JOINT STRUCTURAL BIOLOGY GROUP BETWEEN EMBL AND ESRF

The intense and highly collimated X-ray beams at the ESRF are ideal for studying the generally weak diffraction from large biological macromolecules. Therefore structural biology has become one of the major applications at the ESRF: six ESRF beamlines are concerned with structural biology (**Table 1**).

Some five years ago, in mid-1992, the ESRF and the EMBL approved a Memorandum of Understanding on the use of synchrotron radiation for biology research. This memorandum provides for formal specific agreements to be discussed and implemented covering beamline design and construction and the collaborative use of EMBL, ILL and ESRF facilities (cf. ESRF Newsletter N° 15, p. 3). Since then extensive interactions between EMBL and ESRF have been developed concerning beamline design, construction and operation, development and testing of new equipment, in-house research as well as safety issues.

In order to optimise the use of the facilities we have established a more structured and coherent framework for the collaboration in the form of a Joint Structural Biology Group (JSBG). This group was formally approved by both ESRF and EMBL Councils late last year.

The group is managed by two scientists from the two institutes, who alternate between being head and deputy head of the group. The group acts in a similar way as other ESRF groups in that it co-ordinates the activities of several beamlines which share common scientific interests. At present, the number of JSBG members is about 40 including associate members who formally belong to other groups.

The combination of the "Institut Laue-Langevin" (ILL), the "Institut de Biologie Structurale" (IBS), the EMBL Outstation, and the ESRF has made Grenoble a unique place for structural biology and the JSBG will hopefully play an active role in enhancing this further. The details of the group structure and responsibilities are being finalised with an emphasis on facilitating interactions and information flow among the protein crystallography beamlines and the EMBL groups. The objectives of the group are as follows:

DEVELOPMENT PROJECTS

There are many aspects common to all the JSBG beamlines: (1) beamline components such as collimators, beamstop, cryocooling, and alignment system for small crystals, (2) CCD and Imaging Plate detectors, (3) beamline control with graphical user interface, and (4) general computing environment for processing extremely large volumes of data. One of our aims is to co-ordinate the protein crystallography beamlines to present a similar environment to the users and assist the beamline staff to pursue new technical developments. Currently, there are a number of joint projects such as automatic beamline alignment, storage and transfer set-up of frozen crystals, sample observation devices for micro-crystals, pressurised Kr/Xe cells for phasing, a 40 cm by 80 cm imaging plate drum scanner for beamline ID14 and a rapid imaging plate changer for beamline BM14. Different project teams are formed across the beamlines according to the nature of the projects and their results are reported and discussed in the regular group meetings.

IN-HOUSE RESEARCH PROJECTS

Almost every research project in structural biology requires a large amount of laboratory work to obtain crystals for X-ray studies using biochemical and molecular biology techniques. The ESRF does not have the facilities for such experiments but, under the framework of the JSBG, ESRF scientists have an option of working independently in a laboratory at EMBL, establishing outside collaborations or joining an EMBL research group. Several such projects have already started. The long-term aim is that the JSBG will nurture challenging and front-line scientific projects which require a wide range of expertise in molecular biology as well as beamline instrumentation.

WORKSHOPS

Following the success of the EMBL/ESRF/IBS workshop on multiwavelength anomalous diffraction (MAD) in June 1996, the JSBG is organising a second workshop on the MAD technique in June 1997. This will be extended to other subjects in protein crystallography including training courses in data collection and data analysis.

Table 1: ESRF beamlines concerned with structural biology.

Beamline	*Time dedicated to structural biology*	*Operation since*	*Specific applications*	*Detectors*
ID2 (PX)	*half*	*Sept 1994*	*monochromatic protein crystallography*	*IP*
ID9	*half*	*Sept 1994*	*time-resolved Laue, monochromatic protein crystallography, trapping of intermediates*	*CCD, IP*
ID13	*one third*	*Sept 1994*	*micro crystals*	*CCD, IP*
ID14 A/B			*monochromatic protein crystallography*	
EH1	*full*	*1998*		*CCD*
EH2	*full*	*1998*		*CCD*
EH3	*full*	*Sept 1997*	*large proteins and viruses*	*IP, CCD*
EH4	*full*	*Sept 1997*	*multiwavelength anomalous diffraction (MAD)*	*CCD*
BM14	*full*	*Sept 1995*	*multiwavelength anomalous diffraction (MAD)*	*CCD, IP*

"Test beam time"

It has been suggested by a number of user groups and the Life Science beam time allocation Review Committee that it would be extremely useful if the ESRF provides "test beam times" for users to test newly-grown crystals to see how well they diffract before making a formal beam time proposal. At Stanford Synchrotron Radiation Laboratory, this has already been put into practice. The JSBG will assist beamline scientists to organise such test beam time shifts on selected beamlines.

Sample preparation

At the moment, there are two sample preparation areas close to ID2 and on BM14. There is a plan to build another for ID14A/B. These will be maintained by the JSBG to give users useful space to prepare crystals before and during their beam time. More extensive biochemical facilities are of course available for users at the EMBL.

There is also a plan to equip one of the four experimental stations of ID14 with a P2 level facility for biohazardous experiments such as virus crystals. It consists of a laminar flow enclosure around the kappa diffractometer, and another laminar flow hood next to the experimental station to minimise the risk of accidents during the transfer of virus crystals. The safety aspect of the project is overseen by an EMBL scientist who assists the ESRF Safety Group and the beamline staff.

Working groups

Working groups are formed in order to address global projects common to the JSBG such as the ESRF biochemistry laboratory, tapered optics fiber coupled CCD detectors, management of computer systems of JSBG beamlines, decision of in-house research projects and co-ordinated development of new projects. These groups have well-defined goals and time schedules for completion of the projects.

Collaboration with the IBS in Grenoble

Currently, three scientific collaborators from the IBS (Institut de Biologie Structurale) collaborate with the JSBG members in the design, construction and operation of the ESRF protein crystallography beamlines. They act as liaison between the JSBG and the IBS in instrumentation and structural biological projects as well as workshops. For instance, BM14 and the CRG beamline D2AM benefited from the exchange of ideas on the use of the ESRF X-ray Image Intensifier CCD detectors. A possibility of forming a thematic group on structural virology is being discussed among IBS, EMBL, ESRF and other virology groups in the Rhône-Alpes region.

HERCULES 1997

The seventh session of the HERCULES course (Higher European Research Course for Users of Large Experimental Systems) took place at the Maison des Magistères, CNRS Grenoble, from 16 February to 27 March 1997 with 82 participants from 18 countries (mostly European, but including participants from Brazil, China and Japan who are registered at European Universities):

- session A: neutron and synchrotron radiation for physics and chemistry of condensed matter with 44 full-time participants and 19 part-time participants.
- session B: neutron and synchrotron radiation for biomolecular structure and dynamics with 19 full-time participants.

As in previous years, the course included lectures, practicals and tutorials. This year, session A was particularly centered on recent developments of neutron and X-ray spectroscopy (circular magnetic dichroism, inelastic scattering...). In Grenoble, most of the practicals were carried out at ESRF beamlines (including French, Italian and Swiss-Norwegian CRG beamlines) and at the ILL. The collaboration of EMBL, IBS as well as CNRS and CEA-Grenoble was also greatly appreciated. Participants from the two sessions carried out practicals at LURE (Orsay) and the Léon Brillouin Laboratory (Saclay).

The poster session at the Maison des Magistères (54 posters displayed) was one of the highlights of the course and allowed fruitful exchanges between participants and Grenoble scientists.

HERCULES 98 will take place next year with the same two parallel sessions, from 22 February to 3 April (provisional dates).

Information and application forms will be available at the beginning of July 1997.