their logic gates when current leaks out. However, quantum manipulations of atoms and small molecules offer a way around these limits.

Kenji Ohmori at the Institute for Molecular Science in Okazaki, Japan, and his colleagues describe a new logic component that could be used in quantum-information science. It is an ultra-fast Fourier transform, a standard mathematical tool used in electronic signal processing to convert signals from one function to another.

The team excited an iodine molecule such that its quantum vibrations executed Fourier transforms in just 145 femtoseconds — several orders of magnitude faster than is possible in today's computer chips. The technique shows another way in which a quantum computer could, in theory, be both faster and more accurate than a classical computer. **E.H.**

NEURODEVELOPMENT

Small brain roots

Neuron **66,** 386–402 (2010)

Babies with a genetic disorder called primary autosomal-recessive microcephaly are born with unusually small brains. Five genes have been implicated, and it is thought that a defect in the pool of neural progenitor cells — the precursors of more specialized brain cells — is to blame.

Li-Huei Tsai at the Massachusetts Institute of Technology in Cambridge and her group showed how a protein encoded by one of these genes, *Cdk5rap2*, is linked to the defect by knocking it down in the neocortex of mouse embryos. This caused the progenitor-cell pool to shrink because more cells developed prematurely into neurons instead of replenishing the progenitor supply.

The team also found that, to do its job, Cdk5rap2 interacts with another protein, pericentrin. Malfunctioning pericentrin is associated with another disorder involving abnormal brain size. **C.L.**

POPULATION GENETICS

Nautical niches

Mol. Ecol. doi:10.1111/j.1365-294X.2010.04647.x (2010)

Mobile marine animals such as dolphins seem unlikely to form subpopulations, as there are no obvious physical barriers between them. Nevertheless, cetaceans do congregate in different parts of the ocean, creating distinct genetic groups.

To find out how environmental factors influence this segregation, Martin Mendez of Columbia University in New York and his co-workers carried out a genetic analysis of the franciscana dolphin (*Pontoporia blainvillei*), which lives in the western South Atlantic. They studied tissue samples from 275 individuals from six points along the Argentinian coast, and examined ten years of environmental data on these dolphins' ocean haunts gathered by remote sensing.

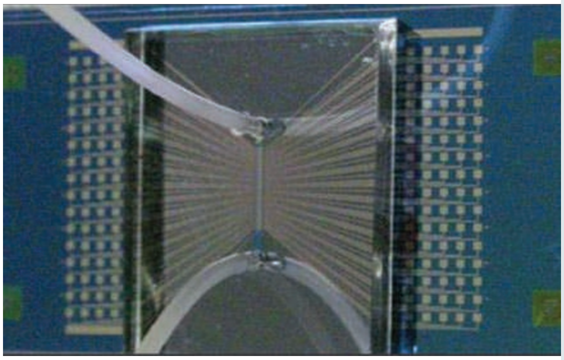
The team found that differences in nuclear DNA structure between subpopulations correlated more strongly with differences in local environmental conditions — such as chlorophyll levels and turbidity — than with geographical distance. **E.M.**

NANOELECTRONICS

Protein transistor

Nano. Lett. doi:10.1021/nl100499x (2010)

A carbon nanotube transistor can be controlled by a protein complex that is powered by the cellular energy source ATP.



AM. CHEM. SOC.

The device (pictured), developed by Aleksandr Noy at the University of California, Merced, and his colleagues, uses a carbon nanotube to bridge two metal electrodes. The nanotube is coated by a lipid bilayer. Embedded in that layer is the ATP-powered pump, which is widespread in cells and mediates the exchange of sodium and potassium ions across membranes. The central part of the carbon nanotube is exposed to an ATP solution.

When the device is switched on, the pump pushes ions across the lipid membrane, changing the conductance of the carbon nanotube and boosting the transistor's current output by up to 40%. Applications could include biological nanoelectronic devices. **K.S.**

Correction

The Research Highlight 'Rat sequencing redux' (*Nature* **465,** 12–13; 2010) incorrectly stated that genome-sequence diversity between the spontaneously hypertensive rat and the reference brown Norway rat is less than that for currently sequenced mouse strains. In fact, the rat sequence diversity is about twice as high.

JOURNAL CLUB

Aaron Clauset
Santa Fe Institute, New Mexico

A theoretician ponders what physics has to offer ecology.

Many species are concentrated in biodiversity hot spots such as tropical rainforests and coral reefs. But our estimates of how many species these and other ecosystems contain are very rough. Conservation efforts and ecological theories would be better served by a more accurate picture.

Our best guesses come from empirical species–area relationships, which count the number of species observed as a function of geographical area. These relationships show sharp increases at local and continental scales, but slow growth at intermediate scales. Despite decades of study, ecologists have no clear explanation of this pattern's origins or what causes deviations from it.

James O'Dwyer and Jessica Green at the University of Oregon in Eugene recently developed a spatially explicit stochastic model of species birth, death and dispersal that can be solved mathematically using techniques from quantum field theory (J. P. O'Dwyer and J. L. Green *Ecol. Lett.* **13,** 87–95; 2010). Amazingly, the model predicts a species–area relationship that agrees with decades of empirical data, without including ecologically important factors such as body size, predation, habitat or climate.

The work both solves a long-standing mystery and exemplifies a good null model. Because the model includes only neutral mechanisms (birth, death and dispersal), deviations can be interpreted as evidence of non-neutral, ecologically significant processes. It also shows the value of shifting the focus from small-scale, context-dependent processes to large-scale neutral dynamics, a perspective more common in physics than biology.

The model and its shift in perspective could shed light on the immense, important and increasingly studied world of microbial ecologies, which is even more mysterious than those of rainforests and coral reefs.

Discuss this paper at **go.nature.com/kYJPDd**