

 MILESTONE 16

More than the sum of the parts

When France and Germany agreed to build a joint research centre for neutron science at the 1964 Geneva Conference on the Peaceful uses of Atomic Energy, it was celebrated as a historic symbol of post-war collaboration between the two countries. By the time the Institut Laue-Langevin (ILL) eventually opened in 1972 in Grenoble, however, few could have anticipated that it would also go on to redefine the very meaning of international scientific collaboration.

The pioneering neutron scattering experiments carried out in the late 1940s (Milestone 8) made clear the immense potential of the technique for addressing fundamental physics problems. However, it was not immediately obvious how this potential could be unlocked: in contrast to X-ray science, there was very little familiarity with neutrons in the wider research community outside the national laboratories that housed the nuclear reactors built in North America, Europe and the Soviet Union from the 1950s onwards.

Collaborations with university scientists were initially set up informally, but as these started to grow in number there was an inevitable need for more formal agreements. In the mid-1950s, a seemingly sensible, but ultimately far-reaching development took place in the United Kingdom. The national body responsible for funding university research and graduate training agreed to pay the Atomic Energy Research Establishment, which operated the neutron facilities, to allocate a part of its neutron scattering facilities and some 'beamtime' — literally the time required to use the beam of neutrons to perform the scattering experiments — to be used by university scientists. Other countries quickly followed suit, and by the early 1960s, a community of neutron scatterers had established itself internationally.



G. Stoltenberg, the German Minister for Research & Technology (left) and A. Peyrefitte, the French Minister for Research (right) agree to build the Institut Laue-Langevin.

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The ILL opened in 1972 as the world's first independent user facility, funded and dedicated entirely for fundamental research. Although initially focused on achieving technical excellence in neutron instrumentation and technology, under the visionary leadership of Rudolf Mössbauer, the ILL successfully brought the user system to the international arena. Mössbauer understood that it was not enough for the ILL to be a world leader in science and technology; it also needed to provide an important service to the wider scientific community.

In parallel to the developments in neutron science, large-scale X-ray facilities were also set up using the synchrotron technology spawned by high-energy physics research programmes such as CERN. As for neutrons, atomic and solid-state physicists had understood the enormous potential intense and tunable beams of X-rays had for their research. Significantly, however, the power of synchrotron radiation also got noticed by the community of life scientists, especially for resolving the structure of proteins. By the 1980s, the demand for access to large-scale

facilities, be they neutron or X-ray sources, came from scientists across all the disciplines.

Formal user programmes are now the template on which almost all national and international central facilities around the world are based on, and they have massively increased the collaborative nature of research. To perform their experiments, researchers can tap into the expertise of dedicated instrument scientists based locally at the facility, so they do not need to be specialists themselves and can focus on the science at hand.

Without the proper organizational structure, the scientific potential of modern-day large-scale facilities would go unrealized. Their spectacular success across the scientific disciplines is a testament to the efficiency of the modern user programme.

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FURTHER READING Briber, R. M., Glyde, H. & Sinha, S. K. *Access to Major International X-Ray and Neutron Facilities* (APS Committee on International Scientific Affairs, 2009) | Mason, T. E., Gawne, T. J., Nagler, S. E., Nestor, M. B. & Carpenter, J. M. The early development of neutron diffraction: science in the wings of the Manhattan Project. *Acta Crystallogr. A* **69**, 37–44 (2013)