



Dalian, Liaoning Province, China

COASTAL ECOSYSTEMS

The cost of economic growth

Anthropomorphic changes threaten the stability of coastal ecosystems, but whether economic growth contributes to such degradation is unknown. To find out, He *et al.* assessed the trends in coastal population, economy, and 15 different human impacts, including salt production, fishing, and marine freight transport, on 30,000 km of Chinese coastline both before and after economic reforms began in China in 1978. They found that all 15 human impacts increased after 1978, even though population growth remained constant, suggesting that economic growth contributed to coastal ecosystem decline. The authors highlight the need for a national policy of environmental management to protect the coupled human-ocean ecosystem. — AMS

Sci. Rep. **4**, 5995 (2014).

OPTICAL COMMUNICATION

Steering an optical signal without wires

All wireless communications—radio, cell phones, wi-fi, or anything else—need reliable links between transmitters and receivers. In general, higher-frequency bands can convey more information than lower-frequency ones. Using a patterned array of tiny metallic nanoantennas, Dregely *et al.* show that they can steer an optical beam wirelessly from a transmitter to any one of a number of receivers. Because light has such high frequencies, these kinds of directed wireless optical channels should be able to transmit even greater amounts of information than devices using more traditional, longer-wavelength approaches. — ISO

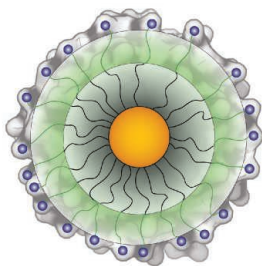
Nat. Commun. 10.1038/ncomms5354 (2014).

CHEMISTRY

Coatings keep gunk off nanoparticles

Nanoparticles have many potential therapeutic applications, such as delivering drugs. In untreated biological fluids such as plasma or serum, however, protein layers can cover the

particles' surfaces, interfering with their intended function. Moyano *et al.* show that gold nanoparticles coated with zwitterionic ligands—neutral molecules with both positively and negatively charged regions—prevent protein coronas from forming around the particles. As



A corona-free nanoparticle

a consequence, the nanoparticles can interact with cells as intended. Furthermore, the hydrophobicity of the nanoparticles can be tuned, which affects the cellular uptake of the particles. — MSL

ACS Nano 10.1021/nn5006478 (2014).

VIRAL COMPETITION

How infection rate determines virus spread

When a virus attacks a plant, it can damage cells locally or it can spread to the entire plant through the vasculature. Viral

spread increases the odds that the virus could jump to other plants. To better understand this process, Rodrigo *et al.* mathematically modeled the timing and features that contribute to viral spread. They also watched viruses infect plants in experiments. A virus was sure to spread systemically when it infected many sites on the plant, and the most successful viruses were the ones that replicated the fastest, not the ones that spread quickly from cell to cell. But with a more moderate number of infection sites, rapid jumping between cells determined success. — PJH

J. R. Soc. Interface **11**, 20140555 (2014).

HYDROLOGY

Looking beneath the drying surface

Groundwater is being depleted in the Colorado Basin region even faster than the rapid drawdown of Lakes Powell and Mead. Castle *et al.* determined groundwater depletion in the American Southwest by using data from the GRACE satellites, which measure minute variations in Earth's gravity field: in this case, ones associated with water movement below the surface. Looking at 9 years of results beginning at the

end of 2004, 4 years after the current drought there began, they find that groundwater use makes up a much larger fraction of basin water use than previously recognized. Its continued depletion, they conclude, may pose a serious threat to the region's ability to meet future water needs. — HJS

Geophys. Res. Lett.
10.1002/2014GL061055 (2014).

OCEAN CHEMISTRY

Mercury levels in surface ocean tripled

Human activities such as coal burning have tripled mercury in the surface ocean, posing a threat to human health, a study finds. Mercury emitted to the atmosphere rains out to the oceans, where it is converted to the neurotoxin methylmercury that bioaccumulates in fish. Lamborg *et al.* collected 8 years of water samples from four oceans and used databases of human-generated CO₂ from coal burning to scale up to worldwide pollution. The ocean contains 60,000 to 80,000 tons of pollution mercury, they found, two-thirds in water shallower than 1000 meters. In the top 100 meters, mercury has tripled compared to preindustrial times. — JY

Nature, 10.1038/nature13563(2014).