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current events

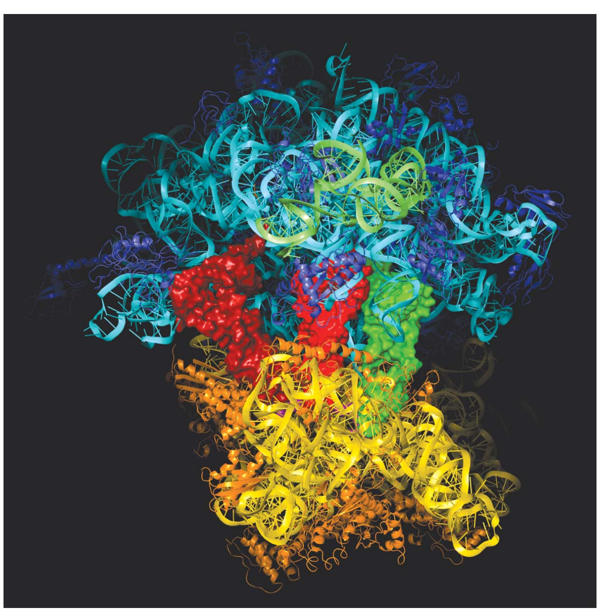
This section carries events of interest to the synchrotron radiation community. Works intended for this section should be sent direct to the Current-Events Editor (s.s.hasnain@liverpool.ac.uk).

Three crystallographers, Venkatraman Ramakrishnan, Thomas Steitz and Ada Yonath, share the 2009 Chemistry Nobel Prize

Three well known figures of the synchrotron radiation structural biology community have been recognized for their work on the structure and function of the ribosome, the cell's protein factory. The ribosome translates genetic code into proteins, which are the building blocks of all living organisms. Ribosome is also the main target of new antibiotics, which combat bacterial strains that have developed resistance to traditional antibiotic drugs. These new drugs work by blocking the function of ribosomes in bacterial cells, preventing them from making the proteins they need to survive. Their design has been made possible by research into the structure of the ribosome, because it has revealed key differences between bacterial and human ribosomes. Structures that are unique to bacteria can be targeted by drugs. The announcement was made during a press conference at the Royal Swedish Academy of Sciences, during which the three winners were described as 'warriors in the struggle of the rising tide of incurable bacterial infections'.

The work on ribosome has featured in our pages when stories of various prizes awarded to Venkatraman (or as we all know him Venki) Ramakrishnan and Ada Yonath have been covered [*J. Synchrotron Rad.* (2007), **14**, 297–298; (2008), **15**, 319–321].

We would like to offer our congratulations to the three recipients who have pursued their structural biology effort for elucidating the structures of ribosomes at many of the synchrotrons spanning nearly three decades. I recall the crystals being screened at the Daresbury SRS (the first dedicated X-ray source) to teams camping over long periods at the DORIS facility in Hamburg. Thus, it was no surprise that the recognition of this sustained effort of three science leaders by the Nobel committee brought global celebration across the synchrotron world, many synchrotron facilities issuing press releases of how they contributed to the breakthrough. From DESY, where Ada Yonath spent substantial time, the Chairman of the DESY Directorate, Helmut Dosch, said "With the aim to decode the structure of this important molecule, Ada Yonath has always sought the best X-ray sources of the world. Her determination in this field of research will be of great benefit for mankind. DESY is proud of having facilitated Ada Yonath's top-level research significantly with its X-ray sources". Ada Yonath and Venki Ramakrishnan, both long-term users of ESRF, were congratulated by Fransco Sette, Director General of the ESRF, who said 'Unravelling the structure of the ribosome is the result of an effort started nearly 30 years ago. The decisive final data sets were only taken in the second half of the 1990s at two synchrotron radiation sources, the ESRF in Grenoble and APS in Chicago in the United States. We are very proud for having contributed to these important results which would not have been possible without specialized instruments and dedication by our scientists at the ESRF'. Lonny Berman from NSLS, Brookhaven, said "The work which was done by Ramakrishnan and Steitz began here at NSLS. Most of Ramakrishnan's early results and all of Steitz's early results arose from measurements done here". Argonne National Laboratory's press release read 'All three recipients of the 2009 Nobel Prize in Chemistry published (more than 60) papers on their award-winning work based on data collected at the Advanced Photon Source'. Clemens Schulze-Briese from the Swiss Light Source (SLS) said 'The group of Venkatraman Ramakrishnan has been using the SLS PX beamlines since 2003. The first major result was the structure of the 70S ribosome from *Thermus thermophilus* in a pre-translocation state at 2.8 Å resolution, which allowed to build an accurate model that reveals the structures of tRNA and mRNA *in situ* and the molecular details of their interaction with the ribosome. This structure was determined with the highest resolution ever obtained on 70S ribosomes [Selmer *et al.* (2006), *Science*, **313**, 1935]'. He added that when these high-resolution data were collected 'it was the only time ever that users were asking the SLS local contact where they could buy champagne in the middle of the night'. The SLS MX team and the SLS detector group greatly enjoyed the intense collaboration with Ramakrishnan's group in advancing the data acquisition methods in ribosome crystallography, in particular with pixel detectors.



Structure of the ribosome.

The interviewer at Nobel asked Tom Steitz about his link with Max Perutz, who, like him, had solved the phase problem for much smaller proteins more than 50 years ago. Tom, declaring that Max Perutz was his idol, and not only that he was a post doc at the LMB in Cambridge for a while, but 'it was Max Perutz who inspired me to go into structural biology when he gave a lecture at Harvard in 1963. As soon as I heard him talk, I decided that this is what I want to do'.

In response to a question of how Venki Ramakrishnan came to work in biology, he said to the interviewer at Nobel "Well, I'll be honest with you, I was a theoretical physicist but my PhD work was on a problem that was not particularly interesting to me at the time. And I used to subscribe to *Scientific American* and I found that there were all these wonderful discoveries happening in biology and I also knew that a number of physicists had gone into biology and been successful. So, I decided to switch''. Venki also said 'I have to say that I am deeply indebted to all of the brilliant associates, students and post docs who worked in my lab as science is a highly collaborative enterprise. The MRC Laboratory of Molecular Biology and the University of Utah supported this work and the collegiate atmosphere there made it all possible. The idea of supporting long-term basic research like that at LMB does lead to breakthroughs, the ribosome is already starting to show its medical importance'.

From Cheshire to Jordan – STFC gifts high-tech scientific equipment for Middle Eastern collaboration

One of the legacies of the world's first dedicated synchrotron light source will be to enable scientific collaboration in the Middle East following the gift of high-tech decommissioned components to the SESAME project by the Science and Technology Facilities Council (STFC) who is responsible for operating Daresbury.

The SESAME project (synchrotron light for experimental science and applications in the Middle East) has brought together the governments and scientists of Bahrain, Cyprus, Egypt, Jordan, Iran, Israel, Pakistan, the Palestinian Territories and Turkey, with representatives from another 11 countries (including the UK) participating as observers to provide help and advice. SESAME will be the region's first major international research centre and will be built in Jordan under the umbrella of UNESCO.

The high-tech components, originally from the Synchrotron Radiation Source in Daresbury, will be used to construct experimental beamlines for research into materials and life sciences. The equipment was formally gifted by the Chief Executive of STFC, Professor Keith Mason, to the UK observer on the SESAME Council, Professor Samar Hasnain, Max Perutz Professor of Biological Sciences at the University of Liverpool, at STFC Daresbury Laboratory on 30 September 2009. Professor Keith Mason said 'The UK was the first country to develop a dedicated synchrotron light source and I am pleased that the donation of some of its components will enable further scientific research and collaboration between the nations involved in the SESAME project'. Samar Hasnain added 'I would like to thank the STFC for this generous donation to the SESAME project. I am delighted that this equipment will go to a project that unites the participating nations, enabling them to work together. It will allow the next generation of scientists from member countries to carry out world-class fundamental scientific research'.

Samar Hasnain (left) receiving the gift from Keith Mason (right) on behalf of SESAME.

Advanced Light Source at Berkeley receives funding to stimulate upgrades

With USD 11.3 million in new funding through the Recovery and Reinvestment Act, the Advanced Light Source (ALS) in Berkeley will be able to accelerate its strategic plan by upgrading facilities needed to operate at the cutting edge of soft X-ray science. The money will specifically provide for four upgrades at the ALS:

(i) USD 5.8 million will go towards replacing about 50 straight-section corrector magnets with hybrid magnets having both corrector and sextupole components, thereby doubling the horizontal brightness in the insertion device beamlines and superbend sources, and tripling the brightness in the central bend-magnet beamlines.

(ii) USD 2 million will be spent to construct and install an elliptically polarizing undulator in the sector-6 straight section, thereby effectively doubling the capacity of the existing ultrafast measurement facility (beamlines 6.0.1 and 6.0.2) in this sector by enabling both soft and hard X-ray beams to operate simultaneously with separate undulator sources.

(iii) USD 2 million will be spent to equip multiple beamlines around the ALS with advanced CCD-based detectors customized to suit particular conditions of space, vacuum, dynamic range and the like. These new detectors will allow scientists to carry out more complex experiments and get results back much faster than had previously been possible.

(iv) USD 1.5 million will go towards developing a superconducting eight-pole magnet providing magnetic fields of up to 6 T in arbitrary directions to extend the new class of novel soft X-ray dichroism experiments now performed at the ALS that have already provided a first glimpse of the wealth of information contained in XMLD and XMCD angular dependence.

Other Recovery Act allocations made earlier include a number of construction and infrastructure projects benefiting the ALS: USD 1.5 million for building 6, which houses the ALS experiment floor as well as offices, laboratories and conference rooms; USD 2.9 million for building 2, which provides office and laboratory space adjacent to the ALS; and USD 14.7 million for accelerating construction of the new USD 35 million ALS user support building, which will include office and laboratory space for about 80 researchers.

'This funding for capital investment will allow us to make much more efficient use of our operational funding from the Department of Energy', said Roger Falcone, who is also Associate Laboratory Director for Photon Sciences. 'We will be able to serve a larger number of scientists and create new scientific and technological capabilities.'

The 30000 square-foot, three-story user support building expected to be completed in September 2010.

Accelerator research receives a boost in the UK

Research into accelerator science and technology in the UK has received a boost with the announcement of nearly GBP 20 million (USD 32 million) of funding by the Science and Technology Facilities Council (STFC) to The Cockcroft and John Adams Institutes. Professor Keith Mason, Chief Executive of STFC, said ‘The awarding of these grants by STFC will support both institutes to develop their existing programmes and continue making significant scientific and technological contributions to the next generation of frontline accelerators worldwide’. The grants will see The Cockcroft Institute of Accelerator Science and Technology located at Daresbury awarded GBP 16.4 million to run to 2017, and the John Adams Institute for Accelerator Science in Oxford awarded a GBP 3.4 million grant to run to 2012. The funding, which will benefit particle, nuclear, atomic and molecular physics research, has been awarded to the two institutes to enable them to continue building upon the UK’s academic expertise and strong research base in accelerator R&D. Both institutes are heavily involved in the research and development towards future global particle physics accelerators based on linear collider technology and for the study of neutrinos.

Swapan Chattopadhyay, Director of the Cockcroft Institute and concurrently holding the Sir John Cockcroft Chair of Physics jointly at the Universities of Lancaster, Liverpool and Manchester, welcomed the award. He said ‘I am delighted at the stability and exciting opportunities for growth now secured for the Cockcroft Institute by this award until 2017. In my privileged position as the Director of the Cockcroft Institute, it will be one of my highest priorities to share our efforts with and add value to the particle physics, nuclear and photon sciences scientific fields in the most optimized fashion achievable, working synergistically and respectfully with mutual counsel from our colleagues in institutions across UK and abroad, including the John Adams Institute’.

Professor Ken Peach from the Departments of Physics at the University of Oxford and Royal Holloway, University of London and Director of the John Adams Institute, added ‘This is excellent news for the John Adams Institute. This covers the hand-over period to Professor Seryi, and will allow him to develop the future programme of the institute and to bid for further funding from 2012’. The new Director of the John Adams Institute, Professor Seryi, who will take up his post in August 2010, continued ‘‘I look forward to working with STFC, Professor Peach and our colleagues in the Cockcroft Institute to develop the next stage of the UK’s accelerator’’.

New NIST nano-ruler

The National Institute of Standards and Technology (NIST) has issued a new ruler, and, even for an organization that routinely deals in superlatives, it sets some records. Designed to be the most accurate commercially available ‘metre stick’ for the nano world, the new measuring tool, a calibration standard for X-ray diffraction, boasts uncertainties below a femtometre; that is 0.000 000 000 000 001 m, or roughly the size of a neutron.

The new ruler is in the form of a thin multilayer silicon chip, 25 mm square (just under an inch). Each one is individually measured and certified by NIST for the spacing and angles of the crystal planes of silicon atoms in the base crystal.

Formally NIST Standard Reference Material (SRM) 2000, ‘Calibration Standard for High-Resolution X-ray Diffraction’, the new ruler gives crystallographers an extremely well known crystal sample for calibrating their precision instruments. It was made possible by the development of a unique parallel-beam diffractometer at NIST that makes measurements traceable to international measurement standards and is believed to be the most accurate angle-measuring device of its kind in the world. The NIST instrument can measure angles to an accuracy better than an arcsecond, 1/3600 of a degree. ‘‘Our accuracy is at about the angle made by the diameter of a quarter, if you’re looking at it from two miles away’’, explains NIST materials scientist Donald Windover, ‘The precision is better, about the size of Washington’s nose’.

Switzerland makes progress with its free-electron laser (FEL)

The SwissFEL project is progressing well. The baseline design of the 5.8 GeV linear accelerator and two undulator lines is almost complete. Among the special design features are wavelength coverage from 1 to 70 Å, r.m.s. pulse length of less than 12 fs, 100 Hz pulse rate in both FEL lines and polarization control for soft X-rays. The technical R&D is moving ahead rapidly, with the first test facility (OBLA) in operation and the second one (250 MeV injector) under construction. The electron gun, which determines the quality of the electron beam, is the most sensitive component in a linear accelerator like SwissFEL. Since the electron beam quality determines the total length of a FEL, particular effort is put into the electron gun development (*i.e.* the focus is on the first few metres of the accelerator). In January 2009, the commissioning of the SwissFEL electron gun test stand started. Just six months after production of the first beam, the electron beam quality required for the low-charge operation mode (10 pC) of the SwissFEL was reached. This provides assurance that the new electron source concepts used can surpass the required parameters. Lasing could then be obtained with shorter undulators, a step forward which could decrease the investment costs of the SwissFEL. The scientific case report is completed and the presentation to the ETH board will be made at the end of 2009. It is foreseen that the project will be included in the ‘BFI Botschaft’ to be discussed in Swiss parliament in 2011. A construction period of four years is planned, beginning in 2012, with the goal to start the commissioning in early 2016.