



STKE: Stimulating Close Encounters

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A cleaning session.

ECOLOGY

Feasting on Fish

Like drivers at a carwash, coral reef fish queue at cleaning stations to have parasites, slime, and broken scales nibbled away by smaller fish and by shrimps. These species interactions are interesting for their tropical ubiquity and the diversity of species that can be found as clients and cleaners. Although some cleaners are obligate professionals, others are dilettantes and adopt this life-style intermittently.

Floeter *et al.* have compiled data from around the tropics to tease out the selection pressures acting on these interactions. The basic emerging relationship is that, owing to abundance, the more common, planktivorous, and gregarious species take up most of the cleaner's time. Client size doesn't seem to be very important, nor does professionalism, when it comes to dealing with carnivores that might eat the fish or shrimp that is cleaning them. Hence, this study adds to a growing body of evidence suggesting a central role for abundance in structuring species interactions. Guimarães *et al.* have also looked at cleaning mutualisms. They document a pattern of nestedness, dominated by a core of a few, very busy cleaner species that service a wide variety of clients, with less popular cleaners and clients, both of which interact with core species but not each other, lounging on the periphery. — CA

J. Anim. Ecol. 10.1111/j.1365-2656.2006.01178x (2006); *Biol. Lett.*

10.1098/rsbl.2006.0562 (2006).

CHEMISTRY

Treacherous Tetrahedron

The relative strength of the triple bond in N_2 renders compounds with three or more catenated nitrogen atoms unstable, often explosively so. Banert *et al.* have succeeded in the careful preparation and isolation of the nitrogen-rich, dangerously explosive tetraazidomethane, $C(N_3)_4$, as a colorless liquid at room temperature. The stable, readily available trichloroacetonitrile molecule proved the most convenient precursor, affording the product after an 18-hour reaction with sodium azide in acetonitrile solvent. Cycloadducts with three and four equivalents of cyclooctyne could be isolated in ~5% yield and were characterized crystallographically. Reaction with norbornene, however, yielded unusual tetrazole derivatives in place of expected 1,3-dipolar cycloaddition adducts. Despite the compound's instability, the authors acquired clean ^{13}C and ^{15}N nuclear magnetic resonance spectra, as well as vibrational and mass spectral data, and an estimated boiling point of 165°C. Both Brønsted and Lewis acids accelerated exchange with free azide. — JSY

Angew. Chem. Int. Ed. 45, 10.1002/anie.200603960 (2006).

BIOMEDICINE

An Absorbing Tale

Folate is a water-soluble vitamin that plays a critical role in metabolism. Because humans cannot synthesize it biochemically, they must

obtain it by ingestion from folate-rich dietary sources. Maternal folate deficiency has been associated with an elevated risk of neural tube defects in the developing embryo, which can lead to malformations of the spine (such as spina bifida), skull, and brain. Because of these public health issues, there is considerable interest in understanding the specific molecular mechanisms that the body uses to absorb folate from food.

Through a combination of database mining, cell biology, and human genetic analysis, Qiu *et al.* have identified a transporter protein that appears to be responsible for the intestinal absorption of folate. Previously isolated as heme carrier protein HCP1, the proton-coupled folate transporter (PCFT) was expressed in the small intestine, bound folate with high affinity, and transported folate efficiently into cultured cells at the low pH that characterizes the intestinal milieu. An inactivating mutation in the corresponding gene was identified as the molecular culprit in a family with hereditary folate malabsorption. — PAK

Cell 127, 917 (2006).

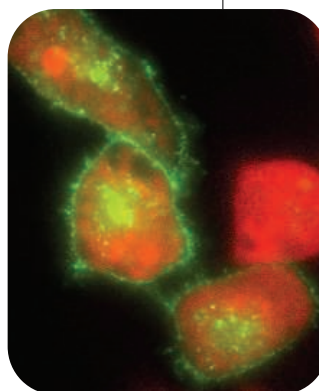
PSYCHOLOGY

Me *et al.*

An established and unsurprising characteristic of people working within teams is that each individual believes that he or she makes a disproportionately large contribution to the group output, so that the summed estimates are greater than the whole. These self-appraisals can be tempered if individuals are encouraged to regard what other team members do, and this shift in perceptions is thought to be conducive to group harmony and satisfaction.

Caruso *et al.* have looked more closely at whether structural heterogeneity within teams might influence perceptions and feelings in other-regarding situations. In studies gauging the self-contribution estimates of coauthors of 150 published papers (and their enjoyment of those collaborations) and experimentally manipulating the perceived and objective contributions to group projects, they found that workers who believed that they had done more (and those who actually had done more) were less satisfied, relative to those who had done less, when asked to consider the contributions of their teammates, in part because they became more aware of inequalities when taking a broader perspective. An additional

Continued on page 1661



PCFT (green) localizes to the plasma membrane.

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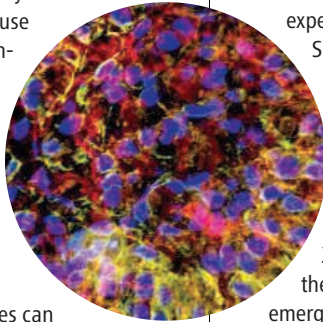
finding is that this deleterious and unintended consequence of encouraging other-regarding behavior was largely mitigated in a competitive setting, where the allocation of rewards acknowledged individual rather than group performance, as exemplified in authorship order. — GJC

J. Pers. Soc. Psychol. **91**, 857 (2006).

CHEMISTRY

Brightening Tumor Analysis

In order to better understand the growth of cancerous tumors, clinicians may evaluate hundreds of samples for the expression of certain proteins, ideally in a quantitative fashion. Current methods of analysis tend to be only semi-quantitative, however, because the fluorescence signals generated from dyes may be distorted by tissue autofluorescence and photobleaching, and moreover,



Antigen detection by QD fluorescence.

immunochemistry techniques can suffer from the imprecision of scoring by visual inspection. Ghazani *et al.* use semiconductor nanocrystals, or quantum dots (QDs), to implement a quantitative analysis technique. In contrast to fluorescent dyes, QDs have much brighter fluorescence signals and are less prone to photobleaching. The QDs in this case are bio-conjugated for specific antigens, and the output fluorescence of a full array can be measured using optical spectroscopy. Efficient algorithms

facilitate subtraction of tissue autofluorescence, as well as other automated corrections. Thus, intensity values can be used to give accurate, sensitive, and quantitative measurements for a range of protein markers. — MSL

Nano Lett. **6**, 10.1021/nl062111n (2006).

APPLIED PHYSICS

Warming Up Neuroimaging

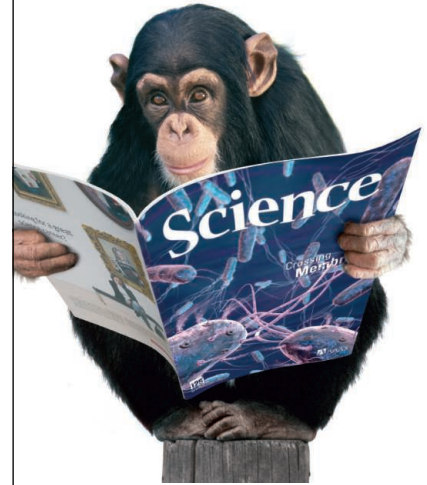
Superconducting quantum interference devices, or SQUIDs, are remarkably sensitive instruments for detecting small magnetic fields. When placed in an array in a helmet-like structure, they can even be used to detect the minute magnetic fields given off by the human brain. However, these neuroimaging machines tend to be large and expensive, in part because they require the SQUIDs to be held constantly at cryogenic liquid helium temperatures.

Recent work has shown that certain atomic gases are also sensitive to small magnetic fields and can be used to detect the fields given off by the heart. By refining this technique, Xia *et al.* have succeeded in measuring the hundredfold-weaker magnetic signals emerging from the brains of human test subjects. A cloud of potassium atoms isolated in a gas cell is optically excited, effectively rendering each atom an individual compass needle. The presence of a magnetic field then causes the atoms to precess, which in turn induces optical rotation of a probe beam used to quantify the field. The measurement matches the sensitivity of the low-temperature SQUIDs without the need for cryogenic cooling. — ISO

Appl. Phys. Lett. **89**, 211104 (2006).

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<< Stimulating Close Encounters

Phagocytes engulf microbes by enveloping them in a patch of membrane that invaginates to form a phagosome; this then fuses with a lysosome, which contributes the enzymes that destroy the internalized pathogen. Trivedi *et al.* exposed mouse macrophages to latex beads to investigate how immunoglobulin G (IgG)—class antibodies, which stimulate phagocytosis, might promote the latter stages of this process. When macrophages incubated with beads coated with either bovine serum albumin or IgG at 15°C (allowing bead engulfment but not fusion) were warmed to 37°C, the association of IgG-coated beads with phagolysosomes was faster than that of the albumin-coated beads. Cytosol from cells transfected with human Fcγ receptor (making them phagocytic) and incubated with IgG beads promoted phagosome-lysosome interactions more effectively than that from unexposed cells, an effect enhanced by transfection of the cells with protein kinase C (PKC). Inhibition of PKC abolished the stimulatory effect of IgG, and further pharmacological analysis indicated that IgG stimulated the actin-dependent tethering or docking (or both) of phagosomes and lysosomes. Thus, facilitation of phagosome-lysosome attachment by way of PKC appears to be one mechanism whereby IgG signaling stimulates phagocytosis. — EMA

Proc. Natl. Acad. Sci. U.S.A. **103**, 18226 (2006).