A N I M A L  C O G N I T I O N

Give Her What She Wants

Most humans have excellent state-attribution skills; that is, we regularly attribute states we experience ourselves (e.g., hopes, desires, beliefs) to others. Such skills are essential for day-to-day human interactions and are particularly important in bonded relationships. The ability to understand another’s perspective and wants has generally been considered to be specific to humans, but the benefits of such skills could confer an adaptive advantage for many species. Thus, these skills may be present in non-human animals but just difficult to demonstrate. Ostojic et al. use a suite of controlled experiments in Eurasian jays and find evidence that state attribution is present in these monogamous birds. Specifically, consumption of one preferred food by females reduced their desire for it later, when compared with another preferred food. They showed that males were attuned to this “specific satiety” and flexibly offered females the preferred food that they had not been offered previously. The authors ruled out several alternative explanations, such as the potential that the female was giving behavioral cues during the feeding: Males had to be able to observe the initial feeding in order to best judge what the female would most want next. Besides demonstrating that male Eurasian jays make thoughtful and observant mates, these results suggest that state attribution may not be ours alone. — SNV


P H Y S I C S

Remote Sensing with a Twist

Our eyes sense light that has bounced off objects, with our brain then making sense of the input flowing through the optic nerve. In this case, the photons that hit our eyes must interact with the object. However, it is possible to get information about an object using photons that have not actually hit the object. This counterintuitive process of “ghost imaging” follows from the quantum-mechanical properties of photons and the ability to find correlations between specially generated pairs of photons. Uribe-Patarroyo et al. use such correlations between beams of light that have been imprinted with specific values of optical angular momentum: The light beam is effectively twisted, with the photons mapping out a spiral as they propagate. Using correlated photons produced by parametric downconversion, whereby a high-energy photon is converted into a pair of correlated photons of lower energy, they send one of the photons to the object and hold on to the other. When the photon hits the object, the process of that interaction changes its degree of twist and in turn affects the correlation between the pair. The object can then be determined by looking at changes in the correlations between the two photons. With a modification of the experimental setup, it should be possible to remotely sense reflective targets at large distances, with the target unaware that it is being watched. — ISO


M I C R O B I O L O G Y

All Together Now

Among communities of microorganisms, interspecies gene transfer is rife, but as a microbial community consumes local resources and develops in time and space, it is becoming increasingly apparent that the products of diverse metabolic activities can also be publicly shared. Ottesen et al. set adrift a buoy with a robotic sampler off the coast of northern California to collect, every 4 hours over 2 days and about 50 km of distance, wild picoplankton for community RNA sequencing. Analyses of transcriptional dynamics revealed that the photosynthetic eukaryote Ostreococcus and the bacterium Synechococcus co-expressed large numbers of genes diurnally. The proteorhodopsin-expressing heterotroph Pelagibacter did not show diel gene expression but did show well-orchestrated regulatory patterns and a high degree of covariance between some major metabolic pathways, indicating immediate responses to changing growth conditions. Whether this apparent coordination stems from species-to-species communication and signaling cascades or is the product of individual responses remains to be determined. — CA


A S T R O N O M Y

A Celestial X-ray Mirror

Bok globules, named after astronomer Bart Bok, are dense clouds of cold gas and dust that are usually condensing to form one or more stars. They are so dense that they can be totally opaque to visible light, often appearing in optical images as dark patches against the bright stellar background. McCollough et al. report a Bok globule that scatters the x-ray light emitted by a nearby binary system and thus appears as an x-ray emission feature in data taken with NASA’s Chandra x-ray Observatory. The binary system, Cygnus X-3, is a powerful x-ray source located in the plane of our galaxy, where a massive, evolved star and either a black hole or neutron star orbit around their common center of mass. The x-ray data show an extended emission region associated with Cygnus X-3 that varies in flux among communities of microorganisms, interspecies gene transfer is rife, but as a microbial community consumes local resources and develops in time and space, it is becoming increasingly apparent that the products of diverse metabolic activities can also be publicly shared. Ottesen et al. set adrift a buoy with a robotic sampler off the coast of northern California to collect, every 4 hours over 2 days and about 50 km of distance, wild picoplankton for community RNA sequencing. Analyses of transcriptional dynamics revealed that the photosynthetic eukaryote Ostreococcus and the bacterium Synechococcus co-expressed large numbers of genes diurnally. The proteorhodopsin-expressing heterotroph Pelagibacter did not show diel gene expression but did show well-orchestrated regulatory patterns and a high degree of covariance between some major metabolic pathways, indicating immediate responses to changing growth conditions. Whether this apparent coordination stems from species-to-species communication and signaling cascades or is the product of individual responses remains to be determined. — CA

and orbital phase with the binary. This behavior is best explained as the result of scattering from a cloud located between Cygnus X-3 and the observer, which acts as an x-ray mirror to Cygnus X-3. The cloud’s size, density, and mass, derived from the x-ray data, are consistent with those of a Bok globule. — MJC


BIOMEDICINE

Protecting Pregnancies

Preeclampsia is a dangerous complication of up to 5% of human pregnancies. The only treatment is removal of the fetoplacental unit by surgery or delivery. To better understand this condition, Doridot et al. generated a preeclampsia mouse model by overexpressing the transcription factor STOX1, which has previously been associated with preeclampsia. When control females were mated to transgenic males, the pregnant female mice showed characteristic features of preeclampsia, such as hypertension and protein in the urine. In addition, an elevated plasma level of soluble antiangiogenic factors was seen. When aspirin was administered early in the pregnancy via the drinking water, hypertension was prevented, as were elevated protein levels in the urine. An effect was also seen in the litter size: Control mice had slightly larger litters than their transgenic counterparts; however, with administration of aspirin, litter size was normalized. These results indicate that providing low doses of aspirin to preeclamptic mice early in gestation prevents disease development and suggests a potential means of human therapeutic intervention for this life-threatening condition. — BAP

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CHEMISTRY

Customizing Polymer Brushes

One way to modify a surface and control or improve its properties is to grow polymer chains off the surface to form a “brush.” One method for growing polymer brushes from surfaces—atom-transfer radical polymerization—can be controlled electrochemically, in that the process can be catalyzed by Cu⁺ ions but not by Cu²⁺. Li et al. used this method to create gradients in the length of polymer brushes grown on a substrate modified with a suitable initiator. They polymerized 3-sulfopropyl-methacrylate with Cu⁺-bipyridyl catalysts generated from Cu²⁺ in a mixed water-methanol solvent. The substrate was placed opposite a working electrode in an electrochemical cell. Because the Cu⁺ catalyst diffused toward the substrate, a concentration gradient was established along the cell. If the substrate was placed parallel to the working electrode, uniform brushes were grown, but if it was placed at an angle, a gradient in polymer brush length (measured with ellipsometry) was created, corresponding to the gradient in catalyst concentration. Prepatterning of the initiator on the substrates—which included gold, silicon, and silicone rubber—allowed the brush to form a “staircase” structure. — PDS


PSYCHOLOGY

Sound Judgment

A centuries-old line of thinking by moral philosophers has linked judgments about moral character to emotions. Contemporary psychological research has provided an experimental basis for these ideas, although the precise mapping of emotions onto morality has not always been established. Seidel and Prinz have been able to demonstrate this by using auditory stimuli that selectively activate the distinct emotional channels of anger—via harshly dissonant music—and disgust—via the sounds of a person vomiting. After a short listening session, people were then presented with scenarios describing violations of autonomy—in which a person was harmed, as in a robbery—or violations of purity—in which cultural norms rendered some actions unnatural. They observed that evoking anger increased the severity with which people judged violations of autonomy but not those of purity, whereas eliciting disgust yielded higher ratings for the latter and not the former kind of moral transgression. — GJC
