

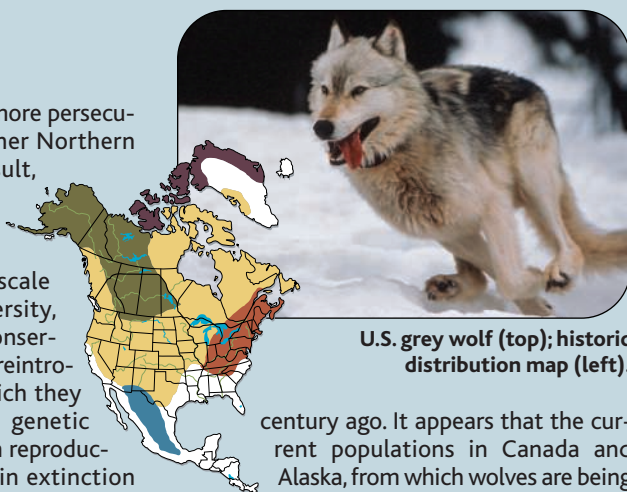
edited by Stella Hurtley

ECOLOGY/EVOLUTION

Mexicans in the Mix

Wolves have probably suffered more persecution from humans than any other Northern Hemisphere predator. As a result, wolf populations in much of Europe and North America are highly fragmented and diminished. Population loss on this scale leads to loss of genetic diversity, which can pose problems for conservation managers attempting to reintroduce animals to areas from which they have been eliminated: lower genetic diversity can mean a decrease in reproductive potential and an increase in extinction risk. It has been suggested that the high mobility of wolves might have mitigated such loss, because of the genetic mixing that would have occurred in the preextermination populations.

Leonard *et al.* quantified the loss of diversity after the 20th-century extermination programs carried out in the United States by comparing the mitochondrial DNA of present-day North American grey wolves with those from museum specimens collected a



U.S. grey wolf (top); historic distribution map (left).

century ago. It appears that the current populations in Canada and Alaska, from which wolves are being drawn for reintroduction programs in the U.S. Rocky Mountains, are missing a substantial part of the diversity of the ancestral wolves; in particular, they lack haplotypes associated with past Mexican populations. Thus, historically, the genetic diversity of grey wolves was geographically structured, and successful reintroductions to the western United States may depend on adding Mexican grey wolves to the population mix. — AMS

Mol. Ecol. 14, 9 (2005).

BIOMEDICINE

A Good Night's Sleep?

One of the distressing symptoms of progressive neurodegenerative disorders such as Alzheimer's, Parkinson's, and Huntington's diseases is the severe disruption of sleep patterns, which leads to anxiety and distress in both patients and their caregivers. Two recent papers now shed light on the cellular and molecular mechanisms of sleep disruption in Huntington's disease (HD).

Petersen *et al.* find that HD patients and R6/2 mice (which mimic many of the features of human HD) exhibit progressive loss of brain neurons in the hypothalamus—a key regulator of many different processes, including sleep. The hypothalamic neurons that die in HD patients and mice produce the neuropeptide orexin, loss of which has been implicated in narcolepsy. Decreasing amounts of orexin in the cerebrospinal fluid of HD patients could thus be used as a marker of HD progression.

Orexin neurons in the hypothalamus also innervate the suprachiasmatic nucleus, which drives circadian sleep/wake cycles by regulating the transcription of several key "clock" genes. Morton *et al.* report that progressive disruption of circadian behavior in R6/2 mice is accompanied by marked alterations in the expression of the *mPer2* and *mBmal1* clock genes. These findings help to explain why HD patients suffer from markedly increased daytime sleepiness and night wakefulness, and hopefully will contribute to better management of these distressing symptoms. — OMS

Hum. Mol. Genet. 14, 39 (2005); *J. Neurosci.* 25, 157 (2005).

CHEMISTRY

Taming SERS

The Raman effect for measuring vibrational spectra is normally quite small, but in the vicinity of rough gold or silver surfaces, localized surface plasmons can enhance signals by orders of magnitude. However, variations in surface roughness can vary the enhancement of the surface enhanced Raman effect, or SERS, which makes it difficult to use for measuring concentrations. Jackson and Halas examined the SERS effect using core-shell nanoparticles of gold or silver nanoshell coatings over silica cores. Unlike colloidal metal particles, the core-shell particles exhibit SERS enhancements caused almost entirely by the plasmon resonances set up by their geometry, not from surface roughness or regions of high field caused by particle

contact. The excitation frequency can be tuned to take full advantage of the plasmon response of the particles, which are simply deposited on glass slides. For a non-resonant excitation energy, the SERS enhancement for a typical organic molecule, p-mercaptoaniline, could be as high as 2.5×10^{10} . — PDS

Proc. Natl. Acad. Sci. U.S.A. 101, 17930 (2004).

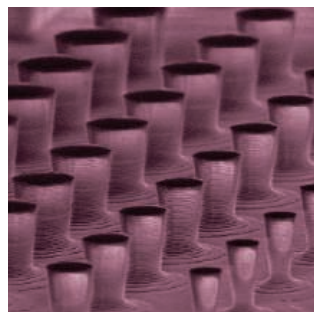
APPLIED PHYSICS

Better Single-Photon Emitters

The reliable emission of single photons in a particular direction from quantum dots and quantum well structures is an important requisite for applications in quantum information processing and quantum cryptography. However, in many implementations, the photons are emitted in bunches with poor control over

the direction in which they are emitted. Bennett *et al.* use a photolithographically defined pillar-design microcavity to restrict the optical modes into which the photons can be emitted. Using such a design for pillars 1.9 μm in diameter, they demonstrate a reproducible method providing a considerable improvement in both the single-photon emission and control over the direction of emission. — ISO

Opt. Exp. 13, 50 (2005).



Pillar design for improved single photon emission.

MICROBIOLOGY

Sleuthing *Streptococcus*

Streptococcal diseases have many disguises, ranging from minor sore throats to life-threatening toxic shock. The epidemiology of streptococcal diseases has long been problematic, manifesting as suddenly emerging and disappearing epidemics of disparate syndromes with no apparent therapeutic correlate. In a population-wide genomic study of 11 years of data from 255 isolates from Ontario, Canada, Beres *et al.* implicated the source of waves of invasive disease to the acquisition or loss of prophages, which rapidly generated unique combinations of virulence genes and their characteristic diseases: toxic shock, bacteremia, or necrotizing fasciitis. However, another 7-year Canadian study of 306 cases of invasive group A streptococcal infections revealed a population-based shift from soft tissue infections to pneumonia, especially in women. Hollm-Delgado *et al.* suggest that underlying conditions in the victims may be causing this shift. They found that the risk of soft-tissue streptococcal infections increased after varicella infections or drug injection, but ultimately could not explain the increase in pneumonia. However a statistical link could not be made between any particular serotype and specific clinical symptoms. It is possible that a prophage may be at work behind the scenes. — CA

Proc. Natl. Acad. Sci. U.S.A. 101, 11833 (2004);
Emerg. Infect. Dis. 11, 77 (2005).

MEDICINE

Mitochondria and Cancer

Human tumors often contain mutations in mitochondrial DNA (mtDNA). Whether these mutations are causally involved in tumorigenesis and the mechanisms by which they might contribute are pressing questions that remain unanswered. One hypothesis suggests that tumor-associated mtDNA mutations lead to increased production of reactive oxygen species (ROS), a by-product of mitochondrial oxidative phosphorylation, which can stimulate cell proliferation. Data from a new study of mtDNA in human prostate tumors are consistent with this hypothesis. Petros *et al.* identified mutations in two mitochondrial genes encoding

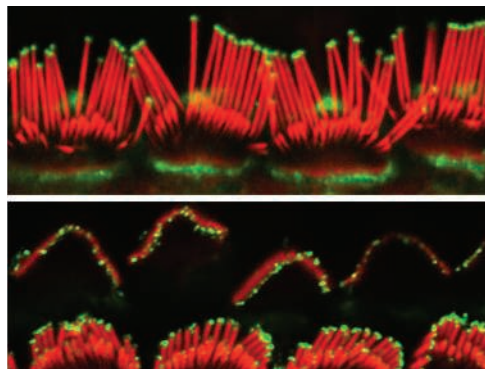
proteins involved in oxidative phosphorylation: cytochrome oxidase subunit I and ATP6. Notably, when mtDNA containing an ATP6 mutation close to the site of the tumor-associated mutation was introduced into prostate cancer cells, the cells generated significantly more ROS in comparison with wild-type controls and grew at a much faster rate in mice, supporting the notion that such mutations play a causal role in tumorigenesis. — PAK

Proc. Natl. Acad. Sci. U.S.A. 102, 719 (2005).

CELL BIOLOGY

Whirlin to the Tip

Hearing depends on the neat arrangement of stereocilia in graduated rows on the apical surface of hair cells in the inner ear. Disruption of this architecture interferes with the ability to detect both sounds and head movement. The architecture is established by the presence of actin cores within each stereocilium



Differential elongation of stereocilia (red) is initiated when myosin XVa delivers whirlin (green) to the tips.

of a defined length. Two mutant mice strains possess abbreviated stereocilia—the shaker 2 and whirler mice. Shaker 2 mice are deficient in the production of a motor protein, myosin XVa, and whirler mice are deficient in a protein termed whirlin. Belyantseva *et al.* now show that the myosin XVa protein interacts with whirlin and promotes its delivery to the tips of stereocilia. When this interaction is disrupted, stereocilia are abnormal and deafness will ensue. The whirlin transport defect, and the aberrant hair bundle pattern, in hair cells taken from shaker 2 mice could be “cured” by transfection with a fluorescently tagged version of myosin XVa. — SMH

Nature Cell Biol. 10.1038/ncb1219 (2005).

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