CHRIST'S HOSPITAL SCIENCE JOURNAL

Diversity In STEM

Michaelmas 2023

Christ's Hospital's Science Journal

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Ancient Science: Discoveries that Went Unrecognised.

When looking back on the history of scientific discoveries, we often picture an Ancient Greek thinker, or a rich alchemist. The background of these breakthroughs focuses on the European upper class. We often forget unsung discoveries from much earlier on. The core pillars of our understanding go accredited to people like Newton or even Pythagoras, but what if the names recognised instead were Madhava or Ulugh Beg?

Ancient Mesopotamia is recognised as the first large scale civilisation and is a valuable part of unsung science. The Mesopotamians developed language, art, agriculture, and mathematics. The number system used by these ancients was counted in base 60, the origin for our time system today. Many believe that the ancient Mesopotamians used Pythagoras' theorem 1000s of years before he was born, an artifact known as Si.427 dating to (1900-1600 BCE). This shows how they dealt with sold farmland; accurately measuring the hypotenuse of the new field line. However, this theory is known as "Pythagoras' theorem" is credited to someone who rediscovered it a millennia later. The Mesopotamians use of maths to solve agricultural problems is astounding and exemplifies geometry's primary purpose; dividing up space. This is but one of the Mesopotamians high level applications of mathematics.

This could not be an authentic look into ancient science without exploring astronomy. Studying the stars has been undertaken by nearly all cultures throughout history with varying levels of detail. Observatories are presumedly part of modern, Western science, but in the 9th and 10th century CE, observatories popped up in the Arab world, such as the observatory in Samarkand. An Arabic prince Ulugh Beg and his team catalogued stars and studied the night sky with instruments not including the telescope, 500 years before the introduction of pre-modern observatories in Europe. Closely tied to religion, the study of the stars aided Muslims to know when to carry our prayer in accordance with correct time. Yet the process in which they undertook this study was far from superstitious, rather highly rigorous, and deductive.

One of the most central breakthroughs in the physical sciences is Isaac Newton's famous calculus (the rate of change) theorised in 1665. There is much dispute over who originally came up with the idea as a German philosopher Gottfried Leibniz also claimed to have produced this system of understanding gradients and areas of graphs. Yet when we look back in history, we start to understand that the first to come up with the idea of calculus may not have been either of these upper-class Europeans, but rather it is thought that the Kerala school in India c.1350. There is writing which describes the infinite series, an important part of calculus which dates back to medieval India and the Kerala school. Much of the writing from the school is hard to decipher, but who knows how much of calculus and possibly other mathematical discoveries they had made? Names like Madhava were central in their school and their writing rivals that of many more mainstream mathematicians of the day.

The history books often recount scientific discoveries as a predominantly rich, European endeavour and that the practice of science was only a part of the developed West. However, as written here, we can see the remarkable breadth of discoveries and practices which predate Western 'breakthroughs. This should not be a call to diminish the works of the scientist who are often credited for these discoveries, but rather a chance to recognise and celebrate some of the forgotten names which have contributed to asking and answering humanities biggest questions.

By Oscar Van– Huet Lindeman, GR, Grecians East

Diversity in Science: Rosalind Franklin & Lise Meitner

Under-representation of women in the field of science

The discovery of the structure of DNA can be argued to be one of the most significant scientific achievements within the last century, which has led to the transformation within the field of medicine and biology. However, even with her daunting years of research, the work of Dr Rosalind Elsie Franklin was stolen from her, which led to her wrongfully being robbed of global acknowledgement and praise. The physicist Dr Lise Meitner aided in the discovery of nuclear fission, but due to her being both Jewish and female she was prevented from her work from being credited. Meitner's collaborator, being male, received a Nobel Prize; this could not have been more discriminative as the professor was nominated 48 times for a Nobel Prize, but people could only recognise her gender and religion, instead of her extensive breakthrough.

Process of Discovery- Franklin

Even with the lack of support from family and society, Franklin continued to achieve her lifelong dream. She fought through the education system, which landed her with a doctorate in physical chemistry from Cambridge University in 1945. Her successful career began from her job at King's College London, in finding the 3D shapes of molecules. Facing struggles within this field due to her gender and her upper-class background and having to deal with countless forms of prejudice within her job, did not affect Franklin in continuing with her work.

Following her doctorate, Franklin went on to spend the years 1947-50 in Paris, educating herself on the techniques of X-Ray diffraction and to determine the molecular structures of crystals. In 1951 she returned to England as a researcher in John Randall's lab at King's College, where she had the delight of meeting her colleague, Maurice Wilkins where the pair worked on separate research projects on DNA. A year into her lab-work, using X-Ray diffraction, led her to the revolutionary 'Photograph 51', which was carefully obtained through a series of steps: figuring out that DNA existed in 2 forms from the pictures taken by X-Ray Diffraction, labelled dry 'A' and wet 'B', and the 'B' form of DNA became 'Photography 51'. This was not easy work, just acquiring 'Photograph 51' took one hundred gruelling hours of X-Ray exposure, and she was left with 365 days worth of calculations essential in analysing the image. During which, James Watson and Francis Crick, were both aiming to figure out the structure of DNA at Cambridge University. Wilkins provided Watson and Crick with the vital information they needed to complete their discovery, without the permission or knowledge of Franklin: this was the sacred 'Photograph 51'. Watson and Crick used the smuggled information finally figuring out the correct double-helix structure that we know today; their model was published in April 1953. By the time Franklin had completed her years worth of calculations, she ended up with the same conclusion as the men and gave her own manuscript. Franklin's manuscript was published together with the pair, however hers being published last, made it seem as if her work was only confirming Watsons and Cricks, and not being independent from it.

Publishing the Structure of DNA

Watson and Crick published their work, using the photo, even crediting Wilkins name as a fellow researcher involved, unlike Franklins who wasn't even mentioned for her key contribution. Before Franklin could've been made aware of the situation, she died in 1958.

In 1962, the three men went on to receive the Nobel Prize for 'their work'. Franklin was wrongfully robbed of great praise. An admirable woman, who faced every possible challenge of sexism, unearthed the key to new advancements within the field of science.

Lise Meitner

The Austrian-Swedish physicist Lise Meitner not only helped with the discovery of the radioactive element protactinium but played a vital role in discovering the phenomenon of nuclear fission. However, due predominantly to her gender and religion, she was excluded from the Nobel Prize while it was awarded to her collaborator Otto Hahn for the discovery of nuclear fission.

Early Life and Education

Born in 1878 in Vienna, during a time of extreme oppression as girls were not allowed higher education, Meitner's family supplied her a private tutor when she was 14. She went on to be one of the first women to earn a doctorate from the University of Vienna in 1906. After graduating, she moved to Germany and accepted a research position at the Berlin Institute for Chemistry before moving to the Kaiser Wilhelm Institute for Chemistry in 1912 to conduct work in nuclear physics. She studied the radioactive isotopes of elements like radium, barium, and uranium, and how these isotopes lost energy. In the 1930s Meitner became concerned with the rise of Nazism in Germany. Although she had been baptized into Protestantism and later converted to Evangelism in 1908, her parents both came from Jewish families, so she was stripped of her working position in 1933. Fortunately, Meitner was able to flee to Sweden in July 1938. She continued her work in Sweden at the Nobel Institute for Experimental Physics.

The Discovery of Nuclear Fission and the Discrediting of Lise Meitner

1938 marked a turning point in Meitner's career when she and Otto Hahn, along with the chemist Fritz Strassmann, made the revolutionary discovery of nuclear fission. Hahn, along with his colleague Fritz Strassmann, found that uranium atoms could be split by bombarding them with neutrons. However, perplexed that mere subatomic particles could achieve this, Hahn contacted Lise Meitner. Together with fellow physicist Otto Frisch, she showed them how fission really worked. This innovation laid the foundation for the development of nuclear energy and atomic weapons, and it was Meitner's insight that was crucial in understanding the process. Hahn was awarded the Nobel Prize for Physics in 1944 for the discovery of nuclear fission while neither Meitner nor Fritz Strassmann was recognised. Meitner's name wasn't even included on the paper Hahn published as he thought it wouldn't be accepted if it had a Jewish co-author. She had even been nominated 48 times for a physics or chemistry Nobel Prize but never succeeded in gaining one.

Lise Meiner's Legacy and recognition

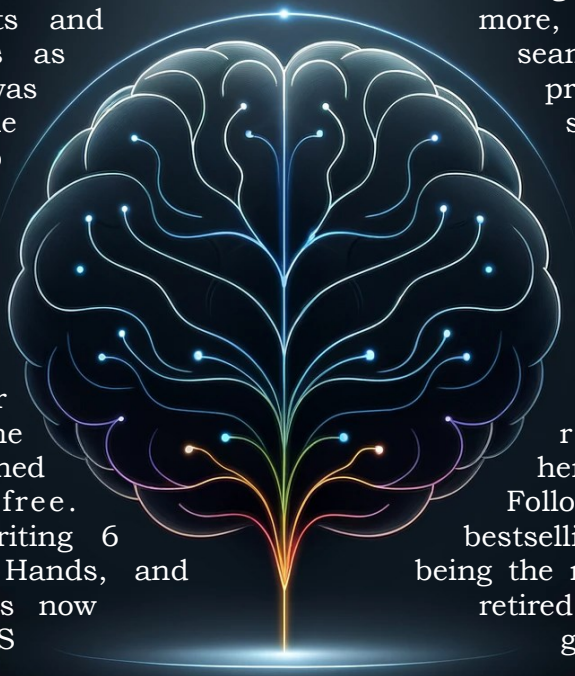
Despite the injustice she faced, this did not stop Meitner, as she was passion driven. She became a well-known figure in the scientific community and finally received awards for her research. Having overcome so many obstacles in life, Meitner actively supported women in science for the rest of her career. In 1997, element 109 was named in her honour of her -

By Kithmi Hewage, DG, Coleridge A & Christine Otuata, DG, Thornton A

Diversity in Neurosurgery

Neurosurgery is a highly specialist profession where just shy of 50,000 people are qualified globally. The speciality combines a variety of intricacies that target the brain, spinal cord, skull, and nervous system, within which there are a multitude of sub-specialties. With so few experts in this field, less so women or ethnic minorities (John Hopkins research shows that women account for 8.4% of neurosurgeons), Black people have the lowest percentages of neurosurgeons compared to their White, Asian, and Hispanic/Latino counterparts.

Ben Carson is an African American neurosurgeon most famous for his successful separation of conjoined twins in 1987. He began his medical journey at Yale University and went on to break new ground in the field, performing the first successful in-utero neurosurgical procedure as well as becoming the youngest ever director of Paediatric neurosurgery in any USA hospital at the age of 33. The relief from the pressure on the hydrocephalic foetal twin's brain was instrumental in the further development of in uterine procedures throughout neonatal medicine. The successful occipital craniopagus twin separation is by far the most renowned career achievement of his. The Binder twins were conjoined at the head and the surgical procedure involved a variety of lengthy procedures; one that required the presence of a large-scale Multidisciplinary Team. Ben organised 70 members of the MDT including neurosurgeons, plastic surgeons, anaesthesiologists and more, who rehearsed tirelessly so the 22-hour surgery was as seamless as possible. A few years after this, Dr Carson was presented with a little girl experiencing uncontrollable seizures that severely impacted her ability to conduct daily functions. Carson performed a paediatric hemispherectomy surgery (surgery involving the removal of a portion of the brain), in this case, the left hemisphere which is responsible for the right side of the body and receiving information from the right visual side, controlling speech, language and word letter and number recognition. Post surgery, despite the removal of the left hemisphere, the girl retained her speech and thoughts whilst being seizure-free. Following his successes not only surgically but also in writing 6 bestselling books, one of which is his autobiography Gifted Hands, and being the recipient of the Presidential Medal of Freedom, he has now retired from surgery and served as a figure head in the US government.



Alex Irene Canady became the first African American female neurosurgeon in 1981, establishing ground not only for female physicians but also the African American community. From the beginning of her journey in medicine, she was discouraged to pursue certain specialities such as neurosurgery. Despite this, her passion for the specialty led her to continue her pursuit for an internship despite the difficulties she faced in obtaining an internship. Through this determination she secured her surgical internship at Yale-New Haven Hospital and became the first woman and African American to begin on their program. Dr Canady's research into neurosurgical techniques led to the invention of programmable antisiphon shunts to treat hydrocephalus, an abnormal accumulation of cerebrospinal fluid inside the brain. The condition has several causes but what is important to note is that congenital (inborn) hydrocephalus occurs in one or two of every 1,000 babies born in the US. The impact of this research has been instrumental in the detection and treatment of this condition and others related to this in newborns and children.

Both Ben Carson and Alex Canady have inspired Black people looking for role models in such a niche specialty. They and others continue to demonstrate the power of determination and hard work despite limitations set by others.

By Manuela Musanga, GR, Grecians East

HeLa cells: how they revolutionized the treatment of disease

Background

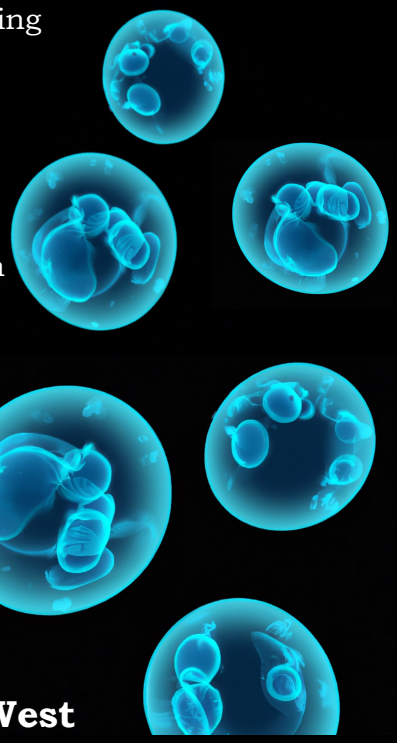
Henrietta Lacks was an African American tobacco farmer born in 1920 in Virginia. After being diagnosed with cervical cancer in 1951 and receiving the standard radium treatment at the time, her doctor extracted two tissue samples from her: one from the cancerous cells and one from the nearby healthy cells. Henrietta died only 8 months after this sample was taken in October 1951.

What made these cells special?

Her doctor had been searching for a cell line to use for cancer research, as cell cultures hadn't been able to be grown outside the body yet. Henrietta's cells not only surviving but multiplying at fast rates was a medical phenomenon at this time. They were the first cells to survive indefinitely and are still the most common cells used in labs today. Henrietta's cells contained an overactive enzyme telomerase, which prevents the shortening of the chromosome telomeres, and allow up to 82 chromosomes to be held in the nucleus, instead of the normal 46, which is what allowed them to survive instead of experiencing ageing and then cell death. Her sample were named HeLa cells, after the first two letters in her first and last name. They were sent to scientists all over the world and contributed to the study of treatments of diseases, most notably used by Jonas Salk for the polio vaccine in 1953, and for the Covid vaccine more recently.

HeLa cells' most notable achievements

Henrietta's cells were the first human cells to go into space in 1960, to study the effects of zero gravity on human cells and have been sent into space many times after this as well. Her cells helped to improve cell culture practices, such as insulation while shipping cells, or rubber lined screws to prevent cross contamination, as it was discovered that HeLa cells could travel through the air and contaminate other cultures through that. HeLa cells even led to the discovery that healthy cells contain 23 chromosomes instead of the previously believed 24 as a lab mix up in 1953 allowed scientists to see each chromosome clearly in the HeLa cells they were working with. This led to the discovery of a technique where chromosomes can be stained and counted that is still used today. HeLa cells even formed the building blocks of what was to become the Human Genome project; the cells were fused with mouse cells to create the first human-animal hybrid cells in 1965, which allowed specific genes to be mapped to specific chromosomes. In the 1980's, Harald Zur Hausen won a Nobel Prize for his work where he linked HPV to cervical cancer after studying HeLa cells, which led to the production of the HPV vaccine which is believed to have reduced death by cervical cancer by 70% worldwide.



Ethical Consideration

Although all these scientific advancements due to HeLa cells have changed the world, it's important to note that Henrietta hadn't given her consent for the sample to be taken, nor did she know about it. In fact, it wasn't revealed to her family that these cells had belonged to her, until the mid 1970's, more than 20 years after her death, and wasn't public knowledge until 2010. This started discussions over ethics in medicine, especially safeguarding for donors and their family. Now, researchers have a stricter set of rules, with informed consent being a focus. Although Henrietta wasn't acknowledged as changing the medical field until years after she should have been, her contribution to science, even if it is unknowingly, has still helped to save thousands of lives worldwide, and will continue to do so.

By Sarah Kluth, GR, Grecians West

Diversity in STEM: An Interview with Dr. Maggie Aderin-Pocock

Dr Maggie Aderin- Pocock is a renowned British space scientist and science communicator whose passion for space has taken her on an incredible journey. Dr Aderin-Pocock graduated from Imperial College London and since then has gained a passion for educating young minds, publishing children's books, presenting TV programmes and more. She is a presenter of the BBC Series, 'The Sky at Night' and has received numerous awards including an MBE in 2009 for services to Science and Education. She worked as part of the team that created the James Webb Telescope, a telescope made by an international team to observe the formation of stars and galaxies. In this exclusive interview we delve into her illustrious career, exploring not only her accomplishments but also the challenges she has overcome.
In this exclusive interview we delve into her illustrious career, exploring not only her accomplishments but also the challenges she has overcome.

You did Undergraduate study at Imperial, what was your favourite project?

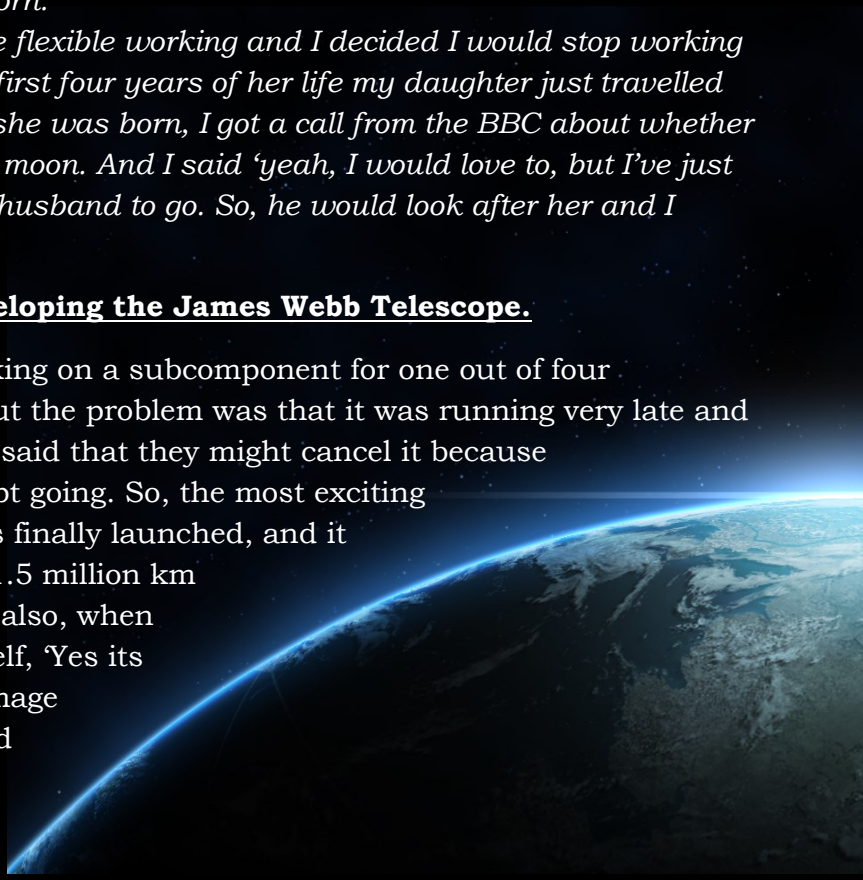
"I mentioned that I made my own telescope when I was a child, sort of 13/14 years old. Since I went to university, one of the things I could do was keep on developing that. One of my first-year projects was to make a tracking system for one of the telescopes. So, what I wanted, was to point the telescope at Zenith and have a computerised tracking system. So, let's say I wanted to look at Saturn, it would move to face Saturn. I had a lot of projects based on the making of a telescope, which I really loved because of the engineering and passion for what I loved, and it led onto my career as a space scientist, you know making equipment to go into space.

What kind of paths did you career take you on and which was your favourite?

So, it was a quite an active decision that I wanted to do the science communication as well as the science, but it was quite a struggle because when you're both it's a lot to juggle. And the breaking point came to me when my daughter was born.
With the science communication I have quite flexible working and I decided I would stop working in industry and do consultancy. So, for the first four years of her life my daughter just travelled around the world with me. Two days after she was born, I got a call from the BBC about whether I wanted to make a documentary about the moon. And I said 'yeah, I would love to, but I've just had a baby'. And they paid for me and my husband to go. So, he would look after her and I would feed her between takes."

Can you share some moments from developing the James Webb Telescope.

"There were a lot of challenges. I was working on a subcomponent for one out of four instruments, and it's quite complicated. But the problem was that it was running very late and very overbudget to the point that congress said that they might cancel it because they spent so much money on it. But it kept going. So, the most exciting time was Christmas day 2021, when it was finally launched, and it went up into space. And with JWT, it sits 1.5 million km away from Earth in a special location. But also, when the first image came out, I thought to myself, 'Yes its working, it's doing its thing'. Seeing that image and knowing I was part of that and enabled that to happen, it was very exciting."



What advice do you have for other Black women in this school that would want to go into STEM?

"In terms of being a minority in a field, being a woman and black, you can use it to your advantage. Many people think, 'I stand out in the crowd, everyone is going to notice me'. But scientists across the world are trying to be noticed, if you've got it built in, I think that can help. But you must be careful, because people will always remember what you say, so make sure it's good but it can be easier to be remembered.

I also think because of the bias that exist, many organisations are trying to redress that balance, and make things more equal, so opportunities can rise from that."

You spoke about the stigma around doing stem especially around minorities, what do you think about the ways education can change to make, stem a more wanted thing to do but also more inclusive.

"I think in terms of gender and minorities, it's a double-edged thing. There are people who think 'girls don't do STEM', those external barriers. But there are also internal barriers, changing the mindset and stereotypical image and I think that's where role models play a vital role. But also showing culturally, that's why I love showing that astronomy has been done across the world, it's not just for white guys in togas, it's for everyone. I think digging into that, we have a history, an interest and fantastic role model that we're good at this, so get those messages out there. It's good to show that we can do anything, find our strengths and weaknesses, and apply that to what we do."

Your show 'The Sky at Night' takes complex scientific topics and making it accessible to a broader audience, how do you approach that.

"Some people have a fear of science, like the 'dinner party'. It's about showing it can be accessible. I speak to people as young as four, as old as 104 and everything in between its about finding the right analogies. For example, when I talk to 4-year-olds, I mention 'Twinkle Twinkle Little Star', a nursey rhyme they are familiar with so we can talk about it. 'What is a star, let's have a look.' It is finding the right hooks for different people and analogies. Finding ways of describing it through things people are familiar with. Also sharing why, I am passionate about it and why you should be passionate about it.

Are there any upcoming projects that you're getting involved in?

"I'm writing another book about the James Webb Telescope. It is an infrared telescope so all the pictures you see is not how it looks; they convert the infrared into visible light. So, it's exploring the invisible universe. It is quite fun looking at all the amazing images and talking about the science behind it. But also, why did they come out with the telescope, what science do we want it to do, how do we want it to perform. Writing is always painful for me because I'm always bad at deadlines and I procrastinate a lot but when you get the final book It's all worth it.

In closing, our Interview with Dr. Maggie Aderin-Pocock has shown the depths of her passion and dedication to science and education. Her remarkable journey from telescope making classes to becoming a pioneer in space exploration is inspiring. Through her engaging discussions and pioneering work on projects like the James Webb Telescope, she continues to make an impact for future generations of scientists and curious minds.

By Subomi Olusanya, GR, Grecians West & Oscar Van-Huet Lindeman, GR, Grecians East

Diversity in STEM: Rhita Wasswa

Can you share your personal journey and the motivations that led to you pursuing a career in engineering, particularly in 5G and Telecommunications, as a single mother in your late 30s?

I am a black Ugandan and at 16, my dad arranged for me to study in the U.K. alone. My English adopted family adored me and encouraged my dreams, but it wasn't easy going to a school as a minority. Initially my dream was to study journalism, but it was hard for me to balance work in the field and being a single mum, so I decided to change my career. I worked at night writing articles and went back to college during the daytime, to study for my Diploma in Electricals & Electronics. My friend helped me with my children and is currently still doing this. I researched for job opportunities that would benefit me and support my children and decided my career path. I am an electronics design Engineer which means I must have knowledge of both electronics and different communication protocols, thus 5G Communications Masters.

As a black female engineer, what specific challenges did you face in the STEM field, and how have you overcome them throughout your career?

My biggest challenge was and still is that, we are the minority. There are a few black engineers & fewer black female engineer. As a women, you find that STEM is a male dominated field and you must cross into their field with determination, focus and the dream to make it. I was often excluded & I found a lot of subtle prejudice. As a black female engineer, I have always had to work twice as hard. It can be lonely so you must create moments to make you happy. I find that it is easier to make friends within a female dominated career than males.

In my current company, I am leading a Diversity & Inclusion team. It not only consists of female & black engineers but any minorities to make our voices heard. As a team we have campaigned for continuous learning links e.g. empathy and resilience at work for diversity and inclusion. People tend to be ignorant with what they say and how they do things since they are not aware of the impact these things can have on others.

Besides this, I have used my position to ensure all workers have equal opportunities as diversity brings diverse knowledge.

What advice do you have for other women, particularly those from underrepresented backgrounds, who are considering a career in STEM or contemplating returning to education later in life?

My advice is to never give up. Women or BAME backgrounds, have more opportunities at such careers because voices are being heard for companies to include us. There is an endless future in STEM and many engineers are over 50 years and still desired with a great input to the industry. STEM is a rebirth every day, every minute, every thought is an idea limitless to gender, sex, age of status.

Could you share any specific accomplishments or projects that you are particularly proud of during your career in engineering, and how they relate to diversity and inclusion in the industry?

I contributed to the production of the maternal EPS belt where I researched, planned & designed the sensors used in the belt for detection of the babies heart and position. I have also worked on different communication test systems designs for vacuum pumps, control systems & drives. As I have previously stated, I am honoured to lead the Diversity & Inclusion Team at my workplace. Initially it was difficult, but our team, through our monthly newsletters, sports teams and activities, are gradually making a difference.

How do you balance your responsibilities as a single mother with the demands of a career in a rapidly evolving field like engineering and what advice do you have for others facing similar challenges?

As a single mother, I plan and ensure majority of my work is done in the office. This allows me to prioritise spending time with my children at home. However, engineering is an ever-changing industry, so I am continuously learning about the new developments and discoveries. My advice to people undergoing similar challenges is to always prioritise time for their family and to never give up on your dreams. Continue to focus on achieving your aspirations which requires planning and discipline.

In what ways do you see the future of engineering evolving, and how can it be harnessed to benefit a more diverse and equitable society?

5G is an emblem of connectivity, especially with mobile networks. Each network is aiming to revolutionise its devices with more efficient, faster and reliable features. Competitors now plan seasons & no more years. It has changed the world from an internet cafe to mobile banking and an expected card-less system by 2030. 6G will come, 7G and so on, it's going become more advanced and efficient. The world will move as it grows in different industries including health, education, travel systems, and many more. For it to benefit the diverse education systems, the government needs to empower, educate and encourage them into STEM fields as they have knowledge of untapped economies & societies which will be beneficial to the STEM Industry. Technology is a thought, an idea and innovation and to exclude diversity will hinder industries, societies & eventually the whole world.

In conclusion, Rhita Wasswa's inspiring journey in the field of engineering, particularly in 5G and Telecommunications, is a testament to her resilience and determination. As a single mother facing the challenges of being a minority in both gender and race within the STEM field, Wasswa's story highlights the importance of perseverance and a strong support system. Her leadership in the Diversity & Inclusion Team further reflects her dedication to fostering a workplace that values diverse perspectives and experiences. She emphasizes the need for diversity in shaping this future. As technology continues to play a pivotal role in various industries, Wasswa believes that a more diverse society can be achieved by empowering, educating, and encouraging individuals from diverse backgrounds to enter STEM fields.

By Adelar Curror, GR, Grecians East

Lack of Diversity in Economics: The 2023 Nobel Prizes

Economics is a subject notorious for its lack of diversity. Notwithstanding the unavoidable association with the male-dominated finance industry, its homogeneity permeates governments, trading floors and academic institutions. Black economists are 64% less likely to work in Russell Group institutions than white economists and are also less likely to hold senior or managerial positions. Students from lower socio-economic backgrounds are less likely to study economics at university, with only 5% coming from areas of low participation to university. Furthermore, among undergraduates, uptake of economics studies is at its lowest among white women. Diversity is crucial to any field, but especially economics. The nature of this social science means that without scholars reflective of the global population, research is open to bias, prejudiced preconceptions, and the overlooking of crucial economic issues.

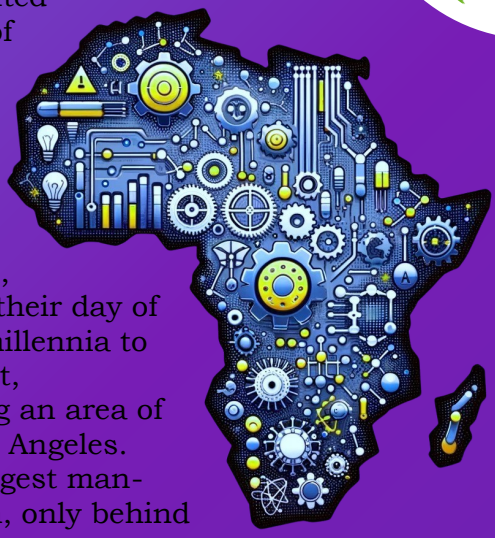
In 2023, the Nobel Prize for economics was, for the first time ever, awarded solely to a woman. Claudia Goldin is only the third woman ever to receive the prize, with the female winners who preceded her; Esther Duflo and Elinor Ostrom, having won alongside other male partners. The Harvard professor was honoured in recognition of her ground-breaking work in examining the historical origins of disparities in pay between men and women, as well as the sources of the remaining gender pay gap. Goldin has analysed the careers and incomes of women for centuries, illustrating the negative effect that the industrial revolution had on individual earnings, as reproductive labour was soon viewed as providing greater economic utility to firms than traditional manufacturing jobs by increasing the labour force, especially as the exploitation of child labour became an invaluable resource to manufacturers. Furthermore, as women were not expected to support their families financially, employers set their wages proportionally lower, and used this to competitively supress the wages of men. However, disparities soon improved with the changing attitudes to gender equality after World War 2, as well as the modern freedoms provided to women through affordable and accessible contraception. Professor Goldin has also provided critical defences for outdated arguments citing educational and career choices for inequalities between current earnings, explaining that the largest impact now comes from the responsibilities and impacts of having children.

As the first woman to receive tenure in Harvard's economics industry in 1989, Goldin is no stranger to being the only woman in a male field. On the problem of economics' image among women she told the BBC "If we explain that economics is about "inequality, health, household behaviour, society, then there'd be a much greater balance,". It is crucial that access to economics is widened from a younger age. In the UK, one in seventeen girls studies A-Level Economics, compared to one in six boys. But inequalities between uptake are not just between males and females. One in five independent school students study A-Level economics, compared to one in twelve students at comprehensive schools. By encouraging a more diverse body of economics students, there will be a greater variety in economics students, leading to a future of smarter government policies and better economic outcomes avoiding the risk of adopting common, suboptimal perspectives. This phenomenon, known as "*groupthink*" has been used to explain a variety of crises and shortcomings in governance, from the failure to detect and prevent the 9/11 attacks to the underestimation of investment risks preceding the 2008 financial crisis. In any case, it is clear that we must do more to break down the social barriers preventing the diversification in the economics sector.

By Evie Duckworth, GR, Grecians East

STEM In Africa

It's no secret that Africa has been a historically underrepresented group in Stem for a while. We all know of the great Pyramids of Giza, but what about other less covered structures? Following along the theme of diversity, let's take a look at the world's most diverse continent and their most impressive creations.



The Great Walls of Benin

The Walls of Benin, locally known as Iyanuwo are a series of several walls and ditches that encircle Benin City in Edo State, Nigeria. These Moats began construction around 800 AD and their day of completion argued to have been completed between the first millennia to the 15th century. Whilst its age is contested, it's length was not, measuring roughly 16,000km (10,000 miles) in total, enclosing an area of roughly 6,500km (2,500 sq. mi), roughly the same area as Los Angeles. This centuries long building effort led to the creation of the largest man-made structure in Africa and the second largest ever by length, only behind the great wall of China.

These walls were made as part of a group effort by the Edo people, including many skilled workers such as craftsmen and engineers from the local area, in a bid to keep their homes and property protected. In their creation of the wall, they prioritised the creation of defensive structures to protect against threats such as moats, trenches palisades and guard towers. These defences clearly paid dividends as the walls stood until 1897, when they were mostly destroyed in a punitive expedition by the British, alongside the destruction and burning of buildings and the looting of treasures and artefacts, such as the renowned Benin Bronzes, leading to a depressing end to an ancient marvel of engineering that was ahead of its time.

The Akosombo Dam

Whilst sub-Saharan Africa has many benefits, one of its less note-worthy attributes is generally access to electricity, with 53% of the area having no access to electricity, however one country stands out from the rest. Roughly 86% of Ghanaians have access to electricity, making it one of the only sub-Saharan countries with an electricity rate of over 85%. Whilst already impressive in its own right, even more so is how the country goes about it, with no other nation in Africa generating their electricity in such an elaborate manner. Their main source of electricity comes from a dam that uses hydroelectric power from Lake Volta, taking up roughly 3.6% of Ghana's surface area, making it the world's largest man-made lake by surface area. The Dam is comprised of two spillways on its eastern-most flank to allowed for controlled relief of water and six 170 Megawatt turbines. This gargantuan project has allowed Ghana not only to provide electricity to its residents, but to additionally sell excess electricity to neighbouring nations, providing the majority of electricity for both Togo and Benin, making it a lucrative business in an area generally devoid of electrical stability.

Whilst this is already captivating, the specifics of engineering used to create this is even more so. To begin with, they first set their parameters of the volta basin by creating a single massive dam wall to hold back the vast swaths of water behind it, measuring 660 meters long and 114 meters high. This resultant basin in which the water would be stored took over four years to completely flood and required the relocation of over 80,000 people from 700 villages to be moved elsewhere, which was 1% of the population at the time of the Dam's creation, highlighting the truly enlarged scale of this project. The power-plant itself is capable of providing roughly 70% of all national electrical demand, making it the 9th largest dam in Africa in terms of power generation.

Conclusion

All in all, Africa, a continent rich in diversity and culture is no stranger to great works of engineering and are more than capable of creating truly awe-inspiring formations, despite the lack of credit they truly deserve. Through looking at the past, we can envision an even brighter future.

By Paisley Ebosele-Park , DG, Lamb B

Meet The Editors

From left to right: George Kuku, Oluchi Otuonye, Ogechi Otuonye, Subomi Olusanya, Sarah Kluth, Adelar Curror, Deborah Abraham, Joanah John, Oscar Van Huet Lindeman & Christine Otuata.

Special Thanks:

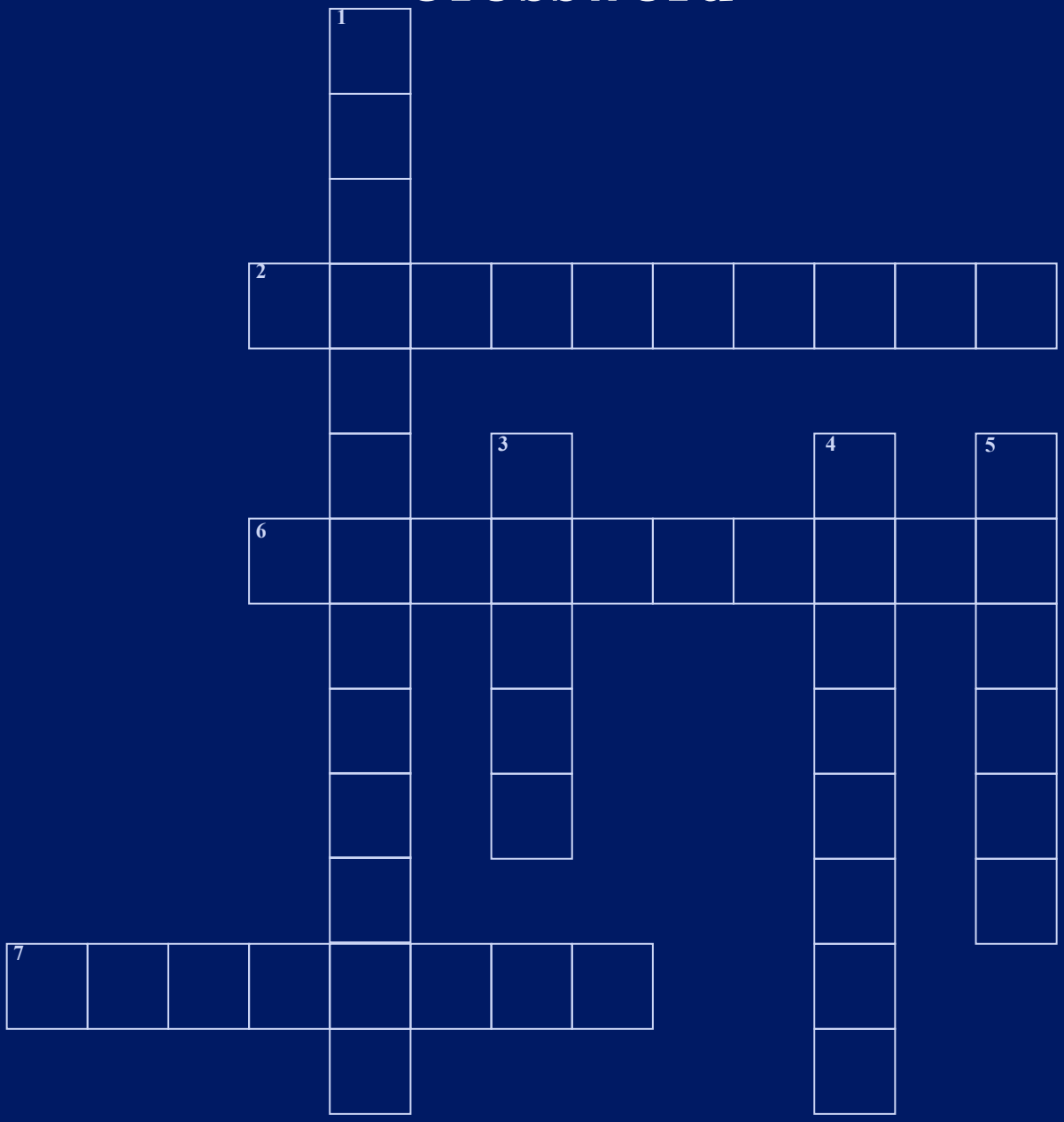
To Wumi Omosini for taking the photo above.

If you couldn't guess, we are on the roof of Old Science with Big School in the back!

Quiz

1. Who was the first woman ever to win a Nobel Prize in Economics?
2. What artifact shows ancient Mesopotamians using Pythagoras' theorem? - Si.427
3. When were the first human - animal hybrid cells created?
4. What part of the brain controls the right side of the body?
5. What phenomenon did Lise Meitner help to discover?
6. Around how many years did it take to flood Lake Volta's basin?

Crossword



Across

[2] The occurrence when groups of people adopt similar flawed or irrational views

[6] An enzyme with prevents the shortening of telomeres

[7] An element that Lise Meitner worked with the radioactive isotopes of

Down

[1] A condition that occurs when fluid builds up inside the brain

[3] The name of the world's largest artificial lake

[4] A form of algorithmic bias that occurs when a system runs on inaccurate sources

[5] The name of a school in India that is thought to have come up with calculus

Quiz Answers:

1. Claudia Goldin
2. Si.427
3. 1965
4. The left hemisphere
5. Nuclear Fission
6. 4 years

Crossword Answers:

Down
[1] Hydrocephalus
[3] Volta
[4] data bias
[5] Kerala

Across
[2] groupthink
[6] Telomerase
[7] Radium



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