Editors' Choice

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PHYSICS: POLARIZATION PUZZLE

When very high-intensity light strikes a solid surface, it can liberate multiple electrons and ions that then continue to collide rapidly with one another, forming a plasma state. These collisions in turn lead to emission across a broader spectrum of wavelengths, as kinetic and electromagnetic energy steadily interconvert. The chaos of such a process might be expected to distribute the emitted light across completely random orientations. However, Liu *et al.* make the surprising observation that under certain conditions, the plasma produced from a silicon (Si) surface initially emits a continuum of ultraviolet light that is >95% polarized. The optimal conditions involved focusing a pair of ultrashort laser pulses spaced 80 ps apart in time onto a Si(111) crystal face; this dual pulse sequence proved key to maximizing the effect. The degree of polarization was also highly sensitive to the distance between the surface and the laser focus, and scaled inversely with pulse intensity (at least within the range sufficient to induce plasma emission). -- **JSY**

Appl. Phys. Lett. **93**, 161502 (2008).

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MATERIALS SCIENCE: GRAPHENE OXIDE RESONATORS

One potential application for graphene (sheets of graphite only one or several layers thick) is as a resonator in nanoelectromechanical systems, in part because of the high ratio of stiffness to mass. However, the formation of large-area films of exfoliated graphene and manipulation of the graphene flakes are experimentally challenging. An alternative is to use a related material, graphene oxide, in which the graphene film is chemically modified with oxygenated substituents. Robinson *et al.* rapidly deposited graphene oxide platelets onto glass by spin casting along with rapid solvent evaporation, which formed ultrathin continuous films. These films could then be chemically reduced, and despite being as thin as 4 nm, could be released from the substrate by being dipped into basic solution. They could then be suspended onto substrates patterned with circular holes (between about 3 and 7 μm in diameter) in order to form drum resonators. Laser interferometry revealed that these membranes resonate in the radiofrequency range and have quality factors up to 4000, which is comparable to those of diamond oscillators and exceeds typical values for graphene oscillators (10 to 200). This increase relative to graphene reflects the enhanced adhesion of graphene oxide to glass surfaces through surface oxygen groups. -- **PDS**

Nano Lett. **8**, 3441 (2008).

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MOLECULAR BIOLOGY: KEEPING ONE'S IDENTITY

The phenotype of a cell is in part defined by its pattern of active versus inactive gene expression. During development, progenitor cells divide and differentiate down specific lineages, and daughter cells retain the same activity profile as the cell from which they were derived. It is necessary to preserve these markers of cell identity through mitosis, when transcription ceases and many chromatin-binding proteins that determine gene activity dissociate from the DNA. Most of the chromatin becomes tightly compacted, but some active regions remain open, due to the binding of specific factors to gene promoters. This enables transcription to resume more easily after cell division and is known as gene bookmarking, being analogous to the way a bookmark allows one to open a book at a specific page; gene-specific bookmarking factors have been identified. TATA-binding protein (TBP) is an essential basal transcription factor, which remains bound to active promoters during mitosis, and Xing *et al.* show that TBP acts as a general bookmarking factor by recruiting the phosphatase PP2A. This enzyme inactivates condensin, which is a large protein complex involved in compacting chromosomes during mitosis. Understanding general mechanisms of bookmarking could be important for controlling cellular behavior during reprogramming, when differentiated cells need to be wiped clean of their previous identity. -- **HP**[*]

Nat. Cell Biol. **10**, 1318 (2008).

[*]Helen Pickersgill is a locum editor in *Science*'s editorial department.

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PHYSIOLOGY: FOUR WINGS ARE BETTER THAN TWO

The hindwings of butterflies and moths are necessary for agility, but not for flight itself. In experiments in which the hindwings of cabbage butterflies and gypsy moths were removed, Jantzen and Eisner found that the forewings were sufficient for these lepidopterans to remain airborne, despite the fact that they constitute only half the total wing area. However, video recordings showed that removal of the hindwing, which is mechanically coupled to the forewing, resulted in substantial deficits in several measures of flight performance, such as linear and turning acceleration. Hence, the hindwing may have evolved as an adaptation for rapid maneuverability in the face of pursuit by predators, chiefly bats and birds. -- **AMS**

Proc. Natl. Acad. Sci. U.S.A. **105**, 16636 (2008).

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PSYCHOLOGY: DON'T GET EVEN, STAY MAD

Declarations of unintentionality ("I didn't mean to hurt you") often suffice to defuse tense situations and to reduce or eliminate vengeful responses to a harmful act. But does the reining in of aggressive behavior reflect deliberate and effortful control of those impulses, or does the claim of a lack of purpose serve to dissolve one's anger? Using a social evaluation setting, Krieglmeyer *et al.* obtain evidence linking the attribution of intention to a conscious overriding of impulsive aggression. They presented students with positive or negative ratings (from an unseen partner) of their ideas for naming a new energy drink; half of the students who had received negative feedback were then told that their partner had mistaken the high-low direction of the rating scale and had in fact intended to assign them positive marks. When assessed specifically for anger using an implicit measure and for behavior by means of the same rating scale, this set of students displayed a lower level of aggression as compared to the students whose negative assessments had been intentional (although they still exhibited a higher level of hostility than the students who had received positive ratings initially). In contrast, learning that the negative ratings had been delivered in error and that the actual intent had been to send positive feedback had no effect on the levels of implicit anger. -- **GJC**

J. Exp. Soc. Psych. **44**, 10.1016/j/jesp.2008.10.003 (2008).

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CELL BIOLOGY: CAN YOU HEAR ME NOW?

It's a bit like talking to your neighbor at a dinner party with a megaphone, but Tovey *et al*. report that the stimulation of calcium release through inositol 1,4,5-trisphosphate receptors (IP_3R) results from enormous amounts (1000 times greater than the amount needed to activate protein kinase A) of the second messenger cAMP produced by adenylyl cyclase (AC) molecules that are closely apposed to the IP_3R channel. The authors were led to this unorthodox interpretation by their exploration of the mechanisms by which parathyroid hormone (PTH), which itself does not cause the release of calcium, enhanced the effects of other hormones on the release via IP_3Rs of calcium from internal stores. Only PTH analogs that activated AC potentiated calcium release. High concentrations of cAMP analogs were sufficient to reproduce the effects of PTH and were not additive with the effects of the hormone. The authors propose that AC and IP_3Rs are in such close proximity that activation of the cyclase produces a massive all-or-none response of the channel that is resistant to modulation by agents that alter cytoplasmic concentrations of cAMP; immunoprecipitation experiments confirmed the prediction that IP_3Rs and AC were associated physically. Such signaling complexes would have on-off or switchlike properties and could allow graded responses by recruitment of more activated complexes rather than graded response at an individual complex. To add to the complexity, the IP_3R-associated isoform of AC is inhibited by calcium. Thus, localized concentrations of cAMP and calcium might oscillate as a result of feedback inhibition. -- **LBR**

J. Cell Biol. **183**, 297 (2008).

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CHEMISTRY: DELIVERING MORE THAN CHARGE

A small platinum or carbon wire inserted into a solution environment can yield substantial chemical insight through charge exchange with local compounds. One limitation of such electrode sensing, however, is that only electrons can be shuttled back and forth. Chen *et al.* have engineered a microfluidic apparatus, which they term a chemistrode, that can deliver or remove complex molecules from specific sites with a spatial resolution of 15 μm. The system relies on a fluorocarbon carrier fluid that pulls well-separated aqueous droplets through a channel that briefly opens to contact a substrate surface for molecular exchange. Analytes absorbed from the substrate can then be subjected to a wide range of traditional spectrometric probing techniques. The authors demonstrate the device through a measurement of insulin secretion kinetics by

murine islet of Langerhans cells. -- **JSY**

Proc. Natl. Acad. Sci. U.S.A. **105**, 16843 (2008).

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