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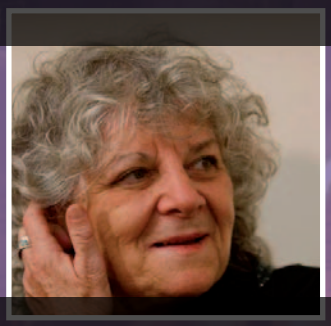
International Women's Day

2011 CHEMISTRY
International Year of CHEMISTRY 2011



A CELEBRATION OF THE RELATIONSHIP BETWEEN WOMEN AND SCIENCE TO COMMEMORATE THE 2011 INTERNATIONAL WOMEN'S DAY AND THE 2011 INTERNATIONAL YEAR OF CHEMISTRY

Background

Women have been pioneers in science for more than a century. 2011 is the United Nations' International Year of Chemistry. One of the four strands of the programme is to celebrate the achievements of women in chemistry, coinciding with the award of the second, (yes second) Nobel Prize that Marie Curie won, one hundred years ago. Other famous examples followed, including Dorothy Hodgkin who was one of the first people to model the structure of DNA, the use of which is critical at the front line of solving crime today. Beryl Platt became a testing scientist for fighter planes during World War II and went on to found Women in Science and Engineering and to chair the then Equal Opportunities Commission.

In many areas of life the role which women played has been written out of the official histories. This is the case with many developments in science. But science is also often written out of the histories of the changing roles of women in society.

Some examples of the critical roles of women initially overlooked are now famous, such as Madame Lavoisier. Mme Lavoisier worked with her husband on groundbreaking research in chemistry, after his death she performed an important role in publishing and translating their work, and as a salon hostess where pre-eminent scientists of the day met to share ideas.

Women played an essential role in the development of scientific thought through their work as translators, explainers, and teachers. Faraday claims that it was a book by Jane Marcet that inspired him to become a scientist. Marcet's most famous publication was Conversations in Science which explained complex theories in an accessible way and reached a very large audience with it Often when women translated important works they would improve the explanations for the benefit of scholars and often improve theories or provide additional proofs or clarifications.

Women's occupations in brewing and baking also led to technological breakthroughs, one famous example being woman who put the" Veuve" into Clicquot. The widow of Monsueir Clicquot, who took over the business on his death, was credited with great breakthroughs in champagne handling that made mass production of the wine possible.

Women have also played a leading role in bringing scientific innovations into everyday use. Science not understood by the public can create a climate of fear that stops its benefits being realised by society.

For example, for a long time after electricity was discovered it remained a mystical force with little practical application. It was first introduced into the homes through the use of it by women as entertainment with performances using static electricity which they would arrange for their house parties. Using electricity in practical applications in the home of benefit to ordinary people was also in large part due to their popularisation by women.

And a long time after vaccination had become common place in the East it was regarded with suspicion in the UK, after all it seemed to run counter to common sense to expose someone to a deadly disease. Luckily for generations of British children Lady Mary Montagu observed the results of vaccination in Turkey and on her return did much to promote the use of vaccinations against smallpox. She had her children inoculated and wrote about it in the press and persuaded the Queen to have the royal children treated too.

But science has also changed women's lives. Today's women would find it hard to countenance doing all their family washing by hand let alone using stale urine for removing tough stains from clothes. In fact the cleaning power of stale urine was also used for scrubbing saucepans, for streak free windows and as shampoo before commercially manufactured chemical detergents were available.

Marie Curie – a true pioneer

Maria (Marie Fr.) Sklodowsk was born in Poland in 1867 but left to study at the Sorbonne in Paris where she reportedly worked night and day in her attic room. At first Maria thought it was her duty to return to Poland to teach. But she met Pierre Curie in 1894 and he convinced her to stay in Paris "to pass our lives near each other hypnotised by our dreams... and our scientific dream'.

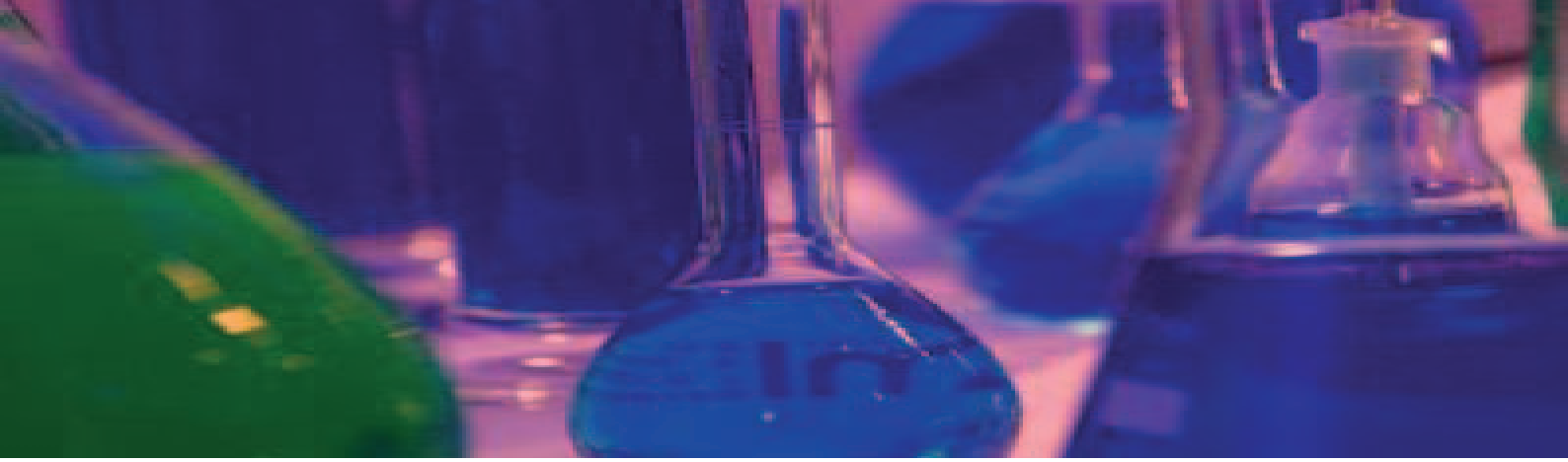
They married in 1895 and despite deeply contrasting personalities (Pierre a dreamer, Maria organised) formed the most famous partnership in the history of science. They worked hard in famously primitive conditions to begin with but they prioritised their family at weekends and holidays, trips to the countryside were an important feature of family life. Marie Curie had begun working on her PhD thesis on Becquerel's rays a few weeks after the birth of their first daughter Irène. She measured radiation with apparatus set up by Pierre but the experiment programme was mainly hers. As usual for a PhD student she had a supervising physicist. In her case it was Pierre. They jointly submitted papers to the French Academy about the discovery of radium and plutonium.

The Nobel Committees Archives show that when the committee first considered awarding the prize for the discovery of polonium only Becquerel and Pierre were to be recipients but Pierre was privately tipped off and insisted Marie be added. As the price did not mention the discovery of radium it left the door open for Marie Curie to win the Nobel Prize for Chemistry in 1911.

The discoveries of polonium and radium are the cornerstone of Marie Curie's celebrity but the reason she is so well remembered was that she achieved this at a time when it would have been exceptionally difficult for a woman to be recognised for scientific achievement by the academic community let alone the general public.

Tragedy struck Marie Curie in 1906 when her husband was struck by a carriage in a street in Paris and died instantly. This tragedy coloured the rest of her life. For years, she could not speak of Pierre to her children. The French academic authorities, upset by the sudden death of Pierre Curie, quickly made the historic decision to put Marie in charge of Pierre's lectures and the laboratory. This simple act swept away the tradition of excluding women from high-level education positions and opened the door for other women.

Marie Curie's first lecture at the Sorbonne on 5 November 1906 was celebrated in newspapers as a victory for feminism. Yet, Marie, depressed at the time was writing despaired "letters to Pierre" in her private diary. She couldn't forget the circumstances that led to her promotion, noting that "some fools congratulated me." Articles described Marie as modest and simple as she demonstrated the blue light of radium at the lecture,

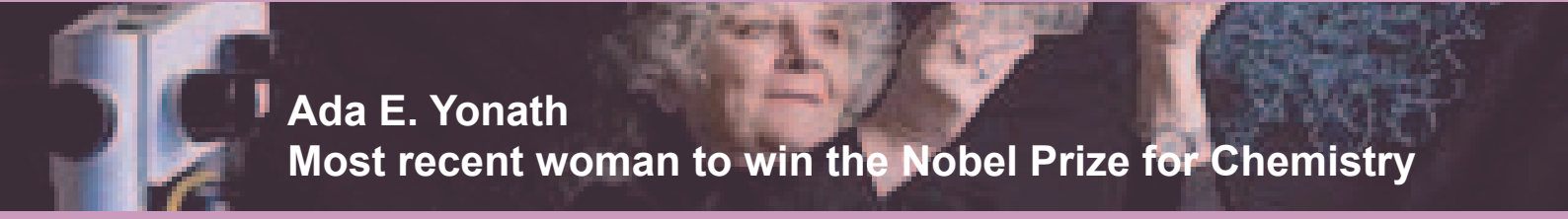


Marie was deeply convinced that women and men were equal in their potential intellectual capabilities. She thought of her nomination for the Nobel Prize as a “normal” decision. In reference to her husband, Marie wrote: “Pierre Curie had devoted his life to his scientific dream, he needed a companion who could live the same dream as him.”
In addition to spending time with her children, resuming her research on radium’s chemical properties provided the best comfort for Marie. She worked hard to prepare her lectures, which extended far beyond radioactivity subjects. She also was now at the head of a small laboratory, which she fought to expand so it would fit more researchers.
In 1911, she failed by one vote in the competition for a seat at the French Academy of Sciences. The Academy had publicly expressed the desire to maintain its male status quo. Prior to the vote, the press and religious fanatics had waged a campaign against Marie for being a feminist, anticlerical, and a free thinker and her supposed “affair” with the physicist Paul Langevin had broken out in the papers. In November 1911 Marie was informed that she would be awarded the Nobel Prize in Chemistry but she never applied again to the French Academy of Sciences. Later, the Academy of Medicine offered her membership in recognition of the role of radium in cancer therapy. She accepted.

The status of Marie Curie among the general public probably has more to do with the medical use of radium than with her role in opening the atomic age. Pierre and Marie Curie had taken no patent for the procedure of radium separation, a decision which added to their reputation as disinterested scientists working for the benefit of humanity.
Marie Curie’s most direct collaboration with the medical profession did not involve the use of radium but of X-rays during the First World War. Curie helped set up X-ray stations in several hospitals and created dozens of radiological cars that could operate near the battlefront. She helped on the scene, examining the wounded to better understand how X-rays could be used, and she organised radiology training for nurses. Marie’s abilities in analysis, decision making, and organisation proved quite helpful in this endeavor.

In many areas of life the role that women played has not been given the recognition by official histories, or that their contribution deserved. But science has also changed women’s lives. In medicines, food and consumer goods science has transformed the way we live now and in doing so improved the life of women.

When Curie realised that her growing international prestige could be used for projects of general interest she campaigned for fundamental research in France. She would even publicly state her support for a woman’s right to vote. She also spent more of her time attending conferences and visiting other countries to promote scientific cooperation,and she also spoke out against the idea of a “failure of science.” “Mankind’s effort toward its greatest aspirations is imperfect as everything which is human,” she said. “It has often been turned off its direction by forces of national egoism and social regression.” Shortly before her death, she defended her love of research against alarms and doubts expressed about the future of science and culture: “I am among those who think that science has great beauty. A scientist in his laboratory is not only a technician: he is also a child placed before natural phenomena, which impressed him like a fairy tale. We should not allow it to be believed that all scientific progresses can be reduced to mechanism . . . neither do I believe that the spirit of adventure runs any risk of disappearing in our world. If I see anything vital around me, it is precisely that spirit of adventure, which seems indestructible and is akin to curiosity.” Marie Curie’s life is an outstanding example of how science can be a human adventure.



Ada E. Yonath
Most recent woman to win the Nobel Prize for Chemistry

Yonath was born in 1939 in the Geula quarter of Jerusalem. Her parents were Zionist Jews who immigrated to Palestine before the establishment of Israel and her father was a rabbi. They settled in Jerusalem and ran a grocery, but found it difficult to make ends meet. They lived in cramped quarters with several other families, and Yonath remembers “books” being the only thing she had to keep her occupied. Despite their poverty, her parents saved to send her to a good school. When her father died at the age of 42, the family moved to Tel Aviv. Yonath was accepted to Tichon Hadash high school although her mother could not pay the tuition. She gave math lessons to students in return.

As a youngster, she says she was inspired by Marie Curie. However, she stresses that Curie, whom as a child she was fascinated by after reading a well-written biography, was not her “role model”. She returned to Jerusalem for college, graduating from the Hebrew University of Jerusalem with a bachelor’s degree in chemistry in 1962, and a master’s degree in biochemistry in 1964. In 1968, she earned a Ph.D. in X-Ray crystallography at the Weizmann Institute of Science.
She has one daughter, Hagit Yonath, a doctor at Sheba Medical Center, and a granddaughter, Noa. In her own words, the aim of Yonath’s research “was to determine the three-dimensional structure of the ribosome – the cells’ factory for translating the instructions written in the genetic code into proteins – and thus reveal the mechanics guiding the process. This was the beginning of a long quest that took over two decades, in which she was met with reactions of disbelief and even ridicule in the international scientific community.
Because the ribosome is so central to life, scientists around the world had been trying for many years to figure out how it works, but without an understanding of its spatial structure there was little hope of forming a comprehensive picture. To reveal the three-dimensional structure at the molecular level, crystals are required, but when dealing with ribosomes, there are added challenges. The ribosome is a complex of proteins and RNA chains; its structure is extraordinarily intricate; it is unusually flexible, unstable and lacks internal symmetry, all making crystallization an extremely formidable task.

“I developed a unique experimental system based on ribosomes taken from the hardy bacteria living the extreme environments of the Dead Sea, thermal springs and atomic piles. In this way we managed to produce the initial micro crystals of ribosome in a fairly short time. However, even after obtaining preliminary diffraction indications, when I described my plans to determine the ribosome structure many distinguished scientists responded with sarcasm and disbelief. Consequently I became the World’s dreamer, the village fool, the so-called scientist, and the person driven by fantasies.

In the mid-1990s, once we proved the feasibility of ribosome crystallography, several groups from leading universities or research institutions initiated parallel efforts. As they could repeat our procedures, I was no more alone in this field. At the end of the 1990s, we as well as those who used our experimental systems succeeded in breaking the resolution barrier, thanks to improvements in the crystals, in the facilities for detecting the X-ray diffraction and in ways to determine the diffraction phases. The first electron density map of the ribosome’s small subunit was a real breakthrough, and for me, a tremendous excitement. Then, in 2000 and 2001, we published the first complete three-dimensional structures of both subunits of the bacterial ribosome.
These discoveries are clearly a high point in 20 years of research, but my quest to understand the ribosome is still far from complete. Armed with new insight into ribosomal structure, I can afford moving on to revealing what else these structures can tell us about the ribosome actions, and how antibiotic drugs block those actions in bacterial ribosomes.
Because ribosomes are so essential to life, many antibiotic drugs work by targeting their actions. The advances we made in our long quest to solve the structure and function of the ribosome may also pave the way toward improving existing antibiotic drugs or designing novel ones”.

And in the future?
We plan on looking to the distant past. Ribosomes are found in every living being – from yeast and bacteria to mammals – and the structures of their active sites have been extraordinarily well-preserved throughout evolution. We have identified a region within the contemporary ribosome that seems to be the vestige of the primordial apparatus for producing peptide bonds and essentially giving rise to life. How did these first ribosomes come into being? How did they begin to produce proteins? How did they evolve into the sophisticated protein factories we see today in living cells? We plan on answering these and related questions in our future work.
Awarding the Nobel Prize exposed the ribosome to the public. It stimulated true scientific interest and turned on the imagination of many youngsters.

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The leadership roles of women in today’s chemical industry

Today science-based businesses, where some of the most incredible discoveries in scientific fields have been led by women, are learning the benefits of female business leadership. This will happen more as girls continue to achieve in science education. Organisations like the Chemical Industries Association, where the last Chief Executive was female, the current Deputy Chief Executive is female and three key departments are led by women (with other examples in the companies we represent) are working to increase the leadership roles of women. In Parliament the Chemical Industry All Party Parliamentary Group is led by a woman.

We want to encourage more women in leadership roles and we are working to make it happen. In this, the International Year of Chemistry, not just science-based organisations but all of us have an opportunity to celebrate the achievements of women in chemistry and to encourage more female leadership.

Support our campaigning by emailing womenincharge@cia.org.uk

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