

## Ada Yonath: A Life of Challenges and Crystallography

As a girl who wants to make a career in science, I believe that any woman who succeeds in what is a male-dominated field, is remarkable; but where a woman is a role model because we admire her as an internationally great scientist in her own right, measured objectively by the quality of her work, then she is someone very special. Ada Yonath is such a person: what she has achieved is of global importance to science and humanity. She overcame many obstacles to pursue her career, but to be fair, many of them were as result of her background and her family's financial circumstances, rather than only her sex. She has held and continues her own as a great scientist first, and as a great woman scientist second. That is how I would like to be measured one day.

To be a scientist involves great passion, and to keep going as one, even more, far more than many other careers require. A passion that can drive a person to overcome challenge after challenge; a passion that instils an inherent curiosity - a burning need to find the answer; a passion that Ada Yonath holds in quantities larger than your regular scientist.

Ada Yonath is a renowned biochemist known principally for her work in discovering the internal structure of the ribosome, a task which many thought impossible. She is a Nobel prize winner and a professor, but her journey to this point was riddled with challenges which she worked tirelessly to overcome from a young age.

Born in Jerusalem in 1939 to a relatively poor family, Yonath did not seem destined for a career in science. However, it was evident from a young age that she possessed a curiosity for the world around her, often questioning her family as to "why that is red" and "why do we have winter?" Her parents, who had little formal education themselves, nonetheless recognised her potential and fought to send her to a grammar school to continue her learning, despite not having the money to afford this. So, whilst at school, Ada worked as a tutor and to help raise the money. Tragically, when she was just 11, her father passed away from illness leaving the family with little income or stability. Ada's mother had to move the family to Tel Aviv to be closer to her relatives. But, even though she was a young girl from the ancient, traditional heart of Israel, now finding herself in its new, fast and western capital, Yonath still managed to plough on and continue her education by working for the school, tutoring other students in maths and chemistry as well as cleaning the chemistry labs.

Eventually, in 1959, all Ada's hard work and dedication to her learning paid off, when she won a place at the Hebrew University in Jerusalem to study chemistry, gaining her bachelors in 1962 and a masters in biochemistry in 1964. During these early years as an academic, Yonath developed an interest in X-ray crystallography, an experimental process by which x-rays are passed through a crystal so that the rays are diffracted by the crystalline structure in varying directions and detected, thus permitting the structure within the substance to be analysed. Ada gained her Ph.D. in this subject from the prestigious Weizmann Institute in 1968, a subject she has pursued for the rest of her career, even up to this day at various universities and institutions around the world, including MIT.

However, all this success was only leading to Ada to her biggest challenge: discovering the internal structure of the ribosome, a task many more senior figures in the academic community thought to be impossible. A ribosome is a subcellular structure that carries out protein synthesis within a cell to enable the production of enzymes which play a crucial role in the function of any living organism. Many thought finding the exact way in which these tiny structures are formed would be impossible due to their lack of internal symmetry and their minuscule size. However, in 1980, after 25000 tries – Yonath became the first person to determine the three-dimensional atomic arrangement of the large ribosomal subunit, one of the two subunits of a ribosome. Her research into this continued to develop as the images she produced became clearer, allowing her to discover the tunnel-like formations within the ribosomes through which newly synthesized polypeptide chains of protein pass through during protein synthesis. This extraordinary discovery led to a brand-new understanding of how this subcellular structure functions.

Professor Yonath's achievement was made possible through her own, pioneering method of Cryocrystallography, in which the protein crystals are rapidly cooled to prevent the radiation damage that x-rays cause to the delicate structures. This allows an accurate image to be produced. Ada Yonath went on to dedicate her life as a scientist to this process. She went on to also map the structure of the small sub-unit of the ribosome, thereby forming a complete understanding of the ribosome which has enabled many innovations in the medical field, particularly in antibiotics.

After completing her research into ribosomes, Ada continued to work, applying her pioneering technique to antibiotics: how they function and, most recently, into antibiotic resistance. This research into over 20 types of antibiotics has led to discoveries that have saved countless lives and will continue to do so well into the future.

Unlike many male scientists whose work is often lauded and reported on early, recognition of Yonath's important work only came 20 years after her discovery. Despite being nominated in both 2000, by the Israel Academy of Sciences and Humanities, and in 2003, by the US National Academy of Sciences, she only received her Nobel Prize for Chemistry in 2009, becoming the first Israeli woman to win a Nobel Prize in any field and only the fourth woman to ever win the prize in Chemistry. Ada Yonath's work is a demonstration of how an endless passion and determination can lead to discoveries many thought to be impossible. Her extraordinary story of hardship and triumph shows that anyone, man or woman, from any background, can work as a scientist and make discoveries that help shape the world we live in. She is a true inspiration for my generation.