

## Understanding Others' Intentions

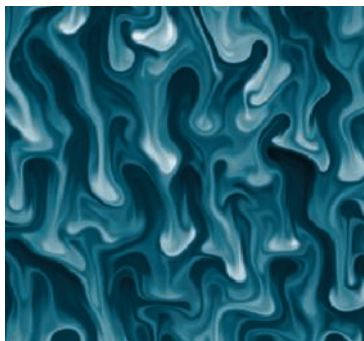
When we act, we intend to reach a goal. Conversely, when we observe someone else act, we can often infer their intentions. **Fogassi et al.** (p. 662; see the Perspective by **Nakahara and Miyashita**) found that in the inferior parietal lobule of an individual about to begin an action, the goal of their action (e.g., grasping for food versus grasping a branch) is reflected in the discharge of the neurons coding the first element of the sequence leading to the goal. In addition, many parietal neurons that code for an action like grasping also discharge while watching someone else grasping (parietal mirror neurons). The majority of these neurons respond differentially when the same observed motor act is performed with a different goal. Thus, these mirror neurons, besides describing the observed motor activity, also predict the intention behind the action.

## Nudging Optical Beams

Most optical switching takes place with mirrors or electro-optic devices. Some applications, however, might be better served with all-optical technology, where light in one beam controls another. **Dawes et al.** (p. 672) report the use of rubidium vapor as an optical switching medium. Strong laser beams interacting in the vapor create multiple exit beams, and these beams can be rotated by applying a much weaker control beam.

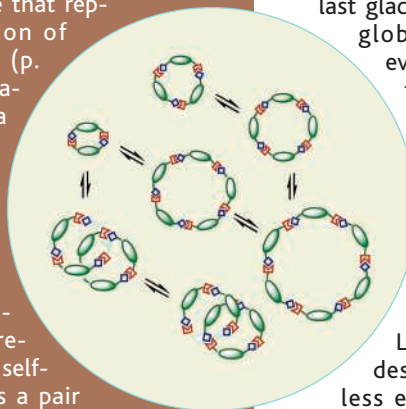
## A Salty Tropical Mix

Diapycnal mixing, which occurs between adjacent layers that stratified because of density differences, can control the distribution of heat, carbon dioxide content, and numerous other properties of the ocean. Double-diffusion, such as by the formation of salt fingers, is a mechanism by which this type of mixing can be enhanced, but which is unquantified over most of the ocean. **Schmitt et al.** (p. 685; see the Perspective by **Merryfield**) present results from a large-scale ocean tracer experiment that covered 1.3 million square kilometers of the tropical Atlantic Ocean.



## Linked Rings from a Library

Combinatorial chemical synthesis can rapidly generate many different compounds, but they often share an underlying structure that represents a fairly small region of chemical space. **Lam et al.** (p. 667) used a dynamic combinatorial approach to discover a surprisingly elaborate structure for binding the acetylcholine neurotransmitter. The authors added synthetic dipeptides to an acetylcholine solution under conditions allowing reversible coupling. At equilibrium, the predominant structure that had self-assembled as a receptor was a pair of linked 42-membered rings, each a trimer of the dipeptide building blocks. This catenane molecule was isolated in 65% yield and showed a 100-nanomolar affinity for the neurotransmitter.



## Climate Clues from Glaciers

Direct instrumental records have shown that average surface temperatures have risen significantly across the globe during the past two centuries. Glaciers have responded to this warming, mostly by retreating, and changes in the extents of glaciers typically have been understood and modeled as a function of the temperature of the overlying atmosphere. **Oerlemans** (p. 675, published online 3 March 2005) has reversed this order. By analyzing a large set of data on glacier length fluctuations dating back to the mid-17th century, he has reconstructed an independent record of temperature variability and found that global warming began earlier (in the middle of the 19th century) than in other temperature reconstructions. Was the last glacial maximum (LGM) a globally synchronous event, or did it ripple in time across the world in a more complex way? **Smith et al.** (p. 678) present a suite of cosmogenic  $^{10}\text{Be}$  ages from moraines in Peru and Bolivia which show that the local LGM in the tropical Andes occurred earlier and less extensive than previously believed. Glaciers reached their terminal position about 34,000 years before present, long before the date of 21,000 years before present often assigned to the LGM, and terminated at positions much higher up-valley than did larger previous glaciers. Their findings imply that the decrease in tropical temperatures there was only half that of most other estimates of 6° to 7°C.

## A Fly's Response to Climate Change

Clinal variations are in genetic polymorphisms that occur across an organism's geographical range as allele frequencies change with climate gradients. A classic example is the cline in the alcohol dehydrogenase (*Adh*) gene of the fly *Drosophila melanogaster* from north to south on the east coast of Australia. **Umina et al.** (p. 691) characterized this cline in a large number of populations ranging from the wet tropics to cool temperate regions along the entire coast. An abrupt shift was observed in the elevation of the *Adh*<sup>S</sup> allele during the past 20 years, when marked change occurred in several climatic variables along the cline. The drier and warmer climate of recent years is likely to account for the change in the cline, emphasizing how the genetic composition of populations could change in response to climate even in widespread species that are adapted to a range of climatic conditions.

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## Societal Pressures and Primate Health

Primate populations, including humans, are organized in various ways, but usually include dominance hierarchies. **Sapolsky** (p. 648) reviews how, depending on the specific features of each society, it may be the lower ranking or the higher ranking members of the society that experience greater stress. This dominance-related stress produces physiological changes that ultimately are detrimental to the individual's health. The principles that emerge from studies on nonhuman primates about dominance effects on health may also apply to humans.

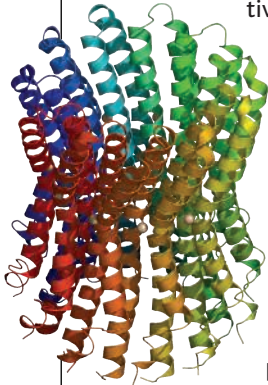
## Designer Surface Plasmons

Conducting metal films usually are not expected to support surface plasmon modes, which are localized excitations of electrons coupled with electromagnetic radiation. However, recent theoretical work has predicted that these bound electromagnetic states could be induced on conducting surfaces by perforating them with holes. Working in the microwave regime, **Hibbins et al.** (p. 670) verify that surface plasmon-like modes can indeed be induced by controlling the geometry of the metallic sample. The ability to tune or design these surface modes may have consequences for applications involving the propagation of surface plasmons.

## Going Through the Ring

The ion-transporting adenosine triphosphates (ATPases) of the F-type (e.g., mitochondrial proton ATPase) and of the V-type (e.g., vacuolar proton ATPases) have roughly similar overall structures, with a threefold symmetric ATPase  $F_1$  (or  $V_1$ ) portion and an integral membrane ring ( $F_0$  or  $V_0$ ) of anywhere from 10 to 14 identical subunits. Some of these enzymes transport  $Na^+$  instead of protons (see the Perspective by **Junge and Nelson**).

**Murata et al.** (p. 654, published online 31 March 2005; see the cover) present a high-resolution structure of the 10-subunit ring of a  $Na^+$ -transporting V-type ATPase. Each subunit contributes four transmembrane helices to a ring of about 83 angstroms in diameter, and the  $Na^+$  binding site is exposed on the outer surface of the ring, about midway into the membrane bilayer. **Meier et al.** (p. 659) present a high-resolution structure of the 11-subunit ring of a  $Na^+$ -transporting F-type ATPase, in which each subunit contributes only two transmembrane helices to a smaller ring of about 50 angstroms in diameter. Both structures are consistent with a model in which ATP-driven rotation of the ring causes a bound  $Na^+$  to be ejected to the outside, which is then followed by refilling of the transport site by a  $Na^+$  from the inside.



## Team-Building Exercise

What are the factors required to build a successful creative team? **Guimerà et al.** (p. 697; see the Perspective by **Barabási**) used network analyses to model such factors and found a clear relation between team diversity, collaboration network structure, and team performance. Within a scientific discipline, greater journal impact factor correlates strongly with larger teams, a lower tendency to "over-repeat" collaborations, and significant presence of both experienced researchers and newcomers. Similar properties appear to have contributed during the last century to define the most successful team composition for Broadway musical productions.

## Genetically Modified Rice in the Field

China has developed rice strains that are genetically modified to be intrinsically resistant to pests, and **Huang et al.** (p. 688) describe preliminary field trials carried out in 2002 and 2003 with these strains. For plots planted with pest-resistant genetically modified rice strains, the farmers could reduce their use of pesticides by as much as 80%. At the same time, yields increased, and the health of the farmers improved significantly with reduced occupational exposure to pesticides.

CREDIT: MEIER ET AL.

advances in:

# Proteomics

Analysis and Automation

Proteomics involves an increasing range of technologies, complemented by sophisticated software tools, by PRIDE ANTHER AND GARY HICKLER

Proteins perform many of the functions that determine how a cell responds to its environment. They can be identified as biomarkers. They can regulate the structure and function of cells. They can be used as reagents. But rapid progress has been made in understanding the structure and function of these molecules. In a cell, a protein is a complex of amino acids, each with a specific function. They are linked together by peptide bonds, and their structure is determined by the sequence of amino acids. Proteomics is the study of the structure and function of these molecules. It involves the identification, quantification, and characterization of proteins. This is a complex task, and it requires a range of technologies, including mass spectrometry, chromatography, and bioinformatics. Proteomics is a rapidly growing field, and it is expected to continue to grow in the future.

Quantitative Proteomics  
In recent years, instead, proteomics has made the transition from qualitative to quantitative. Quantitative proteomics is the study of the abundance of proteins in a sample. It is a more challenging task, but it is also more informative. Quantitative proteomics can be used to study the changes in protein abundance in response to a stimulus. It can be used to study the changes in protein abundance in response to a disease. Quantitative proteomics is a rapidly growing field, and it is expected to continue to grow in the future.

Mass Spectrometry  
Mass spectrometry is a technique for measuring the mass-to-charge ratio of ions. It is a powerful tool for identifying and quantifying proteins. Mass spectrometry can be used to study the changes in protein abundance in response to a stimulus. It can be used to study the changes in protein abundance in response to a disease. Mass spectrometry is a rapidly growing field, and it is expected to continue to grow in the future.

Chromatography  
Chromatography is a technique for separating a mixture of components. It is a powerful tool for identifying and quantifying proteins. Chromatography can be used to study the changes in protein abundance in response to a stimulus. It can be used to study the changes in protein abundance in response to a disease. Chromatography is a rapidly growing field, and it is expected to continue to grow in the future.

Bioinformatics  
Bioinformatics is the application of computational techniques to biological data. It is a rapidly growing field, and it is expected to continue to grow in the future. Bioinformatics can be used to analyze large amounts of data, and it can be used to identify patterns in the data. Bioinformatics is a powerful tool for understanding the structure and function of proteins.

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## Proteomics

Analysis and Automation

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