# EDITORS' CHOICE

edited by Gilbert Chin

VIROLOGY

## Death Lurking in Frame

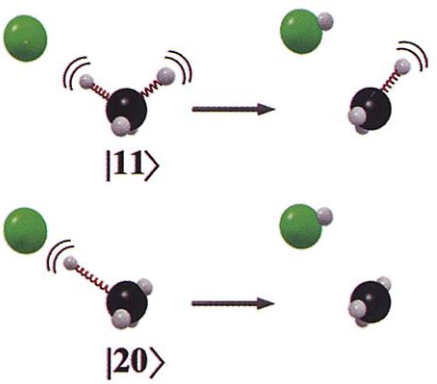
Influenza virus A has eight antisense RNA gene segments that encode 10 proteins, each of which contributes to distinct pathology in different animal hosts. Although the genome was sequenced 20 years ago, Chen *et al.* have serendipitously discovered a flu virus protein encoded by an open reading frame (*PB1-F2*) that is camouflaged within an alternative reading frame of one of the polymerase subunit genes. This open reading frame can be observed in many virus isolates from many hosts, but it is unusual in not being essential for viral replication. Furthermore, it appears to contribute to pathogenicity by promoting the death of immune cells; the PB1-F2 protein localizes to mitochondria and induces morphological changes similar to those seen in apoptotic cells. In human infections with the pandemic H2N2 and H3N2 strains of influenza virus, *PB1* was one of the few segments to originate from avian viruses, and the massive loss of immune cells is associated with avian influenza. — CA

*Nature Med.* **7**, 1306 (2001).

CHEMISTRY

## Excited Spectators

If vibrational excitation of selected chemical bonds is to be used to control the outcome of chemical reactions, then it is necessary to determine what happens to vibrational energy in bonds that are not directly involved in product formation. Kim *et al.* followed the reaction of chlorine atoms with methane molecules in which two vibrational quanta of energy were deposited in different ways. When one C–H bond was excited to the second vibrational excited state (the $|20\rangle$ state), that energy went into the hydrogen chloride product and left the methyl product vibrationally cold. When two C–H bonds were each excited to the first vibrational excited state (the $|11\rangle$ state), one C–H bond in the methyl product was left vibrationally excited. These results show that neighboring bonds in more complex molecules can act as passive "spectators" to those undergoing reaction. — PDS




**Reaction outcomes for different methane excited states.**

*J. Am. Chem. Soc.* 10.1021/ja17180c.

CHEMISTRY

## Fading Fast and Not So Fast

Chemical reactions can be studied spectroscopically at the single-molecule level with the use of fluorescent tracers or dyes. These fluorophores do not last forever; eventually they bleach and become invisible in the fluorescent microscope. Fluorophore destruction is known to be accelerated in the presence of oxygen, but our detailed understanding of the photobleaching process is limited.

Christ *et al.* have studied, one by one, the behavior of several hundred terrylene molecules in air, oxygen, and argon atmospheres. Most of the molecules succumbed to photobleaching, and an argon atmosphere slowed this process by several orders of magnitude. The remaining molecules first switched into a new fluorescent state, with an emission maximum shifted to a shorter wavelength, before subsequently becoming dark. Quantum chemical calculations of possible product molecules indicate that immediate photobleaching and switching into a second fluorescent state are both caused by the covalent addition of oxygen. In the latter case, a second oxidation event then leads to photobleaching, which is consistent with their observation that the lifetime of the secondary photoproduct increases when it is transferred to an argon atmosphere. — JU

*Angew. Chem. Int. Ed.* **40**, 4192 (2001).

ASTROPHYSICS

## How Cold Is it Out There?

The standard cold dark matter (CDM) cosmology predicts that non-ordinary particles (such as cosmic strings, axions, or supersymmetry particles) would have low-velocity dispersions in the early universe and readily aggregate into galactic-sized clumps. Over

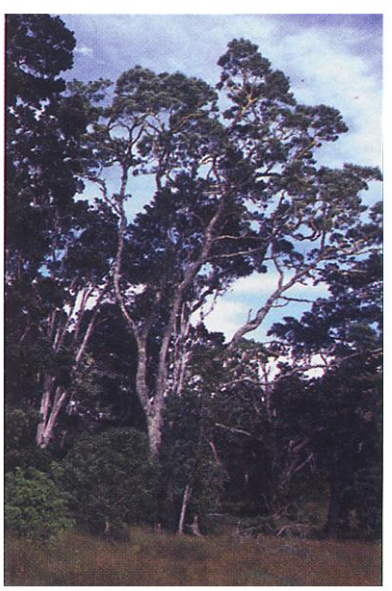
ECOLOGY

## More Rain, Less Decay

The amount of carbon stored in soils is an important component of the global carbon cycle and therefore is relevant to calculations of the effects of climate change on the biosphere. There is a correlation between increased rainfall and increased carbon storage in forest soils, but the search for how these parameters are linked has proved inconclusive.

Schuur *et al.* have examined soil ecology across a gradient of precipitation in a montane forest system in Maui, Hawaii, a natural laboratory where variation in complicating factors such as geology and vegetation history is minimized. In this system, soil carbon storage nearly doubled as the annual precipitation doubled. Of the various processes examined, such as primary productivity (biotic) and soil mineralization (abiotic), a reduced rate of decomposition of organic matter appeared to be the key determinant of increased carbon storage. Reduced oxygen availability to microbes in the wetter soils is the most likely agent of reduced decomposition, which would lead to greater accumulation of soil carbon and slower carbon cycling. — AMS

*Ecology* **82**, 3182 (2001).



**Hawaiian montane forest.**

CONTINUED ON PAGE 2057

SOURCE: (LEFT) KIM *ET AL.*, *J. AM. CHEM. SOC.* 10.1021/JA17180C; (RIGHT PHOTO) STEVEN GOLDSMITH/AUSTIN COLLEGE

time, these clumps would merge to create clusters and superclusters in a bottom-up approach to universe evolution. CDM cosmology thus specifies a large-scale structure for the universe and a small-scale structure for individual galaxies. Unfortunately, recent observations of the dynamics of luminous ordinary matter in galaxies do not lead to the predicted density structure of the unseen dark matter.

Keeton approaches this problem from a different direction by considering the number and sizes of observed gravitational lenses of elliptical galaxies. A gravitational lens can be used to determine the mass and density of the core of a galaxy on the basis of gravitational effects, independently from estimates based on observations of luminosity and galaxy dynamics. The lensing observations indicate that a CDM cosmology requires large-scale structures that are too dense and small-scale structures that are not dense enough, so something exotic, perhaps self-interacting dark matter or warmer dark matter, is needed to smooth out the density discrepancies and resolve the debate between enlightened observers and cold cosmologists. — LR

*Astrophys. J.* **561**, 46 (2001).

GEOPHYSICS

## Characterizing the Chi-Chi Earthquake

A magnitude 7.6 earthquake ruptured a 100-kilometer-long segment of the Chelungpu thrust fault in central Taiwan on 21 September 1999. A collection of 36 papers details the earthquake mechanism, the propagation of the rupture, the structure of the fault and its tectonic setting, the spatial and temporal distribution of surface shaking, the intensity and distribution of infrastructure damage, the triggering of additional earthquakes, and the probabilities and seismic hazard potential of future events. The Chi-Chi earthquake produced some of the largest surface displacements ever measured, such as the 6-meter-high waterfall (fault scarp) across the Tachiahsi river and the 9.8-meter vertical displacement across the Shigan dam. In addition, the Central Weather Bureau of Taiwan had just completed the deployment of more than 600 strong ground motion stations on the island and was able to record the propagation of the rupture and the intensity of the shaking. A movie of the rupture propagation based on the strong ground motion data as well as 15 other data files related to other papers are included on a CD-ROM with the issue. — LR

**Fault surface rupture across Shigan Dam.**

CREDIT: EARTHQUAKE ENGINEERING REASEARCH INSTITUTE/J. P. BARDET

*Bull. Seismol. Soc. Am.* **91**, 893 (2001).

IMMUNOLOGY

## Origins of Resistance to Viruses

The immune response to viruses depends critically on type 1 interferons, a family of cytokines that activate early antiviral pathways and that directly inhibit viral replication within cells. The precise source of type 1 interferons in vivo has been difficult to pin down, although recent studies in humans have demonstrated the existence of rare, natural interferon-producing cells (IPCs) in the blood.

Asselin-Paturel *et al.* identify in mice a subset of IPCs that displays the characteristics of immature dendritic cells (DCs). In particular, the IPCs exhibited a robust capacity for interferon-α production and a group of protein markers distinct from those of other DC subsets. Depletion of IPCs in vivo revealed that these cells were the main source of virally induced interferon-α; in addition, exposure to virus increased IPC survival and their capacity to stimulate antigen-specific T cell responses. Finally, the mouse IPCs showed limited reactivity to bacterial products, consistent with the notion that they are destined to combat viral infection. — SJS

*Nature Immunol.* **2**, 1144 (2001).