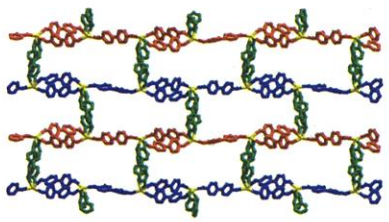
EDITORS' CHOICE

edited by Gilbert Chin

CHEMISTRY

A Fivefold Path

Lanthanides tend toward large coordination spheres that can accommodate eight or nine ligands, yet framework compounds based on lanthanides usually show three- and fourfold connectivity between atoms; this is more commonly seen with transition metals that prefer to have smaller coordination spheres. Long *et al.* have pursued a strategy in which noncoordinating anions are used to open up spaces in frameworks and to avoid interpenetrating network formation. In the process, they have created structures with a rarely seen fivefold connectivity of the lanthanide ions, in this case through bridging 4,4′-bipyridine-*N*,*N*′-dioxide ligands. — PDS



Each lanthanide ion is connected by bridging ligands to five other LA ions.

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

MICROBIOLOGY

Bacterial Wood

The presence of cellulose biosynthetic genes in *Escherichia coli* has remained mysterious. Certainly, the common laboratory strain *E. coli* K-12 produces no cellulose, but this strain cannot be taken as the prototypical bacterium. Zogaj *et al.* have looked carefully at nonpathogenic strains of enterobacteria, including *Salmonella*, *Pseudomonas* and *Klebsiella*, and have detected the production of cellulose.

Cellulose is the most abundant natural polymer and is the intrinsic structural component of plants. Bacteria produce cellulose for physical protection and, in species such as *Agrobacterium* and *Rhizobium*, for adhesion to host cells. When *Salmonella typhimurium* enters stationary phase a distinct multicellular form, rdar, develops under the control of the *agfD* gene. Simultaneously, at least two extracellular matrix components are generated, one being thin, aggregative fimbriae and the other now identified as cellulose. Together, these form a hydrophobic network encasing tightly packed cells within an inert matrix, which probably is important for the survival of commensal organisms in harsh environments. As the biosynthetic genes in the species examined by Zogaj *et al.* form a module with surprisingly homologous sequences, it seems likely that they constitute a laterally transferred unit between cohabiting biofilm residents. — CA

Mol. Microbiol. **39**, 1452 (2001).

GEOLOGY

A Shaky Past

The earthquake in the Pacific Northwest on 28 February 2001 underscores the potential for future damaging earthquakes in this area. It occurred beneath the southern part of Puget Sound on a normal fault in the Juan de Fuca Plate, which is being subducted eastward beneath North America.

In a timely description of historical context, Bourgeois and Johnson have conducted a study of sediments in the lower Snohomish delta in the Puget Lowland, which is near the epicenter of the recent earthquake. Sediment disturbance has been taken as evidence for tsunamis or liquefaction associated with two large tremors that struck this region during the past 1200 years; this study proposes that at least three other earthquakes also occurred during this period. Thus, this region has regularly been subject to strong shaking in the past, including events equal to or more intense than the most recent disturbance. — BH

Geol. Soc. Am. Bull. **113**, 482 (2001).

IMMUNOLOGY

Fatal Reaction

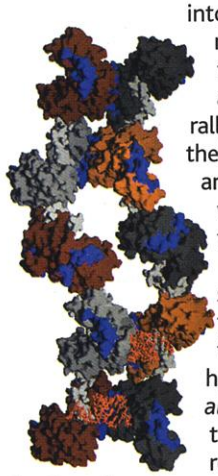
Allergies are familiar to most simply as nuisance responses to innocuous materials such as pollen, yet, at the extreme, allergic reactions to foreign protein can lead to anaphylactic shock and death. In contrast, autoimmune diseases, such as multiple sclerosis, result from the lingering attention of the immune system toward self proteins.

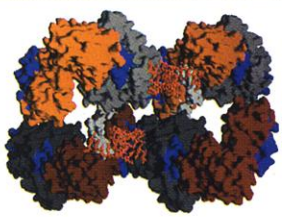
Using a mouse model for multiple sclerosis, termed experimental autoimmune encephalomyelitis (EAE), Pedotti *et al.* blur the distinctions currently drawn between allergy and autoimmunity by showing that allergic reactions can develop toward self, as well as foreign, proteins. Previous studies have shown that although EAE is driven by a chronic T helper 1

BIOMEDICINE

Turning Positive into Negative

Many medically important viruses have positive strand RNA genomes, so called because the genome is the messenger RNA that is translated into protein. Successful replication of these viruses requires that the positive strand RNA be copied faithfully into a negative strand, a process catalyzed by a replication complex containing a virally encoded RNA-dependent RNA polymerase. In the case of poliovirus, new insights into this reaction are emerging from in vitro replication systems, which allow researchers to manipulate the RNA template and protein components.





Two models for polymerase oligomerization (monomers in orange, dark red, light grey, and dark grey).

Using mutant poliovirus RNA templates, Barton *et al.* find that a cloverleaf structure at the 5′ end of the RNA is essential for replication. Because negative strand synthesis is initiated at the 3′ end of the RNA, this suggests that the RNA template circularizes prior to replication, a configuration that may help to stabilize the RNA and clear it of ribosomes. In another study, Hobson *et al.* find that the poliovirus polymerase forms a higher order oligomeric structure that is critical for its function. Polymerase-polymerase interactions were required for substrate RNA binding and for formation of the enzyme's catalytic site. Together, these results reinforce the notion that poliovirus RNA replication in infected cells is carried out by an efficient and highly ordered machinery. — PAK

EMBO J. **20**, 1439 (2001); *EMBO J.* **20**, 1153 (2001).

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SOURCE: (LEFT) LONG *ET AL.*, *J. AM. CHEM. SOC.*, IN PRESS; (RIGHT) HOBSON *ET AL.*, *EMBO J.* **20**, 1153 (2001).

(T_H1) class of inflammation, allergic-type T_H2 cells also might contribute toward disease pathology. By extending the regime of immunizations that induce EAE to include the recovery phase of the disease, when large numbers of allergic T_H2 cells are present, anaphylactic shock and, in some cases, death could be induced. Further examination of the immunizing proteins indicated that the allergic response may have resulted from the persistence of T cells that had not been deleted by the autoantigen within the thymus. — SJS

Nature Immunol. **2**, 216 (2001).

PHYSICS

Optical NMR in Semiconductors

The relatively long lifetimes of nuclear spins compared to electron spins and their inherent resilience to decoherence offer an alternative route for exploring device architectures based on spin manipulation. In this regard, the hyperfine interaction between optically excited precessing electrons and the nuclei has been proposed as a technique for nuclear spin manipulation. However, an earlier paper described resonances that did not correspond clearly to any nuclear moments present in the sample.

Using a new system in which the electrons are restricted to a two-dimensional plane, Salis *et al.* establish that connection unambiguously for transitions of ^{69}Ga, ^{71}Ga, and ^{75}As. A circularly polarized pump pulse excites the electrons, which then precess around an out-of-plane magnetic field. The nuclei are highly polarized, and depending on the extent of the asymmetry of magnetic field, the nuclear spin can be polarized controllably along or against the direction of the magnetic field. The signals seen in the previous study turn out to be normally forbidden $\Delta m = 2$ transitions at half the conventional resonance frequency. — ISO

Phys. Rev. Lett. **86**, 2677 (2001).

ENVIRONMENTAL SCIENCE

A Gold Mine of Difficulties

Many of the world's most polluted sites, including many Superfund sites in the United States, lie downstream of abandoned mines. Abundant heavy-metal pollution in ground and surface waters can damage ecosystems severely, and recovery of these systems has been problematic.

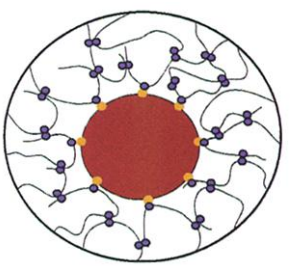
Marcus *et al.* describe some of the hurdles in improving the condition of Soda Butte Creek in Yellowstone National Park. (Concern about pollution has led to protests against renewing gold mining in drainages entering the park.) This creek, in the northern part of the park, drains a mining district that is just outside park boundaries and was abandoned in 1953. The authors found that, in the mine district and floodplain of the river, metal tailings that are not covered by vegetation provide continuous sources of pollution. Major recent floods, including a 100-year flood, had little effect on mitigating in-stream pollution. Similar processes may hinder the recovery of other areas affected by mining. — BH

Geology **29**, 355 (2001).

BIOCHEMISTRY

Through the Isinglass

The nuclear pore complex (NPC) is embedded in the nuclear envelope and enables transport between the nucleus and the cytoplasm. Small molecules can diffuse through the pore, but larger molecules must be bound by nuclear transport receptors that facilitate transport through interaction with the NPC.



Transport receptors (orange) interact with nucleoporin motifs (purple) to facilitate movement of cargo (red).

Ribbeck and Görlich have measured translocation rates and capacities for various model substrates. They find that the NPC is capable of about 1000 translocations per second, corresponding to a mass flux of about 100 megadaltons per second. The affinity of the substrates for NPC components is low and consistent with micromolar affinities measured previously for interactions between substrates and the phenylalanine-rich nucleoporin repeats, which have been implicated in translocation. These repeats are thought to be a major constituent of the central plug, a material of low electron density that fills the pore of the NPC. The authors suggest that these repeats form a sieve-like structure that restricts the flow of large molecules unless they can compete for direct binding to the motifs. Weak interactions of these motifs with nuclear transport receptors would allow infiltration of the barrier and facilitate fast transport. — VV

EMBO J. **20**, 1320 (2001).

CREDITS: RIBBECK & GORLICH, *EMBO J.* **20**, 1320 (2001).