EDITED BY KRISTEN MUELLER AND JAKE YESTON

SOCIOLOGY

Complex Contributions

It is well established that academic achievement is related to socioeconomic status (SES), but it is not yet clear at what age this effect emerges. Tucker-Drob *et al*. examined whether the effects of SES on mental ability could be observed in infancy. They analyzed 750 pairs of twins from the Early Childhood Longitudinal Study, Birth Cohort data file. At 10 months and 2 years of age, the children's mental ability was assessed using tests that included pulling a string to ring a bell, putting cubes in a cup and matching pictures, among other tasks. SES was determined from the education and occupations of the parents and family income.

At 10 months of age, SES was not related to mental ability. Between 10 months and 2 years of age, however, the authors observed that increased SES was associated with larger gains in mental ability. At 2 years of age, the influence of genetics on cognitive development was higher in children of higher SES, whereas genetics had very little effect on the mental ability of children raised in low-SES homes. These findings do not indicate any differences in intrinsic intelligence, but may provide support for efforts to provide enrichment for young children from disadvantaged backgrounds. — BJ

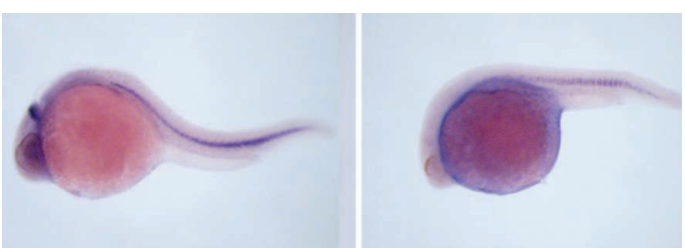
Psychol. Sci. **22**, 125 (2011).

SIGNALING

Signaling Across Pathways

The signaling pathways that regulate cell function are obvious targets for therapeutic intervention, but such strategies are complicated by our incomplete understanding of these pathways and also the links between them. Jacob *et al*. used an RNA interference screen in mouse cells to find new components of the Wnt and Hedgehog signaling pathways. Both are key regulatory pathways in development that are also linked to various diseases, including cancer. Loss of the protein kinase Lkb1 inhibited Hedgehog pathway–dependent gene expression through effects on the primary cilium, where Hedgehog signaling is organized. Loss of Lkb1 also disrupted Wnt signaling, but through a distinct mechanism. Similar results were observed when expression of Lkb1 was inhibited in zebrafish embryos. Similar expanded approaches thus appear necessary to understand the functions of key signaling components and how they might be managed to affect complex diseases. — LBR

Sci. Signal. **4**, ra4 (2011).



PHYSICS

Cloudy, with a Chance of Gamma Rays

The tremendous rumble of thunderclouds that sends children under their bedcovers and provides the electrifying atmosphere indicative of an impending storm also holds fascination for scientists who wish to understand the mechanism of lightning and the associated buildup and release of energy. Experiments have become more sophisticated since Benjamin Franklin's kite-flying forays to probe lightning directly. Of recent interest are terrestrial gamma-ray flashes (TGFs)—flashes of high-energy radiation that occur predominantly at the upper regions of clouds in the tropics and appear to originate deep in the atmosphere at an altitude of 10 to 20 km. Since space-based satellites first observed these TGFs in the 1990s, the formation mechanisms have tended to be described in terms of runaway electron acceleration models resulting from the large electric fields thunderclouds discharge. Tavani *et al.* report on a systematic study of observations across a wide energy range (350 keV to 100 MeV) by the Italian Space Agency's AGILE observatory that raise questions about those models. They argue that the emission spectrum at the very highest energies cannot be reconciled with existing models and that other mechanism(s) must be at play. Although no definitive model is provided, the detailed data set should prove useful for those trying to understand the energy dynamics of our atmosphere. — ISO

Phys. Rev. Lett. **106**, 18501 (2011).

ASTROPHYSICS

Tuning in to Bright Sources

The Fermi space telescope has revealed thousands of new sources of gamma-ray emission; however, the nature of hundreds of them remains a mystery. To check whether some of the unidentified sources could be pulsars, Ransom *et al*. searched for radio pulsations in 25 sources in the Fermi Large Area Telescope Bright Source List—a catalog of the brightest sources detected in the early months of the Fermi mission. These 25 sources

Published by AAAS

were selected to be nonvariable and not associated with known pulsars, black holes at the centers of galaxies, or x-ray sources that had previously been searched for radio pulsations. Radio observations with the Green Bank Telescope revealed three pulsars with millisecond periods, all of which are in binary systems where a neutron star and a companion star orbit one another about their common center of mass. The new pulsars have properties consistent with those of typical radio millisecond pulsars. Their detection suggests that most, if not all, radio millisecond pulsars produce gamma rays, and that their radio and gamma-ray beams are comparable in size. It is thus possible that millisecond pulsars contribute to the diffuse isotropic gamma-ray background. — MJC

Astrophys. J. **727**, L16 (2011).

CHEMISTRY

Carbonic Acid Aloft

The chemistry of carbon dioxide in water plays a remarkably diverse series of roles in our daily lives—modulating acidity in blood and ocean water, lending soda its sparkle and bread its fluff. It's all the more remarkable, then, that the adduct of the two molecules, carbonic acid, spent centuries eluding characterization. Its deprotonated conjugate bicarbonate (HCO_3^-) is reactive but easily isolable; in contrast, it was only recently established that the HOC(O)OH molecule persists for any length of time in solution before breaking apart. Bernard *et al.* have now shown that carbonic acid is also at least kinetically stable in the gas phase as well. By subliming the solid acid and then capturing it in a frozen argon matrix, the authors were able to detect the vibrational signatures of two conformational isomers (with a W-shaped one predominating) as well as a hydrogen-bonded dimer. The findings raise the prospect of finding the molecule in comet tails or other planetary atmospheres. — JSY

Angew. Chem. Int. Ed. 10.1002/anie.201004729 (2010).

SIGNALING

Working Against the Clock

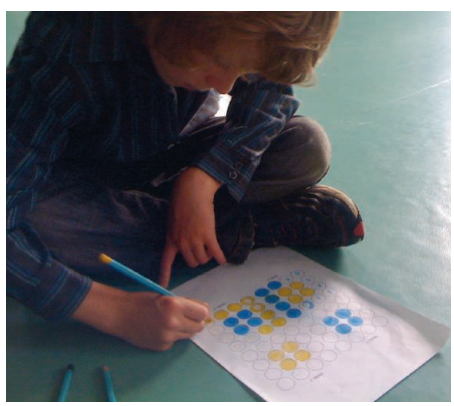
Our circadian rhythms keep us in tune with the day. Some of the molecular signals that implement and regulate the circadian rhythm have been identified, but the complexity of the various systems affected by circadian rhythms is not well understood. Many people work against their circadian clock, whether it be a scientist who hops seven time zones eastward and still hopes to be awake at a conference session with the lights dimmed, or someone who works the night shift and needs cognitive acuity and physical dexterity during the hours when most of us are asleep. To further understand how disruption of the circadian rhythm affects us, Karatsoreos *et al.* studied mice kept in an unnaturally short day/night cycle. With a cycle of 20 rather than 24 hours, the mice showed a variety of disrupted responses. They gained weight, had elevated insulin levels, and demonstrated reduced cognitive flexibility. Neurons in the brain's cortex showed reduced complexity. Study of these mice may help us understand, for example, the unexpected incidence of obesity among shift workers. — PJH

Proc. Natl. Acad. Sci. U.S.A. **108**, 10.1073/pnas.1018375108 (2011).

EDUCATION

Child Scientists

What would happen if, instead of consulting previous literature, scientists asked children for advice on designing experiments? In the case of the Blackawton Bees, 8- to 10-year-old children capitalized on their own curiosity and observations to devise questions, propose a hypothesis, design experiments, and perform data analysis in an original study examining how bees perceive and remember their surroundings. Besides



discovering that bees use both color and spatial analysis in deciding which color of flower to forage from, it served as an example of real science and engaged the students. This is evident in the published paper, written by the students, that contains statements such as "Before doing these experiments we did not really think about bees," and "This experiment is important, because no one in history, including adults, has done this experiment before." In this way, science education became more of a process of contributing to asking questions and devising strategies to answer those questions instead of a passive classroom lesson. Afterward, the students came to the same conclusion that every scientist has come to at one point in their career: "Science is cool and fun because you get to do stuff that no one has ever done before." — MM

Biol. Lett. 10.1098/rsbl.2010.1056 (2010).

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