EDITORS' CHOICE

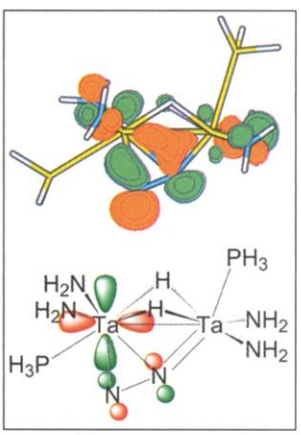
edited by Gilbert Chin

CHEMISTRY

Attacking Dinitrogen

In the chemist's hands, dinitrogen (N_2) is quite unreactive under mild conditions, yet the metalloenzyme nitrogenase manages to convert N_2 to NH_3. Previously, Fryzuk *et al.* have reported on a ditantalum complex produced when N_2 displaced two of the four hydrides bridging the two Ta centers, accompanied by a reductive elimination of H_2; the dinitrogen molecule adopted a side-on binding configuration at one Ta atom and end-on at the other. Now they report density functional calculations and reactivity studies. The lack of δ-bonding in the side-on bond suggests that this binding configuration is enforced mainly by the geometry of the remaining bridging hydrides. Reaction of the complex with propene leads to insertion of the propene into the hydride bonds and a rearrangement to form a compound in which the Ta centers are now connected by the end-on bonded dinitrogen bridge. Because nitrogenase also appears to eliminate H_2 during ammonia synthesis, further studies of these compounds may provide insights into how metal coordination of dinitrogen facilitates biological N_2 fixation. — PDS

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



Calculated molecular orbital interactions of dinitrogen bound both side-on and end-on to tantalum.

CLIMATOLOGY

Water Flowing Upward

Water vapor is an important component of the radiative behavior and the chemistry of the stratosphere, especially in the ozone cycle. It is supplied mostly by mixing with the underlying troposphere and by the oxidation of methane, and both processes are thought to be influenced directly or indirectly by anthropogenic activity. The longest continuous data set of stratospheric water vapor abundance extends back only to 1980, so longer trends can be determined only by combining it with other records. Rosenlof *et al.* have compiled and analyzed ten data sets, which cover the period from 1954 to 2000, and show that the mixing ratio of stratospheric water vapor has increased steadily but irregularly by 2 parts per million by volume during that time (an average rate of about 1% per year). They calculate that this rise is greater than that which can be explained by increases in tropospheric methane concentrations, which implicates changes in the transport of water vapor into the tropical stratosphere as a probable cause. — HJS

Geophys. Res. Lett. **28**, 1195 (2001).

ECOLOGY

Diversity Begets Diversity

There is huge geographical variation, especially between polar and equatorial regions, in the numbers of terrestrial plant and animal species. Ecologists have wrestled with a variety of competing hypotheses—energy availability, habitat heterogeneity, area, and geometric constraints being the major classes—to explain these patterns. Using detailed maps of species distributions and regression analyses with 16 independent variables, Rahbek and Graves investigate the correlates of species richness patterns in South American breeding birds, which constitute at least 25% of the entire bird fauna of the world, across a range of spatial scales. They find that topographic heterogeneity and two elements of climate, precipitation and cloud cover, are the most important predictors of regional species richness for birds: humid montane areas and adjacent regions are the most species-rich. There is a trough in species richness across central Amazonia, confirming that energy input and biome area are not primary determinants of species wealth. — AMS

Proc. Natl. Acad. Sci. U.S.A. **98**, 4534 (2001).

BIOMEDICINE

Cancer Therapy on Target

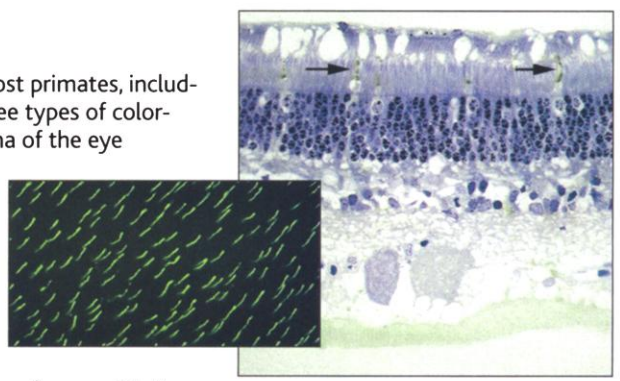
A major limitation of conventional cancer drugs is that they kill rapidly growing normal cells as well as cancer cells. Since the discovery that cancer cells contain specific molecular genetic alterations, researchers have labored to develop new therapies

NEUROSCIENCE

Color Blindness in Whales

The exceptionally good color vision of most primates, including humans, is due to the presence of three types of color-sensitive cone photoreceptors in the retina of the eye (trichromatic vision). Most other mammals have two types of cones (detecting blue and green light), enough to perceive the world in color.

Peichl *et al.* document, however, that whales and seals possess only one type of cone and thus are essentially color-blind. The retinas of these marine mammals, in addition to rod photoreceptors (responsible for black and white vision), contain only L (or long-wavelength) cones. In contrast, the close terrestrial relatives of whales and seals—hippopotamuses and otters, respectively—possess the usual S and L cones. The ancestors of modern whales and seals most likely lived in shallow coastal waters (in which light is red-shifted in comparison to the deep sea) where they seem to have lost their S cones. This clearly is a disadvantage for their present-day ocean-dwelling descendants, who may have needed to develop compensatory mechanisms (including perhaps acoustic communication) to overcome this evolutionary gene loss. — PRS



En face view of seal (inset) and cross section of whale (right, with blue counterstain) retinas stained for L-cones (green; brown, arrows).

Eur. J. Neurosci. **13**, 1520 (2001).

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SOURCE: (LEFT) FRYZUK *ET AL.*, *J. AM. CHEM. SOC.*, IN PRESS; (RIGHT) PEICHL *ET AL.*, *EUR. J. NEUROSCI.* **13**, 1520 (2001).

that target these alterations selectively, with the hope that such therapies would kill cancer cells primarily. In the case of chronic myeloid leukemia (CML), there is a chromosomal translocation (yielding the Philadelphia chromosome) that fuses two unrelated genes, *BCR* and *ABL*. This translocation creates a BCR-ABL fusion protein with a constitutive tyrosine kinase activity that has been shown to be causally involved in the disease. A small-molecule inhibitor of BCR-ABL, called STI571 (for the crystal structure of the ABL-STI571 complex, see Schindler *et al.*, Reports, 15 Sept 2000, p. 1938) was designed in the early 1990s; it was brought to phase I clinical trials as an anticancer agent on the basis of promising results in cell culture studies and animal models.

Druker *et al.* report the exciting and highly anticipated results of these clinical trials. When administered orally at a dose of 300 milligrams per day or higher, STI571 produced complete hematologic responses in 53 of 54 patients with early-stage CML (chronic phase) without serious side effects. In a second study, Druker *et al.* observed hematologic responses in 55 to 70% of patients with a more advanced stage of CML (blast crisis) or with acute lymphoblastic leukemia (ALL), although the responses were less durable than those seen in patients with chronic phase CML. Furthermore, cell culture studies had shown that STI571 inhibits the c-Kit tyrosine kinase, leading Joensuu *et al.* to test the efficacy of the drug in one patient with a gastrointestinal stromal tumor, a tumor type known to express the c-Kit kinase and for which there is no effective therapy. This patient also exhibited a strong response to the drug, showing a 52% decrease in tumor volume within 1 month. These findings offer great hope for the future success of targeted therapies for cancer. — PAK

N. Engl. J. Med. **344**, 1031; 1038; 1052 (2001).

ASTROPHYSICS

Birth of a Black Hole?

Models suggest that black holes may be born in stellar explosions, and the very weak supernova 1997D may be a good candidate for finding evidence for black hole formation. The compact object produced in the center of 1997D should alter the supernova envelope sooner than for other supernovae because the explosion was so weak. An early analysis of the expanding supernova envelope indicated that the amount of nickel-56 (^{56}Ni) ejected was smaller than in any previously observed type II supernova. Two possible explanations for this lack of ^{56}Ni are that (i) a high-mass star exploded, and the ejected material recollapsed to form a black hole; and (ii) the explosion of a low-mass star did not produce much ^{56}Ni, and the leftover material formed a neutron star.

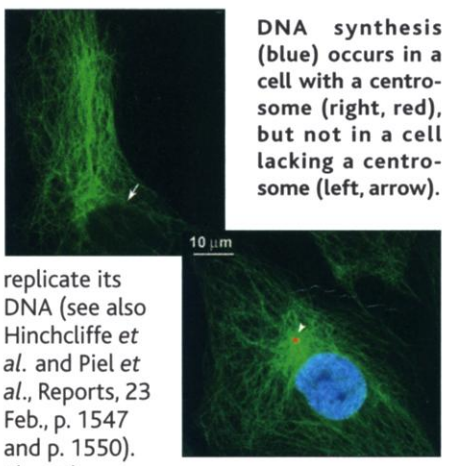
Benetti *et al.* followed the decay of the luminosity of the expanding supernova envelope and found that it was due solely to radioactive decay after 300 days. If a neutron star had formed, it would have interacted with the supernova envelope by this time, so the authors infer that 1997D may instead have produced a black hole. The black hole should alter the supernova envelope after about 1000 days, and thus it will be vital to obtain additional observations of 1997D to detect the black hole's existence. — LR

Mon. Not. R. Astron. Soc. **322**, 361 (2001).

CELL BIOLOGY

Centrosomes and Cytokinesis

The centrosomes are tiny organelles within animal cells that are responsible for arranging the microtubule network. They are particularly obvious during cell division when they help to form the poles of the mitotic spindle. Previously, Khodjakov *et al.* showed that bipolar spindles still formed after the centrosomes had been destroyed by laser microsurgery at an early stage of mitosis. Khodjakov and Rieder now find that, although the removal of the centrosomes did not prevent the completion of mitosis, cytokinesis (the actual separation of the two resulting daughter cells) often was disrupted. When only one centrosome was destroyed, the acentrosomal daughter cell failed to enter S phase and did not replicate its DNA (see also Hinchcliffe *et al.* and Piel *et al.*, Reports, 23 Feb., p. 1547 and p. 1550). Thus, the centrosome is more important for completing cell division and enabling future cell divisions than it is for generating and maintaining the mitotic spindle. — SMH



DNA synthesis (blue) occurs in a cell with a centrosome (right, red), but not in a cell lacking a centrosome (left, arrow).

CREDITS: KHODJAKOV AND RIEDER, *J. CELL BIOL.* **153**, 237 (2001).

J. Cell Biol. **153**, 237 (2001).