Elspeth Garman

Doctor of Science

Durham Cathedral, 3 July 2019

Chancellor, University colleagues, Students, Parents, and Guests.

It is a great honour and a pleasure to welcome, and present to you, Professor Elspeth Garman, one of the most distinguished scientists in the United Kingdom. Professor Garman started her career in nuclear physics and then moved towards the field of her greatest scientific achievements, Macromolecular Crystallography. This technique, which was invented at the beginning of the last century by the Father and Son team William Henry Bragg and William Lawrence Bragg, uses high intensity X-rays to illuminate a tiny crystal of a biological macromolecule to calculate and determine the exact molecular structure in exquisite detail. Who has not marvelled at the beauty and complexity of the structure of DNA determined by Francis Crick and James Walton based on X-ray images collected by Rosalind Franklin in 1953? In all the complexity of its structure also lies the simplicity of the genetic code that underpins all life on this planet. From the first protein structures of Myoglobin determined in 1958 by John Kendrew, that showed how Oxygen is transported in our blood, the precise molecular knowledge of the protein machines that determine every aspect of life has revolutionized our view of modern biology. Macromolecular crystallography has become an indispensable aspect in academia and pharmaceutical industries ranging from basic science to the development of new drugs.

This, Ladies and Gentleman, is the area where Professor Garman's research has made a profound impact. In the nineties so-called synchrotrons, large particle accelerator, not dissimilar to the big accelerator in Geneva, CERN, but designed to produce ultra-high intensity X-rays, many orders of magnitudes stronger than laboratory sources, slowly become a tool for macromolecular crystallography. Professor Garman was among the first to realize that crystals made of biological samples suffer severe radiation damage, just like we would if we were careless enough to put a finger in the beam. Importantly, in her pioneering work she could show that this was not merely a nuisance but had profound effects on the biological interpretation of the resulting molecular structure. Consequently, she and her team

exploited sophisticated methods to mitigate radiation damage by cooling the sample to -170 degrees Celsius. In addition, she investigated the nature of radiation damage and developed programs to estimate the optimal radiation dose. These programs are now used at every Synchrotron in the World. In her seminal 2006 paper, she established a dose limit which in community is now known as the Garman limit. Obviously, this is only one of the many examples of Professor Garman's extraordinary accomplishments. Just to highlight one more, I would like to mention her work on a group of proteins called Neuramidases that are key proteins in viral infections. The atomic structures of Neuramidases from microbial pathogens determined by Professor Garman and others have become the foundation for the development of drugs such as Tamiflu. Her outstanding record in the field is evidenced by well over 100 publications with more than 10000 citations combined, and over 100 structures in the Protein Data Bank, our repository for structural data which is freely available to the scientific community and the public.

Professor Garman started her academic career not far from, here, at Durham University in 1973 as a member of St. Mary's College, reading physics. After graduating with a 1st class degree, she moved to Linacre College at Oxford University for her doctorate with a thesis entitled "*Inelastic alpha particle scattering from ^{16}O and medium mass nuclei in the incident energy range 7-18 MeV".* After staying in nuclear physics for a few years, she made the - in my humble view - excellent decision to move into macromolecular crystallography taking up a position as a research officer at the Laboratory for Molecular Biophysics at Oxford University. In 1999, she joined the Department of Biochemistry as a lecturer, rose through the ranks and was awarded the title of Professor in Molecular Biophysics in 2008.

Professor Garman is a wonderful teacher, an outstanding mentor and an inspiration. As the Director of the Life Sciences Interface Programme of Doctoral Training Centre at Oxford University and later the Director of the Systems Biology Doctoral Training Centre, she has shaped the postgraduate training at the interface of chemistry, biology and physics. She is often quoted an important role model for female scientist but this may not go far enough as she always has been an inspiration for all of us – including myself.

Elspeth always had a passion for public engagement encouraging pupils and students of all backgrounds to follow their dreams. She has been involved in many television and radio programs; including the renowned “BBC Radio 4’s A life scientific’. Her outstanding contributions have been widely recognised. There are too many prizes to name them all, so I only want to note the Humanitarian Award from the Women International in Film and Television Showcase in 2015, the Rose Lecture and Medal at Kingston University in 2014, the Mildred Dresselhaus Senior Award in 2015, the Fankuchen Award by the American Crystallographic Association in 2016, the inaugural Sosei Heptares Prize awarded by the British Biophysical Society in 2018, and most recently the Max Perutz Prize by the European Crystallographic Association in 2019.

Chancellor, it is a real pleasure and a great honour to present Elspeth Garman to receive the degree of Doctor of Science, *honoris causa*.