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Nobel laureate Ada Yonath used Cornell synchrotron for early work on ribosome crystals

Starting in the 1980s, Ada Yonath has been a familiar face at the Cornell High Energy Synchrotron Source, as she used the powerful X-rays at CHESS's macromolecular diffraction facility (MacCHESS) to probe the atomic-level structure of ribosomes.

More than 20 years later, CHESS officials are pleased to note how their National Science Foundation facility, and the National Institutes of Health-funded MacCHESS, made a contribution to Yonath's Nobel Prize-winning work.

A professor of structural biology at Israel's Weizmann Institute of Science, Yonath was a co-recipient of the Nobel Prize in chemistry Oct. 7, along with Thomas Steitz of Yale University and Venkatraman Ramakrishnan of MRC Laboratory of Molecular Biology at Cambridge University. They were honored for their pioneering studies elucidating the structure and function of "one of life's core processes: the ribosome's translation of DNA information into life," the prize announcement reads.

Central to the scientists' efforts was X-ray crystallography, which involves beams of X-rays hitting a crystal and diffracting in different directions and intensities. The observer can then construct a three-dimensional image comprising individual atoms in the sample. It was at the Cornell synchrotron where, during the mid-1980s, Yonath did formative work on well-diffracting ribosome crystals, which eventually led to high-resolution structural models. These models, the award citation reads, are now used by scientists to develop new antibiotics that block the functioning of bacterial ribosomes.

Keith Moffat, who founded MacCHESS in 1982, recalls Yonath as a frequent user of the facilities at Cornell during that decade.

"We gave her a lot of help," said Moffat, who is now a professor of biochemistry and molecular biology at the University of Chicago. "As a user with a particularly challenging problem, she both needed it and welcomed it. The award is for her enormous contributions to the determination of [ribosome structures]; she richly deserves it."

The Nobel recipients used data from many synchrotron sources to perform their work, with CHESS contributing to Yonath's ribosomal research in several important ways, including the progressive improvement of crystal samples over the years that diffracted to higher and higher resolution. By examining these crystals during many of her visits to CHESS, Yonath revealed low-resolution structures of ribosomal subunits, Moffat recalled.

Yonath was also among the first scientists to use the "F1" station, the first CHESS experimental station designed specifically for protein crystallography.

The Royal Academy also noted technological developments necessary to the eventual success of Yonath, Ramakrishnan and Steitz. Several of these involved CHESS and MacCHESS, including the development of methods to protect crystals against radiation damage, the development of charge-coupled device detectors applied to macromolecular crystallography -- first introduced at MacCHESS in the early 1990s -- and other diffraction methods of phasing structures.

CHESS has had connections with Nobel prizes of the past. In 2003 Rod MacKinnon of Rockefeller University shared the chemistry prize for his solution of the structure of a potassium ion channels, using data largely acquired at CHESS.

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