Old Palace of John Whitgift School
Independent Girls' School

Spring
2021

AROUND THE PALACE
Science Supplement

International Day of Women and Girls in Science

International Day of Women and Girls in Science is celebrated on 7th February each year. Women have played a significant role, in all fields of science, throughout history, yet many female scientists, despite having had a profound and positive impact on society, have been relegated to the footnotes of history.

The International Day of Women and Girls in Science logo, designed by Bilal Wazir, shows that great women in science, who pave the way for those who come later in every walk of life, will encourage girls to see female role models, in order to find the inspiration to enter into science. The logo colour represents equality, equity and parity in science, and that science belongs to all citizens, male or female, rich or poor, young or old.

A significant gender gap has persisted throughout the years at all levels in STEM disciplines all over the world. Even though women have made tremendous progress towards increasing their participation in higher education, they are still under-represented in these fields.

Gender equality has always been a core issue for the United Nations and so on 22 December 2015, a decision was made to adopt a resolution to establish an annual International Day to recognize the critical role women and girls play in science and technology communities. It was decided to proclaim 11 February of each year the International Day of Women and Girls in Science.

The theme for 2021 is Women Scientists at the forefront of the fight against COVID-19. To celebrate this day, students at Old Palace were asked to identify and share their favourite women in Science.

Mrs Mills

Dr Maggie Aderin-Pocock MBE

The first time I heard Dr Maggie Aderin-Pocock speak, I was sitting in an auditorium browsing through the programme of a 'Science Live' event I had taken a group of Year 10 students to see.

Being a chemist, I was really looking forward to the lecture by Andrea Sella who speaks beautifully about chemical processes and uses chemicals on the stage to illustrate his ideas. However, from the moment Dr Maggie Aderin-Pocock took to the stage, I was gripped by her sheer passion and ability to communicate very complex ideas about space.

Dr Maggie Aderin-Pocock is a black British female space scientist. She is a Commissioner for the Commission on Race and Ethnic Disparities. She is an award-winning space scientist, broadcaster *(BBC Sky at Night)* and author who has worked with several educational institutions to promote the study of STEM subjects. She holds a degree in Physics and a PhD in Mechanical Engineering from Imperial College.

Maggie does not fill this scientific stereotype, but she is exactly what science needs. After all, she is a 'real person'. Referencing one of her heroes, Marie Curie, she talks about role models: *"Role models should be real people; if you have a role model who is, or is perceived as, a superwoman, then people think, 'Well, that's not me, I can't aspire to be that.' Dr Maggie Aderin-Pocock was awarded an MBE and marvelled at the honour stating "Imagine a dyslexic from London meeting the Queen of England. It's mind-boggling stuff, but that shows how much potential you have."*

Mrs Mills

Marie Curie 1867 - 1934

Marie Curie is remembered for her contribution towards fighting cancer as a French - Polish physicist. She was a scientist at a time when there were almost no female scientists. Most women didn't even go to college. However, Marie Curie wasn't like most women. She was brilliant and determined to succeed.

She always had a passion for learning and had a great knowledge from studying. She grew up in the environment of learning because both of her parents were teachers. Mari Curie was always top of her class.

Marie investigated radioactivity proving that the elements existed. When she was testing a rock called Pitchblende containing uranium, it gave off even more rays. She found two new elements called radium which is a metal that gives off lots of energy and glows in the dark and polonium which she named after her home country Poland.

In 1903 she and her husband Pierre Curie won the Nobel Prize for Physics. She was the first person to ever be awarded two Nobel Prizes. She was the first women to hold the position of a Professor in Physics at Sorbonne studying magnetism and steel. Her oldest daughter Irene was a scientist and won a Nobel Prize in Chemistry.

Marie Curie studied Becquerel rays which come from a metal called uranium that gives off powerful radioactive rays.

However, when Marie Curie started her research the word radioactive didn't even exist! No one knew why it gave off energy or why it could make things glow in the dark. Marie Curie did many experiments including gold, copper and uranium that even Becquerel tried and failed.

During WW1 she organised an X- ray team. Her X– rays helped over 1 million people during the war and the trucks that transported the machine were known as "little curies" because they helped cure people. Marie was made Head of the radiological services by the International Red Cross and she did training courses so other doctors could learn her techniques.

Sadly, Marie died from her exposure from radiation. It damaged her skin slowly and damaged the inside of her body, making her sick. I think Marie Curie is a role model because of her love for knowledge and all the great work that she has done with radioactivity and Cancer. Her prizes show that you can achieve your goal if you work hard. Without her determination and dedication, I believe that we still wouldn't know all the developments that progressed from her work today.

Marie Curie still has her charities all around the UK and continues to help others with a terminal illness, including cancer.

One of Marie Curie's quotes is:

"Nothing in life is to be feared; it is only to be understood."

by **Chloe**, Year 12

Sophie Germain

Sophie Germain is a French Maths Scientist who is most well known for her work on number theory. She is also well known for her work on elasticity which is the degree to which a demand or supply is sensitive to changes in price or income.

Who is she and how did Sophie Germain become famous?

Sophie was born on April 1st 1776 in Paris, France. She was the second child out of her parents' three daughters. Her father was Ambroise-Francois Germain and her mother was Marie-Madeleine Germain. The Germains had a business which had existed for many generations in the family. The business was great and the family were growing quite wealthy. Ambroise-Francois Germain, her father, was also quite politically active as an elected representative.

Coming from a grand family and with the streets of Paris being unsafe at the time, young Sophie stayed a lot of time indoors. Her father, as a well-educated man, had an extensive library. One day Sophie found herself in her father's library and she picked up the book Volume 1 of Jean-Étienne Montucla's *History of Mathematics* and she was fascinated by her life (more fascinated by the way she died).

Sophie was amazed that anyone could be so overwhelmingly interested in mathematics that maths even took it to someone's death. Sophie Gemain did not get go to school or university; she educated herself using her father's library and its books. She decided that she was not going to get the new interest in mathematics just staying there, so she chose mathematics as something she needed to know more about.

As she got older her interest for Mathematics grew and she felt more involved and captivated by Mathematics and Science. However, etiquette dictated that girls' education was limited and it had a ceiling. Girls from rich and wealthy families were be able to take part in intelligent conversations, but they should not rise to psychological and academic fame. Never the less, Sophie continued to chip away at the traditional ceiling and continued studying Mathematics.

Growth in Mathematics and Science

Sophie began studying mathematics seriously at age 13, using Étienne Bezout's mathematics textbook *Traité d'Arithmétique*. From its pages she learned about long-division, proportions, fractions, and logarithms. She started to get to grips with difficult mathematical work by famous Isaac Newton and Leonhard Euler.

During her studying she found that some of her textbooks were written in Latin, which was a language she had to teach herself. Sophie was soon high above the ceiling set for girls and their studies and she did not set herself any restrictions; she read everything she could get her hands on, mainly books about psychology and philosophy.

At the age of 18, when Sophie Germain celebrated her 18th birthday, an exciting new college opened its doors in Paris – the École Polytechnique. Sadly though, women were denied this college, so she had to put together an arrangement with Antoine-August LeBlanc, a student at the École Polytechnique, and she began to submit work by the name of LeBlanc to Lagrange. Lagrange learned that LeBlanc's work had actually been done by Sophie Germain, a woman. He spread the word around about Sophie's work which meant many mathematicians came to visit her. He arranged to visit Sophie and offered her praise for her talent in maths and in studies overall.

Later on in Sophie's life - 1798 and 1801 - she was inspired by another Mathematician to create her own Number Theory. Her most important theory was written in a letter to mathematician Legendre Germain, which proved that if x, y, and z are integers and if $x^5 + y^5 = z^5$ then either x, y, or z must be divisible by 5. She also created the theory of elasticity which treats the relationship between forces applied to an object and the resulting deformations. This hero should be celebrated.

Mahima B, Year 7

École Polytechnique

Vera Rubin

Vera Rubin, born July 23rd, 1938, was an American astronomer who confirmed the existence of dark matter with her pioneering research on galaxy rotation rates.

Rubin developed an early passion for astronomy when her family moved to Washington DC – she would watch the stars rotate around the pole through her bedside window at night, as well as meteor showers, which she tracked using a homemade telescope made of cardboard. She chose astronomical topics for English papers, as she aspired to use every subject as an opportunity to extend her knowledge about the universe.

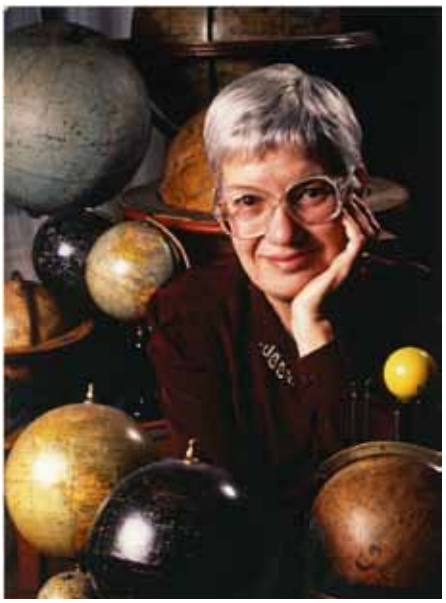
Perhaps, her most important discovery was when she studied the dynamics of nearby galaxy Andromeda (M31) and observed that the outermost components of the spiral galaxy were moving at the same speed as those in the centre, despite what was to be expected – which was that, as mass causes gravity which determines speed of rotation, objects closer to the centre of galaxies should have been moving faster than peripheral objects. Since this was untrue, this was an early indication of dark matter, a type of matter that does not interact with electromagnetic forces, making it almost impossible to detect. Instead, it was dark matter, which was giving these galaxies extra mass, generating the extra gravity which they needed to stay intact. Rubin calculated that the galaxies must contain at least 5 to 10 times as much dark matter as ordinary matter. This discovery was extremely significant as it confirmed the existence of dark matter, which forms the basis of our understanding of the shape, size and future of the universe and is widely accepted as a part of the standard model of cosmology.

One of the many challenges that Vera Rubin faced throughout her career, which I think makes her an especially inspiring individual, was being a woman in a predominantly male-orientated industry. Examples of the many types of discrimination she faced included: her own physics teacher advising her to 'stay away from science' after receiving a scholarship to Vassar College, and attempting to enrol at Princeton but never receiving the graduate catalogue as women there were not allowed in the graduate astronomy program until 1975.

She faced similar challenges throughout her career but continued to champion women's rights within astronomy. For example: if, in a list of speakers at a conference, there were very few or no women speakers, she would contact the organisers and tell them they have a problem to solve.

Overall I think that Vera Rubin, without whom we would not have the same understanding of the universe as we do today, is an extremely inspiring scientist, due to her determination to pioneer and progress astronomy, in spite of the challenges she faced as a woman.

Suraiya, Year 11



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Marie Curie's Life

One woman, Marie Curie, helped change the lives of people all over the world and showed that girls are as good at science as boys!

When Marie lived in Poland, girls were not allowed to go to university, so her parents had to send her in secret. She later moved to Paris to study. Marie married another scientist, Pierre. They worked together to find out about the tiny parts, called elements, that make up everything in our Universe.

They discovered a new element that gave off rays of heat and light - they called this radium. They studied the light and heat it gave off and called this radioactivity. They were given the most important prize in the world for science: the Nobel Prize. Marie was the first woman ever to receive this!

Marie and Pierre found that radium could help the body fight cancer cells. Sadly Pierre died when he was just 46. Marie took over his teaching job at the University of Paris - she was so good they made her a professor. The first woman professor the university ever had!

A few years later, Marie won another Nobel Prize and the university built her a laboratory. Marie worked hard to find a cure for cancer - nobody knew that working with Radium was dangerous. But it was and because of this Marie became very ill and died.

Work on Radioactivity and Discoveries

The Curies became research workers at the School of Chemistry and Physics in Paris and there they began their pioneering work into invisible rays given off by uranium - a new phenomenon which had recently been discovered by Professor Henri Becquerel. He had shown that the rays were able to pass through solid matter, fog and photographic film and caused air to conduct electricity.

Marie also noticed that samples of a mineral called pitchblende, which contains uranium ore, were a great deal more radioactive than the pure element uranium. Further work convinced her the very large readings she was getting could not be caused by uranium alone - there was something else in the pitchblende. Since nobody had ever found it before, it could only be present in tiny quantities, and it seemed to be very radioactive. Marie was convinced she had found a new chemical element - other scientists doubted her results.

Pierre and Marie Curie set about working to search for the unknown element. They ground up samples of pitchblende, dissolved them in acid, and began to separate the different elements present, using the standard analytical chemistry techniques of the time. Eventually, they extracted a black powder 330 times more radioactive than uranium, which they called polonium was a new chemical element, atomic number 84.

When the Curies investigated further, they found that the liquid left behind after they had extracted polonium was still extremely radioactive. They realised that pitchblende contained another new element, far more radioactive than polonium, but present in even smaller quantities.

In 1898, the Curies published strong evidence supporting the existence of the new element - which they called radium - but they still had no sample of it. Pitchblende is an expensive mineral, because it contains valuable uranium, and Marie needed a lot of it.

She got in touch with a factory in Austria that removed the uranium from pitchblende for industrial use and bought several tonnes of the worthless waste product, which was even more radioactive than the original pitchblende, and was much cheaper. Marie set about processing the pitchblende to extract the tiny quantities of radium. This involved working on a much larger scale than before, with 20kg batches of the mineral , grinding, dissolving, filtering, precipitating, collecting, redissolving, crystallising and recrystallising.

The work was heavy and physically demanding - and involved dangers the Curies did not appreciate. During this time they began to feel sick and physically exhausted; today we can attribute their ill-health to the early symptoms of radiation sickness. At the time they persevered in ignorance of the risks, often with raw and inflamed hands because they were continually handling highly radioactive material.

In 1902 Marie eventually isolated radium (as radium chloride), determining its atomic weight as 225.93. The journey to the discovery had been long and arduous.

Ayesha, Year 8

Mary Anning

She was an English fossil collector who became famous for her ground breaking discoveries of Jurassic marine life in the cliffs at Lyme Regis, Dorset.

Rosalind Franklin

I always tell my Year 10 students about Rosalind Franklin and her role in determining the structure of DNA. She was a chemist and crystallographer. I read her biography when I was a student at King's College London. She died of ovarian cancer four years before her colleagues and coworkers Maurice Wilkins, Francis Crick, and James Watson received the Nobel Prize. She was 37 years old. I remember crying on the bus. They didn't recognise the harmful effects of xrays in the lab at the time. Today one the King›s College London buildings is named after her.

Dr Edwards

Marie Curie

As International Day of Women in Science is coming up, I wanted to share my favourite female scientist who has changed the world with her discoveries and cures that have helped thousands of people today.

Marie Curie was a Polish-born French physicist and chemist best known for her contributions to the discovery of radium and polonium and the contributions she made to find treatments for cancer.

At age 24, she enrolled at the Sorbonne University, where she wrote her thesis on radiation which (at the time) was recently discovered by Henri Becquerel. She found that an ore containing uranium was far more radioactive than could be explained by its uranium content. This led her and her husband, Pierre, to the discovery of a new element that was 400 times more radioactive than uranium. In 1898, it was added to the Periodic Table as polonium, named after Curie's birth country.

Later, Curie discovered an even more radioactive element, radium, and through observation of radium, made a fundamental discovery: Radiation wasn't dependent on the organisation of atoms at the molecular level; something was happening inside the atom itself. The atom was not (as scientists believed at the time), inert, indivisible or even solid.

She won one Nobel Prize for her research in 'radiation phenomena' and one, in chemistry and was the first woman to receive a Nobel Prize.

During World War I, Curie promoted the use of X-rays and developed radiological cars, which allowed battlefield surgeons to X-ray wounded soldiers and operate more accurately. However, she and everyone around her did not fully appreciate the danger of the radioactive materials they were handling and, due to this, she was constantly ill from radiation sickness and sadly died due to aplastic anemia in 1934, at age 66. However, her legacy lives on and is such an important figure in history as she helped change the world of medicine!

Lily, Year 9

Gertrude B. Elion

From a young age Elion had the ambition of trying to cure conditions and limit human suffering. Part of this ambition was fuelled by having watched her grandfather, who she was particularly close to, suffer and die from Stomach Cancer when she was 15. She wanted to *"do something that might eventually lead to a cure for this terrible disease".*

Elion wanted to defeat stereotypes and do something that not many women in New York had even dreamed of doing during the 1930s – getting a Phd. One thing that Elion had that many women with the same ambition didn't have was support. Women getting fellowships and degrees still weren't very common. Elion always thought that her biggest support and influence was her mother who supported her throughout her career encouraging to all the way and helping her overcome the criticism she received. When she was just 19, with a degree in chemistry, she got a job as a chemistry teacher, secretary and unpaid lab worker. She famously said *"In my day I was told that women didn't go into chemistry. I saw no reason why we couldn't".*

Alongside Hitchings, Elion took a more logical approach to drug research and used more scientific-based evidence rather than a trial and error method. In 1950, she discovered a drug that helped children with leukaemia and got successful outcomes. In the 1960s she was able to discover a series of drugs that helped fight disease. Before she retired in 1967 she turned her attention to drugs that could help combat HIV and AIDS. Even though she was unable to finish this research and her PhD, her colleagues finished her research, successfully inventing the first treatment for AIDS. She received the Nobel Peace Prize for Medicine in 1988 for the importance of drug treatment for all of her research.

The impact of Elion's research still factors in medicine today. Her research in leukaemia is still used on children today and cures 80% of children with leukaemia. Elion's drug research has helped Doctors explore a drug called Methotrexate. Methotrexate can be used to treat some types of cancer, rheumatoid arthritis and Crohn's disease.

In more recent medical discoveries the use of Anti- TNFs couldn't have been done without her drug research on the growth of cells. Anti TNFs, alongside Methotrexate and many other drugs, have helped increase quality of life and pain levels for people with RA and other health conditions which would not have been possible without all her drug research.

Elion was looking for a cure to cancer but along the way she discovered so much more.

Christina F, Year 10