

Nadrian Seeman at New York University and his colleagues created a 49-nanometre-long track of bound DNA strands with loops, and a single-stranded DNA 'walker' molecule. The walker ratchets itself along when its front 'leg' binds to the next loop on the track, triggering a reaction that frees the back leg. Chemical analyses showed the walker took a step 74% of the time.

The team is exploring other chemical reactions besides base-pair binding to drive the walkers. If such constructs can be designed to carry cargo, they could be used to build molecular complexes, the researchers say.

IMMUNOLOGY

Inflaming the problem

Nature Immunol. doi:10.1038/ni.1722 (2009)

A common genetic mutation may contribute to a painful autoimmune disease by interfering with the production of the anti-inflammatory protein IL-10.

The mutation, in a gene called *NOD2*, is associated with up to half of all cases of Crohn's disease in the West, but how it contributes to the disease has been controversial, in part because mice with the mutation have normal IL-10 production. Xiaojing Ma at Weill Medical College of Cornell University in New York and his colleagues found that cells from patients with Crohn's disease who have the mutation produce less IL-10.

Furthermore, the mutation prevents activation of a protein called hnRNP-A1, which normally binds to a region near the IL-10 gene and stimulates its expression. The authors suggest that the altered *NOD2* protein functions differently in humans and mice.

DEVELOPMENT

The trouble with alcohol

Dis. Model. Mech. doi:10.1242/dmm.001420 (2009)

Excess alcohol consumed during pregnancy starves embryos of retinoic acid, causing deformities such as small head size and missing brain structures.

Abraham Fainsod at the Hebrew University in Jerusalem and his colleagues had previously developed a laboratory frog model of the effects of alcohol. Given alcohol, the frog embryos recapitulate some of the developmental defects of fetal alcohol syndrome.

Fainsod and Hadas Kot-Leibovich now show that alcohol competes with vitamin A, a precursor of retinoic acid, for an enzyme called RALDH2. Increasing RALDH2 levels allows the embryos to tolerate higher doses of alcohol.

CHEMISTRY

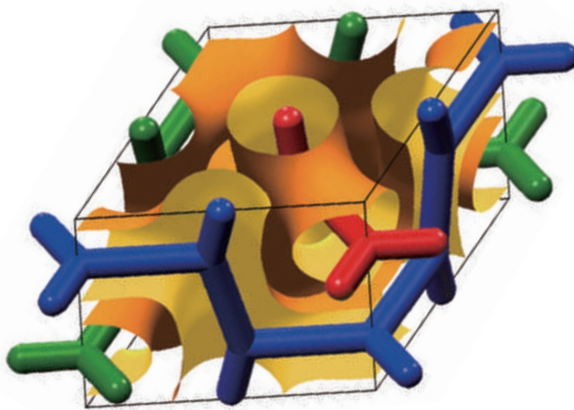
Three in one

Nature Chem. doi:10.1038/nchem.166 (2009)

The most complicated porous nanomaterial ever made is reported by Jackie Ying at the Institute of Bioengineering and Nanotechnology in Singapore, Xiaodong Zou at Stockholm University and their colleagues.

Made from silica, the material has three separate but interwoven continuous porous channels (pictured below). Until now, scientists have only managed to construct mesoporous silica materials containing at most two independent pore systems.

The authors generated the intertwined porous material using a specially designed template made from a positively charged surfactant. The structure contains both ultrashort and ultralong silica channels, and could be used as a molecular sieve to separate different molecules at different rates.



GEOLOGY

Flooding on the Silk Road

Geology 37, 243–246 (2009)

Increased flooding in northwestern China along a section of the old 'Silk Road' trade route is due to accelerated glacier melting, indicating that climate warming is affecting arid communities and their water resources.

Jian Sheng Chen of Hohai University in Nanjing, China, and Chi-yuen Wang of the University of California, Berkeley, analysed oxygen and hydrogen isotopes in the unusually high spring upwelling in a portion of the Hexi Corridor that abuts the Badian Jaran Desert. They traced the water's origin to glaciers four kilometres above sea level in the Qilian Mountains, 40 kilometres away.

The researchers suspect that earthquakes starting in 2003 are responsible for releasing stored groundwater. They also estimate that, at current melting rates, most of the Qilian Mountains' glaciers could disappear by 2050, ultimately depleting the valley aquifer.

JOURNAL CLUB

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An archaeologist looks at South America's early complex societies.

What leads to the rise and fall of civilizations? In coastal Peru, early urban societies based on maritime fishing thrived from 5,800 to 3,600 years ago. Daniel Sandweiss at the University of Maine in Orono and his colleagues report that climate and environmental changes were critical to the rise of these societies (D. H. Sandweiss *et al. Proc. Natl Acad. Sci. USA* 106, 1359–1363; 2009). They find that environmental shifts are well recorded in coastal geological features, which correlate to high Andes glacial cores, notably in the sixth millennium BP, when small urban centres also emerged in southwestern Asia — the 'cradle of civilization'. But as the Peruvian coastal embayments disappeared, around 3,600 years ago, so too did the societies that depended on them.

This paper particularly interested me as our work in the southern Amazon has revealed integrated towns and villages thriving several millennia later on similar resources as the early Andeans — fish, fruit and tubers. Although not as marked as coastal Peru, climatic fluctuations recorded in glacial records, notably the 'Medieval Warming' around 1100–1300 AD, coincided with the emergence of these small territorial polities.

The early complex societies of South America prompt debate over what constitutes urbanism and 'civil society' in its earliest and most minute forms, and make us reconsider the traits and typologies developed from classical civilizations and Western experience. Notably, in some South American cases, corporate labour and civic organization were not based on agricultural intensification and administration of crop surpluses.

Whether we call them urban or not, these societies show unique properties of self-organization and dynamics of the relationship of humans with natural systems.

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