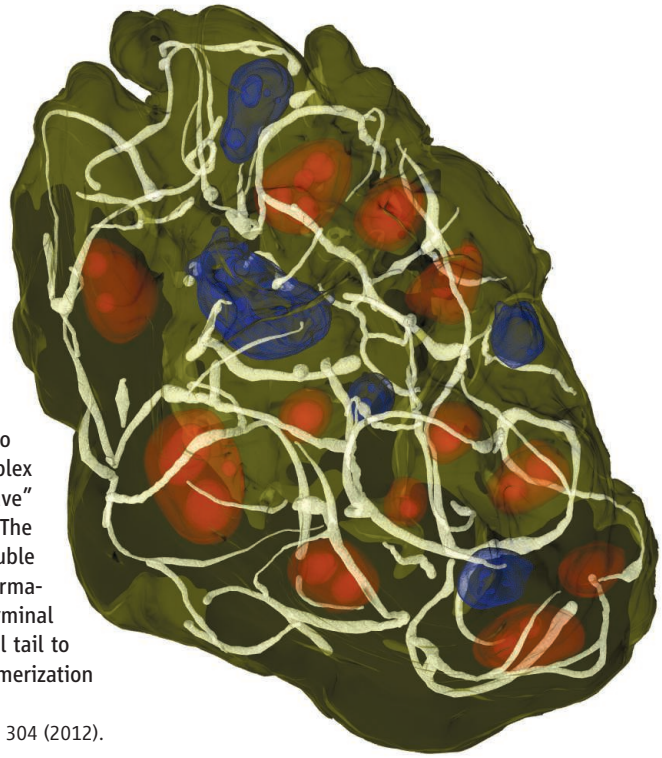
EDITED BY MARIA CRUZ AND STELLA HURTLEY



CELL BIOLOGY

Spinning a E4dly Weave

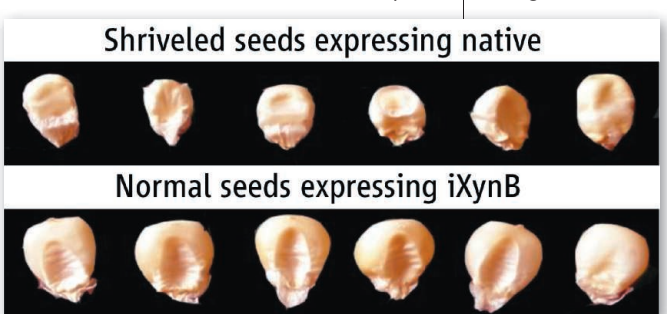
Adenovirus is a small DNA tumor virus. It expresses a number of "early" proteins during infection that take over the host cell for virus production by subverting cellular pathways. These early proteins are often quite small: E4-ORF3 is a mere 13 kD and yet can disrupt large protein complexes, interfere with tumor suppressors in a number of critical cellular pathways, and forms long cablelike structures in the host cell. Using super-resolution and electron microscopy, Ou *et al.* show that these cablelike assemblies appear to form a single continuous polymer with variable curvature and loops. This complex architecture requires nothing more than the E4 protein itself. The intricate "weave" of the polymer partitions the host cell nucleus into viral replication domains. The structure of a mutant form of the protein that forms dimers, rather than insoluble polymers, together with mutagenesis studies, suggest a model for polymer formation in which dimers can reciprocally or nonreciprocally domain-swap their C-terminal tails with other dimers. Glycine residues form a hinge allowing the C-terminal tail to adopt many different conformations that produce polymer branch points. Polymerization is required for E4 to target cellular tumor suppressors. — GR

Cell **151**, 304 (2012).

PLANT SCIENCE

Biofuel Self-Engineering

Biofuels could be a useful substitute for fossil fuels, but various aspects of the production process need improvement to increase yield and reduce costs. One approach would be to express processing enzymes in the growing plant itself. However, to avoid damage to the growing plant, the enzymes need to be held at bay until the time comes to convert cell walls into soluble sugars. Shen *et al.* have tackled this challenge in maize, for which xylanase can be used to break down cell walls into fermentable carbohydrates. Expression of xylanase in the plant alleviates problems of enzyme production and access to substrates, but at the same time produces problems in damaging plant growth, for example, yielding shriveled seeds. The xylanase was brought under control by adding an intein, a self-splicing peptide from the bacterium *Thermus thermophilus*. Use of a thermostable xylanase meant that treatment of the plant material containing the hybrid protein with temperatures in the range of 60° to 70°C resulted in removal of the inhibitory peptide and the generation of functional xylanase. With an optimized version of the hybrid xylanase-intein, transgenic plants showed normal development and normal seed set, and improved biomass conversion to glucose and xylose. — PJH



Nat. Biotechnol. **30**, 10.1038/nbt.2402 (2012).

EVOLUTION

Origins of Variation

It is not clear whether the majority of selection on human genetic variation originates from de novo mutations (SDN) or from selection on previously neutral, or nearly neutral, standing genetic variation (SSV). Peter *et al.* examined theoretical models to determine parameters that distinguish between SDN and SSV. Identifying the origin of the genetic variant was dependent on the strength of selection and the frequency of the variant under selection. Examining genes previously identified to be under selection, but not yet fixed within humans, revealed that both models were applicable; save for the gene that encodes glucose-6-phosphate dehydrogenase, which appears to be under balancing selection and, because of the lack of a selective sweep, did not fit either model. Furthermore, when regions currently not under selection were examined, it was not possible to discriminate between selected and neutral variants. These results support the notion that the origin of human genetic variation that is subject to selection is complex and that an understanding of both standing variation and the de novo mutation rate is important to trace our evolution. — LMZ

PLoS Genet. **8**, 10.1371/journal.pgen.1003011 (2012).

VIROLOGY

Viruses Gone Haywire

One of the hallmarks of human immunodeficiency virus (HIV) infection in people or pathogenic simian immunodeficiency virus (SIV) infection in nonhuman primates is intestinal pathology. Such enteropathy causes breakdown of the intestinal barrier and is thought to result in the leakage of microbial constituents into wider circulation that then drive immune activation and worsening of disease. Whether enteropathy is a direct effect of HIV or SIV infection, however, has not been established. Handley *et al.* used next-generation sequencing, viral culture, and polymerase chain reaction testing to show that pathogenic SIV infection in two independent cohorts of rhesus macaques was associated with an expansion of the intestinal virome (gut-associated viral genomes). Such an expansion was not seen in nonpathogenically SIV-infected African green monkeys. The expanded virome included several previously undescribed viruses as well as adenoviruses. Adenovirus-associated enteritis was observed in some pathogenic SIV-infected animals. Furthermore, parvovirus viremia was associated with advanced AIDS. These findings suggest that an expanded range of viruses within the infected individual rather than SIV/HIV infection itself may cause SIV/HIV-associated enteropathy. — KLM

Cell **151**, 253 (2012).

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PHYSICS

Splitting Pairs

Entanglement is a property of quantum systems whereby correlations exist between the entangled particles, so that measuring the state of one particle instantaneously reveals that of the other. Such quantum-mechanical correlations are a powerful resource for applications in quantum information processing and secure communication. Although much work has focused on the generation and manipulation of entangled photons, the condensed-matter version in the form of superconducting Cooper pairs of electrons offers the potential of fabricating entangled electronic circuits. However, extracting and then splitting the Cooper pairs has been experimentally challenging, with competing processes giving rise to impractically low efficiencies. Schindele *et al.* developed a carbon nanotube–based device that can be used to extract the Cooper pairs from a superconductor and then split and store them on two separate quantum dots defined within the nanotube. The experiments revealed splitting efficiencies up to 90%, sufficient for practical applications in quantum electronic circuits. — ISO

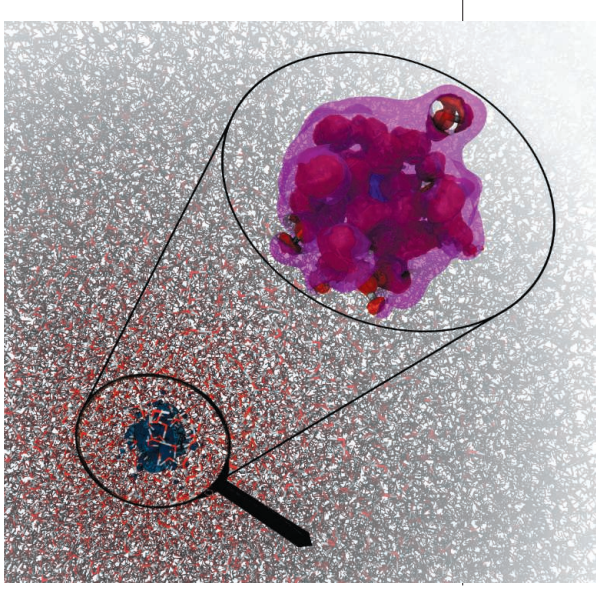
Phys. Rev. Lett. **109**, 157002 (2012).

CHEMISTRY

Cavity Complexities

High-energy irradiation of water can transiently liberate reactive electrons, which are implicated in pathways that chemically damage biomolecules. Such hydrated electrons have been spectroscopically detected, and decades of associated modeling suggested that the charge resides in a cavity, with surrounding water molecules displaced. Recently, however, a theoretical study challenged this model and instead supported a region of increased water density in the vicinity of the charge. Yet, more studies, performed in response, claimed reaffirmation of the traditional structure. In each of these cases, the simulations involved parameterized pseudopotentials. Seeking to resolve the impasse, Uhlig *et al.* carried out a series of ab initio calculations that treated the electron as well as a subset of surrounding water molecules quantum-mechanically; a molecular mechanics approach was applied to model long-range effects. The result did suggest that ~40% of the spin density resides in a cavity, but also partitioned the remaining fraction among neighboring water molecules and a diffuse tail between them. Thus, the cavity description alone appears to oversimplify a complex geometry. — JSY

J. Phys. Chem. Lett. **3**, 3071 (2012).



CREDIT: F. UHLIG *ET AL., J. PHYS. CHEM. LETT.* **3**, 3071 (5 OCTOBER 2012) © 2012 AMERICAN CHEMICAL SOCIETY

EDUCATION

Gauging Competitiveness

Supported by data showing that U.S. students perform substantially below their international peers, politicians justify their education policies by linking them to the need to be competitive in a global economy. How does this type of policy motivation influence voters' attitudes toward supporting public schooling? Using a survey designed to randomize exposure to international competitiveness across respondents, Morgan and Poppe tested 1000 U.S. adults for differential responses to the perceived quality of local public schools and the preferred expenditures for the nation's education system. A randomly selected treatment group was asked two questions on international competitiveness before taking the survey. This group reported lower assessments of their local schooling, coupled with decreased support for increasing the national budget for education, suggesting that although the public may be concerned about the quality of their schools, these concerns do not translate into support for additional education spending. Framing education policy as essential to the United States being competitive in the global economy may thus be counterproductive if politicians are also looking to increase education spending. — MM

Educ. Researcher **41**, 262 (2012).

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