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THE PEOPLE OF SCIENCE:

**WOMEN**  
**AND SCIENCE**



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# WOMEN: BATTLEFIELD SCIENCE

By: Maissa Azab

It is no secret that, despite all historical and contemporary evidence of women's unlimited prowess in all aspects of life, for some reason or the other, most societies have and still to a certain extent regard women as less capable professionally. For centuries, endless outdated societal constraints kept them in their homes and deprived them of, not only education and working in competitive fields, but also their simplest rights as citizens, such as voting, and often even their human right to choose their own paths in life.

Although most of this is something of the past for most countries, even after they have finally been liberated from many of these societal constraints, girls and women still face discouragement, disregard, and outright discrimination in many cases when it comes to competitive professional fields, especially those related to science and technology.

However, as is the case with every other aspect of life, women have proven over and over again their dexterity in these fields. Indeed, in this issue, we highlight just a few examples of women's ingenuity throughout the ages; from Hypatia in Ancient Alexandria, to the famous Arab Maryam "Al-Asturlabiyya", to the iconic Caroline Herschel and Marie Curie, whose name has become synonymous with the phrase "Women in Science".

We also refer to other significant women, whose contributions have changed the world as we know it; a couple of cases in point are Rachel Carson and Maria Montessori. Not only that, we highlight modern day women warriors of science, their battles, and their victories; women who have the power and the will to take mankind to Mars, reshape information technology, cure tenacious human ailments, just to name a few of their endeavors.

Indeed, we promise you an exciting and enlightening read that just might change how you think of the world and maybe your purpose in it.

“What you do makes a difference, and you have to decide what kind of difference you want to make.”

**Jane Goodall;**  
primatologist, ethologist,  
anthropologist and  
UN Messenger of Peace.

“We look at science as something very elite, which only a few people can learn. That is just not true. You just have to start early and give kids a foundation. Kids live up, or down, to expectations.”

**Mae Jemison; physicist and astronaut.**

“If I had not been discriminated against or had not suffered persecution, I would never have received the Nobel Prize. Above all, do not fear difficult moments; the best comes from them.”

**Rita Levi-Montalcini;**  
neurobiologist and winner  
of the 1986 Nobel Prize in  
Physiology or Medicine.

“Humans are allergic to change; they love to say ‘We have always done it this way’. I try to fight that; that is why I have a clock on my wall that runs counter-clockwise.”

**Grace Hopper;**  
computer  
programmer.

# QUOTES BY WOMEN SCIENTISTS

“Do not be afraid of hard work; nothing worthwhile comes easily. Do not let others discourage you or tell you that you cannot do it. In my day, I was told women did not go into chemistry; I saw no reason why we could not.”

**Gertrude Elion;**  
biochemist, pharmacologist,  
and the winner of the  
1988 Nobel Prize in  
Physiology or Medicine.

“Imagination does not become great until human beings, given the courage and the strength, use it to create.”

**Maria Montessori;**  
physician and educator.

“I think it is important for little girls growing up, and young women, to have one in every walk of life. So from that point of view, I am proud to be a role model!”

**Sally Ride;**  
Physicist and astronaut.

“If you know you are on the right track, if you have this inner knowledge, then nobody can turn you off, no matter what they say.”

**Barbara McClintock;**  
Cytogeneticist and winner  
of the 1983 Nobel Prize in  
Physiology or Medicine.



# CAROLINE HERSCHEL

## AN ICONIC WOMAN ASTRONOMER

**The** German-born English astronomer, Caroline Herschel, was the first woman to discover a comet, to be officially recognized in a scientific position and get paid for her contribution to science, to be awarded a Gold Medal of the Royal Astronomical Society, and to receive honorary membership into Britain's prestigious Royal Society.

By: Moataz Abdelmegid

Caroline Lucretia Herschel was born in the town of Hanover, Germany, on 16 March 1750. At the age of ten, Caroline was struck with typhus, which stunted her growth, so that she never grew past 120 cm. Her family assumed that she would never marry; her father wished her to receive an education, but her mother opposed this. Her father sometimes took advantage of her mother's absence to teach her directly or include her in her brother's lessons.

When Caroline was 22 years old, she found her way out from Hannover with the help of her brother William, who had moved to England seven years earlier and made a life for himself as a musician. William exhibited a special interest in astronomy as a hobby; he would then explain to Caroline the amazing things he learned about the stars. Caroline grew fascinated with her brother's new hobby, and she urged him to train her to be his assistant. With time, William became known for his work on high performance telescopes, and Caroline found herself supporting his efforts.

Caroline spent many hours polishing mirrors and mounting telescopes in order to maximize the amount of light captured. Although she never memorized her multiplication tables, it was she who did the complicated

calculations from her brother's observations. She learned to copy astronomical catalogues and other publications that William had borrowed; she also learned to record, reduce, and organize her brother's astronomical observations. She recognized that this work demanded speed, precision, and accuracy.

In 1781, while observing the night sky with the powerful telescope they built together, Caroline and William discovered the planet Uranus; this was the point that turned astronomy into their livelihood. Expectedly, it was William who was greatly celebrated by the scientific society for this discovery, while Caroline's contribution was rather slighted.

William feared that Caroline's name would remain unmentioned if she continued working under his supervision; at his suggestion, Caroline began to separately make observations on her own in 1782. She spent long hours every day observing the sky with her 27-inch focal length Newtonian telescope, detecting a number of astronomical objects between 1783 and 1787. Most notably, she made an independent discovery of M110 (NGC 205), the second companion of the Andromeda Galaxy.



During the following ten years, Caroline successfully discovered eight comets; the first being discovered on 1 August 1786. Her comet came to be known as the "first lady's comet" and brought with it the fame that secured her a place in history books. In recognition of her work and as an encouragement for her to move forward, in 1787, she was granted a salary of £50—equivalent to £5,700 in 2016—by the King of Great Britain, George III, for her work as an astronomer, making her the first woman paid for scientific services.

Following the discovery of her eight comets, she studied the "star catalogue" published by the great English astronomer John Flamsteed, compiling and cataloguing over 3000 stars. She conducted a long 20-year survey of the night sky to cross-index this star catalog, and eventually submitted more than 550 stars that had not been included in the original version.

In the wake of William's death in 1822, Caroline returned home to Germany and

worked on cataloguing every discovery she and William had made. During her lifetime, she received several awards including the Gold Medal of the Royal Astronomical Society. Many of the comets she discovered bear her name; the asteroid 281 Lucretia was named after her second given name, and the crater C. Herschel on the Moon is named after her. Moreover, two of the astronomical catalogues published by her are still in use today.

Thanks to her brother William, Caroline is one of the few historical women astronomers of her time whose life is well documented and discoveries well recognized. She passed away on 9 January 1848; the inscription on her tombstone reads: "The eyes of her who is glorified here below turned to the starry heavens".

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# RED PLANET MISSION: WOMEN ONBOARD

By: Jailane Salem

Working at NASA is a dream for many people, especially those who wish to one day set foot on a surface millions of kilometers away from Earth. Women are part of this great human endeavor; it was in 1978 that NASA hired its very first female astronauts. Since then, many women have travelled into space, and now, with our sights set on Mars, the first manned mission to the Red Planet will have women onboard.

Every four or five years, NASA accepts new astronaut trainees; the selected astronauts are of the highest caliber and have to go through an intensive application and training process. NASA's 2013 batch of astronauts is composed of four women and four men; they were chosen out of 6100 applicants, which shows how competitive and difficult it is to become an astronaut. The trainees have to go through many physical and psychological tests to see how suitable they are for a space mission.

Years of intense training follow, where they must learn many skills that will aid them in their journeys into outer space. One of the things they have to do is to experience the weightlessness that goes with being in outer space; they do so by taking a ride in a plane that simulates that feeling. The plane is sometimes called the "vomit comet" for obvious reasons. Another thing they must learn is how to pilot supersonic jets, which is no small feat.

This batch of astronauts will be the first to be trained and prepared for a Mars mission that is expected to take place in 15 to 20 years. While the astronauts prepare for their eventual travel to Mars, this will only become a reality once engineers and

scientists create a suitable spacecraft. The technology that will allow for a manned Mars mission is still being developed, since the spacecraft that is to be made has to withstand a nine-month long travel period to the Red Planet.

On this task is one of NASA's female engineers, Elizabeth Robertson. Robertson is a propulsion engineer at the Marshall Space Flight Center in Alabama, who just had a breakthrough that will help with the mission to Mars. She and her team were able to manufacture a turbo pump that will be part of the launch engine for the Mars spacecraft.

This pump is quite a complex piece and she was able to manufacture it using 3D printing. The 3D printing is helping by leaps and bounds; what used to take years to make can now take only months. This is great because it allows those working to test what they are making as they go, which gives them the chance to tweak and make alternations as they manufacture the engine parts needed. The cost of 3D printing is also lower than traditional manufacturing, which will help in speeding up the process of making the spacecraft headed to Mars.

By using 3D printing there is much more flexibility when it comes to designing the engines; Robertson said that: "We are no longer constrained to tooling access and straight lines. Cooling passages can be built into housings, multiple parts can be built as a single piece, and wall thicknesses can vary over a part to add or remove strength as necessary".

Another NASA engineer who is overseeing the efforts for the manned mission to Mars amongst many other things

is Teresa Vanhooser. She is the second in charge at NASA's Marshall Space Flight Center in Alabama, and is in charge of leading 6000 people who make up the staff of the center. She is in charge of the astronauts who will be going to explore Mars, and is in charge of the USD 2.5 billion budget of the center.

Vanhooser started working at the Marshall Flight Center in the 1990s and was the first woman at the center to head a mission for Spacelab, which is the laboratory that flies on a space shuttle. She is also responsible for "...leading the environmental data satellite SERVIR, the Chandra X-ray space telescope, and critical testing for the new James Webb Space Telescope—the most powerful ever space viewing device". However, what Vanhooser is most enthusiastic about is the work going on at the center to make the first manned mission to Mars a reality.

So far, the Red Planet had only unmanned spacecrafts as visitors; in the near future, however, human footsteps will be making their way on Mars' surface. As of now, men and women are working side by side breaking grounds in coming up with new technology that will soon put humans where we once thought they will never go.

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## LISE MEITNER



By: Moataz Abdelmegid

The splitting of atoms—nuclear fission—was a discovery that changed our world. Few, however, know that a woman physicist participated in the discovery of the real power of nuclear energy. The irony of the story of Lise Meitner is that her laboratory partner of thirty years, Otto Hahn, was awarded the Nobel Prize for Chemistry in 1944, while she was excluded, resulting in the consequent social “marginalization” of her important physics research and discoveries.

Meitner was born in Austria, in 1878, to a Jewish family. Women were not allowed to attend institutions of higher learning in those days, so she had to study privately to earn a doctoral degree in physics, in 1905, at the University of Vienna. She was only the second woman to do so; afterwards, she went to Berlin, where she met the physics legend Albert Einstein, and attended lectures by Max Planck himself.

Planck had previously refused to teach women, but after a year, she became his assistant and teamed up with chemist Otto Hahn with whom she worked for years; together they discovered several new element isotopes. When Meitner and Hahn moved to the new Kaiser Wilhelm Institute in Berlin, in 1912, she worked unpaid in Hahn's department of Radiochemistry. She got a paid position at the Institute in 1913; she was given her own physics section at the prestigious academy in 1917. She and Hahn discovered the first long-lived isotope of the element Protactinium.

With the discovery of the neutron in the early 1930s, the scientific community began to speculate that it might be possible to create elements heavier than Uranium in the lab. A scientific race to confirm this began between Ernest Rutherford in Britain, Irene Joliot-Curie in France, Enrico Fermi in Italy, and the Meitner-Hahn team in Berlin.

The situation changed when Adolf Hitler came to power in 1933. Meitner was the Acting Director of the Institute for Chemistry, and her Austrian citizenship protected her, while other Jewish scientists lost their positions and were forced to leave Germany. Soon after, she realized that her Austrian citizenship could no longer protect her when Austria was annexed by the Nazi regime; she had to flee. She

and the  
Nobel Prize  
Controversy

moved to and settled in Sweden, where she had the chance to work with the man who established the foundation of our understanding of atomic structure: Niels Bohr.

During that time, she continuously corresponded with Hahn and other German scientists. To that point, Hahn had already performed the experiments that isolated the evidence for nuclear fission, finding that neutron bombardment produced elements that were lighter than Uranium. He was mystified by those results; in one of his letters to Meitner he wrote “Perhaps you can come up with some sort of a fantastic explanation. We knew ourselves that Uranium cannot actually burst apart into Barium”.

Meitner carefully reviewed Hahn's results and formulated a theory that explains how nuclear fission happens; her theory resolved Hahn's mystery, and all of a sudden the experiment results made sense. Soon after, Hahn published his discovery of “a chemical evidence of nuclear fission” without listing Meitner as co-author.

Some believe that he genuinely wanted to list her as co-author, but was forbidden from doing so by the Nazi authority. Whatever his intentions were, it remains an undeniable fact that her insights were key to this discovery and to the developments in radioactivity and the nuclear processes based on this discovery, which changed the world. In 1944, the Royal Swedish Academy of Sciences awarded the Nobel Prize in Chemistry to Otto Hahn for the discovery of nuclear fission, overlooking Lise Meitner. Meitner's name was never mentioned and was never associated with the discovery for many years to follow.

The realization that nuclear fission leads to a chain reaction of huge explosive power had meanwhile urged members of the scientific community to act. Knowing that German scientists had the required knowledge, it was only a matter of time before Nazi Germany developed an atomic bomb. The result was the Manhattan Project that gave birth to the US atomic bombs.

Meitner took it as her duty to work on peaceful applications of nuclear fission; refusing to move back to Germany, even when it was safe for her to do so, she worked in Stockholm doing nuclear research into her late 80s. It is worth mentioning that her research included work on Sweden's first peaceful nuclear reactor: R1.

It was not until 1966 that Meitner received attention; by then, her name was accompanied to the discovery of nuclear fission and she received many awards later in her lifetime. An under-valued scientist slighted by the Nobel Prize Committee, Lise Meitner passed away in 1968, at the age of 90. Described by Albert Einstein as “our Madame Curie”, Meitner stands as an example of great women scientists overlooked. In 1992, and in humble recognition of her great scientific discoveries, element no. 109 was named after her: Meitnerium.

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# And Then

By: Lamia Ghoneim

When you think of famous inventors who changed the world, you probably think of Thomas Edison and his work with the light bulb, Alexander Graham Bell and the telephone, and Carl Benz with the automobile; all men. Women, however, have also played a great role with inventions that have helped further develop the world as we know it. Here are a few of their amazing inventions.

## The Dishwasher

Since mid-19<sup>th</sup> century, men and women have been devising machines to ease the endless household chores of washing clothes and dishes. In the 1880s, Josephine Garis Cochrane, the daughter of an engineer, tired of servants breaking her fine china, and decided to work on perfecting a dishwasher.

Cochrane patented her design in 1886; it consisted of a wire crate to hold plates, cups, and saucers, which fitted into a wheel inside a copper boiler. A motor turned the wheel and, as the crate of dishes rotated, a continuous stream of either soap suds or clear hot water was squirted up from the bottom of the boiler, streaming down over the dishes before draining away.

With this prototype, Cochrane established the Garis-Cochrane Dish Washing Machine Co. Her machine was displayed at the Chicago Exhibition in 1893, and won an award for “the best mechanical construction for durability, and adaptation to its line of work”.



# She

## Changed the World

### The Windshield Wiper

Mary Anderson came up with this idea while travelling on a motorized tram in New York, in the snowy winter of 1903. Visiting from the hot, dry State of Alabama, she noticed that the driver frequently had to stop the tram to clear snow off the windshield.

Anderson devised a gadget that had a rubber-bladed squeegee on the outside of the windshield, which was connected to a handle on the inside by a spindle through the top of the window. All the driver had to do was turn the handle on the inside to clear the rain or snow outside.

This simple solution later became an essential and legal requirement for all vehicles.

### Disposable Diapers

Marion Donovan deserves the gratitude of parents around the world for this ingenious invention; if it were not for her persistence, they would never have made it to market. In the early 1950s, Donovan fashioned a special type of paper that was strong, absorbent, and conveyed water away from the baby's skin. Incredulously, everyone she talked to thought her idea was “superfluous and impractical”. Almost a decade later, in 1961, Victor Mills drew upon her vision and created Pampers®.

### The Coffee Maker

It was a German housewife, Melitta Benz, who introduced the world to filter coffee; unhappy with dregs in the bottom of her cup, she came up with a nifty idea. She rolled blotting paper into a cone, put it into a brass pot drilled with holes, and placed it on

a coffee jug. Ground coffee was spooned into the paper cone and hot water poured over it. The paper cone provided a simple answer to the problem of how to stop coffee grounds getting into the cup.

### Dipped Headlights

It was Emily Canham from Highbury, North London, who first addressed the problem of blinding light from oncoming car headlights in 1908. To lessen the glare, she proposed dividing the lenses into zones. Over the top half of the lens would be placed opaque, ground glass—patterned with wavy lines or geometric shapes—or colored transparent material. The bottom half would be the only one emitting pure, bright light.

### Computer Language

Lord Byron's daughter, Ada Lovelace, mathematician and scientist, was the world's first computer programmer. In the 1840s, Countess Lovelace collaborated with Charles Babbage, the inventor of an analytical engine that is generally claimed to be the first computer.

In 1843, at the age of 27, Lady Lovelace suggested to Babbage that she should work out a language for the engine, based on her knowledge of advanced mathematics. This is now considered to be the first computer program. The software developed by the United States Department of Defense was named “Ada” in her honor in 1979.

Not all female inventors were honored or even acknowledged for their inventions though. It was not always easy for a woman to get patents, a female inventor would often have a patent registered in her husband or her father's name, and never receive credit for her invention. We owe those unknown women gratitude for many of the practical inventions that we use today.

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In 1941, Japan attacked the shores of Pearl Harbor and pulled America into war. Patriotic women were volunteering all over the country to serve in Women Accepted for Volunteer Emergency Service (WAVES); Grace was not one to be left out. She filed for a leave of absence and after an initial struggle due to her age—37 years old—and “slight build” as deemed

It took three months to solve it, but Hopper and her team did the impossible and figured out how to make a sphere collapse upon itself and how to assemble the force point locations for its collapse. Hopper found out after the War that the sphere problem she solved was in fact the implosion problem for the nuclear bomb. This was the same bomb that was then dropped on Japan, and six days later the War ended.

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# The Ladies of the Coding World

By: Jailane Salem

It is 2016, and women are still facing challenges in many work fields; equality is yet to be achieved and there are areas where this is more evident than others. While women are yet to be fully incorporated in all work fields, in the field of computer science, there is a severe lack of women working in it.

There are, of course, many factors causing this; from girls being discouraged from pursuing scientific fields, to not having female role models to follow, to companies favoring males, making it difficult for women to find jobs in competitive companies. In the United States of America, only 0.4% of high school girls show an interest in studying computer science in university, which shows that there is an early onset problem, which needs to be addressed.

In comes "Girls Who Code", a brilliant initiative that has the main aim of inspiring young girls into developing an interest in computer science. This non-profit organization does so in various ways; before delving more into what they do, let us find out what this code is.

A coder is essentially a translator that works as a medium between human language and computer language. Now you might think what could this computer language be? Well, it consists of 1 and 0, and is called the binary code. This is the code that essentially tells the computer what to do. How could those two digits mean anything?

It has to do with the combinations it comes in and they can come in millions and millions of combinations. The combinations are made of groups of eight, which are called bytes. Who would have the time and patience to input 1 and 0 over and over to get the computer to work? Of course, there is a better solution than just someone endlessly pressing the 1 and 0 keys for eternity. In comes what is known

as programming languages.

Programming languages come in two levels: Low Level and High Level. The one closest to the binary code are low-level languages, but these are more difficult to use; whereas high-level languages are easier to use to program in since they are designed especially to be easy to write with and are less detailed. Programming languages have their own rules that dictate how a code can be written.

To create different computer software, websites, and applications, one needs to use different programming languages, and these in turn take what coders write and translate it into binary codes that can then be processed by the computer to create the required result. All that we see on our screens everywhere is the result of coding, and this is why it is essential to computer science.

It is clear that learning how to code is a cornerstone for a career as a computer specialist. In the USA, it was projected by the Department of Labor that by 2020 there will be 1.4 million computer specialist job openings. At the rate things have been progressing, it would be difficult to imagine that half those jobs could go to women, because simply there are not enough women studying computer science. This is exactly the issue Girls Who Code is trying to address; if more female school students are exposed to computer science during their education, the chances are that they will be more interested and willing to pursue a computer science in higher education.

The Founder and Chief Executive Officer of Girls Who Code, Reshma Saujani, saw the gender gap in the technological field, and decided it was high time to start implementing effective solutions. The organization provides many programs for high-school girls that teach them the fundamentals of programming, mobile

development, robotics, as well as web development and design.

This essential schooling in computer science trains girls not only in a class environment, but also offers them the chance to interact with actual professionals from the field in order to gain a real-world understanding of it. In this way, they gain the hard and soft skills needed to forge a path in this field. The organization's mission is to expose more and more girls to computer science education in order to encourage them to enter the field later on in life; they have already tutored 10,000 girls across the USA, and are hoping to reach many more in the future.

Many tech companies are involved in providing support to Girls Who Code; one such company is AT&T New York, which has been involved with the organization since its creation. Marissa Shorenstein, President of the Company, believes that Girls Who Code "... opens girls up to the possibility of a career in computer science, which we know is a gateway to better employment for them and a brighter economic future". With the dedication of organizations like Girls Who Code, gender equality in technological fields could be more attainable in the coming future.

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## WOMEN IN SCIENCE:

## Challenge

The development of humanity is also the story of the development of science; it has been our ever evolving understanding of the sciences that has helped us arrive at where we are at today. However, due to the patriarchal nature of many societies, women were excluded from contributing to the scientific fields, or were admitted with great difficulty, greatly decreasing women's contributions.

There have been gains for women wanting to join the scientific field, and great improvements have been made; however, that does not cancel out the fact that much more needs to be done until women are treated equally to men. While women scientists have increased in numbers with more and more women finding a scientific career appealing, the numbers are still in the low ranges considering we are in the 21<sup>st</sup> century.

Two Organizations trying to make a difference by joining hands are the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the L'Oréal Corporate Foundation. In 1998, they launched the *For Women in Science Award*, which was the first time an international award was created to encourage women in the scientific field. Since then, many women have been recipients of this prestigious award; it has helped shed light on the accomplishments of women in science, and has brought to light the obstacles faced by women scientists and researchers.

The award is aimed towards women from all around the world, to help encourage them persevere and instill confidence in other women who wish to embark on similar journeys. The awards go to five laureates from five continents, highlighting the diversity of scientific research being carried out around the world.

Béatrice Dautresme, who is the Managing Director of the L'Oréal Corporate Foundation, as well as being one of the founders of the program, said of the

importance of the award being given to a diverse group of women that "It is essential because we want to support the idea that the vocations of tomorrow may just as likely be found in Africa as on the campuses of American universities or in Asia".

As of now, only 30% of science researchers are women; much still needs to be done to lessen the gap between men and women working in the scientific field. One main reason is that women are discouraged from studying science in the first place; young girls and women showing interest in science are often steered away from their field of interest because it is perceived as a field for men and too difficult for a woman to handle.

This is why the L'Oréal-UNESCO Partnership has created a program specifically targeting young women working in scientific fields. Doctoral and post-doctoral researchers who have received fellowships from the L'Oréal-UNESCO *For Women in Science* national and regional programs are chosen to take part in the "International Rising Talents" program, which aims at accelerating the advancement of young

women in science globally. This new addition to the awards helps accelerate the careers of 15 young women of great caliber, chosen from a pool of 230 women who are awarded Fellowships.

The jury body that chose this year's award recipients consisted of twelve well-known scientists from around the world chosen by the President of the Jury, our very own Professor Ahmed Zewail. Two of the laureates are Prof. Rajaâ El Moursli and Prof. Yi Xie; both have made contributions to their fields and are great role models for all scientists.

Prof. Rajaâ El Moursli, a Moroccan scientist working in the field of high energy physics and nuclear physics, was honored because of her crucial contribution in proving the existence of the Higgs Boson—the particle that is responsible for the creation of mass in this universe. Prof. Yi Xie from China, on the other hand, is a researcher in inorganic chemistry; she contributed greatly to the creation of nanomaterials that could possibly be used in converting heat or sunlight into electricity.

While this is very encouraging and is of great help to the women who receive such support, it does not lessen the obstacles many women still face. So, what are the obstacles that make the number of women in the scientific field significantly less than that of men?

This prominent gender gap is perpetuated by factors that are financial, social, as well as cultural. Starting with the culture, in many countries, women are not encouraged to pursue their education, let alone join universities. Many are advised to choose career paths that are more "female-friendly", and to stay away from fields like





# Facing Obstacles and Overcoming Hurdles

By: Jailane Salem

chemistry and engineering because they are deemed to be fields for men only.

This encouragement to stay away from the sciences is perpetuated from a young age; even though girls and boys in primary schools both perform well in subjects such as biology, physics, and math; by high school girls are not pushed as hard to perform well in those subjects and many steer away from them because they are not given the same encouragement and motivation to do well by teachers and parents, unlike boys who are told to work harder and study more.

As women are discouraged from pursuing careers in competitive scientific fields, they are not given the support that can increase their confidence as their male counterparts. This lack of support and encouragement makes women turn away from these career paths, and if they do end up pursuing them, they always feel like they have to prove themselves and constantly try to show that they deserve to be in the position they earned.

This can also be reflected in their salaries; there is a huge gender gap when it comes to salaries in general, where men tend to get paid more than women for doing the same job, and this inequality extends to the scientific field. According to the *Independent* (UK): "Women are, on average, paid about £5,000 less than men for a university professorship in science,

but in some academic institutions such as Bristol University and the London School of Economics (LSE), the difference can be as high as about £21,000".

Even though many women do end up pursuing scientific careers, not many continue on to obtain their Master's and PhDs, and even less women pursue post-doctoral research. This is in part because women who start families find it difficult to make time for both a career and motherhood, since both paths are demanding ones. Another issue is that not all academic institutions offer the support needed for women who have families, and therefore, pursuing a degree is not feasible for some women. Moreover, women who end up doing postdoctoral research, the labs are not always in the same place where they have settled, and relocating to pursue the research is not always an easy option.

All these factors work against the advancements of women in scientific research, and with the fields being highly competitive, those working on a part-time basis do not achieve the same advancements as those people who have dedicated all their time and energy to their chosen fields. Perhaps in a future, where childcare support will be included in grants for scientists, we will be able to see women having an easier time of continuing with their research, instead of having to make a



choice between having a family and having a career.

Of course, another obstacle is outright discrimination against women, where if a position is open, those hiring tend to choose a male, even if a woman is qualified for the job. This deep-seated prejudice is slowly being addressed and major gains have been made in improving the presence of women in scientific fields, but simply looking at the names of people who are in charge of departments and labs will quickly show anyone that fairness and equality have still a long way to go until it is achieved. This is partly due to the higher percentage of males who are the ones to make it to the later stage of a research career, and therefore, they have a say in who gets tenure and who is hired into leading positions, and many favor men like them, instead of giving both genders an equal chance.

There are great examples of women choosing scientific careers and making waves in their fields, as well as breaking all stereotypes and outdated ways of thinking. However, many changes need to be made, not only to institutions so as to make sure women and men are treated equally, but to also challenge some societies' discrimination against women. While many efforts are underway, more and more people need to join the winds of change.

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By: Lamia Ghoneim

## More Arab Women Scientists

My seven-year old daughter has all the makings of a future scientist. She is fascinated by science and extremely interested in nature's mysteries. She questions every rule and tries to master every skill, and she works very hard to reach the end result she wants. She collects rock samples for fun, she chooses to watch *Discovery Channel* in her screen time, and last month she asked for a children's encyclopedia as her "good behavior reward".

Watching her conduct yet another experiment in my kitchen fills me with pride and joy, but I am also filled with dread and worry. I worry that her childhood enthusiasm may be interrupted by social norms and stereotypes, telling her that science is not for women, and that the lack of sufficient role models may one day dissuade her from pursuing her true passion. Most of all, I worry about a lifetime of challenges and isolation that she might face if she goes against odds—as I believe she will—and decides to venture into the male-dominated world of science.

### Why Should We Care?

Globally, there are significantly fewer women scientists than men. In the Arab region, this gender gap is even more pronounced. A combination of social, cultural, and financial factors play a role in perpetuating this gender gap, spanning from early education through the higher levels of scientific research.

While the percentage of women studying science in the Arab region have dramatically increased in the past few decades, often even surpassing men in many Arab countries, their numbers

are not replicated in the workforce and research, of which women comprise less than 12%. This universal phenomenon is dubbed "The Leaky Pipeline", when women often abandon their careers in Science, Technology, Engineering, and Mathematics (STEM) shortly after receiving their degree, to pursue a more "practical" alternative.

Setting aside factors that lead women to abandon science, why should we care if more women choose to become scientists? This question seems to arise whenever the issue of addressing the challenges of women in science comes up, but I can easily think of a few answers.

For one, attracting and retaining more women in the STEM workforce will maximize innovation, creativity, and competitiveness. Scientists and engineers are working to solve some of the most difficult challenges of our time, and engineers design many of the things we use daily. When women are not involved in science and engineering, experiences, needs, and desires that are unique to women are likely to get overlooked. We should care because a male-centric view of science is just that—male-centric.

With a more diverse workforce, scientific and technological products, services, and solutions are likely to be better designed and more likely to represent all users and the direction of scientific inquiry will be guided by a broader array of experiences. In Arab countries, where we sadly lag behind in science and research, we especially need to maximize the potential of all our brain power, and that includes women who make up—more or less—half the population.

### Unique Challenges

Globally, women and girls need help in overcoming barriers: the raised eyebrows; the isolation of being the only female in the class or office; the double standards in applying for jobs or research grants; and the insufficient supportive laws for childcare and maternity leaves.

Regionally, the challenges are double-fold. Societal inclination to view women primarily as wives and mothers leads to the assumption that they are less willing and capable of taking on the long hours required for scientific work. As such, opportunities to advance scientific careers through scholarships and promotions are mostly offered to males.

For women scientists to advance in Arab societies, countries must prioritize improving the status of women in general, and new laws are needed to protect women's rights to education, work, equal wages, and criminalizing all types of violence and harassment against women at the workplace, in addition to securing equity in access to training and promotion opportunities.

Only then a new generation of Arab girls who love science and yearn to innovate and discover may face less challenges and therefore thrive. For my part, I will do my best to encourage my little girl/scientist, and make sure she knows how her country, and the entire world, really needs her and her scientific mind.

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# Men vs Women

By: Sara Khattab

## Are They Mentally Different?



Differences in mental abilities, between humans in general, and between women and men specifically, have always been a topic of debate among researchers and scholars. Cognitive and biological bases of differences in mental abilities are being explored, but are not yet understood. There is a “general factor” that powers all mental abilities, which is “general intelligence”; general intelligence can be considered as “brain power”. Some scientists say that it is a fixed trait, others think that it is malleable, while others think that it is the ability to adapt to one’s environment.

There is a thought that mental abilities fade with time. A number of Canadian soldiers were tested while serving in World War II, then retested after around forty years. According to these tests, it was proven that abilities concerned with stored information and knowledge are more stable than abilities that are concerned with thinking under time pressure. However, later on, psychologists argued that one can maintain his/her mental abilities level through living in a complex and intellectually stimulating environment, having a flexible personality, and maintaining speed of information processing.

Feminists argue that any psychological differences between women and men, whether in interests, mental abilities, or emotions, are caused by social conditioning, not by genes. Studies suggest that there are very small differences in general mental ability between men and women; there are differences in the way their brains process language, information, emotion, cognition, etc., but these differences do not necessarily relate to differences in intellect.

Scientists explored four primary areas of differences in male and female brains: processing, chemistry, structure, and activity. They used some medical techniques, such as Magnetic Resonance Imaging (MRI) and Computerized Tomography (CT) scan, to investigate differences in sizes of structural brain components, such as the gray and white matters, in addition to the physiological and neurological activity levels in various brain regions.

The gray matter contains most of the brain’s neuronal cell bodies, which are involved in muscle control and sensory perception, such as seeing, hearing, memory, emotions, and speech. White matter, on the other hand, is a bundle of nerve fibers that transmit signals around the nervous system, mainly connecting the brain’s gray matter and other processing centers together.

It was proven that the male brain has a larger total brain volume than a female by 8–13%; however, this size difference has absolutely nothing to do with intelligence. Other studies argue that the frontal area of the cortex and the temporal area of the cortex are more organized in women, and are bigger in volume. Male brains contain about 6.5 times more gray matter than women, while female brains contain more than 9.5 times as much white matter than men. This may explain why women are multi-taskers, while men excel in highly task-focused projects.

Moreover, men tend to process better in the left hemisphere of the brain, while women tend to process equally well between the two hemispheres. Our human memory center, hippocampus, is often larger in females; there is also a higher density of neural connections into the hippocampus in females. Women also have verbal centers on both sides of the brain, while men have verbal centers on only the left hemisphere; that is why women tend to score higher in IQ tests related to social cognition skills, perceptual speed, memory skills, and verbal usage.

Boys are more prone to learning disabilities than girls; researchers found more boys with dyslexia and language problems. Boys are also more likely to be diagnosed with autism, ADHD, and Tourette’s Syndrome. Yet, men score higher in IQ tests in certain specialized skills; such as spatial awareness, motor skills, and mathematical abilities. There is an area in the brain called the Inferior Parietal Lobule (IPL), which is significantly larger in men, especially on the left side, than in women. This area is thought to control mental mathematical ability; this explains why men frequently perform higher in mathematical tasks than women do.

IQ and mental tests cannot accurately measure intelligence; therefore, it is difficult to prove or disapprove whether there are in fact differences between women and men in intelligence or mental abilities. Moreover, there are always exceptions to every so-called gender rule; there are many women with good spatial skills and men with good language and writing skills.

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# TOP 10



Close your eyes and try to imagine the picture of a scientist: what do you see? Is it a white man in a lab coat? Now close your eyes and try to imagine a woman scientist: what do you see? Is it an old picture of Marie Curie in a dim lab?

If you answered “Yes” to the above questions, you are not alone. To this day and age, in the male-dominated world of Science, Technology, Engineering and Mathematics (STEM), women scientists and their role in driving science forward remains fairly invisible.

It is time to stop talking about Marie Curie whenever the issue of giving credit to women in science comes up. Yes, her work was groundbreaking. And yes, she changed the world. But she would have wanted young girls to have more role models to look up to on their path of pursuing STEM fields, and she would have wanted other remarkable women scientists to be recognized and appreciated.

Today, we highlight ten amazing female scientists who are currently making some of the most important and inspiring contributions to our world. So next time someone asks you to name a notable female scientist, you would not have to solely rely on the amazing Marie Curie.

## 1. Katrin Amunts

As leader of the European/Canadian neurological project “BigBrain”, German Professor and Neuroscientist Katrin Amunts has successfully managed to develop the first high-definition 3D model of a complete human brain. Her team’s BigBrain map is so precise and detailed, and is available to use by neurosurgeons and scientists all around the world, in ultra-resolution, for free.

The fine-grained anatomical resolution of the BigBrain allows the scientists who use it to gain insights into the neurobiological basis of cognition, language, emotions, and other processes. It now serves as an atlas for neurosurgery and provides a framework for research in many directions, including enhanced understanding of brain diseases, such as Alzheimer’s disease.

## 2. Elizabeth Holmes

At 31 years of age, Elizabeth Holmes is the youngest self-made billionaire in the United States of America. Her money and fame came from an unconventional source: her love for science.

When she was 19 years old, her uncle died of cancer; in her opinion, the healthcare he had received was inadequate. She, thus, dropped out of college and went on a

mission to change the healthcare industry. That same year, she founded her company “Theranos”; a blood-testing company that uses a prick of blood to obtain the same test results as you would get from an entire vial.

The concept is disrupting and revolutionizing the industry by making blood tests faster, simpler, and most important, cheaper. Investors jumped at her innovative idea and its potential; her company grew from a small start-up into a USD 9 billion biotech company in 2014, of which she owns a 50% stake at USD 4.5 billion.

Since then, Theranos has drawn some skepticism from the scientific community; in part because they are being secretive about how their process actually works, and because they are still waiting for FDA approval of their finger-prick blood test for some diseases. Holmes, however, is confident that her company will get the FDA approval for all testing very soon.

Meanwhile, Walgreens are already offering her approved blood-tests in many of their stores. Now you can just step into the pharmacy, get your finger pricked quickly instead of having your blood drawn by injection, and a day later, receive your test results.

## 3. Maryam Mirzakhani

In 2014, Maryam Mirzakhani, an Iranian Mathematics Professor at Stanford University, became one of only four people to ever receive a “Fields Medal Award”—an award regarded as the most prestigious award in mathematics since there is no Nobel Prize in Mathematics. She is also the first woman to ever receive the award.

The award recognizes Mirzakhani’s spectacular and highly original contributions to the fields of geometry and dynamical systems, particularly in understanding the symmetry of curved surfaces; such as spheres, the surfaces of doughnuts and of hyperbolic objects.

Although her work is considered “pure mathematics” and is mostly theoretical, it has implications for physics and quantum field theory. Her contributions will have impacts on the theoretical physics of how the universe came to exist, and because it could inform quantum field theory, can lead to secondary applications in engineering and material science.

## 4. Emmanuelle Charpentier, and 5. Jennifer Doudna

American Jennifer Doudna and French-born Emmanuelle Charpentier co-authored a key study published in August 2012 that demonstrated the technical power of a technique they named “Crispr-Cas9” to cut and splice genes with extreme efficiency down at the highest resolution possible on the DNA molecule of life. Known as the creators of gene-editing, the two scientists together created a controversial technology that gives scientists the power to remove or add genetic material at will.

Since then, CRISPR/Cas9 has been shown to work in life forms ranging from bacteria, insects, and plants to fish, farm animals, and humans. It has snowballed into a force that has taken the world of molecular biology by storm, promising new cures, new drugs, and even the possibility



# Most Amazing Women in Science Today

By: Lamia Ghoneim

of eradicating some inherited diseases by the creation of “genetically modified” babies.

Working with cells in a lab, geneticists have applied this technology to cut out HIV, to correct sickle-cell anemia, and to alter cancer cells to make them more susceptible to chemotherapy. With CRISPR/Cas9, a scientist could, in theory, alter any human gene. This is a true breakthrough, the implications of which we are just beginning to imagine.

## 6. Katherine Freese

Author of *The Cosmic Cocktail*, Katherine Freese was one of the first women undergraduate students to graduate with a physics major from Princeton University. She has since taken a position as the director for one of the most prestigious theoretical institutes in the world in Stockholm and is credited for her groundbreaking work to better understand dark matter—a mysterious, invisible material that makes up 26% of matter in the universe, and is considered the longest outstanding problem in all of physics.

Scientists are not sure what the substance is, but they call it dark matter and there are dozens of instruments around the world trying to discover particles of it. Freese has been an early force in dark matter and dark energy science; she was one of the first to propose ways to discover dark matter.

She recently developed the theory of “dark stars” that are a type of star powered not by nuclear fusion, but dark matter. Part of Freese’s work is to determine how these dark stars might be observed in the universe. If she is successful in spotting one, it could be the first time anyone has ever observed dark matter directly.

## 7. Nina Tandon

Chief Executive Officer and Cofounder of “EpiBone”, Nina Tandon is revolutionizing medicine. Her company is the first in the world to use a patient’s stem cells to grow human bone that can then be used to repair bone defects like bone loss, potentially changing how 900,000 surgeries per year

are performed. Ideally, these bones can be grown to the exact shape and size needed and are easily implanted into the body because they are made from the patient’s own cells.

Nina began by studying electrical signaling in the context of tissue engineering, with the goal of creating “spare parts” for human implantation and/or disease models. After receiving her Bachelor’s degree in electrical engineering from Cooper Union, Nina worked on an electronic nose used to “smell” lung cancer as a Fulbright scholar in Rome. Along with running her company EpiBone, Nina continues her research on electrical stimulation for broader tissue-engineering applications.

## 8. Sara Seager

Sara Seager is an astrophysicist and planetary scientist with one big goal: To find another Earth. While that discovery remains elusive, she has already helped discover a whopping 715 exo-planets using the Kepler Space Telescope. By studying and understanding the composition and temperature of these planets, scientists are a step closer to being able to identify atmospheres similar to Earth’s. Ultimately, if Seager succeeds in finding another life-sustaining planet, the scientific possibilities are endless.

## 9. Margaret A. Liu

Nicknamed “The Mother of DNA Vaccines”, Liu is known for her work in developing DNA injections as a vaccine to combat viruses. Using dormant viruses as vaccines runs the risk of the virus becoming active again, which makes Liu’s work in DNA vaccines a safer alternative.

Liu began working on a DNA vaccine for the Influenza virus, and was successful in creating a DNA vaccine that would be effective across many strains of the virus. Now working as the Vice-Chair of Transgene in Strasbourg, France, Liu is working on a way to combat the HIV virus by using DNA injections.

HIV mutates so quickly that it can outmaneuver traditional vaccines made from viral proteins or weakened viruses. Worse, a vaccine made from a weakened virus could prove deadly if the virus mutated and regained virulence. Liu’s work has shown that DNA may offer the hope of better, more stable vaccines that can be rapidly produced. DNA injected as a vaccine will signal the body to churn out proteins that protect against HIV by provoking an immune response to the virus.

## 10. Cynthia Kenyon

Kenyon is an American molecular biologist known for her groundbreaking work in slowing aging. Since the early 1990s, Kenyon, has gained prominence in the science community for her discovery that altering a single gene in roundworms could vastly prolong their life span; a discovery which has broad implications.

Since then, she and her team have doubled, quadrupled, and in some instances sextupled the worm’s life span by manipulating several of its genes. They have also found that the same metabolic pathway, controlled by genes, appears to function in other organisms, including yeast, fruit flies, and mice. Kenyon hopes that her method also functions in people—and might be manipulated to extend human life.

Kenyon now works as the Vice-President of Google’s “Calico” venture, where she helps a team of scientists develop methods to slow aging and prevent age-related diseases. The goal of Calico is to extend human lives by up to 100 years.

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# Rachel Carson

## & the Silent Spring

By: Moataz Abdelmegid



An outstanding conservationist, marine biologist Rachel Carson was one of the finest nature writers of the 20<sup>th</sup> century; she is remembered today as the woman who challenged the notion that humans could obtain mastery over nature. Her sensational book *Silent Spring*, published in 1962, warned of the dangers to all natural systems from the misuse of chemical pesticides such as DDT, questioned the scope and direction of modern science, and initiated the contemporary environmental movement.

In her early life, she was educated at the University of Maryland, before joining the US Fish and Wildlife Service in 1936. This is when she started writing her first book, *Under the Sea-Wind*, published in 1941, in which she described marine life in clear, elegant, and non-technical prose. She retained her government job through the 1940s, until in 1951, she published *The Sea Around Us*, which became an immediate best-seller and freed her from financial worry.

During the 1950s, Rachel conducted research into the effects of pesticides on the food chain, published in her most influential work, *Silent Spring*, which condemned the indiscriminate use of pesticides. Unlike most pesticides, the effectiveness of which is limited to destroying one or two types of insects, DDT was capable of killing hundreds of different kinds at once. Developed in 1939, it first distinguished itself during World War II, clearing South Pacific islands of malaria-causing insects for US troops; while in Europe it was used as an effective de-lousing powder. Its inventor was awarded the Nobel Prize.

When DDT became available for civilian use in 1945, there were only a few people who expressed second thoughts about this new miracle compound. One was nature writer Edwin Way Teale, who warned that a spray as indiscriminate as DDT can upset the economy of nature as much as a revolution upsets social economy. Ninety percent of all insects are good, and if they are killed, the ecosystem is immediately affected.

His warning influenced Rachel, who wrote to several newspapers and magazines to propose an article about a series of tests on DDT being conducted not far from where she lived in Maryland. They all repeatedly rejected the idea; this was when *Silent Spring* was given birth to.

*Silent Spring* took Carson four years to complete; it meticulously described how DDT entered the food chain and accumulated in the fatty tissues of animals, including human beings, causing cancer and genetic damage. A single application on a crop, she wrote, killed insects for weeks and months; not only the targeted insects, but countless more, and remained toxic in the environment even after it was diluted by rainwater.

Carson concluded that DDT and other pesticides had irrevocably contaminated the entire world food supply. The book's most haunting and famous chapter, *A Fable for Tomorrow*, depicted a nameless American town where all life, from fish to birds to apple blossoms to human children, had been "silenced" by the insidious effects of DDT.

Once her book was published, it was heavily attacked by the chemicals industry which, not surprisingly, was making enormous profits selling DDT. One of the remarkable critic opinions highlighted that if Man were to faithfully follow the teachings of this book, we would return to the Dark Ages, and the insects and diseases and vermin would once again inherit the Earth. Some of the attacking opinions took it further to a personal level, questioning Carson's integrity, motives, and even her sanity.

Anticipating the reaction of the chemicals industry, Carson had compiled *Silent Spring* as one would a lawyer's brief, with no fewer than 55 pages of notes and a list of experts who had read and approved the manuscript. Many eminent scientists rose to her defense, and when US President John F. Kennedy ordered the President's Science Advisory Committee to examine the issues the book raised, its report thoroughly vindicated both *Silent Spring* and its author.

As a result, DDT came under much closer government supervision and was eventually banned. The public debate moved quickly from "whether pesticides were dangerous" to "which pesticides were dangerous", and the burden of proof shifted from the opponents of unrestrained pesticide use to the chemicals' manufacturers. It is certain, thus, that the most important legacy of *Silent Spring* was a new public awareness that nature was vulnerable to human intervention.

Conservation had never raised much broad public interest; the threats Carson outlined, however, were too frightening to ignore. As a result, and for the first time, the need to regulate chemicals industry in order to protect the environment became widely accepted. It is believed that was the point real environmentalism was born.

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# SHE AGAINST THE WORLD

By: Shahenda Ayman

Early in 2016, Michigan State University and the Hurley Children's Hospital announced a new Pediatric Public Health Initiative to address the Flint community's population-wide lead exposure. This comes after a Flint pediatrician and mother of two had forced the State of Michigan to end its use of the Flint River as its water source.

Dr. Mona Hanna-Attisha, born in the United Kingdom from Iraqi parents, has become one of Flint's best-known doctors; after completing her residency and chief residency at the Children's Hospital of Michigan, she earned a Master's degree in Public Health, focusing on health management and policy, at the University of Michigan School of Public Health. Currently, she is Director of Pediatric Residency at the Hurley Children's Hospital and Assistant Professor of Pediatrics at Michigan State University College of Human Medicine.

In September 2015, Dr. Hanna-Attisha and her team analyzed patients' blood and found high levels of lead. The lead had been seeping into the city's water supply for more than a year; the cause was highly corrosive water flowing through city plumbing, eating away at the pipes, and letting lead leech into the water.

Using her hospital's records, she studied test results from more than 3000 students in and around Flint and found that the number of Flint children with elevated levels of lead in their blood had nearly doubled from 2.1% to 4%; this was after the city had switched to a new water supply.

She felt that her State was facing an emergency and that she had to do



something about it; thus, she shared her results at a press conference. The early response was not as she expected; State officials insisted that the water was safe and tried to dismiss Attisha's findings. Then, a State official pushed the State to do more research and double check the accuracy of Attisha's findings; the results assured her findings. State and federal officials declared a state of emergency; Governor Rick Snyder sent the National Guard to distribute bottled water and water filters to residents. It is worth mentioning that lead is an irreversible neurotoxin with a lifelong, multi-generational impact; it causes a drop in children's IQ and is directly linked to violent offenses. Attisha, thus, predicts that in the coming years there will be more children who need special education. As a result, she and her colleagues have founded the Flint Child Health and Development Fund;

they will collect donations to face Flint Children's long-term needs resulting from lead exposure.

The Pediatric Public Health initiative brings experts in pediatrics, child development, psychology, epidemiology, nutrition, toxicology, geography, education, as well as community and workforce development. The Initiative will employ evidence-based interventions for inclusion in its response to the Flint water lead exposure. It focuses on three overarching areas: education, nutrition, and medical/health.

Michigan State University (MSU) Extension nutrition staff members are working with the Hurley Medical Center to provide nutritional education, including recipes high in iron, calcium, and vitamin C, all of which help block the absorption of lead into the body. In addition, MSU Extension has shared these recipes through its Supplemental Nutrition Assistance Program (SNAP) education classes.

Erin Brockovich, the now-famous legal assistant who helped win a multimillion settlement from a California utility in a 1993 groundwater contamination case, praised Hanna-Attisha on Facebook on 13 January 2016 for her work, writing "The best news I have heard yet for Flint—thank you, Dr. Mona".

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# MARIA MONTESSORI

## and the Development of YOUNG MINDS

By: Sherine Ramadan

Lately, the Montessori Method has become very popular with early childhood professionals and parents in Egypt; it is not new, however. The method dates back to more than one-hundred years ago, when Dr. Montessori gave the world a scientific, practical, and tested educational method, designed in favor of bringing forth the very best in young human beings.

Maria Montessori (1870–1952) is an Italian physician, intellectual, lecturer, full-time educator, and innovator. She first became interested in education while caring for mentally challenged children in a psychiatric clinic in Rome. Her innovative practices—including a combination of sensory-rich environments and hands-on experiential techniques—soon elicited positive learning behaviors from children previously left behind by society.

She designed a special teaching program that allowed them to read and write, surprising everyone when she presented her students at a public school for an examination together with normal children, and they passed the examination successfully. The success of her method triggered her to ask questions about “normal” education and why children failed.

In 1907, Maria accepted a new challenge to open a childcare center in a poor city district. This became the first *Casa dei Bambini* or “Children’s house”, a quality learning environment for young children. She expanded the range of practical activities and exercises for care of the environment and the self; such as flower arranging, hand washing, gymnastics, care of pets, and cooking.

She also included large open air sections in the classroom, encouraging children to come and go as they please in the room’s different areas and lessons. She taught teachers how to respect individual differences, and to emphasize social

interaction and the education of the whole personality, rather than the teaching of a specific body of knowledge.

*“The child can develop fully by means of experience in his environment. We call such experiences ‘work’.”*

—Maria Montessori

Surprisingly, children made extraordinary progress, and soon 5-year-olds were writing and reading. News of Montessori’s new approach spread rapidly, and within only one year many kindergartens were transferred into *Casa dei Bambini*, ushering in the spread of the new educational approach.

### The Montessori Educational Method

Dr. Montessori’s visionary ideas flourish as the cornerstone of the educational practice; her pioneering work created a blueprint for nurturing all children from gifted to learning disabled.

#### 1. The Absorbent Mind

The child is naturally eager for knowledge and capable of initiating learning in a supportive, thoughtfully prepared learning environment. Dr. Montessori believed that young people learn best when engaged in purposeful activity rather than simply being fed information.

#### 2. Children Are the Center of Learning

The method is designed to help each student discover and develop their unique talents and possibilities. They treat each child as a unique individual learner; children learn at their own pace, and learn in the ways that work best for them as individuals. The goal is to be flexible and creative in addressing each student as a unique individual.

#### 3. Education is Fun

The curriculum is focused on hands-on learning, as students work on activities that teach language, math, cultural and practical life lessons. Each classroom is equipped

with materials that first teach through the senses and later lead to reading, writing, advanced mathematics, problem solving, geography, science and cultural studies. Visual arts, music, and movement are interwoven throughout the days’ activities.

#### 4. Multiage Classrooms

Children are grouped by interest and ability rather than age; multiage classrooms help students learn from and support one another, re-creating a family structure. Older students enjoy stature as mentors and role models; younger children feel supported.

#### 5. The Prepared Environment

Classrooms tend to fascinate children; they are normally bright, furnished with child-scaled pieces, warm, and inviting, filled with plants, animals, art, music, and books. Classrooms permit freedom of movement for active preschool children and easy observation for adults.

#### 6. Respect for the Child

Teachers show respect for children when they help them do things and learn for themselves. When children have choices, they are able to develop the skills and abilities necessary for effective learning autonomy, and positive self-esteem.

Thanks to Dr. Maria Montessori’s beautiful mind, the source of her approach and philosophy, which values the human spirit and the development of the whole child in all aspects; physical, social, emotional, and cognitive. She was nominated twice for the Nobel Peace Prize, awarded the Dutch and French Legion of Honor, and received an Honorary Doctorate from the University of Amsterdam.

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# Women in Science Fiction

By: Esraa Ali

The relationship between women and science fiction (Sci-Fi) is in various forms; women as authors, characters in or readers of Sci-Fi works. Although early published Sci-Fi works were written by and for both genders, it has traditionally been perceived as a predominantly male-oriented genre. Female writings were regarded as fantasies, while male fantasies were granted some higher status as Sci-Fi.

In 1817, when Mary Shelley (1797–1851) accepted her friends' challenge to see who could write the best horror story, she became anxious that she was unable to come up with a story. After thinking about it for days, she dreamt about a scientist who created life and was horrified by what he had made. Her dream later evolved into her well-known novel *Frankenstein* and she was credited with founding Sci-Fi as a field.

*Frankenstein*, or *The Modern Prometheus*, was argued to be the first true Sci-Fi work if compared to earlier stories. Brian Aldiss, a Science-Fiction writer, has argued that the central character "makes a deliberate decision" and "turns to modern experiments in the laboratory" to achieve fantastic results.

Mary Shelley noted "How I, then a young girl, came to think of, and to dilate upon, so very hideous an idea?" The answer to that question could be the environment in which Mary Shelley was raised. Her father, William Godwin—an English journalist, political philosopher, and novelist—encouraged her to join conversations that took place in his home with the most influential scientific minds of her time, many of whom were actively engaged in the study

of anatomy. That factor appeared clearly in her novel; she was familiar with the ideas of using dead bodies for study and the newer theory of using electricity to animate the deceased.

After *Frankenstein's* anonymous publication in 1818, it was both well-received and disregarded. When the author was identified as the daughter of William Godwin, the novel was initially criticized and attacked in some reviews for the "feminine" nature of its author. However, since the mid-twentieth century, critical reception has been largely positive, and today it is generally considered a landmark work of Sci-Fi.

In the two centuries since it was published, *Frankenstein* has inspired countless stories; most of them remained centered around a male protagonist, with female characters appearing as damsels in distress, companions, lovers, family members, aliens, or enemies. Then, the feminist Sci-Fi subgenre emerged, where authors have increased women's visibility and perspectives in Sci-Fi works.

A key figure for a feminist Sci-Fi is Joanna Russ (1937–2011), who despite her small output made a huge achievement. Joanna Russ's power lies in her contribution of many essays on feminism and Sci-Fi; she concluded her essay *The Image of Women in Science Fiction* with "There are plenty of images of women in science fiction; there are hardly any women."

Before the 1970s, female Sci-Fi writings were concerned with writing about male adventures in future worlds,

which reinforced the status quo of a subordinate role for women. Yet, in the following decades, the numbers of feminist Sci-Fi, as well as women writing Sci-Fi, have increased. Not only has the old male-originated genre belief been surpassed, but more female Sci-Fi authoresses have also been gaining recognition. Thus, we find a new generation raised on reading great Sci-Fi novels by female authors; such as *Harry Potter* by J.K. Rowling and *The Hunger Games* by Suzanne Collins, leaving publishers scrambling to sign up a new generation of female authors.

Women are an integral part of the publishing industry; they are active in Sci-Fi publishing, editing, and writing, fighting challenges such as marginalization. Old stereotypes are still around; there are still some men who do not buy books written by female authors or with female protagonist. However, surveys have shown that more women than men buy books; publishers will not risk what a would-be bestseller by alienating their female audience. Women are, thus, definitely part of the past and present of Sci-Fi.

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# HYPATIA

By: Dr. Shaymaa Elsherif  
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Center for Francophone Activities



## The Bride and Martyr of Science

Human history has witnessed tragedies and horrors that the people of science have endured confronting extremism and intolerance. Its records are filled with dreadful and sad scenes of scientists losing their lives, being killed, burnt, or tortured to death, for simply having faith in science, applying it, and not accepting an alternative for it.

The Inquisitions' records in Europe between the twelfth and sixteenth centuries reveal the execution of millions of innocent men and women with charges oscillating between heresy and witchcraft. Both accusations were the only means for dislodging any dissenter tempted to declare what is not pleasant to his/her superiors, whether those in power or authority loyalist clergymen. Scientists were a direct target of these repugnant inquisitions; their talks were deemed to summon heresy and blasphemy, which deserved the most dreadful types of torment and the most heinous types of punishment.

That took place during the Dark Ages, which are known as the "Middle Ages" or the "Medieval Period", during which humanity paid a tremendous price, before it was liberated and revolted against this obscene injustice, moving towards urbanization and modernism. However, the Middle Ages are not the real beginning of scientists' persecution. It had begun hundreds years earlier, when humanity knew science and scientists and, at the same time, intellectual extremism began to rear its head in opposition. Likewise, religious extremism craned its neck to violently snatch a place for itself, aiming to dislodge the science that takes an approach based on doubt, which is different than the approach taken by religion, which is that of certainty; getting rid of it and its people had, thus, become a pressing demand that required immediate execution.

Here, we yearn to the horizons of history to find the memory of "Hypatia", with her elegant beauty, masterful science, and bright intelligence. The professor scientist, distinct philosopher, and the virtuous human, Hypatia of Alexandria, the Egyptian, sheathed with science, followed nothing but it, and her savage executioners could not force her to do otherwise. Hypatia, the daughter of Theon of Alexandria, was born around 470 CE and died tragically around 415 CE; she grew up in a distinguished scientific environment, for she opened her eyes on the world to find her father, Theon the mathematician, to be the director of the Library of Alexandria.

Hypatia was deeply and directly affected by her father's knowledge and culture; she was prominently influenced by his specialization in mathematics, in which she excelled. Hypatia co-authored with her father several books, in which they criticized and analyzed Euclid's *Elements* and Claudius Ptolemy's *Almagest*. However, Hypatia was solely distinguished for focusing on the works of Apollonius of Perga concerned with conic sections. The thorough study of this field enabled her to provide new interpretations of ellipse. These interpretations were of major impact on the development of the explanations of astronomy and planetary motion; that is why scientists hail Hypatia among the pioneers of this field.

Philosophy was not far from the mathematician and astronomer; by 400 CE, Hypatia became the leader of the Alexandrian School of Neoplatonism. She is attributed as the best to explain and comment on the works of Plato, Aristotle, Plotinus, and Heraclitus. We may assume that she had an engaging and distinctive teaching method.

Hypatia was never an advocate of incitement, nor did she seek authority; she was solely preoccupied with her science. Most historians asserted that she did not get married, becoming a nun at the altar of science; yet, she was not safe from haters who wished to dislodge her and instigated her killing. Her accusers and condemners did not grant her the chance to defend herself; it was decided to get rid of her completely and instantly. She was attacked, stripped of her clothes, dragged through the streets of Alexandria, then flayed using seashells. Finally, her corpse was burnt in a bloody, violent, and scary scene, to deliver a message to everyone that believing in science is dangerous and forbidden, and that what the extremists wanted must prevail.

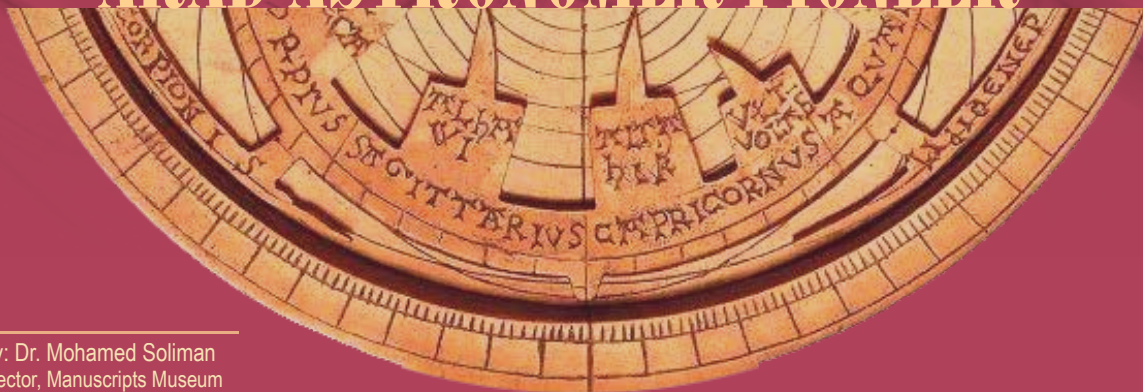
Nevertheless, science has triumphed at the end and Hypatia has lived through her science and beauty. Even if we had lost her written works, we have not lost her essence, and I do not think we will ever lose her. True indeed are the words of Imam Ali ibn Abi Talib:

"Virtue belongs only to the people of science, who are the right guidance for those seeking direction. A person's value lies in which he excels; thus, ignorant are the enemies of the people of science. Seek knowledge and do not accept an alternative; people are largely dead, and only those of science are alive."



# Maryam al-Asturlābiyya:

## ARAB ASTRONOMER PIONEER



By: Dr. Mohamed Soliman  
Director, Manuscripts Museum  
Bibliotheca Alexandrina

Arab Muslim contributions to the human civilization has never been restricted to men; women have always had a great role in these contributions. Naturally, the humanities and religious sciences have these had the greatest share of women's contributions East and West. Indeed, the names of numerous women shine through biographies and translations, especially in the field of "*Hadīth*"—the study of the sayings of Prophet Muhammad and his companions—reaching around 8000 *Hadīth* female experts according to the book *Tabaqāt al-Muhaddithāt*—The Classes of Female *Hadīth* Experts—by Muhammad Akram Nadwi, Researcher at the Oxford Center of Islamic Studies.

However, the role of female experts has not been restricted to the *Hadīth*. There are indeed many female experts of *Fiqh*—the study of Shari'a/Islamic Law—who are mentioned in the encyclopedia *al-Daw' al-Lāmi' li-Ahl al-Qarn al-Tāsi'*—The Shining Light of 19<sup>th</sup> Century People—by the prominent Šamsul-Dīn al-Sakhāwī; the number of mentioned female experts of both *Hadīth* and *Fiqh* reach about a thousand. That is in addition to famous women in the fields of literature and poetry, the names of whom are abundant in our history.

On the scientific front, which is our concern here, there have been significant women scientists of considerable influence; today, we tackle one such scientist: Maryam al-Asturlābiyya, who excelled in astronomy, mathematics, and geometry. We do not know when exactly she was born or died; it is proven though that she lived during the Abbasid Age, during the reign of Saif ul-Dawla al-Hamadānī, 303-356 AH/915-967 CE, who is the founder of the Emirate of Aleppo, north of Syria. It is also well known that she is the daughter of the famous geographer and astronomer Kūšyār al-Jīlī, who died in 420 AE/1029 CE, and is also known as Kūšyār al-Kīlānī after the Persian city of Astān Kīlān—one of current Iranian Governorates.

Kūšyār authored several works about astronomy; amongst them *Risālat Dalālāt al-Kawākib*—A Thesis on Planetary Markers—*al-Lāmi' fi Amthilat al-Zij al-Lāmi'*—Illustrious Examples of the Illustrious Zij—*al-Zij al-Jāmi' wa al-Bāligh*—The Comprehensive and Extreme Zij—*al-Asturlāb wa Kayfiyat 'Amalah wa Itibāruh 'alā al-Kamāl wa al-Tamām*—The Astrolabe, How It Works, and Its Consideration Complete and Perfect—*al-Mujmal fi Usūl Sinā'at*

*al-Nujūm*—The Complete Origins of Star Making—*Usūl Sinā'at al-Nujūm wa Jumalaha wa al-Turuk ilā al-Tasaruf fiḥā wa Isti'māliḥā*—The Origins of Rules Making, Its Phrases, and Methods of Dealing with and Using Them. It is worth mentioning that the Library of Alexandria owns an original copy of the manuscript *al-Zij al-Jāmi'*—The Complete Zij—which was written in 577 AH, and is copied from a handwritten copy by the author himself. It is considered the oldest scientific manuscript amongst the Alexandria Municipality Library Collection, which was handed over to the Library of Alexandria.

As we see, young Maryam was raised amidst a mathematical, astronomical environment, which led to her inheriting these sciences from her father. She delved into both sciences to the extent that she became deft at their complicated equations and calculations; she catapulted from this field—the field of astronomy, now known as space science—to design and build the "complex" astrolabe.

The astrolabe science is a branch of astronomy, which is concerned with the study of simple heavenly objects, their positions, their motions, and their adjustment. It is defined by Hājī Khalīfa in his book *Kašf al-Zunūn*—Revealing Suspicions—as "A science that researches the use of the astrolabe, to understand many of the matters related to the stars, the easiest path, the nearest weakness, revealing the height of the Sun, the horoscope, the azimuth direction, countries' width, etc."

It is worth mentioning that the first invention of the astrolabe was here in Alexandria, during the Greek Era, at the hands of Claudius Ptolemy in 320 BCE. Whatever its definition is, compared to its modern-day equivalent, we can say that the astrolabe is a Global Positioning System (GPS). That is how significant Maryam al-Jīlī's contribution through the invention of the complex astrolabe has been, as it is the ancestor of the GPS, as astrolabes took many different forms during her time; her invention of the complex astrolabe was, thus, of great importance in observation, location and timing determination, as well as calendar definition.

Even though she was not mentioned in detail in translations and biographies, with hardly any information about her life, how she lived and died, she contributed greatly to a scientific transformation in astronomy and the manufacture of astrolabes, so much that her legacy remains to this day.

# MARIE CURIE

## Up Close and Personal

By: Dr. Omar Fikry

Head, Planetarium Section, BA Planetarium Science Center

*"It has been your fortune to accomplish an immortal work for humanity. I have been commissioned to present to you this little phial of radium—one gram. To you we owe our knowledge and possession of it, and so to you we give it, confident that in your possession it will be the means further... to widen the field of useful knowledge and research, and to alleviate suffering among the children of man."*

On 20 May 1921, the President of the USA, surrounded by the Ambassador of France, the Minister Plenipotentiary of Bologna, members of the cabinet, scientists and members of the judiciary, received in the courtyard of the White House a humble, skinny lady dressed in black. The President told her: "It has been your fortune to accomplish an immortal work for humanity. I have been commissioned to present to you this little phial of radium—one gram. To you we owe our knowledge and possession of it, and so to you we give it, confident that in your possession it will be the means further ... to widen the field of useful knowledge and research, and to alleviate suffering among the children of man." The lady was Madame Curie.

Marie Skłodowska, known today as Madame Curie, was born in Warsaw, Poland, on 7 November 1867. Her father was a teacher of physics at a secondary school in Warsaw and her mother was a skilled pianist; Mania—Marie's nickname—inherited her father's brains and the hands of her mother; she showed an early efficiency and great fondness of experimental science. However, her parents did not allow any of their five children to overstrain themselves studying, as tuberculosis ran in their family.

The Skłodowska children prayed every evening: "We appeal to you God to restore

our mother's health"; their mother was very sick and eventually died of tuberculosis when Manya was ten years old. After the mother had passed, the family used to gather around the table sad and poor, for their father had lost his job at the secondary school because of his political activity towards the liberation of Poland from the tyranny of the Russian Czar. He opened a boarding school that received little success; the family, thus, suffered from poor living despite their open minds and their appetite for life.

Those were the difficult circumstances in which Manya was raised; poverty and need from one side, resistance and political activity and disorder from the other; yet, the family survived it all. Years passed and Manya graduated from high school, earning a gold medal for excellence in 1883. One year later, Manya returned from her mother's hometown, the countryside, to Warsaw to face an uncertain future. She and her elder sister Bronya dreamed to study at the Sorbonne, but how could they achieve that while they barely had enough money to cover the tuition of only one?

It seemed an intractable problem; Manya dealt with it saying "I have a solution" and disclosed her idea to her sister "I will find a job and help you till you complete your studies, and then exchange assistance".



This was the plan that was achieved and paid off. Manya worked as a nanny for a rude, bad tempered lady, who economized from the salaries of her employees and was fond of gambling. Unfortunately, Manya fell in love with Kazimierz, her first love, who was son of this stubborn woman, who, of course, rejected the marriage of her son to the girl working for them.

Years and events passed, but Manya did not give up her plan and ambition. With the assistance of Manya, her sister Bronya completed her studies of medicine at the Sorbonne, and it was Manya's turn as per their agreement. She joined the Faculty of Science at the age of 23 and spent four years of continued struggle between studying, working, and saving money from her living expenses after her sister failed to fulfill her promise to her.

Manya worked at the Faculty of Science washing lab tools, cleaning ovens, and preparing scientific experiments; her health worsened due to malnutrition and exhaustion between study and work. However, she overcame all these conditions and acquired her Master's in both physics and mathematics in 1893. She married Dr. Pierre Curie, who was the Head of the Laboratory at the Municipal School of Chemistry and Nature in Paris and had scientific contributions of great value. Dr. Curie was thirty-five years old and Marie adopted his name later.

After marriage, Marie, or Madame Curie, was responsible of the home affairs; she gave birth to two girls while she was studying for her PhD degree in physics. She carried out painstaking and continuous effort, and thus, suffered damage in her left lung as a result of the inherited infection in her family.

Doctors advised her to stay in a hospital, but she did not pay attention and continued her research with her husband, accomplishing unprecedented achievements. She encouraged her husband to conduct further tests on William Roentgen's discovery of the X-ray and its stunning properties in passing through objects. She obtained her PhD degree in that field from the Sorbonne and that was the beginning of Radium discovery.

Madame Curie started on a path seeking one PhD degree but ended with two Nobel Prizes. This article was not enough to reveal more of the secrets of a woman imprinted her name firmly in the timeline of the history of science.



# VISITORS INFO

## Planetarium

### Available Shows

#### Stars Show

45 min. Live Show by the PSC  
Resident Astronomer

#### Oasis in Space

25 min. Full-dome Show

#### Stars of the Pharaohs

35 min. Full-dome Show

#### Seven Wonders

30 min. Full-dome Show

#### The Life of Trees

33 min. Full-dome Show

#### Kaluoka'hina

35 min. Full-dome Show

#### Mystery of the Nile

45 min. IMAX Show

#### Cosmic Voyage

35 min. IMAX Show

#### Alexandria, The Cradle of Astronomy

22 min. Full-dome Show

### Visitors INFO

- For the Planetarium daily schedule and fees, please consult the Center's official website: [www.bibalex.org/psc](http://www.bibalex.org/psc)
- Kindly note that, for technical reasons, the Planetarium maintains the right to cancel or change shows at any time without prior notification.

## History of Science Museum

### Visitors INFO

#### Opening Hours

Sunday–Thursday: 9:30-16:00  
Saturday: 12:00-16:00

#### Guided Tours Schedule

Sunday–Thursday:  
10:30, 11:30, 12:30, 13:30, 14:30, 15:30

- Museum entry fees are included in all Planetarium shows tickets.
- For non-audience of the Planetarium, Museum entry fees are EGP 2.-
- Museum Tours are free for ticket holders.



## ALEXploratorium

### Visitors INFO

#### Discovery Zone

#### Opening Hours

Sunday–Thursday: 9:00-16:00  
Tuesday: 9:00- 12:30  
Saturday: 12:00-16:00

#### Guided Tours Schedule

Sunday, Monday, Wednesday, Thursday:  
9:00, 10:30, 12:00, 13:30, 15:00  
Saturday: 12:00, 14:00  
Tuesday: 9:00, 10:30

#### Entry Fees

Students: EGP 5.-  
Non-students: EGP 10.-

#### Listen and Discover

- For the list of shows available at the "Listen and Discover" and the schedule, please consult the Center's official website: [www.bibalex.org/psc](http://www.bibalex.org/psc).
- For reservation, please contact the PSC Administrator, at least one week before the desired date.

#### Show fees

#### DVD shows:

Students: EGP 2.-  
Non-students: EGP 4.-

#### 3D shows:

Students: EGP 5.-  
Non-students: EGP 10.-

#### 4D shows:

Students: EGP 10.-  
Non-students: EGP 15.-



# She Thought, He Thought

