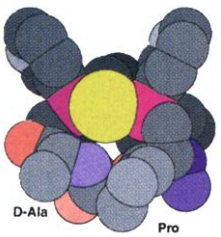
EDITORS' CHOICE

edited by Gilbert Chin

CHEMISTRY

A Turn for the Better

When inorganic chemists want to generate new ligands in order to make improved catalysts, they often turn to molecules containing phosphine groups, whose coordination to metal centers can be carefully tuned, but the design and synthesis of large ligands with multiple binding sites can be tedious.



Palladium with phosphine peptides.

Gilbertson *et al.* have modified standard resin-based peptide library synthesis by utilizing a phosphine-containing amino acid, (diphenylphosphino)serine (Pps), in addition to a D-amino acid and a proline residue that together form a β-turn motif. Libraries of hexapeptides incorporating two Pps residues were used as ligands in palladium complexes that were screened for catalysis of the asymmetric addition of dimethyl malonate to cyclopentyl acetate, a reaction for which few catalysts achieve a high enantiomeric excess (ee). Peptides that maintained the β-turn gave the highest ee's (75 to 80%), and immobilized and free complexes displayed similar catalytic activities. — PDS

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

APPLIED PHYSICS

To Catch One Photon

Research fields as diverse as spectroscopy, materials characterization, and quantum optics are increasingly dependent on the capability of detecting single photons. These photons usually are detected by photomultiplier tubes or avalanche processes. A single absorbed photon creates an electron-hole pair, which is then separated and accelerated in an electric field to create a cascade of free charges as they collide with other atoms in the material.

Shields *et al.* introduce a solid-state, single-photon detector that combines the charge storage effects of quantum dots with the gate-controlled conductivity of thin film transistors. A layer of quantum dots placed near the electron conduction channel of a field effect transistor is loaded with electrons, the induced electric field of which depletes the underlying conduction channel of electrons. The hole of the electron-hole pair created by the incoming photon recombines with an electron trapped in the quantum dot, which adds an extra electron to the conduction channel. The conductivity of the channel increases in steps as single photons are detected. — ISO

Appl. Phys. Lett. **76**, 3673 (2000).

ASTRONOMY

Pulsar Glitches

Only five anomalous x-ray pulsars (AXPs) have been discovered in the universe. These pulsars are thought to be neutron stars spinning with periods of 5 to 12 seconds. The pulsations may be related to an extremely strong magnetic field or to emissions from an accretion disk (either in an intact binary system or from the remnants after a neutron star has swallowed its companion). Although none of the five AXPs appear to be binary systems, evidence for the magnetic field source has been lacking.

Kaspi *et al.* have observed a glitch (a transient acceleration) in the 11-second spin period of AXP IRXS J170849.0-400910 with the Rossi x-ray timing explorer (RXTE). This glitch is similar to those seen in radio pulsars, which may be rapidly spinning neutron stars with strong magnetic fields. These glitches could be created by breaking of the magnetic dipole; this would apply a torque to the crust, which usually is decoupled from superfluid vortices in the star's interior. During a glitch, however, the vortices would couple briefly with the crust and transfer angular momentum to the surface, thereby increasing its observed spin. Thus, the observation of glitches supports a strong magnetic field interaction in these anomalous neutron stars. — LR

Astrophys. J., in press [astro-ph/0005326].

NEUROSCIENCE

Smelling the Roses

With almost 1000 odorant receptor genes, most mammals are able to identify a huge array of odorants. Each of the several million olfactory neurons of the mammalian nasal epithelium expresses just one type of odorant receptor (and from only one of the gene's two alleles), and each receptor is expressed in only one of four zones of the nasal epithelium. But how does each olfactory neuron know which single receptor allele to select?

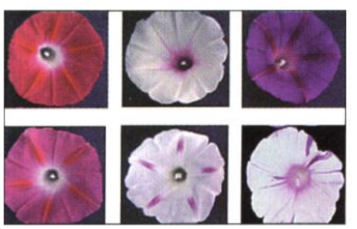
Serizawa *et al.* have engineered mice to express an odorant receptor that carries a green

EVOLUTION AND ECOLOGY

Adaptational Glories

Adaptation can be studied at various scales of biological organization, from molecular to ecological, but in practice there are few organisms or characters of organisms that lend themselves to such analysis. An exception is flower color, a phenotypic character with links directly to ecology (via pollinators) and to molecular biology and genetics (via biosynthetic pathways for floral pigments).

Clegg and Durbin survey 25 years of research by many workers on the genetics and ecology of flower color polymorphisms in the morning glory in Mexico and the southeastern United States, and paint an equally colorful picture of the complexities of floral adaptation. They find that most of the mutations that lead to phenotypic differences in flower color are the result of insertions of transposable elements (for more on transposition, see Davies *et al.*, Research Article, this issue, p. 77). The levels of color polymorphism are high in the southeastern US (where the morning glory has been introduced, and flower colors possibly selected, by humans) and low in its native Mexican highlands; but the patterns of molecular variation are the reverse—high in Mexico, low in the US. Bee pollinators discriminate against white phenotypes compared to other color morphs. This discrimination leads to an increased level of self-fertilization among white flowers; but other disadvantages of the white phenotype combine to hold its frequency at about 10% of the population throughout its range. Hence, even such superficially simple systems contain surprises and unanticipated levels of complexity, but to merge so many levels of biology promises rich rewards for evolutionary studies. — AMS



Six varieties of morning glory.

Proc. Natl. Acad. Sci. U.S.A. **97**, 6941 (2000).

CONTINUED ON PAGE 15

SOURCES: (LEFT TO RIGHT) GILBERTSON *ET AL.*, *J. AM. CHEM. SOC.*, IN PRESS; CLEGG AND DURBIN, *PROC. NATL. ACAD. SCI. U.S.A.* **97**, 6941 (2000).

MOLECULAR BIOLOGY

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dye if encoded by the endogenous gene (representing one allele) and a red dye if encoded by a transgene that has the same regulatory and coding sequences (representing the other allele). Both the gene and the transgene were found only within zone 4 of the nasal epithelium and were rarely co-expressed in the same olfactory neuron. The authors propose that an olfactory neuron may select a single odorant receptor gene in the same way as an immune cell selects a single antigen receptor gene: through DNA recombination, which brings the gene's promoter and enhancer regions into close proximity. — OMS

Nature Neurosci. **3**, 687 (2000).

MICROBIOLOGY

Containing Tuberculosis

Mycobacterium tuberculosis kills more than 2 million people each year, and the emergence of multiple drug–resistant strains (MDR-TB) is of worldwide concern. Dye and Williams combine modeling with data analysis to develop containment scenarios for the current threat from MDR-TB.

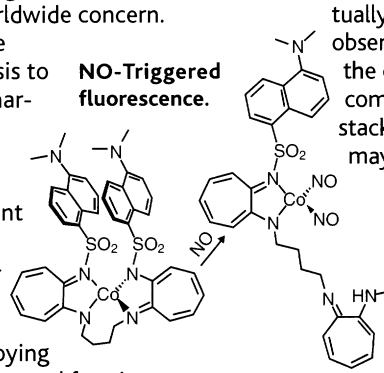
Although there is some evidence that drug-resistant bacilli are less infectious, the authors take a conservative approach in developing their models; their results suggest that employing best practice chemotherapy and four inexpensive first-line drugs for 6 to 8 months of treatment can prevent the emergence of MDR-TB. To ensure a favorable outcome, first-line treatment regimes must achieve cure rates of more than 80%, in conjunction with rapid case detection. It remains easier to prevent MDR-TB from arising than to control an established epidemic, as interruption of MDR-TB transmission would require that 70% of these cases be detected each year and that 80% of these be cured. Nevertheless, there still is no escape from the realization that effective containment of MDR-TB requires new, affordable, and effective second-line drugs. — CA

Proc. Natl. Acad. Sci. U.S.A., in press.

CHEMISTRY

Detection of NO

Nitrous oxide (NO) is implicated in many metabolic processes, yet current methods for in vivo detection of NO rely on measuring metabolites such as nitrite, nitrate, or NO_x species. Franz *et al.* have now synthesized a transition metal complex which directly detects NO in the range of 100 mM. In the "off" state, four nitrogen ligands are bound to the central cobalt atom, and virtually no fluorescent signal is observed. Both quenching by the cobalt atom and excimer complex formation in the stacked fluorescent ligands may contribute to suppression of fluorescence. Replacing two of the imine nitrogens with NO molecules triggers a fluorescent response because one of the dansyl groups is displaced; this fluorescence may be enhanced by formation of a d^{10} Co-dinitrosyl species. This sensor does not react with O_2 and may lead to a more sensitive and reversible sensor for in vivo NO detection. — JU



NO-Triggered fluorescence.

Angew. Chem. Int. Ed. **39**, 2120 (2000).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Presenilins as Enzymes

A peptide known as β-amyloid accumulates in Alzheimer's disease and is thought to contribute to the characteristic and pathologic neurodegeneration. Presenilin (PS) proteins are known to mediate γ-secretase activity, which liberates β-amyloid as a consequence of proteolytic cleavage of the transmembrane amyloid precursor protein; mutated PS proteins have been found in patients with hereditary Alzheimer's disease. Four recent studies have strengthened the case that the PS proteins are, in fact, γ-secretase. Herreman *et al.* and Zhang *et al.* show in blastocyst cultures that cells lacking presenilins also lack γ-secretase activity. Esler *et al.* and Li *et al.* used transition-state inhibitors of γ-secretase and found that these inhibitors bound directly to presenilin. These results add structure to the urgency with which inhibitors of γ-secretase activity are being sought. — JN

Nature Cell Bio. 2, 461; 463; 428 (2000); Nature 405, 689 (2000).

CREDITS: FRANZ *ET AL.*, *ANGEW. CHEM. INT. ED.* **39**, 2120 (2000).