THE TWO BRAGGS

AN EXHIBITION CELEBRATING THE CENTENARY OF THEIR WORK

In the spring of 1912 Max Laue together with Paul Knipping and Walter Friedrich in Munich demonstrated diffraction of x-rays by crystals, but it was the work of William Henry Bragg (WHB) and his son William Lawrence Bragg (WLB) who showed how to interpret the diffraction patterns in order to derive for the first time the atomic structures of crystals. Nobel Prizes were awarded to Laue in 1914, and to the two Braggs in 1915. To date WLB remains the youngest Nobel award winner ever.

WHB was originally convinced that x-rays were particle-like in nature, and so, with his son, he set about showing how Laue's patterns could be explained by particles travelling along 'avenues' within the crystals. However, WLB became convinced that x-rays consisted of waves rather than particles

It was on November 11th 1912 that WLB had his famous paper read to the Cambridge Philosophical Society, and it subsequently appeared in print in 1913. Shortly thereafter WHB realised the importance of WLB's insight and WLB recognised the value of WHB's new x-ray spectrometer, and father and son then collaborated to study the structures of crystals. The importance of this work cannot be overstated, for it heralded a revolution in the scientific understanding of crystals and their atomic arrangements.

This has led to many of the most important scientific achievements of the last century, and these continue to the present day. This was the beginning of the field of x-ray crystallography, a subject that has enabled us to

determine the complete structures of hundreds and thousands of crystals, starting from the very simple to the most complex materials, such as proteins, viruses and the molecule that forms the very essence of life, namely DNA. More than 20 Nobel Prizes have been awarded for research that has built upon the work of the two Braggs.

They both continued research into this field for many years. However, because WHB was a well-established scientist at the time, there was a tendency for him to receive the attention of the scientific community and the public. As a result WLB felt that he was in his father's shadow and this caused him a certain amount of anguish. Despite this, WHB always went out of his way to credit his son with the initial discovery wherever possible, even in his own publications. In truth both of them were very close and in constant contact, and they collaborated on many important contributions to the subject. One way in which the two Braggs decided to alleviate the problem of overlapping research was for WHB to concentrate on organic crystals while WLB would work on metals and inorganic crystals.

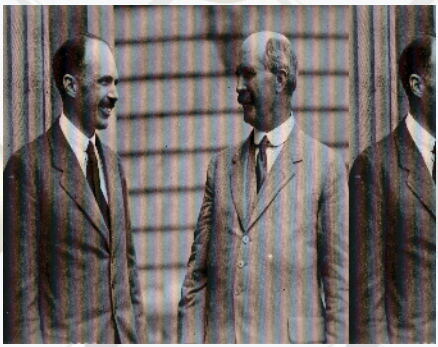
WHB went on with his research into the structures of organic compounds until his death while at the Royal Institution in 1942. During his career he was responsible for the education of several graduate students, and he is credited (along with J. D. Bernal) for encouraging many female students into crystallography, including the Nobel prize winner, Dorothy Hodgkin, as well as Kathleen Lonsdale and Helen Megaw. It is remarkable to note that, out of 18 of his students, 11 were women! WLB too employed several female students and researchers, so that we see that both Braggs played a major role in bringing women into science.

After working in Manchester and the National Physical Laboratory, WLB became head of the Cavendish Laboratory in Cambridge from 1938 until 1953. In this position he stimulated the work of many well-known

scientists, including the Nobel Prize winners Max Perutz, John Kendrew, Francis Crick and Jim Watson. In 1954 he was appointed to the Royal Institution where he remained until his retirement in 1966. WLB died in 1971.

I first encountered WLB while a teenager, when I had the good luck to attend his schools lectures at the Royal Institution, and I well remember his wonderful demonstrations; sometimes these were accompanied by loud whizzes and bangs followed by his boyish grin! He particularly like teaching science to children. It is considered that his schools lectures were attended by up to 20,000 school students per year! Some years later I was fortunate to meet him several times in person. I decided that, since it is approximately 100 years after the initial work of the two Braggs, I would mount an exhibition devoted to the work and lives of both WHB and WLB. A number of historic items of equipment are exhibited, including examples of the original ionisation spectrometers designed by WHB and built by C.H. Jenkinson. Around six of these spectrometers were built and are the forerunners of the computer-controlled diffractometer used by today's crystallographers. The exhibition also includes the Nobel certificates and medals, a number of letters written between father and son, and numerous photographs, many of which have not been made public before. It is not commonly realised that WHB and WLB were accomplished amateur artists, and so I am pleased to exhibit for the first time in public several examples of their artwork. I hope that through this exhibition you will gain true insight into the lives and works of two of our greatest scientists.

Mike Glazer, Emeritus Professor of Physics (Oxford University) & Visiting Professor (Warwick University).



From Smithsonian Institution Archives: Image SIA2007-0340

William Henry Bragg

1862	Born in Cumberland
1869	Moved to Leicestershire
1875	School on the Isle of Man
1881–1885	Student of Mathematics at Trinity College, Cambridge
1886–1908	University of Adelaide – Elder Professor of Mathematics and Experimental Physics
1889	Married Gwendoline Todd in Adelaide
1909–15	University of Leeds – Cavendish Chair of Physics
1915	Nobel Prize in Physics
1917	Commander of British Empire CBE
1920	Knight Commander KBE
1915–23	University College London – Quain Professor of Physics
1923	Royal Institution – Fullerian Professor of Chemistry & Director of the Davy Faraday Research Laboratory
1931	Order of Merit
1932	President of the Royal Society
1942	Died in London

William Lawrence Bragg

1890	Born in Adelaide
1909-1912	Student of Mathematics/Physics at Trinity College, Cambridge
1912	First publication
1915	Nobel Prize in Physics
1919-1937	Langworthy Professor of Physics, Manchester
1921	Married Alice Hopkinson
1921	Elected Fellow of the Royal Society
1937	Director of the National Physical Laboratory
1941	Order of the British Empire OBE
1938-1953	Cavendish Professor of Physics, Cambridge
1954-1966	Director of the Royal Institution
1967	Companion of Honour CH
1971	Died

Acknowledgements

We are grateful to the members of the Bragg family who have lent their paintings, sketches and other memorabilia for this exhibition. Thanks are also due to the following for their general support and loans of scientific items.

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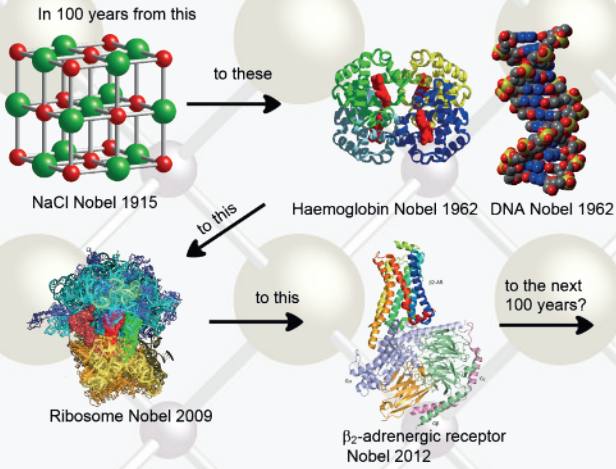
MRC Laboratory of Molecular Biology Cambridge
Museum of History of Science Oxford
Oxford University Physics Department
Ronin Films
Royal Institution of Great Britain
The Royal Society
Science Museum London
Science and Technology Facilities Council
Smithsonian Institute Archives
University of Leeds
University of Warwick



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