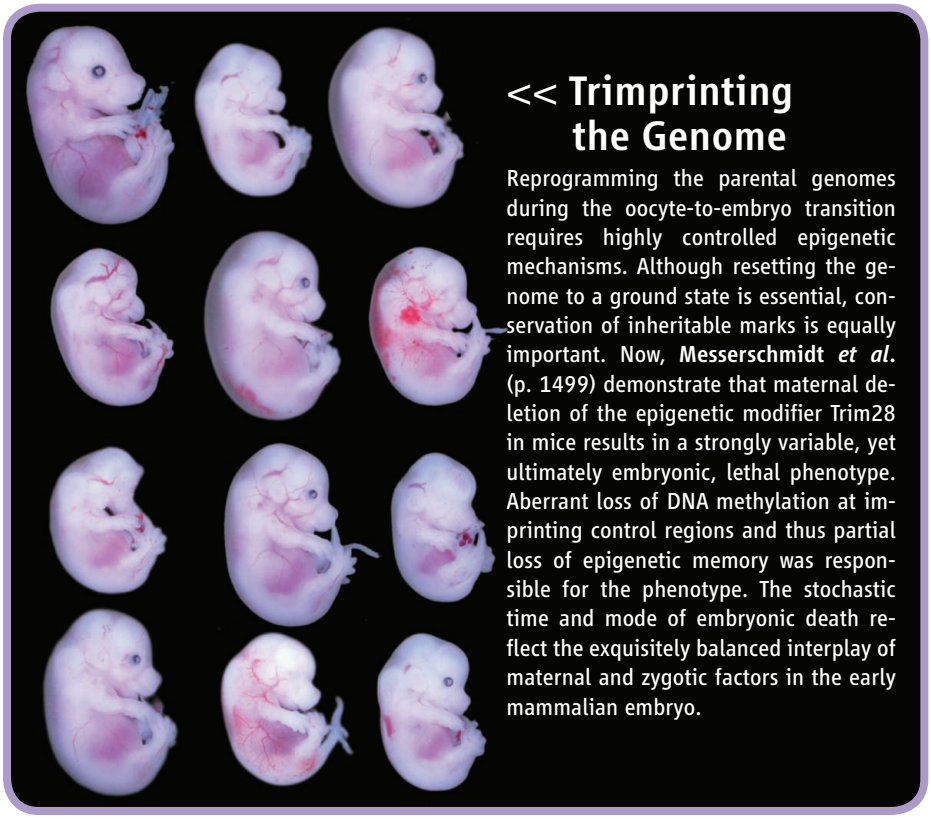
EDITED BY STELLA HURTLEY



<< Trimprinting the Genome

Reprogramming the parental genomes during the oocyte-to-embryo transition requires highly controlled epigenetic mechanisms. Although resetting the genome to a ground state is essential, conservation of inheritable marks is equally important. Now, **Messerschmidt *et al.*** (p. 1499) demonstrate that maternal deletion of the epigenetic modifier Trim28 in mice results in a strongly variable, yet ultimately embryonic, lethal phenotype. Aberrant loss of DNA methylation at imprinting control regions and thus partial loss of epigenetic memory was responsible for the phenotype. The stochastic time and mode of embryonic death reflect the exquisitely balanced interplay of maternal and zygotic factors in the early mammalian embryo.

CREDITS (TOP TO BOTTOM): MESSERSCHMIDT *ET AL.*; GÖMÖRY *ET AL.*

Interacting Topological Insulator

Topological insulators (TIs) hold great promise as a setting for exotic fundamental phenomena, as well as for more practical applications such as quantum computing. This new state of matter has been discovered in materials such as Bi_2Se_3, where electrons' spins are correlated with their orbital motion, but interactions between the electrons themselves are negligible. For a TI to fulfill its potential, a material with interacting electrons is desirable. **Zhang *et al.*** (p. 1464) used density functional calculations to predict that strong interactions in actinide compounds such as AmN may drive a transition into a TI state, with a large insulating gap favorable for device applications.

Tamer Triangulations

Diazomethane is a broadly useful precursor to carbene (CH_2), which, in turn, reacts with olefins to form triangular carbon cycles known as cyclopropanes. These small rings are of fundamental interest for their strained bonds and turn up periodically in natural products, as well as in pharmaceutical and agrochemical research. Unfortunately, the flip side of diazomethane's facile reactivity is its dangerous tendency to explode—a hazard exacerbated by the need to isolate the compound after its preparation in highly basic water before it can be reacted with hydrophobic olefins. **Morandi and Carreira** (p. 1471) now show that an iron cyclopropanation catalyst can circumvent the need for the isolation step, inducing reaction of the hazardous compound in a biphasic aqueous/organic medium immediately after its generation.

Lignin to the Rescue?

The increasing demand for rechargeable batteries is putting a strain on the availability of certain key raw materials. Lignin is the second most common biopolymer and typically makes up 25% of wood. Lignin derivatives are also readily available as by-products from the pulp and paper industry. **Milczarek and Inganäs** (p. 1468) combined lignin derivatives, which are electronic insulators, with polypyrole, a conductive polymer, into an interpenetrating composite suitable for use as a cathode.

Waste Not

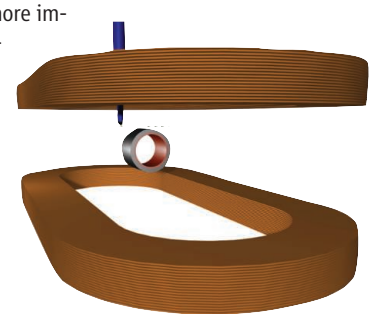
The organic matter in wastewater is a potentially vast and sustainable energy source; however, most wastewater treatment plants consume energy. **Cusick *et al.*** (p. 1474, published online 1 March) combined a microbial fuel cell with a reverse-electrodialysis system to boost the voltage output and the power density over a simple microbial fuel cell. The use of ammonium bicarbonate as a fuel for reverse electrodialysis while microorganisms simultaneously turn organic matter into electricity not only allows for the capturing of waste heat, but could eventually produce enough energy to offset the energy used in conventional wastewater treatment systems.

Building Blocks of Earth

Earth formed from an explosive and energetic series of collisions that accreted material over millions of years. Comparisons between rocks from Earth's interior and more primitive extraterrestrial samples can help tease apart the composition of Earth's starting material; however, discrepancies between the abundance of certain elements or their isotope ratios often obscure their origin. **Fitoussi and Bourdon** (p. 1477, published online 1 March) analyzed the silicon isotopes of a suite of rocks from chondritic meteorites and the Moon to reconcile some of the previous models. By tuning Earth accretion models to account for these Si isotope signatures, enstatite chondrites could be ruled out as the sole end-member composition for bulk Earth. Instead, a heterogeneous mixture of several types of chondritic meteorites is more likely.

Hidden from Magnetic View

An electromagnetic cloak is a device within which electromagnetic fields cannot penetrate, but, more importantly, the device itself does not disturb the electromagnetic fields surrounding it. An article placed in the cloak therefore vanishes from view, creating no shadow or reflection.



Such devices have been demonstrated, but only for a particular band of frequencies. Confirming theoretical work that predicts such cloaking should be possible down to zero frequency, **Gömöry *et al.*** (p. 1466) designed a cloak for a dc magnetic field. With a composite design of ferromagnetic and superconducting material, together with a relatively simple structure, the device could potentially find immediate application.

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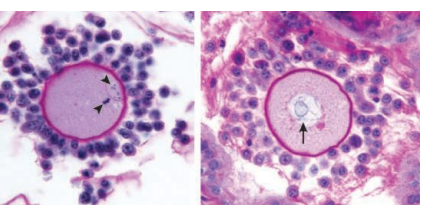
Human Impact?

Following the arrival of humans in Australia 40- to 50,000 years ago, many species of large vertebrates rapidly became extinct. By analyzing sediment cores from a site in northeastern Australia, **Rule et *al.*** (p. 1483; see the Perspective by **McGlone**) show that the extinction of the Australian megafauna caused important ecosystem shifts. Prominent among these were a shift from rainforest vegetation to sclerophyllous vegetation and a sustained increase in the incidence of fire. The cores also provide evidence of the cause of megafaunal extinction in Australia, ruling out climate and anthropogenic fire as possible causes while confirming that the extinctions closely followed human arrival. These findings show how landscapes sometimes have been fundamentally changed by the indirect effects of early humans—which underscores the impact that even prehistoric human societies had on natural systems.

Untangling the Web

Interspecific interactions link species within complex trophic and nontrophic webs (see the Perspective by **Lewinsohn and Cagnolo**). Theoretical work has suggested that certain characteristics of species, or even interactions, may predispose them to extinction from a network. **Aizen *et al.*** (p. 1486) provide empirical evidence that plant-pollinator interactions are lost nonrandomly following habitat reduction in isolated hills in the Argentine pampas. Some types of interaction were more vulnerable to disruption than others, particularly when the specialization of the interacting was high and when the interactions were infrequent. **Stouffer *et al.*** (p. 1489) applied network theory to predict the dynamical importance of species across different food webs. Characteristic three-node motifs were identified, and species were characterized according to the relative frequencies with which they occupied unique positions within the motifs. These relative frequencies and the dynamic importance of the motifs were then used to identify a species-level importance within a food web.



Mistress of Meiosis

Meiosis is essential for proper distribution of maternal chromosomes to eggs during oogenesis. **Su *et al.*** (p. 1496) identified a gene, meiosis arrest female 1 (*Marf1*), which is indispensable for meiosis and other oogenic processes. In mice, *Marf1* mutations resulted in meiotic arrest and an increase in nuclear DNA double-strand breaks, phenotypes linked to up-regulated levels of specific messenger RNAs (mRNA). These findings place MARF1 as a key regulator of mammalian female fertility through its integration of oocyte mRNA homeostasis, meiosis, and maintenance of genomic integrity.

CREDIT: SU *ET AL.*

Reversing Decline?

Apolipoprotein E (apoE) normally helps in the clearance of β-amyloid from the brain, a process that is compromised in Alzheimer's disease. **Cramer *et al.*** (p. 1503, published online 9 February; see the Perspective by **Strittmatter**) now show that a drug that increases apoE expression rapidly promoted soluble β-amyloid clearance in a mouse model of Alzheimer's disease. The drug also improved cognitive, social, and olfactory performance and rapidly improved neural circuit function. Similar therapeutics may potentially help to ameliorate the symptoms of Alzheimer's disease and its prodromal states.

Remembering Stressful Events

Situations surrounding emotional events are better remembered than others that accompany neutral events. However, in severe pathological states such as posttraumatic stress disorder (PTSD), exposure to threatening situations can also result in memory impairment. In this case, a hypermnesia for a salient trauma-related cue is associated with loss of memory for important aspects of the traumatic event. The memory for the core traumatic event is enhanced, but the capacity to place it in the right place and in response to the right cues is reduced. **Kaouane *et al.*** (p. 1510, published online 23 February) associated a high-intensity threat with the infusion of corticosterone in the hippocampus to induce PTSD-like memory impairments in mice. The animals became unable to identify the threat context as the right predictor of the threat, and they showed a fear response for discrete salient cues normally identified as safe. The neural activation patterns in the amygdala and hippocampal regions of these mice were similar to those observed in human PTSD.

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