This Week In PNAS Early Edition

Selected articles appearing the week of August 17, 2009

New for August 19

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Evolution

Origins of aromatic rice
A small group of highly valuable fragrant rice varieties, like basmati and jasmine, possess a characteristic fragrance, although the ancestry of the gene underlying fragrance, *BADH2*, is unclear. A study of these genetic origins in one of the world's largest staple crops has uncovered variants that could enable researchers to develop fragrant rice varieties that could appeal to the tastes of specific cultures. Michael Kovach et al. traced the genetic and geographic origins of the allele of *BADH2* responsible for most fragrant rice varieties. By sequencing the gene and a large flanking region in 242 different rice types, the authors determined that fragrance originated in the *Japonica* varietal group, not *Indica* as previously thought. The authors also uncovered eight new alleles of *BADH2* and found that the varieties carrying these alleles clustered in specific geographic regions across Asia. Two of the fragrant cultivars in their study lacked any mutations in the *BADH2* gene that would be predicted to cause fragrance, implying that additional genes controlling fragrance may exist in rice, according to the authors. — T.H.D.

"The origin and evolution of fragrance in rice (*Oryza sativa L.*)" by Michael J. Kovach, Mariafe N. Calingacion, Melissa A. Fitzgerald, and Susan R. McCouch
[Full Text]

Mathematics

A universe without dark energy
Astronomers have observed that galaxies within our universe have a redshift that is unaccounted for by the Standard Model of Cosmology—galaxies continue to accelerate as they move away from each other. Cosmologists have rectified this anomalous acceleration by introducing the concept of dark energy, which is proposed to permeate space, propel matter, and account for nearly 75% of the mass-energy in our universe. This explanation, however, requires use of the speculative "cosmological constant" to Einstein's equations of general relativity; dark energy is the physical interpretation of the cosmological constant in the Standard Model. Blake Temple and Joel Smoller derived a model of expanding wave solutions of the Einstein equations that could account for the observed acceleration of the galaxies without relying on dark energy or the cosmological constant. The equations give rise to an explicit, one-parameter family of expanding spacetime-waves that speed up or slow down the universe's expansion rate relative to the Standard Model, according to the value of the free parameter. The authors suggest that these expanding waves could emerge in time from the initial disturbance of the Big Bang and propel matter in a manner similar to dark energy. —F.A.

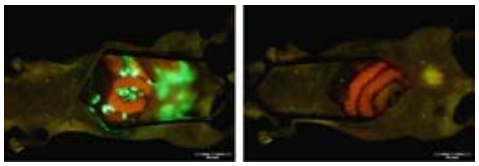
"Expanding wave solutions of the Einstein equations that induce an anomalous acceleration into the

standard model of cosmology" by Blake Temple and Joel Smoller
[Full Text]

Medical Sciences

Fluorescent virus may help surgeons remove tumors

When removing tumors from patients, surgeons must be careful to fully remove malignant tissue while avoiding the adjacent healthy tissue. Few tools, however, currently exist to help physicians visualize these margins. Hiroyuki Kishimoto et al. developed a method that aids surgical navigation by using fluorescence to identify cancerous cells in live animals. The authors used a green fluorescent protein-expressing adenovirus that relies on host cells' telomerase enzymes to replicate. The enzymes are overactive in many types of cancer, including human colon and lung cancers. The authors introduced these cancers into mice, allowed the tumors to develop, and injected the adenovirus into the animals. The virus specifically labeled cancerous tissues, and the fluorescence allowed the authors to remove only the malignancies. The research may lead to more precise surgical navigation in clinical settings, thereby decreasing residual cancer tissue that can regrow and diminishing the resection of otherwise healthy tissue, according to the authors. —F.A.

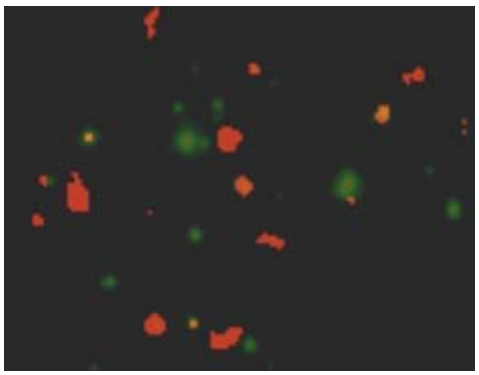


Colon cancer before (left) and after (right) tumor removal.

"In vivo internal tumor illumination by telomerase-dependent adenoviral GFP for precise surgical navigation"
by Hiroyuki Kishimoto, Ming Zhao, Katsuhiro Hayashi, Yasuo Urata, Noriaki Tanaka, Toshiyoshi Fujiwara, Sheldon Penman, and Robert M. Hoffman
[Full Text]

Neuroscience

Gene variant increases alcohol intake in stressed macaques



Functional consequences of the *CRH* -248 C→T SNP.

"Functional *CRH* variation increases stress-induced alcohol consumption in primates"
by Christina S. Barr, Rachel L. Dvoskin, Manisha Gupte, Wolfgang Sommer, Hui Sun, Melanie L. Schwandt, Stephen G. Lindell, John W. Kasckow, Stephen J. Suomi, David Goldman, J. Dee Higley, and Markus Heilig
[Full Text]

Exactly how an individual copes with stress may depend, in part, on which gene variant of the corticotropin-releasing factors (CRF) a person carries. When stress hits, a convergence of neural signals in the hypothalamus and certain extrahypothalamic regions can initiate a cascade of molecules that activate the body's autonomic and behavioral stress responses, which are encoded by the *CRH* gene. This system is critical for survival, but too much of the CRF neurothransmitter has been linked to depression, posttraumatic stress disorder, and alcohol dependence. In rats, an overactive CRF peptide system can lead to higher alcohol consumption, but this link has never been shown in primates. Christina Barr et al. investigated whether a variation in the promoter region of the CRH gene would have an impact on alcohol use in adult rhesus macaques that were exposed to stress at an early age. The authors found that monkeys that carried the T allele had higher levels of CRF and became more anxious during stress than monkeys carrying the C allele. The authors also showed that animals carrying the T allele had higher alcohol consumption than those carrying the C variant. These variations in the CRH promoter could serve as risk factors for alcohol abuse or alcoholism, suggesting that drugs that block the activity of CRF could serve as a treatment for alcohol dependence, according to the authors. —B.P.T.