EDITORS' CHOICE

edited by Gilbert Chin

CHEMISTRY

Molecules on the Move

In a dynamic combinatorial library, molecules are formed by the assembly of building blocks through reversible reactions, such as the formation of hydrogen bonds. The library members interconvert repeatedly; in the presence of a target, the concentration of those molecules that bind strongly to the target of interest may be amplified. Various noncovalent and covalent dynamic combinatorial libraries have been investigated, but strong template-induced amplifications have been difficult to achieve.

Cousins *et al.* now report the molecular amplification of a macrocycle in a dynamic library of pseudopeptides in the presence of specific templates. The amplified molecule can be identified and isolated. Extension of this approach to more diverse dynamic libraries may lead to the identification of synthetic receptors for biological targets. — JU

Angew. Chem. Int. Ed. **40**, 423 (2001).

PHYSICS

Atoms on the Move

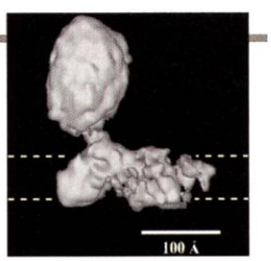
Cold neutral atoms can be moved along defined paths by means of confining potentials (created by current flowing through suitably patterned conductors) in conjunction with a magnetic field. The positional and dynamical control over such composite quantum systems should have utility in high-resolution atom-interferometry or, perhaps, in future quantum computer architectures. However, fine control of both parameters has been elusive.

Hänsel *et al.* have designed a modification that provides the ability to transport atoms to precisely controlled positions above a surface. The confining path formed by the single wire and magnetic field is divided up into a series of potential wells, set up by a periodic pattern of conducting wires running parallel to the central wire. Application of a modulated current to these additional wires resulted in the conveyer belt–like motion of a cloud of ~10^6 trapped cold atoms with average velocity of 5.3 millimeters per second. — ISO

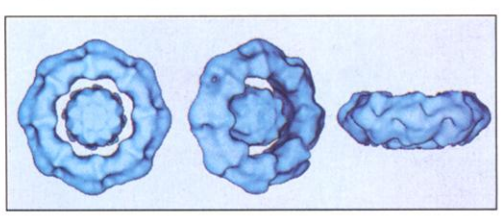
Phys. Rev. Lett. **86**, 608 (2001).

MOLECULAR BIOLOGY

Focusing on Systems



Although much of modern molecular biology has been conducted in the spirit of reductionism—separating, identifying, and analyzing the component parts of cells and macromolecules—the new millennium has intensified a recent thrust toward integrative investigation. How do genes and gene products interact to subserve essential life functions, and how do macromolecules assemble into stable or cyclical conglomerates, such as the major synthetic factories for DNA (replisome), RNA (transcription complex), and protein (ribosome)?



Mitochondrial complex I at 17-angstrom resolution(top) and the yeast nuclear pore complex.

SOURCE: NOGALES AND GRIGORIEFF, *J. CELL BIOL.* **152**, F1 (2001).

Nogales and Grigorieff review electron microscopic studies of a variety of cellular machines. In some cases, we can now see the outlines of amazingly irregular or beautifully symmetric molecular assemblages, and in other cases, it is now feasible to begin constructing frame by frame a filmstrip of how these machines operate.—GJC

J. Cell Biol. **152**, F1 (2001).

BIOMEDICINE

Pièce de Résistance?

Type II diabetes is characterized by resistance to insulin, a hormone that stimulates glucose uptake into muscle and fat. About 80% of humans with type II diabetes are obese, but the link between the two conditions has been unclear.

An important clue comes from work by Steppan *et al.*, who have identified a new protein secreted by adipocytes (fat cells) that antagonizes insulin action. This protein, called resistin, is present at elevated levels in the blood of obese mice and is down-regulated by fasting and by certain anti-diabetic drugs. Blocking resistin activity with antibodies stimulated glucose uptake by cultured adipocytes, and lowered blood glucose levels and improved insulin sensitivity in obese mice. Thus, resistin may prove to be a valuable target for the development of new anti-diabetic therapies. Interestingly, the same research group found other tissue-specific secreted proteins with sequence resemblance to resistin (called RELMs, for resistin-like molecules) in colon, white adipose tissue, and mammary tissue. Whether the functional characterization of these additional family members will match the excitement elicited by the resistin study remains to be seen. — PAK

Nature **409**, 307 (2001); *Proc. Natl. Acad. Sci. U.S.A.* **98**, 502 (2001).

GEOCHEMISTRY

Ancient Anoxic Soils

The rise of oxygen in Earth's early atmosphere was a critical event both for the evolution of life and for geologic and atmospheric processes, although whether this occurred early in Earth's history or about 2.2 billion years ago has been contentious. Much of the evidence for a late increase, corresponding to oxygen production from photosynthesis, has come from assessing the oxidation state of iron in ancient soils (for example, the presence of hematite). One problem is that it can be difficult to separate effects of early atmospheric-dependent weathering from those of later metamorphism in these old rocks.

Murakami *et al.* identified rhabdophane, a mineral that readily forms from apatite early in weathering, in a soil horizon that formed about 2.5 billion years ago on an exposed granite. This mineral contains the rare-earth element cerium in abundance and in a relatively reduced state, consistent with a late rise of atmospheric oxygen. — BH

Earth Planet. Sci. Lett. **184**, 523 (2001).

MICROBIOLOGY

Virulence Loci on the Move

It is increasingly apparent that strains of the bacterial pathogen *Salmonella* produce a variety of symptoms and achieve a broad host range by virtue of the viruses (temperate bacteriophages) they harbor. For example, *Gifsy*-1 has

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the greater virulence potential in mice and contains a gene, *sodCII*, that protects *Salmonella* from the oxidative burst of macrophages. If this gene is experimentally ablated from the phage, the bacteria fall victim to the mammalian host defense.

Having already identified two lambdoid culprits, Figueroa-Bossi *et al.* now implicate three more phages that possess other genes associated with virulence in *Salmonella*; some are substrates for the type III 'pathogenicity island' system possessed by many gut pathogens, which are used to inject virulence factors into host cells and which themselves seem to be remnants of mobile elements. The evidence suggests that phage play a vital role in the evolution of pathogenicity in *Salmonella*. But this is not all—different phages seem to be capable of recombining within their bacterial hosts to swap virulence genes. Especially interesting is how well the phage-encoded virulence loci are integrated with the bacterial regulatory network for virulence determinants. And there is more: the phage-associated virulence loci are clustered downstream from putative distal tail fiber genes, which bear host-specific ligands and thus specify host range. Hence, virulence attributes potentially can be shuffled with host specificity determinants, resulting in the endless variety of *Salmonella* serovars and symptoms seen clinically. — CA

Mol. Microbiol. **39**, 260 (2001).

ECOLOGY/EVOLUTION

Kangaroo Societies

The size of a female mammal's home range tends to correlate quite closely with body size: not surprisingly, larger animals need more space to forage. Macropod marsupials (kangaroos and wallabies), however, show a more complex pattern. Fisher and Owens assemble data on nearly 30 species of Australian macropod and find that female home range size correlates strongly with climatic parameters. In high-rainfall habitats, female range size is much smaller than in arid habitats. Male range size in macropods, on the other hand, is similar across habitats. In wetter habitats, males compete by searching more widely for females; in drier habitats, they compete by fighting, and also are much bigger than females. Hence, climate may have played an important role in determining the evolution of social organization, sexual dimorphism, and mating systems in these animals. — AMS

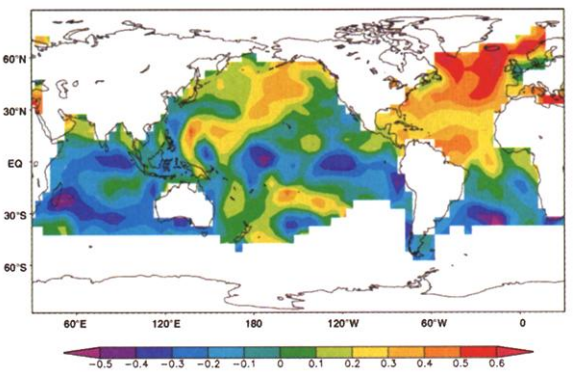
J. Animal Ecol. **69**, 1083 (2000).

CLIMATOLOGY

Influenced Over Decades

Sea surface temperatures (SSTs) in both the North Atlantic and the tropical Pacific exhibit significant multidecadal variability. It commonly has been assumed that variations in the two basins are independent of each other. Latif now suggests otherwise.

By analyzing and comparing time series of equatorial Pacific SST anomalies and the North Atlantic Oscillation (NAO) index, he shows that periods of unusually high Pacific SSTs are followed by development of an Atlantic-basin SST dipole after a lag of about 30 years. These changes, he believes, are linked by an "atmospheric bridge" that transfers less fresh water from the Pacific to the Atlantic when Pacific SSTs are higher. A lower fresh water flux perturbs Atlantic sea surface salinities, which in turn modifies the thermohaline circulation and thereby affects SSTs. Using an atmospheric general circulation model, Latif shows that such a mechanism can hindcast the fresh water fluxes that accompany Pacific SST changes and the NAO in a manner consistent with other models and observational evidence. Finally, he speculates that North Atlantic thermohaline circulation will strengthen during the coming decades in response to the recent rapid increase in tropical Pacific SSTs, thereby weakening the NAO and influencing the climates of North America and Europe. — HJS



The correlation of North Atlantic sea surface temperature anomalies (red) with those of the eastern tropical Pacific 30 years earlier (dark blue at 120°W).

Geophys. Res. Lett. **28**, 539 (2001).

CREDITS: LATIF, *GEOPHYS. RES. LETT.* **28**, 539 (2001).