graphite. Equilibrium between the hot electrons and the carbon atoms is again established in about 0.5 ps. The initial fluid density now equals the density of diamond rather than of graphite, and the internal pressures are very high — of the order of 100,000 atmospheres.

One of the interesting questions about fluid carbon is its electronic state: is it semiconducting like diamond, metallic like graphite (in the planes) or insulating? The reflectivity data, determined partly by the electron plasma and partly by bonding valence electrons, suggest the d.c. resistivity is 650 μohm cm, so that fluid carbon could be described as a poorly conducting metal.

The data do not permit a more detailed description of the phase's structure. It would be interesting to probe the phase by other techniques, for example by X-ray diffraction with sub-picosecond time resolution. The dielectric function indicates there is substantial valence bonding, so that perhaps the fluid phase contains molecular fragments such as C_2 or C_3, which X-rays could reveal.

It is instructive to compare the femtosecond experiments on carbon with those on other materials. These all exhibit a well defined fluence threshold, F_m, for melting, but there exists an interval, typically between F_m and $2F_m$, in which the liquid phase is stable and not susceptible to hydrodynamic expansion. For fluences larger than $2-5F_m$, these other materials get heated above their boiling point and their critical point on a timescale shorter than one picosecond. Only then do these materials undergo the expansion that is unavoidable in carbon. In the case of GaAs, whose crystal structure lacks a centre of symmetry, the abrupt disappearance of second-harmonic generation by the probe laser for pump fluences above a sharp threshold proves the sudden transition to a fluid phase before rarefaction or evaporation can take place. But with symmetric graphite or diamond, second-harmonic generation is not an appropriate probe. □

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MOLECULAR TRANSDUCTION

Do the ear's links link?

Jonathan Ashmore and Michael Evans

OF ALL families of ion channels, those activated by mechanical forces remain perhaps the most elusive. The difficulty has been that, unlike channels such as the sodium or acetylcholine receptor channels, there just are not very many of them about. More importantly, the molecular nature of the channel perturbation and its coupling to cell deformation may not be the same in all mechano-sensitive cells, a class which includes cells as varied as vascular endothelia, sensory receptors and oocytes. Writing in *Neuron*[1], Assad *et al.* provide further hints about how the conversion of mechanical into electrical energy occurs, at least for hair cells in the inner ear.

Hair cells are found in all peripheral structures used in hearing and balance. The cells get their name from the bundle of specialized, pivoting microvilli, termed stereocilia, projecting from their apical surface. As mechano-sensors the cells are extremely sensitive: nanometre deflections of the hair bundle are sufficient to produce a signal which is then relayed up to the central nervous system. But they are sensitive to deflection of the hair bundle in one direction only (towards the tallest stereocilium) and all explanations of mechano-electrical transduction must be able to take this into account.

Although most data are derived from lower-vertebrate hair cells, it is generally agreed that the mechano-electric conversion step is too fast to be explained by known enzyme or second-messenger systems. The best available electrophysiological data indicate that the transduction channels are located near the tips of the stereocilia[2], even though earlier work using calcium imaging and exploiting the permeability of the transduction channels to calcium had suggested that the channels were located much closer to the base of the bundle[3] (a result that now looks increasingly unlikely). Further, but circumstantial, evidence for a channel at the tip is the presence of a fine extracellular filament, possibly elastin, running between the top of each stereocilium and its taller neighbour[4]. These filaments have been termed 'tip links'.

A model for hair-cell transduction which combines these features is therefore a type of trapdoor-and-rope arrangement[5]. In this scheme, the tip link is connected to the channel so that bending the bundle tensions the link, opening the channel (see figure). This is a seductive hypothesis to explain transduction in all types of hair cell; it is consistent with some measurements of the forces required to move the bundle and explains why, because of the link orientation, the bundle has to be stimulated in one direction.

RÉSUMÉ

Pedigree whiskers

NOT so long ago, synthesizing diamonds was a tough task, requiring heat and high pressure. But in the mid-1980s it turned out that diamond will settle out of thermally decomposed hydrocarbon gas. To rub in the simplicity of it all, researchers then learned that welders unwittingly make diamond crystallites in the flames of their oxyacetylene torches. P. W. Morrison Jr, J. E. Cosgrove and P. R. Solomon now exploit this process to make synthetic-diamond filaments (*Appl. Phys. Lett.* **60**, 565–567; 1992). Guided by a microscope, Morrison and colleagues drew out of their torch flame tiny filaments up to 1 mm long by 0.25 mm across. In principle, the authors report, there is no limit to the length of the filaments, which could outclass normal carbon fibres. But the growth rate of under 200 $\mu m\ h^{-1}$ may discourage entrepreneurs.

Sociable beetles

BEETLES can now join the ants, termites and mammals (the African mole rat) on the list of taxa with eusocial members (D. S. Kent & J. A. Simpson *Naturwissenschaften* **79**, 86–87; 1992). The weevil *Austroplatypus incompertus* lives in galleries in the heartwood of *Eucalyptus* trees. Colonies are initiated by solitary fertilized females and, when mature, manifest the three phenomena which characterize eusociability: overlapping generations, cooperative brood care and division into reproductive and sterile (unfertilized) castes. Each colony contains one fertilized and five or so unfertilized adult females, the job of the second group being to deal with predators and to extend and maintain the galleries. Two related species of weevil live in the heartwood of other trees: one is not eusocial, but nothing is known about the social life of the other.

NMR PDQ

PROTEIN structure determination by NMR is no easy way to earn a living. But for the many who would be satisfied with less than a high-resolution crystal structure, D. S. Wishart *et al.* (*Biochemistry* **31**, 1647–1651; 1992) show how much can be achieved with remarkably little effort. They have devised a simple routine for assigning α-helical and β-structure to the sequence of any protein small enough to give a sharp proton NMR spectrum. Their method rests on the observation that the α-CH signal of each amino acid shifts upfield when it enters the α-helical state and downfield when it is in the β form. The α-CH shifts in the two-dimensional spectrum of the protein are then marked as +1, 0 or -1, and three or more successive resonances shifted in the same direction denote a segment of the ordered structure. All the indications are that the method is foolproof; Wishart *et al.* aim next to add criteria for turns.