



THIS WEEK IN Science

edited by Phil Szuromi

Room-Temperature Mid-IR Lasers

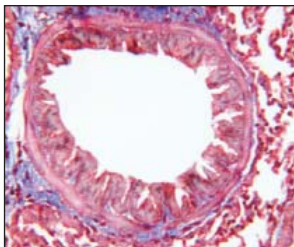
Semiconductor lasers offer portability, compactness, low power consumption, and low cost. For spectroscopic investigation in the mid-infrared (where many molecular species have excitation modes), the stability and sharp linewidth of continuous wave (CW) lasers is a must. However, light sources for this wavelength regime have been limited to low-temperature or pulsed-mode operation (or both). Beck *et al.* (p. 301; see the 21 December news story by Service) report on a technological advance in the design of semiconductor lasers that allows them to achieve CW operation at room temperature. A key feature of their design is to bury the active region to ensure good thermal dissipation of excited carriers. 

Quicker Route to Reactants

Improved routes for the formation of carbon-carbon bonds, especially catalytic ones, are invariably of value. One approach for coupling carbon atoms of aromatic rings, the Miyaura-Suzuki reaction, uses a palladium (Pd) catalyst to couple an aryl boronic acid and an aryl halide. Cho *et al.* (p. 305; see the Perspective by Jones) report on iridium (Ir) catalysts that allow the direct synthesis of the needed arylboron compounds from aromatic hydrocarbons and boranes under "solventless" conditions. These Ir catalysts are highly selective and do not interfere with the subsequent Pd-catalyzed cross-coupling reactions. 

Ascent on T Cell Control

The T-box family transcription factor, T-bet, has recently been identified as a possible master regulator in T helper 1 (T_H1) immune responses through the transactivation of the gene for interferon- γ (IFN- γ). Two studies now look at the effect of T-bet deficiencies (see the news story by Vogel). Szabo *et al.* (p. 338) found that the absence of T-bet expression in mice profoundly attenuated production of IFN- γ by natural killer and CD4 T cells and also shifted the cytokine profile of CD4⁺ T cells toward that of a T_H2 phenotype. Surprisingly, IFN- γ expression by CD8⁺ T cells was not affected. Finotto *et al.* (p. 336) observed that T-bet-deficient mice develop spontaneous airway inflammation resembling acute and chronic forms of human asthma. T-bet expression is also reduced in airway tissue from asthmatic patients,



299 Temperature-Controlled Domain Sizes

Although many nanostructures are formed kinetically, theory predicts that at conditions near a surface-structure phase boundary, small domains may form at equilibrium whose size can be varied. Hannon *et al.* (p. 299) used low-energy electron microscopy to map out such a transformation in detail on the Si(111) surface between the complex (7 × 7) reconstructed surface and small triangular domains of the nearly disordered "1 × 1" phase. The size of the domains can be tuned simply by changing surface temperature.

And In Brevia ...

Unlike mice cloned from embryonic stem cells, mice cloned from somatic cells by Inoue *et al.* (p. 297) appear quite normal, although their placentas are often enlarged.

which suggests that dysregulation of this transcription factor might contribute to airway hyper-responsiveness in humans.

Evidence for Hexavalent Palladium

High oxidation states of the late transition metals are rarely seen for complexes with one metal center, and then only with highly electronegative ligands like fluorine. Chen *et al.* (p. 308; see the Perspective by Crabtree) now report that the synthesis and structure of a trimetallic Pd complex with organosilicon ligands in which two Pd atoms are in the 2+ state and one, which bonds to six Si atoms, appears to be in the previously unobserved 6+ state for this element.

Sea Level at Termination II

There has been considerable disagreement during the last decade concerning the validity of the Milankovitch theory, which contends that glacial cycling is mainly the result of changes in solar insolation at 65°N latitude. Newer evidence suggests that glacial ice volume began to decrease thousands of years before solar forcing in the Northern Hemisphere began to increase. Gallup *et al.* (p. 310) now report that sea level had risen to within 20% of its peak last interglacial value by 136,000 years ago, too soon for the corresponding amount of glacial ice melting to be consistent with Milankovitch theory. By radiometrically dating samples from uplifted coral terraces on Barbados, they determined that the penultimate glacial termination (Termination II), unlike the most recent termination, probably preceded the increase in mid-latitude Northern Hemisphere insolation that Milankovitch theory says should be its cause.

Parental Guidance Suggested

Populations of organisms that become established in new locations frequently diverge morphologically and behaviorally; this process can give rise to new species. What processes drive the initial divergences? Badyaev *et al.* (p. 316; see the news story by Pennisi) report tests on reproductive behavior of two recently established populations of the house finch in different parts of the United States. Parental manipulation of the sex ratio and growth patterns of offspring significantly reduces offspring mortality, thus giving the populations a better chance of establishment and survival in the new habitats.

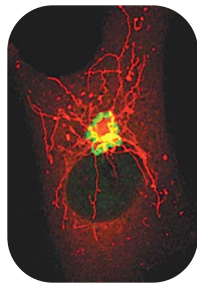
SH3 Search Committee

Src-homology 3 domains (SH3 domains) are so named for their similarity to a region in the proto-oncogene protein kinase Src. SH3 domain family members bind to protein domains character-

ized by paired proline residues, and so mediate protein-protein interactions in cell signaling and cytoskeleton reorganization. Tong *et al.* (p. 321; see the Perspective by Gerstein *et al.*) used phage display to search peptide libraries of random sequences to identify preferred binding motifs for the various SH3 domains. They then searched the predicted proteome of *Saccharomyces cerevisiae* for potential binding partners, and also used a two-hybrid assay to identify proteins that interacted with the various SH3 domains when expressed in yeast. The common interactions from the networks predicted by each of these procedures were then assessed for likely biological significance. ✂

Proteins for One or Many Queens

In the fire ant *Solenopsis invicta*, the social structure of the colony is determined in large part by alleles of the gene *Gp-9*. Colonies in the United States in which the workers bear the *B* allele have single queens, and those bearing the *b* allele have multiple queens. Krieger and Ross (p. 328; see the cover and the 30 November news story by Holden) now show that *Gp-9* encodes a putative pheromone binding protein, which indicates that the number of egg-laying queens is determined by worker recognition. A glutamic acid residue at position 151 of the *B* allele is changed to lysine in the *b* allele, which changes the protein's charge and accounts for their different electrophoretic mobilities of the two alleles. ✂



Have Lipid, Will Travel

The serine-threonine kinase protein kinase D (PKD) binds to the trans-Golgi network (TGN) in mammalian cells and is involved in the release of transport vesicles destined for the plasma membrane. Baron and Malhotra (p. 325; see the Perspective by Bankaitis) now show that in order for PKD to bind to the TGN, it must specifically bind to the lipid diacylglycerol. When concentrations of this lipid were reduced in cells, both PKD recruitment to the TGN and transport out of the TGN were inhibited. ✂

Sheep Likely Free of BSE

Given that sheep in the United Kingdom were fed the same animal protein concentrate that caused the epidemic of bovine spongiform encephalopathy (BSE) in British cattle, has there been similar cross-species infection of sheep? The question is difficult to answer because a similar prion disease, scrapie, has been endemic in British sheep for 200 years or so and is clinically indistinguishable from BSE. Unlike BSE, there is no evidence that human beings can acquire scrapie. Despite the large number of assumptions that have to be made, as few data are available, Kao *et al.* (p. 332) argue, after examining a wide range of possible scenarios, that few sheep have acquired BSE. ✂

Malaria Stage Specificity

The *Plasmodium* parasites that cause malaria invade host cells with the assistance of proteins secreted from their rhoptry organelles. Some of these proteins are members of a multigene family (>35 genes) called Py235. Preiser *et al.* (p. 342) have discovered that different subsets of the Py235 family are transcribed at each of three invasive *Plasmodium* life-cycle stages. The expression of each subset of Py235 is apparently reset by conditions in the host-cell as the parasite transits from one stage to another and from one host-cell type to another, and may be a component in life-cycle changes in the parasite's preference for host cell type.

Factor of Choice

X-linked genes in mammals should be expressed at similar levels in males and females, and so one of the two X chromosomes in females must be inactivated. The choice of which X is inactivated is thought to be governed by a trans-acting factor that binds to the so-called "X-inactivation center" on the X chromosome. Chao *et al.* (p. 345; see the Perspective by Percec and Bartolomei) present evidence that the trans-acting factor is CTCF, a transcription regulator previously shown to block enhancer function at imprinted genes. As was true in the context of imprinting, binding to the X chromosome was sensitive to the methylation status of its target DNA. These results raise the intriguing possibility that there may be mechanistic parallels between X inactivation and imprinting. ✂