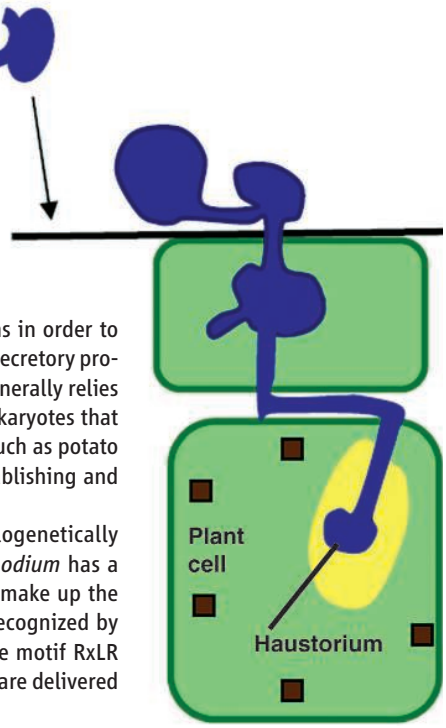
CELL BIOLOGY

A Blight Upon Malaria

Many pathogens, whether of plants or animals, export their own proteins in order to modify their local environment and to disable host defenses. Channeling secretory proteins into the molecular machines that allow them to cross membranes generally relies on short amino acid sequence motifs. Oomycetes are deep-branching eukaryotes that include the notorious *Phytophthora*, which causes devastating diseases such as potato late blight and sudden oak death. *Phytophthora* colonizes plants by establishing and residing within a membrane-bounded haustorium inside cells.

Bhattacharjee *et al*. show that *Plasmodium* and *Phytophthora*, phylogenetically distant eukaryotic pathogens, use similar host-targeting motifs. *Plasmodium* has a host-targeting motif that is linked to over 400 virulence factors, which make up the "secretome." *Phytophthora* possesses virulence determinants that are recognized by plant hosts and, like *Plasmodium,* the highly conserved leader sequence motif RxLR along with a nearby acidic domain can be found in multiple effectors that are delivered into the host cell cytoplasm. — CA

PloS Pathol. **2**, e50 (2006).



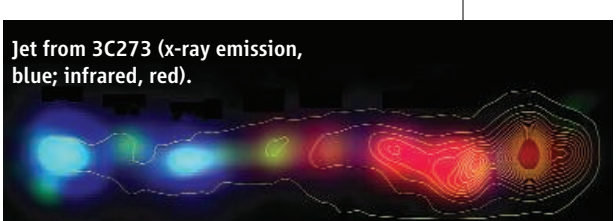
Schematic of *Phytophthora* invasion.

ASTROPHYSICS

Imaging a Quasar Jet

The first quasar to be discovered, 3C273, hosts a prominent and narrow jet of relativistic particles emitted from its galactic core. Detailed pictures of the jet show that it glows from radio to x-ray frequencies and, unusually, can even be seen in visible light. Physical models of the jet have tried to explain how it forms and retains its tight columnar shape despite traveling far beyond its parent galaxy.

Uchiyama *et al.* have examined mid-infrared images acquired with the Spitzer Space Telescope and find that the jet changes color abruptly in the middle. They attribute the long-wavelength (radio to infrared) radiation from the outer part of the jet to the synchrotron emission of charged particles moving at relativistic speeds along the jet in a strong magnetic field. In contrast, the inner part appears to be dominated by a high-energy component that exudes both x-rays and visible light. This short-wavelength emission could arise either from synchrotron radiation by a second population of electrons or protons—an explanation supported by current polarization data—or else from inverse Compton scattering of photons by jet particles. This result runs counter to prior theories that tied the origin of the optical light to the radio emission mechanism, and it suggests that optical emission may yet be detected in quasars with x-ray jets. — JB



Jet from 3C273 (x-ray emission, blue; infrared, red).

Astrophys. J. astro-ph/0605530 (2006).

COMPUTER SCIENCE

Better Technology via Hacking

In the public mind, the term "hacker" has nothing but negative connotations, conjuring up images of subversive outcasts writing illicit computer viruses, breaking into bank accounts, or scrambling Pentagon databases. But the epithet originally meant someone adept at taking technology intended for one purpose and retooling it, often in startlingly creative and unexpected ways; and the global community of information technologists who tweak software and hardware outside normal channels still exists.

Conti, a professor of computer science at the United States Military Academy, takes the position that mainstream computer scientists could learn some lessons from the unconventional thinking in the hacker community. In a special issue on hacking and innovation, he points out that hackers are passionate about technology, unconstrained by traditional methods, and often years ahead of their academic and corporate counterparts. Hackers publish journals and present their work at well-attended technical conferences, but live in a parallel universe apart from better-known professionals. Other articles in the issue explore how hackers help pinpoint security flaws in wireless networks and identify Internet vulnerabilities, and discuss some of the legal issues surrounding nontraditional technology experimentation. — DV

Commun. ACM **49**, 33 (2006).

GENETICS

Mighty Meaty miRNAs

The Texel breed of sheep sports a pronounced musculature, which makes it economically important for the agricultural industry. To establish the basis of the Texel phenotype, Clop *et al.* have used quantitative genetics to map the genomic region responsible, initially to the second chromosome and then, using finer quantitative trait loci mapping, to the myostatin gene; mutations in this gene are known to increase muscle mass in mice and humans. Of the 20 single-nucleotide polymorphisms identified, two track the Texel phenotype closely. One of these is located in the 3′ untranslated sequence of the myostatin gene. The G-to-A change creates an octamer sequence that inadvertently corresponds to the seed, a critical specificity determinant, of the micro (mi) RNAs *miR-1* and *miR-206*, both of which are expressed at high levels in sheep muscle. Analysis of myostatin levels revealed a marked reduction in Texel sheep and is consistent with the role of miRNAs in repressing the translation of target genes. In a bioinformatic analysis of the human and mouse genomes, the authors locate hundreds of poly-

CREDITS (TOP TO BOTTOM): BHATTACHARJEE *ET AL.*, *PLOS PATHOL.* **2**, 5 (2006); Y. UCHIYAMA *ET AL.*, *ASTROPHYS. J.* (2006)

Published by AAAS

morphisms that have the potential to create or destroy targets of miRNA seed sequences, and hence to influence gene expression in a fashion analogous to that seen in sheep. — GR

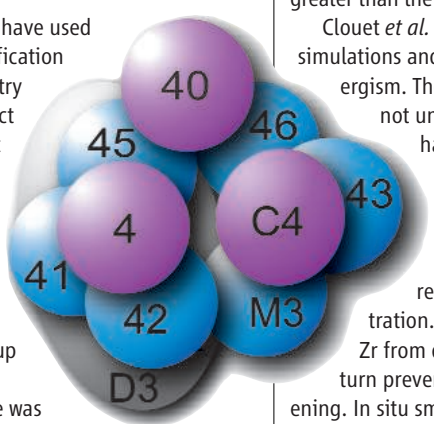
Nat. Genet. 10.1038/ng1810 (2006).

BIOCHEMISTRY

A Party of 10, Again

Applying proteomic technologies has made it possible to catalog the complement of proteins expressed in a cell or a tissue, and experimental and computational analyses have coupled proteins to their partners in social networks of metabolic and regulatory connectedness—an interactome. Partying (multiple contacts simultaneously) and dating (one at a time) have been proposed as classifying behaviors, and probing the interaction surfaces may help sort out which is which.

Hernández *et al.* have used tandem affinity purification and mass spectrometry to map the 10 distinct subunits of the yeast exosome, a complex involved in RNA processing. Of the three subunits with RNA-binding motifs (Csl4, Rrp40, and Rrp4), Csl4 showed up in substoichiometric quantities and hence was tagged so as to pull out only the complete 10-subunit species. Destabilizing the intraexosome interactions with dimethylsulfoxide, followed by mass spectrometry, established the composition and neighbor relationships for the six-subunit ring; likewise, all three RNA-binding proteins could be placed on the same face of the ring, with the largest subunit, the Dis3 RNase, on the other side. — GJC



Schematic of the yeast exosome (ring subunits in magenta, RNA-binding subunits in blue).

EMBO Rep. 10.1038/sj.embor.7400702 (2006).

MATERIALS SCIENCE

Synergistic Alloying

Impurities are often empirically added to a metal to improve its properties through the formation of second-phase precipitates; however, understanding and predicting the performance of different impurities can be complex. Zirconium (Zr) and scandium (Sc), for example, individually form alloys with aluminum that enhance strength and resistance to recrystallization. When Zr and Sc are added together, the net effect is significantly greater than the impact of either one alone.

Clouet *et al.* use a combination of atomic simulations and experiments to explain this synergism. They find that the precipitates are not uniform in composition but instead have a Sc-rich core surrounded by a Zr-rich shell. Sc diffuses more rapidly than Zr within the solid solutions and thus begins to form precipitates first, until reaching an equilibrium concentration. Lattice thermodynamics inhibit Zr from diffusing into the core, which in turn prevents the precipitates from coarsening. In situ small-angle x-ray scattering studies show that once enough Zr reaches the shell, an Al_3Zr composition results that is resistant to further annealing. Overall, these effects lead to a higher concentration of smaller precipitates, enhancing the nucleation of the aluminum and thereby creating a stronger alloy. — MSL

Nat. Mater. **5**, 482 (2006).

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<< Promoting Central Regeneration

In general, neurons in the mature vertebrate central nervous system fail to regenerate after injury. Intriguingly, however, activation of macrophages in the eye after damage to the optic nerve stimulates the regeneration of retinal ganglion cells (RGCs), so that their axons grow beyond the site of injury. Yin *et al.*, who previously determined that macrophage-secreted proteins less than 20 kD in size promoted axon regeneration, used mass spectrometry of a prominent component and identified oncomodulin, a calcium-binding protein that has been found in tumors. Although inactive on its own, oncomodulin potentiated the ability of mannose plus forskolin (which elevates cAMP levels) to promote axon outgrowth in cultured RGCs. Pharmacological analysis indicated that oncomodulin activity depended on Ca^{2+}/calmodulin–dependent kinase II and on gene transcription. Delivery of oncomodulin and a cAMP analog into the vitreous promoted optic nerve regeneration in vivo. Thus, oncomodulin appears to represent a previously unidentified macrophage-derived trophic factor capable of promoting axonal regeneration in at least some central neurons. — EMA

Nat. Neurosci. **9**, 843 (2006).

CREDIT: HERNÁNDEZ *ET AL.*, *EMBO REP.* **7**, 605 (2006)