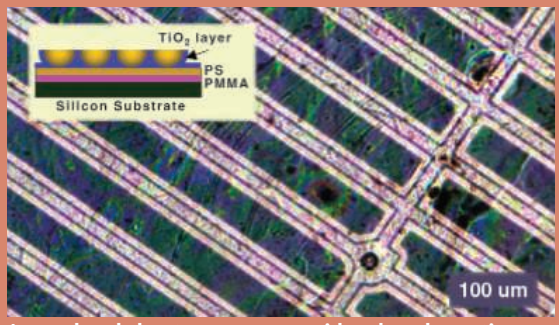
edited by Gilbert Chin

MATERIALS SCIENCE

Large Nanotemplates



A nanobowl sheet on a copper grid and a schematic (inset) of the fabrication.

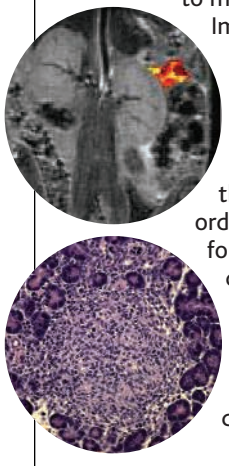
A nanoscale template (for making materials and devices) can be created by coating an array of closely packed particles, but it often is difficult to handle such a film without tearing it, because it is, in essence, a thin ceramic sheet. Wang *et al.* report on the formation of transferable and reusable TiO_2 "nanobowl" templates. They coated a silicon substrate with a 300-nm-thick film of poly(methyl methacrylate) (PMMA) and then applied a 100-nm-thick film of polystyrene (PS). Next, a monolayer of 500-nm-diameter PS spheres was loaded onto the composite film from a water surface, and topped off with a 25-nm-thick coating of TiO_2 via atomic layer deposition. Ion milling removed the top half of the spheres, and the PMMA was dissolved with acetone to free the film from the silicon substrate. Finally, the nanobowl film could be freed completely by removing the PS with toluene. These films (as large as 10 mm^2) were lifted with a copper mesh support and examined in a transmission electron microscope, which revealed that the bottoms of the TiO_2 bowls have a 100-nm opening. The films could then be used as templates to create a regular array of 100-nm gold dots, spaced 500 nm apart. — PDS

Nano. Lett. 10.1021/nl051389x (2005).

IMMUNOLOGY

Diabetes on Display

Autoimmune conditions, such as type 1 diabetes, are unpredictable and difficult to manage. Improvements in treatment will depend on better noninvasive monitoring of those at risk in order to enable forecasting of disease onset, sensitive and accurate screening for changes in disease status, and prediction of how the condition in a given individual might respond to treatment.



Pancreatic infiltration (top) and islet histology (bottom).

Turvey *et al.* used magnetic resonance imaging (MRI) of mouse models of type 1 diabetes, in which the accumulation of a biocompatible superparamagnetic nanoparticle was used to detect changes in microvascular permeability that accompany autoimmune-induced pancreatic inflammation. In the NOD mouse, MRI measures of increased vascular leakage correlated with diabetes close to the time of disease onset, but were not as useful in longer-range prognosis. In a therapeutic setting in which T cell tolerance was achieved using antibody to CD3, prediction of therapeutic efficacy was possible, with low vascular leakage values corresponding to a favorable response to therapy, reflected by normal-range blood glucose levels. Similar noninvasive monitoring using magnetic nanoparticles is already being assessed in the clinic for lymph node metastases, and these experimental studies suggest that their use in organ-specific autoimmune conditions may also be feasible. — SJS

J. Clin. Invest. **115**, 2454 (2005).

BIOCHEMISTRY

Some Like It Briny

Recent expeditions have exploited the power of metagenomics to prospect in harsh and hazardous environments for unusual and useful microbial molecules. Ferrer *et al.* have sampled a deep-sea hypersaline anoxic basin (DHAB) in the eastern Mediterranean, and then nurtured microbial growth by feeding with Arabian light crude. They have isolated a remarkable esterase, cataloged as O.16 (for more on DHAB microbes, see van der Wielen *et al.*, Reports, p. 121, 7 January 2005). This enzyme reversibly adopts three quaternary structures: (i) a 104-kD monomer in standard buffer; (ii) a heterodimer of 21- and 85-kD chains upon disulfide reduction; and (iii) a 325-kD trimer under high pressure (20 MPa), high salt (3.5 M NaCl), and a reducing agent. In a fashion consistent with the ionic and anoxic conditions 3500 m below sea level, the activity of the trimer is maximal and about 700 times that of the monomer. Furthermore, in terms of its potential use in chemical synthesis, O.16 is stable in a variety of nonpolar and polar solvents. — GJC

The RV *Urania*.

Chem. Biol. **12**, 895 (2005).

PSYCHOLOGY

A Cooling-Off Period

In interpersonal situations, conflicts are inevitable and tempers can flare, sometimes with long-lasting and deleterious consequences for one's psyche. Coming to grips with emotional upset has been pursued via talk-based therapies, and Kross *et al.* suggest one way that these interventions might be focused for greater benefit. Translating negative experiences into abstract or intellectualized representations may run the risk of suppressing and avoiding the very reasons for the distress, yet opening the door to reliving the emotionally troubling events may lead to destructive and iterative rumination. In two experiments, the authors show that adopting the viewpoint of an observer while continuing to attend fully to theaffective components of the experience can help to process negative emotions, perhaps by yoking the autonomic arousal system (hot) to cognitive control circuits (cool). — GJC

Psychol. Sci. **16**, 709 (2005).

CREDITS: (TOP) WANG *ET AL., NANO. LETT.* 10.1021/NL051389X (2005); (BOTTOM LEFT) TURVEY *ET AL., J. CLIN. INVEST.* **115**, 2454 (2005); (BOTTOM RIGHT) MANUEL FERRER *ET AL.*

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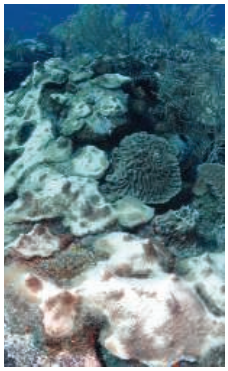
ECOLOGY/EVOLUTION

Bleaching in Hot Water

When corals lose their symbiotic algae, they bleach. Coral bleaching is known to be caused by a number of factors such as increased salinity, disease, or increased sea surface temperature (SST). The relationship with SST, in particular, has raised concerns that global warming could trigger more frequent and widespread episodes of bleaching. Because of its potentially serious effects on the productivity of reef systems and the biota they support, this relationship has been researched closely in a number of tropical reef systems. Despite clear evidence that increased SST can trigger bleaching, it has proven hard to predict from individual reef-based or laboratory studies how SST influences bleaching at the regional scale.



Bleached coral.

McWilliams *et al*. have assembled coral bleaching data from two decades of research in the Caribbean, at the scale of cells of 1° of latitude and longitude, and examined their relation with SST anomalies over the period. They find an exponential increase in the extent and intensity of bleaching episodes with increasing frequency of SST anomalies, such that 100% bleaching is reached with SST increases of slightly less than 1°C—well within the predicted temperature rise for the rest of this century. — AMS

Ecology **86**, 2055 (2005).

CHEMISTRY

Site-Specific Catalysis

Chemical patterning of surfaces has traditionally been achieved by zapping a reactive coating with light or electron beams. More recently, "dip pen" techniques have used atomic force microscope (AFM) probes to plant molecules in selected surface locations. Davis *et al*. show that AFM probes can also be used as spatially selective catalysts. They capped the silicon nitride probe tips with palladium nanoparticles, which catalyzed the Suzuki coupling of aryl boronic acids to a layer of aryl bromides that were bound through sulfide linkages to a gold surface. After submerging the film in a methanol solution of the boronic acid and a base, they maneuvered the probe to the desired reaction site and induced coupling by applying 20 to 25 nN of force between tip and surface. Reducing the force to the 1- to 5-nN range allowed imaging of the patterned surface without further catalysis. For verification of spatial selectivity, coupling was performed with amine-substituted boronic acid substrates, which were subsequently labeled with fluorescent dye. — JSY

J. Am. Chem. Soc. 10.1021/ja043235+ (2005).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Fateful Feedback

Control of cell differentiation is thought to result from bistable regulatory networks that allow a transient developmental signal to instruct cells to adopt a differentiated state. In the nematode *Caenorhabditis elegans*, Johnston *et al*. examined a network that determines the alternative fates of two taste receptor neurons, known as ASE left (ASEL) and ASE right (ASER). These neurons are bilaterally symmetric but express distinct sets of chemoreceptors that are necessary for the worm's navigation in search of food. The authors find through genetic analysis that two key transcription factors, DIE-1 and COG-1, which promote the expression of genes specific to ASEL and ASER neurons, respectively, act in a feedback loop in which they are linked by two microRNAs (miRNAs) encoded by *lsy-6* and *mir-273*. Expression of *lsy-6* is enhanced by DIE-1, and the *lsy-6* miRNA inhibits the expression of ASER-promoting factor COG-1, which in turn promotes the expression of *mir-273* miRNA, which closes the loop by inhibiting expression of the ASEL-inducing gene *die-1*. Although the stimulus that causes switching of this loop to favor production of one or the other transcription factor remains unknown, the results provide the essence of a miRNA-containing transcriptional feedback loop that can account for the stabilized expression of terminal cell fate in the ASER and ASEL neurons. — LBR

Proc. Natl. Acad. Sci. U.S.A. **102**, 12449 (2005).

CREDITS: KAREN CHENEY

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