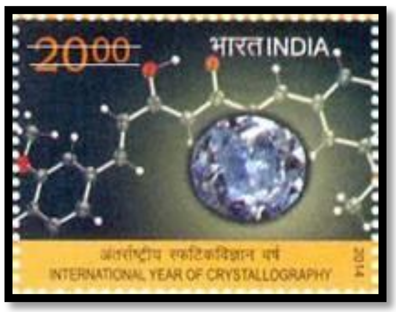
Crystallography meets philately

You cannot have an International Year without a commemorative stamp, so here is the first beautiful stamp issued by Indian Post to celebrate this International Year of crystallography.



Technical data of the Indian Post stamp

INTERNATIONAL YEAR OF CRYSTALLOGRAPHY

Crystallography is the study of crystals and of the determination of the internal structure of crystals using diffraction of X-rays, neutrons and electrons. Crystallography is a subject with many applications in physics, chemistry and biology. It is ever present in modern life in drug development, nanotechnology, biotechnology and in the development of new materials.

The year 2014 marks the centenary of the beginning of modern crystallography and its identification as the best tool for the structure determination of matter. To commemorate the outstanding achievements of crystallography and its contribution to humankind, the United Nations has designated 2014 as the International Year of Crystallography 2014 (IYCr2014).

The International Year of Crystallography 2014 commemorates not only the centennial of X-ray diffraction but also that it is 400 years since Kepler's observation in 1611 of the symmetrical form of ice crystals, which began the wider study of the role of symmetry in matter. The major objectives of the IYCr2014 are to increase public awareness of the science of crystallography, to foster international collaboration between scientists worldwide and to promote education and research in crystallography and its links to other sciences.

Department of Posts is issuing a stamp on IYCr2014 to propagate the achievements of crystallographers across the globe and underline the importance of this field to young scientists and the general public. The commemorative postage stamp depicts a diamond and the structure of curcumin, the active constituent of turmeric, as determined by X-ray crystallography. The diamond is known for its exceptional hardness and the flashes of light given off by its natural crystal structure. Curcumin is the compound responsible for the bright orange of turmeric. It is known to exhibit biological, pharmaceutical and wide-ranging pharmacological activities such as antioxidant, anti-inflammatory, antimicrobial and anticarcinogenic.

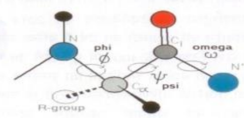
Department of Posts is happy to release a Commemorative Postage Stamp on the International Year of Crystallography.

Credits:-

Text	:	Based on the material furnished by the proponent
Stamp/FDC/ Cancellation	:	Alka Sharma

भारतीय डाक विभाग
Department of Posts India

अंतर्राष्ट्रीय स्फटिकविज्ञान वर्ष
INTERNATIONAL YEAR OF CRYSTALLOGRAPHY



विवरणिका
BROCHURE

अंतर्राष्ट्रीय स्फटिकविज्ञान वर्ष

स्फटिकविज्ञान, स्फटिकों तथा एक्स–रे, न्यूट्रान तथा इलेक्ट्रॉन के विवर्तन के माध्यम से स्फटिकों की आंतरिक संरचना के निर्धारण का अध्ययन है। स्फटिकविज्ञान एक ऐसा विषय है, जिसके भौतिक शास्त्र, रसायन शास्त्र तथा जीव विज्ञान के क्षेत्र में अनेक उपयोग हैं। औषधि विकास, नैनो प्रौद्योगिकी, जैव प्रौद्योगिकी तथा नए तत्वों के विकास के रूप में स्फटिकविज्ञान की आधुनिक जीवन शैली में सर्वत्र उपस्थिति है।

वर्ष 2014, आधुनिक स्फटिकविज्ञान के प्रारंभ की शताब्दी और तत्वों की संरचना के निर्धारण के लिए सर्वश्रेष्ठ माध्यम के रूप में इसकी पहचान का वर्ष है। स्फटिकविज्ञान की उत्कृष्ट उपलब्धियों और मानव जाति के प्रति इसके योगदान को रेखांकित करने के उद्देश्य से संयुक्त राष्ट्र ने वर्ष 2014 को अंतर्राष्ट्रीय स्फटिकविज्ञान वर्ष 2014 (आईवायसीआर 2014) के रूप में घोषित किया है।

अंतर्राष्ट्रीय स्फटिकविज्ञान वर्ष 2014, न केवल एक्स–रे विवर्तन की शताब्दी का वर्ष है बल्कि यह 1611 में केपलर के उस निष्कर्ष के 400 वर्ष पूरे होने का भी अवसर है जब उनके द्वारा बर्फ के स्फटिकों का सममित रूप होना बताया गया, जिसके परिणामस्वरूप तत्वों के सममित रूप की भूमिका का व्यापक अध्ययन प्रारम्भ हुआ। आईवायसीआर 2014 का मुख्य उद्देश्य स्फटिकविज्ञान के बारे में जन जागरूकता बढ़ाना, विश्व भर में वैज्ञानिकों के बीच अंतर्राष्ट्रीय सहयोग को बढ़ावा देना तथा स्फटिकविज्ञान के क्षेत्र में शिक्षा और अनुसंधान के साथ–साथ विज्ञान की अन्य विधाओं से इसके संबंध को प्रोत्साहित करना है।

डाक विभाग, आईवायसीआर 2014 पर एक डाक–टिकट जारी कर रहा है। इसका उद्देश्य विश्व भर के स्फटिक वैज्ञानिकों की उपलब्धियों का प्रचार–प्रसार करना तथा युवा वैज्ञानिकों के साथ–साथ आम जनता में इस क्षेत्र के महत्व को रेखांकित करना है। स्मारक डाक–टिकट पर एक हीरे तथा कर्कुमिन, जो कि हल्दी का सक्रिय तत्व है, की एक्स–रे स्फटिकविज्ञान द्वारा निर्धारित संरचना अंकित की गई है। हीरा अपनी असाधारण कठोरता तथा प्राकृतिक स्फटिक संरचना के कारण अपनी जगमगाती चमक के लिए जाना जाता है। कर्कुमिन वह यौगिक है, जिसके कारण हल्दी को उसका चमकदार नारंगी रंग प्राप्त होता है। यह अपने जैविक, औषधीय तथा व्यापक भेषज विज्ञान उपयोगों जैसे एंटी–आक्सिडेंट, सोजिश–रोधी, जीवाणु–रोधी और कैंसर जन्य–रोधी गुणों के लिए जाना जाता है।

डाक विभाग, अंतर्राष्ट्रीय स्फटिकविज्ञान वर्ष पर एक स्मारक डाक–टिकट जारी करते हुए प्रसन्नता का अनुभव करता है।

आभार :–

मूलपाठ	:	प्रस्तावक द्वारा उपलब्ध कराई गई सामग्री पर आधारित
डाक–टिकट / प्रथम दिवस आवरण / विरूपण	:	अलका शर्मा

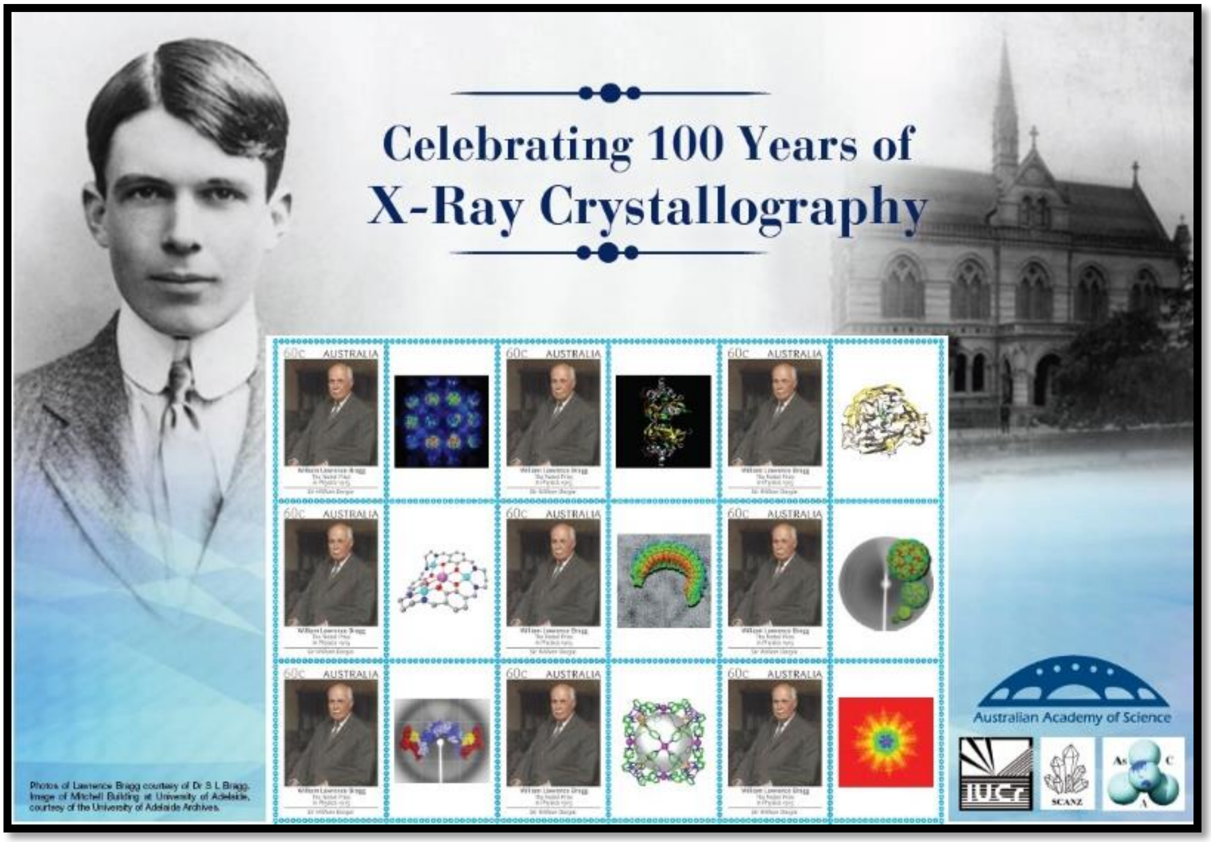
भारतीय डाक
India Post

तकनीकी आंकड़े
TECHNICAL DATA

जारी करने की तारीख Date of Issue	:	30 जनवरी, 2014 30 January, 2014
मूल्यवर्ग Denomination	:	2000 पैसा 2000 p
मुद्रित डाक–टिकटें Stamps Printed	:	4.1 लाख* 0.41 Million*
मुद्रण प्रक्रिया Printing Process	:	वेट ऑफसेट Wet Offset
मुद्रक Printer	:	प्रतिभूति मुद्रणालय, हैदराबाद Security Printing Press, Hyderabad

*एक लाख प्रस्ताव हेतु
*0.1 Million for proponent

मूल्य ₹ 5.00

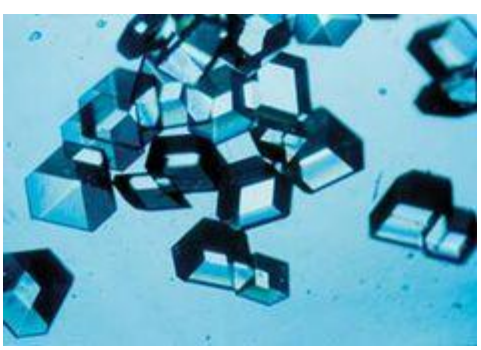


A special commemorative sheet produced by Australia Post was released on August 28, 2012

What's crystallography?

As defined by the International Union of Crystallography, crystallography is "the branch of science devoted to the study of molecular and crystalline structure and properties, with far-reaching applications in mineralogy, chemistry, physics, mathematics, biology and materials science".

Crystals of the substance being studied are prepared and then irradiated with X-rays. The resulting diffraction pattern is measured and interpreted, using Bragg's Law and other mathematical formulae, to generate an electron density map of the crystal contents.



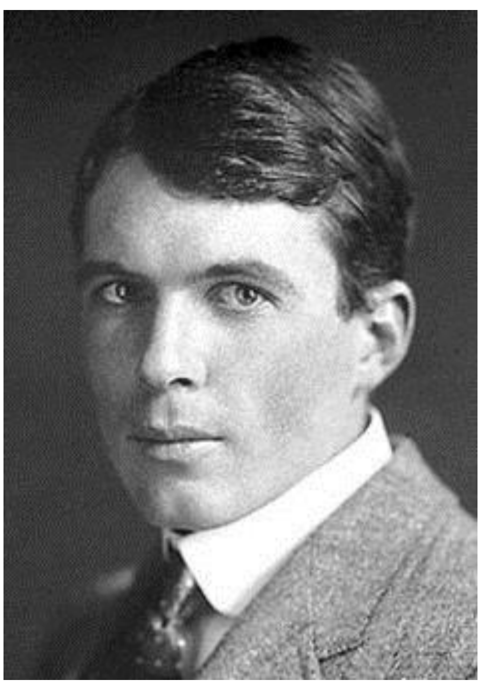
Insulin crystals

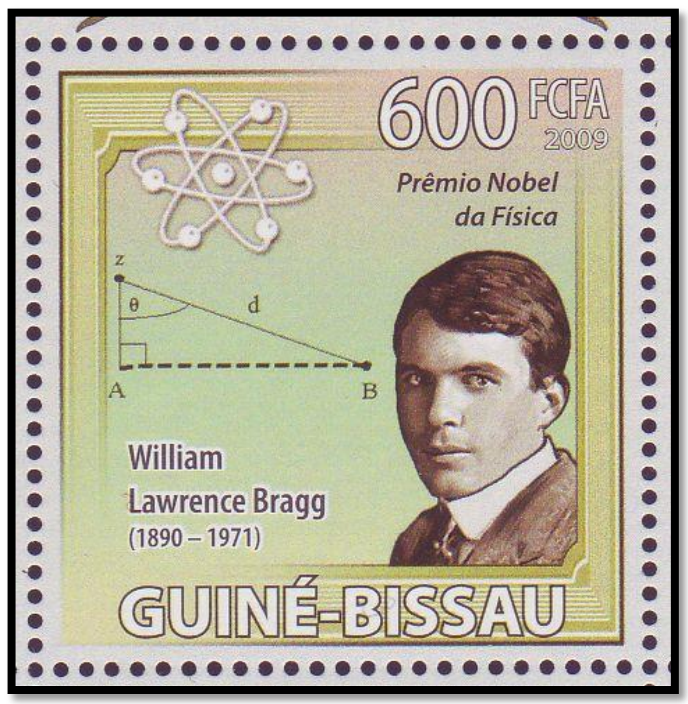
The map reveals the structure of the atoms forming the crystal, and both the map and the crystal structure can be visualised with high-end computer graphics software and hardware. Solving a new crystal structure and seeing it in 3D for the first time provides a thrill of discovery like no other.

Crystallography allows us to see our world at the level of the atom, by generating crystal structures that can be analysed and probed, and then used to design new and improved molecules.

The Braggs – of Bragg's Law fame – used crystallography to explain how sodium and chloride together form salt crystals and how carbon atoms interact to form diamond crystals. Others have used crystallography to discover how some materials repel water, how plants harvest light, how antibodies recognise pathogens, and how aspirin eases inflammation and pain.

In 1912 Lawrence Bragg, a young Australian working in Cambridge, made a key discovery that helped establish the field of crystallography. But we need to go back a few more decades to reveal the full and fascinating story of this brilliant Australian.



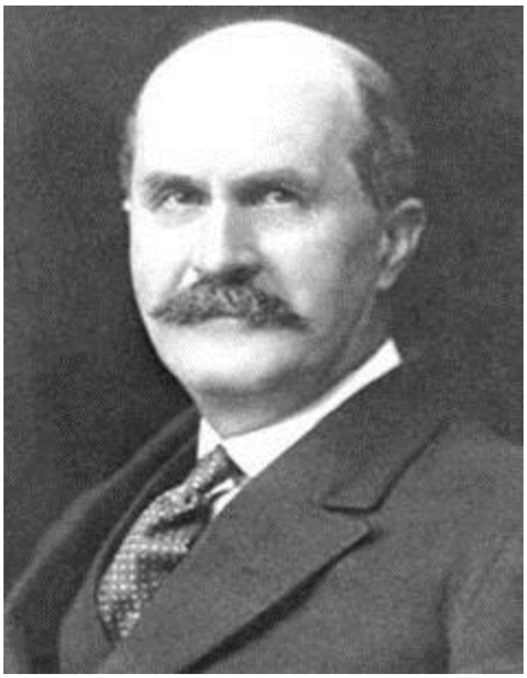


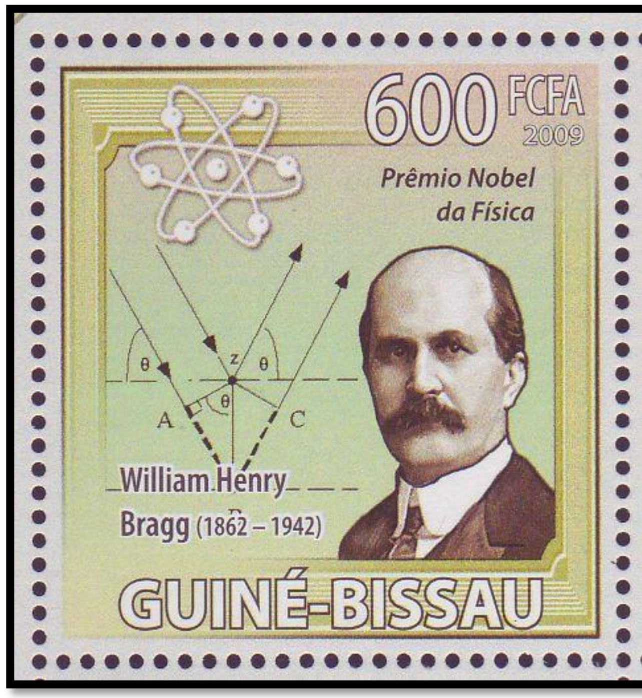
Lawrence Bragg

In 1886, Lawrence's father William Bragg, an Englishman educated at Trinity College Cambridge, took up the Professorship in Mathematics and Theoretical Physics at the University of Adelaide. He was 24 years old.

In Adelaide, he met and married a young Australian woman, Gwendolin Todd. Gwendolin herself came from a distinguished family because her parents were Charles and Alice Todd. Charles Todd directed the establishment of the overland telegraph between Adelaide and Darwin, a massive infrastructure and engineering undertaking that was the information superhighway of its day.

When completed in 1872, messages that in the past would have taken months to reach their recipients arrived in just 24 hours. Not surprisingly, Charles and Alice Todd were well-loved and highly respected members of the Australian community: their names have been commemorated in the city of Alice Springs and the River Todd.



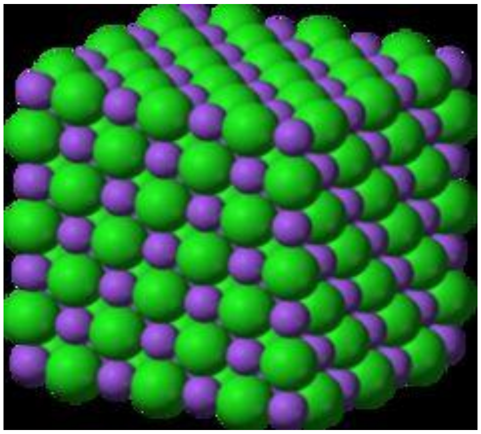


Sir William Henry Bragg

Lawrence Bragg was born into an extraordinary family in 1890, the eldest of three children to William and Gwendolin. He was exceptionally bright; finishing high school at St Peter's College Adelaide aged 14, and completing the equivalent of an Hons degree in science at Adelaide University in three years.

In 1908, his father William Bragg accepted the position of Chair of Physics at Leeds University, and the family moved with him in 1909 to the UK. Lawrence, aged 19, studied at Trinity College Cambridge for a second undergraduate degree in Natural Sciences. He graduated with first class honours in June 1912, aged 22.

At around the same time in Germany, physicist Max von Laue discovered that when X-rays were shone through a crystal of copper sulphate, the crystal acted like a grating and produced a diffraction pattern that could be measured on photographic film.



The Crystal structure of table salt

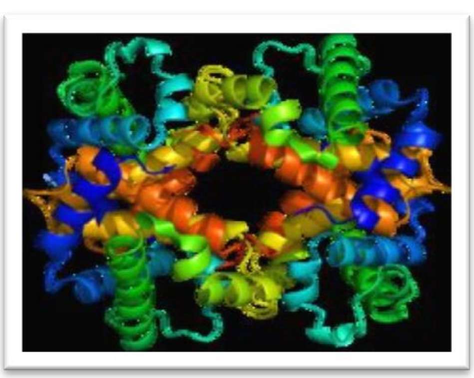
Max von Laue was awarded the 1914 Nobel Prize in Physics for this discovery. The significance of his work was that the diffraction pattern held the key to understanding the structure of the atoms forming the crystal. If the relationship between diffraction pattern and the atomic structure could be established, the secrets to the structure of matter would be revealed.

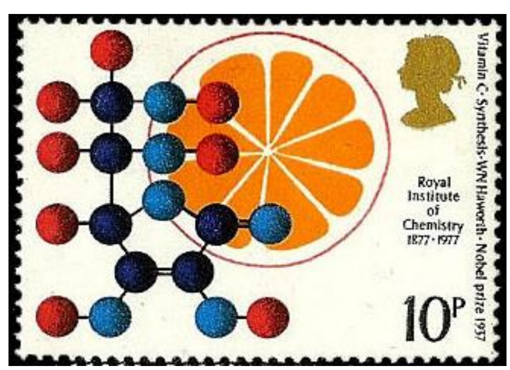
Lawrence Bragg discussed von Laue's work with his father in the European summer of 1912. Back in Cambridge, he derived the formula that underpins the field of crystallography, and presented his findings at the November 1912 meeting of the Cambridge Philosophical Society.

Subsequently, he and his father applied the formula - now known as Bragg's Law - to solve the first crystal structures, rock salt (sodium chloride), diamond, potassium chloride and many others.

War and turmoil

In 1914 war broke out in Europe and scientific research was halted. In August 1915, Lawrence was posted to France where he developed sound ranging methods for pinpointing enemy artillery positions – work for which he was later awarded a military cross and an OBE.





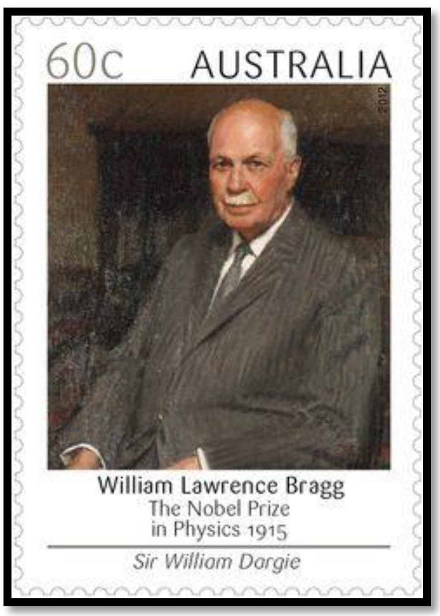
Hemoglobin, alpha

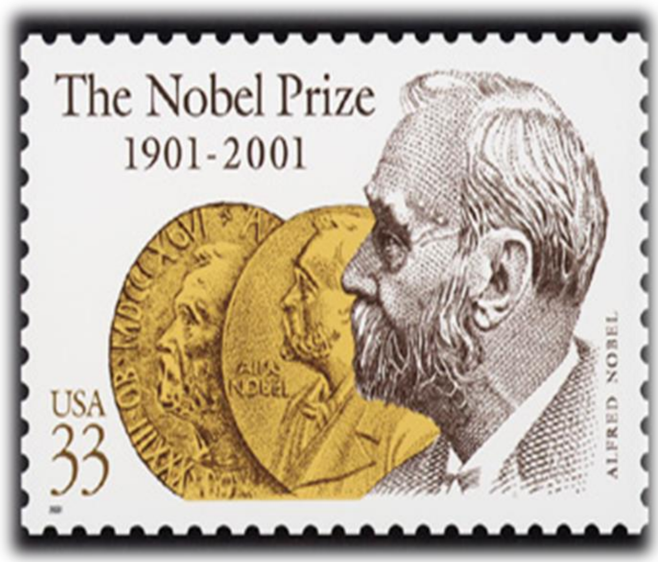
That same August, Lawrence's younger brother Bob was posted to Gallipoli, where he died a few weeks later.

Barely two months after that, Lawrence - aged 25 - and his father William were awarded the 1915 Nobel Prize in Physics for their analysis of crystal structures. One can hardly imagine the emotions the family must have been going through at the time.

In 1938, Lawrence was appointed Cavendish Professor of Experimental Physics at Cambridge where he initiated studies on biological molecules.

He recruited Francis Harry Compton Crick and James Dewey Watson - later awarded the 1962 Nobel Prize in Physiology or Medicine for their discoveries relating to nucleic acids – and Max Ferdinand Perutz and John Cowdery Kendrew – awarded the 1962 Nobel Prize in Chemistry for determining the first protein crystal structures, those of haemoglobin and myoglobin.

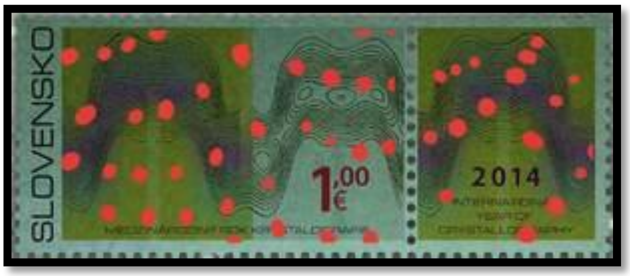




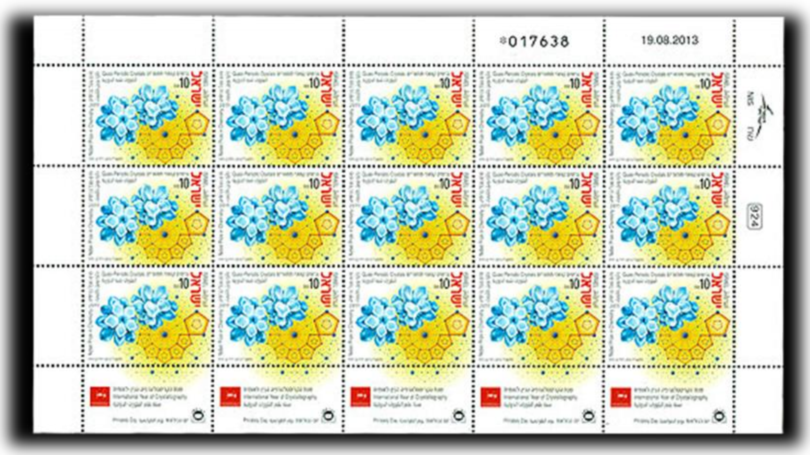
In 1912, no-one could have imagined Lawrence's discovery of Bragg's Law and its application to crystal structure determination would one day lead to the structures of proteins, structure-based drug design and structural genomics, let alone to the crystal structures of challenging membrane proteins. Yet these are but a few of the many direct consequences of Bragg's groundbreaking work a century ago.

Though few Australians know about this extraordinary man, our first Nobel Laureate, and the prize's youngest ever recipient, momentum is building. A public symposium is planned in Adelaide for December this year. And before this, in August, Australia Post will release a series of five stamps honoring our early Nobel laureates. One of these – pictured above right – will feature Lawrence Bragg

Worldwide commemorative stamp issued by various postal departments around world to celebrate this International Year of crystallography.



Slovak Post

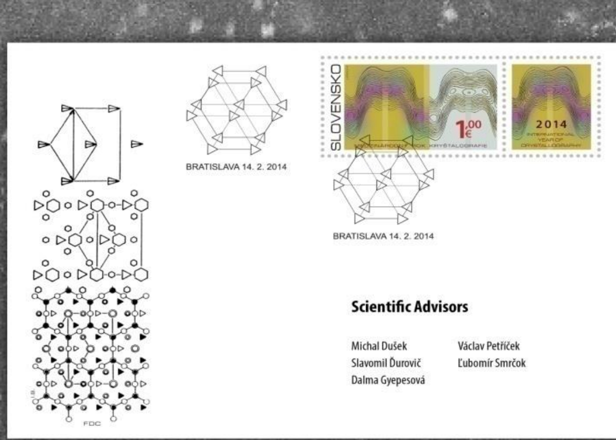


Israel Post

The Swiss Postal Service **Die Post** will issue two postage stamps on 6 March 2014 to mark the International Year of Crystallography. The stamps show natural crystals of the minerals epidote and amethyst.

Royal Mail will commemorative one stamp to celebrate the 350th anniversary of the Royal Society. The stamp celebrates the advances in X-ray crystallography Professor Hodgson

INTERNATIONAL YEAR OF CRYSTALLOGRAPHY



Date of issue: February 14, 2014
Design of Stamp and FDC: Igor Benca
Design of Commemorative Cancellation: Adrian Ferda
Print: Postal Printing House of Securities Prague
Printing Method: Offset with UV protective layer
Print Run: 300 000 pcs

Issue of postage stamp devoted to the International Year of Crystallography is very good occasion to popularize new discoveries in this field of research. One of the basic thoughts in the search for a crystal structure is a presumption of its symmetry and of the periodic arrangement of its basic building elements – atoms, eventually molecules.
Since we live in three-dimensional space, we intuitively and usually correctly understand three-dimensionally ordered structures. However, improving experimental methods allowed us to discover that there is an important group of solids that deviate from this strict rule, while their properties are related to seemingly negligible deviations from the well-established order.

With the help of electron density isolines in the Ta-Ge-Te alloy crystal the postage stamp shows that instead of the expected placement on the straight line, atoms positions are modulated so that they create a crenel, which ultimately results into the change of substance's properties. The motive depicted on the First day cover (FDC) shows such usage of symmetry that abstracts (from bottom to top) from a specific atoms arrangement in a kaolinite structure to symbolic schemes of OD theory that reflecting the laws of symmetry, lead to simplified and more understandable presentation. Design of FDC cancellation represents a fragment of such a structure.
On the Commemorative sheet issued along with FDC is a depiction of Laue's diagram of a chromium compound crystal with a threefold symmetry axis in line with the primary X-ray beam. UV protective layer printed on postage stamp is derived directly from Laues's diagram depicted on Commemorative sheet which is finally stamped by commemorative cancellation dedicated to honour of Max von Laue.

Dorothy Crowfoot Hodgkin

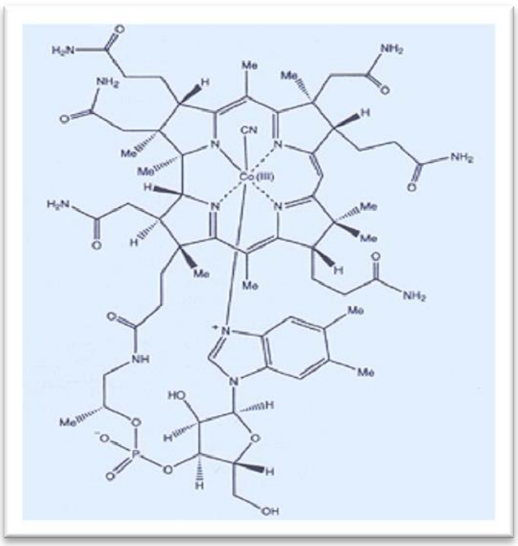
Dorothy Crowfoot Hodgkin was honored on this postage stamp issued in the United Kingdom.

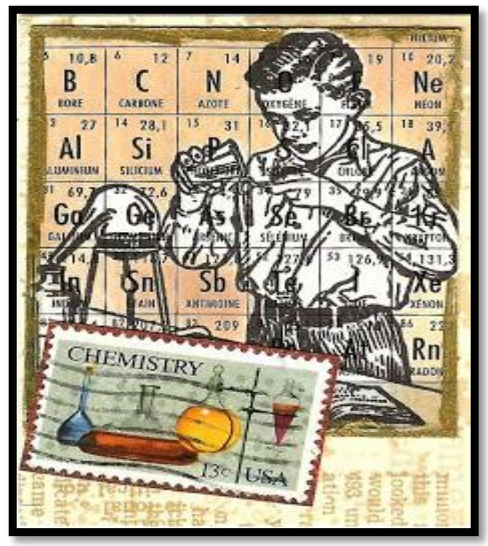
In the late 1930s Dorothy Crowfoot Hodgkin (1910–1994) became a leading practitioner of the use of X-ray crystallography in determining the three-dimensional structure of complex organic molecules. In the 19th and well into the 20th century, chemists like Emil Fischer conducted long and tedious chemical reactions and degradations to gain clues about the three-dimensional structures of molecules and then performed syntheses to test their deductions. About the same time as Hodgkin was beginning her work in X-ray crystallography, chemists were also examining spectra from spectroscopes descended from the mid-19th-century invention of Robert Bunsen and Gustav Kirchhoff, not just to analyze for elemental content, but to gain structural information about molecules.

Hodgkin was born in Cairo, Egypt, to English parents, John and Grace Crowfoot. Although her formal schooling took place in England, she spent a significant part of her youth in the Middle East and North Africa, where her father was a school inspector. Her parents were authorities in archaeology, and she may have followed the family vocation but for a childhood fascination with minerals and crystals. She enjoyed using a portable mineral analysis kit to analyze pebbles that she and her sister found in the stream running through the family garden in Khartoum, Sudan. When she was 15, her mother gave her Sir William Henry Bragg's *Concerning the Nature of Things* (1925), which contained intriguing discussions of how scientists could use X-rays to "see" atoms and molecules.

At Somerville College, Oxford, she studied physics and chemistry and chose to do her fourth-year research project on X-ray crystallography. She had to crystallize the substance under study, shoot X-rays at the crystal, and then study the way the X-rays were diffracted off the planes of the crystal's structure. The technique, which involves a lot of mathematical analysis, was developed by Bragg and his son, William Lawrence Bragg, who shared the 1915 Nobel Prize in physics for their work. Yet X-ray crystallography was still a relatively new technology with many challenges and hence opportunities for research when Hodgkin entered the field.

After graduation she studied at Cambridge with John Desmond Bernal, who had worked for five years with the senior Bragg. She and Bernal collaborated successfully, using X-ray crystallography to determine the three-dimensional structure of several complex organic molecules important to the functioning of living organisms. (The Braggs had worked primarily with inorganic molecules while developing their methods.) In 1937 she received her Ph.D. from Cambridge—the same year she married Thomas L. Hodgkin, who became an authority on African history. Both Hodgkins held academic appointments at Oxford, and they raised their three children there with the help of the Hodgkin grandparents.

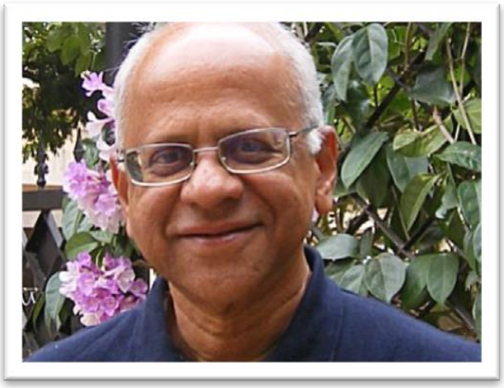


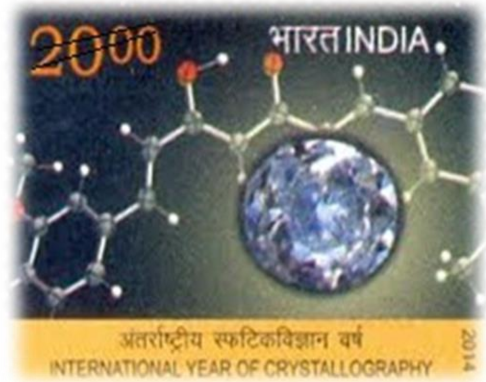


The molecular structure of vitamin B_{12}, which Dorothy Hodgkin determined using X-ray crystallography.

Hodgkin’s most significant scientific contributions were the determination of the structures of penicillin, insulin, and vitamin B_{12}. In 1964 she won the Nobel Prize in chemistry “for her determinations by X-ray techniques of the structures of important biochemical substances.” She was the third woman ever to win the prize in chemistry (after Marie Curie and Irène Joliot-Curie).

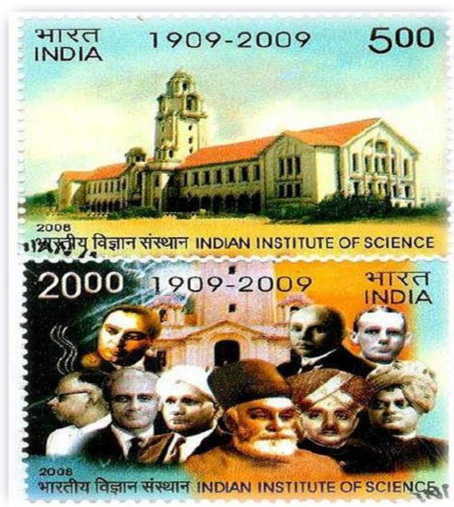
Hodgkin is fondly remembered by her research students, which included many women. She was also involved in a wide range of peace and humanitarian causes and was especially concerned for the welfare of scientists and people living in nations defined as adversaries by the United States and the United Kingdom in the 1960s and 1970s—for example, the Soviet Union, China, and North Vietnam. From 1976 to 1988 she was chair of the Pugwash movement, which was originally inspired by the concerns voiced in 1955 by Albert Einstein and the philosopher-mathematician Bertrand Russell that work by scientists—such as the creation of the hydrogen bomb—would lead to conflict and needed the insights of and input from the world's scientists. Later the Pugwash conferences dealt with other potential dangers raised by scientific research.





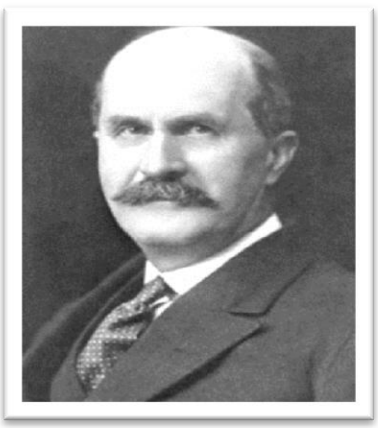
Professor Gautam Radhakrishna Desiraju,
Indian Institute of Science, Bangalore,

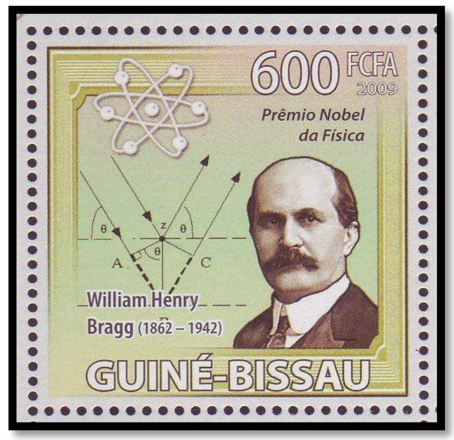
Professor **Gautam Radhakrishna Desiraju** (born August 21, 1952) is an Indian chemist who works in the Solid State and Structural Chemistry Unit of the Indian Institute of Science, Bangalore. He works in the area of structural chemistry and crystal engineering. Desiraju has played a major role in the development of crystal engineering for nearly three decades. He, among others, has been responsible in recent times for the acceptance of the theme of weak hydrogen bonding in structural and supramolecular chemistry. His books on crystal engineering (1989)[and on the weak hydrogen bond in structural chemistry and biology (1999)are especially notable. He has co-authored a textbook in crystal engineering (2011).[He is one of the most highly cited Indian chemists and has been recognised by a number of awards such as the Alexander von Humboldt Forschungspreis and the TWAS award in Chemistry. He was elected President of the International Union of Crystallography for the triennium 2011-2014



Indian Institute of Science is a premier university for scientific research and higher education located in Bangalore, India. Established in 1909 with active support from Jamshetji Tata it is also locally known as the "Tata Institute"

The Crystallography Interactive Timeline

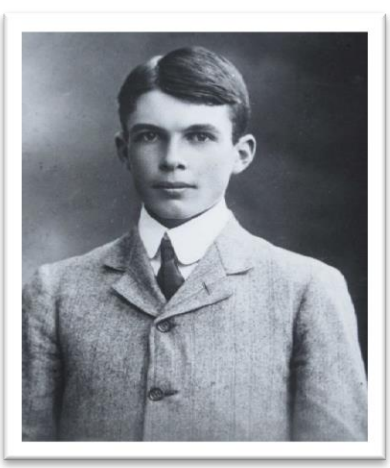


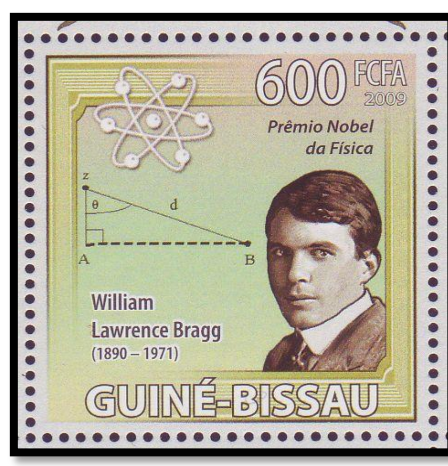


July 2, 1862

William Henry Bragg Born

W.H Bragg is born in Westward, Cumberland (England) to Robert John Bragg, and Mary Nee Wood.





March 31, 1890

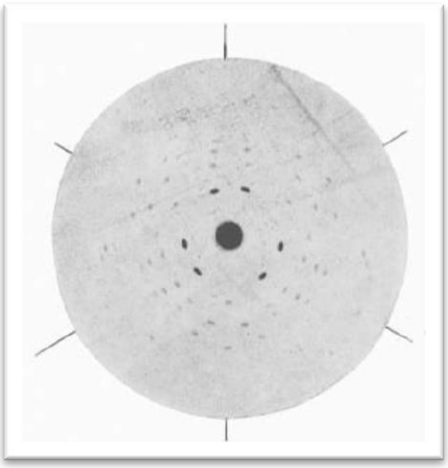
William Lawrence Bragg Born

W. L. Bragg (Lawrence Bragg) is born to W. H. Bragg, and Gwendoline Todd in Adelaide

December 1904

'Alpha Rays' and Radium

W. H. Bragg publishes his paper 'On the Absorption of Alpha Rays and on the Classification of the Alpha Rays from Radium' having been given a sample of Radium Bromide following an address to the Australasian Association for the Advancement of Science earlier in the year.

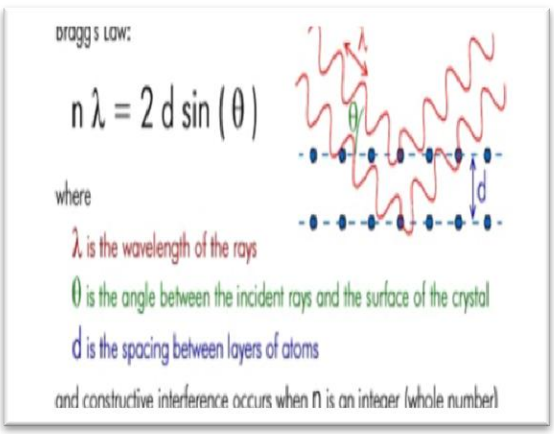


June 1912

Max von Laue

X-Ray Diffraction by Crystals Demonstrated

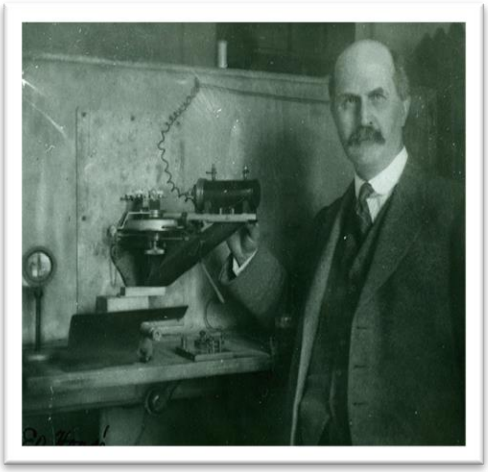
In June 1912, Max von Laue, Walter Friedrich and Paul Knipping demonstrate and confirm the nature of X-rays as waves by demonstrating their diffraction by crystals of Copper Sulphate and Zincblende.

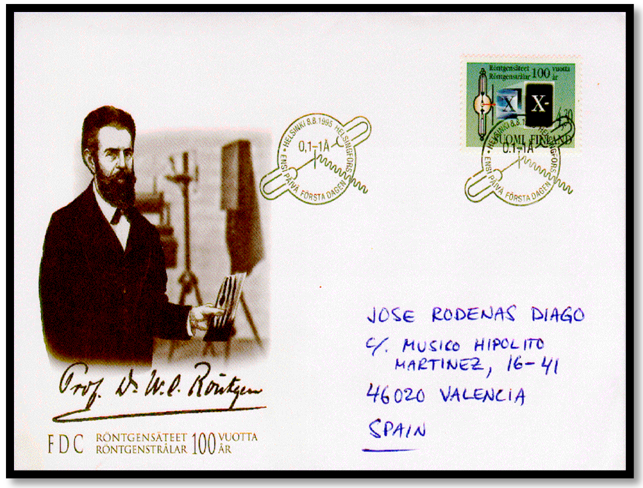


November 1912

Braggs Law Published

After returning to Cambridge, Lawrence Bragg set about determining an explanation of the different reflective strengths of diffraction within a crystal of Zincblende. This work lead to the development of Braggs Law, which is a cornerstone of X-ray crystallography

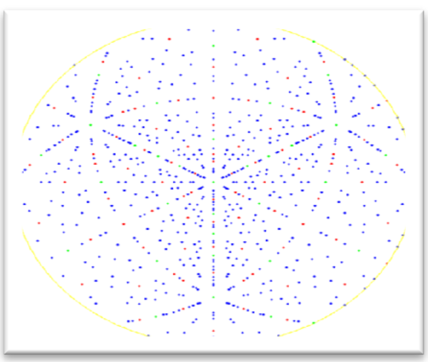




January 1913 — December 1913

William Bragg Builds the First X-ray Spectrometer

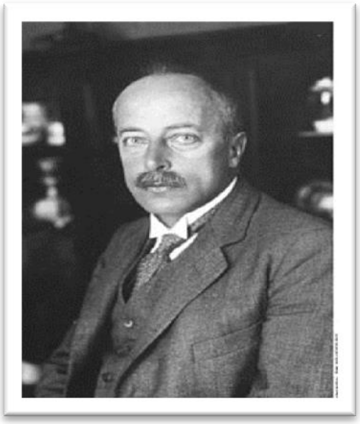
Building on the experiments carried out by his son, William Bragg builds the first X-ray Spectrometer at Leeds. The spectrometer not only allowed the X-rays to be directed at the crystal face from any angle, it also allowed the intensity of the reflected X-rays to be determined



July 1913

William Bragg Determines the Structure of Diamond

Using the newly developed X-ray Spectrometer, William and Lawrence Bragg determine and publish the crystal structure of Diamond; the first organic compound to be characterised using the new technique.



October 1914

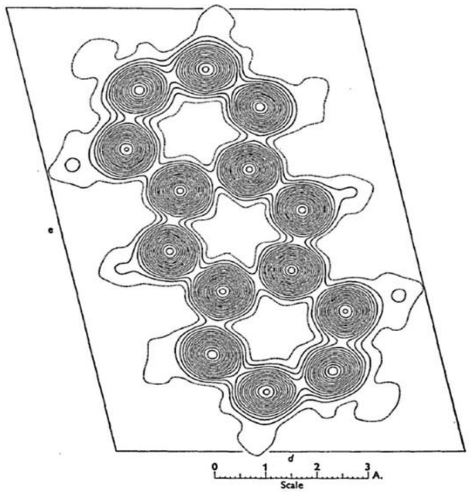
Laue Wins the Nobel Prize

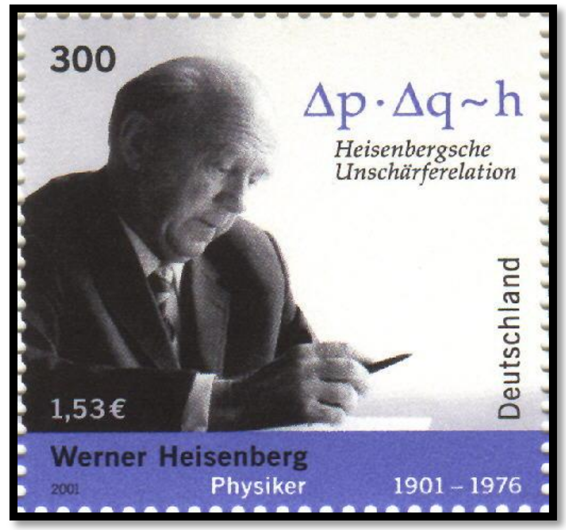
Max von Laue wins the Nobel Prize for Physics for the discovery of the 'Diffraction of X-rays by crystals'.

October 1915

Father and Son share the Nobel Prize

W. H. and W. L. Bragg share the Nobel Prize for Physics "for their services in the analysis of crystal structure by means of X-rays". This covering their development of the X-ray spectrometer, and the subsequent development of X-ray spectra, X-ray diffraction, and crystal structure determination techniques. At 25, Lawrence Bragg is still the youngest person to win a Nobel Prize.

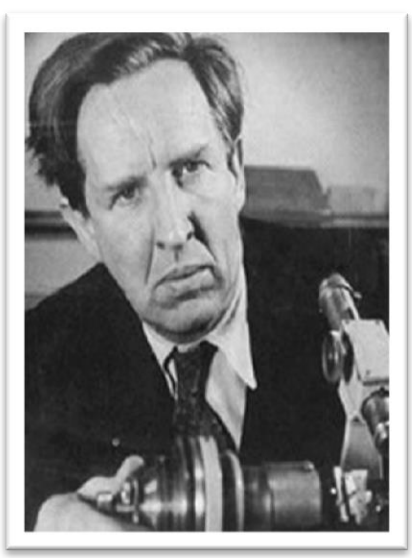




1921

W.H. Bragg Solves two other Organic Compounds

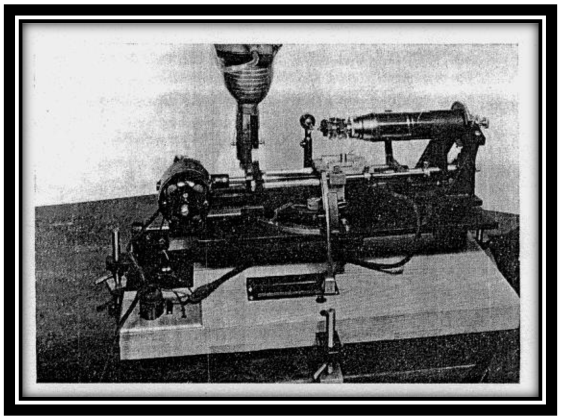
William Bragg uses the bonds found within his previously determined structure of diamond in order to examine the structures of Naphthalene and Anthracene - two other organic molecules.



1924

J D Bernal Solves the structure of Graphite

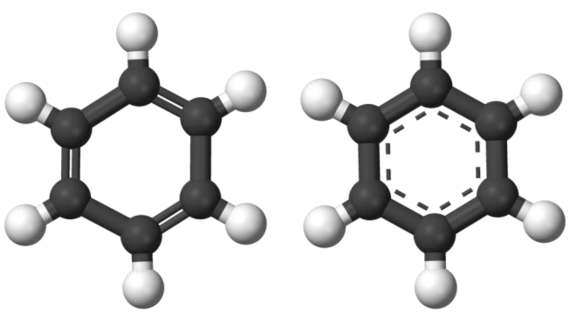
While working under the supervision of William Bragg at the Royal Institution, John Desmond Bernal determines the structure of Graphite, one of the naturally occurring forms of Carbon.



1926

Bernal standardises the use of the Weissenberg Camera

The Weissenberg camera allowed the simultaneous acquisition of large amounts of diffraction measurements; speeding up the process of gathering enough data for accurate two dimensional Fourier analysis of organic crystals.

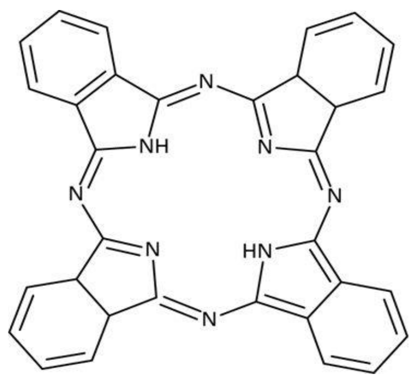


molecular formula of benzene.

1929

Kathleen Lonsdale Proves the structure of Benzene

Having worked at the Royal Institution with William Bragg, Kathleen Lonsdale moved to Leeds with her husband. While there, she used two dimensional Fourier analysis alongside X-ray spectroscopy to determine the structure of hexamethyl benzene - ending a controversy which had lasted from 1865 by proving that Kekule was correct in his planar structure of benzene.



1932

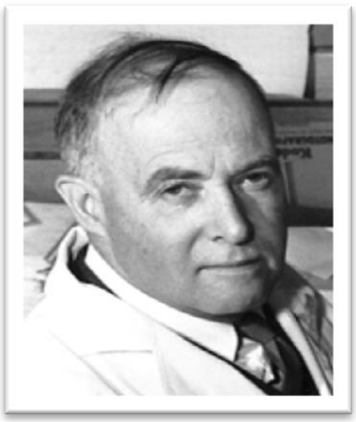
Robertson et al determine ever more complex Crystal Structures

John Monteath Robertson et al first refine the structures of Anthracene and Naphthalene suggested by William Bragg, and then go on to characterise the structures of many other organic molecules of increasing complexity - ending with the determination of the structure of phthalocyanine. These structures had largely been described by organic chemists; however, the new analysis allowed the accurate determination of bond angles and bond lengths.

1942

Cholesterol Iodide structure solved accurately by Crystallography

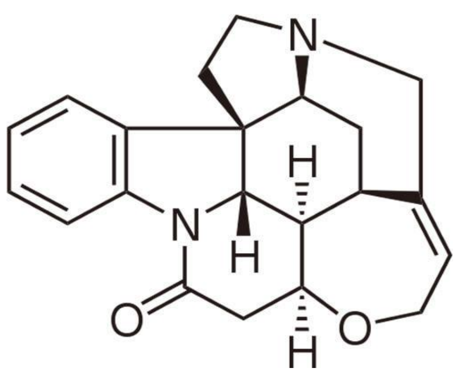
Despite the structure of cholesterol being largely determined by chemical techniques, an accurate, detailed structure was first provided by crystallography, through the work of Harry Carlisle and Dorothy Crowfoot Hodgkin.

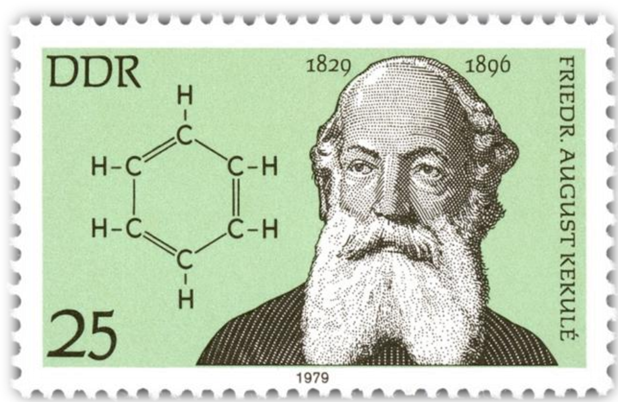


1946

Nobel Prize for Protein Crystals

James B. Sumner wins the Nobel Prize for Chemistry, after demonstrating that it was indeed possible to crystallise a protein.



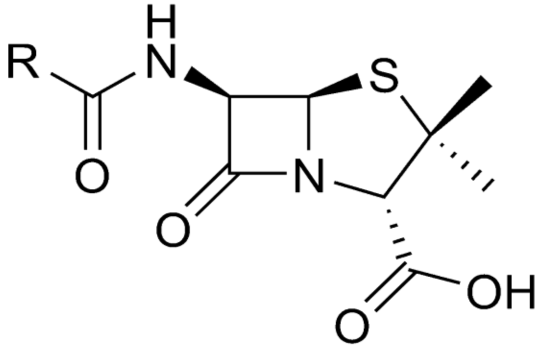


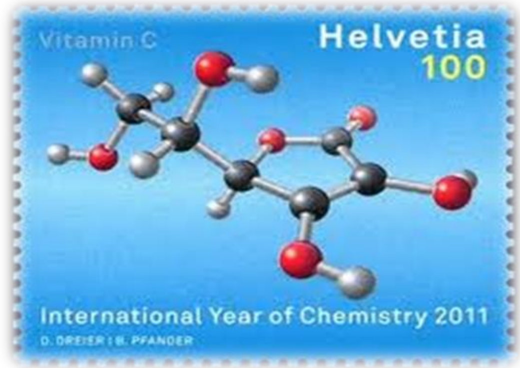
The Structure of Strychnine

1948

Race to solve the structure of Strychnine

Having started work on the determination of the structure of Strychnine in 1947, Bijvoet published a precise structure in 1948; unfortunately for him, the structure had just been published by Sir Robert Robinson, who had used chemical methods to determine between two possible alternatives.



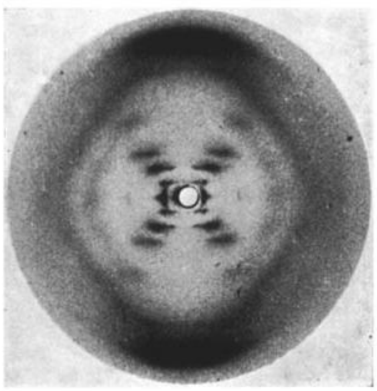


The Structure of Penicillin

1949

Investigation into the Structure of Penicillin

Although Dorothy Hodgkin and coworkers had determined the structure of penicillin by 1945, the work was not published until 1949. This work was important, as it showed that the structure contained a beta-lactam ring system - this contradicted the widely held view of the structure at the time.

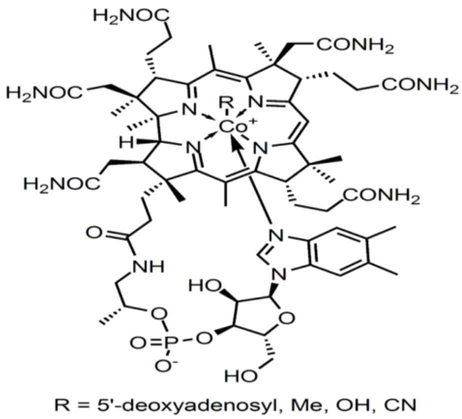


Double helix structure of DNA

1953

Crick and Watson publish their hypothesis on DNA structure

Although not officially credited with taking part in the work, Rosalind Franklin had taken X-ray diffraction images of DNA and suggested the helical structure prior to the publishing of the work by Watson and Crick. The images she had taken were shown to Watson and Crick without her knowledge or approval, and in fact, Francis Crick later acknowledged that it was her data that was 'the data we used' to develop the hypothesis.

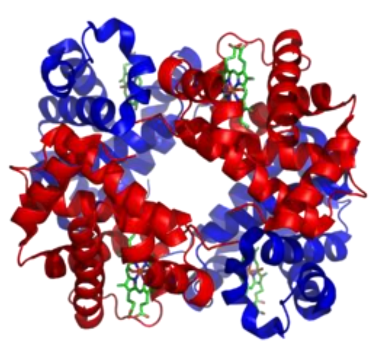


The Structure of Vitamin B12 (Cobalamine) the most structurally complex of all vitamins

1957

Structure of Vitamin B12 Solved Purely by Crystallography

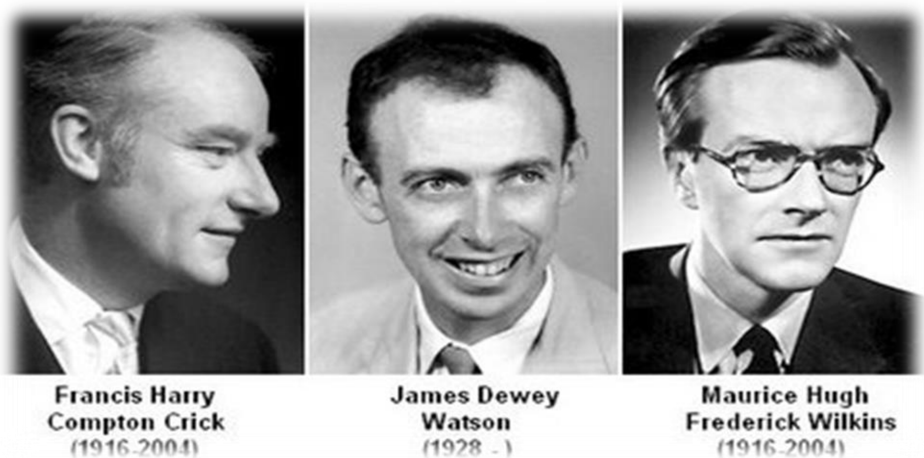
After 8 years of collaborative work, Dorothy Crowfoot Hodgkin et al publish the completed structure of Cobalamin; a feat which had eluded chemists due to the potentially misleading chemical evidence available at the time.



1962

Protein Crystallographers win the Nobel Prize

John Kendrew and Max Perutz win the Nobel Prize for Chemistry for their determination of the structures of Myoglobin and Haemoglobin using the technique of X-ray crystallography. These are important discoveries, as these molecules are responsible for the delivery of oxygen around the body.



1962

Watson, Crick and Wilkins awarded Nobel Prize for work on DNA

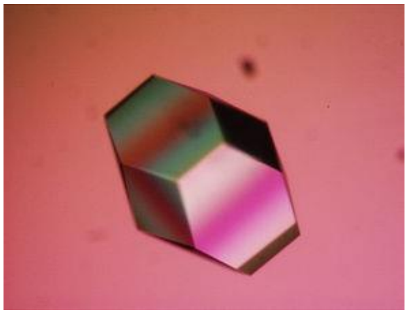
Despite the hypothesis of the structure of DNA being inspired by the work of Rosalind Franklin, she did not win the Nobel Prize in 1962 alongside Watson, Crick, and Wilkins. Unfortunately, the prize was awarded after her death in 1958, meaning she was ineligible.

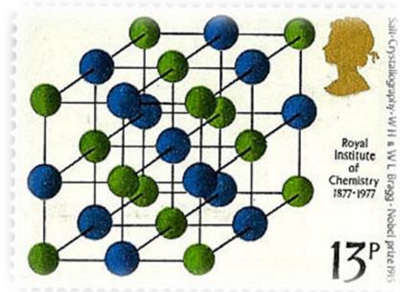
Dorothy Crowfoot Hodgkin

1964

Dorothy Hodgkin wins the Nobel Prize

The Nobel Prize for Chemistry was awarded to Dorothy Hodgkin for 'her determinations by X-ray techniques of the structures of important biochemical substances'

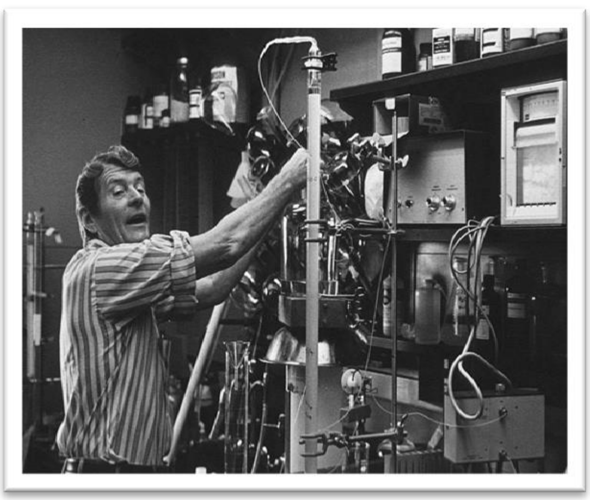


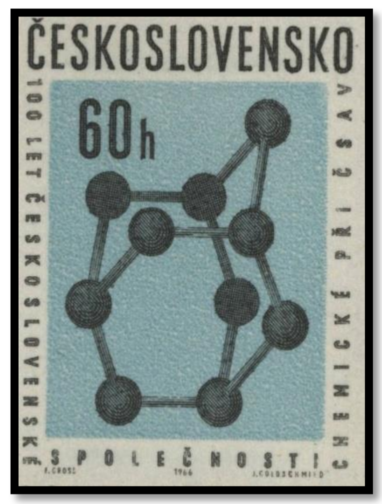


1965

Structure of Lysozyme solved by Crystallography

The research group of Lawrence Bragg at the RI (including David Phillips, Louise Johnson, and A.C.T North, et al) characterise the structure of the enzyme Lysozyme via crystallography; announcing the discovery at the Royal Institution. Lysozyme can be found in various forms, and had been studied previously by Alexander Fleming due to its mild antibiotic properties.





1972

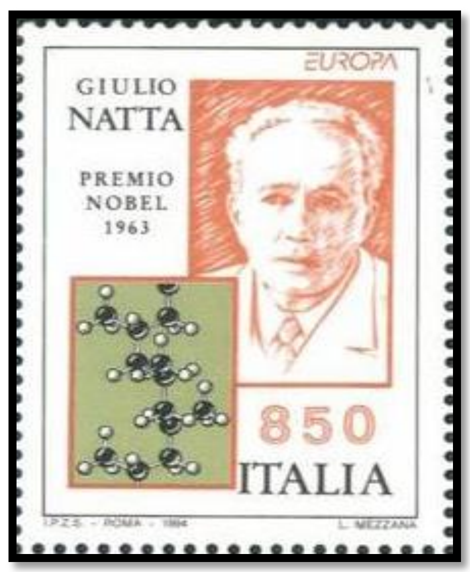
Nobel Prize for work on Protein Chain folding

Christian Anfinsen, Stanford Moore, and William Howard Stein share the Nobel Prize for Chemistry. Anifnsen is noted as having 'collaborated closely' with the crystallographic group of Professor Cotton at M.I.T during his later studies on a nuclease of Staphylococcis Aureus

1988

Crystallography characterises a Photosynthesis Site

In 1984, Johann Deisenhofer, Robert Huber and Hartmut Michel solve the first structure of a membrane protein, and also the first of a Photosynthetic reaction site. This structure was the most complex to be solved by Crystallography thus far.



1994

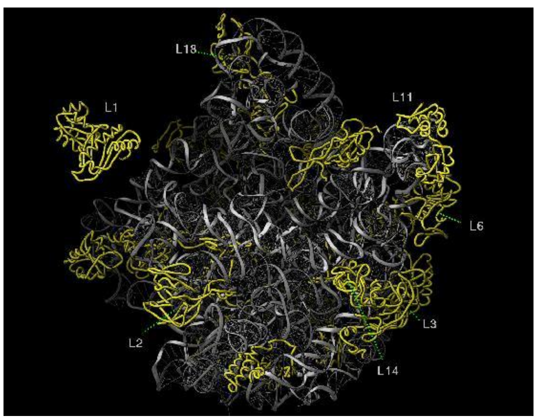
Neutron Diffraction developed and wins the Nobel Prize

Neutron Diffraction - a new technique which allows the position of nuclei within a structure to be determined directly - leads to Bertram N. Brockhouse, and Clifford G. Shull being awarded the Nobel Prize for Physics this year.

2007

UK National Synchrotron 'Diamond Light Source' Opens

A state-of-the-art third generation synchrotron, the Diamond Light Source is the facility which sees a great proportion of Crystallography research in the UK. Currently, it has 22 'beamlines' (discreet experimental set-ups run by principle scientists) with approval for another 10 to be in operation by 2017

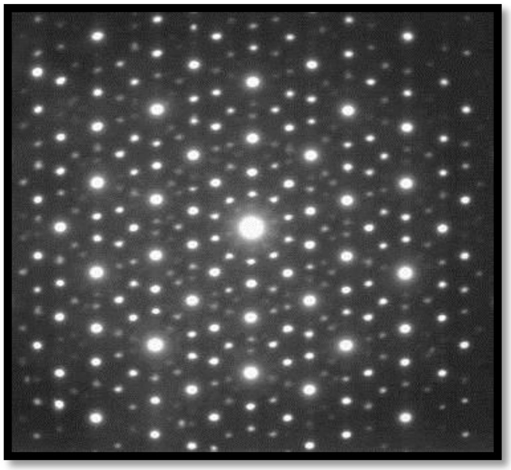


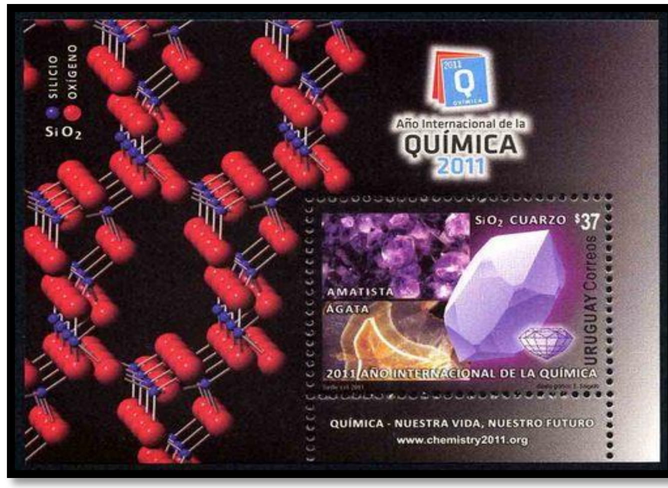
A representation of the structure of the Ribosome

2009

Nobel Prize for the structure of the Ribosome

Ada E. Yonath, Thomas A. Steitz, and Venkatraman Ramakrishnan win the Nobel Prize for their joint work in the characterisation of the Ribosome - One of the most important pieces of cellular machinery - via the use of Crystallographic techniques (among others).

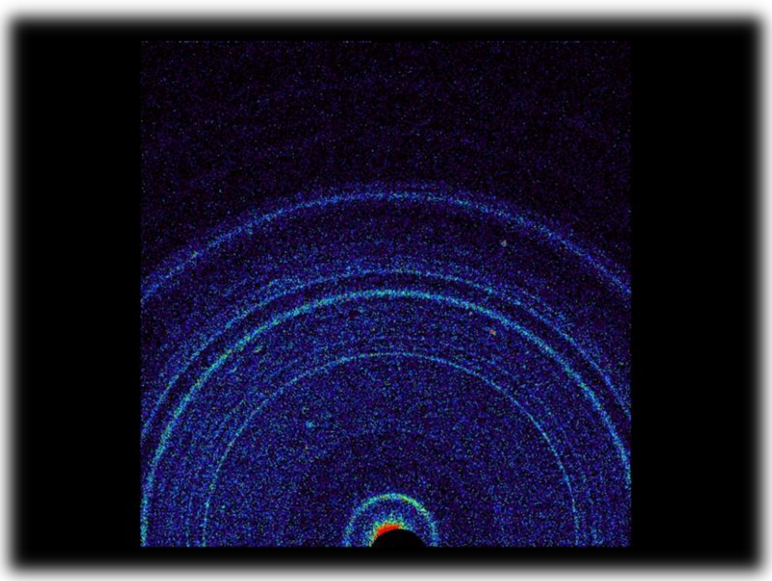




2011

Quasicrystals win the Nobel Prize

A new crystal form containing a type of symmetry previously thought impossible was observed in 1982 by Dan Shechtman who wins the Nobel Prize for Chemistry for his discovery this year.

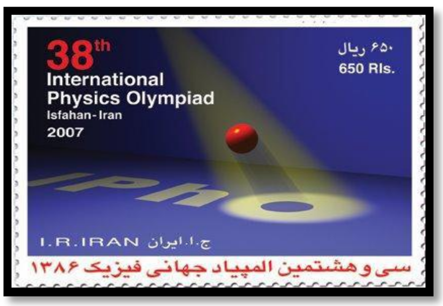


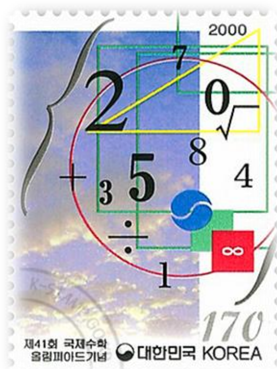
Crystallography on Mars

The NASA Curiosity rover (Mars Space Laboratory) uses a bespoke lightweight X-ray diffractometer to analyse the martian soil; coming to the conclusion that it resembles the soils of Hawaii.

Celebrating Crystallography

Bragg Centenary 1913 – 2013





2013

100 Years of Crystallography

100 years after the discovery of X-rays and X-ray diffraction, 28 Nobel Prizes have been awarded to scientists working on, or utilising this technique... But how many more will follow?

Future Crystallography

2018

ESA Exo-Mars Mission Launches?

The European Space Agency (in partnership with Roscosmos) plan to land a new Mars rover in 2018, looking for signs of life on the Red Planet. The Rover will be equipped with the latest in miniaturised X-ray diffraction technology, designed to help it analyse samples from up to 2 metres below the surface, collected with its drill.

After reading The History of Crystallography through philately, we hope you will be encouraged to buy stamps and use them to send letters to near & dear and save philately