EDITORS' CHOICE

edited by Gilbert Chin

PHYSICS

Poking at Atomic Cooper Pairs

The recent observation of the onset of degeneracy in a Fermi gas, in which the atoms are cooled to such low temperatures that their associated de Broglie waves start to overlap, has opened up new opportunities in atomic and quantum physics. One prediction is that the interaction between Fermionic atoms can be tuned to form Cooper pairs, just as two electrons do in superconductors when they overcome their Coulombic repulsion and pair up. However, the expectedly small superconducting gap and the nature of the Fermionic system will require new techniques. Törma and Zoller propose using laser pulses to detect the superconducting ground state of the atomic Cooper pair and determine the extent of the pairing. Lasers would be used to tune and manipulate the coupling between the internal energy levels of the atoms, which would alter their interaction strength, and should result in a controllable and measurable phase transition between the superconducting and normal states. — ISO

Phys. Rev. Lett. **85**, 487 (2000)

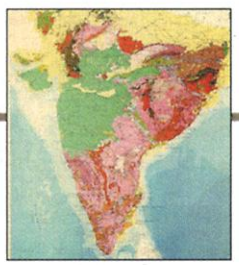
OCEANS

Carbonate Deficit in the Southern Ocean

The deep waters of the Pacific and Indian Oceans are a mixture of North Atlantic Deep Water (NADW) and Southern Ocean Ventilated Water (SOVW), which combine in the deep Southern Ocean (the ring of ocean that encircles Antarctica and extends north to South America, Africa, and Australia). The product of this combination, Circumpolar Deep Water (CPDW), then flows north into the deep Pacific and Indian basins. One might expect that the carbonate ion concentrations of the deep Pacific and Indian Oceans would be between those of NADW and SOVW, but they are not. Instead they exhibit an apparent deficiency in carbonate ion that cannot be explained by chemical or biological processes.

Broecker and Sutherland consider this dilemma by first noting that CPDW displays the same carbonate deficiency as the deep waters of the Pacific and Indian Oceans. This means, then, that it is in the Southern Ocean that the carbonate deficiency originates. They suggest that the cause of the deficit could be that deep-water formation in the Southern Ocean was much stronger during the Little Ice Age (~1350 to 1880 A.D.) than it is now, and that the carbonate ion content of that water was lower as well. Therefore, the deep Pacific and Indian Oceans that exist today may have been formed with a component of Southern Ocean deep water unlike the SOVW that is being made at present. — HJS

Geochem. Geophys. Geosys. **1** (2000).



GEOLOGY

When It Rained Rocks, It Poured Lava

The Deccan flood basalts, one of Earth's largest volcanic provinces, erupted near the time of the Cretaceous-Tertiary boundary and its major extinction (which included the demise of the dinosaurs)—or perhaps was coincident with it. Resolving this question has been difficult because alteration of the Deccan's basalt flows has hindered accurate dating and led to a wide range of age estimates. Hofmann *et al.* collected samples from the main lava pile and analyzed separate minerals in an attempt to overcome this problem. Dating by $^{40}Ar/^{39}Ar$ of plagioclase separates from several flows indicates that most of this large pile of lava (2500 meters in thickness) erupted in a relatively short interval (less than 1 million years) about 65.5 million years ago. This age is coincident with dates for the Cretaceous-Tertiary boundary, and the rapid eruption rate is similar to that of most other flood basalt provinces. The authors suggest that previous older ages for these rocks were the result of disturbance of argon in the minerals. — BH

Exploring the Deccan trap (green area in map).

Earth Planet. Sci. Lett. **180**, 13 (2000).

ASTRONOMY

Cooler Dwarf Stars

The coolest stars with just enough mass to fuse hydrogen are the M-dwarfs. Two new classes of brown dwarfs have been added to the end of this stellar sequence. The L-dwarfs are slightly cooler and less massive than M-dwarfs, and they cannot sustain hydrogen fusion; T-dwarfs are even cooler and less massive than L-dwarfs. Hundreds of T-dwarfs and tens of L-dwarfs have been discovered in the solar neighborhood during the last 4 years.

Kirkpatrick *et al.* describe photometric and spectroscopic work on 67 newly identified L-dwarfs, revealing that L-dwarfs have temperatures between 1300 to 2000 Kelvin and that the atomic lithium abundance declines in the cooler L-dwarfs, which suggests that lithium is being converted to a Li-rich molecule. Burgasser *et al.* concentrate on one T-dwarf (2MASSW J1237392+652615) and note a hydrogen alpha emission that persisted during three nights of observations. This emission indicates that the T-dwarf may have either a magnetic field that creates stellar flares in its chromosphere or an active accretion disk (along with a close binary companion) that emits Hα. Thus, the L-dwarfs are more abundant than previously suspected, and the lowly T-dwarfs may be more active than expected. — LR

Astron. J. **120**, 447 (2000); *Astron. J.* **120**, 473 (2000).

BIOMEDICINE

Sniffing Out a Job for BRCA1

The discovery that mutations in the *BRCA1* gene predispose individuals to an increased risk of developing breast or ovarian cancer has prompted the search for what the normal BRCA1 protein does in the cell. BRCA1 has structural motifs characteristic of transcription factors, and it increases the expression of certain genes including the master tumor suppressor gene, *p53*. The finding by Bochar *et al.* that BRCA1 is a crucial component of SWI/SNF, an 18-protein complex that remodels chromatin, now suggests how BRCA1 might regulate gene transcription.

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SOURCE: (TOP TO BOTTOM) GEOLOGICAL SURVEY OF INDIA; GILBERT FERAUD/CNRS

Within the SWI/SNF complex, BRCA1 binds to a DNA-dependent ATPase called BRG1, the catalytic component that is essential for chromatin remodeling. If BRG1 is defective, BRCA1 is no longer able to switch on transcription of p53-responsive genes. Intriguingly, BRG1 binds to BRCA1 within the region encoded by exon 11, the section of the *BRCA1* gene that harbors many of the predisposing cancer mutations identified so far. Now the search is on for mutations in BRG1 and other SWI/SNF proteins that also might predispose to cancer. — OMS

Cell **102**, 257 (2000).

PHYSIOLOGICAL ECOLOGY

Smart Seeds

There are a variety of mechanisms that enable seeds to time the moment of germination so as to optimize the chances of survival, the detection of changes in the light, water, and temperature regimes being the most common. The ratio of red to far-red (R:FR) light is an important environmental factor, representing the amount of light available for photosynthesis beneath a canopy of competitors.

In some cases, these mechanisms are extremely subtle. Batlla *et al.* show that seeds may be able to anticipate the growth of a competitive canopy above them, thereby avoiding futile germination. The germination of seeds of *Silene* and *Brassica* placed under a developing wheat canopy was inhibited even at low leaf area indices (a measure of canopy cover) and very small reductions in ambient R:FR; seeds exposed to direct solar radiation slightly enriched with FR did not germinate either.

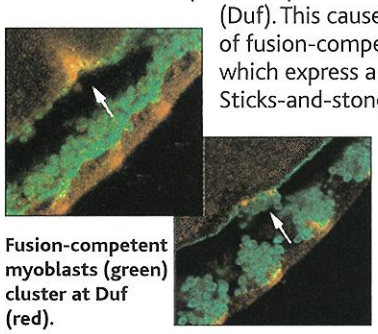
The ability to detect a canopy in the earliest stages of development, even if conditions are otherwise set fair, suggests that plants can glean more information from the light environment than hitherto thought, and reinforces the importance of the regeneration niche in permitting species coexistence. — AMS

Functional Ecology **14**, 195 (2000).

DEVELOPMENT

Myoblast Fusion

The formation of muscle involves the fusion of muscle fiber precursor cells, myoblasts, to form long syncytial tubes known as myotubes. Ruiz-Gómez *et al.* show that in *Drosophila* the formation of myotubes is seeded by founder myoblasts that express the protein Dumbfounded (Duf). This causes the clustering of fusion-competent myoblasts, which express a protein termed Sticks-and-stones (Sns) as described by Bour *et al.* Because only founder cells express Duf, and only fusion competent myoblasts express Sns, these expression patterns help to explain the inherent asymmetry observed in myoblast fusion. It remains to be seen whether Duf and Sns interact directly with one another via their Ig domains, but it is probable that they underlie recognition and interaction between the two classes of myoblasts. — SMH



Fusion-competent myoblasts (green) cluster at Duf (red).

CREDIT: RUIZ-GOMEZ *ET AL.*, *CELL* **102**, 189 (2000).

Cell **102**, 189 (2000); *Genes Dev.* **14**, 1498 (2000).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Escorting RXR Out of the Nucleus

Staying in the nucleus is certainly important for nuclear receptors like the retinoid-X receptor (RXR) to regulate transcription, and this localization may well depend on which other nuclear receptors RXR partners with. Katagiri *et al.* report that when RXR heterodimerizes with an orphan nuclear receptor called NGFI-B, RXR is promptly escorted out of the nucleus in response to nerve growth factor (NGF) treatment. When a putative nuclear export signal was mutated in NGFI-B, translocation of both nuclear receptors to the cytoplasm was inhibited, indicating that NGFI-B regulates the subcellular distribution of RXR through heterodimerization. The presence of NGFI-B also interfered with the DNA binding activity of another heterodimer comprised of RXR and the retinoic acid receptor, and treatment of cells with NGF decreased retinoic acid-induced transcription. Thus, RXR-NGFI-B association may be a point of crosstalk between the NGF and retinoic acid signaling pathways. — LDC

Nature Cell Biol. **2**, 435 (2000).