many possible routes to quantum computing have been suggested, but the most promising are solid-state implementations — most famously, nuclear spins of phosphorus atoms in a silicon matrix[10] — because they can be scaled up to generate the massive parallelism required for useful computation.

The counter-intuitive rules of quantum mechanics imply that, unlike classical computers, quantum computers should perform best with a slow clock speed[11] (in other words, the devices within them should switch slowly). This necessarily suggests that rapid decoherence of the quantum states encoding information is unacceptable. Entanglement between two solid-state quantum bits, or qubits, was reported for the first time at this conference — albeit with a rather rapid decoherence time of 300 picoseconds (J. S. Tsai, NEC). The qubits used were based on low-temperature superconducting tunnel junctions. Perhaps this breakthrough indicates where the future of quantum computing actually lies.

Another departure from conventional computing philosophy would be to work with light rather than electrons. Whereas the periodicity of the structure of crystalline materials is comparable to the wavelength of mobile electrons, advanced materials techniques enable periodic structures to be produced in which the repeating unit matches the wavelength of light — these are photonic band-gap materials. Complex structures formed with these advanced techniques (for example, ref. 12) could be used to manipulate light and form computer logic gates. Indeed, computer simulations suggest that light can bend around cleverly constructed corners with no discernible energy loss (S. John, Univ. Toronto).

The conference was also presented with some aspects of nanotechnology that could have an indirect impact on tomorrow's computers. For example, the issue of heat dissipation mentioned earlier could be locally monitored using a 75-nm-diameter carbon nanotube containing the liquid-metal gallium, which would act like a

proof-of-principle display unit

[14].

So where will it all end? The graphics of S. John were reminiscent of the best that Hollywood can achieve, and the many talks relating to biology could at times make this physicist feel that he had come to the wrong conference. The nanoscale therefore seems to be the length scale at which science has become truly interdisciplinary. The question is, will it reconcile science fact with science fiction? ■

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[1], Enquist and colleagues describe tight scaling relationships between species richness and diversity among the higher taxa (genera or families), in both living and fossil plant communities. These patterns should eventually help in understanding how species diversity is controlled and how total biomass is partitioned among coexisting species.

Enquist *et al.*[1] used allometric scaling equations that have traditionally been applied to problems of body size and relative growth. In mammals, for example, a power function[2] describes the relationship between brain size (x) and body size (y):

$$\text{Brain size} \propto \text{constant} \times (\text{body size})^{z}.$$

The exponent z is the scaling coefficient, and describes whether y is increasing faster ($z > 1$) or more slowly ($z < 1$) than x. On a log–log scale, these relationships plot as would be expected by chance, a pattern first noted in the 1940s by the statistical ecologist