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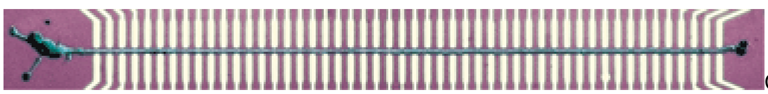
Nanowire arrays meet neurons

Arrays of nanometer-scale devices have been integrated with individual axons and dendrites of mammalian neurons and used to measure and control neuronal activity (*Science* **2006,** *313*, 1100). Using fabrication methods they developed previously, Harvard University chemists Fernando Patolsky, Brian P. Timko, Charles M. Lieber, and coworkers constructed arrays of silicon nanowire fielc effect transistors and interfaced the devices with axons (shown) and dendrites of cultured rat neurons. Featuring active junction areas of just 0.01 μm^2, these artificial synapses were used to detect, stimulate, and inhibit electrophysiological signals that propagate along axons and dendrites, carrying information in the brain. The team notes that the study may lead to new methods for investigating synaptic processing in neural networks with spatial and temporal resolution unmatched by other techniques. In addition, the work cou be used to develop real-time cellular assays for drug discovery.


Courtesy of Charles Lieber

Single mutation transforms enzyme's function

By making a single amino acid change in an enzyme, researchers have completely changed the class of reaction catalyzed by that enzyme. Guided by the predicted mechanism of action of arylmalonate decarboxylase, Hiromichi Ohta and coworkers at Keio University, Yokohama, Japan, find that mutation of one residue in the enzyme converts its catalytic activity from enantioselective decarboxylation of α-aryl-α-methylmalonates to racemization of α-arylpropionates (*Chem. Commun.* **2006,** 3600). This is not the first time an enzyme's activity has been modified by a single amino acid change. But Per Berglund of Sweden's Royal Institute of Technology, in Stockholm, who carried out one of the earlier efforts, says the Japanese study "is still an extremely nice example of creating a new activity in an enzyme by carefully studying the reaction mechanism." He notes that such changes usually involve reinforcing an enzyme's existing side reaction, while this study shows that the capability for the new reaction does not have to be present at all in the parent enzyme.

A twist on single-molecule conductors

The more an aromatic molecule twists, the less electrical current it can conduct. That's the conclusion of a Columbia University team that has made the first reliable measurements of how the conductance of a single molecule held between two gold electrodes is affected by the molecule's conformation (*Nature* **2006,** *442*, 904). Scientists knew that the current passing through such a "single-molecule junction" depends on the molecule's conformation. But these measurements-typically made with thiols or isonitriles-tended t be so variable that there was no way to rigorously test and compare the behavior of different kinds of single-molecule junctions. To make their measurements more reproducible, Latha Venkataraman and her Columbia coworkers studied seven biphenyl diamines thа were attached to each electrode via an amine group. The calculated twist angle (q) between the two phenyl rings ranged from 0^{o} to 88^{o}, depending on the molecule's substituents. As the twist angle increased, the degree of π-conjugation decreased, resulting in lowe conductance through the molecule. A plot of the data shows that the molecular conductance is related to cos^{2}q, which is what theory predicts.

Waterproof filter paper