ASTRONOMY

A Stellar Future Ahead?

Barnard 68 is a dark molecular cloud about 400 light years away from Earth. It contains mostly molecular hydrogen mixed with other molecules and dust grains in such high concentrations as to render it completely opaque at optical wavelengths. Stars are thought to be born in dark, cold places such as this. Yet Barnard 28 is still starless; before a star can form within the core, it needs to contract under the force of gravity for a period sufficient to ignite nuclear fusion. There is contradictory evidence as to whether Barnard 68 is still stable or already in a very early phase of gravitational collapse. Burkert and Alves now argue that Barnard 68, far from being a stable, isolated molecular cloud, is colliding with another, smaller cloud, as suggested by its asymmetric and distorted shape. Their numerical simulations of the collision imply that signs of an impending gravitational collapse can already be seen in Barnard 68, and the cloud should condense into a Sun-like star within the next 200,000 years. — MJC

Astrophys. J. **695**, 1308 (2009).

PSYCHOLOGY

Learning Control at an Early Age

Adults who try to master a second language often never attain the degree of fluency with which they converse in their mother tongue. In contrast, children usually fare considerably better, and it is not uncommon for the descendants of immigrants to display proficiency in the parental language as well as that of their peers. Even more impressively, infants exposed to two languages from birth assort two distinct vocabularies and sentence structures while reaching milestones in language production as quickly as their monolingual compatriots.

Kovács and Mehler demonstrate that cognitive control, which is inferred to be needed for switching between language representations, develops more rapidly in 7-month-old infants that have grown up in a bilingual, rather than monolingual, household. Both sets of infants learned at the same rate to associate auditory cues with the visual reward of a gaily-colored puppet shown either to their left or their right, but only the children of parents with different mother tongues (in Trieste, most frequently Italian and Slovene) were able to inhibit the learned response when the reward location was switched and to shift their anticipatory gaze to the other side. — GJC

Proc. Natl. Acad. Sci. U.S.A. **106**, 6556 (2009).

CELL BIOLOGY

Signals of Stress

Two papers have identified a signaling function for ribonucleases in stress. During times of stress, protein synthesis is inhibited via phosphorylation of eukaryotic translation initiation factor 2A (eIF2A). Yamasaki *et al*. focused on observations that translational arrest can occur in cells that express a mutant eIF2A that lacks the phosphorylation site. They found that cells exposed to oxidative stress accumulated cleavage products of transfer RNA (tRNA). Angiogenin is a secreted ribonuclease that has been implicated in tumorigenesis because it promotes the formation of blood vessels, and the authors found that depleting cells of angiogenin inhibited the stress-induced cleavage of tRNA. Thus, stressed cells may signal their neighbors by secreting angiogenin.

Yeast cells also cleave tRNA when exposed to oxidative stress, and Thompson and Parker have identified Rny1 as the ribonuclease responsible. Rny1 was released from the vacuole into the cytoplasm in response to oxidative stress, and overexpression of Rny1 caused apoptosis (cell death) in yeast. Nevertheless, Rny1 must do more than cleave tRNAs, because mutants that lacked catalytic activity could still promote cell death. Intriguingly, the human ortholog of Rny1, RNASET2, has a tumor-suppressing activity that is independent of its catalytic activity. Thus, it appears that release of Rny1 from the vacuole (analogous to the apoptotic release of cytochrome c from mitochondria) both causes cleavage of cytoplasmic tRNAs and affects signaling pathways controlling cell death. — LBR

J. Cell Biol. **185**, 35; 43 (2009).

APPLIED PHYSICS

Quantum Phone Calls

Certain conversations or transactions are meant to be private. Yet despite the encryption of digital communication in one form or another, information theory presents a loophole whereby such encrypted messages can be compromised, if only in principle (in practice it may be extremely difficult to do so). Quantum mechanics closes that loophole altogether. Sharing quantum mechanically–entangled photons can provide a secure key with which to encrypt and send a message, safe in the

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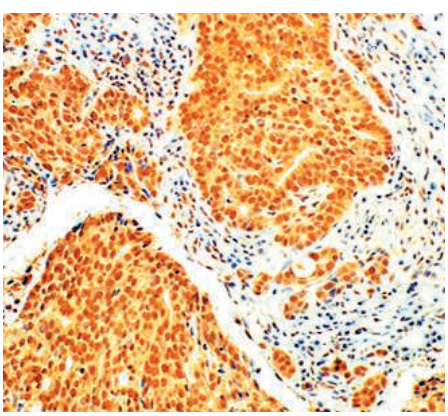
knowledge that the message cannot be opened by an eavesdropper, at least not without alerting you to the breach. Chen *et al.* demonstrate a quantum key distribution protocol in a real-world application scenario, with the quantum key distributed over a network consisting of three stations linked by 20 km of commercial optical fiber. The generated keys can be used immediately in the context of encrypted real-time telephone conversations between the separated stations. With such a demonstration, quantum privacy in your own home may not be a too distant prospect. — ISO

Opt. Express **17**, 6540 (2009).

BIOMEDICINE

Becoming Androgen-Independent

Signaling pathways comprising many proteins translate extracellular signals into phenotypic responses via selective regulation of gene expression. Transcription factors interpret the signals and, in concert with situational cofactors, manipulate an appropriate combination of genes. In prostate cells, the androgen receptor is a transcription factor that promotes distinct gene expression patterns in order to regulate proliferation, differentiation, and cell survival. Xu *et al.* show that the E3 ubiquitin ligase RNF6 can modulate the gene expression output patterns of the androgen receptor by atypical polyubiquitination of the receptor. Prostate



cancer is a leading cause of death in men, and current androgen-ablation therapies provide only a temporary solution because resistance develops rapidly. The authors found that RNF6 (brown in the image) was up-regulated in hormone-refractory prostate cancer cells and was required for their growth, suggesting RNF6 as a potential drug target for the treatment of prostate cancer. — HP*

Cancer Cell **15**, 270 (2009).

CREDIT: XU *ET AL.*, *CANCER CELL* 15, 270 (2009)

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

CHEMISTRY

Acid Analysis

Acids catalyze a wide range of chemical reactions by lending a proton to stabilize a particular intermediate structure. As Macht *et al.* show, however, the sensitivity of chemical rates to catalytic acid strength can vary in a subtle and at times surprising manner as a consequence of the reaction mechanism. The authors specifically compared the rate dependence of three reactions—dehydrations of 1- and 2-butanol and isomerization of hexane to 2-methylpentane—to the varied acid strengths of a range of solid acid polyoxometalate and zeolite catalysts. The overall barriers to reaction increased from 2-butanol dehydration to the alkyl isomerization, with 1-butanol dehydration effectively in the middle of the range. However, both dehydrations evidenced the same sensitivity to acid strength, whereas the alkyl isomerization sensitivity was roughly three times higher. To account for this result, the authors suggest that the concentrated charge distributions in the dehydration transition states are stabilized to some extent by conjugate base charge on the catalyst—an effect enhanced as acid strength drops—and so the overall impact of catalyst acidity is reduced. Conversely, the significance of this electrostatic stabilizing interaction is diminished for the more diffuse charge distribution in the isomerization transition state, resulting in a more pronounced barrier dependence on acid strength. — JSY

J. Am. Chem. Soc. **131**, 10.1021/ja900829x (2009).

SYSTEMS BIOLOGY

Ex Vivo Treatment

Although laboratory experiments are usually designed on the basis of pure populations of cells, responses within an organism often rely on heterogeneous populations. This is certainly true of tumor-infiltrating lymphocytes (TILs), which are used in adoptive cell transfer for the treatment of metastatic melanoma. Oved *et al.* used computational approaches to characterize—according to a panel of cell surface markers—TIL populations isolated from 91 human patients and to predict their reactivity to melanoma cells. No single marker could accurately predict the anti-tumor reactivity of the entire population; however, a set of population-based markers predicted the anti-tumor reactivity of the population (as defined by levels of interferon-γ produced) with 89% accuracy. The authors then took 12 non-reactive TIL populations from four other patients and succeeded in manipulating the frequencies of subpopulations in order to convert the populations into a reactive state—hopefully a step toward less toxic tumor therapy in vivo. — BJ

Mol. Syst. Biol. **5**, 10.1038/msb.2009.15 (2009).

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