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ECOLOGY: ALL WASHED UP

Toxic algal blooms, or red tides, caused by dinoflagellates pose a danger for humans and many other vertebrates. In November 2007, a late red tide of *Akashiwo sanguinea* in Monterey Bay caused a mass stranding and high mortality of winter visiting seabirds. Jessup *et al.* report that the birds' plumage had become coated in a sticky green froth exuded from the algae that contained surfactant mycosporinelike amino acids, which acted like a detergent to strip the feathers of their natural waterproofing oils. Consequently, the soaking birds, already weakened from migration, became hypothermic, and many died. If the surviving birds were cleaned as if they had been caught in an oil spill, then most made a full recovery. The algae seemed to have no other toxic activity, although inhaling aerosolized green scum apparently caused lung pathology. With the major shifts currently affecting the marine environment that are favoring other types of red tides, this kind of algal hazard is likely to become a more widespread occurrence. -- **CA**

PLoS ONE **4**, e4550 (2009).

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CHEMISTRY: CLICKING ONTO NANOFIBERS

Vertically aligned carbon nanofibers--stacked "cups" of grapheme--are of interest for electrochemistry because they expose a high fraction of edge sites with much faster electron transfer rates than the basal plane sites that predominate on carbon nanotubes. For applications such as sensing, it would be useful to attach redox-active groups to the surface of these materials. Landis and Hamers report that copper click chemistry can be used to attach groups such as ferrocene. The carbon nanofiber surfaces were functionalized with azide groups, and ethynyl-substituted ferrocenes were then covalently attached through the Cu(I)-catalyzed cyclization reaction. The attachment was quite stable--the redox couple could be cycled at least 1500 times. The rates through this pi-bonded bridge were similar to those for ferrocene groups attached through saturated alkyl linkages, suggesting that electron transfer occurs through the aqueous solvent rather than the hydrocarbon bridges. -- **PDS**

Chem. Mater. **21**, 724 (2009).

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APPLIED PHYSICS: CIRCUIT TRAINING FOR FLUIDS

A nagging problem in microfluidic reactor design is the need for bulky external apparatus to control the

pumping and directing of the fluid flows. To circumvent this issue, Leslie *et al.* tried to mimic passive electrical circuits--resistors, capacitors, and diodes. Capacitors store electrical charge, a function mimicked by bonding a deformable elastomeric film to a fluid microchannel, so that the film bulged to allow more fluid storage as the overall pressure increased. Diodes, which permit flow in only one direction, were fabricated by bonding a deformable film on top of a weir, thus allowing flow only when the pressure was above a critical value. Through a combination of these circuit elements, fluid flow could be predicted and controlled by modulating a pressure source with time through a selection of resistive channels and capacitors. More complex flows were achieved by creating branched streams that merged at the output channel. The flow from each branch was regulated by the frequency of the pressure oscillations, effectively rendering the device a bandpass filter. Diodes, with their nonlinear response to pressure, were used to convert oscillatory flow to steady flow, similar to the conversion of electrical current from ac to dc. -- **MSL**

Nat. Phys. **5**, 231 (2009).

MICROBIOLOGY: DO WE HAVE A QUORUM?

Bacteria can communicate with one another and act cooperatively as a group--a process known as quorum sensing (QS). However, such communication and cooperation can be exploited by "cheaters," who benefit from the shared metabolic or otherwise beneficial activities without contributing to them. In the case of the pathogenic bacterium *Pseudomonas aeruginosa*, the signal molecules that facilitate population-wide QS regulate important disease-related processes, such as biofilm formation, swarming motility, and the production of secreted virulence factors. Rumbaugh *et al.* demonstrate that this potentially deadly cocktail of activities can be undermined by mutant bacteria that cheat. In a burn injury model in mice, infection with QS *P. aeruginosa* leads to rapid death of the host; infection with QS mutant bacteria resulted in significantly less mortality. The mortality caused by QS bacteria was substantially diminished in the presence of the mutant bacteria, which, through their exploitation of the QS bacteria, were able to flourish at their benefactors' expense, reducing the overall virulence of the infection. Furthermore, the mutant bacteria, which cannot normally mount an effective systemic infection, were able to spread to the liver in the presence of the QS bacteria, presumably by piggy-backing on the social activities of the QS bacteria. QS mutants are known to arise in clinical settings and may thus affect the virulence and course of infections. -- **GR**

Curr. Biol. **19**, 341 (2009).