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19.01 – Crystallographic Teaching

OCM-19.01.01 THE IMPACT OF SYNCHROTRON RADIATION ON CRYSTALLOGRAPHIC TEACHING. By P.F.Lindley*, SERC Daresbury Laboratory, Warrington, Cheshire WA4 4AD, UK.

The routine availibility of Synchrotron Radiation has radically increased the range of structural problems that can be tackled and has also led to a resurgence of "old" techniques, such as the Laue method. Synchrotron radiation provides a source of very high intensity, highly collimated, wavelength tunable X-radiation, particularly useful over the wavelength range 0.3 - 2.5 Å. In structural biology, the high intensity has led to successful studies on a number of large macromolecules including viruses such as the foot-and-mouth-disease virus and the 50S ribosome particle. Detailed studies on proteins and enzymes have greatly assisted substrate, inhibitor and drug design studies and these structures under-pin much of modern molecular biology.

The high intensity also enables diffraction patterns to be recorded and measured from very small crystals, typically in the 10 - 50 μm range and this has led to a number of structure determinations not possible using conventional sources.

The wavelength tunability can be used to minimise radiation damage and the determination of phase information using multi-wavelength anomalous dispersion methods is playing an increasing role in macromolecular structure determination.

The intensity distribution in the "white" radiation spectrum of a synchrotron source is well matched to the Laue technique. Laue methods have now been developed to enable the rapid collection of data from biological macromolecules and time-resolved studies are beginning to give insights into intermediates involved in reaction mechanisms. Small angle X-ray solution scattering has also attfacted renewed interest and the combination of crystallography and solution scattering can be very powerful. Solution scattering is being increasingly employed in the study of polymers of industrial importance.

X-ray absorption techniques can also be readily applied to the study of metal centres in a whole range of materials of both biological and non-biological interest.

In summary the availibility of synchrotron radiation in a number of centres throughout the world has had a profound impact on crystallographic structural studies and this impact, together with the new applications and methodologies, should be reflected in crystallographic teaching at all levels.

OCM-19.01.02 X-Rays, Synchrotron and Safety. By H. von Philipsborn, Faculty of Physics, University, D-8400 Regensburg.

For many reasons it would be unfortunate if crystallographers were to consider X-rays just as useful screw drivers to extract structure information from crystals; if X-ray tubes were just used for diffraction; if instruments for measuring X-rays did not serve radiation protection. Practical instruction about the effects of high dose levels of radiation is necessary, since the exposure rate of an X-ray beam may be several kR/s, compared to μR/h in the natural radiation environment. The ratio and the danger is even higher at a synchrotron.

Various dosimeters and dose rate instruments commercially available at reasonable cost for general radiation protection should be better known and used by X-ray crystallographers. A wide variety of instructive experiments can be performed with radioactive minerals, X-ray beams and detectors for a better understanding of the fundamental interactions between radiation and matter in detectors, samples, shieldings, and persons.

The International Commission on Radiological Protection stated the Principle of ALARA: Radiation protection efforts should be optimized, i.e. all doses should be kept as low as reasonably achievable, taking into account economic and social factors. Practises must be justified, protection optimized, and individual doses limited.

OCM-19.01.03 IUCr VISITING PROFESSOR PROGRAM

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The visiting Professor program was instituted by the IUCr Commission on Crystallographic Teaching as a cooperative venture between the Union and host countries. It aims to bring experienced teachers of crystallography into places where crystallographers can clearly define their needs and make appropriate local arrangements.

There have been visiting Professor ventures in Indonesia, Sri Lanka, Viet Nam and China. Each of these was sustained by one teacher working very hard for one to three weeks with varying degrees of support from local people and facilities. It is necessary to prepare thoroughly and take everything that might be needed in the way of teaching aids and handout materials along because the availability of library material, photocopiers, computers and projectors can never be taken for granted.

Needs vary enormously from very basic introductory courses on the nature of the crystalline state through experimental possibilities, particularly powder diffraction, to updating experienced crystallographers on advanced single crystal structure anlaysis and computing techniques, specially those available on small personal computers.

Assisting the application of crystallography by working closely with scientists of widely different age groups, cultures, educational backgrounds and experience seems an appropriate activity for the IUCr Commission on Crystallographic Teaching.

