EDITORS' CHOICE

edited by Gilbert Chin

ASTRONOMY

Very Cool L-Dwarfs

Dwarfs are low mass, very cool, main-sequence stars, and recent large-scale star surveys have identified a new spectral class, called the L-dwarfs. The low estimated masses of L-dwarfs suggest that most of these objects are brown dwarfs that are rich in hydrides rather than methane. McLean *et al.* have obtained high-resolution spectra of six L-dwarfs that range in temperature from 2200–2000 K to 1600–1250 K with the near-infrared cryogenic spectrograph (NIRSPEC) on the Keck II telescope.

As the temperature of the star decreases, the spectrum changes systematically: the neutral potassium band broadens and weakens, but persists in the lowest temperature L-dwarf; the iron hydride (FeH) band weakens and disappears at about 1600 K; the water band strengthens, as do the neutral alkali metal bands of Na, Rb, and Cs. These spectral features are consistent with models of a cooling atmosphere in which the iron hydride condenses into iron metal. The less refractory alkali metals can persist as neutral species to lower temperatures than the iron, and because they are present in the L-dwarf spectra to about 1200 K, they will form sulfides rather than chlorides when they do condense. — LR

Astrophys. J. **533**, L45 (2000).

MOLECULAR BIOLOGY

Robust Survival Strategy?

The eubacterium *Deinococcus radiodurans* has an extraordinary ability to survive radiation-induced DNA damage. A clue to its survival strategy has emerged from a study of the Rsr protein, which is an ortholog of the 60-kilodalton eukaryotic protein Ro and was identified in the recently sequenced *D. radiodurans* genome. Although the function of Ro in eukaryotic cells is unclear, it associates with small cytoplasmic RNAs (called Y RNAs), as well as 5*S* ribosomal RNA, and is a major target in some human autoimmune diseases. Chen *et al.* have found that a *D. radiodurans* strain deficient in Rsr is significantly more sensitive to ultraviolet (UV) radiation than the wild-type, and that UV irradiation causes accumulation of a Y-like RNA that forms a complex with Rsr. Thus, Ro-like ribonucleoproteins play a role in the recovery of UV-irradiated *D. radiodurans* and, in principle, could do likewise in eukaryotic cells. — PAK

Genes Dev. **14**, 777 (2000).

GEOCHEMISTRY

Taking Water to Extremes

Water is perhaps the most thoroughly studied substance at ambient conditions; however, in most of the Earth, it is at conditions well beyond its critical point (373°C and 2.21 megapascals), and its properties are less well established. Water is of crucial importance in volcanism and in many reactions in the mantle and lower crust, where temperatures are 1000°C or more and pressures lie in the gigapascal range. Because it has been difficult to measure even the most basic properties of water under these conditions, thermodynamic relations have been used to extrapolate from data derived at much lower pressures.

Withers *et al.* have developed a method to measure the density of water at extreme conditions and have obtained results up to 1100°C and 4 gigapascals (this pressure and temperature correspond to a depth of about 120 kilometers in the Earth). They synthesized water inclusions in corundum (aluminum oxide, a very hard mineral that is insoluble in water) at these conditions, so that the density was preserved in the inclusion when the sample was returned to ambient conditions (because the inclusion size and mass of water are constant). They then show that the hydrogen nuclear magnetic resonance shift can be related to the fluid density. Their data confirm some of the extrapolations (equations of state), but not others. — BH

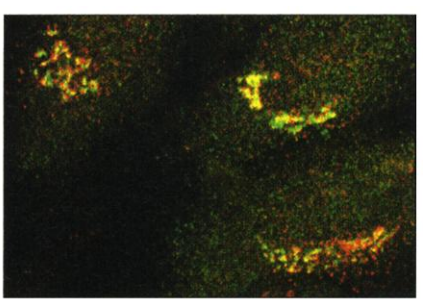
Geochim. Cosmochim. Acta, **64**, 1051 (2000).

PHYSICS

Confined, Cold, but Still Moving

The observation of metallic behavior in dilute two-dimensional electron gases (2DEG) that was first observed six years ago came as a surprise because the prevailing theory indicated that such systems should be insulating. Further experiments revealed that a metal-to-insulator transition (MIT) occurred as the electron density in the 2DEG was varied. Several theories have since been proposed to explain these intriguing results, but so far no consensus on a leading candidate has emerged.

Kravchenko and Klapwijk now introduce experimental results extending the lower temperature region over which the MIT can be observed. Of particular interest is the result for the electron density pegged exactly at the critical value. At that point, the resistivity remained temperature-independent all the way down to 35 millikelvin.



Directing traffic at the TGN

CELL BIOLOGY

Sorting and Membrane Traffic

Soluble and membrane proteins destined for lysosomes or vacuoles are sorted from other proteins in the trans Golgi network (TGN). Three groups—Hirst *et al.*, Dell'Angelica *et al.*, and Boman *et al.*—have isolated proteins (named GGAs) that are involved in this process, most likely in the formation of coats on transport vesicles. The GGA proteins are structurally related to another class of coat proteins, the γ-adaptins, which are involved in trafficking proteins from the TGN to the plasma membrane. Immunoelectron microscopy and immunofluorescence microscopy localized the GGA proteins to the TGN. These proteins also contain a VHS domain, thought to be involved in membrane traffic and signal transduction, and a GAT domain that appears to be involved in targeting the GGA protein to the TGN membrane and in binding ARF1, a small GTP-binding protein already implicated in membrane traffic. In yeast strains lacking the GGA proteins vacuolar targeting of a hydrolase was defective. The identification of other coat proteins that interact with the GGAs should lead to a better understanding of the sorting machinery at the exit of the Golgi. — SMH

J. Cell Biol. **149**, 67 (2000); *J. Cell Biol.* **149**, 81 (2000); *Mol. Biol. Cell* **11**, 1241 (2000).

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SOURCE: DELL'ANGELICA *ET AL.*, *J. CELL BIOL.* **149**, 81–93 (2000).

Although a clear understanding of the mechanism driving the effect remains elusive, these new results do place constraints on possible theoretical models. — ISO

Phys. Rev. Lett. **84**, 2909 (2000).

NEUROSCIENCE

Topographic Map Labels

Some sensory input channels to the mammalian brain, such as vision or touch, originate as topographically organized information. In order to retain visual information as the signals are transferred from the retina to the superior colliculus, the axons from one region must connect to their target regions in a similarly organized manner. Indeed, axons originating from the temporal or nasal portions of the retina are destined to form connections in the anterior or posterior regions, respectively, of the superior colliculus. The signals that regulate the axonal map-forming capability include the ephrin ligands, expressed in gradients across the superior colliculus, and their corresponding Eph receptors, expressed in gradients across the retina.

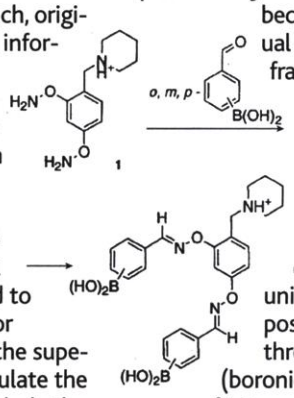
Feldheim *et al.* have generated mice carrying mutations in ephrins A2 and A5, and analyzed the effects on retino-collicular connections. The results indicate that with the loss of the inhibitory ephrin signal, axons carrying the corresponding receptors are less restricted in their choice of targets. The outcome is not simply a lessening of inhibition, but rather a lessening of discriminating competition between axons. A corresponding pairing of ephrin A5 and the EphA4 receptor has been observed by Vanderhaeghen *et al.* in the somatosensory cortex and thalamus, respectively, and is thought to contribute to the topographic mapping of touch. — PJH

Neuron **25**, 563 (2000); *Nature Neurosci.* **4**, 358 (2000).

CHEMISTRY

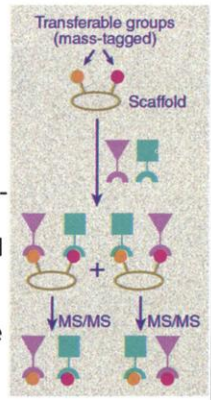
The Versatility of Boron

Combinatorial synthesis can be used to generate a mixture of compounds, commonly called a library, that then can be screened to identify promising drugs or catalysts. When isomeric reactants are used as building blocks, the analysis of the mixture by mass spectrometry becomes quite difficult because the masses of individual compounds, and even of fragments of compounds, can be virtually identical.



Nazarpack-Kandlousy *et al.* describe an approach for resolving this type of complexity. They attached substituted benzaldehydes containing boronic acid units in *ortho*, *meta*, or *para* positions to a central scaffold through oxime ether linkages (boronic acid compounds also are of interest for their ability to combine reversibly with the hydroxyl groups of carbohydrates). They sorted out the several possible isomers by labeling the boronic acid compounds with boron and deuterium isotopes and by selectively labeling some of the aminooxy groups of the scaffold with nitrogen-15. Mass spectrometry resolved the parent compounds, and a second round of ion fragmentation in the mass spectrometer resolved the pair of isomers due to the labeled nitrogen. This approach may be extended to more scaffold positions with the use of defined ratios of isotopes in the initial labeling reactions. — PDS

J. Am. Chem. Soc., in press.



Tagging substituents and scaffold

Science's stke

A Perpetrator of p53-dependent Apoptosis

The activation of the tumor suppressor protein p53 can lead to cell cycle arrest or to apoptosis. Attardi *et al.* used subtractive hybridization to identify a gene involved specifically in the p53-dependent apoptosis pathway; *PERP* (p53 apoptosis effector related to PMP-22) was induced in p53-mediated apoptosis of mouse embryonic fibroblasts, but not in p53-deficient fibroblasts and not in UV-triggered apoptosis. The *PERP* promoter contained two putative p53 binding sites, and expression of *PERP* in p53-null cells resulted in cell death, suggesting that this newly identified protein may lie downstream of p53. PERP shares sequence similarity to PMP-22/gas3, a group of plasma membrane proteins connected to human demyelinating peripheral neuropathies such as Charcot-Marie-Tooth. — JN

Genes Dev. **14**, 704 (2000).

CREDITS: NAZARPACK-KANDLOUSY *ET AL., J. AM. CHEM. SOC.*, IN PRESS.