for structure determination were clearly an index of the growth of macromolecular science in the country over the past five years spanning the first phase of the national facility at Biophysics Unit. The concluding session was on a discussion on crystallographic research of the present and future in the country. Rossmann was requested to comment on his impressions of the research facilities and activities in the country. Rossmann was very hesitant to make comments as his impressions would inevitably be based on superficial knowledge of the status of work in India. With that understanding he remarked that the situation in India has always been somewhat strong on the theoretical but weak on experimental work. He appreciated the general atmosphere of enthusiasm in India for scientific research although he felt that it would be necessary to undertake challenging structural problems despite fears of failure for good research to flourish. The willingness to undertake such risks might be related to cultural aspects although it is generally assumed that scientific enterprise transcends cultures. He also felt that the hierarchical structure in India may not be very conducive for healthy scientific research. Participants were generally happy about the services of the national facility and the progress that has been made at Bangalore and elsewhere. The anticipations for the second phase were very high and it was hoped that the crystallographic community in India will work with solidarity in the coming years to make a qualitative and quantitative improvement of the activity in this exciting area of research.

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CORRESPONDENCE

Enhancing S & T coverage

This has reference to N. C. Jain's proposal to provide several important journals, annual reports, task reports, etc., free to some select science writers and journalists in India (*Current Science*, 1994, **66**, 98). I fully endorse his proposal on an experimental basis – in fact, it could become a research project in itself in science popularization, if somebody takes it seriously enough. An experiment of this sort would help us know for instance, whether any media-worthy findings are appearing in our journals or not, whether our science journalists are committed or not, whether science news coverage about Indian work would increase or not, and so on. In fact, the cumulative experiences of the science writers to whom the journals would be provided would give some interesting insights into their minds, the media people and scientists as well. After all, it is only after noticing a scientific finding in an Indian journal that a science writer would contact the concerned scientist or scientists. The interactions that would follow between science writers and scientists would be much more interesting to record and study for our future programmes of science popularization

I only wish somebody takes this 'experiment' seriously enough to monitor its progress and record its findings which would prove useful in working out strategies for future science popularization programmes. To date, much is talked about Indian media, scientists and science journalists without any proper study. Here is an opportunity which would help clarify our notions about them.

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One of the principle reasons for less coverage of indigenous S & T coverage in our mass media is, to some extent, nonawareness of existence of primary information. Secondly, even if the writers are aware of these sources like learned journals and periodicals containing Indian S & T research reports, reviews, etc., they are beyond direct physical access of majority of science communicators. In support of suggestions made by N. C. Jain, I urge the management of Indian journals to urgently examine these valuable suggestions and undertake steps for their implementation in public interest. The 'scheme', as envisaged by Jain, when implemented, may be run initially for two years and then evaluated with a liberal view. This would perhaps also help in seeding a temperament among our science communicators to look inward rather than away at foreign source material. Not much expenditure will be incurred on sending a couple of journals to science communicators.

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Apropos N. C. Jain's suggestions on 'Enhancing indigenous science coverage in communication media', the endeavour deserves all praise. Notwithstanding, there is no dearth of science communicators in the country, but because of high priced national/international S & T journals and preoccupations related with the office and home affairs, most of the science writers find themselves unable to afford the same and to spare the time in different libraries on a regular basis; which in turn, results in very poor science coverage in various media in the country. On the other hand, the science communicators from small cities/towns and remote areas have been most unprivileged as far as availability of those journals is concerned. If the active science communicators in general and the budding science writers hailing from such areas in particular are provided with a few S & T journals of their choice, that could be an impetus for them. That will not only help in enhancing our S & T coverage but the quality is also bound to improve.

The question now arises as to who is going to provide the funds for it. The first possibility that strikes the mind is the National Council for Science & Technology Communication (NCSTC) under Department of Science & Technology, New Delhi, which was established a decade ago as a nodal agency for S & T communication, its sole endeavour having been towards popularization of science particularly among laymen at the grass-root level.

Apart from all its regular activities, the NCSTC should come forward to allocate the funds ensuring the purchase of S & T journals and distribution of the same to the active science writers. In order to avoid the misuse of public money, the names in the mailing list can be added or deleted judging from the writer's performance, as suggested by Jain. On an experimental basis, the members of Indian Science Writers Association, a Delhi based professional body of science communicators, may be included in the mailing list. The commendable suggestions made by Jain must not go unheeded.

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RESEARCH NEWS

Scanning tunnelling microscopy studies of the fullerene C_{60}

In the area of fullerene research, the dust has settled and the time for rhetoric is over. The emphasis in recent months has been on mature experiments that tie up loose ends. Two 1994 papers from A. V. Narlikar, S. B. Samanta and P. K. Dutta of the National Physical Laboratory, Delhi on the scanning tunnelling microscopy (STM) of C_{60} seem to bear this out. The papers [*Philos. Trans. R. Soc.* (*London*), 1994, 346, 307–320 and *Proc. R. Soc.* (*London*), 1994, **444**, 325–332] report detailed STM studies of C_{60} samples deposited on polycrystalline silver substrates. The authors emphasize the two possible classes of defect structures in these systems, the one within the fullerene cage; what might be referred to as molecular defects, and the other, extended lattice defects including dislocations and stacking faults.

In the name of self-sufficiency, we briefly review the STM technique. In STM, a pointed conducting tip is maintained at some finite bias, over the surface to be studied. The surface itself is grounded, and this restricts STM to conducting and semiconducting samples. When the tip-sample separation is of the order of nanometres, a tunnel current which depends exponentially on the separation, is set up between the tip and the sample surface. The topology of the surface is mapped by moving the tip over the surface while following the tunnel current in the manner of a gramaphone stylus 'reading' the music on a record.

The first paper emphasizes the extended lattice structure of solid C_{60}. STM images clearly show up the fcc packing of C_{60} molecules, in agreement with existing X-ray, neutron and electron microscopy data. Figure 1 *a* is an STM image of the fcc (001) planes of the C_{60} lattice and Figure 1 *b* is an STM image of the close-packed (111) plane. Typical dimensions and fcc directions are shown in these figures. In both images, each C_{60} molecule resembles a ball, the reason being that the truncated-icosahedral structure is averaged out over a sphere due to rapid molecular rotation. STM is a technique that probes the electron density around a surface rather than directly probing the atomic position. Considering this, Narlikar *et al.* find, quite surprisingly, that the molecular diameters as measured by STM match the diameter of the carbon cage (0.7 nm), rather than the van der Waals contact (1.0 nm).

The reason why fcc type of sphere packing often prevails over hexagonal close-packing is the ability of the fcc lattice to accommodate a large variety of defects. An example is shown in Figure 1 *c*, where one clearly sees the presence of two extra half planes, corresponding to two edge dislocations (marked), forming a dislocation dipole. The Burgers circuit yields a Burgers vector of 1.0 nm in accord with slip along the ⟨110⟩ directions. The image in Figure 1 *c* is almost a textbook illustration of a dislocation dipole.

The second paper concentrates on the molecular structure of the fullerene C_{60} as determined by STM. Rapid molecular reorientation in the solid phase of C_{60} at ambient temperatures and pressures do not usually allow for atomic details to show up in STM studies. The authors suggest that either the proximity of the silver substrate or the high fields generated by the STM tip freeze molecular motion over STM timescales allowing atomic features to be resolved. The observation that the orientations of adjacent C_{60} molecules are uncorrelated is presented by the authors as one more detail in the mosaic of evidence showing that solid C_{60} under ambient conditions is orientationally disordered. This mosaic includes synchrotron X-ray[1] and neutron[2] diffraction studies on C_{60} powders. Of course, it is a rather sweeping assumption that STM is a totally non-invasive technique. This is something we return to elsewhere.

Figure 2 *a* shows an atomic resolution image of a frozen C_{60} molecule. The outline of a five-membered ring, surrounded by six-membered rings is dis-