



Women in Science



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Inspiring Stories
from Africa

Women in Science

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from Africa



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The Network of African Science Academies (NASAC) was established on 13th December 2001 in Nairobi, Kenya and is currently the affiliate Network for InterAcademy Partnership (IAP) in Africa. NASAC is a consortium of merit-based science academies in Africa and aspires to make the “voice of science” heard by policy and decision makers within and outside the continent. NASAC is dedicated to enhancing the capacity of existing national science academies and champions in the cause for creation of new academies where none exist.

In 2009, NASAC constituted the Women for Science Working Group (WfS WG), a forum for women scientists in Africa aiming to apply the gender-lens in science and the work of science academies. This was done mainly through sharing experiences and setting the gender-specific priorities for academies. Additionally, the Group also encouraged gender mainstreaming in science curricula in education so as to foster pursuit of scientific-careers by girls in schools. The members also agreed to serve as role models.

The NASAC WfS WG has provided immense support to this publication. In their initial deliberations, NASAC was to target publishing 100 stories in the first edition. Unfortunately, when the first call-to-participate was made, only 51 nominations were received from NASAC members and partner institutions. Subsequently, a questionnaire and request for interviews was circulated, from which only 30 nominees responded. It is for that very reason that a decision by consensus was taken to publish all stories received, especially since the target audience would be girls and young women. This publication therefore contains both prominent and early-career women scientists. Much emphasis is placed on the story of their journeys in pursuing their careers, so that girls and young women can be inspired to consider scientific careers as a viable option.

The publication of this first edition of *Women in Science - Inspiring Stories from Africa* was made possible through the financial support from Inter Academy Partnership (IAP), and specifically through IAP-Science.

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Inspiring Stories from Africa

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FOREWORD



Women are under-represented in Science, Technology, Engineering and Mathematics (STEM) fields globally, but the situation is worse in Africa. In response to this, the Inter-Academy Partnership-Research (IAP-R) partnered with NASAC to publish a book profiling African women scientists. Women in STEM fields face various challenges such as educational constraints, cultural and gender prejudices as well as stereotyping, which influences their opportunities and choices. The result of which is a severe reduction on the number of women who enrol to complete studies and are employed in STEM fields. Consequently, the Women for Science Working Group also identified profiling African women scientists as a priority area for NASAC in 2011.

This publication profiles women in STEM fields in Africa. The stories are written mainly to inspire girls and young women to pursue careers in science. The language used is simple and the stories can be retold in ways that demystify STEM careers. The women scientists featured in this publication come from all walks of life; privileged and under-privileged, residing in either rural or urban settings. Like others in their category, these women scientists have combined several techniques and roles to find fulfilment and contribute to development. They are mothers, wives, counsellors, teachers or caregivers among other gender roles. In spite of their success in STEM careers, efforts and sacrifices, they still encountered and overcame various challenges. These scientists demonstrate that women can excel

in STEM fields. They are humble and in touch with reality; particularly the challenges that women and men face in their countries. Despite this, they have sought solutions and innovations through science.

This publication contains stories of thirty women from eighteen countries across Africa, who have excelled in various STEM careers such as Agricultural engineering, Biotechnology, Biochemistry, Analytical and Nuclear Chemistry, Engineering, Mathematics, Medicine, Biotechnology, Information Science, Pharmacy, Physics and Veterinary Medicine among others. The stories as told by the women scientists affirm the importance of science in solving human problems. They also underline the sacrifices one must make for one's dreams to come true. By reading these stories, you will learn that women have the capacity to excel in science and that from an early age, curiosity and interest in science has to be nurtured so as to blossom into successful careers. This however, does not always happen as some of these careers are erroneously considered incompatible with womanhood. The scientists whose stories are narrated however show a commitment to the mentorship of young women and men in various STEM careers.

It is with much humility and joy that I present this book. It is my earnest hope that this book lights up your path to excel in STEM careers and that you will grow in strength and wisdom to overcome any odds that life may throw your way. The stories

have beautiful pictures, which demonstrate that beauty and science are compatible, science and womanhood is possible and above all, that a balance between information, inspiration and determination are pertinent to achieving your goals. I am honoured

to write a foreword to this book, which celebrates the achievements of the intrepid women who have paved the way for the next generation of female engineers, biologists, mathematicians, doctors, astronauts, physicists, computer scientists and more.



Prof. Mostapha Bousmina

President, NASAC

INTRODUCTION

“*Women, in time to come, will do much*”



The stories of the African women scientists in this book breathe life into the statement, “*Women in time to come will do much*” - Mary Ward, 1585-1645. Amidst a lot of resistance from the church and society in her time, she founded Loreto schools (mainly for girls) as she was convinced that with a good education, women would positively impact their families and communities.

The stories and achievements of women in the field of science allow the reader to traverse the continent of Africa and the diverse fields of science. Through these stories, one feels their remarkable energy and commendable efforts. Their struggles to succeed amid social, economic and cultural barriers to women’s uptake of science, work/life balance, perceptions and stereotypes demonstrate that women can overcome and ultimately excel in science through self-will and determination.

I walked with each of these women from their narrations about childhood curiosity and what propelled them to science right through to their adulthood and current engagements. It is evident from their stories that an innocent early interest can and should always translate into a science career that we as women scientists are passionate about. The stories emphasise the central role played by parents, siblings, teachers and close relatives as enablers of girls’ success in science. Unfortunately for some, the same people stand in the way of women and girls’ flourishing careers in science. From these stories, we learn the important role that

information on science careers can make to girls’ and women’s career paths.

The stories in this book show that women scientists – old and young – are involved in projects that are conceived and driven by the struggles, day-to-day needs and the concerns of people in their communities. Indeed, through the projects they have initiated, these women scientists are providing home-grown solutions to the problems women, children, men and indeed communities face. These include disease and malnutrition, poverty, environmental degradation and food security, to mention just a few. Whole communities are reaping the benefits of their work.

This book, therefore, serves as a push to all girls and young women to take up any science in this universe and make a career out of it. It complements a previous publication from the Inter-American Network of Academies of Science (IANAS) titled ***Women Scientists in the Americas - Their inspiring stories*** and the lives and careers of successful women scientists in the Americas. It also assures those in doubt (often due to misinformation) that science is wonderful, it is exciting; and the women who are in scientific careers are beautiful, well-groomed, and above all, happy to be who they are.

Dr. Pacificah F. Okemwa

*Consultant Writer and Secretary
NASAC Women for Science Working Group*



Adeyinka FALUSI

Nigeria

“ Young girls and women can be encouraged to excel in the Sciences through a role model approach ”



Adeyinka Falusi is the President of the Sickle Cell Hope Alive Foundation (SCHAF) and a retired professor of haematology at the University of Ibadan, Nigeria. She has published over eighty journal articles and over hundred invited-guest abstracts and conference proceedings.

Growing up in Efon Alaaye in Ekiti State, Nigeria, Adeyinka was inspired to study science by an older girl (Grace Oladunni Olaniyan, now Prof. Taylor) who lived in their neighbourhood. Adeyinka marvelled at Miss Grace's diligence and in true nature of a child, she was also curious about the huge science textbooks that Miss Grace read. She dreamt of being admitted to Queen's School Ede, one of the best government secondary schools in Nigeria at the time to get to study science like Miss Grace. Luckily for her, in 1959 she was selected as the only successful candidate

from Efon Alaaye for enrolment to Queen's School where she received a good foundation in science. Her fascination and curiosity in science grew in leaps and bounds and translated into the discovery of her research interest in experimental science which was nurtured by excellent tutoring at the premiere University of Ibadan.

With many years in her science career, Adeyinka has made remarkable strides in research. She recorded new findings in different areas and types of anaemia and sickle cell disease as genetic conditions as demonstrated in her publications on the matter. Much of the research Adeyinka has done has contributed greatly to the management of non-communicable diseases such as sickle cell disease, breast cancer and malaria. However, in her view, the most exciting project was on sickle cell disease, between 1982 and 1987. Her findings led to the global rewriting of the existing scientific literature on the prevalence of specific variants of sickle cell disease among Nigerians. As a result of her excellent scientific findings over the years, Adeyinka received the L'Oreal-UNESCO award for Women in Science (Africa 2001) as shown in the photo below. This award is presented to one outstanding scientist per continent each year. Other commendations Adeyinka has received include Fellow Nigerian Academy of Science (FAS, 2009), National Productivity Order of Merit (NPOM, 2009) Award among others.



It did not escape Adeyinka that the Nigerian population would require a platform to help create

awareness about sickle cell disease and provide support and information to patients. This led her to begin a social intervention by establishing the Sickle Cell Hope Alive Foundation (SCHAF) in 2012 and inaugurating it in 2014. Under her leadership, the not-for-profit organisation has made great strides including writing a parents' handbook guide for sickle cell patients and which is distributed free.

As an African woman scientist, Adeyinka also researched other diseases that affect women, including breast cancer. Subsequently, in collaboration with other scientists, a specialised laboratory in immunohistochemistry (IHC), which provides services in Nigeria precisely on breast cancer, was established by her team. She developed the first ethics review guidelines and ethics policy document for the University of Ibadan and also assisted in capacity building for ethics of research in other Nigerian institutions and in Africa.

Adeyinka's life, as an African woman scientist, has helped to disprove the notion that a career in science is incompatible with the burden of bringing up children. With her husband, Prof. Abiodun Falusi, they raised five children. On this however, she acknowledges that in Africa the load of child care is heavily on the shoulders of women and this discourages some women from embarking on a career in science which sometimes requires extensive hours of work in laboratories.

Despite the obvious challenge of long working hours, Adeyinka says support from her family helped her to pursue her career. On other work-related challenges like interrupted power supplies and lack of essential equipment, she was able to collaborate internationally with other scientists to

apply for competitive grants that helped her to carry out her work.

With this in mind, Adeyinka has provided mentorship to a number of women scientists like Professors Chinedum Babalola and Millicent Obajimi who are shining stars in the world of science. She has also established various awards to encourage young female scientists in her locality. These awards include the Adeyinka Falusi L'Oreal-UNESCO Laureate Annual Award for Best Graduating Female Science Student at the University of Ibadan, from 2009 to date, the Adeyinka Ologbenla-Falusi Female Empowerment Programme (AOFFEP) for the Best Female Science Student and two runners-up in Efon-Alaaye, Ekiti State, from 2010 to date and the Annual Award for the Best Graduating Female Science Student at her former secondary school Queen's School, Ibadan (2010 to date).



With a career spanning decades, Adeyinka has grateful words for her mentors and role models. One of them is Prof. Lucio Luzzatto, an academic and researcher, whom she describes as an Italian with a Nigerian heart. Prof. Luzzatto allowed Adeyinka to carry out her research in his various

laboratories and also helped her source grants. Her other role model and childhood inspiration is Prof. Grace Olaniyan-Taylor, of the Department of Chemical Pathology, University of Ibadan. She also acknowledges her PhD supervisors who were instrumental in her science career.

Adeyinka is convinced that besides study, young girls and women can be encouraged to excel in the sciences through a role model approach.



Akissa BAHRI

Tunisia

“ Young girls should be trained in science careers and be mentored to pursue leadership positions ”

Akissa Bahri is a professor at the National Agricultural Institute of Tunisia. Previously, she worked as Coordinator of the African Water Facility, Director for Africa at the International Water Management Institute and Director of Research at the National Research Institute for Agricultural Engineering, Water, and Forestry in Tunis, Tunisia.

She attended Lycée de Jeunes Filles Armand Fallières from 1959 to 1963 for her primary school education and Lycée Carnot from 1963 to 1971 in Tunis, Tunisia for her secondary school. She was then selected by the director of the School of Engineers of Tunis, Mr. Mokhtar Latiri, to be among the few students sent to France to the preparatory classes at the Grandes Écoles. She prepared for the entrance exams into the Grandes Écoles of Agronomy at the Lycée Hoche in Versailles (1971–1974). In 1974, after passing the competitive entrance examination, she was admitted to the École Nationale Supérieure d’Agronomie de

Toulouse, France, where she obtained her degree as an agricultural engineer. She then received a doctorate degree in engineering science and technology (plant production and product quality) in 1982 from the National Polytechnic Institute of Toulouse, France. In 1995, she got her PhD in water resources engineering from the Department of Water Resources Engineering, Institute of Science and Technology, Lund University, Sweden.

Akissa’s parents, Jalila Ben Othman and Mohammed El Hédi Bahri, had strong personalities who influenced her early educational aspirations. Her father had trained at the prestigious Azzaitouna University and obtained the highest diplomas. Her mother had great talents in different fields. In addition, her family comprised of scientists and from early in life, emphasis was put on scientific disciplines. Luckily, her parents gave her the same opportunities as her brothers. Coming from Tunisian



upper-middle class families, her parents valued education and gave priority to the intellectual and personal fulfilment of all their four children.

When she began her work at her research institute, Akissa was one of the only two women out of ten researchers. The agriculture and water sectors were male dominated and her primary challenge was proving that she could undertake field research work even in difficult conditions and make a difference. Akissa was interested in understanding the farmers' practices and therefore started her research work by conducting investigations on the farmers' production systems of the Valley of Kairouan in central Tunisia. This part of the country is affected by water scarcity and salinity problems. The farmers had special cultivation practices where the irrigated part of the farm was mainly reserved for pepper. After transplanting the young pepper shoots, irrigation was halted for a month to boost development and fruit production. She intended to study these practices in combination with studies related to water and solute transfer. She conducted field investigations and experiments to analyse the interactions between soil, water, plants and the farmers' practices from geochemical and agronomical points of view. Her work allowed her to better understand the development of salinisation processes in the irrigated schemes of the Valley of Kairouan and farmers' agro-ecological practices.



Her work was awarded the Grand Prize of Scientific Merit for Development from Guinness Foundation, in 1984.

A very attractive project, in her opinion, was her research into the use of renewable energy for pumping water and other purposes. She worked on the first solar pump that was installed in the experimental research station she managed in central Tunisia. It was aimed at reducing the country's dependency on fossil fuels and finding alternative energy sources to the diesel or electric pumps that farmers were using to pump water from wells up to fifty metres deep. The solar energy was generated by photovoltaic panels. The solar-powered pump incurred less maintenance costs than the diesel pumps and had less negative environmental impact.

Akissa also trained in Gainesville, Florida, USA in alternative energy technologies for three months. She then worked on a renewable energy project managed and implemented by the US National Aeronautics and Space Administration (NASA) and the Tunisian Electricity and Gas Company that aimed at equipping the village of Hammam Biadha with renewable energy. This research not only excited her but opened new doors for frontier science. Unfortunately, due to the international decrease in the price of fuel, the research programme was discontinued. The picture below shows one of the solar water pumps tested in Tunisia in the 1980s.



Her most impactful project was research on the agricultural use of reclaimed water and sewage sludge. These practices, if not well managed, become a threat to public and environmental health. Through laboratory work and field tests, Akissa and her team of researchers identified best practices for using the reclaimed water and sludge. The findings were communicated to the Tunisian government authorities with the aim of influencing policy directives to guide farmers' practical application. Consequently, she became a key policy adviser and in 1996, she received the Kuwait Prize in the field of waste recycling from the Kuwait Foundation for the Advancement of Sciences.

In her position as Laboratory Chief at the National Research Institute for Agricultural Engineering, Water and Forestry and Head of the National Commission for Agricultural Water Research Programming and Evaluation, she was able to influence the research directions and the results' transfer with a strong focus on efficient agricultural water use. She was also a member of the team that contributed to the adoption of regulations for water reuse and land application of bio-solids in Tunisia issued in 1999 and 2007. The results derived from her research work were used to draft the Tunisian policy and regulations on bio-solids management.

She has also developed extensive practical experience in those fields in Tunisia, other semi-arid areas of the Mediterranean region, the Middle East and elsewhere in Africa. Thus, she has been involved in drafting the *"Guidelines for municipal water reuse in the Mediterranean countries"* and in contributing to the drafting of the *"Recycled Water Master Plan for the Abu Dhabi Emirate"*. Furthermore, Akissa has been involved in many other cutting-edge innovative projects on promoting sustainable urban sanitation service provision at different stages of the sanitation value chain and through a mix of institutional models (business-led, NGO-led or municipality-led). These projects implement different approaches to improving the sustainability of sanitation services along the complete value chain, including developing the capacity of service providers, facilitating access to finance, developing integrated business approaches, and strengthening municipal institutions. Treated waste is reused as fertiliser or provides biogas or electricity, leading to a significant reduction in greenhouse gas emissions. She has also presented many keynote addresses and scientific papers at conferences at national, regional and global levels on various topics on her area of interest.

Akissa wants change for Africa and her country and this keeps her motivated. Nearly half the population of the developing world suffers from diseases associated with inadequate provision of clean water. This is predominant in sub-Saharan Africa where an estimated 1.2 billion cases of diarrhoea occur annually with deaths of about 770,000 children under the age of five years. The need to deal with these problems is what drives her work as a scientist. She would also like to contribute to the education of a new generation of urban water leaders and managers, who will promote reforms, as well as new technologies and business models to build the cities of the future.

As a young female scientist, some of the challenges she faced included lack of funding for research, building up a research team with a strong team



spirit, and handling managerial duties together with scientific work. A break came in 1980 when she became an International Foundation for Science (IFS) grantee. It improved her access to funding. From the onset of her career, she was tasked with heavy managerial responsibilities at the expense of her research work. She had to learn management on the job as she did not train as a manager and had to develop her expertise through "learning by doing". The recognition and appreciation of her work motivated her to do more. She has also received support from well-known scientists from different parts of the world such as Prof. Takashi Asano (UC Davis, California, USA), Prof. Gunnar Lindh and Prof. Ronny Berndtsson (Dept. of Water Resource Eng., Faculty of Engineering, Lund University, Sweden), and Prof. Frank Rijsberman (Director-General of the Global Green Growth Institute, Seoul, Korea).

The main challenges she has faced are related to the status of women in an Arab-Muslim culture and in the professional world which was male-dominated, and to finding a right work-life balance. She explained that she was unable to find a balance between her demanding work and personal life – she chose her work.

Regarding her role models, Bahri indicated that on a personal level, her mother, grandmother and



generally the Tunisian women of yesterday and today are role models because they are an example of courageous women who had to struggle, often against the current, to succeed and did not give up in the face of adversity.

Professionally, the late Kenyan environmentalist, Prof. Wangari Maathai greatly inspired her. She was a renowned scientist, environmentalist and political activist who fought for environmental protection, human rights, peace and democracy in her vocation. She surmounted great obstacles to achieve the results for which she is known today. Prof. Wangari Maathai who died in 2012, was awarded the Nobel Peace Prize in recognition of her contribution to sustainable development, democracy and peace.

Akissa expresses the need to educate and empower girls and young women to emulate the best practices and role models. Young girls should be trained in scientific careers and be mentored to pursue leadership positions. She strongly believes that career women ought to support each other and the young generations. Specifically, for the latter, role models ought to share their knowledge and experience, encourage them and highlight their potential so that they are more confident in their capabilities to push the frontiers.



Alsácia ATANÁSIO-NHACUMBE

Mozambique

“ I would like to see an increase in the enrollment of girls in Science and Engineering courses... ”

Alsácia Atanásio-Nhacumbe is the director of the National Biotechnology and Biosciences Centre (CNBB), which is a public institution under the mandate of the Ministry of Science and Technology, Higher Education and Technical Vocational Training (MCTESTP) in Mozambique. In 2007, she was awarded a certificate of excellence by the country's Minister of Science and Technology for good performance when she established the National Research Fund (FNI) as Executive Director.

Throughout primary and secondary school, she achieved excellent grades in all subjects although her passion leaned more towards natural sciences. She interacted well with her colleagues and teachers. In standard eight, she was offered a government scholarship by the country's founding President Hon. Samora Machel as the best student in her class.

The scholarship covered her studies including university education. She became the first woman veterinarian in Mozambique with a PhD in Veterinary Science which she was awarded in the year 2000. She studied the prevalence of protozoa and the effects of gastro-intestinal nematodes in the production of goats in Mozambique. This has contributed to measures for strategic control of diseases in the country.

In addition, as the Executive Director of the National Research Fund, from 2006 to 2013, she established and managed

this institution. Through it, two hundred research, innovation and technology-transfer projects were funded, which has strengthened the national research system. Furthermore, as Coordinator of the World Wide Web Foundation's Project "Women's Rights Online" in partnership with the Science, Innovation, Information and Communication Technology Research Institute, she contributed to a research and advocacy initiative on digital equality and women's rights online report card for Mozambique, with a five-point action plan to narrow Gender-Based Digital Divide.

As an animal parasitologist, her projects have had great impact on agriculture in the country. She has designed strategic measures for the control of gastro-intestinal parasites in goats raised under the traditional system in communal pastures used by smallholder farmers. These measures reduce losses

in the production of small ruminants, hence increasing income generation of rural livelihoods through animal production. In 2000, she reported, for the first time the occurrence of anthelmintic resistance of gastro-intestinal parasites to the benzimidazoles and imidati azoles in goats. Also, as Executive Secretary of the Technical Council for Agricultural Research from 2003 to 2005, she led reforms in the agricultural research system in Mozambique. This led to the creation of the current Agricultural Research Institute of Mozambique in 2004.



Alsácia is motivated by the contributions she has made to the advancement of science in Africa. She was a member of both the Global and sub-Saharan Africa design teams of the “International Assessment of Agricultural Science and Technology for Development” where she also represented Mozambique as a bureau member from 2004 to 2007. She has also worked with the Forum for Agricultural Research in Africa and the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) as a panellist in different events on the theme *women in science and agriculture*.

As a scientist, she would like to see more attention paid to increasing the enrolment of girls in natural sciences and engineering courses in Mozambique, and, indeed, the whole of Africa. However, Alsácia is aware that not much attention has been paid to financing scientific research in Africa. In her view, therefore, African governments need to increase state budgets for scientific research and reduce dependence on donations and credits.

She has faced great challenges, both as a researcher and as a manager of various research institutions. In addition, as a woman researcher, she sometimes felt that her efforts and contributions had not been rewarded or recognised sufficiently, which she found demotivating. Other challenges she faced are linked to lack of funding, which led to lack of equipment and infrastructure for her research. Of concern to her too are the low salaries for researchers in Mozambique. But, equally important for the next generation of scientists, is an absence of women role models to encourage younger women and girls to undertake studies at tertiary education and post-graduate levels. To help overcome these challenges, Alsácia has often worked with national and global partners to mobilise resources for the National Research Fund (FNI) of Mozambique. Much of the secured resources were directed towards purchase of scientific equipment and laboratory modernisation. To address the lack of role models, she undertook post-doctoral studies at the age of

fifty-three to update her knowledge in her research field, and to serve as an example for younger researchers, particularly women, that age should not be considered a barrier to progress in scientific, or any other, career.

Socially, she suffered lack of support and understanding by her spouse which sometimes holds her back. Additionally, in 2014, she suffered gender-based violence (GBV) online via WhatsApp, Facebook, E-mail, cell phone text and voice messages by people who always posed as her friends. This affected her self-esteem and confidence.

To overcome the economic challenges, she changed jobs temporarily, and, between 2003 and 2015, she worked as a manager within the research system in Mozambique, but went back to serve in the research institution (CNBB) in 2016. Regarding marital problems, there are occasions when she has had to take professional decisions unilaterally, without agreement or consent of her husband. This has helped her to keep focused on her objectives and targets.

About online GBV, she reported the matter to the police. She then decided to embrace the network on Women’s Rights Online in 2014 to fight for women’s rights using technology and the Internet. She also



coordinates a research and advocacy initiative on Digital Gender Divide and Women's Rights Online (WROs) in Mozambique, implemented by the World Wide Web Foundation. She organised a conference during which a Report Card on WROs was launched to create a platform and movement for debates around the issue, particularly online GBV.

Today, Alsácia considers Prof. Maria Isabel Fazendeiro, from the Technical University of Lisbon, Portugal, as her role model. Prof Fazendeiro introduced her to parasitology, and supervised her

first professional training at Santarém Zoo-technical Station, Portugal, from September 1993 to March 1994. Prof. Maria Ângela Ornelas de Almeida, from the Federal University of Bahia (UFBA), Brazil, is also her role model, whom she worked with and encouraged her to undertake post-doctoral studies after some reluctance due to social issues and age. She, in turn, encourages women and girls to pursue STEM careers as many institutions and funding organisations regionally and internationally now guarantee gender equality in access to research funding.

Amal Amin Ibrahim Shendi NADA

Egypt

“ Allow girls and women to embrace science ”



As a child, **Amal Amin Ibrahim Shendi Nada** had a chance to read a book about Marie Curie, the first woman scientist to win the Nobel Prize. The life of Marie Curie inspired Amal as it depicted the importance of science and how much sacrifice one has to make for one's dreams to come true. Her passion for science was also kindled by the environment in which she grew up as her parents were well educated and owned numerous books on different subjects. In early life, she started reading a range of topics including history, local and global literature, as well as politics.

In retrospect, Amal notes that she owes her way of thinking, interests and work as a global citizen and scientist to her childhood years. She is currently an associate professor at the Polymers and Pigments Department in the National Research Centre (NRC), the biggest research centre in Egypt and surrounding regions. In addition, she has a great deal of experience holding various positions in the field of nanotechnology, materials science and organic Chemistry. She has a PhD in organic chemistry (polymer technology and catalysis) which she obtained from Cairo University, Egypt and Ulm University, Germany through a *Deutscher Akademischer Austauschdienst* (DAAD) scholarship. She has published widely and is a reviewer for various journals in the field of organic chemistry. Some of her contributions to society through science include using nanotechnology in high performance cement, biomaterials for medical applications, converting agricultural wastes to biomedical applications, as well as smart materials for electronics and solar cells.

In 2009, Amal was selected by the Inter-Academy Panel (IAP) and the Egyptian senior academy as the first young female Egyptian scientist to travel to the World Science Forum held in China the same year. From this forum, Amal became one of the co-founders of a global movement of young scientists, the Global Young Academy (GYA), which was officially launched in 2010. Amal describes her involvement in this project as one of her glorious moments which made her become more global in her thinking. It imbued her with more determination to let *science talk* as a *global language* to address global concerns irrespective of political and religious considerations. Subsequently, Amal wrote a project proposal to the Egyptian high level authorities to kick-start the Egyptian Young Academy of Science (EYAS). The proposal was submitted amidst political



unrest in Egypt which delayed its approval, but it finally took shape in 2014. She is a member of the advisory board of EYAS.

Her other remarkable achievements include crafting two international scientific agreements between the NRC (Egypt) and both the Georgian Biotechnological Centre and the Michigan Technical University in the USA. Such actions have become commonplace to Amal as she has always transferred the knowledge she acquires from other countries to her country. In addition, she founded and headed the Egyptian Society of Advanced Materials and Nanotechnology and was coordinator for the Arab network of that organisation. Amal was chosen as The World Academy of Science (TWAS) young affiliate from 2010 to 2014 and she is a member of several prestigious national and international scientific organisations. She has visited, worked at and had research collaborations with scientists in many countries including France, Germany, USA and China.

Amal speaks of gender and family related challenges that need to be overcome to allow girls and women to embrace science. Women scientists need opportunities and training equal to those of men, and, in addition, appreciation from society for the double roles they play as family administrators and researchers. To this end she acknowledges the importance of her nomination

to the World Economic Forum in 2009 as a young woman scientist, and her nomination in 2015 for the International Union of Pure and Applied Chemistry (IUPAC) Chemistry prize for women scientists. Amal says that she has struggled to be a good mother while at the same time being a good scientist and in some instances, she has had to make drastic choices to balance these. For instance, she decided to take her daughter with her when pursuing her PhD in Germany, even though this was not an obligation. During her experiences in navigating family and gender challenges, Amal has come to realise the power of her social community in supporting her as a woman scientist against changing environments and hard working conditions. This includes having a supportive spouse like hers.

In celebration of her decision to take her daughter with her to Germany, Amal describes one of the rewarding moments in her personal life when her daughter later chose to study science and medicine. She notes that at that moment she felt she had succeeded in becoming a role model herself. Her own first role model was Marie Curie and she lives for mentoring and encouraging young women in science. This led her to organise the first international conference for women in science and international networking whose theme is bridging the gap in STEM in favour of sustainable development – Women in Science without Borders (WISWB). However, her dreams are bigger than the conference as she hopes to foster healthy collaborative relationships between women and men scientists around the globe. Amal believes so strongly in science that she is convinced that scientists are like prophets (messengers), and at a personal level, she believes that science is her means to serve her country, the world and all humanity.



Aminata Sall DIALLO

Senegal

“ Science must be used as a tool for decision-making ”



Aminata Sall Diallo is the advisor to the minister of higher education in charge of research and cooperation, coordinator of the national programme against hepatitis, chief of the project *“Reform and alignment of higher education on economic needs”*, executive director of the partnership for applied science, engineering, and technology as well as coordinator of the African centre of excellence of the World Bank in Dakar, Senegal.

Her earliest drive to take up a scientific career was her natural curiosity and fascination with the biology experiments in high school. The discovery of bacteria, viruses and parasites that were not visible to the naked eyes and the use of a microscope made science interesting for her. Thus, despite the resistance of her father, curiosity urged her to enter the world of science. Tired of discouraging her from pursuing science, her father finally let her take up medical studies. This rebellious spirit was useful for her survival in medical school as the male teachers behaved as if science was rightly their domain and women were intruders. Aminata’s belief that *‘who wants can’* helped her overcome this male domination in medical school. She learned quickly that there was so much the human race did not know and which had to be explored. *“The questions I asked myself and asked of my professors, some of which remained unanswered, showed me that there were many things to look for and discover”*, said Aminata.

She was interested not in just treating the sick, but in researching and discovering the hidden causes

of ailments. She therefore enrolled and completed several certificate courses in bacteriology, virology, immunology, microbial chemistry and biochemistry of natural substances, molecular biology of the cell, and received a doctorate degree in biological Sciences. In 1992, she decided to specialise in liver physiology and enrolled at the University of Paris VII, where she graduated with a degree in cell biology and functional digestive process focusing on herpetology.

“The most impactful project I worked on is the evaluation of mother-to-child transmission of Hepatitis-B virus”, Aminata said. Upon her return to Senegal, she was appointed coordinator of the national hepatitis control programme, whose main mission was to ensure that children got immunised. It was important to determine the best age at



which to immunise for optimal results. In those years, the World Health Organization (WHO) had recommended the vaccination of infants at six weeks with a combined vaccine. Their argument was that vertical mother-to-child transmission in Africa was low. It was, however, not clear how they had arrived at this and deep down Aminata felt the need to verify these data. She therefore started to evaluate mother-to-child transmission of the virus.

To her surprise, the results were very different. In her research, mother to child transmission was at a high 19.4% while the WHO had placed it at 0.5%! Thereafter, it was important to find out what could explain this discrepancy and she soon discovered that in Africa, there were many factors that had not been considered by the WHO that changed or modified mother-to-child transmission. Armed with these findings a modified schedule was introduced in Africa whereby vaccination was embarked upon at birth. Thereafter, with the help of colleagues from the Mathematics department, Aminata embarked on the accumulation of scientific evidence and modelling of mother-to-child transmission of hepatitis B estimated at 20%. After several years of accumulated evidence that the vaccine schedule was not appropriate, WHO asked countries to vaccinate at birth. The impact of this research on the health of

the people was enormous and she is proud of it. In her own words “without Science, hepatitis B would never have been controlled in Africa with such an effective schedule”. Therefore, Science must be used as a tool for decision-making. This tool should be in the hands of as many women as possible as they need to take their rightful place in the world. Their experience, knowledge and insight will contribute to solving some of the problems, such as diseases, that people in Africa face. Her research into hepatitis B has encouraged Aminata who underlines that the solutions to the problems of Africa are in the hands of the Africans themselves. Therefore, as an African she wishes to contribute to the development of the continent.

Aminata emphasises that science is not the prerogative of men. Women have contributed greatly to the development of science and more would be achieved if more women pursued careers in science. Some can enter the research community and ensure better governance as the leadership of women is recognised as different from their male counterparts. As scientists, women face many challenges which are often exacerbated by the perception that women are less productive than men in science-related work and careers. The fact that there are few women science teachers at university level makes the situation worse. This is one of the reasons why Aminata pursued all the diplomas necessary to embrace the career of teacher-researcher. In addition, the admiration she had for one of her teachers, Madame Toure Mame Fatou Dia, was a motivating factor as she says; “*even if it was unconscious, I wanted to become like her*”. Her teacher’s death further strengthened her desire to become a physiologist like her, which she considers the best tribute she could give her role model.

The main social challenge Aminata came up against was getting married in her first year of college when medical studies were very demanding in terms of time and mind. This was due to both the demands of marriage as an institution, and to the fact that she had children during her undergraduate



studies. As she still yearned for further education she had to struggle to fulfil the demands of college, her marriage and her children. In addition, she belonged to a family where education was highly valued. Her father and brothers were all brilliant and had attained university education. She, therefore, had the pressure to excel and uphold the family name. Additionally, her own spirit of competition could not allow her to underperform. On this Aminata quipped; *"I did not want to do less than them [her brothers] because I always had a spirit of competition"*. Hence, she survived because of her

perseverance and determination which helped her to overcome these challenges. She also received a great deal of help from her husband who supported her and provided her with excellent living conditions.

Aminata encourages young women and girls to explore the world of science, which she regards as a marvellous world that contains many secrets. In order to succeed, they should acquire the basics of mathematics which is useful in problem solving and allows deeper understanding of the world which in itself, she says, is truly satisfying.



Asha DOOKUN-SAUMTALLY

Mauritius

“ Girls and women should be encouraged to become more involved in science-related fields ”

It may seem like an obvious career choice for **Asha Dookun-Saumtally**, having grown up in Mauritius whose major crop is sugarcane. Her journey to become a plant scientist focusing on sugarcane began at secondary school where biology classes really fascinated her. At this level, she was exposed to plant and animal cells with practical lessons that required the students to examine and dissect plants, insects and animals. Her passion for science grew and she received immense support from her parents who did not hesitate to pay for her university studies at the University of Newcastle, UK, for her first degree in biochemistry and microbiology.

Asha holds several positions with various responsibilities both globally and nationally. She is the principal research manager at the Mauritius Sugarcane Industry Research Institute (MSIRI), a

position she has occupied since 2010. In addition, she is the biology commissioner of the International Society of Sugarcane Technologists (ISSCT), the foremost society of the sugarcane industry worldwide. At national level, she chairs the National Biosafety Committee, is a council member of the University of Mauritius (UoM) and a member of the Academic Council of the University of Technology Mauritius (UTM).

In 1986, having completed both her Bachelors and Master of Science degrees, Asha joined MSIRI as a technical officer, and the first woman scientist, in the department of pathology. During her PhD research, Asha used her acquired knowledge to set up a laboratory to produce monoclonal antibodies that would help to detect specific strains of a major bacterium that affects sugarcane. This laboratory was the first of its kind in Mauritius. Upon completion of her PhD in 1993, she became the first woman scientist with a PhD at MSIRI. Consequently, she was promoted to head the newly created biotechnology department and became the first woman to oversee a scientific department at the same research institute.

It is abundantly clear that Asha has made an impressive impact on the sugarcane industry in Mauritius through her research work at MSIRI. She has positioned the institution's research and development in sugarcane biotechnology on a par with other institutions worldwide. Notably, she put together procedures for carrying out diagnosis



for sugarcane and potato diseases. In addition, her lab was the first in the country to adopt new molecular technologies including PCR (polymerase chain reaction), real-time PCR, genetic mapping, deoxyribonucleic acid (DNA) fingerprinting, DNA bar-coding, genetic transformation and next generation sequencing in the field of biotechnology. Asha notes that sugarcane breeding, among other projects funded by the European Union, were some of the opportunities that gave her much satisfaction.

Without mincing words, Asha describes herself as first and foremost an African scientist and secondly a woman scientist. She also explains that women have an inquisitive mind and a strong *gut-feeling*. The field of science has taught her to be systematic, rigorous and disciplined, qualities she has used to put together her team of dedicated and competent scientists in her various research projects.

She describes science as a very noble profession for women and acknowledges that during her earlier career days, it was questioned whether women could do certain tasks such as field work, be able to give instructions and maintain discipline. The questions were put to rest over time as she excelled in all those tasks. Admittedly, Asha quips that being a woman scientist is a challenge in itself, especially if one is working in a male-dominated environment. However, she explains that if one aims at quality and builds up confidence and competence, over time one feels very comfortable with less apprehension and is able to excel in this field no matter how complex it is. To this end, in spite of her numerous administrative and science-related responsibilities, Asha finds the work both interesting and rewarding.

MSIRI has been more than a workplace for Asha. Her mentors and role models are people she met and interacted with in the institute. One of them is Dr. Jean Claude Autrey, who was the head of the Plant Pathology Laboratory when she joined the institute and later became the director. She describes him as a visionary who is dedicated to his work and

promotes excellence. Asha's other role model is her husband, Dr. Salem Saumtally, who is now the director of MSIRI. The couple met at work and Salem, being a scientist, understood the long hours that scientists needed to devote to their work and was supportive in helping Asha's career bloom.

Asha has nuggets of wisdom for women and girls in science. On working as a team, she quotes the African proverb "*If you want to go fast, go alone but if you want to go far, go together*". This is her acknowledgment for the contributions all her colleagues have made towards her milestones. She also adds that girls and women should be encouraged to become more involved in science-related fields, given the opportunity to address societal challenges, and make the world a better place through the application of science.





Callinice D. CAPO-CHICHI

Benin

“ Science is a passion and it offers solutions to many of the problems our people face ”

Callinice Capo-Chichi was born in Benin and her earliest role model was her mother, Dr. Sossouhounto A. S. Denise, a leading anthropologist. While her father would have preferred her to stop studying at Masters' level and get married, it was her mother who supported and encouraged Callinice, often telling her to pursue her education to the highest level possible.

She is an associate professor of biochemistry and molecular biology at the University of Abomey-Calavi (UAC) in Cotonou, Benin. She is the coordinator of the first level of the masters' programme in biochemistry, molecular biology and their applications. She is also a research director of molecular biomarkers in cancer and nutrition in UAC and voluntary faculty at the University of Miami. She

teaches molecular biology and cancer-cell biology in the faculties of science and technology, and of medicine and pharmacy at UAC.

In high school, Callinice was fascinated by laboratory experiments especially during Biology lessons. The best were those they did to highlight brain and nerve interactions. This influenced her drive to explore the molecular mechanisms underlying body organ alterations. Her passion for science therefore came naturally as she made efforts to understand the function of cells in body organs and went on to acquire a PhD. She followed in the footsteps of her mother, who was the first woman with a PhD in anthropology in Benin.

Callinice's most significant discovery was when she sought to unveil the molecular mechanisms leading to chromosomal instabilities prior to ovarian cancer initiation (from 2003 to 2007). Her findings are currently being applied in hospitals in Benin. Between 2011 and 2014 she researched the lack of nuclear envelope proteins as molecular tools for cervical cancer prevention and treatment before the appearance of clinical signs. This research has been instrumental in the management of cancers that affect women. Callinice loves being a scientist, because, as a woman, she has been able to focus on diseases affecting women, especially cancer. She is using science to find better ways of dealing with ovarian, cervical and breast cancers. She does this by investigating the molecular conditions in the organs that provide an environment conducive to



the initiation of cancer cells, and determines how these can be prevented and treated.

In her observation, today's graduate students need to be challenged more, mentored and supported to work hard to obtain data for publication.

Callinice believes there are many women scientists in Africa and in Benin who lack sufficient funding to perform innovative research. She notes that most government funding is directed towards projects led by male scientists. Doing innovative research is expensive, but she has learned to work with old equipment and to collaborate with scientists at international universities and laboratories as these are well funded.

Her role models are her mentors in Miami, Prof. Xiang-Xi Xu, and in Benin Prof. Ambaliou Sanni because they always supported any new projects she proposed. Although Prof. Xiang-Xi Xu wanted her to

remain in Miami, she insisted that she wanted to work at home in Benin to grow the capacities of young scientists. Callinice also has a very supportive husband who helped her start a journal to publish scientific reviews in health Sciences and nutrition. Their works can be found on www.researchgate.net and www.pubmed.gov.

As a parting shot Callinice feels girls can do better in science if they have the freedom to pursue this field and supportive supervisors. In her words, *"Science is a passion and it offers solutions to many of the problems our people face. Be self-driven, wake up and do it. Science is interesting and can generate ideas that might lead to big discoveries"*.





Eléonore Chikani YAYI LADEKAN

Benin

“ Young career women should keep their ambition, persevere, be humble, confident ”

Eléonore Chikani Yayi Ladekan is a faculty member at Maitre de Conférences and supervisor of the organic section of the Department of Chemistry in the University of Abomey Calavi in Benin.

Just like her father, Eléonore has adored scientific subjects since her years in primary school. Her hobbies during the holidays revolved around solving mathematics problems, reading literature on physical sciences and connecting electrical devices. In secondary school, she was struck by the fact that there were very few girls in science class. She was curious about what caused such a situation.

Upon joining university, the scarcity of women in the Faculty of Science was even more conspicuous. In spite of this, she did not have a problem choosing to major in science because the practical work interested

her. Ultimately, practical experiments such as acid-base and oxido-reduction reactions influenced her to choose the path of chemistry. Upon completion of her Master's degree, she opted to continue with her studies rather than become a secondary school teacher. This was despite discouragements and warnings that women who hoped to have children should not pursue chemistry due to exposure to dangerous chemicals. She chose to continue with her doctoral education as she was still young and enjoyed great moral support from her parents. There were twenty women out of three hundred students in her freshman year and by the end of the course only two of them remained. Eléonore's ambition was to prove that a woman could succeed in the field of chemistry. She highlights the role of her teachers who encouraged her and enhanced her strong commitment to succeed.

Her most famous project was the study of the influence of intra-specific and environmental parameters on the chemical composition of the essential oils of *Ocimum* species growing in Benin. The project was funded by the International Foundation Science (IFS) which greatly helped in the acquisition of laboratory equipment and materials. The project enabled her to establish the chemical substances in medicinal and aromatic plants such as *Ocimum*. The experiments not only satisfied her curiosity but also brought her joy.

Eléonore's most impactful project was a thesis she presented for the International Prize for Cooperation and Development. The aim was to present the research and demonstrate its impact on development.



Her work was selected and for the first time, a woman's doctorate was supported and awarded with an international prize in Benin. Thereafter, her team was invited to Tervuren, Belgium to receive the award. Upon her return home, the dean of the faculty of science also celebrated this success. This was a moment of great pride and accomplishment for her, which gave her more confidence and new impetus to strive towards other successes. This also promoted her standing in her village because she had demonstrated some properties of the medicinal plants commonly used although people could not yet explain their curative properties.

Eléonore's motivation to work as a scientist is because of her African identity. She also wishes to contribute to the valorisation of the knowledge of African women despite their many occupations and show that women can assert themselves in society. She faced many challenges in her work as a scientist including the stereotypical beliefs that relegate women to the lowest ranks in higher education. One such belief is that *'women who embrace scientific careers, which are mainly reserved for men, end up very badly in family matters'*. She hopes to overcome these socio-cultural barriers and prove that women can succeed in this field too.

Career related challenges that Eléonore faced include lack of external funding to finance research and thesis writing, as well as balancing her teaching, research and further training given her administrative duties. Socially, she had to overcome social and cultural barriers especially when raising women's awareness of their abilities. Other challenges include problems in striking the elusive work-life balance and how to achieve family cohesion without external influences. A high sense of responsibility, organisation, a great determination to succeed and dealing openly with criticism are some of the strategies she employed to address the challenges.

Eléonore has many role models. They include fiery woman scientist Mary Curie for her courage

in fighting and overcoming the obstacles she encountered, Prof. Yvonne Bonzi Coulibaly who has supervised many research projects and defended herself excellently during scientific symposia and Prof. Adole Glitho who is the president of the Association of Women of Togo, was the first Dean of the Faculty of Sciences of Lomé, an entomologist at the University of Lomé, a member of the Board of Directors of the International Development Research Centre (IDRC) of Canada among other positions. Prof. Glitho has greatly supported many women's initiatives and created conditions for women to access higher education. Eléonore encourages young career women and girls to keep their ambition, persevere, be humble, confident and, above all, have faith in God and commitment to their goals.





Elizabeth Anne BUKUSI

Kenya

“ Encourage young women and men interested in science to reach beyond the galaxy, literally... ”

Elizabeth Anne Bukusi is Chief Research Officer and Co-Director for Research Care Training Programme (RCTP) at the Centre for MicroBiology Research, Kenya Medical Research Institute (KEMRI). She is also a Research Professor in the Departments of Global Health, and, Obstetrics and Gynaecology at the University of Washington, Seattle, USA. She is also an Honorary Lecturer in the Department of Obstetrics and Gynaecology at the Aga Khan University, Nairobi and volunteer Professor in the Department of Obstetrics, Gynaecology and Reproductive Sciences at the University of San Francisco, California, USA. Additionally, she is a faculty member at the Centre for Bioethics and Culture, Sind Institute of Urology and Transplantation in Karachi, Pakistan.

In a personal achievement, Elizabeth is (in her view) probably the only Kenyan and African female

gynaecologist who has ever climbed the 17,000 feet Mt Kenya to the second highest peak - Nelion, and the first Kenyan who does not work with the Kenya Wildlife Service (KWS) rangers to have ever reached that peak. She took on the challenge as a fundraiser for her church.

Elizabeth attributes her earliest drive to pursue and excel in school to her father who was passionate about education. As the first born in a polygamous home, after educating his siblings, he made certain that Elizabeth and her sister, a real scholar and an inspiration, were equally well educated. Despite a passion for teaching, Elizabeth's sister's entry into medical school encouraged her to follow in her footsteps. At that time, students who did well were discouraged from studying education. Sciences were highly promoted, so based on her performance in high school, Elizabeth was advised to choose medicine or pharmacy for her undergraduate degree.

Her mother was a teacher and a champion for the education of women so she encouraged Elizabeth to further her education and excel. Her mother also limited her television watching and cultivated in her a reading culture and a love for books. The picture to the left shows Elizabeth early in her career with her grandmother and mother.

As a young doctor, just from internship, Elizabeth went to work on the Kenya-Uganda border, an area prevalent of malaria and sexually transmitted diseases. She encountered different medical



emergencies such as a ruptured ectopic gestation and severe anaemia in a child after malaria infection, both of which required blood transfusions. In the two years she worked there, she became concerned by the high rate at which blood units were discarded. Back then HIV test kits were not as prompt as they are today. Blood was first taken to be tested later and, if found positive, discarded.

This high rate of disposal of blood units made her interested in making a difference to the then early HIV epidemic and to reduce sexually transmitted infections (STIs). She noted that the ectopic pregnancies were caused mainly by previous STIs. Due to these experiences, Elizabeth wanted to influence women's health. She therefore chose to specialise in Obstetrics and Gynaecology.

Upon completion of her training and residency, she did a Masters' in public health (epidemiology) on a National Institutes of Health (NIH) Fogarty training scholarship at the University of Washington. This enabled her to learn more about research. She then pursued and attained a PhD in epidemiology. Each step in her academic life opened doors to more opportunities in training and research.

Elizabeth has worked with Dr. Craig Cohen in the provision of healthcare to HIV-positive individuals under the US President's Emergency Plan for AIDS Relief (PEPFAR) programme. Elizabeth and Craig began work in Nairobi, later moved to Kisumu and then expanded to neighbouring South Nyanza that had recorded the highest HIV prevalence in Kenya at the time. The infrastructure there was not well developed and the people needed critical care. The programme grew to become the second largest HIV care programme. Through this programme many people living with HIV have been able to live longer and healthier lives. Elizabeth is grateful for the passionate and committed team of healthcare workers she has worked with; people who go beyond the call of duty to offer care.

Her research team was part of those who showed that pre-exposure prophylaxis (PrEP) for HIV works. *A pill a day, to keep HIV away*; the outcome of a landmark study that has helped shape the HIV prevention field and has demonstrated that young women in particular, now have a choice on how to protect themselves.

Elizabeth wants to continue to work in Africa so that she can associate with people who are as passionate



as she is and to give back to the continent. Having benefitted from being trained and supported, she feels the need to contribute to the building of strong training and research institutions. She also notes that it is difficult to generalise when managing HIV and AIDS. There is need to consider the many options available for a specific group. As a gynaecologist, Elizabeth is categorical that the face of HIV remains a young African woman from sub-Saharan Africa. In her opinion, elimination of paediatric HIV remains a challenge because as long as there are women of reproductive age becoming infected, Africa will continue to struggle for an HIV-free society. She is, however, troubled by the stigma towards persons living with HIV/AIDS that still exists in Africa in general, and in Kenya in particular, which fuels new infections.

In her career, she has experienced many challenging ethical problems but what stands out for her is an incident in her early research days. A woman who had tested HIV-positive was unwilling to disclose her status to her husband. There was not any preventive measure in those days, microbicides were still a novelty and the early ones, like Nonoxylone 9, later found to be toxic, were yet to be tested. The woman was afraid of being branded promiscuous and end up homeless. Elizabeth was uncertain of

her responsibility in the situation. The woman was determined to use condoms to protect her spouse but she would not tell him and she did not think her husband would agree to be tested. Elizabeth was indeed faced with a dilemma and, what troubles her to this day, is that this is still a recurring problem considering the social and economic situations that many women find themselves in. She believes that if Africa is to be HIV free, the focus must be on young women and adolescent girls as well as the community that makes them so vulnerable.

Equally, Elizabeth has encountered many challenges in her social life. She has had to cope with being separated from her family, especially her children, for nine months during her Masters' studies in the US. The memory of her four young sons huddled together haunted her for long a time afterwards, but, with the support of her family, she was able to get through this period of separation. One of her younger sisters went to live with her family to offer her sons support while their mother was away. In addition, her mother, grandmother, mother-in-law and older sister have always been her greatest supporters. Today, her children inspire her, saying that they need theirs to be an HIV-free generation.

Another challenge she experienced was when she had to attend a sitting of the Kenyan Parliament to clear up a misunderstanding. In the end, it proved to be an invaluable experience as she got an opportunity to talk about the work they were doing and to advocate for increased research funding locally. What she also found encouraging was the support of the scientific community during those trying times.

Over the years, Elizabeth has been mentored by many great people. She particularly pays tribute to Prof. Allan Ronald of the University of Manitoba, Canada, who encouraged her to get into research as it was the only way to tell if she was any good at it. There also was King Holmes of the University of Washington who not only taught her about being a good researcher but also how to always bring out what is best in everyone. Craig Cohen



and Elizabeth peer-mentored each other as they worked together. Theirs was a great partnership as they complemented each other: Craig, much like King, was the one with great ideas while Elizabeth was earth-bound, practical and pragmatic. In appreciation of the value of mentoring, Elizabeth continues to work with young researchers from whom she learns a lot. She only nudges them in the direction of their dreams, provides a platform for support and watches them soar.

Elizabeth encourages young women and men interested in science to reach beyond the galaxy, literally and metaphorically. She has mentored many upcoming professionals and has been privileged to see them achieve more than she had at their age. Therefore, she is convinced of a brighter future for young researchers especially with increased local funding for research.



Fatma HAMAD

Tanzania

“ Women scientists have a duty to encourage, mentor and inspire more women and girls to study science ”

Fatma Hamad is a lecturer at Dar es Salaam University's College of Education and holds a PhD in Chemistry.

Fatma naturally loved science subjects in primary and secondary school, but had no idea about her future career. Her interest was accentuated during her advanced level secondary study. She chose physics, chemistry and mathematics combination mainly because she loved and enjoyed studying these subjects. Inspired by an uncle who was a successful electrical engineer, Fatma started considering engineering as her future career while in A-level study. Her uncle did a great job

in supporting, encouraging and motivating her to follow in his footsteps. However, deep inside, Fatma had a conflict. She also desired to become a chemistry teacher. This was mostly because she really enjoyed classes conducted by one of her chemistry teachers called Madam Asha. Owing to her inspiring teaching and lifestyle as a woman, she became a role model to her.

Fatma's early academic life was not stable. Despite conflicting interests, after completion of her A-levels study, quite out of character, she succumbed to peer influence by some of her friends and decided to seek employment instead. She took up work with the National Bank of Commerce, one of the biggest banks at that time in her country. In addition, she got married and gave birth to three children in quick succession. Interestingly, she was not happy, even though her life seemed rosy and successful. One day, she suddenly decided to quit her job and go back to study. She has never looked back and she is currently teaching chemistry, the subject she was passionate about. Her passion for science sparked her desire to contribute, through her own research, to on-going efforts to solve the practical problems facing her country and Africa. Through her job, which entails teaching, researching and consulting, Fatma is convinced these problems can be solved through scientific procedures and principles.

The most engaging project Fatma has worked on is the development of novel ruthenium indenylidene metathesis catalysis. This is because metathesis is among important reactions with a wide range



of applications. For example, Shell Chemicals produces up to 1.2 million tons per year of linear higher olefins from ethylene through a process in which cross-metathesis is a key step. A number of bioactive compounds are produced using metathesis reactions. For example, polymer based stuff is the product of ring-opening methathesis polymerisation. Polymers have a wide range of applications that far exceed those of any other class of material available. These include, among others, the production of textile and electronic devices, biomedical devices and optical devices. Thus the prepared catalysts can be used in local industries to solve problems such as the production of clothes. This way, through applying science, Fatma has managed to solve practical problems.

The most impactful project is one that is on-going. Fatma is working on turning agricultural by-products into renewable fuel. She says, *"This will have an impact because these by-products are normally released into the environment as waste. Thus, their successful conversion into fuel provides an opportunity for the development of an alternative energy source while solving economic and environmental problems."* Currently, Fatma's team has three parallel projects with this objective in mind:

1. The investigation of the *suitability of dyes* extracted from different components of cashew trees, such as leaves, bark, nut shell liquid, etc., as sensitizers in solar cells. This project is undertaken in collaboration with iThemba Labs in South Africa and supported by TWAS (The World Academy of Science) and the Non-Aligned Movement Centre for Science and Technology,
2. *Turning biomass into usable fuel* by using catalysts that are absorbed to the water-oil interface. This project is undertaken in collaboration with Bangor University, UK and is supported by The Schlumberger Foundation.
3. *Development of sustainable bio-diesel* from Ghanaian and Tanzanian seed crops. This

project is undertaken in collaboration with Aston University, UK and is supported by the Leverhulm Royal Society.

The motive behind Fatma's decision to work in Africa is her desire to take part in solving problems facing the continent. In her view, there is no scientific justification of the persistence of any problem. Africa still needs to apply modern technology and expertise to significantly overcome these problems. The other reason is that she wants to be a role model for young African girls by being a successful black female scientist. She knows she can inspire girls and women to work as scientists.

For a long time, the so-called hard sciences have been a man's field. In Fatma's case, for instance, she was one of only two girls in a class of more than twenty students during her advanced level study. Therefore, she had to prove that she was studying physics, chemistry and mathematics not by chance but because she was determined, deserving and capable. Some boys in her class would often jokingly remind her that "becoming a female engineer is only a pipe dream". This taunting and hostility towards



women and girls has, for a long time, resulted in very few female science role models available in African societies. Fatma, therefore, encourages African girls and women to pursue science careers as these are not meant for men and boys alone, as everyone can be a scientist. Girls and women have a critical role to play in transforming this narrative by being successful scientists.

Africa has limited resources and there are even fewer resources allocated to research. Consequently, turning research results into innovation is difficult and this hinders capacity and enthusiasm for women and men to stay in science. In addition, lack of gender parity in accessing the limited research resources that are available, benefiting from research results, as well as the absence of gender sensitive research policies has been challenging. However, it is precisely these challenges that inspire Fatma to work harder and more efficiently so as to compete for the limited resources, while shifting the paradigm of inequality to enable her to achieve more.

Earlier in her life, Fatma was discouraged from pursuing science because of the misconception within society that it is only for boys and men. In addition, like in any other career, female scientists have to overcome challenges from family responsibilities and related stresses. In particular,

this hampers full participation in research related activities while still managing their time fairly. Fatma has managed to overcome these challenges by being smart, focused and strategic in every step of her life.

Fatma identified her chemistry teacher, Madam Asha, who was talented in teaching, smart and hardworking among her role models. The other is Prof. Mubofu who's success in material science and mentorship skills have always inspired her. She notes that women scientists have a duty to encourage, mentor and inspire more women and girls to study science. In Tanzania, this is being done through the "Bridging Programme for Girls in Science" which was launched in June 2013 with the aim of increasing the number of girl students in science-related subjects at secondary school level. The strategy used is a mentorship network whereby girls' clubs were established in selected schools and female students undertaking science and education courses at University of Dar es Salaam were trained as mentors. The student-teachers attend a series of capacity building seminars on how to enhance the interest and performance of girls in science subjects and are asked to mentor girl students at secondary schools during their teaching practice. The network is currently expanding to involve more schools and students.

Florence Mutonyi D'UJANGA

Uganda

“ Society needs to accept that women can pursue careers in science-based fields ”



Florence Mutonyi D'ujanga is an associate professor in the Department of Physics at Makerere University, in Kampala, Uganda. She was the first woman in her country to obtain a PhD in physics and the first female head of the Department of Physics in the entire College of Natural Sciences. Like millions of people around the globe, a young Florence was in awe watching television images of Neil Armstrong's historic walk on the moon on 20th July 1969. Much more, she was inspired by her father telling her that if she wanted to go to the moon, she needed to excel in mathematics and science. This became her motivation. Peer pressure in secondary school almost discouraged her from embracing science. It was, however, her earlier motivation that encouraged her pursuit of science. At university, girls were few; so much so that by the third year, she was the only girl majoring in physics. This did not deter her because by that time she had a goal in mind to achieve.

Her most impressive project was one on space weather and ionospheric physics in which many African physicists were involved using global positioning system (GPS) receivers. The project was in collaboration with other universities in Europe and America. Through this project, many researchers in equatorial Africa were able to obtain GPS receivers which were being used in this research. In addition, many students in her university obtained their Masters degrees since they had access to equipment. She also published a number of papers during the project which enabled her to

be promoted at the university. In addition, Florence was also able to establish space science studies in her university because of this project.

Florence is motivated to work in Africa to be a role model for young women and girls daily. She, therefore, partners with other organisations such as UNESCO to visit schools and give talks to encourage girls to remain in the sciences and pursue scientific careers in university.

She feels strongly against the negative effects of gender-based stereotypes and myths that portray science as masculine as this has discouraged many bright and talented girls from pursuing science. Additionally, Florence emphasises the need to discard traditional myths such as women's work is





only in the kitchen, as these have also kept some away from the sciences.

Florence has experienced many challenges in juggling her demanding career in science, marriage and family life. She admits that sometimes quality family time is lost. However, through prioritising, she made time for all aspects of her life. At times, she

also has trouble mingling with people who often view her as different. Hard work and believing that even women can make it in science have been the driving force in her progress. Florence recommends that members of society need to accept that women can successfully pursue careers in science-based fields. Therefore, there is a need to sensitise communities to accept that girls and women can pursue sciences successfully. This is because it has been demonstrated that many women who succeed were encouraged by parents who valued education.

As a parting shot, she says *"while marriage does not appear to hurt women, having young children does affect their chances for advancement since child-care responsibilities fall disproportionately on women"*. She therefore recommends that scholarships for women be extended to well over forty years of age. This is because after this age, women will have had families, are more settled and can perform better when they are not pressured by the ticking of the *'biological clock'*. She emphasises the need for mentoring girls beyond high school to include those with basic degrees in science but who have stagnated due to the burdens of domestic chores and care for their families.

Gladness George MWANGA

Tanzania



“ Science is not only for men, it is for all, especially us girls ”

Gladness George Mwanga, the 2014 UN Food and Agricultural Organisation (FAO) Young Innovators' Award winner, is a research assistant and a PhD candidate at Nelson Mandela African Institution of Science and Technology in South Africa, specialising in Information and Communication Science Engineering. She is presently working on automating decision-making processes on farms.

As a young girl, Gladness was encouraged by the support she received from her parents and her primary school mathematics teacher. Due to the way they taught and encouraged her, she quickly learned mathematics and started enjoying any subject that had some calculations. On joining high school, Gladness was automatically enrolled for the science class due to her exemplary performance in these subjects. In her view it was the encouragement and good foundation during her formative years that ushered her into the science path.

When Gladness got the FAO prize, she emerged the winner from among 15 entries from countries in Africa in the category Rural Innovations and Technologies for Agriculture. Her entry aimed at linking veterinary services with farmers through the use of ICT such as mobile phones and web applications. She believes she emerged the best as her innovation offered easy ICT solutions whose impact can improve access to and provision of veterinary services to farmers who would otherwise lose their livestock due to delayed or lack of access to such services. During her Master's degree, Gladness worked on a project aimed at

linking ICT and agriculture to solve information problems in the agricultural sector. As part of her research, she developed a Livestock Information Management System that integrates both the Web and Mobile Applications. The goal of her research was to create a medium through which livestock information could be exchanged by automating the traditional manual extension services so as to improve efficiency and effectiveness in livestock information flow between farmers, extension officers, researchers and buyers. Currently, farmers, extension officers and buyers can only access the system by using their mobile phones. Researchers and other users such as policy makers can access the system using the web application which is more detailed and provides further information that



farmers may not find a use for. Happily the system is now working as a prototype to manage livestock farming information. However, the plan is to have it expanded to accommodate other forms of farming and agriculture in general.

The impact of this project has been impressive. Gladness notes that currently the online extension service allows farmers to send a query through their mobile phone to extension officers who also use the same channel to give informed advice. This, in her view, increases effectiveness in delivering extension services by allowing available professionals to work remotely and reach all farmers as needed. Additionally, access to information by farmers will assist farm-level decision-making by providing timely, relevant, and accurate information regarding market access, farming inputs, research findings, livestock feeds and pharmaceuticals. This information is essential to livestock keepers as it adds value to their livelihoods, improved record keeping and enhanced production chains. The system also provides a virtual platform where stakeholders including farmers, researchers and extension officers can not only meet, chat and discuss their issues, but also post their professional opinions.



Gladness loves to work as a scientist on the continent of Africa with its many challenges because she has always been passionate about doing things that bring about positive changes and she sees herself as a source of that change in peoples' lives. This, she says, is the *"driving force behind my studies and in my daily life"*. With this passion, she has set a mission to work hard in exploring ICT so as to use it progressively to improve the quality of life for people in all communities.

Gladness' role model is H.E. Rhoda Peace Tumusiime who is the Commissioner for Rural Economy and Agriculture at the African Union. Her expertise, experience and commitment have won her several key positions on regional and international organisations.

Gladness advises young women and girls to believe in themselves and pursue their dreams with determination. In her words, *"Science is not only for men, it is for all, especially us girls. No one is born knowing everything and experience comes through practice. Let's think boldly and have a positive mind"*. She notes that the gender gap in science is controllable as it is more related to social pressures rather than actual ability and academic performance. Therefore, pioneer scientists will need to provide mentorship, encouragement and advice to improve women's access to science careers. She says this can be achieved by conducting training for teachers to become good ambassadors and to mentor young women, or by organising events such as national science clubs which motivate young girls to explore this field.

Hilda NYAMBE-SILAVWE

Zambia

“ If your passion is science, go for it; do not let anything or anyone limit you ”



Hilda Nyambe-Silavwe is from Zambia and holds a PhD in food science and nutrition from the University of Leeds, UK. She is a scientific officer at the National Institute for Scientific and Industrial Research in Zambia. Her day-to-day duties revolve around research, but she also lectures part-time as she believes in passing her knowledge on to younger generations.

Hilda's interest in science began in her formative years in primary school. Her late father always encouraged her to work hard at school and aim for the best so that she could become a medical doctor, because at that time, those admitted to study medicine were the top performers in science. This was the beginning of her interest in science. In senior secondary school, Hilda was placed in a pure sciences class due to her good grades in her junior secondary examinations. What struck her in the pure sciences class was that each of the subjects, physics, chemistry and biology were taught separately and in more detail than in the combined sciences classes. In addition, pure sciences classes had laboratory practicals on topics covered during theory sessions. It was these laboratory practicals that made her interest in science grow more deeply as she found them extremely interesting. Pure sciences were also related to life in a natural way and were factual, hence there was no need to prove anything but deal with things the way they were. This made sciences simpler than other subjects and hence her exemplary performance in high school.

Hilda was admitted to the University of Zambia for her undergraduate degree. That was when she realised that the study of science not only enabled one to pursue medicine, and become a medical doctor, but that there were a wide range of career paths one could take as a scientist. That is when it occurred to her that her passion was food science and nutrition. Around the same period, a new programme in these subjects had just been introduced at the university with support from the Belgian Government, so she enrolled in food science and technology. Although this change disappointed her father greatly, Hilda promised him that one day she would become a doctor, not in medicine but in the field that she really



enjoyed. That was how her journey in what she calls *'the wonderful world of food science and nutrition'* began and her passion for science was further ignited because she really liked this chosen field.

Hilda's first lecturer in food science and nutrition was Dr. Kabwit Nguz who was the programme coordinator from Ghent University in Belgium and who became her first mentor too. He believed in her and encouraged her to go further in her studies, thereby making her aware of other possibilities beyond the undergraduate course she was pursuing. She was privileged to be among the first three women to pursue a degree in food science and technology for the first time in Zambia at the University of Zambia.



Hilda identifies her most gratifying science project as one that involved determining how diet may play a role, in addition to physical activity, in the prevention of type 2 diabetes. It stands out because for the first time, she could see science in action by showing results in human volunteers in addition to conclusions drawn from laboratory experiments. She describes this as her most impactful and significant contribution to science as the research showed there was a direct link between diet and the prevention and management of type 2 diabetes. These findings were published in a leading journal and demonstrated that the consumption of fruits and vegetables which are rich in fibre and contain compounds known as polyphenols, are indeed good for human health and may play a role in the prevention and management of type 2 diabetes. The diet, however, works best when combined with lifestyle changes especially increasing one's physical activity. The results may provide a solution to the growing global problem of diabetes.

What motivates Hilda to work as a scientist in Africa is the desire to make a difference in the lives of people on a continent where people face many challenges including malnutrition and disease. As a scientist, Hilda is committed to using her knowledge to carry out research and develop solutions for some of the issues affecting Africa. Stretching the maxim that *prevention is better than cure*, Hilda adds that food security and nutrition are essential for development. Hilda also lectures part-time because she believes success is not meaningful if it is not shared. In her words, *"For development to be achieved, there needs to be continuity of enthusiastic scientists in whichever area they are in"*. She lectures mainly to nurture interest and enthusiasm in science just like her own journey in science was enriched by her mentors who believed in her and encouraged her to work hard. She is categorical that if she had never been mentored and encouraged her story would have been different today, hence the importance to do the same for others.

Hilda laments that scientists are often not given the much-deserved respect and support they receive as can be observed by the poor remuneration compared to other non-science careers. This is partly because scientific research is expensive and it takes long to generate results. She underlines that science is important as it contributes directly to health, food security, food safety, clean water, sanitation, and ultimately, national development. Therefore, although women scientists face many challenges, such as lack of funding, mentors and platforms for sharing and collaborative research, there is a need to seek scholarships and grants globally as well as to join professional bodies in one's field.

Socially, Hilda explains that it is not that easy to explain the importance of science and what it is really all about to family members and friends. In addition, being a scientist is very demanding and time consuming, and, from time to time, it may require putting in extra hours beyond what is normal. If not planned well, this may affect family time and relationships, and it may also seem unfair

as the remuneration is not always commensurate to the effort. To overcome these social challenges, Hilda has had to explain science in simple language and try as much as possible to carry out research on topics that affect humanity so that the outcomes can be easily understood. In addition, she has to plan her activities well in order to allow for family time and relationships. Hilda's role model is Prof. Enala Tembo-Mwase, who has always combined being a scientist, wife and mother, and who has risen to the highest position of Vice-Chancellor of the University of Zambia.

She informs young women and girls that there is nothing more fulfilling in life than doing the job that you really enjoy. If your passion is science, go for it; do not let anything or anyone limit you. Being a girl or woman should never be an excuse because you have the equal right to achieve your dreams. If your dream is to be a scientist, become one and you will never regret it. The sky is the limit for girls and women in the same way it is for boys and men, she asserts.



Isabelle Adole **GLITHO**

Togo

“ Everybody needs to work hard to excel ”

Isabelle Adole Glitho is an entomologist and researcher at the University of Lome in Togo. She holds a Master's degree in entomology, a PhD in entomological physiology and a second PhD in bioecology and management of insect populations. She has received multiple awards including that of merit from the University of Benin and the Knight of the Order of Academic Palms of Cameroun in 2010. She was also the recipient of the Kwame Nkrumah Scientific Prize in 2013, awarded by the African Union. She has published over eighty articles and fifteen

scientific reports. In addition, Isabelle has presented more than one hundred and fifty papers on insect physiology, bio-ecology, integrated pest and vector management and on women in science.

She is currently researching the use of micro-parasites and botanical pesticides in biological pest control. This method is one of the most environmentally friendly ways of controlling destructive pests instead of using chemically based pesticides. To this end, she is working on the development of models of sustainable management of pestiferous arthropods that are currently used by many African researchers and several farmers in West Africa. She also conducts research on the identification of termites and ants, some of which form part of the diet in Togo. Much of her research focuses on ensuring food security.

Isabelle has been recognized for the creation of the Laboratory of Applied Entomology at the University of Lome and the establishment of an International Master's degree in Environment, Water and Health. The programme admits students from at least five countries in West Africa.

Asked what her most impactful project has been so far, Isabelle indicated that it was hard to choose. She feels strongly about all the research she has been involved in as her work is informed by her belief in making use of African values such as *Ubuntu*, loosely translated as working in, with and for the benefit of communities. Based on this, in 1995 she founded the Togolese Association for the promotion of women in Science at the University of Lome. The aim



of the association is to boost female faculty across all science sectors at the university.

In 2001, her group also began a mentoring programme to ensure that female students who take up sciences were retained. The programme matches senior level students with first and second years to help them cope with the challenges that often make women drop science courses in favour of humanities and education. Involvement in this programme has, however, been challenging due to the small number of young women enrolling in science based courses. Consequently, the association expanded the mentorship programme to high schools because at that level, most girls did not select science subjects due to negative beliefs and stereotypes about it as being masculine and difficult.

Her biggest challenge has been teaching and researching in an institution with insufficient equipment and facilities. She also notes that mentoring women in science, although noble, is not something the government is interested in. Therefore, mentoring and tutoring of young girls in science has been left to a small group of female



professors, lecturers and senior students who lack both time and finances. Nonetheless, the association is constantly raising funds which are used to facilitate the high school mentorship programme and to provide female science students in the university with an allowance. This has resulted in an increase in the number of female students pursuing science as well as improved numbers of women faculty in science courses. She wishes to assure young female students that the problems they face are not unique to them and that science is just as difficult for boys. Everybody needs to work hard to excel.



Judith Sèdaminou **GBENOUDON**

Benin

“ Encourage girls and women to be confident if they choose to pursue science careers ”

Judith Sèdaminou Gbenoudon is a lecturer in immunology and biochemistry, as well as the director of the Laboratory for Immunology, Infectious Diseases and Allergy at the University of Abomey-Calavi, Benin. She is also the president of the US International Visitor Leadership Programme (IVLP) Alumni Association. She was the first woman to be appointed director of Systems (Informatics) in the Ministry of Higher Education and Research in Benin, a position she held for three years (2013–2016). Judith was the first person to set up a research laboratory in immunology in Benin and has won many research and project grants. She also initiated and oversaw the formation of the Benin Society of Immunology.

As a child, Judith was clever and talented, and her leaning towards science was obvious. She observed things and often attempted to link and relate causes

and effects of day to day happenings. During her childhood, she often suffered from malaria attacks despite good medical care and access to a family doctor. She therefore grew up with the curiosity and the sense of wanting to search for solutions to contribute to solving serious health issues in her country. Her wish was not just to treat people, but also understand and solve the root causes of diseases. Therefore, she chose biochemistry and later immunology.

At primary school, she was a brilliant student and encountered no barriers in choosing science subjects and later embracing a career in science. In secondary school, her physics teacher was very encouraging and was sure she would go far in physics and chemistry. At high school, she had a choice to study science and technology or science, biology and geology or arts subjects. She chose science, biology and geology and obtained her 'Baccalaureate'. She was the best performing student in her school and the fourth best nationally. At university, Judith chose to study biochemistry so that she could understand the processes of life, cells, and specifically to find cures for sicknesses such as malaria. She attests that her biochemistry studies were very exciting and that the courses were well conceived and delivered by committed instructors. This helped her successfully link theory and practice thereby making her studies exciting and fulfilling.

Much of the course content was about different aspects of life as well as the functioning of the body.



She thoroughly enjoyed the practical experiments as they involved working both with her hands and with her mind. In many instances the results she achieved amazed her and on interpreting them, she was convinced she was pursuing the right career. Some highlights of the course were preparing aspirin, extracting active components from Indian herbs for studying cell physiology, as well as observing cell behaviour in fluorescent cells using contrast microscopy and special glasses.

The most exciting project Judith has been involved in was research into why, in some people, the immune system chooses not to respond to infections, that is, their immune system simply tolerates the infectious agent as it would do for self-tissue components. This research led to the discovery of the so-called regulatory T-cells in the human body. The project also shed light on new aspects of immunology and improved what was taught and written in text books.

Judith's most impactful science venture was a project known by its acronym EBUSS – the Empowering and Bringing Women at Pre-University Levels to Choose Science Subjects and Careers in mathematics, physics, chemistry and biology. She developed this project to encourage girls to embrace scientific careers. The project was funded by several international funders. And throughout its lifetime, five thousand people of all ages and categories became sensitised to science. The key components of EBUSS included a survey, motivation and training of seven hundred school girls from eighteen schools to be empowered, and if interested, to participate in the science camps that were also run. Due to the impact of this project, Judith has been interviewed several times on radio and television. Additionally, she has given talks to thousands of secondary school children. Consequently, many students, both boys and girls, have taken a keen interest in science. In addition, between 2012 and 2016, Judith contributed to publicising science careers among the youth through organising science symposia.

Judith loves working in Africa as a scientist because there are not enough women involved in science on the continent. In her view, this is due to cultural burdens and expectations associated with being a woman in Africa. She suspects that male colleagues in science are not very supportive to a woman who excels. Her approach in the face of these challenges has been to contribute to the overall understanding of science in the country and popularising it among persons of all ages and both sexes. Her realisation is that everyone in society ought to play a role in ensuring that more women and men take up careers in science. She has also since noted that the emerging obstacles to women pursuing careers in science are not only people-based but also socio-cultural-based. That is, the prevalent beliefs and stereotypes regarding the appropriate image of a good girl or woman will also negatively impact on her self-esteem and confidence.

She says women face many barriers in their careers. In Africa, these barriers are transmitted through education by parents who believe that women should not opt to study courses that take too many years as this will interfere with their marriage. She narrated how an old woman in her neighbourhood once warned her mother that if she let her continue with her



studies, she would be blamed should her daughter remain unmarried. Concerned, her mother steered her towards applying for a course in midwifery. Judith completed and even passed the interview. However, when she emerged as the best performing student in the national examination, her mother supported her proceeding to advanced level secondary education and higher education in general.

Judith also indicated that boys in her class often confronted her by saying that it was not normal for a girl to strive as hard as she did. A case in point was in high school when some classes were merged. One of the boys warned her that he was not a weakling like all the other boys she had been defeating in class. At the end of two years, he failed to beat her. The two of them went on to join the same university and while in their third year, the boy confessed to her that working hard and pursuing one's objectives were not a reserve for men alone. As fate would have it yet again, Judith and this man now lecture in the same university and he often tells others about his unsuccessful attempts to discourage and dismiss women's efforts in the pursuance of science.

That episode in her life recedes as Judith has addressed the many challenges as a scientist, most of which are both social and professional. Her biggest challenge is how to remain a role model in her science career and at the same time be a total woman. She maintains that this can only be achieved progressively. Her immediate focus is to inspire as many girls as possible in the pursuit of science. Running a successful research laboratory

and establishing reliable collaborative networks has also been challenging. To address these, she has often sought both external and local support. Socially, events related to the breakdown of her family seriously affected the growth of her career as a scientist but these have slowly translated into a source of strength.

Judith identified a number of role models including Barbara Broeker, a professor in immunology and patent holder from the University of Greifswald, Germany and Minka Broeler, professor in immunology at the Institute for Tropical Medicine in Hamburg, Germany. In her opinion, the two are women of strong character who inspired her during her early career especially with their love for research and making new discoveries. Her other role model is Lucie Fanou Ayi, a professor in the Department of Biochemistry at the University of Benin, who for a long time was the first and only woman in that department.

Judith encourages women and girls to take control over their decisions to pursue science as they, not their parents, are the only ones who know their talents. It is their duty to stand firm by their choice rather than seek advice from family members who might lack the correct information. Young women and girls, she advises, should discard cultural ideas whose time has passed. Culture should evolve. Finally, she encourages girls and women to be confident if they choose to pursue careers in science, but warns that they might not always be appreciated at the beginning.

Letitia Eva OBENG

Ghana

“ A choice to engage in the sciences should be guided by a deep interest and a yearning desire to find practical answers to the questions of today ”



Born in Ghana, **Letitia Eva Obeng** was a child who wondered just about every simple happening in nature. For example, she was curious why little fish and crabs in streams die when out of water; why the many feet of a centipede do not get entangled as it moves; where the strange substance called water went when poured on the ground and how does it happen to be up in the sky when it comes down as rain. These and similar questions were explained later in secondary school and, coupled with inspiration from her zoology professor, she became firmly planted in the sciences. She is currently retired from a professional life that spans some sixty years.

Letitia is a trailblazer. She was the first woman in Ghana to obtain, in 1952, a Bachelor's of Science (Honours) degree in Zoology and Botany from the University of Birmingham, UK and was subsequently appointed the first female science lecturer at Ghanaian College of Technology, now known as the Kwame Nkrumah University of Science and Technology (KNUST).

In 1962, she became the first woman in her country to obtain a Master's of Science degree in Parasitology also from the University of Birmingham. Two years later, she broke her own record and became the first woman in Ghana to obtain a PhD from the School of Tropical Medicine at the University of Liverpool for research into the aquatic stages of the *Simuliidae* (black flies) responsible for the transmission of the parasite which causes river blindness (onchocerciasis). On the continental

and global scene, after having had a great deal of experience in parasitology, freshwater sciences and environmental management, Letitia became, in 1974, the first African female senior staff member of the United Nations Environment Programme (UNEP). Later, in 1980, she became the first African female director of the Regional Office of UNEP and its first female representative to the Africa Region. In addition to these firsts, she was the first elected female fellow of her country's Academy of Arts and Sciences and became its first female President in 2007.

One of Letitia's exciting projects in her science career was, while in her 20s, organising and setting up a laboratory to teach zoology at the College of Technology in Kumasi, Ghana. Additionally,





she was instrumental in organising and establishing from scratch, the Institute of Aquatic Biology (IAB), a new institute for water research and part of Ghana's Council for Scientific and Industrial Research (CSIR). She directed IAB's hydro-biological research on the Volta Lake from 1964 to 1974. The research that she undertook at IAB was a very fulfilling experience for Letitia. It responded to a crucial national need to monitor and study the ecological changes and possible environmental impact of Volta Lake, which

was the largest man-made lake in the world at the time. It also provided an opportunity for global learning on man-made lakes.

As a woman scientist Letitia's contribution to science, especially in Africa, was fuelled by her interest in parasitology which made her aware of the spread of parasitic infections, especially among unsuspecting children, in endemic tropical areas of Africa. She laments the general public's ignorance about parasites, the lack of interest in knowing about them and the reluctance to take the necessary precautions to deal with them. That notwithstanding, she published a scientific, but 'easy to read' book entitled *"Parasites, the Sly and Sneaky Enemies*

inside You" with explanatory sketches and an implied message that *"knowing about an enemy is the best possible tool for defeat"*. She is aware that some school children showed an interest in the subject and hopes that awareness of parasites will grow.

The science profession is not devoid of myths. One of the general myths she would like to refute about women and the sciences is based on the frequent question she has been asked in her lifetime: why she chose to study science when many men did not want to touch the subject. Regarding this myth, Letitia says *"the implication, of course, is that science is such a difficult subject that even men (who are supposed to be cleverer than girls) shy away from it! Fortunately, with so many women now in the sciences, it should be difficult to scare our current smart female generation away from these subjects."*

Letitia's exceptional role model is Ms. Emily Vivian Asihene who was not a scientist but a rare pioneer, a female educationist during a period of limited acceptance of female higher education. *"She was intelligent, capable, dedicated, and my inspiring and unique role model"*.

As a parting shot to girls in Africa, Letitia posits that science is an exceptionally exciting area of study with boundless opportunities for original thinking, innovation and contributing to the world's development. She advises that a choice to engage in the sciences should be guided by a deep interest and inquisitiveness in the science subject and perhaps, even more important, a yearning desire to find practical answers to the questions of today.

Maria MUSOKE

Uganda

“ Science is the only hope that will take African development forward ”



Maria Musoke is a lady of many firsts. She was the first Ugandan woman to get a PhD in information science in 2001 from the University of Sheffield, United Kingdom. She was also the first woman to be promoted to a full professor of information science at Makerere University in 2010. For this she received a Gender Equality Award in 2010 which was reported in various Ugandan newspapers.

She is the first information scientist from sub-Saharan Africa to chair the Health and Bioscience Libraries Section of the International Federation of Library Associations and Institutions (IFLA), which is the highest world body governing the Library and Information Science (LIS) profession and has been in existence for over eighty years. She was the first vice-president of the Association for Health Information and Libraries in Africa (AHILA), a regional body, from 1990 to 1996, and is one of the founder members of that association.

Maria became one of the first two Ugandan women to serve on Makerere University's top management in 2004. The university, which was established in 1922, took over eighty years to have the first Ugandan women on its top management. She was the first Ugandan woman to head Makerere University Library Services in 2004, a post she held for two terms until December 2014. Her contribution was best captured in Uganda's leading newspaper, the New Vision in November 2014. *'Musoke leaves Makerere University Library Better'*, the paper said in a headline. She was also the first documentalist of the Women and Gender Studies Department at

Makerere, from 1990 to 1995, and one of the founder members of that department. She is also a founder member of several other women's NGOs such as the Uganda Women's Network (UWONET) and the Forum for African Women Educationalists (FAWE) in Uganda. Maria was the first Library and Information Science professional to become a Fellow of the Uganda National Academy of Sciences in 2014. Later she became a member of the International Committee on Big Data in the open data world and, in 2016, chairperson of their Women in Science committee, among others.

Maria has received many national and international awards, honours and other forms of recognition for her contribution to information science particularly



focusing on health and women. In 2001, she won an ICT stories international competition titled *"Simple ICTs reduce maternal mortality in rural Uganda"*. She has been recognised for writing excellent papers including one that presented a model of a hybrid blend between traditional document delivery methods and technology driven ones, presented to the International Federation of Library Associations (IFLA) conference in 2008. Maria has over thirty journal papers and book chapters on issues relating to user studies, health and academic librarianship, thereby bridging various research gaps.

Her early life was characterised by her childhood observation on life as she walked to school. What made the trip interesting was the beauty of nature that was reflected in all the plants she saw. Right from the beginning, she loved nature. She describes her journey to school as follows: *"I used to walk to primary school but stopped many times to touch flowers, smell and pick them to compare, but sometimes I had to fight with bees in the process. Up to today I love flowers. I also used to do the same for leaves. Elders would find me picking leaves and flowers on the way and beat me because I was playing and delaying getting to school. When we started studying Biology, I was really interested. My fellow students used to complain that Biology*

is very wide compared to other subjects, but I loved it and never felt the burden that others were experiencing. I ended up graduating as a biological scientist (Botany and Zoology) and later moved on to Information Science".

Her greatest and most impactful project was a post-doctoral study which was based on the realisation that a major challenge facing health professionals in Uganda is the limited access to current literature which can build their capacity to make evidence-based clinical decisions and ultimately improve health care. Such information ought to be repackaged in a user-friendly manner which, for health workers, took the form of a Health Information Digest which was printed and distributed to over 1500 health workers in Uganda. This was followed by rural outreach training of health professionals on how to access current literature using information literacy skills. Maria has demonstrated how information science can be employed to improve healthcare in Uganda. She says, *"My greatest excitement is when a health worker reports that the information literacy training I conducted enabled him/her to build skills to retrieve the needed information and in a timely manner to save lives"*

In 2016, she published part of the findings of this project in a book titled *Informed and healthy: theoretical and applied perspectives on the value of information to health care*. It was published by the Academic Press of Elsevier in both print and electronic versions and is available on *ScienceDirect.com*. To celebrate this achievement, Makerere University organised a high-profile book launch which was very well attended. Above is a picture taken during the event when the Vice-Chancellor, Prof John Ddumba Sentamu, handed over a plaque to Maria. As part of her post-doctoral contribution to Makerere University, Maria introduced two new courses, *health information systems and services*, taught at Masters level since the 2001/2002 academic year, and a cross-cutting



course for graduate students and researchers titled *information competence and management* that started in 2005.

Maria is also one of Uganda's national leaders who continue to serve her country by playing various roles and whose daily life involves making decisions that contribute to national development, training and mentoring the young generation of scholars. Like many academics, she has encountered several challenges including research fatigue, limited research funding and delays in publishing her works. In addressing these challenges, Maria pointed out that she needs to inform those with whom she engages about the importance and benefits of

research. In addition, researchers have to continue writing funding proposals, and keep reminding editors to hasten the publication process.

The two people who ignited her passion were her late sister and her graduate supervisor. Her advice is that research will go on, as new questions always emerge during the research process that trigger our curiosity, and hence take the investigation forward. Girls and young women should love science rather than shunning it as being too difficult. It is easier to find employment when one holds a science qualification. In her opinion, science is the only hope that will take African development forward.



Marian Asantewah NKANSAH

Ghana

“ Scientific research, in Africa, is still in its early stages, but has great potential ”

Marian Nkansah is a faculty member at Kwame Nkrumah University of Science and Technology in Ghana. She teaches general, analytical and nuclear chemistry. She won a Young Scientist Poster Award at CHEMRAWN XII held at the Stellenbosch University in South Africa. Her primary research interests include the determination of the levels, trends and occurrence of contaminants in water, soil, air and food.

During her doctoral studies in Norway, she supported and volunteered at the Redd Barna, an organisation whose work aims to secure children's rights. She is also the executive director and co-founder of the Gaudete Institute, a non-profit organisation in Ghana. Marian is passionate about

the arts and music, education, environment, science and technology. Other personal interests include critical thinking, teaching, research, public speaking, and writing.

Marian grew up on a school compound since both parents were educationists. From the backyard garden to the woods around the campus, everything in her home environment spoke science. She was increasingly observant and inquisitive of her surroundings and would pick up various scientific terms such as 'pollination', 'isolation' and 'mating' before she turned five. In primary school, she represented her school in a district science quiz. Therefore, majoring in science was an obvious choice for her. The exposure to science in her early life was a major contributor to her interest in science.

It was a firm foundation for many firsts, including being the first of her high school group to acquire a PhD, the first woman PhD holder to teach in the Department of Chemistry at the Kwame Nkrumah University of Science and Technology and the first female chemist to be inducted as a member of the Ghana Young Academy. She was also among the first cohort of



affiliates of the African Academy of Sciences and the first recipient of the FM Al-Kharafi Prize of The World Academy of Sciences (TWAS) for Women in Science as well as the first Ghanaian woman member of the Global Young Academy.

In Marian's opinion, the most amazing project she has been involved in was a study she conducted on the potential toxicity of classroom dust on the health of school children, which was the first of its kind in Ghana. She was invited to do radio and television interviews on her findings and later was published online by media houses. Besides this study, she also has worked on heavy metals in spices and geographic white clay, which is commonly craved by expectant women in many parts of Africa. These studies demonstrate how seemingly harmless materials can cause heavy metal exposure.

One of her greatest motivations is the fact that the outcomes of her research have global impact despite having had national objectives at the beginning. In her view, research in Africa is still in its early stages but has great potential. This is what propels her to go to the laboratory on a day-to-day basis. Of the challenges she has encountered, key among them has been the stereotypical belief that as a woman she should be *wired* more towards the humanities. Many times, it has been assumed that, upon entering an important scientific meeting, she is the secretary and as a result she often has to introduce herself as a stakeholder. She often makes jokes of it, telling the people present that she's used to such assumptions.

Marian has also had to make-do with inadequate government funding for research, making it a challenge to access basic laboratory glassware, chemicals and sophisticated equipment. She has been compelled to apply for research grants from international organisations and collaborates with international partners who help run analyses or invite students for research visits. In her research, Marian has also encountered superstitious people who are reluctant to take part in certain studies for example, clinical studies that require samples such as nails or hair. She therefore must first involve opinion leaders in their communities, such as chiefs, who are educated, who then in turn enlighten the people in their community. Her greatest challenge as a woman scientist has, however, been juggling effectively all the responsibilities of her professional life with the expectations of family and her community. To manage this, she keeps a planner calendar and a daily to-do list. However, when she is overwhelmed, she does not hesitate to ask for help.

Marian's mother, Mary Nkansah, is her role model. She taught her never to feel inadequate or limited because of her gender. Marian advises young girls who are interested in science neither to be frightened nor discouraged by the stories of those who have tried and failed. Instead they should stay focused, tap into their inner strengths, surround themselves with people who believe in their dreams and pursue their dreams with everything they have got.



Mary ABUKUTSA-ONYANGO

Kenya

“ Excellence or failure all start in the mind. Believe you can do it and the rest will fall into place ”

Mary Abukutsa-Onyango is a Professor of Horticulture in the Department of Horticulture, Faculty of Agriculture at the Jomo Kenyatta University of Agriculture and Technology (JKUAT), Kenya. Mary set off with a series of firsts for herself. She was the first woman to get a PhD in sciences not just in her family but her village as well as her sub-district, and the first woman to serve as a coordinator for the Centre of Natural Sciences and Technological Development at Maseno University (1999 to 2003), as Dean of the Faculty (2003-2004), as Director of the School of graduate studies, and at the same university (2006-2007), and give a professorial inaugural Lecture in Sciences at JKUAT in 2010.

She has won many awards including: the African Union scientific award, first position in Earth and Life Sciences category; the Regional Universities

Forum for Capacity Building in Agriculture's (RUFORUM) 2010 award on Impact Research and Science in Africa for her outstanding contribution to agricultural research for development in Africa; the Africa-wide Women and Young Professionals in Science award in 2009; the city of Edinburgh Medal and Prize for research on indigenous vegetables, agro-biodiversity and public health, awarded during the 2014 Edinburgh International Festival of Science and Technology. In 2016, she also became the first woman scientist in Kenya to release nine varieties of African indigenous vegetables.

She was born and grew up in a rural setting in Western Kenya. She was a sickly child who suffered attacks due to allergic reactions to animal sources of food. Despite this she attended the local Ematsuli primary school and was very curious and eager to learn new things. Her parents were very loving, and raised her in a strict Christian family environment. Her father was a school headmaster while her mother was a peasant farmer. Although her father encouraged her to excel in all subjects, he put a lot of emphasis on mathematics and sciences and this made her develop a great interest in the sciences and, to the surprise of many at the time, her favourite subject was mathematics. On the other hand, her mother always took her to the farm, and often emphasised the importance of being hands-on in the farm "working with our hands". This was her method of ensuring the family had enough food and that the house and compound were kept clean. Her mother often fed her on indigenous vegetables due to the allergic reactions to animal proteins.



It was in primary school that Mary developed a passion for Sciences and especially agricultural Sciences. At this stage, she joined the 4K (*Kuungana, Kufanya, Kusaidia Kenya*) club where she was involved in growing vegetables. When she proceeded to secondary school, Bunyore Girls High School also in Western Kenya, she was a top student for the four years she was there, with her favourite subjects being mathematics, biology and chemistry. She obtained the East African Certificate of Education certificate with first division; the highest grade at that level. She was then admitted to Ng'iya Girls High School in Nyanza for advanced studies in mathematics, biology and chemistry where she excelled and received the East African Advanced Certificate of Education certificate with three principals. This qualified her to study medicine which was her father's and teachers' wish. However, Mary preferred agriculture due to her interest in agricultural sciences since early age. Her interest in agricultural sciences had further been awakened by the struggle she saw her mother go through to put food on the table. She hoped to unravel the potential hidden in African leafy vegetables that saved her life and yet were not available on markets.

Mary graduated with a Bachelor of Science (Agriculture) Honours degree from University of Nairobi, and thereafter, worked briefly for the Ministry of Agriculture. She soon got a scholarship from the University of Nairobi to pursue a Master of Science in agronomy which she completed in a record two years. Four years later she won a World Bank scholarship to pursue a PhD in horticultural sciences in the UK at Wye College of the University of London, which she completed in three years between 1992 and 1995. Since then Mary has worked at two Kenyan universities moving through the ranks from lecturer to professor. Within that period, she initiated pioneering research on African indigenous vegetables thereby repositioning them from being regarded as a poor man's food to African super vegetables. Looking back, Mary credits her parents for who she is because at a very young age

they instilled in her virtues of integrity, excellence, hard work, honesty, commitment, organization, timeliness and the love of God; virtues she upholds to this day.

The most satisfying project Mary has worked on is "African indigenous vegetables variety development and seed systems". This project was aimed at developing varieties of African indigenous vegetables to improve production and consumption of these neglected crops. This project was significant because it was solving an existing problem of poor seed quality, it was participatory, multi-institutional and multi-disciplinary. Its aim was to reposition neglected yet nutrient-dense crops to provide home-grown solutions to the challenges of



food insecurity and double burden of malnutrition in Kenya. It resulted in the release of nine varieties of African indigenous vegetables that contribute to increased production and utilisation of African leafy vegetables in Kenya and Africa at large.

On the other hand, the most impactful project she has worked on was *"Networking to promote the sustainable production and marketing of indigenous vegetables through urban and peri-urban agriculture in Sub-Saharan Africa-IndigenoVeg"*, funded by the European Commission (2006–2008). The project was Africa-wide involving seven African countries (Benin, Ivory Coast, Kenya, Senegal, South Africa, Tanzania and Uganda) and five European institutions. It involved travelling to all the countries to promote the production of indigenous vegetables in a safe way in 14 African cities. It was impactful due to the

high number of tangible deliverables including a book, scientific papers and peer-reviewed journal publications, recipes for indigenous vegetables preparation and dissemination of leaflets and brochures. The moment of greatest excitement was when she travelled to Francophone countries and tried to communicate to the audience, that did not speak English, technical information and had to find innovative ways to pass the message effectively.

Mary used an African proverb to explain why she likes to work as a scientist in Africa yet she can access better opportunities elsewhere. She notes *"Use the stick in your hand to kill a snake"*. Thus, for her, it is the ability to provide home-grown solutions to Africa's unique challenges such as poverty, food insecurity, hunger and malnutrition through the study of African super-foods that have been neglected and the rich agricultural biodiversity that exists in Africa. She also believes that many good things can come out of Africa.

There are many challenges Mary has faced as a scientist. These include the wrong belief still held by many that women cannot be good in mathematics and sciences. She has proved many skeptics wrong, including her own teachers, that women can excel in science and mathematics and the myth that good science cannot come from Africa. She underlines that the problem is funding and facilities in institutions in Africa as the governments hardly invest in science. She, therefore, notes that Africans have excelled when given the right environment, as the human resource is not the issue but the lack of an enabling political and legal environment where scientific research and careers can thrive. These challenges continue to inspire Mary to do more in terms of raising stakeholder awareness and policy dialogues which has often unlocked research funds and uptake of research findings. Lack of funds has driven her to seek training on writing winning grant proposals. Regarding facilities, Mary ensures that each proposal includes a component on equipment which has been helpful enhancing the capacity of her laboratory.



Socially, Mary is faced with the challenge of balancing family and work, as well as a cultural expectation that as a woman, she cannot be more successful than her husband. An additional challenge is the frequent separation from family due to her different working stations. To solve this challenge Mary applies wisdom in prioritising activities in the order of importance and urgency, then employs proper planning, negotiating and effective communication. She also applies lessons from motivational books such as Stephen Covey's *"Seven Habits of Highly Effective People"*. Recently, she also developed a personal vision and mission statement that helps her determine what is important.

Culturally, some of Mary's relatives believe she should never hold a position higher than that held by her husband and have told her so. Some even

discouraged her from getting a PhD. This called for open communication and sometimes negotiation to reach an amicable agreement and support from her husband, children and parents. She also must plan for family time as her work station is far from that of her husband and has had to involve their children in such planning and decisions.

Mary's role models remain her late parents, Enos and Rosebella Abukutsa. The Vice Chancellor of JKUAT and Professor of biochemistry, Prof. Mabel Imbuga, also inspires her in everything she does especially her resilience and calm demeanour even in a crisis. Mary would like all young women and girls to keep in mind a conviction that *"All things are possible for her who believes. Excellence or failure all start in the mind. Believe you can do it and the rest will fall into place"*.



Olanike ADEYEMO

Nigeria

“ Science happened to me, but passion is what has kept my love for science burning ”

Olanike Adeyemo is professor and Head of the Department of Veterinary Public Health and Preventive Medicine at the University of Ibadan in Nigeria. In 2017, she became the first woman to ever occupy the position of Deputy Vice Chancellor (Research, Innovation and Strategic Partnerships). She describes her journey to Sciences in one sentence: “*Science happened to me, but passion is what has kept my love for science burning*”. This is because, growing up, her parents strongly believed in the empowerment of the young through education which set her off on her career path quite early. At the time, most parents preferred their children learn trades as these translated into quick employment. Later, in secondary school, she was zoned into taking the “science” subjects (biology, chemistry and

physics) as students were allotted disciplines based on academic performance. She was subsequently led into the veterinary profession and went on to become the first woman university graduate in her family. Olanike admits that she passionately chose her path in veterinary public health because of its vantage, dynamic role in human, livestock, wildlife and environmental health. To this end, she is the first woman in the field of aquatic veterinary medicine in Nigeria with a PhD in aquatic epidemiology and toxicology. Additionally, she was the first female professor in her department in the University of Ibadan.

In her exciting profession, one of Olanike’s impactful projects was a research she carried out on the effects of oil dispersants (used to clean up oil spills) on the embryos of *Menidia beryllina*, (small inland silvery freshwater fish) which showed that some oil dispersants are toxic. The research also demonstrated that the chemical characterisation of oil dispersants is very important because oil spills occur around the world and this directly impacts human communities besides wildlife, both aquatic and terrestrial. This research set the stage for the development of safer and more effective clean-up procedures upon occurrence of oil spills.

Olanike regards her gender as an attribute saying her womanly intuition and perception help with project conceptualisation, design and implementation. She explains that she has always defined a project by its societal impact; “*If it is not impactful, then it is not*



worth my effort." In addition to that, she believes strongly in providing feedback to communities, peers and students as this always informs future research.

On research, Olanike cites funding as the major challenge she has faced as an African scientist, which also translates to lack of access to cutting-edge techniques and infrastructure. To overcome this, she has constantly looked outwards (western countries) for funding and grants for laboratory equipment, trainings and collaboration opportunities to bridge the gap. She has successfully been funded and awarded several grants to carry out research and present scientific papers in various fora.

Another barrier she notes is the lack of a mentorship culture in her institution which leaves young academics floundering. She, however, appreciates that she was privileged to have mentors throughout her career and thus makes herself available to junior colleagues so that she can mentor them. One of her role models and mentor is her PhD supervisor, Prof. Samuel Adewumi Agbede, a fish immunologist. He taught her the value of hard work early, while allowing her to grow independently. In her description of her mentor she notes, "He guided me gently without attempting to make a clone of himself out of me; I could bounce ideas off him and when I was in doubt, he was selfless enough to allow me to seek knowledge independently". Her earliest mentor was, however, her teacher in primary school who always encouraged Olanike to work hard in her studies and always assured her there was a bright future if she focused on her education. Her primary school class two teacher, who she only remembers as Mr. Joseph, had an interest in girls' education, which seemed unusual way back then, especially because it was on the northern part of Nigeria (Kaduna); but maybe that was why he was so keen. He always bought her a present each time Olanike took the first position in examinations. "Thereafter, he came home with me to meet with my parents" to encourage them to allow her time to study as she wanted.

Olanike also acknowledges culture as a challenge to women in science in Africa. She points out that, in Nigeria, culturally and socially, the values, beliefs, attitudes, and behaviours still have a strong patriarchal leaning. Thus, she adds, working as a female academic is fraught with the challenges of dealing with gender-assigned responsibilities in the work place while struggling with a system which inherently does not expect her to measure up because she is female.

Despite this, she has been able to focus and maximise the attractive side of academia including: flexibility, collaboration, networking, research, job security and most importantly, freedom to use initiatives to chart her career path. Admirably, she was the first female veterinarian in Nigeria elected to Nigerian Academy of Science and the African Academy of Sciences.

Her parting shot to girls is, *"The only person that can limit you is yourself because every system puts down rules and guidelines which individuals can work towards"*. Olanike insists that to achieve what you want you have to set goals, work hard and stay focused. Her observation over the years has been that, when a woman steps up and performs excellently, respect and recognition as well as accolades follow.





Saada Naile Ahmed ELMAHI

Sudan

“ The only failure in life is not believing in yourself ”

Saada Naile Ahmed Elmahi is an assistant professor at Sudan's National Centre for Research, Medicinal and Aromatic Plants Research Institute in the Department of Agro-technology. Her childhood was filled with motivation and encouragement from family and friends to take up science and study to

the highest possible level of education. In particular, she recalls how her mother used to sing to her a song of hope before she put her to bed. The song was an encouragement as her mother prayed that she would grow up to be a brilliant and distinguished woman who would attend the University of Khartoum, one of the best universities in Sudan. The dream of studying was strengthened further by the fact Saada always had high scores throughout her primary and secondary school life. *“Throughout my earlier school years my family members referred to me as ‘doctor’”,* she recalls.

With that encouragement, Saada owed it to herself to attain the highest possible level of education. Indeed, she is the only woman in her family with a PhD. She graduated from the Faculty of Agriculture, University of Khartoum in 1999 and with a Master of Science degree at the Institute of Environmental Studies in 2006. She got a scholarship from the Tunisian government in 2007 to do a PhD in Tunisia, at the National Institute of Agricultural Sciences, University of Carthage, Tunis. Her PhD was in plant production sciences where she focused on organic agriculture. She received the degree with an excellent grade in 2014 after studying French, a necessity for living in a Francophone country. It was a unique experience which added a lot of value to her credentials. Additionally, she was the first woman to leave her home city in Sudan and travel abroad to study. Saada was also the first female Sudanese to obtain a PhD from Tunisia.



Saada has since worked with many organisations, both international and national, including non-governmental organisations. From these she gained professional experience and knowledge which has greatly enriched her career. In the last 15 years, Saada has accumulated experience in different fields gaining the capacity to think and act positively and scientifically in every aspect of life. As a result, she has gained the confidence to tackle whatever duties she undertakes. Saada has also worked with the National Centre for Research (NCR), the Medicinal and Aromatic Plants Research Institute (MAPRI), and the Eastern Nile Watershed Management, the Sudan component of the Community Watershed Management Project, funded by the World Bank, the Governments of Finland and Sudan, and many others.

Saada worked with the community around Dinder National Park in Sudan as a women development assistant and with the Dinder National Park project implemented by the Sudanese Environment Conservation Society, the United Nations Environmental Programme (UNEP) and the Global Environment Facility (GEF). This work she describes as one of her most satisfying achievements and exciting projects. Her work involved conducting social and economic studies, awareness raising, training activities, capacity building and communication activities, natural resources management, conflict mitigation and dispute management by applying participatory approaches. She was able to impact the lives of people from three towns and 40 villages around the park.

Her success from this engagement was not only limited to acquiring knowledge as she was also able to write a non-scientific booklet entitled *"Dances of Pan Trees"*. A thousand hard copies of the booklet were distributed. It depicts the success stories and the experiences of the people of Dinder area and how training and awareness activities influenced their attitude positively. Her reflections as an African woman scientist are insightful as she

believes the work of Science is to turn problems into opportunities. For this reason, Saada adds that as a woman she can understand the problems of



her people and, as a scientist, could respond better to them by looking to her discipline for solutions.

In her journey of using science to find solutions for the advancement of her community, Saada acknowledges that African scientists face barriers mostly because they lack financial, political and technological support. This has been a hindrance to building careers and in her case, whose interest lies in research and development, she constantly worries about how she can translate research findings into the real community services that African people need. On this challenge, she further highlights that what mostly drives African research work is not the needs of the people, but rather what kind of resources are available, and projects are subjected to the will of national decision makers. Thus, a researcher often has to strategise to target the decision-makers with programmes that help in bridging the gap between what they (decision-makers) want and what the people need.

Despite these challenges, Saada's experiences as a volunteer in environmental protection gave her a chance to interact with various communities in remote parts of Sudan where they lack basic needs but are equally guilty of mismanaging the available natural resources. These interactions cemented her ambitions and have helped her build a career in

different topics including agriculture, environment and rural development.

Saada acknowledges three people who have been role models and mentors in her life. One of them is her mother, a primary school level 4 drop-out, whose belief in her daughter's greatness has always inspired Saada. In her own words *"my mother is the first professor of my life who taught me the value of knowledge, patience and faith"*. Her second role model is Prof. Suad Sulaiman who is the Research Director at Sudan Medical Heritage Foundation. Saada describes her as an iron lady, who is well organised and devoted to knowledge and Sciences and who has always advised and encouraged her. Another role model is Prof. Balgis Osman Al Asha, a climate change expert at the African Development Bank. Saada speaks highly of Prof. Al Asha as someone who knows what she wants and has a deep caring for the local people whom she works with in different areas in Sudan while still delivering on her job in the positions she holds at an international level.

"The only failure in life is not to believe in yourself". That is Saada's encouragement to girls and women. She echoes that girls need to trust themselves, think about others and remember that every problem on the African continent can be turned into an opportunity if they have the knowledge, courage, patience, hope and faith.

Saâdia NASSIK

Morocco

“ I want to prove to the world that an African woman can be happy as a scientist ”



Saâdia Nassik is a veterinary doctor and an assistant professor at the Agronomy and Veterinary Institute (IAV) Hassan II Rabat, Morocco. Her earliest drive to study science was when she began her studies at veterinary school as these were challenging but also motivating. In primary school, she was a keen and curious girl who wanted to know everything. In high school, she was always the best performing student and she obtained her highest marks in mathematics, history, philosophy and science. At the university, she received two awards in recognition for her excellent performance.

In 2010, she received an academic excellence award from the Agronomy and Veterinary Institute Hassan II and in 2011, an Excellence award from the North African Congress.

Every day her work as a veterinary doctor and a professor presents a new challenge. Working on avian pathology to establish the cause of death of birds was very interesting. This was mainly because it involved studying bacteria (mycoplasma) that cause chronic respiratory infections in birds and which impact chicken and turkeys production. As Saâdia sees it, the most impactful project she has been involved in, and continues to work on, is sharing with her students the love she has for science and for the continent of Africa. She also finds it rewarding explaining to children how to protect themselves from the fatal rabies disease which is transmitted to humans through bites from dogs.



Saâdia loves working in Africa as a woman scientist because she believes it is the right thing to do. In this regard she quips, *“I want to prove to the world that an African woman can be happy as a scientist; thanks to the sun, thanks to her mind and strength, and thanks to her determination!”* She therefore, dreams of using science as a tool to help African women, starting with those in her country, build their own businesses and improve their incomes. In her view, they have the potential to be independent women and to change the narrative of helpless dependency that women in Africa have been associated with. If she were able to write a book on Africa it will be titled *“Africa in other words”*.

Being a woman veterinarian in an Arab and African country posed her biggest challenge. This stems from the cultures and traditions that associate veterinary work with men. She therefore has a responsibility to





prove that a beautiful Arab woman can handle and treat animals, regardless of their size. In her own words, *"a woman has the strength to face large animals"*. Being able to disapprove such negative beliefs about women and what they can or cannot do has been a challenge she faces daily, yet it is one that continues motivating her every day.

Saâdia's role model is world renowned American TV talk show host Oprah Winfrey, whom she describes as a woman who knew how to transform her difficulties into advantages and has invested in improving other peoples' lives across the globe. She is also inspired by the rural woman. In her words *"she is strong, she faces head on the challenges of life and nature. She never gives up and she keeps her smile. Her face is the expression of all her past; she is a woman who embraces her wrinkles with pride"*.

Her words of advice to young women and girls seeking to pursue and excel in science careers are *"you have the potential to be the best woman in the world, but you have to prove it. And your precious treasure is your brain and your perseverance. You can do it!"*.

Sarifa Abdul Magide FAGILDE

Mozambique

“ Women can do well... pursue science careers and help to make a difference ”



Sarifa Abdul Magide Fagilde is a professor of mathematics education at the Pedagogical University of Mozambique. She was the first woman to get a PhD in Mathematics in her country. She was also among the first group of students to be trained as a secondary school mathematics teacher when the country's first President, Samora Moises Machel, decided to close all high schools. All students were directed to be trained as teachers or to take pre-university courses due to the huge shortage of qualified personnel in the former Portuguese colony. This followed a massive exodus of teachers and other qualified people when the country got independence from Portugal. In 1996, Sarifa was instrumental in the formation of the Mozambican Association for Research in Mathematics and Science Education. Currently, she is also the Director of the Office of International Relations at the Pedagogical University. Sarifa is also an accomplished athlete and has served as the president of Athletics Mozambique and a council member of the African Athletics Confederation where she still is an honorary member.

Since her childhood, she was gifted with an ability to work with numbers. She always performed well in science and mathematics and to date, she keeps some of her primary school examination papers. In secondary school, she often achieved good grades in the two subjects, sometimes performing better than the boys in the mixed school she attended. One of the things she vividly remembers is that she had very good mathematics teachers who inspired her to enjoy it.

Sarifa's pursuit of excellence in her career has not been without setbacks. She confesses that as she grew up, mathematics and science were a preserve of male students. These subjects were likened to a *'beast with seven heads'* and it became a challenge for her to show that she could *'slay it'*. She therefore devoted herself to prove that she was up to the task and has since become a role model for many women and girls. In 1996, when serving as Dean of the Faculty of Mathematics and Natural Sciences, it was disheartening to listen to a male colleague tell her to her face "I am sorry Sarifa, but I cannot have a female *'boss'* in this Faculty". This obviously posed a personal challenge, but undeterred, as Dean, she had well defined roles and continued to serve in that capacity, working well with all her colleagues, for about four years.

One of the most significant projects Sarifa has been involved in was the creation, in 2001, of a network for mathematics and science education among eleven participating countries including Mozambique. The network sought to collaborate in addressing common challenges in mathematics and science education. A year later, the network changed its name



to “*Strengthening Mathematics and Science in Secondary Education in Western, Eastern, Central and Southern Africa (SMASSE-WECSA)*”. Because of her commitment to achieve the goals of the network, Sarifa was elected to serve as a Vice-Chair for the organisation in 2006. The project has since grown to become *SMASE-AFRICA (Strengthening Mathematics and Science Education in Africa)*.

The most impactful programme she has worked on was “*Creating the Mozambican Scientist of Tomorrow*” which she initiated when she served as an advisor to the Minister of science and technology. The programme which is housed in the Ministry of Science, Technology, Higher Education, Technical and Professional Studies is implemented in partnership with the Ministry of Education and Human Development. The resources for implementation come from both Ministries. Participating students solve non-curricular mathematics, science and technology problems,

including puzzles and games. These are taxing and require a great deal of skill and knowledge of the core subjects including mathematics and sciences. In addition, students do laboratory experiments and participate in scientific fairs at least once a year. The best students are thereafter called to participate in mathematics and science Olympiads at national and international levels. The best girls are often awarded with prizes in the Olympiads and other organised activities. Students are selected to join the programme annually while some volunteer to be in its activities. They, however, have to remain in the programme until they finish high school.

The aim of this programme is to increase the number of students undertaking mathematics, science and technology careers, and particularly to motivate more girls. It started with three hundred students but currently more than ten thousand students are involved. This growth has motivated Sarifa to work towards increasing the number of women in science and mathematics. Thus, she became a founder member of the Academy of Science of Mozambique and of the Mozambican Association for Research in Mathematics and Science Education.

Like many career women, Sarifa has faced social challenges. This is due to the expectation of the society that after marriage women are expected to remain at home as housewives and take care of children. However, she won a scholarship when her first-born son was just thirteen months old. She left him behind, travelled abroad to pursue higher education in Australia and it was only after four months that she was able to bring the baby with her. Although family and friends blamed her for leaving the baby behind with his father, she always had the support of her husband. A totally unexpected problem was rejection by her daughter. When her daughter was about one year old, Sarifa travelled more frequently and every time she returned home her daughter resented her. She describes this as “*the most painful experience*”. Eventually, both children came to accept her and thereafter she was careful to explain to them that she had to travel and why.



Sarifa has also had to deal with the challenge of having too many demands on her time and energy. An example was when her mother passed on and she had to become the mother in her family. Being the eldest girl, she had to take care of the domestic chores in the home over and above her teaching and studies. In addition, she remained active in sports. Indeed, what helped her survive the workload and related stress was her involvement in sports. She strongly believes that being a mother, a career woman and an athlete can be combined and one can excel in all at the same time. Today, she is occasionally called upon as a role model to talk about not only mathematics and science but also sports.

Sarifa's role model is the late Prof. Paulus Gerdes, one of the fathers of ethno-mathematics. He taught

her how to apply mathematics to contemporary life which made the subject not only enjoyable but also stimulated her curiosity. She advises young women and girls to be persistent and not be discouraged. She concludes that women can do well in STEM careers. They should pursue them to make a difference and help their countries and the world to change the notion that some careers are only for men. Sarifa encourages young women and girls to *"Go ahead. The journey is long, but possible and enjoyable, and in the long run they will be proud of themselves"*. She also encourages everyone to take up some sport or physical exercise as it alleviates stress and energises one to be able to accomplish their commitments. In her view, this does not have to be competitive, although such intensive sporting worked for her.



Sombo MAKECHE

Zambia

“Pursuing careers in science will give women an opportunity to be innovative and contribute to making life better for all”

Sombo Makeche is a faculty member at Mulungushi University in Zambia. She was appointed lecturer upon completion of her Master's degree after having worked as a staff development fellow and teaching assistant. She was among the first women to be given the overall best graduating student award in the School of Agricultural Sciences at the University of Zambia (UNZA). She is among the youngest lecturers in the School of Agriculture and Natural Resources' Agribusiness unit at Mulungushi University.

In her formative years, Sombo attended a government primary school with a lot of pupils in one class. Although this made individual

pupil-teacher interaction difficult, it promoted competition as everyone wanted to perform well in order to become someone great in the future. This competition made it possible for several pupils, including Sombo, to perform well. Upon completion of her primary education, she was selected to join a convent school for her junior secondary school, after which she qualified to join a technical high school where she emerged as the best female student. She attributes her consistency to her desire to achieve greater things in life. This desire gave her the drive to work hard despite having very few female colleagues in the school. Since then, she is convinced that there is nothing that is limited to men only. Thus, what men can do, women can also do and in some instances, even better. This informed her decision to take up a career in science despite it being depicted as very difficult and a man's career. Sombo then proceeded to UNZA where she studied for a Bachelor of Science (BSc) in agricultural economics, and thereafter, a Master of Science (MSc) in the same subject at the University of Pretoria. In both institutions and levels there were very few female students in her classes, but this did not diminish her appetite to excel in her career as a scientist. Her gender was never a limiting factor, and, in fact, she interacted very well with her male counterparts and they shared knowledge leading to the successful completion of their studies.

Sombo is motivated by the possibility of being able to contribute positively to improving the livelihoods of the people in her country. This is a major factor



that has triggered her investigative mind. Her passion for science and scientific research was ignited by the need to help change the world, especially by means of helping smallholder farmers increase their incomes to reduce poverty levels. She notes that in many African countries, particularly Zambia, the majority of the population lives in rural areas and a large percentage of that population are farmers. However, on-farm incomes are low and this contributes to increasing poverty levels. Scientific research is a means of addressing some of these poverty issues and of bettering the lives.

One of the best science projects she has worked on was research she conducted involving smallholder farmers and private traders in Kalomo district of Zambia. This project helped Sombo to understand how transactions between these two parties take place, which enabled her to dismiss wrong perceptions about the operations of the private traders, also known as briefcase buyers. For her, this was a great opportunity as it involved close interactions with farmers and traders which improved her understanding of the maize trading sector.

Among the most impactful projects Sombo has been involved in was the analysis of trader behaviour in the maize marketing system in her country. This project entailed finding out if traders do indeed exploit the smallholder farmers by paying very low prices compared to other marketing channels such as wholesalers and millers. The findings of this study showed that smallholder maize farmers are indeed exploited. The recommendations made have had an influence on policy in the maize sector which positively impacted on the functioning of markets to the benefit of the farmers.

Asked what motivates her to work as a scientist in Africa, Sombo noted; *"I am motivated by what women have been able to discover through science."* She gave the example of Dr. Judith Lungu, Vice Chancellor of Mulungushi University, and an

animal scientist who has, through livestock research projects, developed better ways of rearing livestock so as to prevent diseases and reduce livestock mortality rates. She notes that other women scientists have also contributed to ways of improving the livelihoods of farmers, particularly smallholder farmers whose incomes are often low. The stories of such women scientists have increased her passion for science whose aim is making a difference in the lives of the poor in Africa by improving their incomes.

As a young scientist Sombo has faced many challenges including firstly being made to feel inadequate in analysing issues effectively, because she is a woman. She emphasised that men are often seen to understand science-based issues better than women, which is not true. It translates into men being unfairly considered before women for positions entailing scientific analyses and decision making, both in the private sector and in academic institutions. Secondly, she often lacks funding for research, and finally, there are situations where she has been made to work under the supervision of a man, who sometimes adds little value to the project



but then takes credit for the job. These challenges inspired and gave her the urge to prove that she can analyse and deliver scientific results which aid in decision making both at the micro and macro levels. She has since resolved to work harder, read more and seek guidance from specialists to achieve more. She is happy that several people and institutions have recognised her hard work and determination and often involve her in various projects.

Socially, Sombo has also had her share of challenges. Key among these is her family who felt disheartened by the thought that, being so career-oriented, she might not settle down to have a family. Their disquiet was made worse by the fact that Sombo did not spend a great deal of time with family and friends, including failure to attend family events either being away in school or at work. To address this, today she plans her time carefully, thereby creating time for socialisation, especially during holidays. This way she can finalise her project work as well as her school assignments. She also limits her work to office hours and school days as much as possible and avoids carrying work home which has helped increase her time for social activities.

Sombo's role models are Prof. Kawwanga Yambayamba, Dean of the School of Agriculture and Natural Resources at Mulungushi University, Dr. Judith Lungu, Vice-Chancellor of the same university, Prof. J.F. Kirsten, Director of the Bureau for Economic Research at the University of Stellenbosch and former Head of the Department of Agricultural Economics and Rural Development at the University of Pretoria, and Ms. Melissa van der Merwe, lecturer and researcher at the University of Pretoria in South Africa. These people have always encouraged her to work hard and take up challenging projects. They themselves have achieved so much through hard work and dedication and this gives Sombo the drive to put in her best to whatever she does.

In conclusion, Sombo tells young women and girls that nothing is impossible. Besides, impossible has "*I'm possible*" in it – she informs them. Therefore, everything and anything can be achieved if one only puts one's mind to it. Girls need to know that they can do so much more than they can imagine; the power lies in their determination, hard work and self-belief. It is her wish that many more girls become involved in science-related fields because it is interesting and the challenges make one realise their great potential. Furthermore, pursuing careers in science will give women an opportunity to be innovative and contribute to making life better for all.



Sylvie Hounzangbe ADOTE

Benin

“ Challenges will always be there... one must keep evolving and improving one's competencies ”



Sylvie Hounzangbe Adote is a lecturer, full professor and manager in charge of the Laboratory of Ethnopharmacology and Animal Health (LESA) at the Faculty of Agronomic Sciences of the University of Abomey-Calavi. She is also the president and founder of the Benin Association for Education and Scientific Research of Women. She is a career educationist who has several years of teaching experience both in secondary school and higher education. In her own words, *“my career benefited from several teaching experiences I have gathered over ten years in Côte d'Ivoire and Benin as a biology teacher before spending the remaining of my still ongoing teaching career in higher education”*. Currently, she is a teacher at the Faculties of Agronomic Sciences at the Abomey-Calavi University (South Benin), the University of Parakou (North Benin) and the University of Agriculture of Kétou (East Benin). She teaches different courses including cell biology, animal anatomy and physiology, zootechnology and ethnopharmacology.

Sylvie has also held key administrative positions including: Vice President of the African University of Technology and Management, Cotonou, Benin, where she oversaw academic affairs (2009-2013) and National General Director of Scientific and Technological Research (2011-2015) at the Ministry of Higher Education and Scientific Research in Benin. As the National General Director of Scientific and Technological Research, she coordinated the national research system of Benin. She also served as Vice Chancellor of the University of Lokossa

(2015-2016), and during this assignment, she coordinated the academic activities and research, organized the capacity building of university actors (teachers, researchers, administrators and students), and set up partnerships between universities and companies. In the span of her career, Sylvie has carried out several feasibility studies, monitoring and evaluation of research and development projects, both in Benin and outside.

After primary school in Cotonou (Cadjehou Public Primary School), and secondary school at Notre Dame d'Afrique in Atakpamé, Togo, a prestigious school for girls, Sylvie then joined the Lycée du 11 Février at Lomé. She was ranked highly enough to be allowed to enrol at the School of Sciences of the University of Benin in Lomé, where she studied chemistry, biology and geology. After two years, she accompanied her husband to Côte d'Ivoire but never eased in her academic pursuit. She obtained her BSc (1984), MSc (1986) and PhD (1991) at the University of Abidjan, Côte d'Ivoire. Later, in 2004, she obtained a second doctoral degree at the University of Abomey-Calavi. Her passion for science arose from a curiosity to understanding biological phenomena and



with a keen interest in the knowledge of indigenous medicinal plants.

Sylvie has served Benin in many capacities. To the pride of the whole female scientific community there, she was the first and the only woman Vice Chancellor. She was the first woman to be recruited in the Department of Animal Production of the Faculty of Agronomic Sciences, the first woman to achieve the rank of associate professor (*maître de conférences*) in animal production and the first woman full professor (African and Malagasy Council for Higher Education, CAMES) in all disciplines (except medicine) in Benin.

The most exciting science project that Sylvie has undertaken was from 2008 to 2010 when she coordinated a project entitled "*Valorisation of potentially anthelmintic local plants in the tropical animal system*", funded by CORUS-France, a grant which she obtained competitively from an international call for projects. This contributed to enhancing food security and alleviating poverty within the framework of sustainable development by improving the productivity of animals. The project also contributed to strengthening the cooperation between different research teams from Benin and

Cameroon and France. This cooperation continues to this day and several doctoral students have benefited in terms of financial support for research and theses writing in the partner countries.

In her evaluation, the most impactful project was the implementation of gastrointestinal de-worming prophylaxis, done per the breeding cycle of the *Djallonke* sheep and the growth phase of the lambs to improve their productivity and the pre-weaning growth of the lambs. This work was very well received by the breeders and colleagues involved in rural development in Benin as it improved both productivity and profitability.

In addition, Sylvie coordinated a project funded by the West African Economic and Monetary Union (WAEMU), obtained through a competitive international bid. This multi-disciplinary and multi-institutional project dealt with the treatment of gastrointestinal parasitism using medicinal plants. It demonstrated that there were many medicinal (anthelmintic) plants from Benin and Burkina Faso.

Sylvie is motivated to explore further work in Africa due to her love for the continent and her country. She is proud to promote the indigenous knowledge in her field of research. Besides, the collaboration with African researchers is always very exciting and rewarding as it often leads to new knowledge and avenues for further research. The extreme poverty faced by cattle breeders in Benin and the West African sub-region has motivated her research interests. Poverty is disempowering, but within this story of misery, Sylvie found her calling, which is to develop effective, available and low-cost treatments for the management of animal health and reproduction breeding stock.

Her work has not been without challenges including the valorisation through scientific research of local knowledge and the richness of African biodiversity. Equally inhibiting has been the lack of funding and equipment for scientific research on the continent. To address these challenges, Sylvie set up an



ethnopharmacology and animal health laboratory in 2006 to bridge the existing gaps.

Sylvie has authored more than fifty scientific publications, supervised seven doctoral theses, twelve DEA (the equivalent of a Master's degree) and ten professional Masters degrees. She has also sensitised and trained breeders in the use of medicinal plants for gastrointestinal deworming and other pathologies.

There are many challenges as one strives for excellence, she cautions. In her view, it is important to have a happy family. In this regard, she dedicates time to hers during which they discuss family issues. She also honours her responsibilities as a wife, mother and grandmother and provides for the financial and social needs of her family. She explains that it takes sustained hard work, without discouragement, to achieve one's goals in life. In addition, challenges will always be there but one must keep evolving and improving one's competencies.

Sylvie has had many role models during her career as a scientist. Key among them are Prof. Diomande Tiémoko, her DEA (MSc) director, who died a week before her defence in 1986 and whose rigor in science writing taught her a great deal. She considers Prof. Isabelle Glitho, at the University of Lomé, Togo as another model woman scientist as she is known internationally, particularly for her fight for the emancipation of women in science. Sylvie underlines the need for mentorship of young women and girls in scientific careers and to encourage their active participation in women's associations which organise sensitising sessions for girls, authorities and parents. The setting up of listening committees in universities and schools and the organisation of social gender actions are some of the activities she has been involved in. To succeed, she urges women and girls to set clear and precise objectives and to pursue these with diligence and consistency regardless of any difficulties encountered. She emphasises that to succeed; one must fight and work hard.



Tebello NYOKONG

South Africa

“ Young women and girls who wish to pursue science careers should seek education to the highest level ”

Tebello Nyokong is a South African chemist and professor at Rhodes University. She is the recipient of several awards including the Presidency of South Africa's Order of Mapungubwe in Bronze, the L'Oreal-UNESCO award for Women in Science for Africa and the Arab States, as well as the Kwame Nkrumah Scientific Prize from the African Union. From alternating between attending school, taking care of sheep and dreaming of one day owning her own pair of shoes, she's become one of the top ten most influential women in science and technology in Africa.

Despite having a good background in mathematics and science from primary school, Tebello instead chose the arts stream in high school due to peer influence and a general belief that science was hard. The common stereotype then was that science is not

for girls as its demands would conflict with domestic and wifely responsibilities. Looking back, she notes that the choice was due to lack of proper guidance and the fact that choices were heavily influenced by societal stereotypes. For three years, she trudged through arts subjects before she was discovered by a female science teacher. She therefore owes her teacher a great deal since she took a risk by enrolling her in the science stream with only two years of high school remaining. Tebello's earliest influence was her father, who right from the beginning shaped her to become what she is today. Her father was liberal and never thought that certain things such as science were beyond her capability just because she was a girl. Her father would, however, have preferred if she got married and settled earlier in line with societal expectations. When she finally joined the sciences, it was her science teacher's passion and ability to simplify everything she taught that revealed her capability leading to impressive performance in these subjects. Asked what drove her passion for science, Tebello underlines her ardent curiosity regarding how things work and her love of challenges. These two aspects have continued to drive her pursuit of science. In her own words, she notes, *"I like doing what other people think is hard because I enjoy being challenged."*

The most satisfying project Tebello has been involved in is medical research on photo-dynamic therapy, which provides an alternative to chemotherapy in cancer treatment. This research is influenced by the fact that chemotherapy has adverse effects



on cancer patients and some die because of its negative effects. Photo-dynamic therapy is based on the use of the blue dye used to colour denim clothing, which is inert and harmless on its own, but can be activated by exposure to red laser beams and used to develop drugs. Most importantly, this project demonstrates that Africa has the capability to develop home-grown technologies and medicines which provide solutions to problems, even though the continent is not known for scientific excellence.

One of the hurdles she faced when starting her research was difficulty in obtaining funding. However, she has since learnt to adapt to difficult situations such as preparing for impromptu deadlines. For example, one time someone called her at home at ten o'clock at night and said they would be at Rhodes University the following day and if she was interested in their funding, they required a proposal by ten o'clock in the morning. By that deadline, she had the proposal written. The effort earned her three-million-Rands-worth of lasers.

At the start of her career, Tebello admits that she had problems publishing. To solve this, although it was difficult, she used the international reviewers' comments to help improve her papers. In this regard, she says *"the nice thing about being a woman is that criticism does not affect us as badly as it would affect men. I learned from my international peers by them criticising my work"*. One of the challenges Tebello has had to overcome as an African woman scientist is academic loneliness in her research career. This is due to being the only woman, and the only African woman scientist, of her repute in her university. This means that most of the time she is on her own without anyone to talk to when things go wrong, or to share happiness with each time she has a breakthrough in her research. In her view this has been the most terrible part of her career. She has managed to overcome this through *'moderate insanity'* which gives her the courage to go on. She says she has the courage to go on and

she overcomes her challenges by working even harder. Furthermore, Tebello always seeks ways of improving herself, while having fun. She does not expect handouts and never uses being a woman as a ticket to getting anything.

On the whole, she avoids administration as it comes with extensive responsibilities which can stand in the way of scientific research. However administration sometimes finds her and she admits that some is needed as it helps one to learn how things work. Her greatest drive to excel is her passion for Africa. She opines that the continent is known for its wars and famine rather than as a major player in science and technology, a perception she wishes to change, even if only in a small way.

Tebello believes people can change their circumstances through education. Young women and girls who wish to pursue Science careers should seek education to the highest level and work hard to excel in their careers. She attests that hard work has earned her success, including her many awards and recognition.





Uphie Chinje MELO

Cameroon

“ If women steer away from the sciences, they reduce the scope of women’s contribution to the development of the nation ”

Uphie Chinje Melo is a professor at the University of Yaounde in Cameroon. She has been a visiting professor at the University of South Wales and a managing director at the Local Materials Promotion Authority in Cameroon. She has a Maitrice’s degree in inorganic chemistry from the University of Yaounde and a PhD in metallurgical engineering from Imperial College, London. She was the first woman in Cameroon to obtain a PhD in engineering and, more significantly, from Imperial College of Science, Technology and Engineering, one of the most prominent engineering schools in the world, and the first woman in Cameroon to become a full professor in engineering. She was also the first female to head a state-owned scientific research cooperation, namely the Cameroon Local Materials Promotion Authority best known by its

French acronym MIPROMALO. In 2009, Uphie was the recipient of the President of the Republic’s Prize for Best Researcher in Cameroon. She was also awarded, by Africa Reconnect, a dynamic women’s group in South Africa. The recognition for accelerating positive change in her country as the African Frontline Researcher of the year in Africa.

As a child, Uphie liked playing scientific roles such as veterinary doctor, medical doctor and nurse, in the role-playing games she took part in. In school, she did very well in arithmetic which was her best and easiest subject. She also liked domestic science, especially the topics about art and needlework. In secondary school her passion for science became very clear. Her interest increased tremendously because she excelled greatly in her science subjects. Her teachers loved this, especially her mathematics teacher, a priest who often offered candies to the students who answered the most questions correctly, and often Uphie got the sweets. She mainly selected science subjects at the general certificate education (GCE) O level, and took exclusively science subjects in her ‘A’ levels, convinced that she would follow a path in science, although at that time she did not know exactly what specific career she wanted.

Uphie’s most impactful project, which spanned several years, involved the development and use of locally produced construction materials as a substitute for imported ones. The process entailed research into the transformation of local iron oxide ores using simulated reformed natural



gas. She introduced materials engineering into her department in the University of Yaounde, researching and supervising several PhD students, and subsequently creating pilot training centres. Eventually there were industrial production units where materials are produced. These ecologically friendly construction materials are sold to the public at a low cost. To ensure the project's success, professionals and decision-makers had to be convinced of its viability. In addition, students, builders and researchers were trained and the public was sensitised to the importance of these materials.

Uphie loves working as an African woman scientist because it is a domain that has, for many years, been male dominated. For years women themselves assumed that science was a man's world. After attending a Vital Voices Campaign in Cape Town, South Africa, Uphie realised the importance of supporting and mentoring other women. She had felt very natural in the midst of male colleagues with whom she had interacted for over 20 years as the only woman in the Department of Inorganic Chemistry. In the past five years, only three young female colleagues joined her department, one of them having been her PhD student. She calls the attention of young girls and their parents to the fact that if women steer away from the sciences, they reduce the scope of women's contribution to the development of the nation. In her view, this means that their experiences and knowledge as women will not contribute to this development.

In her career as a scientist, Uphie has encountered many challenges. The first, despite reservation from colleagues, was developing courses that were hitherto non-existent in Cameroon universities. Shortly after her recruitment into the Department Of Inorganic Chemistry, she received a transfer from the Faculty of Science to the Higher School of Engineering to start a Materials Engineering Department. Unfortunately, the Head of Department in the science faculty, who was pivotal in her recruitment,

was not pleased. So Uphie stayed in the department and introduced research in construction materials into the Department of Inorganic Chemistry, where she was a lecturer. This received initial opposition from colleagues as they felt that it was not pure Chemistry, but behold, today Uphie is Head of the Applied Inorganic Chemistry Laboratory, whose main research domain is Engineering Materials! The department has already produced more than twenty PhD graduates since 2007 and is proud of several specialized professional courses.

Uphie's second challenge was introducing the use of materials fabricated from natural local resources, including compressed earth blocks, fired bricks, geopolymer blocks and roof tiles, in the construction of state infrastructures. This was initially negatively received, but as the general manager of the state cooperation (MIPROMALO), Uphie wrote letters and statements which backed these up using evidence from completed studies. She then sent these to all technical ministries and state corporations that ought to have been involved in the sector, including the Prime Minister's Office, advising them that the economy of Cameroon would not progress if these materials could not be developed and used in the country's building industry. It took two years of demonstrations, and convincing different



stakeholders, for the Prime Minister and Head of Government to issue a circular (No 002/CAB/PM of 12 March 2007), instructing the use of local materials in the construction of public buildings in Cameroon.

The third challenge was getting post-graduates and researchers to valorise their research findings. After several failed attempts, she has recently created trans-disciplinary work teams to encourage start-up projects exploiting their own research results. She has done this because of her realisation that few researchers are able to achieve this on their own.

Uphie identified a friend named Namakau Kaingu of Caingu Mines Limited as her role model. They met in 1998 at an African Industrial Minerals Conference in Tanzania. Namakau conducted full discussions as an experienced geologist, only for Uphie to later learn that Namakau was not formally educated in the sector but had moved into it based on her interests in gemstone mining entrepreneurship. She

even envisaged the financial potential of the sector and today she is a successful gemstone miner in Zambia. She was instrumental in setting up *Zambian Women in Mining* and has subsequently become fully involved with similar international networks.

As her parting shot, Uphie tells young women and girls that they can become scientists and at the same time live a full life as any other woman in any other profession, including that of beauty models. She reminds them that being a scientist does not mean they ought to look shabby. She believes that women make the best scientists as they are good at the preparation of products that involve mixing of diverse substances, much like in cooking. Women have been to the moon, and anyone can also do that. She encourages women and girls to pursue challenging careers in science, encourage their friends as well to be like them and strive to achieve the highest academic qualifications in their chosen profession.

Yaye Kene GASSAMA

Senegal

“ Science is a powerful tool to improve our daily life ”



Yaye Kene Gassama is a professor of plant biotechnology at the University Cheikh Anta Diop in Dakar. She is the vice-chair of the National Academy of Science and Techniques and Chair for Fundamental Applied Sciences and Innovation. She was the first woman to attain the level of full professor in fundamental sciences in Senegal. She was the second woman in her country to be appointed a cabinet minister (in charge of scientific research) and expressly tasked with the responsibility of implementing her country's national policy on scientific research. She has also had the honour of being Chair of the African Ministerial Council on Science and Technology (AMCOST) II and with her colleagues from elsewhere in Africa, she spearheaded the development of the Africa Science and Technology Consolidated Plan of Action (CPA) initiated by the African Union's New Partnership for Africa's Development (NEPAD).

Her earliest drive to study science stemmed from the encouragement she got from her father who worked in finance. He believed in science and in her intellectual capacity. He, therefore, ignited her passion for science by discussing scientific topics with her. His favourite motto was, *“Always forward, backward never”*. Young Yaye embraced this motto in all aspects of her life and from class to the sports fields, it was always marching forward. She was good at sports and played basketball and athletics in high school.

Yaye has worked on three most impactful projects. First was a study on the utilisation of the neem tree

in the treatment and prevention of malaria. This was conceived as an effort to use African knowledge in plant biotechnology. With the support of the Association Education Santé of the First Lady of Senegal, in 2004 a semi-industrial unit for organic products was created to enhance the preparation and packaging of neem syrup and other organic products. This greatly contributed to the fight against malaria, particularly during the rainy season, as these products are cheap and readily available. Second, under the United Nations Environmental Programme (UNEP) and after three years of intense negotiation with national stakeholders, her team was able to develop a consensual legal framework on the use of genetically modified organisms (GMOs) in Senegal. Senegal has since enacted a law and established regulatory bodies on the



implementation of GMOs in the country. Third, at national level, Yaye was instrumental in developing a strategic vision using an innovative approach, to facilitate the transformation of scientific knowledge into marketable products and services for strategic sectors like ICT, agriculture and food technology. She, however, notes that for this to have the desired impact, the contributions of both men and women in science should be strengthened. Her view is “if we consider that science is a powerful tool to improve our daily life, it is also very important to have well trained human resources”.

Yaye believes that science is the driving force for socio-economic development in Africa. This is her conviction based on overthirty-five years’ experience in training students and communities at different levels of science. She has trained and supervised forty-seven Masters and eight PhD students in plant biotechnology dealing with staple food plants and agroforestry. She has also participated in seventy-one juries.

As Minister in charge of science and technology, she made progress in the “socialisation of science” in Senegal by creating five platforms or poles of innovation in the country where information on technologies and practical skills are transferred to young girls and boys in:

- i Informatics tools and techniques of computer assembling,
- ii laser technology coupled with computational graphics for art and handicraft design,
- iii production of improved seeds using *in vitro* techniques,
- iv conservation of tropical fruits using techniques of desiccation under vacuum, and
- v production of fortified food (enriched with vitamins and proteins).

This programme has given the opportunity to almost two thousand young people to be trained in innovative technologies and acquire new expertise and new skills to perform their activities. Although Yaye has since left the ministry, the programme is on-going.

Recognising the importance of plant genetic resources in stabilising ecosystems in agricultural productivity, nutrition and population health, through plant and microbial biotechnology, Yaye is dedicated to researching the functioning of biological systems in arid and semi-arid ecosystems. Her investigations are based on major crop species (rice, vigna, tomato,) and forest species of economic and ecological importance such as the date palm, acacia, *Prosopis*, *Sterculia* and *Bambusa*. In the field of plant biotechnology, her team sought to determine the optimum culture conditions that promote large-scale regeneration of species of arid tropics using *in vitro* techniques. They also managed to genetically transform *Hibiscus sabdariffa* and they succeeded in selecting rice lines tolerant to salinity through another culture. The team also made substantial contributions to maintaining a favourable environment for long-term conservation of tropical fruits and legumes such as tomatoes and mangoes.

As a mother of two, one of the challenges that Yaye has faced is proving that a woman can have her place in the world of science. Due to social, economic and cultural restraints, many of her female colleagues



have not gone beyond the grade of lecturer while men cheerfully cross over to become full professors. She, however, chooses to focus on her professional career and not accept cultural constraints and stereotypes associated with family life.

She received numerous scholarships and grants from different organisations which allowed her to acquire equipment and research material. This financial autonomy has been key in realising her research work plans and the production of publications. It has also enabled her to rise through the ranks in the academia from assistant to master assistant, then to lecturer and finally to full professor. Arduous work and strong determination allowed her to become the first female full professor in basic sciences in Senegal.

In her career path, Yaye has similarly overcome challenges. For instance, when she conducted research on forest trees, the field work was difficult, due to the regular observations and recordings that had to be done to obtain morphological data, soil parameters and to study the physiological behaviour of natural populations. Climbing trees at midnight to monitor the flowering phase of trees was not an easy task, but it had to be done. Days and sometimes weeks had to be spent in harsh conditions, with minimum eating and sleeping, to obtain valid

results. It is her passion and commitment to science, a desire to succeed and an aspiration to become a leader in her field that gave her the strength to overcome all the barriers she encountered.

Her role model is Prof. Yvette Pares, her professor in microbiology. Prof. Pares dedicated herself entirely to science and often said that she was married to science. She helped Yaye discover the beauty of life at the molecular level and opened her mind and heart to science. The support and mentoring she received from Prof. Pares made her desire to do more for the girl-child. She notices that girls, despite being very smart, encounter hindrances such as marriages, pregnancies and difficulty in finding fellowship in a host laboratory, which blunts their potential. As a member of the Advisory Board of Forum for African Women Educationalists (FAWE) and Female Education in Science and Mathematics (FEMSA) Senegal, she promotes the education of girls in science and mathematics, mentors young girls and encourage them to become more involved in science, and she also visits high schools all over Senegal to motivate girls to do this. She also encourages women scientists to take advantage of the selective granting of fellowships and quotas to women, to help them to perform in their fields of research.



Yeweyenhareg FELEKE

Ethiopia

“Women should initiate research activities as they proceed in their scientific careers”

Yeweyenhareg Feleke is an academic staff member, consultant internist and endocrinologist and researcher at the Endocrinology and Metabolism Unit, Department of Internal Medicine, School of Medicine, College of Health Sciences, Addis Ababa University in Ethiopia. She is a former president of the Ethiopian Medical Association. Under her leadership, the Institutional Review Board (IRB) of the School of Medicine of Addis Ababa University became the first African Institution Review Board recognized by WHO-FERCAP-SIDCER (*World Health Organization-Forum for Ethical Review Committees in the Asian and Western Pacific Region-Strategic Initiative for Developing Capacity in Ethical Review*) in November 2009 in the Philippines.

It was the same year when Yeweyenhareg became the first female professor in health sciences in

Ethiopia and the second female professor at Addis Ababa University. She was one of the forty-nine founding members of the Ethiopian Academy of Sciences established in 2010. She was recognized as one of the sixty-four Tamsalet Phenomenal Ethiopian women, and her story is documented in a book written by Mary Joy Waglay and Networking of Ethiopian Women Association (NEWA). The book was inaugurated by the First Lady, Roman Tesfaye, wife of the Ethiopian Prime Minister. In 2015 she was also recognized as one of the seven Women of Excellence of Ethiopia (WOE).

Yeweyenhareg was born and brought up in a rural part of Ethiopia. As a young girl, particularly in elementary school, she liked asking questions and seeking explanations for a variety of phenomena she did not understand, including social aspects and natural phenomena. She wanted to know more about, among others, the geographical distribution of land, historical events, plants, the sky and patterns of stars, and the growth of plants and animals. She also loved observing the relationships between animals, plants and other creations. In high school she was more focused on natural sciences and she found chemical reactions in the laboratory intriguing.



Unravelling mathematics problems, especially proving theorems and the analysis of algebra questions delighted her. Her grandfather gave her a small plot of land to cultivate and grow vegetables such as carrots, kale, cabbages, onions and potatoes. On this little farm, Yeweyenhareg performed all the necessary activities including digging, pouring water, preparing shades and adding fertilizers usually prepared from animal waste and dry leaves. She carefully observed the growth of her plants and sought to understand why some grew well and others did not, thereafter noting the lessons she had learnt and seeking to improve production in the next growth cycle.

She even noticed that some plants could be used to relieve human diseases including fever and abdominal pain. Thus, when family members were sick, she would give them local herbs in the form of solutions to drink or apply locally. Examples of these curative herbs include “*Yemehmedhanit*” and “*YekurtetMedhanit*” in the local language. Because of such activities, her relatives nicknamed her ‘*Doctor*’. She acknowledged that this childhood life helped her build important skills, attitudes and knowledge in medicine. She also had good educational opportunities in her country and ultimately scored excellent grades in mathematics, chemistry and biology in high school, which enabled her to pursue medicine as a career.

As a consultant internist and endocrinologist, Yeweyenhareg is heavily involved in the management of patients with internal diseases, diabetics and other endocrine diseases at the Tikur Anbessa Specialised Tertiary Referral Hospital. Much of her research work has covered several areas in internal medicine, and more specifically she has focused on diabetes mellitus and associated illnesses as well as other endocrine diseases. Her work has produced several important results, often leading to tangible conclusions and actionable recommendations. She has published more than forty-two scientific manuscripts in reputable journals, both national and international.

Since 2014, Yeweyenhareg has been heavily engaged in a national project on Non-Communicable Diseases (NCDs) organised by the Ethiopian Federal Ministry of Health. As one of the delegates from Ethiopia, she attended the 67th and 68th World Health Assembly (WHA) in Geneva where major decisions were made on NCDs. Accordingly, the Ethiopian Federal Ministry of Health established a technical working group on NCDs. She has played a pivotal role in all the technical working group activities including the development of a National Strategic Action Plan for Non-Communicable Diseases (2014-2016), the development of national treatment guidelines and training materials on major NCDs such as hypertension and diabetes, conducted the national WHO STEPS survey on NCD risk factors and prevalence, thereafter developing baseline data for subsequent interventions on these diseases.

She indicates that many of her publications are based on original research. These include an assessment of health care systems for diabetics, cost of care for diabetes, highly active antiretroviral therapy (HAART)-associated metabolic abnormalities in HIV patients and serum calcidiol in the African population. Her most impactful work, however, involves teaching and mentoring young researchers, recognising them as



her successors and the seed for future generations in Science. Thus, building the minds of young medical doctors and scientists over the last two decades has been of great fulfilment. This is because she hopes to bring change in science in Africa and make her contribution to the continent's growth and development in science and technology.

In her career, Yeweyenhareg has had to overcome many challenges including lack of time as she is involved in many activities in academia, research, patient care, community work and personal life among others. She has also faced difficulties in obtaining research funds, delayed publication and delayed disbursement of funds due to bureaucracy in the procurement process. Under-representation of women in leadership in academic circles and research and a male-dominated working

environment also pose a challenge. To address these problems, she always aspires to do more and never gives up. In addition, she looks for alternatives and seeks advice from friends and family. She also gets advice and support from her husband, children, friends, colleagues, advisors and the Ethiopian government.

Yeweyenhareg identifies her former teachers as her role models. She informs young women and girls that they need commitment to pursue their studies in undergraduate, postgraduate and fellowship training programmes. They also have to be determined and engage in hard work. They should also initiate research activities as they proceed in their scientific careers. Yeweyenhareg is most grateful to all who have supported her to achieve such great success.

Zoubida CHARROUF

Morocco

“ A scientific career for women in Africa is the future for the development of this continent ”



Zoubida Charrouf is a professor of chemistry in the Faculty of Science, Mohammed V University, Morocco. She was the first Moroccan woman to graduate from Ecole Nationale Supérieure de Chimie de Lille (ENSCL), France. She started primary school with her brothers under her mother's watch but without her father's knowledge. He was conservative and believed that a girl's role was to help her mother at home. Eventually, he found out that she was attending school but allowed her to continue because she had proved an excellent student. She had a liking for science, as opposed to other subjects, as she found science subjects logical. She was also a very curious student who found that there was a scientific explanation for almost everything.

Her academic trajectory became evident in college where she surpassed the boys in her class in mathematics, often with very good grades. Thus, her professors oriented her towards science subjects and every year, Zoubida rewarded them by winning the prize of excellence. She wanted to pursue chemical engineering but the course was not available in Morocco and her parents could not afford to send her for studies abroad. She therefore worked for a year to pay for her studies in France where, after five years of study, she obtained a diploma in chemical engineering from the national school of Chemistry of Lille (ENSCL).

Despite this, Zoubida was never able to obtain an interesting job in this field. Instead, on her return

to Morocco, she mostly got administrative jobs. In addition, where she worked, women could not perform or take up jobs that entailed more demanding responsibility. Therefore, she decided to prepare for her doctorate since scientific research excited her.

Zoubida's most impactful project was on the preservation of the *Argan* tree. This is a drought-tolerant tree that is endemic to Morocco. The plant has acted as a green curtain against desertification by the encroaching Sahara. However, deforestation, overgrazing and agricultural land clearance has reduced the number of trees by more than half. Her idea was to transform the environmental problem into an economic opportunity and at the same time preserve the *Argan* forest. She started with the main



product: to produce *Argan* oil, and she developed a new technology to mechanize a part of the production process. This helped speed up operations, improve oil quality, reduce waste, and prolong the oil's shelf life, hence reducing production costs and improving incomes from oil sales.

Zoubida has also worked on the pharmacological properties of *Argan* oil and discovered molecular substances unique to it which can be utilised in making cosmetics. After this research, Zoubida undertook field work, during which she set up

women's co-operatives to produce and market *Argan* oil in Morocco. This enabled the women to build a new industry, run and owned by them. Moreover, it encouraged them to feel responsible for protecting and sustainably managing the *Argan* trees. This new industry is based on a strong scientific base of research. It has increased general awareness and knowledge of *Argan* products, improved the processes used to prepare and preserve them, and has helped to establish the use of *Argan* products in the cosmetic industry globally.

Zoubida considers this to be her most impactful project because it enabled organisations of women in rural areas to develop new skills, take part in literacy programmes, work outside their homes and, above all, earn an income of which they are in control. The success of this project has had other positive effects including women's participation in governance in the community. These women are now actively involved in local elections and have become advocates for their villages, giving them a voice within government and a new status within society. Through Zoubida's support, women have become pivotal in developing *Argan* oil as a popular cosmetic ingredient, and are active in introducing pressed cake and leaves from the tree to the industry.

This work has transformed the country's economy. The export of *Argan* oil has increased from 200 litres per year to 1,200 tons, with another 1,500 tons sold within the country itself. In addition, the price of a litre of *Argan* oil has increased from US\$ 3 in 1996 to US\$ 35 in 2017. The number of co-operatives continues to increase, and the impact of her work continues spreading.

The environmental impact of the project is also massive. In view of this, Zoubida notes that this project has helped to improve forest cover as it has promoted restoration (people now have a reason to plant more *Argan* trees) and their preservation due to the use of sustainable oil extraction methods. The work has seen vulnerable women transform



their lives and their communities. Their status has improved and they have gained the power to manage their income and to invest in the future of their children. Thus, apart from transforming an industry and changing the lives of thousands of women, Zoubida's work has inspired environmental sustainability, ecotourism, and the re-birth of other traditional local products, thereby showcasing the potential of rural women and natural resources.

Zoubida is motivated to continue working as a scientist in Africa because the continent has many medicinal plants which are not valued and therefore their potential remains unknown. This has led to many cases of biopiracy. In her view, therefore, Africa must invest in the progress of a green economy and the development of local communities. This is the key to real sustainable development and scientists from Africa, more so women, have a role to play. She is also motivated by the situation of rural women on the continent who are marginalised and in most cases also lack formal education. This means that even when they have traditional knowledge, it cannot be sustainably used to benefit them and their communities. Both women and men researchers, therefore, need to work towards the development of communities, the empowerment of women and preservation of the environment.

During her work, Zoubida has faced many challenges. The most critical has been lack of funding. However,

she emphasises that giving up is not an option. To solve this problem, collaborations and using what exists locally have been her main strategies. A challenge that inspires her is how to preserve Moroccan natural resources. She acknowledges that not enough has been done in research to unravel the properties of natural resources such as the *Argan* tree. Thus, despite the research already done, there is still a gap in the knowledge of the chemical composition of *Argan* oil as its many uses in traditional medicine is yet to be explained. There must, therefore, be other active properties in the *Argan* tree fruit and other products that ought to be identified and their uses fully explored. She emphasises that research should not remain at the basic level in African countries. Developed to the highest level, research must serve the country to improve the incomes of local populations and protect the environment for future generations. Zoubida, however, acknowledges that researchers may not be able to undertake such expensive research without proper funding and good well-equipped laboratories.

For Zoubida, all scientists in her field are role models because their research inspired her. She believes that the scientific careers for women in Africa are the future for the development of the continent. She therefore urges young women and girls to take up science careers for the good of African nations and communities.



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Prof. Jennifer A. Thomson

Editor

Jennifer Thomson (PhD Rhodes) is a *member of the NASAC Women for Science Working Group* and Emeritus Professor in the Department of Molecular and Cell Biology at the University of Cape Town. She held a post-doctoral fellowship at Harvard, was Associate Professor in Genetics at the University of the Witwatersrand, visiting scientist at MIT, and Director of the Laboratory for Molecular and Cell Biology for the CSIR, before becoming Head of the Department of Microbiology at UCT in 1988. She won the L'Oreal/UNESCO prize for Women in Science for Africa in 2004 and has an Honorary Doctorate from the Sorbonne University. Her research field is the development of genetically modified maize resistant to the African endemic maize streak virus and tolerant to drought. She has published three books on Genetically Modified Organisms: *Genes for Africa*, *Seeds for the Future*, and *Food for Africa*, and is a frequent speaker at international meetings, including the World Economic Forum and the United Nations. She is a member of the board (previously Chair) of the African Agricultural Technology Foundation (AATF), based in Nairobi and Vice-Chair of ISAAA (International Service for the Acquisition of AgriBiotech Applications). She serves on the National Advisory Council on



Innovation of the South African Minister of Science and Technology and is a member of the Independent Science and Partnership Council of the CGIAR (Consultative Group for International Agricultural Research). She is the President of the Organisation for Women in Science for the Developing World (OWSD) and chairs the South African chapter.

Dr. Pacificah Florence Okemwa

Consultant Writer

Pacificah Florence Okemwa is *the Secretary of the NASAC Women for Science Working Group* and a senior member of Academic staff at Kenyatta University. She holds a Masters' (1993) and PhD (2007) in Religious Studies from the same institution. She is a mother of three sons. Pacificah is one of the founder members of the Department of Gender and Development Studies that was initiated in the year 2008 after successfully seeking a transfer from Religious Studies to Gender which was duly granted due to her passion and interest in gender matters. She is a self-taught Gender scholar, researcher and participant trainer. Much of her research and publications are on Gender and Women issues. She has supervised 25 Masters and one PhD candidate to completion. In 2002, she won the Lecturer of the Year Award of Kenyatta University.





The Network of African Science Academies (NASAC) was established on 13th December 2001 in Nairobi, Kenya, and is currently the affiliate Network for Interacademy Partnership (IAP) in Africa.

NASAC is a consortium of merit-based science academies in Africa and aspires to make the “voice of science” heard by policy and decision makers within Africa and worldwide. NASAC is dedicated to enhancing the capacity of existing national science academies and champions the cause for creation of new academies where none exist.

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