2014 international year of crystallography

INTERNATIONAL YEAR OF CRYSTALLOGRAPHY

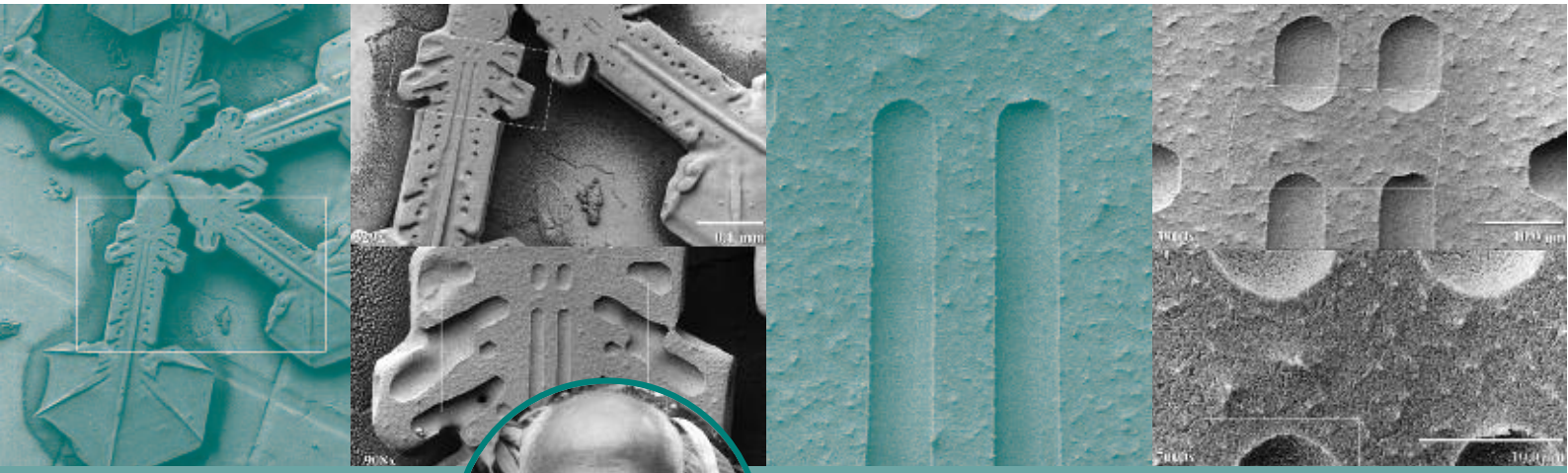
CRYSTALLOGRAPHY REVEALS THE SUBLIME BEAUTY OF NATURE, AND IT DRIVES INNOVATION IN FIELDS FROM MINING TO AGRICULTURE AND HEALTH. TODAY, IT IS CRITICALLY IMPORTANT FOR SCIENTIFIC PROGRESS IN THE DEVELOPING WORLD.

Sixty years ago, the researchers James Watson and Francis Crick earned scientific immortality with a publication detailing, for the first time, the structure of DNA. The discovery would help unlock the elemental secrets of life, and their work would later be honoured with a Nobel Prize. But the story has another, less well-known, dimension: Watson and Crick drew much from X-ray crystallographic images of DNA captured by Rosalind Franklin.

Even today, impassioned debate continues in some quarters on whether Franklin has received due credit for one of the defining discoveries of human history. But that may be emblematic for the field of crystallography: It has been an immensely powerful force over the past century, driving research that has advanced knowledge while generating countless billions of dollars in economic growth. And yet it is rarely a priority for governments and it is scarcely known by the public.

That is likely to change in the months ahead. Last year, responding to a proposal by Morocco, the United Nations declared 2014 as the International Year of Crystallography. UNESCO and the International Union of Crystallography (IUCr) are planning a range of scientific and public engagement events that seek to bring more visibility to this influential field. And many of the events will be focused on the developing world, said IUCr President G.R. Desiraju.

Crystallography "is easy to do, relatively inexpensive, extremely accurate, and generally independent of sophisticated infrastructure," Desiraju said in a recent

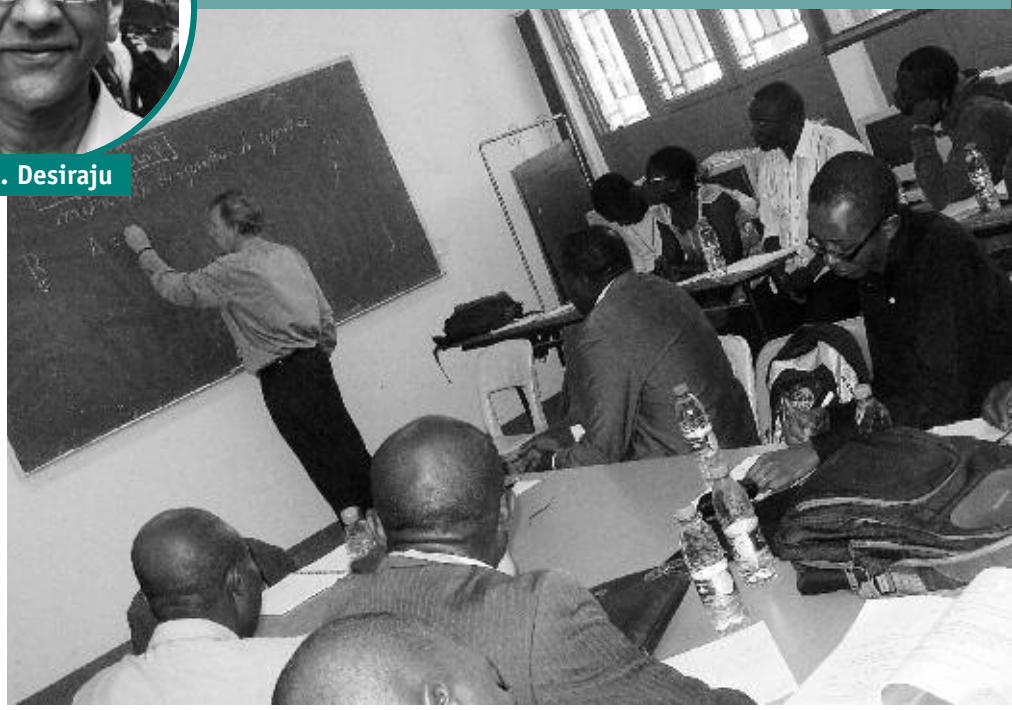


G.R. Desiraju

email interview. "Thus, in the developing world, it is the single most important technique that has led to a rapid increase in the number of quality publications in respected international journals.

"It provides training that fine-tunes desirable qualities such as precision and accuracy in scientific research, and encourages a quantitative bent of mind."

As a field of research, crystallography is a natural extension of human fascination with the symmetry seen throughout nature – in snowflakes, in minerals, and, with more powerful instruments, in the arrangement of atoms in a molecule.

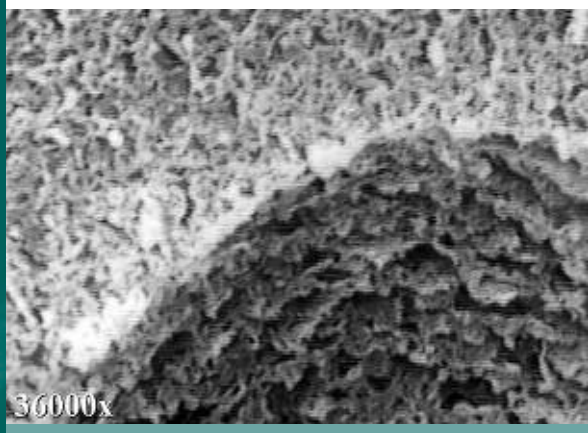


IUCr vice president Claude Lecomte (at the blackboard) teaching a crystallography workshop in Cameroon.

Next year marks the 100th anniversary of Max von Laue's Nobel Prize for the discovery of X-ray diffraction by crystals. In this process, X-ray beams can be fired at a crystalline material; by studying images of the diffraction patterns, researchers can "quickly get to the internal structure of matter", explained Desiraju, a 2002 TWAS Fellow. In 1953, Watson and Crick used Franklin's X-ray diffraction images to establish that DNA is a double-helix. Franklin, independently, had arrived at the same conclusion.

In contemporary applications, crystallography studies diffraction at an increasingly small scale, sometimes using X-rays generated by powerful synchrotron sources. Crystallography is essential in materials science; analysis of crystalline structures allows scientists and engineers to create new materials – pharmaceuticals, aerospace components, computer memory – that have considerable value in everyday life.

Though crystallography is not well known by the



Claude Lecomte

public, the Nobel Prizes are a clear reflection of its importance: Since 1900, 28 Nobels have involved crystallography, with six in the last 10 years – and in each of the last three years.

An IUCr delegation visited TWAS in March to discuss the Academy's support for the International Year of Crystallography. The delegation was headed by IUCr Vice President Claude Lecomte and also included Luc Van Meervelt, secretary general and treasurer of the IUCr; Michele Zema, project manager for the international year; and Jean-Paul Ngome Abiaga, assistant programme specialist with UNESCO's International Basic Sciences Programme in the Division of Science Policy and Capacity-Building.

Crystallography is essential in materials science, allowing scientists and engineers to create new materials.

"Crystallography should be a prime field for focus and investment by policymakers and educators in developing nations", TWAS Executive Director Romain Murenzi said after the meeting. "Nations that develop skill in this field create their own power – the power to address challenges in food production, clean water and health. That makes the International Year of Crystallography very important, and we look forward to working with Prof. Desiraju and his colleagues."

The organizers recognize the importance of crystallography for the developing world and will have a range of special programmes next year. The IUCr already funds the successful 'Crystallography in Africa' education and training programme; ambitious outreach is planned for Latin America and Asia as well.

"The generic pharmaceutical industry in India is a very good example as to how crystallography is being applied in the developing world, where there is much benefit for the common man", said Desiraju.

An opening ceremony for the International Year of Crystallography is scheduled for 20-21 January 2014 at UNESCO headquarters in Paris. Organizers are developing plans for crystallography labs situated in a hub country of different regions; students and young researchers from neighboring nations will be invited there to attend tutorials, hands-on experiments and workshops. The IUCr also will be holding summit meetings in Asia, Africa and Latin America, convening educators, industry researchers, policymakers, science administrators and others.

Desiraju is expected to discuss the plans in a speech to the TWAS General Meeting on 2 October in Buenos Aires. ■

Edward W. Lempinen

Learn more about the International Year of Crystallography at www.iycr2014.org.