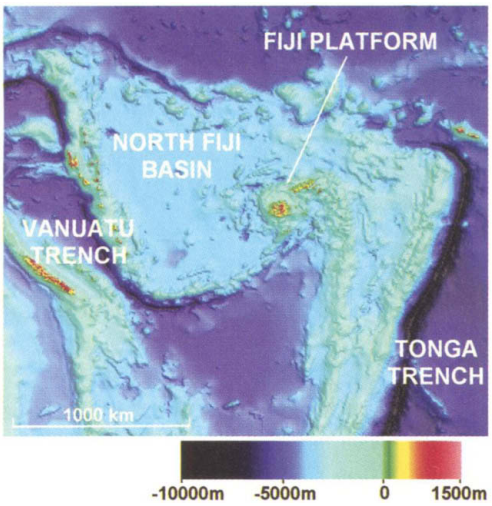
EDITORS' CHOICE

edited by Gilbert Chin



Bathymetry and topography of the Fiji region.

GEOLOGY

A Quick Turn to the Left

The Fiji Islands sit in an area of almost byzantine tectonic complexity—a zone of seafloor spreading and transform faulting between the Tonga and Vanuatu trenches in an offset section of the Pacific-Australian convergent plate boundary. Understanding this region's history can help in interpreting the geologic evolution of more ancient arc and back-arc settings, such as those thought to have characterized parts of the western margin of North America and the Mediterranean region.

Paleomagnetic results indicate that the Fiji platform itself has rotated substantially (21° to 135° counterclockwise) during the late Cenozoic. Begg and Gray have placed new constraints on the timing and magnitude of the rotation by supplementing the paleomagnetic studies with analyses of the progressive changes in the orientation of age-dated lava-filled dikes and in the slip direction of faults in Tavua, a Pliocene volcano on the island of Viti Levu. Assuming a roughly constant direction of regional compressive stress, they find that the Fiji platform rotated by approximately 50° in the brief interval from 5 to 3 million years ago. — SW

Tectonics **21**, 10.1029/2000TC001259 (2002).

BIOGEOCHEMISTRY

Fish Stories

Adult Atlantic salmon (*Salmo salar*) return from the ocean to spawn in single stream reaches, but the life history of juveniles during their freshwater phase is less certain, due largely to the difficulty of tracking individuals. A better understanding of this life stage would be helpful for improving conservation and management strategies. Kennedy *et al.* have measured strontium isotope ratios in salmon otoliths—ear stones formed from concentrically deposited layers of calcium carbonate—and used these to reconstruct their habitats; different streams have distinct isotopic signatures that are determined by the underlying bedrock of the watersheds. The Sr ratios reveal that some juvenile Atlantic salmon, which have been assumed to move no more than 50 m during their 2-year freshwater residence, can move back and forth between habitats or even steadily downstream in the course of becoming smolts. — HJS

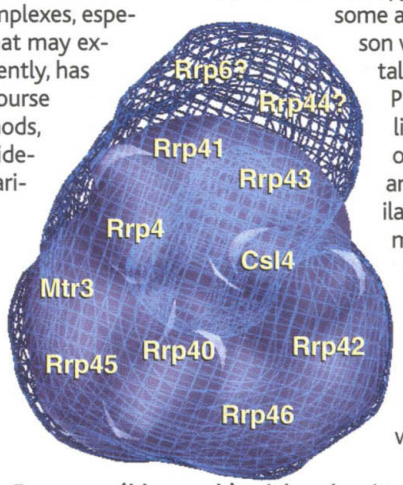
Can. J. Fish. Aquat. Sci. **59**, 925 (2002).

BIOINFORMATICS

Something Old, Something New

The difficulty of determining the crystal structures of macromolecular complexes, especially those that may exist only transiently, has prompted recourse to other methods, such as the widely used comparison of amino acid sequences as well as the newer mapping of protein-protein interactions.

Aloy *et al.* have borrowed from both toolkits in building a model of the structure of the yeast exosome, a complex of 11 distinct subunits that furnishes exonuclease activity during the processing of RNA molecules. Sequence analysis of the yeast proteins and of bacterial polynucleotide phosphorylase (PNPase) delineated core and peripheral domains representing ribonuclease and RNA-binding domains. Electron microscopy of the exosome and comparison with the crystal structure of PNPase established an overall size and shape similarity. Placement and ordering of the six core domains within the trimeric envelope was accomplished on the basis of functional site analysis and a comparison to the structure of the trimeric proliferating cell nuclear antigen. How accurate is this map? Some interaction data are consistent, some not. — GJC



Exosome (blue web) with subunit positions, overlaid on PNPase trimer.

EMBO Rep. **3**, 628 (2002).

CHEMISTRY

Gaining Support Openly

A valuable route to aryl propanoic acids, which are used in the synthesis of antiinflammatory drugs such as ibuprofen, is the carbonylation of either alkenes or alcohols. A palladium catalyst is used to add water and carbon monoxide to these molecules to generate preferentially the branched (iso) acid. However, the solution-phase catalysts for these reactions present a recovery problem, and, to date, traditional supported catalysts, such as Pd on alumina or clays, deactivate rapidly through leaching of the metal. Mukhopadhyay *et al.* show that Pd complexes anchored to the mesoporous silicates MCM-41 and MCM-48 exhibit high conversions and selectivities for a variety of substrates and show no evidence of leaching after use. — PDS

J. Am. Chem. Soc. 10.1021/ja025991q (2002).

BIOTECHNOLOGY

A Litmus Test for Cocaine

Biomolecules are increasingly used to construct sensors for the detection of small molecules, such as drugs or explosives, because of their high sensitivity and selectivity. However, it is not enough that the sensor recognizes and binds the target molecule; the interaction must also result in a detectable signal, ideally a visible color change. Stojanovic and Landry describe a sensor based on an aptamer (an oligonucleotide) previously shown to bind cocaine with selectivity and sensitivity. After

CONTINUED ON PAGE 901

screening 35 dyes for color changes upon addition to cocaine-aptamer mixtures, they selected a cyanine compound to prepare their aptamer-dye sensor. When cocaine was added, it displaced the dye, causing a decrease in absorption at 760 nm. The micromolar affinity of the aptamer may prove sufficient for a handheld detection device in the cocaine supply interdiction effort. — JFU

J. Am. Chem. Soc., 10.1021/ja0259483 (2002).

MOLECULAR NEUROSCIENCE

Promoting Diversity

One of the most remarkable features of the mammalian nervous system is the enormous diversity (in electrophysiology, connectivity, and morphology) of neurons. The molecular codes that impart this diversity and the mechanisms by which it is generated are questions of intense interest.

Among the proteins thought to contribute to neuronal diversity are the protocadherins (Pcdh's), a family of cell surface molecules encoded by three clusters of genes, organized (much like immunoglobulin genes) into a "variable" region (which may contain 14 or more variable exons) and a "constant" region (which can have three constant exons). *Pcdh* transcripts containing combinations of variable and constant exons are expressed throughout the nervous system. Tasic *et al.* and Wang *et al.* show that each *Pcdh* variable exon is preceded by a distinct promoter and that the choice of promoter during transcription determines which variable exon is included in the pre-messenger RNA. The variable exon is then joined to a constant exon by *cis* splicing. In principle, if each neuron expressed several different isoforms of Pcdh, this two-step mechanism could generate millions of Pcdh-based neuronal subtypes. — PAK

Mol. Cell **10**, 21 (2002); *Genes Dev.* **16**, 1890 (2002).

PLANT SCIENCE

Interference in Plants

The discovery of more than 150 micro RNAs (miRNAs) in animals suggests that these small ~22-nucleotide RNAs are involved in a wide range of gene regulatory processes, a speculation supported by their diverse developmental and tissue-specific expression profiles. The well-characterized animal miRNAs *lin4* and *let7* are known to down-regulate the translation of their target messenger RNAs by binding to imperfectly matched binding sites.

Two groups, Llave *et al.* and Reinhart *et al.*, report that miRNAs are present in *Arabidopsis*. Llave *et al.* identify 125 small RNAs, mostly from intergenic regions as expected but also from predicted coding regions and transposons. Reinhart *et al.* find 16 miRNAs similar to those characterized in animals. Intriguingly, both groups identify one miRNA that has a perfect antisense match to the coding region of a transcription factor, rather than the imperfect match seen in *lin4* and *let7*. This is reminiscent of the perfect match between small interfering RNAs (siRNAs) and their targets in RNA interference (RNAi), where the target is cleaved and destroyed, suggesting that this plant miRNA may function as an siRNA. — GR

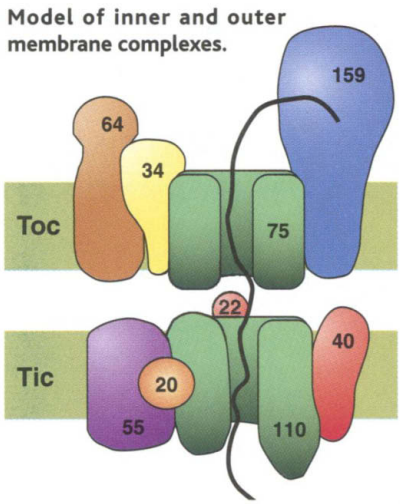
Plant Cell **14**, 1 (2002); *Genes Dev.* **16**, 1616 (2002).

BIOCHEMISTRY

Tic Toc

Chloroplasts (and mitochondria) are intracellular organelles defined by an inner and an outer membrane. Many of their constituent proteins are synthesized in the cytosol and thus need to traverse one or both membranes to reach their destinations. In an improved in vitro system, Hinnah *et al.* have measured the electrophysiological properties of Toc75, which forms the core of the peptide-translocating channel across the outer chloroplast membrane. Analysis of the currents as a function of voltage, ionic composition, and transit peptide sequence leads them to describe the channel as a constricted central region 1.4 nm in diameter, with a vestibule that is almost twice as wide. After crossing the outer membrane, imported proteins encounter the Tic complex; Heins *et al.* provide electrophysiological data indicating that Tic110 is the main component of this translocating channel, with a central filter of 1.5 nm. — GJC

Biophys. J. **83**, 899 (2002); *EMBO J.* **21**, 2616 (2002).



CREDITS: SOURCE: HEINS *ET AL.*, *EMBO J.* 21, 2616 (2002); ILLUSTRATION: DEBRA J. MORGENEGG/*SCIENCE*