Journal cost survey sparks row

A recent issue (May 14, 1990) of *The Scientist*, published by the Institute for Scientific Information, Philadelphia, reports that a temporary court injunction has been obtained by Gordon and Breach Science Publishers against the distribution in Germany of the November 1989 issue of the *Notices of the American Mathematical Society*. It is argued by Gordon and Breach that this issue carries an article that is prejudicial to their journals. The matter under dispute is the following.

Henry Barschall, a retired professor of physics in Wisconsin, USA, published in *Physics Today* (July 1988) an article based on a survey that analysed the subscription rates of physics journals published by various organizations. This analysis showed that the subscription rates of several journals published by Gordon and Breach were higher than those of journals published by others. Another survey published by the American Mathematical Society in November 1989 arrived at a similar conclusion.

Gordon and Breach, questioning the methodology adopted in the survey, sued the publishers of *Physics Today* (the American Institute of Physics), the American Physical Society and Barschall for publishing such comparative subscription surveys in the courts of France, Switzerland and West Germany, where the cases are still pending. It also sued the American Mathematical Society for the same reasons. As a consequence of this, the injunction has been given, withholding the distribution in West Germany of the November 1989 issue of *Notices*.

In the context of steep increase in journal prices and several budgetary constraints faced by libraries all over the world, surveys of this type, though not totally definitive, will certainly help libraries review their journal subscription lists. However, the methodology of the survey is a matter of opinion.

The controversy has evoked considerable interest among librarians, publishers, scientists and those who study such issues.

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Fuzzy features promise to clear up quasicrystal structure

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It is more than five years since the icosahedral phase was reported in rapidly solidified Al–Mn alloys by Shechtman *et al.*[1] This phase exhibits five-fold symmetry corresponding to the icosahedral point group in reciprocal space. In the diffraction patterns, unlike those of simple crystalline phases, the spots are not arranged periodically; however, the spots are reasonably sharp and their positions are related to one another by powers of τ ($=(\sqrt{5}+1)/2$, the golden mean[2]). How can the diffraction patterns be explained? There are three main classes of models that have been proposed to understand such fascinating diffraction features. These are (i) crystalline models[3,4], (ii) icosahedral-glass models[5], and (iii) quasicrystalline models[6]. All these models can explain the diffraction symmetry of the icosahedral phase but not the intensities of the peaks. However, there are some subtle features in the diffraction patterns, purely from a geometrical point of view, that may be important in arriving at the correct model even without going into the details of intensity calculation. One such feature are the arcs of diffuse intensity reported for the first time by Mukhopadhyay *et al.*[7] in Al–Mn alloys; the arcs appear in special positions in the diffraction pattern and disappear after a suitable heat treatment, leaving weak and sharp ('superlattice') spots in those places[8]. The first report of arcs of diffuse intensity and superlattice reflections generated much excitement on both theoretical and experimental fronts. It is surprising that so far there have been no papers based on the twinning of crystallites or on classical crystallography to account for the diffuse intensity in icosahedral phases. The glass model, based on random packing of icosahedral clusters maintaining the orientational order, at present can predict only the position of the arcs but not the superlattice spots[9]. On the other hand, the quasicrystal concept seems to have got immediate support, and can be extended in a natural way to interpret reasonably well the phenomenon of diffuse intensity[10].

Quasicrystals have a periodic structure in higher dimensions. In the present case, for the icosahedral phase, it has been shown that the structure can be periodic in six-dimensional space. The 6D cubic lattices can be projected irrationally to generate the quasiperiodic structures. As in the case of 3D cubic lattices, there are three cubic Bravais lattices in 6D, namely simple cubic, body-centred cubic and face-centred cubic. These structures, after projection, can give rise to simple icosahedral (SI), body-centred icosahedral (BCI) and face-centred icosahedral (FCI) structures respectively. So far the diffraction patterns in rapidly solidified Al–Mn alloy can be successfully indexed by the SI model. But the centre of the arc of diffuse intensity cannot be assigned integer indices based on the SI model[7]. The superlattice spots arising from these arcs have been indexed following the BCI model by doubling the 6D lattice parameter of the SI model, as has been demonstrated by Mukhopadhyay *et al.*[8] This is the situation in reciprocal space.

Naturally, there is a real-space structure corresponding to the FCI geometry in 6D space whose reciprocal space is a BCI lattice. Clearly, there is an overall change in the diffraction patterns without disturbing the intense peaks. This indicates some sort of ordering reaction on the parent structure. Thus it has been proposed that partial ordering or short-range ordering leads to the arcs of diffuse intensity and perfect or long-range ordering gives rise to the superlattice spots, which changes the space group of the lattice in 6D space. From the quasicrystalline framework it is obvious that there is a realistic possibility of a disorder–order transformation in the icosahedral phase. However, the ordering in atomic scale is not yet known; first one must know where the atoms are in the quasicrystalline model. Work is in progress to resolve the issue with the help of 6D crystallography. Nevertheless, from geometrical considerations, the ordered structure in real space can be realized as an FCI-type superstructure of the SI lattice. One has to wait and see whether or not a BCI-type superstructure of SI is possible in any other alloy system. It is pertinent to point out that the diffraction patterns from Al–Fe–Cu and related alloy systems show evidence of FCI ordering of the SI structure in real space even without annealing[11, 12]. The long-range-ordered quasicrystals are highly stable and can be grown to a larger size suitable for single-crystal X-ray studies. These experiments are expected to yield more interesting data which will help to understand the structure of quasicrystals in the near future.

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Electronic device screens chemicals for biological activity

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A new device invented at Stanford University, called a silicon microphysiometer, now allows routine measurement of the metabolic responses of cells to physical and chemical stimuli[1]. The principle that this device taps is that all biological, chemical or physical changes in the environment of a cell are reflected in changes in the concentration and flow of molecules within the cell. The extensive interconnection among the different biochemical processes allows the detection of a response that is only indirectly associated with the primary stimulus.

Catabolic processes are ideal candidates for the indirect detection of responses. The primary catabolic products in mammalian cells, carbon dioxide and lactic acid, cause changes in acidity in the environment of the cells, which therefore reflects the metabolic activity of the cells. The silicon microphysiometer, developed by Molecular Devices Corp., Menlo Park, California, uses light-addressable potentiometer sensors (LAPS) to measure changes in pH in the culture medium surrounding a small number of cells. It consists of a microvolume flow chamber in which the cells to be tested are immobilized. One wall of the chamber is the silicon-based LAPS. Apposed to the sensor, 100 μm away, is a coverslip with the adherent cells. Medium is pumped through the channel between the sensor and the coverslip. The medium, differing from normal growth medium in lacking bicarbonate, has reduced buffer capacity and thus enhances pH changes. For measurement of metabolic rate, flow of medium is halted for 30 to 200 seconds. Cells acidify the medium in the chamber because of production of lactate and some carbon dioxide. When flow is resumed the pH in the chamber rises and then returns to the pH of fresh medium. The rate of acidification of medium, measured by the microphysiometer, is a measure of the metabolic rate of the cells.

The immense potential of the device has been demonstrated in a recent study that evaluated the use of this instrument for continuous monitoring of receptor-mediated changes in the metabolic rates of living cells[2], demonstrating the instrument's utility in screening new therapeutic drugs by measuring cellular responses accompanying receptor–ligand interactions. The expected qualitative effects of various nonspecific toxic chemicals on the metabolic rates of cultured cells have also been seen in experiments that employed the microphysiometer.