EDITORS' CHOICE

edited by Stella Hurtley

BIOMATERIALS

Let It Grow

In order to successfully grow replacement tissues or organs, one not only needs to grow the right cell types but also have the cells take on the correct overall shape, morphology, and porosity. Cells are thus typically cultured onto scaffolds, which need to be highly porous, with interconnected pores and large overall surface area. Previous efforts have focused on poly(DL-lactide-co-glycolactide), where the porous network was made by casting the polymer from solution, with the subsequent leaching of a secondary particulate phase to form the porous network. However, in these cases, the pore networks are often not interconnected, and residual solvent caused the scaffolds to shrink during the cell growth cycle.

Yoshimoto *et al*. explore the use of electrospinning to develop nonwoven, microporous scaffolds of poly(e-caprolactone) (PCL), a polymer that is known to have low toxicity and low cost and undergoes slow degradation. The scaffolds were seeded with mesenchymal stem cells, derived from the bone marrow of neonatal rats, and cultured for up to 4 weeks. Within 1 week, the cells produced extracellular matrix. At 4 weeks, type I collagen and mineralization were observed, and throughout the cell growth process the scaffolds did not show any shrinkage. Detailed analysis showed that the cell growth occurred throughout scaffolds, suggesting that electrospun PCL has tremendous potential as a scaffold material. — MSL

Biomaterials **24**, 2077 (2003).

ENVIRONMENTAL SCIENCE

The Gases of Cooking

Greenhouse gas (GHG) emissions are normally associated with the CO_2 produced by fossil fuel burning in the developed world. However, even the use of solid biomass for heat and cooking in the underdeveloped countries adds to the GHG budget, not in CO_2 but in GHGs such as carbon monoxide and methane that result from incomplete fuel combustion. In order to assess relative GHG potentials of different fuels, Bailis *et al*. measured actual emissions from a month of measurements of three-stone and ceramic woodstoves and charcoal stoves in an agricultural community in central Kenya. Although charcoal stoves burn more cleanly in terms of particulate matter and thus do less damage to respiratory health, they are much greater emitters of non-CO_2 GHGs when the total production cycle is taken into account. The authors discuss various policy implications, from the political issues that affect charcoal production to the need to introduce and distribute improved charcoal stoves. — PDS

The three-stone stove with metal grating.

Environ. Sci. Technol. 10.1021/es026058q (2003).

MEDICINE

Unwelcome Transmission

Improvements in immunosuppressive drugs and organ storage technology have enhanced the success rate of organ transplantation, but these surgeries still place recipients at elevated risk of certain malignancies, including Kaposi sarcoma (KS). Because KS is caused by human herpesvirus type 8 (HHV-8), development of this tumor in the transplant setting has been attributed to activation of latent virus in the host or transmission of free virus from the donor organ.

In a small study of kidney transplant recipients, Barozzi *et al*. present highly suggestive evidence that KS can also arise through transmission and engraftment of donor tumor cells or their progenitors. Presumably such cells would normally be eliminated by immune surveillance, but the immunosuppressed state of the organ recipients may allow their uncontrolled proliferation. This finding not only underscores the importance of screening donor organs for HHV-8 but it is likely also to renew interest in earlier speculations that sexual transmission of KS in AIDS patients may sometimes occur through direct transfer of shed tumor cells. — PAK

Nature Med. 10.1038/nm862 (2003).

GEOLOGY

Surviving the Snowball

Before the pre-Cambrian–Cambrian boundary, there is geological evidence of periods of extraordinarily extreme climatic variation. Some postulate this veered from millions of years of total glaciation at –50°C to sudden shifts to surface temperatures averaging 40°C. The exact nature of the physical conditions is hotly debated, as are the effects of these extremes on the survival of prevailing life forms. In their examination of the microfossils of Death Valley, Corsetti *et al*. have found complex communities of prokaryotes and eukaryotes preserved in cherts and carbonate rocks, including various forms of stromalites and on-

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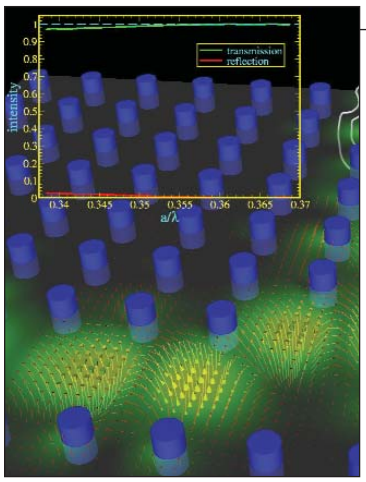


Simulated operation of an all-optical network fabricated in a 2D-3D photonic bandgap hybrid structure.

PHYSICS

Total Internal Light Confinement

In traditional light-guiding techniques, the light is confined to the region of high refractive index by total internal reflection. However, miniscule modulations or defects on the surface can lead to significant diffractive losses of the light out of the guide and are generally difficult to remove. Chutinan *et al*. propose a scheme involving the coupling of two- and three-dimensional (3D) photonic bandgap structures to suppress these diffractive losses. In their proposed design and fabrication scheme, the optical network is patterned in a 2D layer of a photonic crystal slab. This is then sandwiched between 3D photonic bandgap cladding layers, which are specifically engineered to prevent any leaky modes at the wavelength of interest. Although experimental verification is some way off, the simulated results of all-optical networks indicate a promising route toward leak-free all-optical microchips. — ISO

Phys. Rev. Lett. **90**, 123901 (2003).

CREDITS: (LEFT) CHUTINAN *ET AL., PHYS. REV. LETT.* **90**, 123901 (2003); (RIGHT) BAILIS *ET AL., J. ENVIRON. SCI. TECHNOL.* 10.1021/ES026058Q (2003)

coids. The communities seen in the preglacial cherts are very similar to those in the postglacial carbonate films, and it appears that complex communities persisted for 200 million years of climatic vacillation. The new findings suggest that the environmental scars noted in the geological record were not so severe that mass extinction of shallow water microbiota occurred, at least in shallow tropical seas. — CA

Proc. Natl. Acad. Sci. U.S.A. **100**, 4399 (2003).

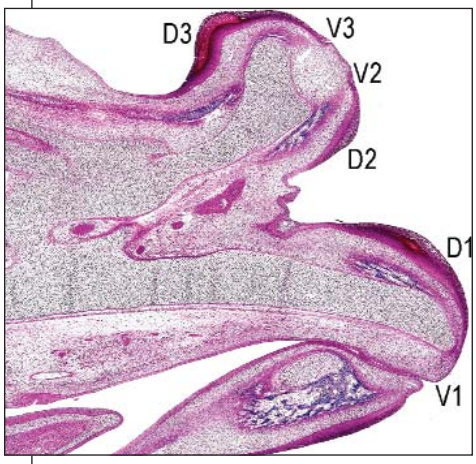
DEVELOPMENT

Making a Beak

Development of complex body structures such as the face poses the question of how patterns are formed during embryogenesis. One organizing principle presumes that neural crest cells, the precursors of specific tissues such as the craniofacial mesenchyme, have a predetermined fate. Yet neural crest cells also display remarkable plasticity in response to experimentally manipulated external signals.

Hu *et al*. addressed the underlying mechanism of facial patterning by examining how a bird's beak attains its specific three-dimensional organization. Fate mapping of cells and gene expression analysis of the early chick embryonic frontonasal process (FNP), the region that gives rise to the face and beak, revealed that before the arrival of neural crest cells, a distinct dorsoventral axis is established. Transplantation of this frontonasal ectodermal zone (FEZ) from quail to chick embryos resulted in additional dorsoventral boundaries and the outgrowth of extra ectopic upper beak structures at the graft site in an orientation-dependent manner. Ectodermal signals from the FEZ could thus override any prepatterning in neural crest cell–derived mesenchyme of the FNP. This challenges the belief that the neural crest is the source of patterning information in the face and demonstrates the responsiveness of neural crest–derived tissue to local patterning cues. — LDC

Development **130**, 1749 (2003).



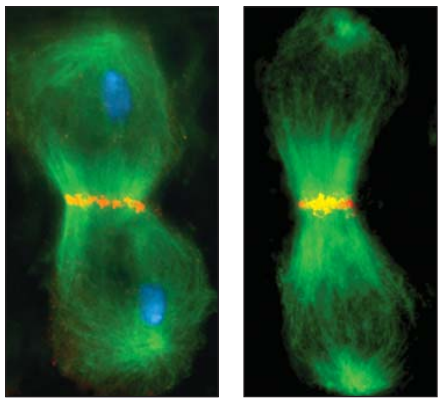
Three beak-like outgrowths (1, 2, and 3) are generated after FEZ grafting.

CREDITS: (LEFT) HU *ET AL., DEVELOPMENT* **130**, 1749 (2003); (RIGHT) BUCCIARELLI *ET AL., J. CELL BIOL.* **160**, 993 (2003)

CELL BIOLOGY

Chromosome-Free Spindles

During mitosis, chromosomes are separated to daughter cells by the mitotic spindle, a bipolar arrangement of cellular microtubules. The relative contribution of the chromosomes themselves to spindle formation and dynamics has been the subject of debate.



Telophase with (left) and without (right) chromosomes (blue). A molecular motor (orange) accumulates at the midzone at the center of the spindle composed of microtubules (green).

Now Bucciarelli *et al*. have been able to observe spindle dynamics in a chromosome-free environment, while still looking at a living intact cell system. Using *Drosophila* mutants that produce secondary spermatocytes that lack chromosomes, morphologically normal spindles were observed in the absence of chromosomes. The anucleate cells possessed centrosomes that could act as spindle poles generating microtubule asters and spindles that underwent anaphase, and telophase-like elongation and disassembly. After the chromosomeless telophase, the cells underwent normal cytokinesis and cleavage. One of the proteins that would usually accumulate on partitioning chromosomes, aurora B kinase, still accumulated at the midzone, implying that chromosomes are not required for its localization to the central spindle. — SMH

J. Cell Biol. **160**, 993 (2003).

BIOMATERIALS: Let It Grow

Science **300** (5618), 395a.
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