Good news for Collaborations in the Middle East

by

Samar Hasnain[1], Louise Johnson[2], Joel L. Sussman[3] and Soichi Wakatsuki[4]

[1]Molecular Biophysics Group, CCLRC Daresbury Laboratory, Daresbury, Warrington,Cheshire WA4 4AD UK, [2]Laboratory of Molecular Biophysics, University of Oxford, Oxford OX1 3QU UK andDiamond Light Source, Chilton, Oxon OX11 0QX [3]Dept. of Structural Biology and The Israel Structural Proteomics Center, The Weizmann Institute of Science, Rehovot 76100 ISRAEL [4]IMSS, KEK, 1-1 Oho Tsukuba, Ibaraki 305-0801 JAPAN

"Scientific thought is the common heritage of all mankind" (Abdus Salam, 1986). The SESAME project (Synchrotron-light for Experimental Science and Applications in the Middle East (http://www.sesame.org.jo)) is a regional initiative, under the auspices of UNESCO (*SCIENCE*, News (2004) 306, 1465) that will help fulfill this vision. Until recently synchrotrons have been the prerogative of the industrially advanced countries. Because of their impact across a range of scientific fields and their near-market benefits in terms of spin-offs, employment, training and technology transfer, many of the emerging economies, including Brazil, India, Korea, Singapore, Taiwan have build their own sources (http://www.srs.ac.uk/srs/SRworldwide). There are now about 60 operating synchrotron sources around the world and about 10 are under construction.

SESAME will open the door to treasures of scientific research and co-operation. The project, comprising full contributing members Bahrain, Egypt, Israel, Jordan, Pakistan, Palestinian Authority, and Turkey and observers Germany, Greece, Italy, Kuwait, Russian Federation, Sweden, UK and USA, is headed by Prof. Herwig Schopper, President of the Council, and Prof. Khaled Toukan, Director of SESAME, and also Minister of Higher Education and Scientific Research of Jordan. The new synchrotron has been optimized to final design energy 2.5 GeV, circumference 133.1 m, electron emittance of 27 nm rad with the potential for up to 27 beam lines and available for users by the end of 2009. SESAME's performance will be equivalent to most modern third generation sources (Figure 1). The six beam lines in the phase one of experimental program will include macromolecular crystallography, photoabsorption spectroscopy, small angle/wide angle scattering, EXAFS, powder diffraction and infrared spectroscopy and will cover experiments for material sciences, environmental sciences, atomic and molecular sciences and biomedical research. The macromolecular crystallography beam line will be designed for MAD (Multiwavelength Anomalous Dispersion) and SAD (single wavelength anomalous dispersion) experiments in the energy range 5-13 keV and will use the latest in-vacuum undulator design.

In preparation for SESAME's installation, the 4th users meeting was held during 6-8 December 2005 at the Dead Sea Spa Hotel, in Jordan, an hour's drive from the SESAME site at Allan, near Amman. The meeting attracted some 140 participants from the member countries as well as countries considering joining this unique project in the Middle East.
Participants were able to view the progress that has been made with the construction of the building and associated laboratories under the supervision of R. Al Sarraf from the Al-Balqa University, Jordan (Figure 2).

The establishment of this unique centre will encourage region-specific research at the highest level. The multi-disciplinary approach was evident at the users meeting, which in addition to presentations from some of the leading figures of synchrotron radiation world (Wim Bras, Paul Dumas, Michael Hart, Louise Johnson, Hideo Kitamura, Manolis Pantos, Soichi Wakatsuki and others), also attracted many of the synchrotron experts of the region, most of whom are currently working on sources around the world. These included Ercan Alp (APS and Turkey), Zahid Husain (ALS and Pakistan)

and Mohammed Yousef (Oregon and Egypt). Many contributions from the SESAME users were heard from experts including Iqbal Choudhry (HEJ, Pakistan) who spoke on natural product resource for drug discovery program, Magid Al-sherbiny (Egypt) on schistosomiasis, Engin Ozdas (Turkey) on the structural properties of lithium borocarbide, a potential candidate for high temperature superconductivity, Joel L. Sussman (Israel) on targeted structural genomics and Taghi Bahreyni Toosie (Iran) on the potential for a medical beam line. The meeting also learned about the use of synchrotron radiation in archaeology in the Middle East as, for example, in the characterization of the Dead Sea scrolls textiles and dyes, the metallurgy and mineralogy of the 3rd millennium BC bronze and pottery finds in Syria, the analysis of Islamic lusterware from 9th C AD, and the analysis of the limestone used in the great pyramids of Giza where information is being used to test theories of construction techniques.

SESAME will be the catalyst for a concerted effort to use structural biology to combat indigenous infectious diseases and genetic diseases know to be widespread in the area (see, *e.g. the 'CTGA Database for Genetic Disorders in Arabs' at: http://www.cags.org.ae). Examples of the sorts of problems relevant to the region that may be addressed by synchrotron studies were highlighted. Schistosomiasis (bilharzia) is the second most prevalent tropical disease in Africa after malaria and is a serious problem in developing countries. The disease is associated with water resource development projects where the snail intermediate hosts of the parasite breed. As reported by Magid Al-sherbiny (Egypt) the disease has been almost eradicated in North Africa by the drug praziquantel. Praziquantel was originally developed for veterinary use but found to be safe for humans. One treatment can confer immunity for a lifetime. Although much is known of the action of the drug on the effects of calcium permeability in the worm and the subsequent tetanus state that exposes surface antigens, the precise drug target is not known. The combination of target identification and structural studies will provide the basis for understanding the action of this almost miraculous drug and the design of other anti-parasite agents. With an ageing population, neurodegenerative diseases are a concern both for rich and poor countries. Acetylcholinesterase has become a high profile target for potential drugs, especially in the treatment of Alzheimer's disease. Following the structure determination by Joel Sussman's group at the Weizmann Institute in 1991, which showed the catalytic triad at the bottom of a deep gorge, the structure of many potential therapeutic agents in complex with acetylcholinesterase have been determined, leading to new insights for drug action. Of particular interest is the compound huperzine from the plant Huperzia Serrata, long used in Chinese medicine, and currently in Phase II clinical trials. Structure has given the impetus for new lead compounds based on the natural product inhibitor. Continuing the theme of the exploitation of natural compounds in drug research, Iqbal Choudhry described the systematic approach at the HEJ Institute of Chemistry in Karachi to identify the active agent in over 2000 plants from Pakistan's diverse vegetation. By screening against a panel of enzymes, a* number of acetylcholinesterase inhibitors, calcium channel blockers and antioxidants had been identified. Garlic has been used by local populations to treat leishmaniasis, a parasite disease spread by the bite of infected sand flies. Chemical studies have led to the isolation of an active compound. There is the desire to complement the bio-activity guided isolation work on medicinal plants with structural studies on the targets and the use of microbiology and biotechnology to assist some of the more challenging chemical syntheses.

The SESAME project has drive and excitement. Clearly there is still some way to go before delivery but much has been accomplished so far. The goodwill, the leadership, the scientific cooperation, and sponsorship by the national and international organisations have all contributed to its progress so far. As Herwig Schopper commented "Success has many fathers".

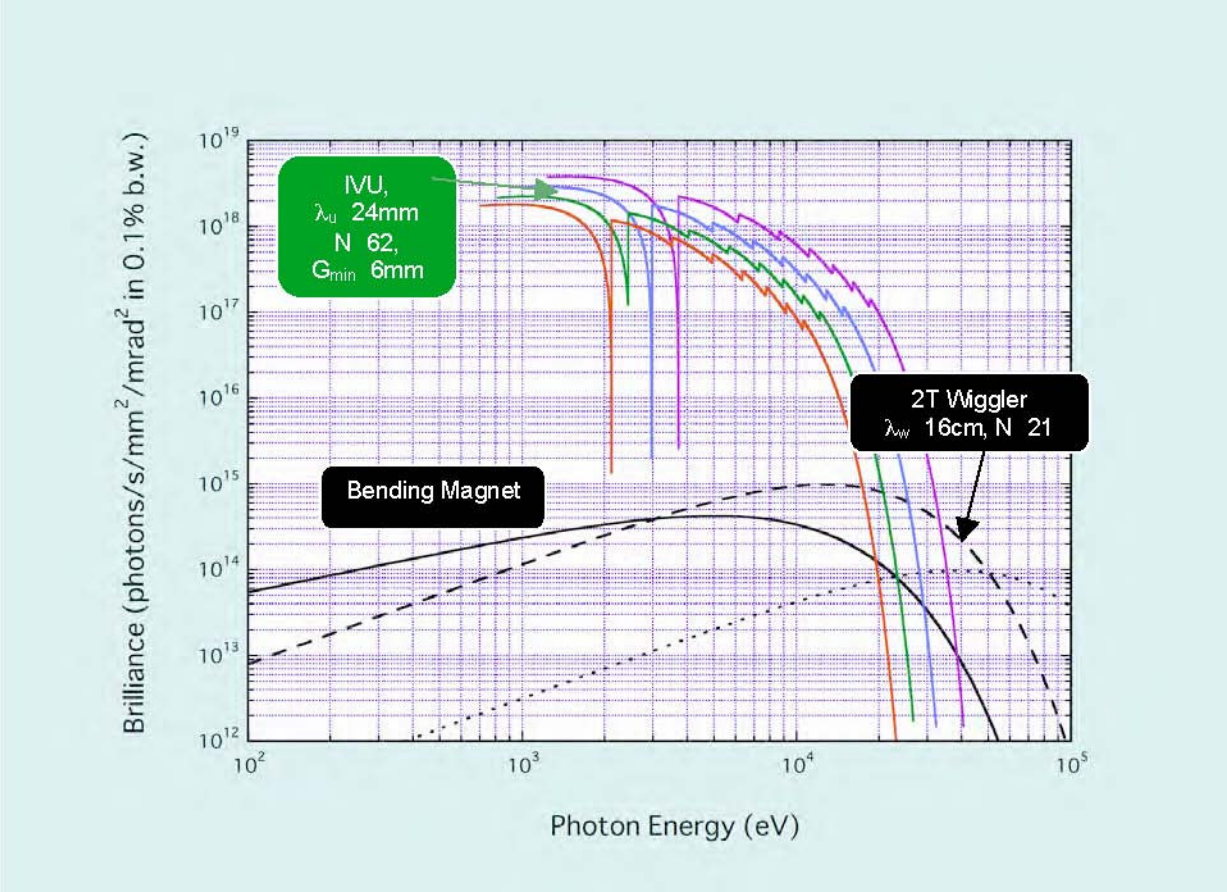

Figure 1 Spectral output of SESAME sources including an in-vacuum undulator (IVU) showing the different harmonics (courtesy H. Kitamura) Figure 2a Participants at the 4th users meeting at the SESAME site, at Al-Balqa Applied University (Jordan), 6-9 December 2005.

Figure 2b Council members and others at the SESAME building site at Al-Balqa Applied University Jordan. Front row: Professor Herwig Schopper, Professor Khaled Toukan, Dr Maciej Nalecz (UNESCO), Professor Samar Hasnain, Professor Said Asaf; back row: Professor Aslam Baig and others .

Figure 2c Participants at the 4th Users SESAME meeting at Al-Balqa Applied University (Jordan), 6-9 December 2005: Soichi Wakatsuki (KEK), Joel L. Sussman (Weizmann Institute of Science), Louise Johnson (Oxford) and Samar Hasnain (Daresbury & Chair of SESAME Beamlines committee) are standing near the entrance of the SESAME building.