EDITORS' CHOICE

edited by Gilbert Chin

PHYSICS

Flowering Lasers

When individual lasers are brought together, the beams of coherent photons can couple together, resulting in the formation of new modes and spatial patterns. This coherent coupling may find a number of practical uses; for example, the new modes can be used to encode information in signal processing, or they can be used to improve the distribution profile of the emission. Most coupling, however, has been in the weak regime, where the characteristic properties of each beam tend to be preserved and only the overlapping region is modified. Using a closely packed hexagonal array of vertical cavity surface emitting lasers, Yadin *et al.* show that the stronger coupling yields flower-like patterns that span the entire area of the array. Moreover, the spatial patterns are maintained as the light propagates, providing a potential route for enhanced transmission of information in free space. — ISO

Emission patterns of coupled lasers, at two injection currents and pulse lengths.

Opt. Lett. **27**, 1908 (2002).

GEOPHYSICS

Infamous Volcanoes

Seismic data can now provide detailed views of magma systems in active volcanoes and how these are related to recent eruptions and regional tectonics and volcanic hazards. Several approaches are used, but all rely on the fact that sound waves travel better through solid rock than through liquids (if at all) and that earthquakes can occur near where magma is migrating, but not within a magma body.

Musumeci *et al.* examined the distribution of microearthquakes in the late 1990s around Mount St. Helens and show that under the volcano is a narrow conduit extending down to about 5.5 km, where the main magma body lies. The magma seems to be injected periodically into a dike-like body controlled by a gap in a regional strike-slip fault. Di Stefano and Chiarabba, using tomography, show that the magma chamber under Vesuvius extends from near sea level to a depth of 2.5 km and likely merges with a larger chamber at a depth of about 10 km. Smaller dikes from this chamber extend toward vents that erupted in the 20th century. — BH

J. Geophys. Res. **107**, 2264; 2278 (2002).

CHEMISTRY

Support Your Library

Although synthetically challenging to construct, high-diversity libraries of chemical compounds are becoming an important resource for large-scale drug screening trials. One problem is that current synthesis methods cannot differentiate between different molecules displaying functional groups with similar reactivity. Preparative reactions therefore have to be carried out in separate reaction vessels, or by means of laborious protection and deprotection cycles. Calderone *et al.* have developed a one-pot approach by attaching short strands of complementary DNA sequences to each pair of reactants. This enables several types of otherwise incompatible synthetic reactions to proceed in parallel in the same pot without interfering with each other. — JU

Angew. Chem. Int. Ed. **41**, 4104 (2002).

ECOLOGY/EVOLUTION

Of Cascades and Connectance

The trophic cascade, whereby predatory animals control the abundance of herbivores, thereby influencing the biomass of plants, is a central concept in ecology, especially for aquatic systems. Shurin *et al.* have performed a comparative meta-analysis of experimental manipulations of predator numbers in six different ecosystems, using biomass of plants and biomass or density of herbivores as the units of measure. There was 10-fold variation among the systems in the effects of predators on herbivore density—greatest in lakes and oceans and least in streams and terrestrial systems. The stronger effects of predators in lakes and oceans suggests that human effects on plant production and ecosystem processes, already severe through exploitation and bycatch of predators, will be greater in aquatic systems than on land.

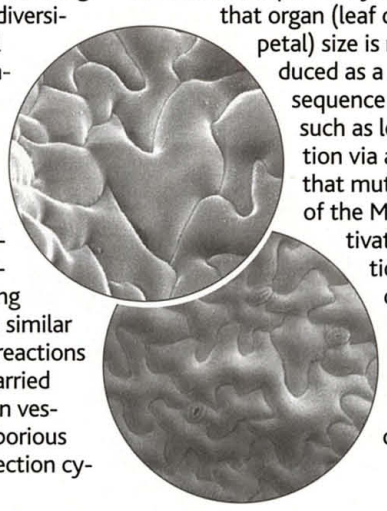
In a separate study, Schmid-Araya *et al.* survey a range of different stream food webs and find that the number of actual connections compared to possible connections be-

GENETICS

Neither Too Big Nor Too Small

How does an organism produce not only an appropriately sized organ but also the right number of appropriately sized cells in that organ? Examples of correlations between size and number exist, as do instances of independent variation. Autran *et al.* have characterized the *struwwelpeter* mutant in *Arabidopsis*. They find that organ (leaf or petal) size is reduced as a consequence of reduced cell number; in some cases, such as leaf epidermis, there is partial compensation via an enlargement in cell size. It appears that mutation in *SWP*, which encodes a subunit of the Mediator complex (a transcriptional coactivator), closes the window of cell proliferation earlier, without altering the duration of the cell cycle, meaning that fewer cycles are completed. Partial compensation occurs when the endoreduplication of DNA that accompanies the postmitotic increase in cell size goes on for one or two rounds more than usual. — GJC

Epidermal pavement cells in wild-type (bottom left) and *swp* (top left) plants.



EMBO J. **21**, 6036 (2002).

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CREDITS: (LEFT) YADIN *ET AL.*, *OPT. LETT.* **27**, 1908 (2002); (BOTTOM) AUTRAN *ET AL.*, *EMBO J.* **21**, 6036 (2002)

tween species (the "connectance" of the food web) decreases with increasing numbers of species. The connectance values were lower than in other aquatic systems, again suggesting a lesser role for top-down control in streams. — AMS

Ecol. Lett. **5**, 785 (2002); *J. Anim. Ecol.* **71**, 1056 (2002).

ASTROPHYSICS

A Peculiar Progenitor

Supernovae come in two flavors: The type Ia are thermonuclear explosions of white dwarfs, whereas the types Ib, Ic, and II are produced by core collapse in massive stars. The different types of supernovae are distinguished by their spectra and brightness variations over time.

Benetti *et al.* noticed that one of the brightest supernovae ever observed, SN 1991D, has spectral characteristics of type Ia and types Ib or Ic. The progenitor may have been a binary system consisting of a white dwarf and a low-mass helium star, and it is possible that the white dwarf exploded within the helium envelope of its companion or while the white dwarf was still spiraling into the companion. This rare combination of events would explain the mixed spectral signals and could also have produced an extremely high luminosity as the explosion interacted with the helium envelope. In addition to aiding our understanding of the progenitors and mechanisms of stellar explosions, which are relevant to star formation and nucleosynthesis, the brightest type Ia supernovae are used to estimate the age, geometry, and expansion rate of the universe. Bright peculiar supernovae, such as SN 1991D, could complicate these estimates because they do not fit the standard model of type Ia explosions. — LR

Mon. Not. R. Astron. Soc. **336**, 91 (2002).

IMMUNOLOGY

Adapting to the Task

In the immune system, stimulation and activation of lymphocytes depend on receptors that connect to intracellular signaling pathways via intermediary adapter proteins. Such receptors are classified according to whether they represent primary recognition structures or mediate secondary costimulatory signals. Two studies now suggest that NKG2D—a receptor used in both adaptive and innate immune responses—belongs to both classes.

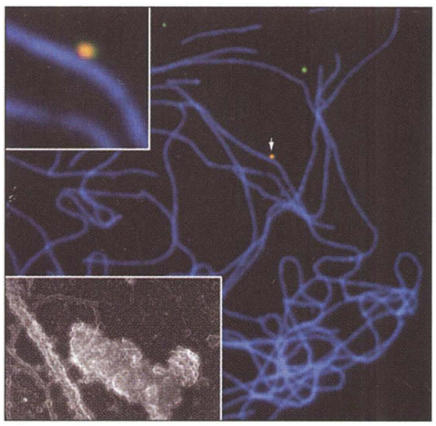
Gilfillan *et al.* observed that, in mice lacking the known NKG2D adapter DAP10, functional NKG2D expression was lost on $CD8^+$ T cells but was maintained on natural killer (NK) cells through use of a second adapter, DAP12. Diefenbach *et al.* provide an elegant mechanistic explanation for how this is achieved, by demonstrating that NKG2D is generated as two isoforms that associate differentially with DAP10 and DAP12; in addition, DAP12 expression was restricted to macrophages and NK cells. Through the use of alternative splicing of receptor and varied expression of adapters, these studies reveal how the one receptor functions either as a primary receptor in NK cells or as a costimulatory protein in T cells. — SJS

Nature Immunol., 10.1038/ni857; 10.1038/ni858 (2002).

CELL BIOLOGY

First Moves

Retroviruses, like human immunodeficiency virus (HIV), bind to receptors on the cell surface and are released into the cytoplasm after fusion of the viral envelope with cellular membranes. Once in the cytoplasm, the virus must convert its RNA genome into DNA by reverse transcription, before integration into the host cell DNA and subsequent generation of new viral RNA. In order to examine the very early stages of infection of HIV, McDonald *et al.* fluorescently tagged virions and tracked them after entry into living cells. Within 2 hours of entry, the viral particles had been transported toward the cell nucleus along microtubules by the molecular motor dynein. Further analysis confirmed that, once in the perinuclear region (in the vicinity of the microtubule organizing center), the virus became associated with reverse transcription complexes (RTCs), some of which still appeared to contain intact viral capsids. — SMH



Microtubule (blue)–associated RTCs (orange) viewed by fluorescence microscopy and by electron microscopy (lower inset).

J. Cell Biol. **159**, 441 (2002).

CREDITS: MCDONALD *ET AL.*, *J. CELL BIOL.* **159**, 441 (2002)