain range may balance or even exceed the rate of erosion. **Lease and Ehlers** (p. 774) examined the exhumation histories of the northeastern Andean Plateau. The erosion of sediments older than ~10 million years was controlled largely by tectonic processes. However, more recent sediments suggest that a shift to cooler temperatures increased precipitation 3 to 4 million years ago.

## Insect Cycles

Rapid increases in insect population sizes can result in significant crop losses. Seasonal temperature has been proposed to drive such outbreaks. Despite clear evidence that temperature can drive individual insect development, its influence at the population level is much less clear. **Nelson *et al.*** (p. 796, published online 1 August) analyzed data collected over 50 years on the tea tortrix moth, which affects Japanese tea plantations, to reveal the impacts of temperature on cyclical outbreaks.

## Resistance May Not Be Futile

Recently, Ug99, a particularly devastating strain of wheat stem rust fungus, has emerged, which could potentially threaten food security. Now, two genes have been cloned that offer resistance to Ug99. **Saintenac *et al.*** (p. 783, published online 27 June) cloned *Sr35* from *Triticum monococcum*, a diploid wheat species not often cultivated. **Periyannan *et al.*** (p. 786, published online 27 June) cloned *Sr33* from *Aegilops tauschii,* a diploid wild grass that contributed to the hexaploid genome of cultivated wheat. The genes both encode proteins that show features typical of other disease resistance proteins and offer opportunities to slow the pace of Ug99 progression.

CREDITS (TOP TO BOTTOM): MARTIN LÜTHI; MILLIEN *ET AL.*



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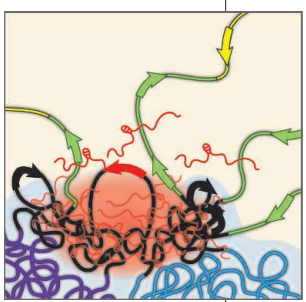
*Additional summaries*

## Understanding Xist-ance

Large noncoding RNAs (lncRNAs) are increasingly appreciated to play important roles in the cell. A number of lncRNAs act to target chromatin regulatory complexes to their sites of action. **Engreitz *et al.*** (p. 767, published online 4 July; see the Perspective by **Dimond and Fraser**) found that the mouse Xist lncRNA, which initiates X-chromosome inactivation, was transferred from its site of transcription to distant sites on the X chromosome purely through their close three-dimensional proximity to the *Xist* gene. Xist initially localized to the periphery of active genes on the X chromosome but gradually spread across them using its A-repeat domain, until the Xist RNA bound broadly across the inactive X chromosome in differentiated female cells.



CREDIT: ENGREITZ *ET AL.*

## Early Multi

Multituberculate mammals (multis) first arose in the Jurassic and became extinct in the Oligocene, a span of over 100 million years, which makes them the longest-living order of mammals known. This highly diverse and abundant group filled many niches occupied by today's similarly diverse rodents. Multis are known for their complex dentition and unique locomotor adaptations, which facilitated their divergence into a suite of ecosystems. **Yuan *et al.*** (p. 779) describe a new basal multi from a nearly complete skeleton that shows that the underpinnings of these adaptations arose early in the evolution of the order, setting the stage for the major diversification and radiation of the group that came during the Cretaceous and Paleogene.

## A New Linc in Innate Immunity

Long noncoding RNAs (lncRNAs) have recently emerged as important regulators of gene expression in a wide variety of biological processes, although specific roles for these molecules in the immune system have not been described. **Carpenter *et al.*** (p. 789, published online 1 August) now define the function of one such lncRNA in the immune system, lincRNA-Cox2. Whole-transcriptome profiling revealed that lincRNA-Cox2 was induced in mouse macrophages in response to activation of Toll-like receptors—molecules that detect microbes and alert the immune system to respond. LincRNA-Cox2 both positively and negatively regulated the expression of distinct groups of inflammatory genes. Negative regulation of gene expression was mediated by lincRNA-Cox interaction with heterogeneous nuclear ribonucleoprotein A/B and A2/B1.



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