PHYSICS UPDATE

A SILICON DEVICE FOR TRIGGERING A NERVE CELL has been constructed, opening up the possibility for two-way, nontoxic communication between computer chips and nerve cells. Previous artificial neuron junctions were metallic and generated ordinary electric currents. Such junctions have corrosion-prone electrodes, and their currents create electrochemical by-products and heat that can damage the nerve cells and themselves. The silicon device, constructed by Peter Fromherz and Alfred Stett at the Max Planck Institute for Biochemistry in Germany, contains a "stimulation spot" that triggers neural activity simply through the rearrangement of electric charge, as in a capacitor. Insulated by silicon oxide, the stimulation spot has a size (between 20 and 50 microns) matched to that of the leech nerve cell connected to it. A voltage pulse applied to a blocked p–n junction beneath the spot rearranges electric charge on the silicon oxide film and therefore on the insulating membrane of the nerve cell. Above a certain threshold of built-up positive charge, the nerve cell fires; nearby neurons are unaffected. The device complements Fromherz's "neuron transistor," which receives ionic signals from nerve cells and transcribes them into electronic signals in silicon. "These two devices join the two worlds of information processing, the silicon world of the computer and the water world of the brain," says Fromherz. Adapting this device for biomedical applications such as computer-controlled artificial limbs is not yet envisioned. Researchers first need to build and understand devices that interact with neurons embedded in tissue and that can handle the interference of non-neuronal cells in the body. (P. Fromherz, A. Stett, *Phys. Rev. Lett.* **75**, 1670, 1995.) —BPS

LOOKING FOR A DIAMOND for that special someone? The transition zone between Earth's upper and lower mantle might be a good place to search, according to high-pressure experiments on a mantle-like melt conducted by Akio Suzuki, Eiji Ohtani and Takumi Kato of Tohoku University, in Sendai, Japan. In the experiments a diamond (placed in the sample as a density indicator) began to float in the melt at pressures between 16.3 and 20.5 gigapascals, the exact pressure depending on the temperature and composition of the melt. If Suzuki, Ohtani and Kato are correct, diamond has been accumulating between 500 and 600 km below Earth's surface throughout the planet's 4.5 billion-year history, making the transition zone a vast reservoir of diamond. Although the results of the Japanese team have not prompted a diamond rush to the transition zone, they do give a probable density range for material there (3560–3590 kilograms per cubic meter). This density is significant because it determines the buoyancy of olivine and other minerals descending in subducted slabs from Earth's lithosphere. (Suzuki *et al.*, *Science* **269**, 216, 1995.) —RL

EVIDENCE FOR DETERMINISM FOUND IN A MAJOR CLASS OF HEART ATTACKS. Untreated, ventricular fibrillation is always fatal within minutes. Whereas most previous research assumed VF to be a random process, an interdisciplinary team of researchers in Canada and the US has found evidence of subtle patterns in the electric currents associated with VF and in the intervals between those currents. Analyzing VF episodes in dogs, the team developed and applied statistical tests to demonstrate that the complex electrical activity of a fibrillating heart appears to have nonrandom, deterministic characteristics. The finding, they admit, "has been controversial." Many seemingly random systems are now known to be deterministically chaotic. Such systems offer the possibility of "feedback control" (PHYSICS TODAY, May, page 34) to nudge them into a desired state. The researchers caution that "the practical implementation of such control is still highly speculative and will present significant challenges." (F. X. Witkowski *et al.*, *Phys. Rev. Lett.* **75**, 1230, 1995.) —BPS

GENERAL RELATIVITY HAS SURVIVED ANOTHER TEST. Einstein's theory predicts that the light from a distant star will be deflected in the gravitational field of a massive body. In the latest version of this test, astronomers from Harvard, MIT and the Haystack Observatory used antennas in Massachusetts and California to measure the deflection of radio waves coming from the quasar 3C279 within a few days of its being occulted by the Sun. The combination of using very long baseline interferometry (PHYSICS TODAY, April 1994, page 19) and observing at three widely spaced frequencies produced a very accurate measurement. The goal of the experiment was to estimate the relativistic parameter γ, which equals one for general relativity. The experimenters obtained a value of 0.9996 with an estimated standard error of 0.0017. According to Brian Corey and Irwin Shapiro, some previous VLBI determinations of γ have used larger data samples, but this latest result embodies the largest deflection signals; the observers were able to follow 3C279 closer to its disappearance behind the Sun than had any previous attempt. (D. E. Lebach *et al.*, *Phys. Rev. Lett.* **75**, 1439, 1995.) —PFS