



PROFILES OF WOMEN SCIENTISTS IN ASIA

Their inspirational stories



aassa
THE ASSOCIATION OF ACADEMIES
AND SOCIETIES OF SCIENCES IN
Asia

iap SCIENCE
RESEARCH
HEALTH

the interacademy partnership

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The Association of Academies and Societies of Sciences in Asia

The Association of Academies and Societies of Sciences in Asia (AASSA) was established in 2012 through a merger of the Association and Academies of Sciences in Asia (AASA, founded in 2000) and the Federation of Asian Scientific Academies and Societies (FASAS, founded in 1984) with 34 member academies and societies of science from 30 countries from the region.

The principal objective of AASSA is to achieve a society in Asia and Australasia that relies on science and technology to play a major role in the region's development. AASSA is a forum for scientists and technologists to discuss and provide advice on issues related to science and technology, research and development and the application of technology for socio-economic development.

The profiles in this document reflect the diverse and wide range of countries that constitute the AASSA membership. The member countries are Afghanistan, Armenia, Australia, Azerbaijan, Bangladesh, China, Georgia, India, Indonesia, Iran, Israel, Japan, Jordan, Kazakhstan, Korea, Kyrgyzstan, Malaysia, Mongolia, Nepal, New Zealand, Pakistan, the Philippines, Russia, Singapore, Sri Lanka, Tajikistan, Thailand, Turkey, Uzbekistan and Vietnam.

Further information on AASSA can be found at <http://aassa.asia>

Foreword

Achieving gender equality and empowering all women and girls, especially in the field of science and engineering, has been one of the major goals of AASSA since its foundation in 2012.

As a matter of fact, AASSA has held four workshops on women in science and engineering in collaboration with the national science academies of Azerbaijan (2012), India (2013), Turkey (2014) and Korea (2015). The result of these workshops and the subsequent country reports was summarised and published by AASSA in 2015 as its report *Women in Science and Technology in Asia*. This report brought attention to the general situation of women scientists in Asia based on relevant statistical data.

This report, *Profiles of Women Scientists in Asia*, is the product of an InterAcademy Partnership and Australian Academy of Science project and focuses on the lives of 50 distinguished women scientists nominated by AASSA member academies. It is a collection of moving stories of those pioneers who have encountered biases and frustration, overcome many difficulties



and obstacles and finally succeeded in achieving great accomplishments in their pursuit of science. It is also a collection of inspiring, trailblazing stories that will act as a beacon to those young women and girls who will follow these pioneers into science and technology fields. Just as these pioneers had their own mentors and role models who discovered their talent and encouraged and guided them in their scientific careers, I have no doubt that the 50 women scientists profiled in this report will become role models themselves for the future generation of young girls in their pursuit of science.

To conclude, on this occasion I would like to thank the InterAcademy Partnership for funding this project and highly commend the AASSA Special Committee for Women in Science and Engineering under the excellent leadership of its chair, Professor Cheryl Praeger, and the staff of the Australian Academy of Science for their hard work, commitment and dedication to this project.

Professor Yoo Hang Kim

President

Association of Academies and Societies of Sciences in Asia

Foreword

As chair of the AASSA Special Committee for Women in Science and Engineering, it has been a pleasure to oversee, together with the 11 members of the WISE committee, the project *Profiles of Women Scientists in Asia*, which was funded by the InterAcademy Partnership.



All 30 member countries of AASSA were invited to nominate a senior female scientist and a young female scientist to provide information on their scientific careers and how they have managed the ups and downs of being a female scientist in Asia. The nine questions in the survey were put together by the WISE committee members, and we were pleased to receive input from 50 researchers across the AASSA membership.

The researchers come from a variety of sciences, including the physical and biological sciences as well as the social sciences. The stories submitted by the scientists are inspirational and touching. They highlight the importance of receiving encouragement from their parents, spouses, teachers and mentors to pursue science. Many scientists note their love as children of nature, reading and mathematics, although some of them went on to establish careers in chemistry, physics and health. Several recognise Marie Curie as their role model, and of course many also mention the challenges they face by being scientists, because in some countries, women were—and sometimes still are—expected to stay at home and look after their children and families. Some women made the sacrifice

to not have a family or bear children but to focus on their careers, while others with children note that the lack of childcare was a barrier for them academically.

It is evident that the women profiled in this publication have worked very hard over many years in order to succeed in their careers. Some gave up careers abroad and instead elected to return to their home country to further their discipline, their own society and the world. Pride in their country, and a strong drive to give back to their society, is evident throughout the entries. We salute the courage of these scientists, and of women scientists around the world, for their dedication and passion to use science to make the world a better place.

We commend their stories to you, the readers, and hope that they will serve as role models for girls and women to encourage, improve and promote the retention of women in the sciences.

We would like to acknowledge the funding and support received from the InterAcademy Partnership and AASSA, the encouragement and assistance of Professor Yoo Hang Kim, president of AASSA, and his team, and the backing from the Australian Academy of Science in delivering this important project.

Professor Cheryl E Praeger
Chair

AASSA Special Committee for
Women in Science and Engineering

ASSA Special Committee for Women in Science and Engineering (WISE) 2017–2019

Chair

Professor Cheryl E Praeger

Professor Cheryl Praeger is a member-at-large of the AASSA executive board (2016–18) and chair of the AASSA WISE committee. She is a fellow of the Australian Academy of Science and recently finished her four-year term as the Academy's foreign secretary. In this capacity she played a key role in building and strengthening the Academy's international collaborations and promoting international scientific engagement, particularly at the regional level. Professor Praeger is emeritus professor of mathematics at the University of Western Australia. She was appointed member of the Order of Australia in 1999 for service to mathematics, was the Western Australian Scientist of the Year in 2009 and was inducted into the Western Australian Science Hall of Fame in 2015. She has a special interest in science and maths education, women in science and in mentoring young researchers. She and her husband, John Henstridge, have two adult sons.



Ex-officio

Dr Doe Sun Na

Dr Doe Sun Na is a biochemist and a professor emeritus at the University of Ulsan College of Medicine in Seoul, Korea. She is a fellow and a board member of the Korean Academy of Science and Technology KAST and has served as a vice president (2013–16) and as the chair of the Academy's Women Scientist Committee. She served as the chair of the AASSA WISE committee from 2013 to 2017. Dr Na founded two organisations for women scientists and engineers: the Women's Bioscience Forum (WBF) in 2001 and the Korea Federation of Women's Science & Technology Associations (KOFWST) in 2003. KOFWST has grown to become one of the largest, if not the largest, women scientist organisations in the world, with 60 000 members. Dr Na has received many awards and medals, including the Republic of Korea's Order of Science and Technology Merit and Légion d'Honneur Chevalier of the French government.



Professor Dato Dr Khairul Anuar bin Abdullah

Professor Dato Dr Khairul Anuar bin Abdullah obtained a degree of Drs from the Faculty of Medicine, Universitas Gadjara in 1974 and his PhD from the Department of Tropical Medicine at the Tulane School of Medicine in immunology of infectious diseases in 1982. Since 2012 he has been the vice-chancellor of MAHSA University and is currently a vice president of AASSA. During his 34 years of service, he has gained enormous experience in teaching parasitology to medical, pharmacy, nursing and biomedical students. His teaching has included both theory and laboratory diagnostic skills parasitology. His research career began in 1975. During his career he has obtained many grants both from local and international organisations and has published more than 304 publications and abstracts in peer-reviewed journals. Among his many awards, he has received the Malaysian Society of Parasitology and Tropical Medicine's Silver Medal in 1988 and the Sandosam Gold Medal for his achievements in and contribution to tropical disease research in 2002.



Members

Dr Elena A Grigorieva

Dr Elena A Grigorieva is a leading researcher in the laboratory of regional social–economical systems at the Institute for Complex Analysis of Regional Problems Far Eastern Branch Russian Academy of Sciences (ICARP FEB RAS) (2013–present). Earlier she was researcher (1995–2002) and scientific secretary (2002–13) at ICARP FEB RAS. She graduated as a Specialist with Honours in meteorology from the Russian State Hydrometeorological University in St Petersburg, Russia. Elena has a PhD in environmental science from the Far Eastern Federal University in Vladivostok, Russia. Elena is a well-known bioclimatologist, an active member (2005–present) and vice president (2014–17, 2017–20) of the International Society of Biometeorology and a member of the AASSA WISE committee (2017–19). Her research interests cover a number of themes in biometeorology that include climate and human health, human bioclimatic indices, human thermal acclimatisation, acclimatisation in extreme climates, climate and tourism, and climate and agriculture. Elena has a son and a daughter.



Professor Dr Arzum Erdem Gursan

Professor Dr Arzum Erdem Gursan received a Bachelor in Pharmacy from Ege University, Turkey, in 1993. She received her master's in 1996 and her PhD in 2000, both from the Department of Analytical Chemistry in Faculty of Pharmacy in Ege University. She has been working in the same department as a professor since 2009. She received a Junior Science Award (2006) and a Science Award (2015) from the Scientific and Technological Research Council of Turkey. She was elected as an associate member of the Turkish Academy of Sciences in 2007 and a principal member in 2016. In 2017 she was elected as a member of the AASSA WISE committee and as a fellow of Royal Society of Chemistry.

Professor Erdem Gursan has authored or co-authored more than 140 papers in refereed journals and conference proceedings, given more than 20 invited talks in international meetings and conferences and is the co-author of 12 book chapters and review papers. She has the ownership of one patent approved. She is married and has a son.



Professor Dr Nadira D Karunaweera

Professor Dr Nadira Karunaweera is the chair and senior professor of parasitology at the University of Colombo, Sri Lanka, and a visiting fellow at the School of Public Health at Harvard University. She is a fellow of the National Academy of Sciences of Sri Lanka and currently general secretary of its executive council. She is a member of the AASSA WISE committee. Her awards include the Senior Research Scholar Award from the Radcliffe Institute, the Fulbright Advanced Research and Lecturing Award, the NIH Tropical Medicine Research Center Award and a Fellowship award from the World Health Organization. Local awards include the Presidential Award for Excellence in Research, the National Apex Award for Professional Excellence and the Zonta Woman of the Year award.

As an expert in tropical diseases she continues to serve on many national and international scientific and consultative committees or boards sharing her expertise in an honorary capacity. She has published widely and has authored over 100 peer-reviewed journal articles, several book chapters and shares the ownership of two patents.



Professor Dr Azra Khanum

Professor Dr Azra Khanum obtained her PhD in biochemistry and molecular biology from Quaid-i-Azam University in Islamabad, Pakistan. She has held positions at the Arid Agriculture University Rawalpindi, including chairperson of the Department of Biological Sciences, dean of the Faculty of Sciences, director of the Division of Continuing Education, Home Economics and Women Development, and acting vice-chancellor. She has been the director of the Institute of Natural and Management Sciences, Rawalpindi, and dean of the Barani Institute of Management Sciences, Rawalpindi.

Professor Khanum has received the civil award Tamgha-i-Imtiaz from the Government of Pakistan, the Gold Medal of the Pakistan Academy of Sciences, the Fogarty International Center Postdoctoral Fellowship from the National Institutes of Health in the US and is a consultant for TOKTEN, within the United Nations Development Programme. She is a fellow of the Pakistan Academy of Sciences and the Pakistan Academy of Medical Sciences. She is a member of the Organization for Women in Science for the Developing World and the AASSA WISE committee.

Professor Khanum has obtained research grants from national and international funding agencies and has published around eighty articles in internationally reputed journals.



Dr Aura C Mattias

Dr Aura C Matias is a professor at the University of the Philippines Diliman. She obtained her Doctor of Philosophy in industrial engineering specialising in human factors at Purdue University in Indiana in the US.

Dr Matias has been involved in teaching, research and extension work for government, academe and industry, specialising in human factors engineering or ergonomics. She has been professionally involved in government policy formulation and decision-making structures in environmental management and human resource development. She has provided valuable operational and business planning information, increased public awareness through the development and implementation of a performance-based rating systems and increased the commitment by industry to pursue health promotion and advocacy.

In 2011 she was elected to the Philippines National Academy of Science and Technology as academician in the field of industrial engineering.



Professor Tinatin Sadunishvili

Professor Tinatin Sadunishvili is a professor of biochemistry at the Agricultural University of Georgia. She is the head of the Department of Plant Biochemistry and Biotechnology of the Durmishidze Institute of Biochemistry and Biotechnology at the university. Prior to the appointment of her current positions, she had been working at the Institute of Plant Biochemistry as research scientist, senior scientist and leading scientist. In addition, she has taught biochemistry at Georgian Technical University.

Professor Sadunishvili has focused on plant biochemistry from the beginning of her career. Her areas of investigation include plant nitrogen assimilation, enzyme structure and kinetics, plant adaptation to different biotic and abiotic stresses, as well as plant-pathogen-bacteriophage interactions. She has published more than 150 journal articles, six book chapters and three research monographs, many of them with her students (eight PhD students, six research master's students and nine postdoctoral research associates) and research colleagues. She has played an active role supporting and mentoring young scientists, especially women.



Professor Dr Anjana (Maharjan) Singh

Professor Dr Anjana (Maharjan) Singh is a member of faculty at the Central Department of Microbiology,

Tribhuvan University, Nepal. Her PhD is from Jawaharlal Nehru University in India (2004) and her postdoctoral degree is from the University of Virginia (2008–09). She has 12 national and international awards and served as the head of department from 2004 to 2008, and again from 2012 to 2016. She is an academician of the Nepal Academy of Science and Technology.

She has 102 national/international publications, has supervised 98 master's theses and six PhDs. She is a peer reviewer of six journals and has been a member of the AASSA WISE committee since 2015. She has attended 56 national and international meetings, including important workshops organised by AASSA and the InterAcademy Partnership in India (2013), India and Izmir (2014), Korea (2015), Bangladesh (2016) and Malaysia (2018). She was an executive member of the Board of Studies, South Asian University, from 2016 to 2018. She has also been a member of a cluster committee of the University Grants Commission in Nepal since 2015.



Dr Miyoko O Watanabe

Dr Miyoko O Watanabe is the deputy executive director of the Japan Science and Technology Agency (JST), and she also serves as director of the JST Office for Diversity and Inclusion. Dr Watanabe is vice president of the Science Council of Japan and a member of the Specialist Committee on Priority Policy in the Council for Gender Equality of the Cabinet Office of Japan. She has long experience in research of semiconductor physics at the Toshiba R&D Center in Japan.

She conducted her physics research as a postdoctoral fellow at Dalhousie University, Canada, from 1986 to 1988 and as visiting researcher at the Nanoscale Physics Research Laboratory at the University of Birmingham, UK, in 1997. After returning to Toshiba, she served in various roles, including senior research scientist, chief specialist of the Audit Division and executive quality leader at the Innovation Division of Toshiba Headquarters. She is involved in supporting and mentoring young women scientists.



Dr Linxiu Zhang

Dr Linxiu Zhang is the director of the International Ecosystem Management Partnership of the UN Environment Programme (UNEP-IEMP), a collaborative centre between UNEP and the Chinese Academy of Sciences (CAS). She is also a professor and honorary director of the CAS Center for Chinese Agricultural Policy.

Her research concentrates on policy-relevant studies on rural development in China, particularly in poverty alleviation, poverty and environment dynamics, climate change adaptation, labour market development, public investments and the economics of rural education and healthcare.

She has published more than 260 papers in peer-reviewed journals and also received numerous awards. The most recent ones include the Ten Most Outstanding Women in Science award from CAS (2013), the TWAS-Celso Furtado Prize in social sciences (2013), the Fudan Management Excellence Award (2014) and a TWAS fellowship (2014).



AFGHANISTAN

Nominated by the Academy of Sciences of Afghanistan



Professor Soraya Popal



Organic chemistry

**President, Academy of
Sciences of Afghanistan**
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Biography

My father was a member of parliament during the Afghanistan kingdom period in 1948 and my mother was affiliated to a clerical family. She had discipline and strong self-confidence. I have two sisters and three brothers. I am single. I received a MSc in organic chemistry in 1990. Fortunately, after years of hard work, I am proud to be the first woman to have earned the highest academic rank (senior research fellow) in Afghanistan. I also have succeeded in publishing the second period of *Aryana Encyclopedia* after about half a century, in 10 volumes in our two national languages (Pashto and Dari). It is worth noting that I have done research on many kinds of mulberry and nuts of Afghanistan, such as walnuts, almonds, pistachios, pine nuts and peanuts, and the seeds of apricots,

melons, watermelons and pumpkin. Also, I have written scientific research articles that have been officially published in the scientific journals of the Academy and Kabul University.

When did you know you wanted to pursue a career in science?

At elementary school it was easier for me to study natural science topics than social sciences. Later, when I went to high school, I was pretty sure that I could continue in natural science, so I chose natural science studies. After school, I passed the entrance examination at university and succeeded in the engineering department in Jalalabad. This was just the beginning of jihad in our country. At that time, Jalalabad was not particularly safe for girls, so I went to the Faculty of Natural Science at Kabul University. Kabul was also not better than Jalalabad; there was fear, disappointment, killing, etc., but I had to stay and continue to study.

Who or what inspired your passion and curiosity in science?

In fact, the beautiful nature and good natural conditions of Afghanistan pave the way for industrialisation, without which our industry is impossible. Things like our high mountains with enough mines, the natural resources, fertile soil, temperate climate for agriculture, seas rich with water and

minerals, all kinds of fruits, vegetables and legumes, with high-quality medicinal plants, oily plants, fibres and industrial plants. In addition, I always asked myself why our country is still not self-sufficient, despite all this natural capital, and why our country's imports are higher than its exports. So all this stimulated curiosity in me and encouraged me to be interested in science.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

When I graduated from university, Professor Dr Fattah Nazir (head of the chemistry department at Kabul University) encouraged me to work at the Academy of Sciences. After passing the exam, I became a scientific member in the Academy's chemistry department. Fattah Nazir was not only a kind professor, but also always thought about his students' futures and encouraged them to study science. Also, my father played an effective role in my career. I cannot express my father's feelings when I told him that I was admitted to the Academy of Sciences. My father encouraged me in my scientific and research work until he died. He always encouraged me to research Afghanistan's native fruits and vegetables and other natural substances because of their special value.

What do you think is your greatest scientific achievement to date?

My greatest scientific achievements so far are:

- receiving the highest scientific rank at the Academy of Sciences of Afghanistan
- managing the great project 'Publishing of *Aryana Encyclopedia* second period' after about 50 years in Afghanistan
- publishing 10 volumes of *Aryana Encyclopedia* in the two national languages of Afghanistan, Dari and Pashto
- writing and editing hundreds of scientific articles in *Aryana Encyclopedia*
- my numerous scientific research works
- my leadership and management of Afghanistan's highest and only scientific research institution (Academy of Sciences of Afghanistan) since 2013, and through which I proved that Afghan women are able to lead and manage academic institutions in our society.

What motivates you to work as a scientist in Asia?

The important things that motivate me to work as a scientist are:

- because our country is rich in natural materials, which is the most important motivation to work as a scientist
- in the hope of ending the war in our country and rebuilding using natural resources
- the desire of Afghanistan's self-sufficiency in all aspects
- in the hope of having a civilised, industrial and advanced country.



What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Undoubtedly, there are many problems for women working in a traditional country like Afghanistan. When I was just working as a scientific member in the Academy of Sciences of Afghanistan I had no particular problems, but when I was appointed as head of the Academy, the most difficult challenge I faced out of many was that they did not want to accept a woman as head or director. They had made a plan to force me to resign within six months. They accused me at the Afghanistan parliament of being a communist. It was the biggest challenge in my life to overcome. But with God's help and great efforts, I was able to prevail over the difficulties and accusations. 150 words is not enough to describe this bitter story here. Finally, after long combat, I succeeded.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

An advanced and industrial Afghanistan that relies on its own economy because of enough natural resources is only possible through technology and encouraging and educating people in science. Civil wars, insecurity, instability and smuggling out the natural resources of Afghanistan are the important barriers in front of progress and development.

What would you say to young women considering a career in science?

My advice to women who have taken steps in science and technology is:

- try to improve your skills and professional knowledge through capacity-building programs
- use fellowships and scholarships to complete your education
- participate in conferences and seminars at the national and international levels

- participate in professional and educational workshops.

My most important advice for the families—especially to fathers, brothers and husbands—is:

- allow your daughters, sisters and wives to be educated
- encourage and support them in sciences
- provide facilities to them to advance in science and technology
- cooperate with them to work hard and be successful.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to ‘Women in Science and Engineering’?

In Afghanistan, few women work in the sector after completing education, so there is no gender equality. Many families prefer their daughters to be school teachers, because they attend school for only half a day. Men think that women can then take better care of their house and children. There are fields of study for girls in science, such as agriculture and engineering, but when they get married, some leave their job and become a teacher. On the other hand, many men want their wives and their daughters to be treated by female doctors, so they allow their daughters to study medicine.

Learned academies should:

- encourage families to allow their daughters to study, especially in science and engineering
- provide opportunities and facilities for girls to study
- realise that cooperation with the Afghan government and national and international educational institutions is needed.

I am the head of a research institute where women and men work, and the implementation of gender equality in science in this office is one of my responsibilities. I have and will continue to try my best to provide scholarships,

fellowships and workshops on education and research in science for men and women. Recently, the Academy provided scholarships and fellowships to support seven women and nine men to study, and one man to do research. The Afghan government's policy and commitment to the international community is to balance gender in each section. The government has instructed the Ministry of Higher Education to adhere to the principle of positive discrimination for girls and provide them the opportunities to study and work. The Academy can implement gender equality in science by cooperating with the Ministry of Women's Affairs and the Ministry of Higher Education.



AUSTRALIA

Nominated by the Australian Academy of Science



Professor Michelle Simmons

Physics

Director, Centre of Excellence for Quantum Computation and Communication Technology

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https://en.wikipedia.org/wiki/Michelle_Simmons

Biography

Professor Simmons has pioneered unique technologies internationally to build atomic-scale electronic devices, opening up the prospect of developing a silicon-

based quantum computer. She is the 2018 Australian of the Year and one of a handful of researchers in Australia to have twice received a Federation Fellowship and now a Laureate Fellowship, the Australian Research Council's most prestigious award of this kind. She has won the Pawsey Medal (2006) and Lyle Medal (2015) from the Australian Academy of Science and was, upon her appointment, one of the youngest fellows of this Academy. She was named Scientist of the Year by the New South Wales

government in 2012 and in 2014 was inducted into the American Academy of Arts and Sciences. She was awarded the CSIRO Eureka Prize for Leadership in Science in 2015 and in 2016 the Foresight Institute Feynman Prize in Nanotechnology for her work in 'the new field of atomic electronics', which she created. She is editor-in-chief of Nature Quantum Information and was named the 2017 L'Oréal-UNESCO Asia-Pacific Laureate in the Physical Sciences.



When did you know you wanted to pursue a career in science?

I have always been interested in understanding the world around me. I love complexity and like solving hard problems—especially technological ones. As a young girl, I actually dreamed of becoming an astronaut. That didn't work out, but being a physicist is the perfect alternative. I love the nexus between describing the world with words and with equations.

Who or what inspired your passion and curiosity in science?

My first hero was my advanced Level physics teacher, Jim Clarke, who encouraged me to pretend I was a wave and bounce around the classroom. Since then, I've been inspired by Richard Feynman, John Bardeen, as well as the hundreds of students and postdocs that I've worked with.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

In my public life there are many people who have influenced me, here are just a few: Professor Chennupati Jagadish, for his unceasing hard work and sense of responsibility; Professor Stephen Menzies, for his creativity and intellect; and Dr Cathy Foley, who is a trailblazer both for women in physics and for physicists having an impact in the world.

In my private life my husband has been a major role model. He is optimistic, energetic and insightful. He works incredibly hard, is amazingly diligent

and always surprises me. He has a unique way of looking at the world and constantly challenges my beliefs and thinking.

What do you think is your greatest scientific achievement to date?

The thing I am most proud of is creating the new field of atomic electronics. Many people thought it would be impossible to place an atom with precision in an electronic device and then measure it directly, let alone control the quantum spin of the electron on that atom to encode information. Along the way we discovered unexpected behaviours. For instance, we've engineered silicon wires as thin as four atoms wide to behave like a metal such as copper, demonstrating that Ohm's law survives to the atomic scale. Pretty much every device we make is unique, and atom by atom we are building up a picture of the way the world behaves at the quantum level.

What motivates you to work as a scientist in Asia?

Australia is a phenomenal place to undertake high-quality research. Through the Australian Research Council there is the possibility of academic freedom that comes with independent fellowships and the ability to work on large-scale projects with other academics from across the country. The research base in quantum science and engineering is deep and rich and the facilities world class. Being removed from the rest of the world allows us to think for ourselves and take on ambitious challenges. In short, it is fiercely competitive and fiercely collaborative. There really is no better place to be!

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I have found that there are many opportunities for being a woman in a man's world. Fundamentally, people have underestimated what—as a female scientist—I could do, so there were minimal expectations and I could get on with creating and charting my own path with minimal interference! Nowadays there are many scholarships and fellowships to help young STEM experts along, and I would encourage young women to make the most of these.

Two of the biggest challenges I have faced in research are more generic—groupthink and the ever-increasing amount of bureaucracy. Groupthink is everywhere, yet it is the antithesis to scientific endeavour. My prescription in this case is to remember, no matter who you are, it is always important to question the world around you and build your own understanding based on your own efforts. Bureaucracy seems to be inevitable as research efforts grow in size. In this case, however, there is no remedy. You just have to battle through it.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I want to build a quantum computer. We have unique fabrication technologies and are on the cusp of creating a whole new transformational industry in computing. I would love to see that come to reality and flourish in Australia. I want to encourage young ambitious Australians to

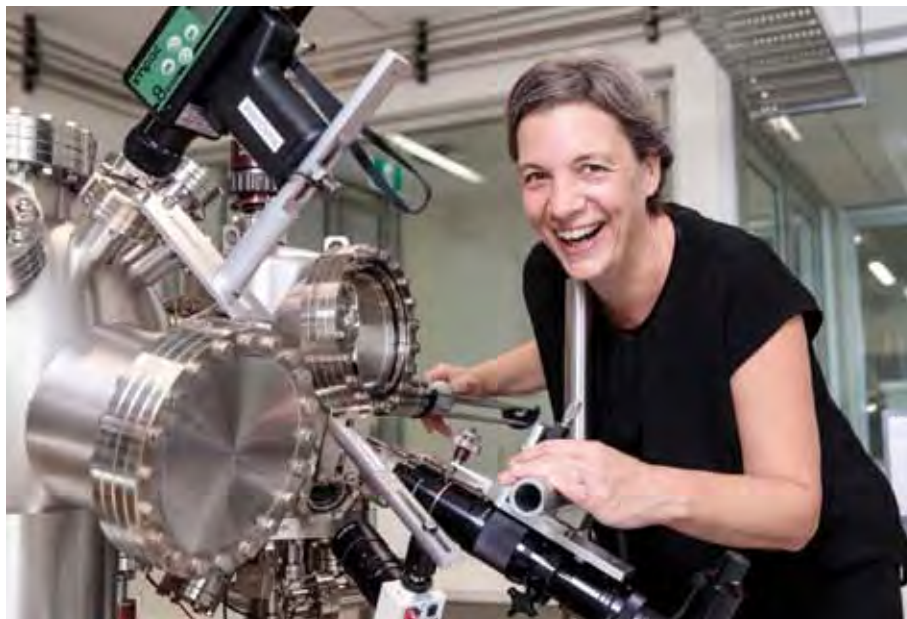
take up this challenge and make this new industry happen here!

What would you say to young women considering a career in science?

Work hard, believe in yourself and don't be afraid to go for it. Avoid the easy options. There are great rewards that come from embracing hard challenges and carving your own path. You might be surprised by what you can achieve!

It also pays to be open minded about your career. One great thing about a STEM education is that the skills you learn—coding, maths, critical thinking, logic, data analysis, research, the ability to communicate complicated concepts, etc.—are all transferrable skills that can open many doors. Undertaking STEM subjects will open rather than narrow your choices in life. Work hard and realise that your success is up to you.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?



There is pure joy in gaining a scientific understanding of the world. It is just a different way of thinking and looking at the world, where you have to learn a different kind of language. As with any type of skill—for example, playing an instrument or learning a sport—it requires effort, but the harder you work at it the more rewarding it becomes, and the deeper the satisfaction when you solve a complex problem. Having an ability to provide both a mathematical and descriptive understanding of the world is very powerful.

While to date there have been fewer females taking physics, maths, computer science and engineering roles, it is important for them to recognise that many jobs of the future will be in these fields. Not only will it give them greater freedom, but I believe better pay, more flexibility and wider choices. They should not miss out!

Dr Mahshid Firouzi

Chemical engineering

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Biography

I am an Advance Queensland Research Fellow in chemical engineering at the University of Queensland (UQ). I hold a Bachelor of Engineering and a Master of Engineering, both in chemical engineering from the Iran University of Science and Technology. I came to Australia in 2010 to pursue my career as an academic. I was offered a full scholarship in Australia to do my PhD and I completed my study in 2014. Following completion of my PhD I started working as a research fellow and chief investigator at UQ on applied research in close collaboration with major companies in the oil and gas industries. I am interested in fluid dynamics and interfacial interactions of gas–liquid–solid in multiphase flows. I use mathematical modelling, big data analytics and experiments to enhance energy recovery and reduce the associated environmental impacts.

When did you know you wanted to pursue a career in science?

I discovered my passion in science when I was a school student. I loved every

moment of my time at school, particularly studying chemistry and mathematics. I was also passionate about teaching other students who needed help. Because of my interest in maths and chemistry I decided to study chemical engineering. Later, I found that I learnt more about chemistry at school than at university studying chemical engineering. However, I never regretted choosing chemical engineering and, in fact, I continued on to pursue my master's and PhD in the field. As part of my research interest, I experiment with and model bubbles and droplet interactions. I am so passionate about my work that I still love watching the same high-speed footage of the movement of bubbles and droplets in a flow 20 times over.

Who or what inspired your passion and curiosity in science?

Some of my school teachers and my father had a profound role in my childhood in inspiring my passion in science. Later, working on multiple research projects has assured me that I want to dedicate my life to science.

I have to admit that, after finishing my PhD study, I wanted to study medicine to be able to help people around me with their health and see the immediate impact of my work. I always wished I could help my grandmother when she was talking about her heart problem with me and looking for



advice from her granddaughter, who is a doctor but not a medical doctor. Then I realised that, as a researcher and engineer, I can help others—including my grandmother—by solving other critical issues in their lives. I can make their lives better by solving energy and environmental problems. I can motivate younger generations to love maths and science and help with making life continually better.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I have had different role models at different stages of my career, including successful peers at school and my mentors at my current workplace. One of my role models is Professor Maryam Mirzakhani, the first female winner of the top prize in mathematics, the Fields Medal. Maryam, who sadly passed away in 2017, proved to me that hard work and being ambitious pays off, regardless of your gender and nationality. She is a perfect example of intelligence and humility.

What do you think is your greatest scientific achievement to date?

I focus on translating my fundamental research into practical outcomes across a broad range of areas. Recently I applied my mathematical and experimental findings from other projects to a new area and proposed a novel technology to enhance gas production and minimise the associated environmental impact in gas wells. This work has been submitted for



a patent with the Patent Cooperation Treaty. The significance of this work has been recognised by the Australian Research Council and the government Advance Queensland Fellowship program, and through funding support from my industry collaborators. Currently, we are working on validating the proposed technology at laboratory scale prior to conducting a field trial.

What motivates you to work as a scientist in Asia?

I initially chose Australia and UQ to pursue my PhD due to a particular research group that is known for their expertise in gas–liquid–solid interactions. Now, after eight years of being in Australia, I have built up my research career and expanded my expertise through working with experts from different disciplines in academia and industry. I still see enough challenging

opportunities for me as a researcher to contribute to solving real-world problems facing the energy industry. Also, as a female researcher and engineer I see it as part of my mission to raise the profile of women engineers in Australia, where women in engineering are underrepresented.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Working as a female researcher and engineer in a male-dominated environment can be quite challenging. However, I have never seen this as an obstacle, thanks to the support of wonderful male mentors and colleagues during my career.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My immediate goal is to have a secure position in academia so that I can use my time and energy to focus on and expand my research group and contribute more to my field. This is currently challenging in engineering and other maths-intensive fields in an academic environment, because of the lack of job opportunities for young researchers and universities lacking enough commitment to remedy the existing gender imbalance. In the long term, I aim to improve people's lives through solving existing environmental, energy and (hopefully) medical challenges. I hope one day I can contribute to curing cardiovascular disease by better understanding heart blood flow through my flow modelling skills.

What would you say to young women considering a career in science?

I strongly encourage young women to consider a career in science, as science is all about creativity and curiosity. These abilities are not limited to any particular gender, despite outdated stereotypes.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

I strongly believe in gender equity in science, particularly in maths-intensive STEM fields such as engineering, where women are hugely underrepresented. Based on the data from Australian Department of Education and Training, only 18% of research staff in engineering are women. This has influenced female scientists in different aspects, particularly their job opportunities, promotion and recognition, compared to their male counterparts. This is due to conscious or unconscious gender bias of decision-makers. In engineering it is mainly males who occupy these positions and who make up the majority of hiring committees. I believe research institutes and organisations should be obligated to solve this gender imbalance by increasing the number of their female representatives and providing them with support to achieve their aspirations.

BANGLADESH

Nominated by the Bangladesh Academy of Sciences



Dr ZN Tahmida Begum



Botany (phycology, limnology and hydrobiology)

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Biography

I have three brothers and three sisters and lost my father when I was only 10 years old (in 1955). My husband got his PhD from the University of London in 1977. We have two sons.

In the professional field, I have 85 scientific publications in national and international journals. In 1976 I discovered a new structure (tubular elements) in a Bangladeshi cyanobacterium. It is a new addition to science and this finding was published in the *Journal of Cell Science* in 1977. In 1977 I developed a blue-green mutant of that cyanobacterium through gamma radiation and in 1970 I made the first report of 245 species of phytoplankton (primary producer), which

is being used as a guideline for further research. In 1982 I first initiated research on the role of biological nitrogen fixation through cyanobacteria in Bangladesh.

When did you know you wanted to pursue a career in science?

I was brought up in an environment of beautiful gardens of fruits and flowers, and my brothers and sisters inspired me to do gardening. I loved the environment and was concerned about the conservation of vegetation. My three brothers studied differing scientific disciplines, and this inspired me to pursue a career in science.

Who or what inspired your passion and curiosity in science?

First, my beloved father, who loved nature and taught us about the wonder of science, followed by my science teachers. As my second brother was a zoologist, I had the chance to use a microscope and I saw the beautiful living world present in water and soils, including phytoplankton and zooplankton. Madame Marie Curie was one of my inspirations, as was Begum Rokeya, one of the pioneers who fought for the education of girls back in 1876.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

The following scientists were the influencing role models in my career in Bangladesh: Dr Qumrun Nahar, Dr Anowara Begum, Dr Maleka Al Razi, Dr Rahmat Ara—all were my teachers. In the UK, Professor MB Godward, my PhD supervisor, inspired and motivated me to pursue a career in science. I learned from them how to devote myself in research work and not be disheartened if negative results are obtained. They motivated me by saying that if one wants to be a career woman, she should be hardworking, methodical and honest in thinking and laboratory performance. Thus, throughout my career, I was sincere to my research work and also very much caring in guiding my research students and undergraduate students.

What do you think is your greatest scientific achievement to date?

I do not think I have yet made my greatest scientific achievement, but I feel that I should have done so through my research. If I could advance my biological nitrogen fixation technology to be usable by farmers then I would be most happy. But I can say that I had some brilliant students who became good researchers. I was one of the authors of the books *Role of cyanobacteria on rice field soil fertility of Bangladesh* and *Ecology of some selected wetland macrophytes of*

Bangladesh, published by LAP LAMBERT Academic Publishing, Germany, in 2011 and 2012. I was one of the editors of the *Encyclopedia of Flora and Fauna of Bangladesh* of the Asiatic Society of Bangladesh from October 2004 to June 2009, which published 56 volumes; 28 in an English version and 28 in a Bengali version.

What motivates you to work as a scientist in Asia?

Since Bangladesh is an agricultural country in Asia, where the majority of women are not exposed to education (especially science education), I was motivated to make women aware about the benefits of science, especially conservation of environment, disease and malnutrition, the importance of sharing good things among themselves and to be conscious about their capability to contribute to society in a positive way.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Yes, I have had to face different challenges as a female scientist. During my master's, when I wanted to do research on genetics or plant physiology subjects, I was not allowed as I was a female student. During teaching and research I was not promoted or inspired by colleagues. I was offered a scholarship for higher studies leading to PhD at the University of London when my first son was only one year and three months old. I went to London while my baby son and husband remained in Bangladesh. After completing my PhD and returning, for the

past 48 years I have faced discrimination in different workplaces. With much effort, strong determination and sincerity and support from my husband and two sons, I overcame different types of challenges. I had to work hard to establish that a female scientist can do what a male teacher can do. I participated in many workshops and conferences in Australia, China, India, Nepal, Pakistan and the US.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My aspirations are to see future women scientists have a better platform to serve at national and international levels, and through sincere scientific research contribute something positive to mankind. Science is hard, a painstaking and continuous process, and I hope women

can display their talents through dedication to science. There may be barriers, but I believe that if a woman is dedicated, no hindrance can stop her from reaching her goals.

What would you say to young women considering a career in science?

My suggestions to young women who opt for a career in science are, although we, the female scientists, must face different types of obstacles and disparity, we should not be disheartened nor step backwards in fear or dismay. They should have strong self-will and determination from childhood. They are to be inquisitive about diverse fields of science. To demonstrate this, they should study diverse fields of science and the life histories of important women scientists who achieved their goals.





I would suggest to them that they have more practical knowledge about their surrounding environment, including environmental degradation, health hazards, food security, space science, aeronautical science and poverty alleviation. They should have a curiosity about why and how, and develop their ideas with their teachers, friends and colleagues. If young women can practice some of these suggestions, I believe they will be future good scientists.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any

events or organisations related to 'Women in Science and Engineering'?

Although we are in the twenty-first century, there are still obstacles for gender equity in science. To address this urgent issue in my country, the mindset of the public and law-making authorities needs to change. If they continue to think that senior male scientists should occupy positions when expert senior women scientists are available, then justice will not prevail.

Women scientists should establish their capability through hard work, knowledge, sincerity and a methodical approach. They should prove that we are as capable as male scientists. In Bangladesh, to my knowledge, there is only one association of women scientists, which has been trying to establish equity for women in different universities and institutes.

The Bangladesh Academy of Sciences supports gender equality and AASSA is playing a positive role in promoting women scientists in Asia.

I am associated with the Women Science Association and the Women into Science and Technology Asia Region as a life member. I am also a life member of the Association of Women Scientists of Bangladesh, trying to eliminate the gender inequality among scientists. I am associated with the organisation of Young Women Conference/Workshop, organised by the Bangladesh Academy of Sciences since 2009.

In Bangladesh, although girls are doing very well in competitive examinations and some get good positions in different institutions, many fail to do justice to their respective jobs. This is due to limitations such as non-cooperation from family members, their own lack of drive and non-initiative in conducting research work.

Dr Shamsun Nahar Khan



Chemical biology, drug discovery and development

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Biography

Dr Khan is the eldest daughter of Dr Hasmat Ara and Sahfique Khan. Her father is involved with the development of Bangladesh as executive director and senior adviser of Gonoshasthaya Kendra (Peoples' Health Centre), a healthcare provider to the vast majority of the population in Bangladesh with knowledge of global healthcare issues. Her mother started her career as a medical doctor (Dhaka Medical College and Hospital) and later on as an academician teaching pharmacology at the Bangladesh Medical College, a renowned medical institute. Dr Khan has three siblings: her younger sister (Dr Rezwana Khan) is microbiologist, her elder brother (Dr Kawser Khan) is a physician and youngest brother (Salehin Khan) is a pharmacist.

Her professional achievements include:

- TWAS Atta-ur-Rahman Prize in Chemistry, 2012
- Award for Young Scientists from TWAS and the Bangladesh Academy of Science, 2011
- Merit Scholarship Programme for High Technology from the Islamic Development Bank, 2010
- Excellence in Research and Teaching Award from East West University, 2009
- TWOWS Postgraduate Training Fellowship Award, 2002

When did you know you wanted to pursue a career in science?

My interest developed during undergraduate studies at Jahangirnagar University, while I was working at Gonoshasthaya Kendra under the supervision of Professor Dr Samad Talukder, a medical microbiologist. I was working on multi-drug resistant bacteria and its sensitivity to natural products. I also conducted clinical trials on various medicinal plants and chronic skin diseases, which did not show any sensitivity by the conventional steroids but in which I observed fascinating activity. I accomplished excellent results, which I presented at the annual meeting of the International Centre for Diarrheal Disease Research, Bangladesh. I enjoyed my undergraduate research work and

I knew that I would pursue a scientific research career.

Who or what inspired your passion and curiosity in science?

Having a mother (Dr Hasmat Ara) professionally engaged as a physician was great motivation for me to go into science. My mother is an enthusiastic and keen clinical researcher as well. She introduced me to science and trained me to comprehend it with a logical approach. She inspired me to dream of a life full of scientific works for the betterment of mankind. I grew up playing with my mother's professional devices—stethoscopes, blood pressure measuring machines and prescription writing pads—with my sister (Dr Rezwana Khan) playing the role as patient and me as physician. I knew from my childhood that I would be following in her footsteps, and thus I chose to study pharmacy with a view to producing new and innovative medicines to the people.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My father is a wonderful guide and mentor throughout my life; he provided me an enlightened environment with books (he has a huge personal library) and association with intellects and scientists

from home and abroad. My interaction with Professor Peter Houghton (Kings College London) is a key motivating factor in my science career. His appreciation for my clinical research work is ever bright in my memory. During my PhD, in my leisure time I was always walking through the corridors of my research institute. I was mostly attracted by the photograph of Rosalind Franklin (1920–58), an X-ray crystallographer who significantly contributed to our understanding of DNA, RNA, viruses, etc. Her fascinating work and personality still now attract me to the world of science and research.

What do you think is your greatest scientific achievement to date?

My keen interest in the discovery and drug development started earlier in my research career. I discovered more than 20 classes of new alpha-glucosidase inhibitors from both natural and synthetic sources. These are of interest due to their therapeutic potential in the treatment of a variety of disorders, including diabetes, HIV infection, cancer and lysosomal storage diseases. The outcome of this research is reflected in more than 50 research articles in peer-reviewed and reputed journals. Due to the important clinical and industrial application of my research, I have been awarded seven US

patents and publications. Other interesting and promising research involved the identification of a complex structure of 7SK small nuclear RNA and HIV-1 TAT peptide, through nuclear magnetic resonance conducted as a postdoctoral fellow at the Department of Molecular and Cellular Biology at Harvard University.

What motivates you to work as a scientist in Asia?

I wish to have a wonderful 'Centre of Excellence/Research Centre' in Asia, as a new and innovative drug development facility. Asia is a land of opportunity. Many of the modern sciences originated in ancient Asia, such as



alchemy and algebra. Medical sciences were extensively developed and explained through the contributions of Avicenna. Asia has a long heritage of science practice in its own way, through traditional medicine, for example. This long and unique heritage of sciences is always motivating and inspirational. Asia is blessed with a talented and hardworking population. Providing excellent science education and training to these inhabitants will produce skilled manpower that may lead a rapid economic development.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

My strong determination and hard work led me to do my work in the best possible ways. I always focused on my work and goals. I might have faced several challenges, but I never considered them to be challenges at the time. I spent 17 to 18 hours in the laboratory to solve scientific problems that really were challenging. Keen observation, enthusiasm and hard work allowed me to solve many of these problems.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My dream is to have a wonderful research centre in Bangladesh with a modern, multidisciplinary approach to drug discovery development. It will help the entire Asiatic region, but I think it would be the most challenging part of my life. I am hopeful and focused. I would put

sincere effort to build it up. Finance and policy of this future organisation will be very challenging.

What would you say to young women considering a career in science?

Women are a strong and wonderful segment of society. Being a woman in science may be challenging to some extent. The young generation needs to develop a strong professional attitude to overcome all kind of barriers to moving forward. Believe in yourself and develop a problem-solving approach. A well-planned career with continuous hard work will help to build a strong and firm science-oriented career. Passion for the research through extensive hard work will lead you towards accomplishments. Enlightenment is one of the fundamental constituents to live a purpose-oriented life. Enlightening and empowering women through science education and practice will lead our country toward sustainable economic development.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Gender equity in science in Bangladesh is quite legitimate. The major concern in Bangladesh is high-quality research-based science practice at the front line.

Developing research institutes with modern research facilities is the most fundamental issue at this point. I believe that, without hands-on experiments, science practice is quite impractical. Local learned academies have realised this but we need to work hard to fill this gap in order to do excellent science. Technology transfer to this region is challenging and urgently needed for further innovative research project development. Intensive research procedural changes are required. Processes such as technology innovation, diffusion, adaptation and implementation need to be implemented urgently for the dissemination of scientific research practice. National Bangladesh pharmaceutical industries have already earned excellence in high-quality medicine manufacturing, and, as a result, many of the top national pharmaceutical industries have US FDA approval to export medicine to the US. Bangladesh is currently exporting medicines to more than 165 countries, covering Asia, Europe, North America, Africa, the US and Russia. At this moment we require rapid advancement in the research and development sector to develop new molecules against different therapeutic disease targets. Research and development of technology has always been seen to play a central role in socio-economic development, and change in technology has been seen as an essential ingredient in development throughout the world.

CHINA

Nominated by the Chinese Academy of Sciences



Professor Xiaofeng Cao



Epigenetics

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cm/200907/t20090731_2287246.html](http://sourcedb.genetics.cas.cn/yw/zjrc/cm/200907/t20090731_2287246.html)

Biography

Professor Xiaofeng Cao leads the Center for Genome Biology at the Institute of Genetics and Developmental Biology and is the co-director of the Centre of Excellence for Plant and Microbial Science, jointly established by the Chinese Academy of Sciences (CAS) and the John Innes Centre in the UK. She has a bachelor's in applied biochemistry from Peking University, a master's in biochemistry from China Agricultural University and a PhD from the College of Life Sciences, Peking University. During her PhD, Professor Cao was a visiting scholar at the John Innes Centre and later a postdoctoral research fellow at Washington State University. She was a research associate in the Department of

Molecular, Cell and Developmental Biology at the University of California, Los Angeles (UCLA). After she won CAS's Young Talented Investigator Award (2002) she returned to work in China. She has received numerous awards for her research, and was elected as a CAS academician in 2015 and a TWAS fellow in 2016. She is married and has two children.

When did you know you wanted to pursue a career in science?

I attended junior and senior middle school at the Affiliated High School of Peking University. The school, which is one of the best middle schools in Beijing and the nation, nurtures students to be self-confident, distinctive, responsible, creative and innovative, as well as outstanding citizens who contribute to the public good, respect the natural world and show care for other people. It was in junior middle school that I first became interested in science and participated in a biology club. I felt that as a scientist I could become the kind of person my school was nurturing me to be.

Who or what inspired your passion and curiosity in science?

My curiosity about the mysteries of nature propelled me to develop and maintain a passion for science. My earliest scientific role model was Marie Curie, twice a

recipient of the Nobel Prize. After I began working in epigenetics, the outstanding geneticist Barbara McClintock became my next role model. As the discoverer of transposons (movable sequences of DNA whose transposition can alter a cell's genetic identity), McClintock is one of the greatest genetic scientists of the twentieth century. However, her key discovery was not immediately recognised by scientists. Only 40 years later was she honoured for the discovery by receiving a Nobel Prize in Physiology and Medicine. McClintock's scientific brilliance, as well as her persistence, inspired my work.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

Among individuals who I knew personally, the greatest role model of my career was Professor Lungfei Yen (1921–2001), who advised me in my master's program in biochemistry. Professor Yen urged me to use new technology and methods in my research and keep up with the development of biotechnology. My work in his lab allowed me to broaden my intellectual horizons. It nurtured my self-confidence and made me embrace the challenge of new research questions. Professor Yen also served as a model through his respect for colleagues and support for young scholars. Dr Liam Dolan

and Dr Steve Jacobsen, my advisors in the UK and US, both influenced my work. Liam always encouraged me to attend scientific meetings to learn from others and to broaden my intellectual horizons.

What do you think is your greatest scientific achievement to date?

I carried out pioneering work at UCLA on Arabidopsis methyltransferases CMT3 and DRM2, which are responsible for *de novo* and the maintenance of DNA methylation to maintain epigenetic gene silencing. Since I returned to China, I provided the first example of a histone methyltransferase-suppressing transposition of an active retrotransposon in rice. I also provided the first experimental evidence showing that transposons are important in controlling important agricultural traits in rice and are not just 'junk DNA'. Moreover, I identified the first plant Histone H3K27 demethylase, one of the most important epigenetic regulators, and revealed its binding mechanism towards genome. Despite beliefs that protein arginine methyltransferase 5 (PRMT5) acts through transcriptional control, I discovered that Arabidopsis PRMT5 is required for genome-wide pre-mRNA splicing, a conserved co-transcriptional/post-transcriptional regulation mechanism. This important work revealed an important link between protein arginine methylation and co-transcriptional regulation. I discovered that PRMT5 is involved in splicing machine activation. This further proved the correctness of my earlier discovery and increased my confidence in my conceptual thinking, techniques and methods.

What motivates you to work as a scientist in Asia?

China has 8% of the world's arable land but 20% of its population; in contrast, US figures are 13% and 5%, respectively. To solve China's serious imbalance between arable land and population, the government is investing a great deal in agricultural research, thus creating many opportunities for scientists. Since China's economy still has much room for advancement, science is an extremely important tool for development, giving Chinese scientists a great sense of mission. Therefore, scientists not only enjoy a gratifying sense of intellectual achievement but feel honoured to make an important contribution to our homeland, as well as developing countries in Asia. I am also happy to be in China because I value the relationship with the students I mentor and believe education is particularly revered here.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I have faced both personal and career challenges. On the personal side, I have had to figure out how to combine my family life—including being a parent—with my career, realising that having a happy and healthy family life is an important foundation for a fruitful career. Fortunately, my husband, my mother and parents-in-law have been very supportive. On the career side, an important challenge was deciding where to further my career—in the US, where I did postdoctoral research, or in China. I subsequently chose China



and received great support in this decision from my husband. I also received exceptional support from Chinese entities, such as CAS, which helped me establish my own lab. Although I have certainly received a great deal of external support, my capacity to overcome challenges has also relied on a fundamental self-confidence, persistence and curiosity imbued long ago by teachers, educational institutions and family.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My team discovered a sterile male gene that controls thermosensitivity in hybrid rice. Hybrid rice carrying this gene represents more than 95% of two-line hybrid rice acreage in China. We still need to understand the molecular mechanisms for controlling temperature. Only when we understand how temperate controls rice fertility can we produce hybrid seeds that minimise temperature fluctuation risks.

What would you say to young women considering a career in science?

I would encourage young women to be active, independent, self-confident and innovative. I would encourage them to make use of existing platforms for mutual cooperation and exchange and develop additional opportunities for academic cooperation among women. I would also advise women in the field of science and technology to carefully manage the relationship between home and laboratory. Furthermore, women should have confidence that they have unique insights as well as communication

advantages specific to their gender. All in all, women should not view their gender as a disadvantage, but as an opportunity that offers unique insights relevant to society and science.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Many young women have come into the fields of science and technology with the popularisation of scientific knowledge and the rise in female educational levels. As a result, there are now many famous women scientists and scholars in every academic field continuously innovating and making outstanding contributions. However, women only represent 6% and 4% of all academicians in the Chinese Academy of Sciences and the Chinese Academy of Engineering, respectively. With women still representing such a small percentage, it is necessary to nurture the talents of high-level women scientists.

Since 2004 I have served as director of the Committee on Women within the Institute of Genetics and Developmental Biology. In 2013 I became a member of CAS's Committee on Women. In the same year, I also became a vice-chairman of the Botanical and Biological Sciences Women Scientists Branch of the Chinese Botanical Physiology and Botanical Molecular

Biology Association. To encourage more women to enter science, I regularly participate in university visits by women scientists in my field, during which we discuss the rewards and challenges of being a scientist. I have also organised international women in science academic events, such as the joint CAS and Japan Science and Technology Agency's 'Women Scientists Forum', the 'World Life Science Conference: Woman in Life Science', and participated in the 'Sino-British Women Scientists Forum' and the 'OWSD 5th General Assembly and International Conference on Women in Science and Technology in the Developing World'.

Professor Bo Gao

Metrology

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Biography

Professor Bo Gao was born in 1976 in Heilongjiang Province, China. She is married and has eight-year-old twin daughters. She is now working at the Technical Institute of Physics and Chemistry (TIPC) of the Chinese Academy of Sciences. She is the deputy director of the TIPC-LNE International Laboratory of Cryogenic Sciences and Technology in low-temperature metrology. She is the chief scientist for the project 'Research on international primary thermometry in low temperature' under the Chinese National Key Technologies R&D Program. Bo is also an invited expert on the Consultative Committee for the Thermometry Working Group for Contact Thermometry. She is also the low temperature range leader in China for the European Metrology Research Programme project 'Implementing the new kelvin-2'.

When did you know you wanted to pursue a career in science?

I did not start walking until I was about five years old, an experience that allowed me to take in the world around me gently,

enjoying tiny creatures, from small animals to insects. One of my fondest memories was watching the metamorphosis in caterpillars unfold before my eyes on a bush near my childhood home. To search for answers, my mother introduced me to science books at the sole library in our hometown, so that I could learn about the science underlying the transformation. Understanding this process and seeing what scientists do drew me into this career.

Who or what inspired your passion and curiosity in science?

My doctoral advisor, Professor EC Luo, is a very fine scientist. What makes him

so good is that he is never afraid of a challenging scientific problem and approaches seemingly impossible questions with great enthusiasm. In the same spirit, he worked with me to select a challenging fundamental research problem related to low temperatures that would end up laying a significant foundation for my future research work. Meeting my current colleague, Laurent Pitre, who shares my passion for fundamental research, led me into the field of state-of-the-art thermometry and has inspired me to keep working at the international level.



Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My mother is my role model because, although she is not a scientist, she worked for many years as a government accountant and instilled in me the importance of having persistence and a determined spirit. She also encouraged both me and my younger sister to not be shackled by historical roles pushed onto young women and to follow instead our own passion in life. My younger brother and sister have also shown me the importance of keeping an open mind.

What do you think is your greatest scientific achievement to date?

My current research mainly focuses on the national primary thermometry construction in the low temperature range. I have developed a novel 'single pressure refractive index gas thermometry' method. This method has the best potential uncertainty compared to current primary thermometry methods. The implementation of this new primary thermometry method would provide the source value in China for thermodynamic temperatures in the low temperature range. It would also mark the first implementation in China of the new kelvin at temperatures below 24.5561 K since the International Temperature Scale was set up in 1927. I had the great pleasure of working at LNE-Cnam in France when the group was determining the Boltzmann constant using acoustic thermometry. The collaboration achieved the best ever,



definitive measurement for the constant, its value contributing a 52% weighting in the final adjustment by the Committee on Data for Science and Technology.

What motivates you to work as a scientist in Asia?

Asian economies are in general on the rise, but there is still a shortage of people working in fundamental research fields. It is therefore necessary to increase funding and support for this type of research and for skilled researchers, since research will provide further economic, societal and scientific benefits within China and abroad. With so much support from government funding bodies, I have been given more freedom to explore my research than some of my international colleagues.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Female scientists must not only work as hard as their colleagues but also have family responsibilities that may be greater than their male colleagues (such as pregnancy, breastfeeding, etc.). Being the mother of eight-year-old twins, I feel the strain because I must work in a lab that is very far from my home. As a result, I can only see my family one day every week. In the meantime, their father and grandparents help take care of them. My husband and children have even jokingly said they hope I don't get funding or apply for international funding so that I can spend more time with them. I video chat every day to maintain a presence in the lives of my husband and children and am indebted to my family for their continued love and support.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I want to work with my team members to establish a temperature value transfer system for China in the extremely low temperature range. This project is a 20- to 30-year plan due to the scale of the work. It will require sustained support from government funding bodies, as well as perseverance and enthusiasm from my colleagues to build a portfolio of accomplishments.

What would you say to young women considering a career in science?

We are in a new age of equality between men and women. Women scientists are playing a growing role in science. So if you like science, stick with it and enjoy it! Life is a marathon and it takes many steps to add up to a lifetime of success!

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

In China we have already entered a new era in terms of equality between men and women. As women must spend more time taking care of infants, science funders have responded favourably by extending the age limits for many important science funding awards. I am not involved in any organisations related to women in science and engineering.

GEORGIA

Nominated by the Georgian National Academy of Sciences



Dr Liana Melikishvili



Ethnology

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Biography

Dr Melikishvili was born in 1943 in Tbilisi, Georgia. She graduated from the Faculty of Orientalistics at the Tbilisi State University in 1965; in 2002 she defended the doctoral thesis. For many years she was a chief researcher and a member of the Scientific Council at the Javakhisvili Institute of History and Ethnology, as well as head of the Institute's Department of Ethnology of the Caucasus and a supervisor of the Ethnic Conflict Research Group. The study of the polyethnic societies of Georgia's border zones became one of the fundamental directions of her research. In 2000 she received the Order of Honor in appreciation of a 'considerable personal contribution to research into problems of the socio-economical and cultural development of various ethnic groups residing in Georgia and in reward of her fruitful scientific and

organisational activities'. She is married with two children.

When did you know you wanted to pursue a career in science?

I was brought up in the surroundings of famous Georgian scientists and this inspired my interest towards ethnology. After I graduated from university I started my work at the Institute of History and Ethnology as an assistant.

Who or what inspired your passion and curiosity in science?

Famous Georgian ethnologists Giorgi Chitaia and Vera Bardavelidze, who were close friends of my family and often visited us.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

About 30 years ago I made acquaintance with the famous sociologist Ernest Gelner, who was interested in research in Georgia. We had made some research plans but, sadly, he passed away. Our meeting influenced my future goals.

What do you think is your greatest scientific achievement to date?

My greatest achievement is my research in different regions of Georgia, in the so-called 'hotspots', to prevent potential

conflicts. Strategically important projects under my authorship are 'Early manifestations of ethnic conflict in multiethnic society', 1995–97, and 'Security strategy in polyethnic society in terms of unstable Caucasus', 2000–02.

What motivates you to work as a scientist in Asia?

My first profession is Orientalistics. Being on the border of Europe and Asia, Georgian culture has many historical relations with Asian culture and it is well reflected in our traditional culture.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I have never faced any challenges as a female scientist.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My age and professional experience make me hope that I will be able to overcome any barriers. I have many plans regarding ethnopolitical problems in my country.

What would you say to young women considering a career in science?

Do not be afraid of difficulties; overcoming each barrier is one more step to your success. Work is the best way to your goals.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Gender equity might be a problem in many spheres in our country, but in science it is not so. Men and women scientists are equal: their salaries are similar, men scientists are not more privileged than women, they have equal rights, etc.



Dr Ia Pipia



Molecular genetics, genomics

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Biography

I wanted to become a biologist from a very young age. Fortunately, my dream came true and today I work in the field of molecular genetics, namely in plant genomics. After finishing school I enrolled at the Ivane Javakhishvili Tbilisi State University and completed a Bachelor of Arts and Master of Arts. I studied a postgraduate course at the Durmishidze Institute of Biochemistry and Biotechnology. Since then, genome studies have become the scope of my scientific interests. Later I defended my PhD thesis (in 2006) and worked at the institute for several years. I continue my scientific activity at the Institute of Molecular Genetics at the Agricultural University of Georgia. I am involved in

the teaching process as well, delivering lectures in genetics. I have many good students and this makes me very happy; I greatly value working with students. In my opinion, an educated new generation is the future of a country. I have also worked in leading scientific laboratories in the US and Israel.

When did you know you wanted to pursue a career in science?

Since childhood, when I realised that there are other living organisms in nature apart from human beings. I became interested in the similarities and differences between us and these organisms: why we are like this, why we are not of different kind, or what we have in common with other organisms and what is the principle on which the phenomenon of life is based. I knew from school that science could give answers to the questions I was interested in.

Who or what inspired your passion and curiosity in science?

My passion in science started with many interesting books, scientific television programs, meeting with many interesting people and conversations with them. My family has made a huge contribution to it—I was brought up in an environment where education was of the highest value.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

People I met at different stages of my life had various influences on my development into a scientist: my university teachers, my scientific supervisors and personnel who I worked with and work with today. Every day when I met with those people they were giving an example of how to be devoted to the work, how to develop, how to solve problems, how to be a good scientist. I am grateful to each of them.

What do you think is your greatest scientific achievement to date?

I belong to a small group of Georgian scientists that has been studying genetic diversity and the role and importance of Georgian grapes in world's history of viticulture by applying genome-based approaches. Our team has carried out a unique project—whole genome sequencing of four Georgian grape varieties (chkhaveri, saperavi, meskhuri mtsvane and rkatsiteli). This survey is especially important for Georgia, which is known as 'cradle of viticulture'. I am proud to be involved in this project, as vines and wine are inseparable parts of Georgian culture and history. Georgia is the country with the earliest record of winemaking, home to unique wine-making tradition

(the ancient Georgian Qvevri wine-making method was added to the UNESCO world heritage list in 2013) and grape varieties unknown in the rest of the world.

What motivates you to work as a scientist in Asia?

Working in science is based on interest and love of your work. Anything can be motivational that might seem unimportant at first glance. Obstacles are overcome easily when you see that your work is interesting and valuable for other people as well. I remember when I was carrying out DNA extraction from plant tissue for the first time independently. I was watching extracted DNA fraction and I thought that I was very lucky because I had an opportunity to meet DNA—the molecule of life. I still experience this feeling every time I see the same excitement in my students.

Georgia has a unique and ancient cultural heritage, famed for its hospitality and cuisine, and has a special biodiversity. All of this makes me motivated, and with my scientific activities I am trying to introduce my country to others and show them Georgia's scientific and cultural potential.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Science has always been accompanied by challenges and it will remain this way. The main thing is to find the power in yourself to overcome them. There are many successful female scientists in my country. As scientists they do not face any special difficulties. Challenges may



appear when women make a choice and decide to become a scientist. Social environments may become an obstacle.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I work on very interesting research in the genomics of grapes. I have good scientific contacts abroad and innovative ideas, which will grow my research. Experimental biology is an expensive discipline; we have to attract funding for research all the time. This is the main challenge—to obtain the required resources for research when they are needed.

What would you say to young women considering a career in science?

Don't be afraid of challenges and competition. Be goal oriented and diligent.

Be self-critical and confident. Confidence will help you take reasonable risks. Self-criticism will help you avoid mistakes. Science is difficult and takes time and energy. Sometimes months of hard work does not produce desired results, but it is interesting and allows us to solve problems that seemed impossible. It gives an opportunity to create something that will become a basis of important future research. Science gives us a certain freedom. It does not restrict our activities and does not turn daily activities into routine. Every new experiment opens new spaces, takes you to new ideas and so on—it is a work that is always interesting.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Gender equity is more or less a global problem. Georgia faces this problem too, but in spite of this we have successful female scientists. I am sure that the full ability of each person will be used for development and progress for a better world, and gender equity shall not hinder this. Marie Curie, Rosalind Franklin, Rita Levi-Montalcini, Jennifer Doudna, Emmanuelle Charpentier and many others are the best examples of female scientists. They made a significant contribution to different fields of science.



INDIA

Nominated by the Indian National Science Academy



Dr Chandrima Shaha



Life sciences

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Biography

Chandrima Shaha is the former director and current professor of eminence and chief of the Cell Death and Differentiation Laboratory at the National Institute of Immunology, New Delhi. Dr Shaha is an elected fellow of The World Academy of Sciences, the Indian National Science Academy (where she is currently the vice president of foreign affairs), the Indian Academy of Sciences and the National Academy of Sciences, India. She is a JC Bose National Fellow of the Department of Science & Technology of the Government of India. She is a recipient of the Ranbaxy Science Foundation Award for Basic Medical Research, Om Prakash Bhasin Award for excellence in biotechnology, Archana Sharma Memorial

Award of the National Academy of Sciences, the Chandrakala Hora Memorial Medal and Darshan Ranganathan Memorial Award from the Indian National Science Academy and the Shakuntala Amirchand Award of the Indian Council of Medical Research.

When did you know you wanted to pursue a career in science?

From childhood, when I was first introduced to the beauty of scientific inquiry by my father. Subsequent to that, a great interest was created in high school.

Who or what inspired your passion and curiosity in science?

My father inspired my curiosity in science by making me aware of the Universe and its mysteries and of nature around us. At home, I looked through a microscope into a miniature world and through a telescope at the stars and came to know about the origin of the Universe. The childhood reading of lives of scientists resulted in further interest and subsequently, school was a platform for much science education. At school I was introduced to the theory of evolution, which was fascinating. Undergraduate college was where I pursued science, but at postgraduate level I experienced real laboratory life. After postgraduate studies I joined research full time.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

There is no one influencing role model that led to my choice of a career in science. It was the general perception about scientists that I imbibed through reading about their lives and the possibility of having an exciting time in the laboratories, that resulted in my career choice. Motivation came from parents, school teachers and scientists that I knew through social circles.

What do you think is your greatest scientific achievement to date?

I have been working on mechanisms of cell death in an organism that causes the neglected tropical disease of leishmaniasis. It is the *Leishmania* parasite, a unicellular organism surviving either in the sand fly gut or in mammalian macrophage cells. Over the years, my laboratory has shown how cell death processes occur in this unicellular organism. Early reports from the laboratory created a change in thinking in unicellular cell death research, as it was shown that some of the metazoan characters of cell death manifest in this unicellular parasite. Thus, the laboratory has contributed majorly towards the understanding of the biology of the parasite relating to its survival, providing a basis for many emerging areas of research.

What motivates you to work as a scientist in Asia?

After my postdoctoral studies in the US I came back to my home country to build a laboratory of my own. At that point in time (in the early eighties), there were many challenges in building a successful laboratory. However, I was fortunate to have ample opportunities to build the laboratory and train many doctoral, postdoctoral and undergraduate students to build their own career in science. The particular motivation to work in Asia is to be able to work in my own country, contributing to solving its own problems.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

To me, hard work, sincerity and creative thinking never had a gender. I was competing equally with my male colleagues and I got my due. There were no specific challenges in the science, rather in making myself comfortable in a largely male community of scientists.

These are social challenges, and they can change by exposing women scientists to different situations. The way I was comfortable in a society of scientists in the eighties has evolved and today it is very different, as women are more assertive and perceptions have changed.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I am a very senior scientist and have made contributions to the area of my work. My aspirations are now to extend my research to societal benefit, to train more young women to come into science and to propagate the notion of the utility of science in bringing about societal changes.

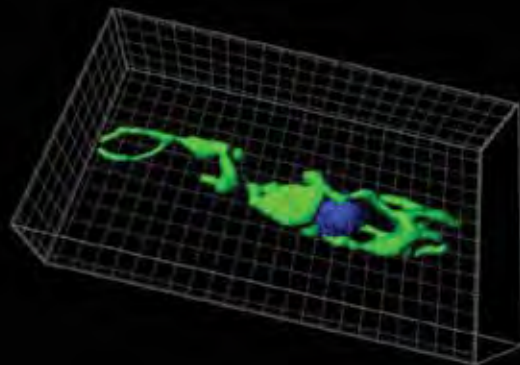
What would you say to young women considering a career in science?

I would urge young women to take up a career in science. Women are creative and with scientific training could achieve a great deal. When women take part in

science equally with men, we can dream of a society that advances fast and is fully equipped to face the challenges of tomorrow.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Gender equity in science has still a long way to go. In India it is more of a social issue and the convenience of women pursuing a career in science with mid-career breaks is a concern. India has done very well with a lot of opportunities for women in science. The academies are actively engaged in promoting women scientists and the government has been sensitive about it. However, the ecosystem has to be more women friendly, with childcare facilities and other efforts to make it convenient for women to work. Career breaks have to be looked at with more sensitivity. Yes, I have been a part of STEM activities at different times and under different banners.



The mitochondria of the *Leishmania* parasite

Confocal photomicrograph

Dr Ranjani Viswanatha



Chemical and physical sciences

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Biography

I am a professor at the New Chemistry Unit at the Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore. I work at the interfaces of physics and chemistry in the field of nanomaterials. I obtained my doctoral degree at the Indian Institute of Science in Bangalore and after a couple of postdoctoral stints in the US, about seven years ago I joined the Jawaharlal Nehru Centre for Advanced Scientific Research. I have received several national awards as a distinguished young scientist. Personally, I come from a family of scientists and I am now, by choice, a single parent of an eight-month-old son.

When did you know you wanted to pursue a career in science?

I was born into a family of academicians with a large number of uncles and aunts who were scientists. So even as a child, I always wanted to do a doctorate if I was good enough for it. Eventually, I guess only after I started my doctoral degree, did I realise that I was happiest when I was doing science and talking about science, and that I really wanted to take it up as a career. However, I was so seamlessly driven towards it that I went from doctoral degree to postdoctoral and to a job as a scientist almost as easily as one would decide to go from first to second and to third grade in school.

Who or what inspired your passion and curiosity in science?

My mother was instrumental in recognising my passion and curiosity at an early age. Starting from a young age of, maybe, four or five years old, she recognised my interest and talent and since then has been supportive of my decisions, giving suitable input at appropriate times—despite the fact that they were not the trendy decision. She has also been instrumental in imparting a lot of non-traditional learning and thinking that has formed the basis of my interest in

science today. My father has formed a supportive tent around me and my sister, standing by all our decisions and giving us a lot of freedom to follow our dreams.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My career in science started taking shape unbeknownst to me when a few like-minded scientists realised that science in Karnataka, India, was suffering for lack of proper guidance and scientific thinking. Jawaharlal Nehru Planetarium started a non-traditional learning program on weekends with a few scientists, to supplement a college education with an emphasis on how to approach a problem with a scientific thinking, rather than solving the actual problem. Later, when I started my doctoral degree, I learnt a lot from my supervisor, which helped consolidate my career in science.

What do you think is your greatest scientific achievement to date?

I work with the properties of very small particles known as nanomaterials, where properties are dictated by the size of the particles. I get very excited about the new concepts that I have discovered,

and I have provided new perspectives to existing concepts, leading to scientific articles that have been cited more than 200 times. However, the achievement that I treasure most is the small jobs that I pursue: to inculcate scientific thinking into the future generation of students. The most significant examples include the design of science ambassador programs for school children, scientific demonstrations and year-round thinking-oriented lectures in physics and chemistry. I also contribute to a non-traditional learning program that I was part of as a student, and I hope that one day I can impart scientific thinking to the future generation.

What motivates you to work as a scientist in Asia?

Two main reasons motivate me to work as a scientist in India. The first is to educate the younger generation, to encourage them to evolve into a responsible nation and soak up the rich culture of the country. I believe that I have a responsibility to contribute to the improvement of the country. One way of achieving this is to educate the youngsters in scientific thinking. Doing research within the domains of the region-specific challenges is something that I enjoy immensely. Secondly, on a personal front, India, like any other Asian country, is a country with a rich culture, and I would like to soak in that culture while I work as a scientist.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

The biggest challenge I faced is the consequences of a patriarchal family, which is largely still dominant in Indian society. As I was born into a non-patriarchal family, I did not face any discrimination until it was time to get married. Clearly, I realised, we were in the minority. Almost regularly, husbands personally feel insecure if their wives outperform them and societal pressures build up. Hence doing well in studies and having a successful, accomplished career feels like a negative for women and they are obliged to give up their careers for the sake of the family. While I chose to overcome this challenge in a non-traditional path by choosing to have a choice baby through donor sperm (with the help of an extremely supportive family

and friends), I would like this norm to be broken to pave the way for traditional paths. In this aspect, we, as mothers of sons, have a huge responsibility to teach our sons to respect women and their work, as this is an integral part of the woman's identity and will pave the way for a more open-minded society in the future.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My aspiration is to set up a spectroscopy laboratory. Funding is key for success. I also have the sole responsibility of bringing up my son. However, science is not a job confined to four walls. My most successful ideas come at night while I am trying to put my son to sleep. I do not see science and parenting as mutually exclusive options.



What would you say to young women considering a career in science?

For those considering a career in science, irrespective of their gender, I would like to say that science is a very satisfying profession. For all the hard work and dedication that is part of being a successful scientist, the excitement of being the first to discover something gives immense satisfaction and makes work fun. From my experience as a mother, I would like to debunk the myth that science is incompatible with parenting. In fact, it aids family life, as science strengthens the mind and poses endless challenges that need creative solutions. So once a scientist, always a scientist—even at home—leading to a very rewarding motherhood.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

I have not faced gender discrimination either in my personal life or in my professional sphere. However, I am in the minority. I believe that in order to address predetermined gender roles, one has to start from the grass-root level. It is important to educate the future generation, especially in rural areas, on the importance of providing opportunities

for young girls. It is important for the learned academies to develop initiatives specifically to address this issue at a regional level. In addition, while there exist a few programs to develop young girls in the country, what has so far not been extensively addressed is to educate rural members against predetermined gender roles. In a country that is so diverse in thinking—from learned academies hosting many female scientists, to the still-prevalent female foeticide—we need to develop initiatives that educate our citizens to respect the women and girls of society.



INDONESIA

Nominated by the Indonesian Academy of Sciences



Professor Dr Damayanti Buchori



**Entomology, insect ecology
and biological control**

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Biography

Dami Buchori is the fourth of five children. Her father was an education expert, senior pedagogue and intellectual, and influenced much of how Dami views her life and career. She received her MSc from the University of Illinois and her PhD from Indiana University. She has three children from her marriage to Zainal Arifin Hasibuan. She is a professor in the Department of Plant Protection at Bogor Agricultural University and heads the university's Centre for Transdisciplinary and Sustainability Science. She has been an adjunct researcher at Columbia University in New York since 2002.

Dami has been very active in conservation NGOs. In 1998 she was the Indonesia program coordinator for the Wildlife Trust and member of the Wildlife Trust Alliance. In 2000 she founded and chaired the PEKA Indonesia Foundation, an NGO specialising in insect conservation and environmental education. From 2006 to 2009 she was the executive director of the Indonesian Biodiversity Foundation and from 2009 to 2011 she was the senior scientist and conservation director at The Nature Conservancy—Indonesia Forest Program.

When did you know you wanted to pursue a career in science?

It started in 1972, when I was in elementary school and the newspapers were full of stories of crop loss due to the brown planthopper (BPH). I was 12 and I remember being so interested in it and started reading newspapers. When I learnt about the BPH pest explosion, I knew I wanted to pursue ecology. I was curious about interactions in nature and human-nature interactions. I was particularly interested in why pest populations explode: why does a species that does not have a history of explosions change its behaviour and cause so much damage? What changes the ecology of the pests? Such basic questions led me to study evolution ecology.

Who or what inspired your passion and curiosity in science?

I think what inspired me most was that, at the time, experts and scientists couldn't figure out what BPH was, whether it was a newly introduced species or a local species that had evolved or mutated. The BPH explosion opened up a new field of ecology, which was itself a relatively new field at that time. I became fascinated with the problem: the issue of nature change and evolution. I became interested in human–nature interaction.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My motivation in science is influenced a lot by the education system in Indonesia, where science has always been (too) emphasised. I have always found physics, biology and mathematics fascinating to study, and I was more challenged when studying the natural sciences when compared to other subjects. My elementary school teachers have been some of my main supporters and motivators. If it were not for these teachers I may not have the amount of passion for science that I do now. In middle and high school I started reading Eugene Odum's book on ecology and became even more convinced that I wanted to pursue a career in the subject.



What do you think is your greatest scientific achievement to date?

My greatest scientific achievement is my work on host–parasite interactions, biological control and community ecology of transformed habitats. I have found key biocontrol agents for certain pests in cabbage/cruciferous, long bean, cucumber and soybean. The bioecology of the parasitoids and its mass-rearing techniques has been developed. There are numerous species that are unidentified, and it won't be surprising if new species are found within the collection of insects that have been gathered through my work on habitat transformation. The research on community ecology and habitat transformations provides new insights into changes in community composition (species turnover) as habitats are

transformed, and the results can be used in habitat engineering to ensure ecosystem services provided by insects stay intact.

What motivate you to work as scientist in Asia?

I am proud to work in my country and pursue scientific research in Indonesia. There are so many issues and problems to tackle. The uniqueness of Indonesia as an archipelago and tropical country can provide new insights into the ecology of small islands. The Wallace Line and the diversity of different parts of Indonesia are still waiting to be explored. Many new species are yet to be identified. There are not many scientists working on insect conservation in Indonesia, and there are a small number of women among those who are working in the field.

What are some of the challenges you have face as a female scientist and how have you overcome these challenges?

The biggest challenge is, of course, the balance of being a scientist and all the responsibilities that come with it (research, publication and teaching), with being a mother and a wife. The guilty feeling of not being a good mother, not a good wife, when I need to work extra hours and weekends in the lab, or writing proposals, reports or manuscripts, and the guilty feeling when I am at home doing household chores and not in the lab pursuing science. So I learn to live with the guilt. I learn to understand and accept that I cannot be the type of scientist that dedicates 200% of their life to science. The balancing act of being a woman in all its forms is something that all female scientists need to be prepared for. One of the most important things that I learnt was sleep management, how to have quality sleep and sleep effectively, even for short period of time.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My future aspirations are developing transdisciplinary sciences in Indonesia and the interphase of science practice (action research). Currently, questions related to the advancement of science and technology and its impact on society are even more important. The research that I do, as basic as it is, is ultimately geared to making people's lives better. Science and ethics are intertwined and I believe that science without ethics will result in disaster.

What would you say to young women considering a career in science?

Be strong and persistent, have faith and believe that you can. Don't worry about pursuing both career and personal life—you can juggle both worlds. Usually women are good at time management, which is important. Be present and mindful and never let anything get you down longer than necessary. Do not get disheartened by failures, because you learn when you fail. Failure makes you humble and a better person. Always stand up for what you believe in and never fear to make bold decisions, even if it singles you out. People will soon realise the quality you have. Become an intellectual through science. Gain the wisdom through your rise and fall.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional, and international levels to support a future of gender equity? Are you involved in any event/ organisations related to 'Women in Science and Engineering'?



In Indonesia there are quite a number of women pursuing science, although the number and the quality needs to be improved. At the moment there are more women than men enrolling at university level, however—career-wise—men dominate the scientific communities. This means that all those women who were studying science do not stay in science once they graduate. The academic communities and professional bodies should have a bigger role in encouraging women to work in science.

This is particularly true for international bodies, where sharing experiences with scientists from other countries can help inspire local students. Providing training for women scientists, or cross-learning between women scientists, is very important in helping women stay in science. It is very important to be inspired and to inspire younger generations to pursue science. I was involved in a USAID project on developing STEM education for high school teachers, where women were the focus.

Dr Felycia Edi Soetaredjo

Chemical engineering

Vice Dean for Academic, Student and Cooperation Affairs, Widya Mandala Catholic University Surabaya
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Biography

I am the mother of a son named Ariel Frederick Humphrey. In 2012 I was chosen as one of the finalists for the Outstanding Young Australian Alumni Award (for 2010). I won Outstanding Lecturer in the East Java region several times, and in 2016 I was elected as the first winner of the Outstanding Lecturer in Kopertis VII (East Java). In early 2016 I was elected as new member of the Global Young Academy. In August 2016 I was elected as new member of the Indonesian Young Academy of Science (Akademi Ilmuwan Muda Indonesia). Recently, I was awarded the 2017 Elsevier Foundation Award for Early-Career Women Scientists in the Developing World and in 2018 I was elected as one of the Asian Scientist 100 list.

When did you know you wanted to pursue a career in science?

I worked as a private tutor while I was studying for my undergraduate degree and I was very happy when my students got good scores or if they chose science as their major in high school and undergraduate level. Because I dreamed to one day pursue my further degree overseas I decided to be a lecturer, but at that time, I did not know about research. By the grace of God, I received an Australian Development Scholarship and started my journey at the University of Queensland in Australia. My perspective has been changed ever since about research and science.

Who or what inspired your passion and curiosity in science?

Since I was a kid I was amazed by scientists like Marie Curie, Albert Einstein, etc., however I never imagined being a scientist. As a kid, there was a river behind my home. Once there were fish floating in the river. At the time I thought it was a blessing as people could catch fish easier. As a grown up, I realised that the fish were floating due a factory discharging its wastewater. I could not imagine the effect on the people who took the fish without knowing this.



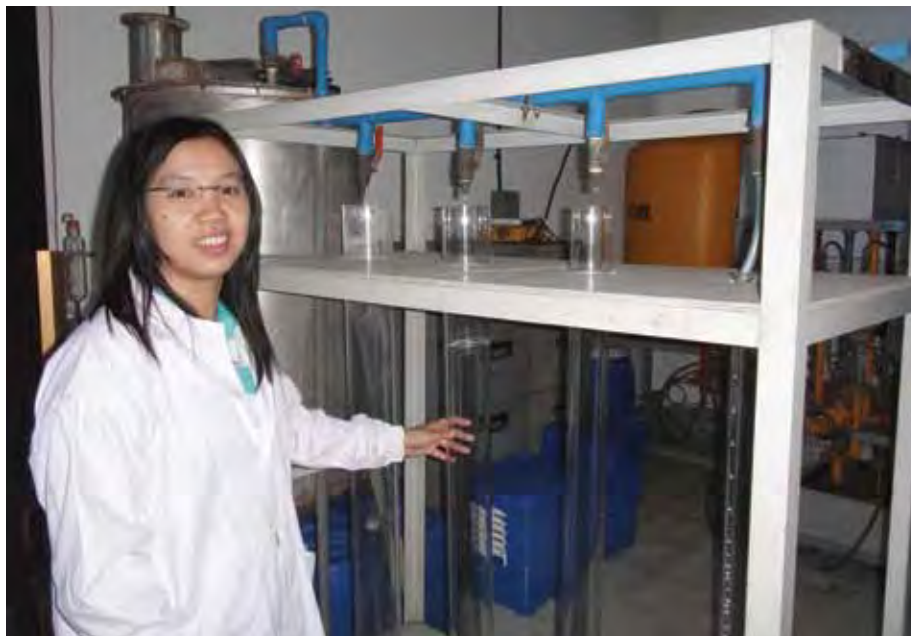
I noticed rivers in my city are similar. As water quality is getting worse, I feel the burden to do something. Even though what I do is only a small part, I believe if more scientists get together to solve local problems one by one, one day we will have a better environment.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I had a supervisor when I did my undergraduate research. He told me that you must be creative when you are in Indonesia since we do not have sophisticated equipment like universities in Australia or Taiwan, but because Indonesia is rich in biodiversity you still can do more in science. He has received a number of prestigious awards in Indonesia. He became my inspiration as he showed me that if he could do it, I also can do it.

What do you think is your greatest scientific achievement to date?

In research, my greatest achievement is developing a method to treat reactive compounds in wastewater in a short time. This method was formulated together with my research group. In my career as a lecturer I have been working on coaching students for innovation through a technopreneurship course. Currently, progress with a collaboration with the Faculty of Entrepreneurship at Widya Mandala Catholic University for commercialisation is going well, and I am looking forward to their innovation being commercialised.



What motivates you to work as a scientist in Asia?

I think the biggest motivation is my family. My husband is a businessman and it is not easy for him to move to another country and build a business from nothing. The second motivation is that I was born in Asia and there are so many things in Asia—particularly in Indonesia—that still need improvement, and I can do something about it here in Indonesia.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

The biggest challenge for me as a female scientist is balancing my time and attention between family and career. Another challenge is the limited research funding and facilities since I work in a private university. So far, we manage this

problem by collaborating with overseas researchers.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I want to advance my performance in research and apply the results to society. I believe the way to be a role model is to retain our junior colleagues and coach them to continue my research and take it even further. The barriers are funding, especially since applying for international research funding is limited for certain countries or ages.

What would you say to young women considering a career in science?

Even though there are many obstacles, I keep encouraging my junior colleagues to keep trying. The obstacles make us become creative and persistent.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

I think we do not really have this issue in Indonesia, especially in big cities. I feel I have had equal opportunities in science since I was in school until now. In some areas there is a perspective that science and engineering are for men, however this perspective is fading away. I am a member of the Organization for Women in Science for the Developing World.



IRAN

Nominated by the Academy of Sciences of the Islamic Republic of Iran



Professor Tahereh Kaghazchi



Separation processes in chemical engineering

**Professor (retired),
Amirkabir University of Technology**
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Biography

I was born on 29 January 1947 in Tehran, Iran. I was married (widowed), with two daughters. I have been the deputy dean for research and the head of the petrochemical engineering group/department, including many other positions. My academic achievements and positions are:

- PhD Chemical Engineering, University of Bradford (UK), December 1973
- MSc Chemical Engineering, University of Bradford (UK), 1970
- BSc and MSc Chemical Engineering, University of Tehran, Faculty of Engineering, 1968
- Assistant Professor, Tehran Polytechnic, 1973–77
- Associate Professor, Tehran Polytechnic, 1977–88

- Professor of Chemical Engineering, Amirkabir University of Technology, 1988 onwards
- Invited Professor, University of Tehran, Faculty of Engineering
- Invited Professor, Petroleum University of Technology, Ahvaz
- Invited Professor, Shahid Bahonar University of Kerman

I have been member of the Academy of Sciences of Iran, the board of trustees of Amirkabir University of Technology, the higher board of the Ministry of Education and many scientific societies. I had the titles:

- Distinguished Professor of Amirkabir University, 1991 and 1992
- Distinguished Professor in Chemical Engineering Iran, 1993
- Outstanding Scientific Personality (Chehreh Mandegar), 2002

When did you know you wanted to pursue a career in science?

From the time that I was a student I was always interested in science and engineering, especially chemistry, and later when I understood that when chemistry goes from laboratory to industry we can have different chemical products, my attention turned to chemical engineering. For the entrance exam at university, I chose chemical engineering as my favourite subject. When I entered

university I came to understand how chemical engineering can help us to improve our countries' industry in different branches. Knowledge of chemical engineering can help us in industries such as petrochemicals, minerals, foods and other related fields.

Who or what inspired your passion and curiosity in science?

There was not any specific person that inspired my curiosity in science; I was always interested in scientific problems, the way science improves things and its role in our lives, and, in fact, whatever we see in our everyday life has something to do with science. Of course, my father always encouraged me to continue my education at university. Especially, he wanted me to study medicine, but my interest was chemical processes. I am very grateful to him, although he is not now with us for me to express my gratitude to him. Science and technology play a great role in human beings' lives, although during recent decades and with the development in technology we have polluted our environment and made great trouble.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

In fact, there was no specific role model in my life. When I realised how scientists all around the world can change the life of

human beings and the important role of technology in helping people, I decided to be a scientist. Advances in science change the world, and advances in technology that is mainly based on science produce wealth and a better life for people. People in countries that have the knowledge of advanced technologies are healthy, more educated and can produce better opportunities for their children to grow up with. Of course, one cannot neglect the side effects of technology, such as pollution of the environment, which can be controlled by new technologies or by replacing old ones with green technologies.

What do you think is your greatest scientific achievement to date?

My field was separation processes, so I had the chance to enter different industries, such as petrochemical processes, which had many problems in separation processes, and gas



sweetening processes, as Iran has large resources of natural gas. I could also go into food separation processes, mineral separations, etc. During of my 40 years of active work I tried my best. Not only because of my country's need, but mainly I had students and teams of researchers under my supervision working on two fields—producing different solid adsorbents and their applications in chemical separations and working on membrane separations. I tried and I succeeded to make a separation research laboratory where my students and researchers worked together. We had connections with industries for our projects, trying to solve their problems.

What motivates you to work as a scientist in Asia?

Human life without science cannot improve. People in the countries with large amounts of natural resources, such as gas, oil, minerals, etc., cannot produce wealth from their resources without scientists and engineers. So I think we should encourage our young generation to gain an ability in new technologies and be up to date with new research and advances in related fields. I believe women can be educated and work in different science and engineering fields just as well as men.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

It is evident that, during the past few decades in most Asian countries, the number of female scientists has increased. When I started to work as an

assistant professor in the university more than 40 years ago it was very difficult to work like male colleagues, especially since I was the only female working as an assistant professor in our department. It was a very serious engineering place, made up almost entirely of men. In my class, when I was teaching a unit operation course in chemical engineering, I had only two females among about thirty students. I had to work very hard to be able to compete with my colleagues. Although I believe that universities are the best places to work for women, getting there is very hard, and women need to work harder than men to show themselves and be accepted by students and colleagues.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

Until about 35 years ago there were no PhD programs in chemical engineering in Iran. With a small team from our department in Amirkabir University of Technology, we established a doctorate program for the first time in Iran.

What would you say to young women considering a career in science?

Marriage influences work commitments for women but not for men scientists, so one of the important things for young girls is to marry a man who understands and respects educated girls. Another challenge for married women scientists is taking care of children and the household in addition to their workload, and having an understanding husband could make this easier for young women scientists.

Of course, the government's realisation and support for women through certain policies improves participation of woman in science and technology. I advise young female scientists to work hard, be sincere and do not pay much attention to discriminations.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

It has been about three years since we started a task group of 'status of women in engineering in Iran' in the Academy of Sciences of Iran, in which a team is working on a project to collect data on the number of girls entering Iranian universities in engineering fields compared to boys, followed by analysis of the regional percentage of girls living in different places in Iran. We continue this



study on MSc degrees and PhDs to understand the impact of university study in finding a job for girls who enter higher levels of education. The final report of this project will be ready within three to four months (in Farsi). What we realised from our data gathering is that in Iran, girls and boys have an almost equal chance of entering engineering studies.

Like other countries, girls need family and government support, especially when they go into marriage and family making process. Encouragement of women scientists in self-realisation of their potential is necessary. It is essential to have women in leadership and decision-making positions.

Professor Zahra Emam-Djomeh

Food science and technology

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Biography

I was born on 3 June 1968 in Tabriz, Iran. I have three older brothers who are all educated in different fields: informatics, medicine and law. I am single (not married) and I don't have any children. I obtained my BSc in food science and technology in

1992 from the University of Tabriz.

I continued my education in France with a MSc in food science and technology in 1994 from Blaise Pascal University.

I received an industrial fund to continue my studies there and finally obtained my PhD in 1998. I returned to Iran immediately and I was employed at the University of Tehran as an assistant professor in 1999.

I received several promotions and achievements (such as the best researcher of the University of Tehran,

best researcher in the region of Tehran, best researcher of Iran (male or female), distinguished female researcher of Iran and so on) during these years. Now, I am a professor at the University of Tehran.

When did you know you wanted to pursue a career in science?

During my high school years I was very interested in science and I wanted to pursue a career in this field.



Who or what inspired your passion and curiosity in science?

In my childhood there were several television programs about famous scientists such as Marie Curie, Luis Pasteur, Avicenna, etc. I was very impressed by them—especially by Marie Curie.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I was influenced by Marie Curie's life and adventures and she was my idol. Her courage and perseverance influenced me. She was one of the reasons that I chose France and chemistry-related subjects for my studies.

What do you think is your greatest scientific achievement to date?

I have educated many students, among them there are several successful women working in different areas (education, industry, administration). I also worked on some Iranian products and their health benefits. My most important research is about pomegranate and camel milk, their bioactive compounds and preservation and use in nutraceutical products. We launched three healthy products (that can prevent many diseases) in Iran with the help of food industries.

What motivates you to work as a scientist in Asia?

When I finished my studies in France, I had a very good job position there. Despite that, I decided to come back to



my country because I thought there were many people like me in France, but very few in Iran. I think—here—I can see how I can influence my environment and how I can open ways for women in the social life of Iran. For example, in 2000 there were very few female professors in my faculty (I was the only one in my department) but now more than 30% of professors are women. And I am the first woman who is the dean of a campus in the University of Tehran (the Aras International Campus).

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

When I entered in my professional life I was relatively young and the challenges were too much. The biggest one was that neither the scientific community nor the

industrial environment trusted a young female scientist. I had to work 10 times harder to convince them that I am as good as (or even better than) my male colleagues. Sometimes I proposed to work without any contract (for free), just to convince the industry that I can complete my work as well as my colleagues. Even with my students, I spent more time competing with my male colleagues to win their trust. I consider this period as a blessing because I worked harder and I progressed more rapidly than other scientists thanks to this pressure.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

Actually, I am interested in an interdisciplinary topic: food-based

nanocarriers for bioactive compounds. My biggest barrier is the industrialisation of our findings.

What would you say to young women considering a career in science?

Not to be discouraged, to work hard to open some barriers and not to accept any evident or hidden discrimination against women. If a woman believes in her potentials and strengths, she never can accept giving up her dreams and plans.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

I think there are still many things to be changed that are mostly cultural problems

rather than official ones. First of all, women must believe in their abilities. Local authorities and officials must change some discriminatory rules (such as the university entrance exam for some engineering subjects) and ensure the employment of educated women. Educated women also must try to engage more seriously in social events and organisations to show more and more women's capacities and merits. Yes, I am a member of an Iranian scientists' society.



ISRAEL

Nominated by the Israel Academy of Sciences and Humanities

Professor Ruth Arnon



Immunology

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Biography

Professor Ruth Arnon, former vice president of the Weizmann Institute of Science (1988–97), is a renowned immunologist. Among her scientific contributions is the development of Copaxone, a drug for the treatment of multiple sclerosis, which is presently marketed worldwide. A member of the Israel Academy of Sciences and Humanities, she chaired its Sciences division (1995–2001) and served as the president of the Academy (2010–15). She was president of the European Federation of Immunological Societies, secretary general of the International Union of Immunological Societies and the president of the Association of Academies of Sciences in Asia (AASA). Her awards include the Robert Koch Prize in medical sciences, Spain's Jiménez Díaz Prize, France's Legion of Honour, the Wolf Prize for Medicine, the Rothschild Prize in biology and the Israel Prize. She has

an honorary doctorate from several universities in Israel and abroad. She is married with two children and six grandchildren.

When did you know you wanted to pursue a career in science?

Since early childhood, I was attracted to topics related to nature and natural sciences. I also loved arithmetic. I read many books about discoveries and discoverers, and they aroused my curiosity.

Who or what inspired your passion and curiosity in science?

At a very early age I read the book *Microbe Hunters*. I was fascinated by the biography of the great scientists and their discoveries—to me it was like a detective story. For each chapter, I wanted to reach the end and know what had happened.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

A role model for me was Madame Marie Curie. I admired her determination and stubbornness, her unlimited devotion to her experimental work. The true story about her coming to the lab in the middle of the night, being curious about the results of her experiment and not being able to wait for the next morning—admirable!

What do you think is your greatest scientific achievement to date?

My greatest achievement to date is the development, together with my colleagues Michael Sela and Dvora Teitelbaum, of the drug Copaxone, which is probably the best drug for treatment of multiple sclerosis patients. It has been on the market worldwide for more than 20 years and is still going strong. At present, another product of my research, a universal flu vaccine, is being evaluated in Phase III clinical trials. If successful, this vaccine may bring tremendous benefit to the combat of influenza.

What motivates you to work as a scientist in Asia?

I am an Israeli. Israel, although of very small area, is probably the only country in the world that is at the border of three continents. It is in close proximity to Europe and to Africa but it is located in Asia. Hence, we have strong scientific contacts, collaborations and involvement in both Europe and Asia. As such, the Israel Academy of Sciences and Humanities is a member of both the European organisation, the European Federation of Academies of Sciences and Humanities, and the Asian organisation, the Association of Academies and Societies of Sciences in Asia (AASSA). In this realm, I served for a time as president of AASA (before merging to become AASSA).

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I personally have never experienced discrimination as a female scientist. However, not giving up the opportunity of having a family meant working hard in order to achieve the fullness of my scientific work and, at the same time, raising two children and taking care of my family. I hope I have succeeded in both tasks.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

The sky is the limit! So many new findings, so many new methodologies that provide endless opportunities. Due to my age, I personally will probably not be able to take advantage of them. But for young scientists, including females, there are tremendous opportunities—I don't foresee real barriers.

What would you say to young women considering a career in science?

I would say: if you love science, go for it!! It may not be easy but the satisfaction is tremendous. Don't be discouraged by failure—there are always failures on the way. But on the whole, there is the pleasure of coming to work every day and following your curiosity.



What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

In academia in most countries, including my own, there is great inequality among genders: while among students there is a majority of women, in academic positions it is the reverse. Furthermore, the higher

the rank, the bigger the difference. In the rank of professor, less than 25% are females. There has been a gradual improvement over time but we are still far from equality.

Professor Yonina Eldar



Electrical engineering

Professor, Technion – Israel Institute of Technology

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[YoninaEldar/index.php](http://web.ee.technion.ac.il/people/YoninaEldar/index.php)

Biography

Yonina Eldar is a professor in the Department of Electrical Engineering at the Technion – Israel Institute of Technology, where she holds the Edwards Chair in Engineering and heads the SAMPL lab. She is an adjunct professor at Duke University, a research affiliate with the research laboratory of electronics at MIT and was a visiting professor at Stanford University. She is a member of the Israel Academy of Sciences and Humanities and an IEEE fellow and EURASIP fellow. She has received many awards for excellence in research and teaching, including the IEEE Signal Processing Society Technical Achievement Award, the IEEE/AESS

Fred Nathanson Memorial Radar Award, the IEEE Kiyo Tomiyasu Award, the Michael Bruno Memorial Award from the Rothschild Foundation, the Weizmann Prize for Exact Sciences and the Wolf Foundation Krill Prize for Excellence in Scientific Research. She was selected as one of the 50 most influential women in Israel and is author and co-author of three books. She is married to Shalomi and a proud mother of five children: Yonatan (19), Moriah (15), Tal (12), Tal (6) and Roei (3).

When did you know you wanted to pursue a career in science?

I always enjoyed maths and physics in school and knew I wanted to work in a field that combined them. It was important to me to do work that has an impact on people and involves working with people. During my undergraduate studies, I was fortunate to be able to learn from two mentors, Professors Arie Yeredor and Udi Weinstein, who exposed me to the beauty and unlimited opportunities of signal processing and scientific research. I completed my PhD at MIT, where I worked with Professor Al Oppenheim, who leads a remarkable and unique signal processing group. When I finished, I knew that my passion was in research, development and working with young, talented students.

Who or what inspired your passion and curiosity in science?

I was very fortunate to grow up in a home where knowledge was always highly regarded. My parents are both educators and are extremely devoted to and passionate about teaching, reading and learning. My parents would use every opportunity, including travelling, family dinners and more, to teach us about the world. Although they are not scientists, they installed in me and my siblings the desire to learn, to teach and to make an impact.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My ultimate role models are my parents, who always strived to make a difference and impact society. Although our fields are very different, I choose research and educational activities that I believe will benefit society. My first steps into the world of signal processing were guided by Professor Arie Yeredor, a close friend, and Professor Udi Weinstein. They are two inspirational teachers and researchers, truly passionate about signal processing. In their teaching they stressed that, if you really understand something, it can be explained in a simple way—no

matter how complicated. This mantra has guided my research and teaching. Professor Al Oppenheim, my PhD advisor, leads a unique group of students who work on innovative solutions and ideas, stressing out-of-the-box thinking rather than solving ‘hot’ problems. This has inspired many of my activities.

What do you think is your greatest scientific achievement to date?

We developed the first analogue sub-Nyquist receiver that is able to sample and process signals at rates much lower than the Nyquist rate, which was considered the ultimate limit for analogue to digital signal conversion. This allows reducing sampling rates, processing rates, power, size and other physical parameters, such as acquisition time, without harming performance. Since our first prototype we have developed several complete hardware systems in areas ranging from communications to radar, optics and medical imaging, including a wireless ultrasound receiver. These prototypes can overcome various technological barriers by exploiting signal structure and the processing tasks in the sampling front end.

What motivates you to work as a scientist in Asia?

My parents moved to Israel from Toronto, Canada, when I was a young child. Being Jewish, they were always passionate about living in Israel, home of the Jewish people. We were fortunate to be raised in Israel with unconditional love for our

country and nation. It was always clear to me that I would also build my family here. Despite the challenges on the scientific front, it is exciting and rewarding to know that our work in Israel has a direct impact on the future of the country.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

There are many challenges, from raising a family while pursuing a career, to some that result from a dominant implicit and explicit bias—especially in engineering fields. It is extremely important to have a strong support system at home and mentors (both female and male) at the workplace. Recently, due to my own experiences and some lack of support by colleagues, together with other female friends and colleagues I have tried to be active in creating such groups for women scientists at all career stages. Providing opportunities for women scientists, such as invitations to give talks and nominating deserving women for awards, is an important way to try to overcome the inherent implicit bias. Unfortunately, some engineering associations do not have a very good track record in recognising deserving women members. A recent survey by the IEEE reported that more than 70% of women experienced negative outcomes in their careers due to gender. As a community, we need to find ways to change this, by mentoring, supporting each other, actively promoting women scientists and ensuring that deserving women are properly rewarded.



What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My aspiration is to build a truly interdisciplinary lab that uses signal processing to develop new devices and algorithms that will enable discoveries in biology and physics and impact the clinical world. These goals require close collaboration with leading scientists in those areas and with clinicians. I am currently working on establishing such collaborations.

What would you say to young women considering a career in science?

Women should know that they have a unique and important role in science. There is no evidence that suggests that women are not as good in science as men are. On the contrary, women add a unique aspect to science: in general, women tend to be more interdisciplinary and broader in their thinking. They are often motivated to interact more with colleagues and students, facilitating collaborative and interdisciplinary research. They are often attracted to topics that have a direct impact on society and are often motivated to connect technology to society. Define your goals and make choices that are right for you—there are many ways to succeed. Believe in yourself and in your own way. Don't try to follow someone else's path.

JAPAN

Nominated by the Science Council of Japan



Professor Motoko Kotani



Mathematics

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Biography

I am a geometer, mathematician, professor at the Institute for Mathematical Sciences, Director of the Advanced Institute for Materials Research (Tohoku University) and executive director of RIKEN in Japan. I am also an executive member of the Council for Science, Technology and Innovation of the Japanese Cabinet Office and a member of the Science Council of Japan.

I graduated from the University of Tokyo and received a doctorate of sciences in 1990. I started my academic career as lecturer and then associate professor at Toho University. I moved to Tohoku University as an associate professor in 1999 and was promoted to full professor in 2004 in the Institute of Mathematical

Science. Since 2012 I have been the director of the Advanced Institute for Materials Research, which was established under the World Premier International Research Center Initiative in 2007, and led promotion of mathematics–materials science collaborations. I was president (2015–17) of the Mathematical Society of Japan—the first woman president.

When did you know you wanted to pursue a career in science?

I have always enjoyed reading books, setting questions and studying them since I was a small kid. I did not know that there were professionals who make a living in research, but had a dream to lead a life full of books. I was good at and fascinated with maths and physics in school and gradually formed my future picture as a professional mathematician when I entered university, where I majored in mathematics. I never gave up on my dream.

Who or what inspired your passion and curiosity in science?

Mathematics is the language of the Universe. When you study mathematics and science, you often feel how beautifully our Universe is organised. It is full of symmetries, which give us a feeling of harmony. It is, however, not its concern to form symmetry, but only to obey the

principle of minimal action. The principle assumes all figures and motions in the Universe aim to achieve the least energy output. Why does the principle lead to beautiful symmetry? Mathematics gives answers to the question. It is mysterious why mathematics, an artificial language, can explain the mystery of the Universe. I was curious and have a passion to discover this.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

Shin-Itiro Tomonaga, Nobel laureate in physics in 1965. He was an idol when I was a kid. I was surprised and moved when I read the diary he wrote during his stay in Germany, when he was desperate to discover a proper framework for quantum electrodynamics. Even a genius like him suffered and had a hard time discovering a proper framework—but he never gave up and he put all his effort into physics. Research is searching for a lost key in total darkness. There are often no clues, no hints, only worries that we are searching for a key where it is not. But suddenly the light comes and we can see the key clearly. Researchers are happy to dedicate themselves to have such moments of discovery. He wrote several essays and all of them inspired me.

What do you think is your greatest scientific achievement to date?

Development of discrete geometric analysis and its application to materials science. Discrete geometric analysis is a discrete version of geometric analysis. Mathematics is useful in describing our world by using partial differential equations (analysis). Geometric analysis is to study analysis with geometric viewpoints. Modern technology allows us to observe and control atoms and molecules. They cannot be described by partial differential equations because they are discrete. That is why we need a discrete version of geometric analysis to meet modern science and technology needs. I enjoy developing discrete

geometric analysis so that it works as a useful tool to bridge micro and macro, or layers of different scales of matter, and apply this new mathematics to understand how microscopic structures produce useful properties and functions of materials. It is also interesting to develop mathematical notions in a discrete world.

What motivates you to work as a scientist in Asia?

I was born and grew up in Japan and have a professional position here. I stayed in foreign countries—one year in Germany at a Max Planck Institute and one year in France at the Institut des Hautes Études Scientifiques—as a visiting scientist/professor and advanced my research and networks during these stays when I was

younger. It was a fruitful time. I would like now to host young researchers from Asian countries and from countries all around the world. The institute I serve at as director is international and has around 40% international members.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

A balance between work and personal life in the early stage of my career was a challenge. Mathematics is an individual study and I was able to control my working time by myself, even when I was young. I could bring my work back home. I did not have much difficulty because I was a woman in general.



What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

Develop mathematics to understand the relation between structures and functions of materials using discrete geometric analysis. My institute accommodates both mathematicians and materials scientists and enjoy working with members to create new materials science with mathematical viewpoints. This year I started a new project to create an innovative collaborative research area for mathematicians and materials scientists. I hope it enables more researchers to join our challenge.

What would you say to young women considering a career in science?

When I started my career I had little confidence in myself. I was not sure if I was gifted enough to contribute to the development of mathematics, but I was not able to give up my pursuit of a career in mathematics. Later I found that mathematics is rich—much richer than I expected. It has a variety of challenges and many ways to develop. You do not have to worry about your potential and believe in your passion because science is rich enough to accept it.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to ‘Women in Science and Engineering’?

Japan is far behind in gender equity in society. It is ranked 114th among 144 countries in the Global Gender Gap Report 2017. The Japanese government has put much effort into changing the situation for several years but made little progress. Japan is a conforming society. People do not want to be different from others. Traditionally, women stay at home and men work outside. This image of gender role persistently remains unchanged, and the working environment is not good for women to keep both career and children. The percentage of women in academia is only 15.7%. Many universities have recently started positive actions by improving the working environment. I am in charge of the promotion of diversity in employees, researchers and administrative staff of the institute, setting the gender equality policy, promoting support for researchers with small children, establishing communication networks for women, and I started the SETI chairs for excellent women scientists. I hope this will encourage more women in science and engineering and help to change the situation.

Professor Hiroko Tokoro



Materials science

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Biography

I have a husband and a child. My husband is also a researcher at a university and always encourages me (sometimes severely!) to do research. It is sometimes hard to have plenty of time to talk to him, but whenever we have time we talk about research. With raising a child and having daily work, it is hard to have enough time to do research. However, being surrounded by a wonderful family makes me feel appreciated and happy every day.

When did you know you wanted to pursue a career in science?

When I was a student I wasn't too worried about the future. I focused on things in front of me while trying as hard as possible. That's how I kept doing research. When I realised my student life was over, I got a job as a researcher.

While I was a student, I longed to continue research, but it was when I started working as a researcher that I clearly felt determined to live as a researcher. In order to keep doing research, I had to earn a living by doing research. I then took the reality of becoming a researcher more seriously, when previously it was somewhat like a dream. This is how I aimed to become a researcher as my career choice.

Who or what inspired your passion and curiosity in science?

The first time I studied science was physics at high school, which was very interesting and fun. I came to like physics very much. The teacher taught me the beauty of science even outside the classroom. I entered university majoring in physics and I became fascinated with it through doing many experiments. The professors at my lab were all top researchers and guided me, often strictly. I always wanted to continue research. Although the personalities of the professors were, of course, all different, all of them gave passionate supervision and support to all students—including me—who wanted to become researchers. I am very fortunate to have all those teachers and supervisors when I was in high school, at university and when I started working as a researcher. This is how I could make my way as a scientist.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

This answer may disappoint you, but I haven't been very aware of the thought of role models. As I haven't thought of my senior colleagues or professors in that way, it is rather hard to answer. However, many people have influenced me and my work. For example, when I supervise my students, I picture my physics teacher at high school and professors at university and try to provide advice that was useful to me at that time. While doing research, I imagine my professors at graduate school and supervisors at work. I respect their acute sensitivities and I try to develop similar sensitivities for doing research.

What do you think is your greatest scientific achievement to date?

My research is in solid-state science. Within solid-state science, my interest is in the phase transition phenomenon, focusing on the bi-stability of substances. My co-researchers and I found a new type of light-induced phase transition mechanism, which had never been identified before. We named the mechanism 'light-induced phase collapse'. This mechanism reveals the possibility of the phase transition phenomenon of substances that hadn't been thought to be

phase-transitive substances. This discovery of the 'light-induced phase collapse' is the biggest scientific achievement of my research to date.

What motivates you to work as a scientist in Asia?

Again, this answer may be disappointing, but as I don't particularly regard myself as an Asian scientist, it is rather hard to answer. However, part of my identity is that I am Asian. I am proud to work as a scientist in Asia.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

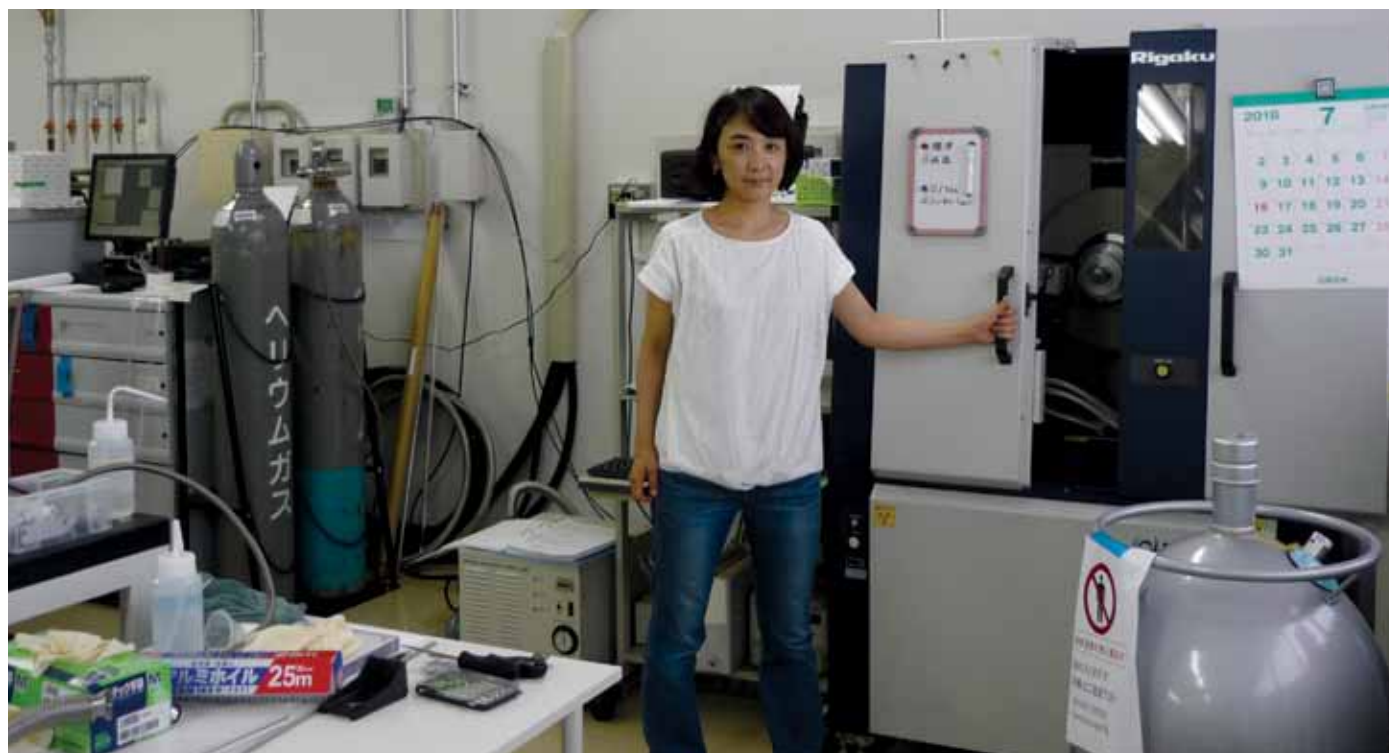
The challenges I face as a female scientist involve handling multiple tasks among life events and research (in other words, work). I can't think of any others. When I found out that I would have a baby, my colleagues and all the people related to my work congratulated me and received the news favourably. I was very fortunate. The thing is, the amount of research time I used to have has reduced drastically. I haven't found a solution for this, but right now I am trying to ask for help or trying to increase my productivity.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My research is in solid-state science. My aim is to develop the kind of solid-state substances that are ecologically friendly to the environment and that contribute to the development of human beings, both academically and industrially.

What would you say to young women considering a career in science?

If you are interested in doing research or want to continue research, I definitely advise you to do it. This may particularly apply to Japan, but in Japan, there are



many cases where women don't need to work after they are married. If a woman keeps doing research, she will inevitably face many challenges both at work and in private life. In those times, I always believe it is bad to choose the easier solution (giving up research). I always advise young people to choose the way by taking into account their long-term future rather than near future.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

I am Japanese. I believe the most important thing for women to continue working (doing research) is to have a strong heart and keep doing research while maintaining that strong spirit. It is also important that her parents and other family members don't discourage her or prevent her from doing research, even if they are worried about her life. It may sound strange, and it's not said openly, but in Japan women are rumoured to remain single or become unhappy if they choose a career as a researcher. Therefore, their parents wouldn't feel comfortable or may object if their daughter chooses science courses at school. I think providing good educational advocacy programs, which include parents, at elementary, junior and senior high school levels is an urgent issue.

JORDAN

Nominated by the Royal Scientific Society, Jordan



Professor Hanan Issa Malkawi



Microbiology and molecular biology, biotechnology

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Biography

Professor Malkawi earned her bachelor's degree in biological sciences at Yarmouk University in Jordan. She received a scholarship to pursue both a Master of Science and a doctorate at Washington State University, after which she returned to Jordan and was appointed professor at Yarmouk University.

She has been involved in research in biotechnology and its applications in environment, health, agriculture, microbiology, food and industry, and in several projects in education and linking academia with industry. She served as the European Commission's Higher Education Reform Expert for Jordan and has received several awards and fellowships. She is an active member in several national and international committees and organisations.

Professor Hanan is known for her devoted efforts in helping and inspiring young Jordanian scientists and entrepreneurs—especially women—to pursue graduate studies and research and build a career, by assisting them with mentorship, providing guidance and engaging them with society and other organisations. She is a mother of four kids.

When did you know you wanted to pursue a career in science?

I have had a passion for science since primary school. I was always scoring the highest in each class, and from first grade onwards my science and maths grades were among the highest in the school. Because I had the highest rank in the governorate of Irbid, when I graduated from school the Ministry of Education offered me a full scholarship to pursue my bachelor's degree in biological sciences. I undertook my degree at Yarmouk University, where I graduated first rank with honour, both within my department and the entire university. Yarmouk University offered me a full scholarship to pursue both a Master of Science and PhD in the US.

Who or what inspired your passion and curiosity in science?

My father, peace be upon his soul, was my role model in my love of education and science. He fully supported me to be an educated woman and travel alone to US

for my MSc and PhD degrees. This was against the norm in my extended and strict Muslim family (Malkawi), which was known at that time to not allow young, unmarried girls to leave the country. It was my first time leaving Jordan, which was a challenge for me. My father stood alone; he broke the norms of family traditions and supported me in being a true scientist. This made me even more determined to accept the challenge and continue my study and career in science. I was also fascinated with famous scientists and their achievements and inventions; for me it was an intellectual challenge.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

Several scientists and leaders have motivated me and left an invaluable influence in the trajectory of my science career, among whom are:

- Charles Darwin, who pioneered the field of evolutionary biology and said 'A man who dares to waste one hour of time has not discovered the value of life.'
- Marie Curie, the first woman awarded a Nobel Prize, and whose quote always motivated me: 'Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less.'



- Her Royal Highness Princess Sumaya bint El Hassan, a leading advocate for science as a catalyst for change in the Arab world, committed to being a true science enabler in a region where so many challenges urgently require solutions.

What do you think is your greatest scientific achievement to date?

One of my greatest achievements is in environmental biotechnology. I have been working on characterisation and investigation of naturally unique microorganisms that have adapted to live in harsh and extreme Jordanian environment (such as the Dead Sea, hot springs, polluted and contaminated areas, dry and hot environments) and using them and their products (such as enzymes) for several applications in industry, food, health, pharmacology, agriculture, energy and the environment.

Another achievement is in the field of bio-nanotechnology. My team has been able to use nanoparticles in several applications in environment and health, such as using magnetic nanoparticles for fast detection and the removal of pathogenic bacteria from water resources, and using magnetic nanoparticles in cancer diagnosis and therapy.

What motivates you to work as a scientist in Asia?

As a scientist, my motto is to encourage and mentor women and young scientists to pursue their career in STEM. I have worked continuously hard to leave a trail for young scientists who look up to me.

In Asia, women still represent a minority in science research. They still do not have many opportunities in leadership responsibility in science, both in academia and decision-making processes. I strongly believe that promoting women in science will lead to changed mindsets, eliminating gender stereotypes that have limited women's professional goals since their early childhood. I always work hard to encourage youth to study science and enrol in science-related careers.

In Asia, STEM is an ideal communication channel for enhancing social engagement and creating innovative ideas to overcome poverty and to promote peace.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

One of the challenges I have faced was when I was in a high-responsibility leadership position, vice president for research and international relations at Yarmouk University. It was the first time in the university's history that a woman has held this position, and I was the only female professor to sit on the Deans' Council and university boards and participate in decision-making processes at that time. I guess, under my leadership, I managed to let people work and cooperate professionally, as a team. My science background helped me to think and act wisely, smartly and innovatively.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

Currently, being the vice president for science engagement at the Royal Scientific Society of Jordan, my aspirations are to communicate science to non-scientists effectively and engage the public, society, policymakers and private sector in order to facilitate and contribute to the exchange of knowledge, perspectives and preferences, leading to correct and wise solutions and decisions.

What would you say to young women considering a career in science?

Believe strongly in your goals and abilities and keep working hard. Science has no borders—it is the most effective tool for peace. All sciences, including social sciences, are interdisciplinary, thus your science career should make immense contributions to human welfare.

Women have the complete package and by nature are multitasked human beings. God empowered us to have this gift. Be a role model in your science career and inspire other women and men.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?



Despite the advancements and achievements of women in science, there are still social and cultural factors that influence the equity of women in research and development. Most of the criteria with which scientists are evaluated, for hiring, promotion, speaking invitations or prizes, has been shown to be biased in favour of men. Another challenge for women scientists is the difficulty of combining an academic career with a family due to barriers against working mothers.

In my country, Jordan, although more women are graduating from universities with degrees in STEM-related fields, women still remain a minority in these fields. Progress in reducing gender gaps in some scientific subjects has been slow due to multiple barriers to change. It is necessary for social norms to evolve, employers' attitudes to change and for the education system to move away from

gender stereotyping. To support the future of gender equity in science, I recommend the following approaches: support innovative programs and research activities that create opportunities for women in STEM:

- put more women into positions of leadership
- overcome the cultural, social and economic barriers facing women
- generate the data needed to drive cultural and policy change for global gender equality
- contribute to databases that identify women scientists for positions and activities that are essential components for career advancement.

I have been involved in several events, mentorship programs and activities in promoting women in STEM.

KOREA

Nominated by the Korean Academy of Science and Technology



Professor Aree Moon



Pharmaceutical biochemistry

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Biography

I received my PhD from the Department of Biochemistry, Biophysics and Molecular Biology at the Iowa State University (US) in 1989. I have been a professor at the College of Pharmacy at Duksung Women's University in Seoul (Korea) since 1995. My main research field is cancer research, with a focus on the signalling of breast cancer progression. I have published more than 120 peer-reviewed papers in reputed journals. I have been on the editorial boards of the *Journal of Molecular Signaling* and the *International Journal of Oncology*. I received a number of awards including the Korean Order of Science and Technology Merit and L'Oréal-UNESCO For Woman in Science Korea Award. I am currently the president of the Pharmaceutical Society of Korea.

When did you know you wanted to pursue a career in science?

Ever since I was a high school student I have been interested in science, especially in biology and chemistry. When I studied biochemistry as a junior at the College of Pharmacy of Seoul National University, I knew that I wanted to pursue a career in science.

Who or what inspired your passion and curiosity in science?

My parents always encouraged me to be a scientist since I was a young girl.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My adviser at college, Professor San-Sup Lee, a professor emeritus at Seoul National University, inspired my passion in science. Dr Carol Warner, my PhD thesis adviser at Iowa State University, has been a role model during my career. She taught me how to be a good scientist and a good mother as well. My Korean role model is Professor Young-Choong Kim at Seoul National University, who taught me that academic achievement is very important. I also learnt from Professor Do-Sun Na at the University of Ulsan College of Medicine about the value of an effort to work for women scientists.

What do you think is your greatest scientific achievement to date?

My laboratory has been studying molecular and inflammatory signalling on breast cancer progression. We elucidated Ras isoform-specific signalling pathways that lead to breast cell invasion. In particular, we demonstrated that H-Ras, but not N-Ras, induced invasive and migratory phenotypes in breast epithelial cells. Our findings provide insight into the molecular basis of Ras isoform-specific interplay with flotillin-1, leading to tumorigenicity and aggressiveness of breast cancer. We also showed that signalling from an inflammatory lipid sphingosine-1-phosphate (S1P) upregulated an inflammatory C-reactive protein (CRP). Our results demonstrated the molecular basis of a crucial link between CRP and adhesion signalling, thereby providing useful information about CRP-induced aggressiveness of breast cells in the inflammatory microenvironment.

What motivates you to work as a scientist in Asia?

I decided to go back to my home country, Korea, after I obtained my PhD in biochemistry from Iowa State University in 1989. The main motivation for this decision was my family in Korea. In addition, I wished to contribute to science in my country.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I have faced several challenges and obstacles as a female scientist. First of all, I had a hard time finding a job in academic institutes. At the time, in the early 1990s, it was very difficult for a female scientist to be hired as a professor in universities. Secondly, it was not easy for me to find a balance between work and family, especially when my daughters were young. I have overcome these challenges with passion and enthusiasm for research.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My future aspirations related to science are elucidating signal pathways for breast cell invasion and identifying molecules

involved in aggressiveness of breast cancer in the tumour microenvironment. Further barriers to reaching those goals are research funding and manpower in my laboratory.

What would you say to young women considering a career in science?

To young women considering a career in science, I would say not to give up but to move forward, despite the huddles and barriers ahead of them. It is worth trying. Women have virtues such as harmonisation, elaborateness and meticulousness, which can be advantages as scientists.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or

professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

In my country, the issue of gender equity in science has been addressed by many male and female scientists for decades. Consequently, I think the state of gender equity in science is getting better, but it is not yet enough. The most urgent issue of gender equity in science is enhancing the opportunity to be hired in an academic position. It is crucial for academies or professional bodies to support a future of gender equality. I was involved in establishing the Women's Bioscience Forum in 2000, and in 2011 I was the president of the forum. I am currently a vice president of the Korea Federation of Women's Science & Technology Associations.



Professor So-Jung Park



Chemistry

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Biography

So-Jung Park is a professor in the Department of Chemistry and Nanosciences at Ewha Womans University in South Korea. She obtained her PhD in chemistry at Northwestern University under the guidance of Professor Chad Mirkin with a thesis on DNA-mediated assembly of nanostructured materials. Her PhD work was recognised by several prestigious awards, including the Nobel Laureate Signature Award for Graduate Education in Chemistry. She carried out postdoctoral research with Professor Paul Barbara at the University of Texas at Austin and joined the University of Pennsylvania's Department of Chemistry in 2005, where she was promoted to associate professor with tenure in 2012. She moved to Ewha Womans University as professor in 2013. Her current research

focuses on self-assembly of nanoparticles and functional polymers. Her achievements have been recognised by the NSF CAREER Award, the ARO Young Investigator Program Award, the Camille Dreyfus Teacher-Scholar Award and the Sigma-Aldrich Chemist Award. She is currently serving as an associate editor of *ACS Applied Materials & Interfaces* and an advisory board member for *Nanoscale*.

When did you know you wanted to pursue a career in science?

I have always known that I wanted to be a scientist, ever since I can remember. I don't know exactly why. I was a child with lots of curiosity and I thought science was like a magic key that would lead me to the answers. Growing up, science classes were my favourite subjects in school. I liked making sense of what is happening around us.

Who or what inspired your passion and curiosity in science?

I decided to study chemistry in college and went to Ewha Womans University for my undergraduate degree. I had an opportunity to participate in research, and that was when I thought that I could be good at chemical research. My task was to synthesise a series of solid-state materials with the perovskite structure. At first, the experiments seemed to have failed, as all my initial compounds turned

out to be something else. Nevertheless, I was able to explain why they crystallised into different structures, which led to my first publication. It was like solving a puzzle and I really enjoyed the experience and the sense of achievement. Although I always knew that I wanted to pursue a career in science, I became more certain about my career choice through this experience.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I feel very lucky to have had good teachers and co-workers who have inspired and motivated me throughout my career. I got my master's under the guidance of Professor Sung-Jin Kim. She is a great teacher and advisor, truly caring about students. I very much enjoyed my time in the lab as a master's student and decided to pursue a PhD in chemistry. After working at the Korea Institute of Science and Technology, I began my doctoral research under the guidance of Professor Chad Mirkin at Northwestern University. It was exciting to work in the new and emerging area of nanoscience, and I learned a great deal about scientific method and rigour from my advisor. Through this positive experience, I was more certain about going into academia.

What do you think is your greatest scientific achievement to date?

My main research focus is to develop ways to control the assembly structure and properties of nanoparticles and functional polymers. Nanoscale materials possess fascinating optical, electrical, magnetic and catalytic properties. The most interesting aspect to me is that their properties can change dramatically by placing them close together and controlling their arrangement. My lab uses the self-assembly principles in biology to control the assembly structure and properties of nanoparticles and functional polymers. We have fabricated unique assembly structures with interesting properties, such as superparamagnetic

vesicles, raspberry-like metamolecules and DNA corona.

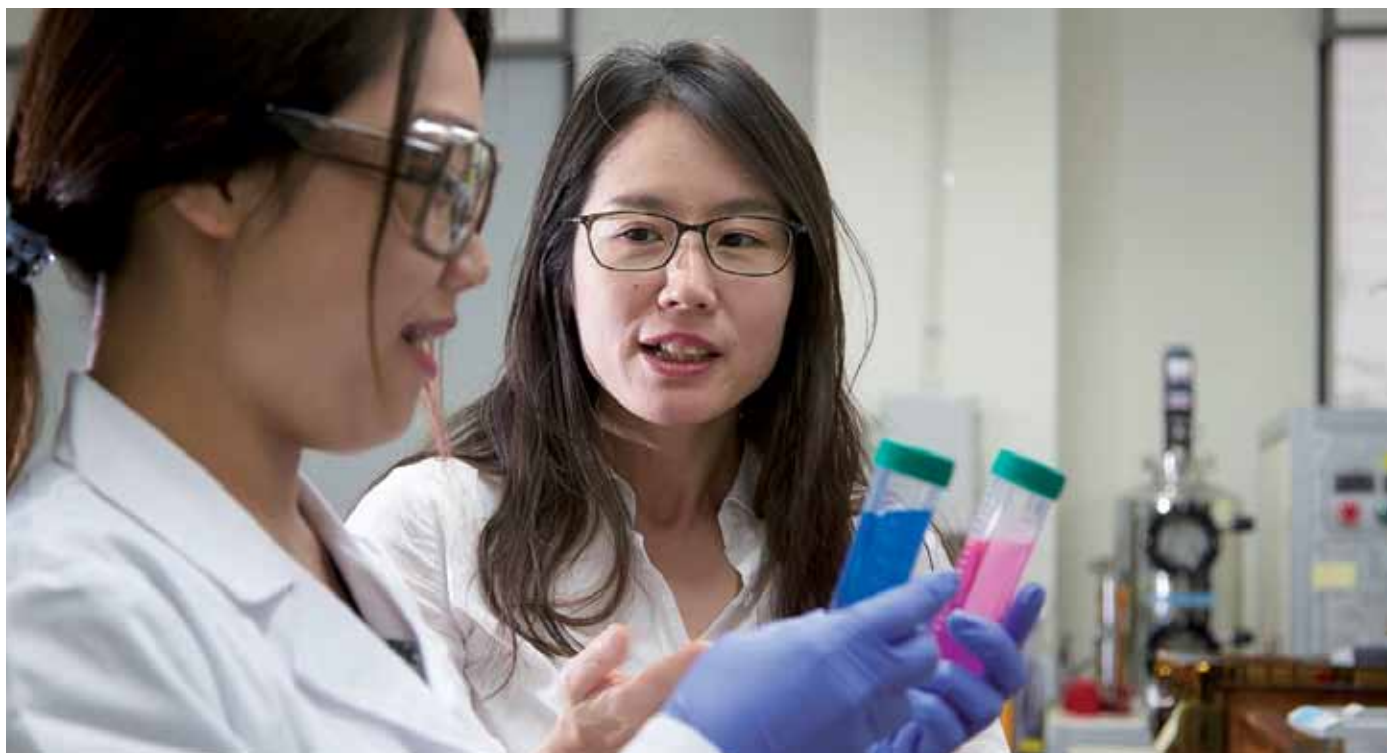
What motivates you to work as a scientist in Asia?

I started my independent career at the University of Pennsylvania. After spending eight years there as both an assistant and associate professor, I decided to move back to Korea. The main reason was my family. I am married and have one child. My husband is a professor in the College of Business Administration in the University of Seoul in Korea. We had a long-distance relationship for many years and I decided to move back to Korea, mainly to live with my family. It was not an easy move, as I had to set up my lab all

over again in a different continent, but I was confident that I could continue my research and be successful in Korea. Korea is strong in science and technology and has intelligent and hardworking people. I believe new environments bring new opportunities, and I have high anticipation for what might come next.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I am the second daughter in a family of three girls. I attended an all-girls middle and high school and a women's university. Women graduate students were not in the minority in the chemistry graduate program at Northwestern University.



I did not feel any difficulty as a woman in my life until I became a professor, when I started to notice how the imbalance in the number of males and females can affect hiring, evaluation and decision-making processes and their outcomes. I try to bring up the issue whenever appropriate with my colleagues and friends and hope that the next generation can work without this additional burden.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

Biological systems are made by self-assembly of various molecular and nanoscale materials. We are interested in building smart materials that respond to external stimuli. Stable research funding is the main issue. Besides that, I think that managing time and keeping a good balance between research and service in the scientific community is another important issue.

What would you say to young women considering a career in science?

Follow your heart and go for it!
Experiment!

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

The work environment for women has become better in Korea in recent years. However, the female/male ratio in the workplace is still quite low in Korea. This is especially true for high-level jobs. We should make efforts to implement effective policies for encouraging women scientists.

KYRGYZSTAN

Nominated by the National Academy of Sciences of the Kyrgyz Republic



Dr Stamova Rahat



Philosophical science

Leading Research Associate and Deputy Head of the Department of Social Philosophy, Aesthetics and Ethics of the Institute of Philosophy and Political and Legal Studies, National Academy of Sciences of the Kyrgyz Republic
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Biography

Striving for knowledge is a characteristic feature of the Kyrgyz people. My grandfather graduated from the madrassa in Ufa in 1911 and my grandmother took part in the opening of medical centres and kindergartens. She was a female activist, chairperson of a kolkhoz until the end of the Great Patriotic War, during which two of her sons died. My parents graduated from the Faculty of History of the Kyrgyz National University and worked as teachers, starting at pedagogical school and then at higher educational institutions. Because of war, my father did not go to Moscow (where students were sent for academic success) for a postgraduate program, but he was still

fond of science and he defended his candidate's dissertation and became an assistant professor. My uncle was among one of the founders of the National Academy of Sciences of the Kyrgyz Republic. He was one of the first academicians, professors and doctors.

When did you know you wanted to pursue a career in science?

I did not immediately come to science, although on a subconscious level I always wanted to do it. I realised that my two brothers and two sisters were much more talented, and I assumed that they would be engaged in research. One of my sisters graduated from the Faculty of Mathematics and Mechanics at Leningrad State University and worked in science for about 20 years, but life forced her to change profession. For us there has come an 'era of change'. Great influences on my choice in science were provided by my grandfather, grandmother, parents and achievements of my uncle.

Who or what inspired your passion and curiosity in science?

My father first raised my curiosity in science, he worked over his thesis every night, late after work. A love and recognition of everything new came from my grandmother; persistence and perseverance from my mother, as well as discussions about the success of Kyrgyz science—including my uncle. I was greatly

impressed by the scientific work of my adviser, Doctor of Philosophy Professor Pimenova Valentina Nikolaevna, and the atmosphere of the Institute of Philosophy of the Academy of Sciences of the USSR (now the Russian Academy of Sciences), where I was sent as a trainee researcher and where I first contacted Science with a capital S! The monthly methodological seminars of the institute, with interesting reports and arguments, were the true disputes of real scientific men!

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My years of study and defending my candidate's dissertation at the main institute in Moscow influenced my future scientific activity a great deal, as did working in the institute, where we constantly learnt from the leading figures of our science in the Republic. They passed the thorny path, being an example for those who followed. The country also had a challenging time: the transition to a market economy was difficult for a small republic and it affected our spirituality and identity. For a long time there was a deficit of information, and while globalisation and the internet did not allow us to join the world, it gave us the chance to know more by looking at the world in a different way!

What do you think is your greatest scientific achievement to date?

Kyrgyz scientists are able to consider a wealth of preserved spiritual culture, based on the achievements of the foremost thinkers of our time, to highlight main problems and advance solutions. The greatest scientific achievement is one more attempt to determine an essence of a personality. Having a global impact is a transformational process for an individual. I am working with students to identify actual problems of our time: the problem of nationalism and information society, the role of globalisation and its impact on a region, the Arab Spring, the role of civil society and its future in the region, the human problem, comparative analysis and so on. This research is embodied in monographs, articles and speeches at congresses and conferences.

What motivates you to work as a scientist in Asia?

Central Asia is my homeland. In the early twentieth century, my grandfather opened a madrasa to teach religious and secular knowledge for youth. My parents spent their life on this work and I continue the tradition. Those who know all the

problems of our region can understand an essence of our ethnos; we can protect everything that was created in our region and pass it to a new generation. Westernisation and globalisation greatly simplified adaptation to the modern world; many problems in our region are global problems. Low levels of education and knowledge are a problem for humanity. We must do everything to improve our society and the people in it.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

For a long time, I did not feel any difference as a female scientist because there was parity. After a while, a feeling of discomfort is with me because of pullback into the past. It would seem that previous developments have been gaining momentum, but I remember a spiral development where a return is coming though at a different level. In my practice, an equal treatment in all areas of life has gradually changed to distant traditional roles for women. Men dominated high positions and the last word was with them. But women shoulder the entire burden of family and children—they did not let a

newly emerged country fall apart and tried to save their families. During the past seven years, our country's policy has been aimed at increasing the importance of women, as evidenced by a growth in women in leadership roles.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

A low level of livelihood does not allow youth to choose science. Gradual improvements of the levels will lead to growth of youth in science. Connecting youth with science and education helps to raise the level of knowledge in society. Our task is to train scientific youth.

What would you say to young women considering a career in science?

For young women considering a career in science, I would advise them to be very patient and persistent, because all trends in the development of society are characteristic of science as crises become more regular. However, globalisation and the openness of other countries allows us to easily overcome the barriers inherent to my country. You can build a career by getting an education and a degree



abroad, which makes it much easier to overcome barriers existing in our region. Another way is to discover science through education. As a rule, it's a slower way, but more reliable and predictable.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

The problem is very contradictory, complicated and topical, because it remains open. Scientific research work requires logic and the ability to think rationally; it is wrong to attribute these qualities only to men. Often, the subordinate role of women in the family in traditional and semi-traditional society (and my country belongs to that) is automatically transferred to science. However, my long experience in this field allows me to disagree with this position. In my youth, I witnessed equal treatment of women in science when they considered the opinion of each person, and such a strong division by sex was not



allowed. Being in a crisis state, my country has been on the path of survival for a long time. During the past five to seven years, not without the help of developed countries, our society has been trying to solve many of the most serious problems in a civilised way. However, ethno-national, cultural and confessional features have not played a significant role in the state of gender certainty in science in the past two decades. The general rule was the predominance of women candidates in science, but not so many

women doctors of science, and female corresponding members and academicians were reduced to zero. There was a universal dominance of male managers in science and academia. A more democratic state is seen in universities and other educational institutions. The current situation can be changed by the level of the society's living standards and the degree of development of civil society to which we all aspire.

MALAYSIA

Nominated by the Academy of Sciences Malaysia



Dr Asma Ismail



Medical microbiology

Medical biotechnology and rapid diagnostics for infectious diseases

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Biography

I was born into a family that is very much related to Malaysian public health development in the 1960s, since my father was the Malaysian chief public health inspector. With this background, he always emphasised the importance of education and providing quality health for all. I began my career as a lecturer at the Universiti Sains Malaysia in 1986 and obtained my full professorship in 2000. In 2003 I was appointed as the founding director of the Institute for Research in Molecular Medicine, a national centre of research excellence focused on diagnostic technology platforms based in the Universiti Sains Malaysia. In May 2008 I was promoted to deputy vice-chancellor (research and innovation) and after that

I became a woman of many firsts: vice-chancellor of the Islamic Science University of Malaysia in 2012, director-general of Higher Education in 2014, vice-chancellor of the Universiti Sains Malaysia (one of the top research universities in Malaysia) in 2016 and president of Academy of Sciences Malaysia, also in 2016.

When did you know you wanted to pursue a career in science?

Upon completion of my ordinary levels I had a heart-to-heart with my father. Despite being good in science, I loved design and creativity and I wanted to become an interior designer. My father went into shock mode and wanted me to do medicine. After rounds of deliberation, I met my father halfway and decided to take up science as a platform to perform impactful research for the betterment of human future. I wanted to do something that could make a difference. I am a firm believer in developing indigenous technology platforms combined with novel scientific discoveries to create innovations that can provide a competitive edge for the country and improved societal well-being.

Who or what inspired your passion and curiosity in science?

My passion and curiosity were invoked through milestone events in my life.

The eye-opener event to help humanity was during my visit to a microfinance-based non-government organisation, BRAC Village, in Bangladesh in 2009. I had never seen so much poverty in my life. People were living in low-zinc enclosed homes and the village maternity clinic was shared with roosting chickens. As I sat in the 'clinic', my microbiology-trained eyes could not believe what they were seeing as the nurse gave maternity check-ups to women in their third trimester. The nurse performed rudimentary diagnostic tests for the patients simply because of the lack of electric sockets to perform advanced tests. I felt the need then to champion development of affordable diagnostics to help the poor and marginalised in low resource settings.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

In Malaysia there were very few scientists to aspire to, so I have been guided by conscience and values as to what is required to fill a need for the country. My passion for developing diagnostics for infectious diseases that affect the poor became a blue ocean strategy, since multinational companies were not willing to create diagnostics that would not sell for profit. The challenge was to generate



affordable molecular diagnostics that do not need a cold chain, are easy to perform and have no need for expensive equipment. I believe science should meet the Sustainable Development Goals and encourage the mentality of 'help me if you can' and not 'catch me if you can'. Using science to make a difference for those who need it most is what motivates me to stay in the game.

What do you think is your greatest scientific achievement to date?

As I am passionate about developing diagnostics for the poor, I studied proteomics and its application in the development of rapid diagnostics for typhoid fever. My studies on the specific biomarkers led to the discovery of an

antigenically specific protein of *Salmonella typhi*. The discovery was translated into four rapid typhoid diagnostic kits that were commercialised in more than 18 countries since 1994. TYPHIDOT, a rapid dot enzyme immunoassay for acute typhoid, generated sales, publications, improved the quality of healthcare especially among the poor, generated more than 500 jobs worldwide and supported the growth of the local Malaysian industries. In partnership with the Malaysian Technology Development Corporation, I created a biotech startup in bio-diagnostics. TYPHIDOT is my greatest scientific achievement; it helped to diagnose more than two million cases worldwide and has been acknowledged by World Health Organization.

What motivates you to work as a scientist in Asia?

Asia is a very dynamic region and if you like challenges, then it's the place for you. We have so many problems—health, water scarcity, food security, you name it—that need solutions. Once a product is commercialised it is important that the product continues to be enhanced and competitive. Experimentation inspires innovation and develops better diagnostics.

During a trip to Indonesia I was shocked to find babies less than a year old were positive for typhoid. I learnt that in parts of Indonesia, malnourished mothers did not have enough milk and used contaminated water with mashed bananas as a milk replacement. The child would later develop typhoid. I devised a test to indicate acute typhoid requiring immediate treatment. Providing solutions to real-life problems is never ending and rising to life's challenges continues to motivate me.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I am an outlier. Despite low gender parity in Asia, I do not recall facing a challenge as a female scientist in Malaysia. Even compared to when I was doing my PhD in the US, I do not feel any difference in the way I am treated. Maybe because of my attributes, personality and leadership style, I do not feel the discrimination. I do not see problems as obstacles; I try to find ways to provide the solutions. If you keep a level head on your shoulders, remain objective and work on the problem as a

team, I am confident there are ways to rise above the challenges. Being a team player, it is important to keep egos aside. Sometimes you drive but at other times you take a back seat.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

STEM is the fuel for tomorrow's economy. The way forward is to collaborate and co-create. But science alone is not enough. To collaborate there must be *trust*, a balanced integration of arts and science, to inculcate values, ethics and integrity that will create positive social change with which to face twenty-first century challenges.

What would you say to young women considering a career in science?

To all women in science, I have just three words for you: go for it! There is no doubt that the fuel of tomorrow's economy is STEM. Let us continue shaping our world towards a harmonious, prosperous and sustainable society. Keep believing that you are meant to do something great. Always use science to search for knowledge, celebrate technology as our practice and inspire innovation to improve our quality of life.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any



events or organisations related to 'Women in Science and Engineering'?

Malaysia is one of the countries that has reached gender equity in research, with 49.9% of researchers being women. Among its achievements is the fact that women make up the majority of students enrolled in undergraduate programs at a university. In that regard, Malaysia's strong emphasis on education has enabled it to overcome one of the major hurdles that many other countries still struggle with. Achieving gender equity, however, is only the first step towards gender equality. It is important that women's strong education in science, technology and innovation translate into related areas of employment. But gender disparities stubbornly persist in the workplace. In Malaysia, women in science, technology and innovation are segregated along occupational lines.

A higher proportion of women work in professions related to medicine or biology; a lower proportion of women work in physics or engineering. For example, 72.9% of pharmacists are female, while only 10.6% of professional engineers are female. As important as educational attainment is, it has little effect on the subtler forms of gender inequality like sectoral segregation. My aspiration towards this issue is to realise equality and inclusiveness to ensure that everyone has an equal opportunity in every aspect of our operation, be that academic or professional services.

Some of the involvement that I had contributed to as a judge are in L'Oréal-UNESCO For Women in Science Malaysia Fellowships, the Islamic Network of Women Scientists and as a judge for the Islamic Development Bank for Science and Technology Awards.

Dr Wan Wardatul Amani Wan Salim



Biosensors and micro/nanoelectronics

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Biography

Dr Amani is an assistant professor in the Department of Biotechnology at the International Islamic University Malaysia. She received a Bachelor of Science and a Master of Science in electrical engineering from the University of Minnesota Twin Cities in 2001 and 2003, and a PhD in biomedical microelectromechanical systems and microelectronics from the Weldon School of Biomedical Engineering at Purdue University in 2009. Dr Amani is the third of five children and the daughter of Dr Wan Salim and Jariah. She was born in Kota Bharu in Kelantan, grew up in Penang and spent almost 18 years in the US. Prior to her position at the International Islamic University Malaysia, she was appointed Principal Investigator to a NASA small

satellite project called SporeSat (www.sporesat.org). The satellite was launched into space in April 2014. Dr Amani was also a TEDxKL speaker and her talk focused on the subject of frugal innovative technologies in developing countries.

When did you know you wanted to pursue a career in science?

I only knew I wanted to pursue a career in science after my second year at the University of Minnesota. I was intrigued by the research work coming from a professor's laboratory; at that time microfabrication was still in its infancy. A dim yellow light from the microfabrication lab made me curious about how devices are fabricated in the laboratory and the white 'bunny suits' often associated with Intel fashion was something I dreamed to try. It was that moment that drew my curiosity and from cleaning glass slides, I was already right in the clean room, building interesting devices for science.

Who or what inspired your passion and curiosity in science?

I grew up in a family that loves education and knowledge. My father always bought books for us to read and my presents were always books. My parents never interfered with our reading time and always encouraged us to read. I was particularly intrigued by encyclopaedias,

and reading various books on science made me curious about how discoveries are made. So I think the encouragement from my parents to read a lot is what inspired my passion and curiosity in science. As I grew older, my passion and curiosity grew from interacting with my lecturers at the US universities. I owe it also to the US education system that allowed me to explore various fields and to experiment with many ideas and possibilities in science without restriction.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I always wanted to pursue a career in science but it was hard to find role models during my teenage years in a Malaysian boarding school. The subjects were mundane and I was looking for something more exciting. So I read a lot and the library was my hangout place, and books quickly became my window to the outside world. I was fascinated when reading about the Curie family and the list of Nobel Prize winners from that family—particularly Marie Curie, for being the first woman to win a Nobel Prize. But it was not winning a Nobel Prize that intrigued me, it was more of the impact it made on the world. I knew I had to do something significant.

What do you think is your greatest scientific achievement to date?

I was the first Malaysian to lead a NASA nanosatellite project. I was responsible for leading a group of scientists and engineers from NASA and Purdue University. I was exposed to NASA and their projects during my postdoctoral training, which enabled me to lead the SporeSat project. My main contribution was to develop a multiplex sensing platform that can measure extracellular calcium ions from a single cell of fern spore. We discovered that extracellular calcium ion from the spores can be polarised when exposed to microgravity. This work helps to answer a fundamental question about how our body senses

gravity. The challenging part of the work is the interface between science and engineering.

What motivates you to work as a scientist in Asia?

I was doing a lot of meaningful work in the US, but it wasn't until after I launched SporeSat in April 2014 that I asked myself 'what's next?' Yes, space was great and all, but I believe that there is more meaning to my science. Being more of a do-er, I search for areas that I can work in to contribute to Malaysia. The experience of visiting hard-hit flood areas in Kelantan with a group of academics was the turning point in my work. I now aim to develop devices that are not only strong in

fundamental science but can also impact humanity through providing affordable healthcare and clean water at a low cost.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Challenges I face as a female scientist include managing cultural norms, and how society perceives women who are dedicated to their work in general. When you don't follow the norms, there will always be labels of what you are as a woman, and trying to stay focused amidst all these can be a challenge. It can be harder when you are just starting to embark in the field as a junior scientist, with long hours in the research



laboratories and the investment of time and energy to make things happen. The endeavour towards science requires support (moral and financial) and understanding from family and society, and sometimes it can be very isolating. To overcome the challenge, I find myself having to share my stories with those around me, in my talks and in writing opinion pieces to the public. To overcome the challenge is to educate others on why I do what I do and why it matters.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My future aspirations would be for scientists to be engaged actively in policy and decision-making for the country and to be well connected to the R&D of various businesses. Leaders need to accept the importance of having those with expertise in science and technology involved in their planning and decision-making.

What would you say to young women considering a career in science?

The things in science that are tough and hard are what makes science beautiful. Science is a challenging field, no doubt, but is also very rewarding, for it can have a direct impact on the world. If you want to do science, just go ahead and DO it. Do not be perturbed by the toughness of the field, career prospects or perception

people have on science, but, instead, use science to educate yourself and others, and open new endeavours that can take humanity forward. Future scientists must educate society on the importance and impact science can have on various aspects of humanity, so science can have a place that it deserves.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

In Malaysia and globally there has been a decline in male student enrolment in universities and, particularly, my engineering classes typically have more female students than male. With the increased number of women enrolling in universities, there will not be a problem of female students entering STEM fields. Unlike the US, Malaysia does not have this problem; Malaysian females do not need encouragement to venture into STEM, they will enter the field regardless. Females are well represented in tertiary science education in Malaysia. However, one must not look at the representation of females in universities as the determining factor that females are well represented in

STEM and are doing well in the workforce. Malaysia still has a culture where women are mostly responsible for taking care of the household. So even if more females are entering STEM, how many are still practising after school and get the support they need?

Women are underrepresented in decision and policymaking, and many workplaces do not address many female-related issues, such as childcare (which should not be a female issue in the first place). Women are forced to make choices between family and career, and I find it heartbreaking that women are still forced into that dilemma in 2018. Learned academies should engage actively with policymakers and be in positions of decision-making, so policies are women friendly. This is needed locally, regionally and internationally. Funding should be provided for women to engage with programs that enrich them, and there needs to be safe and effective avenues for women in science to share their struggles, and for these struggles to be addressed collectively. I am involved in various organisations related to women, one of them is IChemE women in science.

MONGOLIA

Nominated by the Mongolian Academy of Sciences



Professor Tsendsuren Oyunsuren



Genetics, molecular biology

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Biography

I was born in Ulaanbaatar, Mongolia.

I graduated from Odessa State University in Ukraine as a biologist and geneticist.

I received a PhD from Eötvös Loránd University in Budapest and the Hungarian Academy of Sciences. I started my job as a junior researcher in the Institute of General and Experimental Biology at the Mongolian Academy of Sciences in 1976.

I am now the head of the laboratory and a senior researcher in the Institute of Biology, as well as a professor at the National University of Mongolia. I am also member (academician) of the Mongolian Academy of Sciences and chairperson of the Academy's Sub-Assembly of Biology. I have more than 100 publications. I am married and have two sons.

When did you know you wanted to pursue a career in science?

I was inspired by my family, especially my father, who was an entomologist and professor at the National University of Mongolia. During my childhood I often visited his department and laboratory and several times I had a part in his expeditions. He received his PhD from the Lomonosov Moscow State University in 1963. During that time a person with a PhD degree was very rare in our country and I was very proud of my father. My father was my flagship and he influenced me very much to like science and pursue a career in science.

Who or what inspired your passion and curiosity in science?

Even before my study at university, I knew that after graduation I would work in the Mongolian Academy of Sciences, the main science institution in our country. In university my professors in genetics, AI Vorobyov and TF Blankovskaya, introduced me to laboratory and field experiments and how to evaluate results. This made me very much interested in science, especially in genetics and cytology. Later, in the Biological Research Centre of the Hungarian Academy of Sciences, I learnt and gained a lot of knowledge and undertook experiments in molecular genetics and molecular biology. My (our) first publications in international journals inspired my passion in science.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My father and my teachers inspired me to like books, to love modern biology and science, to be a good researcher and to make a career in science.

What do you think is your greatest scientific achievement to date?

My research was the first accurate description of hepatitis virus spread and its genotypes in Mongolia. As a result of the work it became known that 15 to 25% of the Mongolian population is infected by hepatitis. There is a high rate of hepatitis C in blood donors, and this finding had a very important impact in preventing the spread in Mongolia. In my research work, the history and dynamics of changes in the hepatitis population were analysed, along with previously reported epidemiological data, and the social–historical background of Mongolia. It determined the time of origin and spread of hepatitis C and D in the country. These results have had much scientific and practical significance for medical practice, especially for diagnostic and treatment approaches of hepatitis viruses, as well for the development of molecular genetics and molecular epidemiology in Mongolia.

What motivates you to work as a scientist in Asia?

In Asia, which is almost a third of the global human population inhabits, science is less developed compared with America or Europe. Here in Asia we have many problems to solve, such as improving human health conditions, protecting the environment and using it properly, improving universal schooling and learning, etc. For solving those and other problems it is necessary that we develop science and technology in the region.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

We are lucky; in our country we do not have almost any problems because we are female scientists. We have all opportunities to work as a researcher successfully and be promoted if we have good scientific achievements. As female scientists we have to be very good at organising our time, because we have to look after our children and family and go through childbirth. In our constitution the laws on science, technology and other matters state that there must be equal opportunities for women and men.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My future aspiration is to strengthen science development in our country at the international level, especially in molecular genetics and molecular biology, and to seek national research leadership and international recognition through building

on areas of existing strength, fostering the development of new opportunities and broadening our base of research. For this, it is necessary to train our young researchers and upgrade laboratory facilities, and unfortunately this is very challenging due to budget deficits.

What would you say to young women considering a career in science?

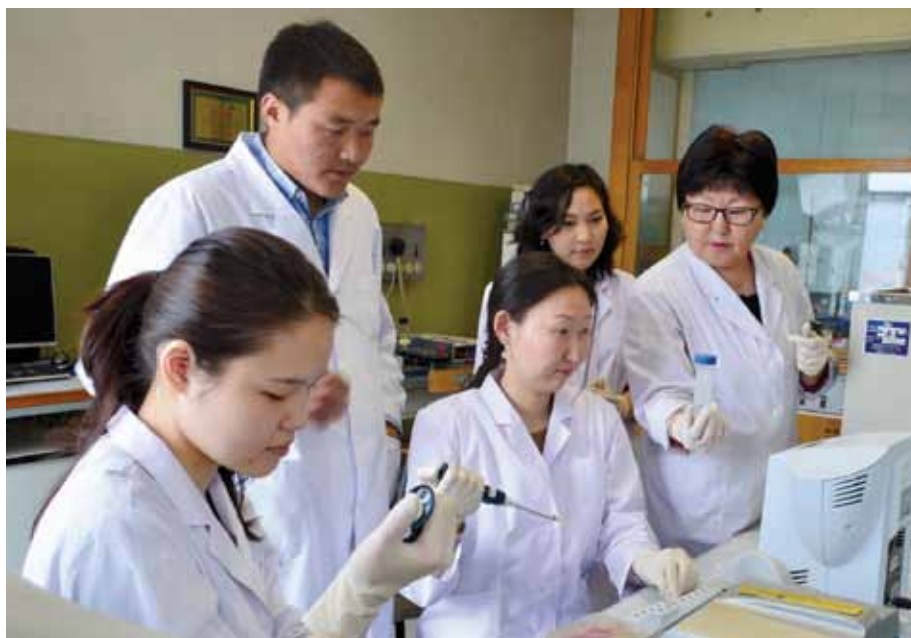
I would say to young women:

- love science, love your job
- read a lot and learn continuously
- be interested in new findings and discoveries
- develop your knowledge of science widely
- be well organised
- be a good presenter and writer

- dream of the future and brim over with confidence.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

In Mongolia we do not have a gender problem, so woman scientists are lucky that they have possibilities of success if they have aspiration. I am the president of the Mongolian Association of Women in Science.



Dr Namjil Erdenechimeg



Biochemistry

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Biography

I am a principal researcher at the Food Chemistry Laboratory at the Institute of Chemistry and Chemical Technology. I was born in a little city in western Mongolia. My dad was an engineer and is honest, ambitious, hardworking and persistent. My mother is a kindergarten teacher and is a hardworking, kind, creative and generous person. They wanted me and my siblings to grow up healthy, intelligent and friendly and they achieved this. I have 20-year-old daughter who graduated from the University of Finance and Economics (Mongolia) in 2018. She is an accountant—a serious, determined and capable person, and sometimes I learn from her. My family has always encouraged my choice.

My current research focuses on plant polysaccharides. Due to the potential therapeutic effect, biodegradability and relatively low toxicity, polysaccharides from natural sources have broad prospects of development in health food and pharmaceutical applications. Polysaccharides have become important in today's drug development. My group analyses the sources of biologically active polysaccharides from medicinal plants, and isolate and identify structural features of biologically active polysaccharides.

When did you know you wanted to pursue a career in science?

When I was a little girl I wanted to be an engineer like my dad and I dreamed of working in the chocolate factory making new sweets and chocolates in different shapes, tastes and colours. When I was in elementary school I loved reading everything, from fairy tales to science fiction novels. In the end, I developed an interest in science and wanted to know: how do things work? And why do they do that?

Who or what inspired your passion and curiosity in science?

I had good teachers at high school and they introduced me to the basic principles of molecular biology, botany, chemistry and physics. They helped me to understand that science is interesting

and that there are many mysteries in it that need to be unravelled and explained. Also, my father played a major role when I needed to choose a profession: he told me that biochemistry and biotechnology are interesting areas of the natural sciences. So I decided to study biochemistry at the Dnepropetrovsk State University in Ukraine. I consider myself a happy person because I won a scholarship from the Russian government and the Russian Presidential Scholarship throughout my undergraduate, master's and doctoral degrees.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My role models are my parents and my doctorate supervisor and the head of the Laboratory of Repair Enzymes at the Novosibirsk State University in Russia, Professor GA Nevinsky, who is the expert in the catalytic activity antibodies, enzymes. He not only taught me about being a good researcher, but also to be ambitious and to persevere and be confident in yourself.

The character and lifestyle of my parents played a major role in my life. Thanks to them, I became honest, hardworking, persistent and patient, and this led me to the success of what I have achieved.

What do you think is your greatest scientific achievement to date?

My greatest project was a doctoral study focused on catalytic activities of antibodies. Various catalytic antibodies, or abzymes, have been detected recently in the sera of patients and animals with many autoimmune diseases, where their presence is most probably associated with autoimmunisation. Normal humans or animals usually do not contain abzymes. In contrast, polyclonal antibodies from healthy humans and animals have an intrinsic superoxide dismutase activity and catalyse formation of hydrogen peroxide. The main result of my research was that electrophoretically homogeneous immunoglobulin G from the sera of healthy Wistar rats had property peroxidase and oxidoreductase activities similar to horseradish peroxidase. Based on the application of strict criteria, we proved that peroxidase and oxidoreductase activities are intrinsic properties of polyclonal abzymes

What motivates you to work as a scientist in Asia?

I love my work and I have always been passionate about what I do. As a scientist, I want to commit to using my knowledge to carry out research and develop new technologies for some of the problems affecting my country.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I received my doctorate from the Institute of Chemical Biology and Fundamental



Medicine at the Siberian Branch of Russian Academy of Sciences. When I was away from my family I missed them more than anything, especially my daughter. I was supported by my family, and this gave me the confidence I needed to achieve my goals. Balancing science and family is not easy for all women.

Like any researcher, I have had moments of frustration when you spend an enormous amount of time and effort on experiments and do not have the results that you hoped for; you feel overwhelmed and want to stop. From my experience, I believe that if you have a goal and you want to achieve success in science—and you love your work—you have to sacrifice many things and be patient.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I would like to work in interdisciplinary projects on agro-cultural, food and medical sciences. To achieve this I need funding and equipment. Unfortunately, with the current economic crisis, our government has not been able to invest in projects the past few years as we would like. However, we should not perceive this as a limitation, but rather as an opportunity to improve our proposals to be more appealing at the international level.

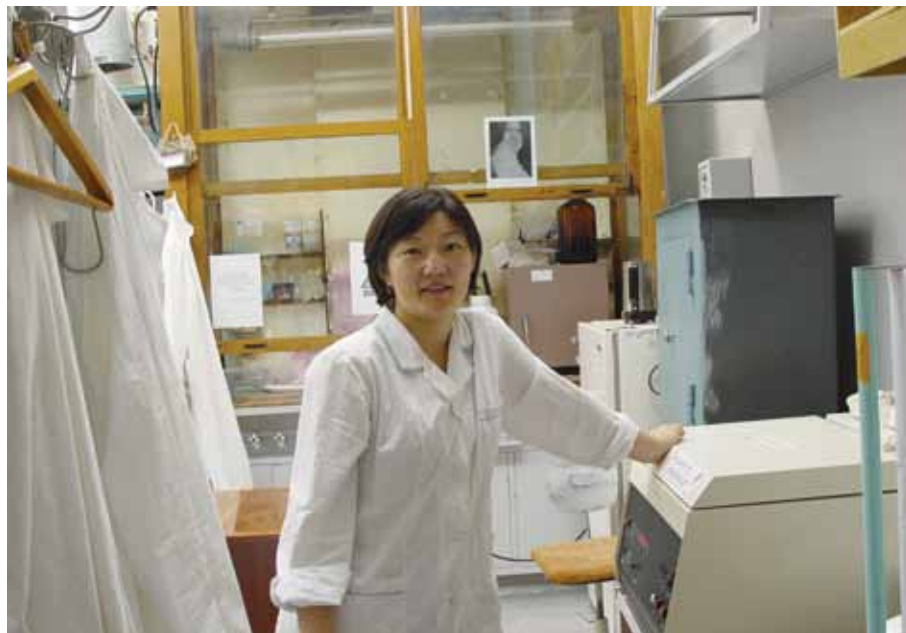
What would you say to young women considering a career in science?

Although being a scientist is not so easy, regardless of whether you are a man or a

woman, if you have short- or long-term goals and a desire for success, anything is possible. You can do it, just believe in yourself and be a brave. I think that hard work, enthusiasm and, of course, support of family and mentors will help all us to be successful, not only in science but in another areas. Science is beautiful and there are so many things that need to be figured out and invented.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to ‘Women in Science and Engineering’?

In Mongolia, there are equal numbers of women and men working in different fields of science. Women’s participation is essential for good governance of poverty reduction and for fairness in society. In general, women are dominant in education and the health sector, but not in decision-making. I have not experienced any kind of discrimination due to being a woman in a professional sphere. In my opinion, women face more discrimination in society than in science.



NEPAL

Nominated by the Nepal Academy of Science and Technology



Professor Dr Ganga Shrestha



Statistics

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Biography

I live in a joint family with my husband, mother-in-law, son, daughter-in-law and grandson. My daughter is married and settled in the US. Regarding my professional achievements, I joined Tribhuvan University in 1970 and was a chairperson of the Central Department of Statistics from 1978 to 1983. From 1990 onwards I was a professor in this department and I retired in 2011. I was awarded my PhD degree from the Department of Mathematical Statistics at the University of Delhi in 1986 and was nominated as an academican in Nepal Academy of Science and Technology in 1992. I helped found a Master of Science in statistics in Tribhuvan University. I have more than 20 scientific publications (national and international) and three books in statistics for bachelor's level. I was the team member of two

projects, one funded by the United Nation for Population Fund Award and another by the Danish International Development Agency.

When did you know you wanted to pursue a career in science?

In my family, my elder brother was the first person to choose science in his intermediate level studies, and he became a dairy technologist. I was inspired by his work. He was one of the first people to contribute to the field of dairy development in our country. At that time, I was almost sure I wanted to study science. After intermediate levels I was

willing to do engineering, but as I was a girl my family did not approve, and so I carried on my bachelor's level with physics, chemistry and mathematics. I got my master's degree in statistics under the Colombo Plan Scholarship.

Who or what inspired your passion and curiosity in science?

I had the opportunity to attend an international conference working group for four weeks in 1978 at the East-West Center in Hawaii. At the conference I had a chance to interact and learn from top demographers, and I was lucky to work with Professor William Brass from the



London School of Hygiene & Tropical Medicine and Dr Griffith Feeney from the East–West Center. Actually, my research career started then. In 1982 I participated in a conference on mathematical ecology at the International Centre for Theoretical Physics (ICTP) in Trieste, Italy. The lectures inspired me to carry on research on mathematical demography. Most of my publications are based on stochastic models in fertility analysis in contested survey and census data from Nepal. In 1985 I was awarded an associate membership of the ICTP.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My role model is Professor Abdus Salam, the Nobel laureate who established the ICTP. It is a very encouraging centre for physicists and mathematician researchers from developing countries. Many scientists from developing countries have benefited from developing their academic careers at the centre. I was very much motivated with his effort for the establishment of Third World Academy of Sciences (TWAS, now The World Academy of Sciences) and the Third World Organization for Women in Science.

What do you think is your greatest scientific achievement to date?

Being a university teacher, my greatest achievement has been producing bright students in statistics. Some of them have been assets for the development of our nation. Their contributions through teaching, medicine, engineering and



other professional fields have had a significant impact on our country. Two of my female students were awarded PhD degrees under my supervision.

What motivates you to work as a scientist in Asia?

When I hear of the contributions of scientists and technologists to their nation I feel very much motivated to do some work. In my opinion, the development of a country is related to science and technology. Different aspects of science have their own speciality for the development of a nation.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

In a country like Nepal, a female scientist has to face many challenges. The most

crucial point is that the elders are illiterate. In a joint family the elders do not understand how much hardship a professional female scientist has to face at work. In my case, as I belong to an educated family in Kathmandu, I find myself in a better position than most, although there are some social obligations that affect the academic career.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My future plan is to do research on population ageing and the number of years of potential life lost in the context of Nepal. I am interested in comparative research of provinces in Nepal.

What would you say to young women considering a career in science?

My message to young women scientists is to work hard, be focused and have a clear vision. The most important thing is to have interest in the field. Try to understand what you want to achieve and keep the habit of sharing your knowledge with others.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to ‘Women in Science and Engineering’?

I have not noticed a significant issue in urban Nepal, however in rural areas it may be different. In my opinion, priority should be given to people in rural areas so that they might be aware of the importance of science education. There should be programs launched for these underprivileged girl students. Scholarships should be given and they should be encouraged and motivated to learn science.

Professor Dr Jiwan Shrestha



Zoology (fish and fisheries)

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of Science and Technology
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Biography

Jiwan Shrestha is the ninth girl born to a simple farmer's family in a remote area of eastern Nepal, in a village named Jaljale. Her parents and other elder family members were all without education. She was schooled in the Dharan Municipality, in a girl's school that offered no science. She obtained an Intermediate education from India (Uttar Pradesh), a Bachelor of Science from Tri-Chandra College in Kathmandu and a Master of Science specialising in fish and fisheries from Vikram University in Ujjain under the Colombo Plan Scholarship. She completed her PhD in fish and fisheries at Tribhuvan University in Nepal.

When did you know you wanted to pursue a career in science?

My elder brothers and sisters studied abroad under scholarships and it was they

who advised me to study science after school. So I decided to go for science and I studied the basic undergraduate science courses with biology as my main subject. During postgraduate studies I opted to take up fish and fisheries as my major.

Who or what inspired your passion and curiosity in science?

My family members encouraged me to take up science, as there were few girls going for science courses in those days. After completing a master's in science I joined Tribhuvan University in Kathmandu as a lecturer for teaching and guiding research activities for postgraduate students in the Central Department of Zoology. Nepal is a small country but rich in biodiversity, and I was intent on establishing a fish and fisheries unit in the department. Accordingly, courses were designed and the Fishery Labs were set up. The number of students who enrolled in this unit was very encouraging, as this was a new and important subject for them. Fish specimens collected by the students from different river systems of Nepal encouraged me to study the fishes of Nepal further.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My keen interest to study and conduct research on Nepalese fishes was

boosted, inspired and motivated by my family members, and resulted in me being the first woman in Nepal to get a PhD in the subject. The topic of my PhD was *Studies on fishes of Nepal*, in which I reported more than 120 Nepalese species for the first time. The book *Fishes of Nepal* is the outcome of my PhD work.

What do you think is your greatest scientific achievement to date?

During the course of my career I undertook travels to various nooks and corners of the country in relation to my various projects on fish and fisheries, which helped me to identify 228 different fish species from Nepal. My greatest achievements to date are my published findings in the form of books and research articles in various journals. I have tried to cover most of the rivers, lakes, reservoirs and ponds of Nepal, from Terai in the low altitude to mountainous regions. However, some high altitudes are yet to be explored.

What motivates you to work as a scientist in Asia?

Because of the similarities in the biodiversity and sociocultural aspects of many Asian countries, my work in this field could be extrapolated to other regions, which could be my humble contribution to the region. My work may help to plan and formulate the policies and programs

to conserve, preserve and promote the biodiversity of this whole region.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Being a female scientist in a mountainous country like Nepal, it was necessary to undertake travels to various places despite knowing that I would have to walk on foot up and down hills and mountains in remote areas without suitable accommodation and food. I accepted the risks and challenges and used these as my golden opportunities, and I always enjoyed encountering wild animals, mountainous river floods, etc. during my field trips. When I would return home from the field, I would have no sleep in my comfortable bed and I would dream of my field trips with the sounds of raging rivers, chirping of birds and so on. I don't know how I got to sleep. This experience I shared as a popular article in the daily newspaper *Kantipur*.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My aspiration is to preserve, promote and conserve the unique endemic and native fish species of Nepal in the face of challenges such as the introduction of exotic fishes in aquaculture systems, hydropower engineering construction, deforestation and siltation. Among the identified 228 fish species, there are more than 15 endemic to Nepal. All these are unique to the mountainous river system



in their structure, behaviour and ecology, with cultural and economic values in the society.

What would you say to young women considering a career in science?

Considering the socio-economic and cultural conditions of Nepal, young women are encouraged to pursue science as it has multitudes of avenues to follow. Young women may also realise that they shouldn't remain within the confinement of the house and society.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of

gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

There is a gender disparity in general education in society, however nowadays young girls are opting for science education. This shows a silver lining in the cloud. But with hardships like early marriage and supporting the family with household chores, males are privileged to be able to pursue science courses more readily. So it is an uphill task to maintain gender equity in society. The main role of academicians should be to launch programs that aim to eradicate superstitions like menstrual stigma (chhaupadi) and female foeticide, etc. The government of Nepal already notes gender equity and the promotion of schooling and higher education in its constitution.

NEW ZEALAND

Nominated by the Royal Society Te Apārangi



Distinguished Professor Margaret Brimble



Organic and medicinal chemistry

**Distinguished Professor,
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Biography

Professor Brimble was born and educated in New Zealand and received her PhD in the UK funded by a Commonwealth Scholarship. Her list of achievements follows:

- Fellow of the Royal Society London, 2018

- Royal Society Chemistry Sosnovsky Award in Cancer Therapy, 2018
- Marsden Medal (New Zealand Association of Scientists) for Lifetime of Achievement in Science, 2016
- International Union for Pure and Applied Chemistry Distinguished Women in Chemistry Award, 2015
- Appointed by Her Majesty the Queen as Companion of New Zealand Order of Merit for Service to Science, 2012
- Royal Society Te Apārangi Rutherford Medal (New Zealand's top science prize), 2012
- Royal Society Te Apārangi MacDiarmid Medal, 2012
- Royal Society Te Apārangi Hector Medal, 2012
- Royal Australian Chemical Institute Adrien Albert Award in medicinal chemistry, 2011
- Royal Society of Chemistry Natural Products Chemistry Award, 2010
- L'Oréal-UNESCO For Women in Science Asia-Pacific Laureate in Materials Science, 2007
- President of the International Union for Pure and Applied Chemistry's Organic and Biomolecular Chemistry Division III, 2016–17

- Past President of the International Society Heterocyclic Chemistry

When did you know you wanted to pursue a career in science?

I studied maths and mainly languages at high school. I did first-year chemistry at university and loved the organic chemistry labs. We made aspirin and I was so fascinated by the fact that you can make organic compounds in the lab that can be beneficial to human life. I decided organic chemistry was a logical, organised subject but it is also highly creative. You can't beat making new molecules for the first time! After carrying out an honours research project I was hooked and knew that I wanted to do research in organic synthesis.

Who or what inspired your passion and curiosity in science?

I was always intrigued by what makes drugs work. How did they help people get better? When I started understanding chemistry and biochemistry I could piece together the complex chemistry of life and wanted to learn more. I then wanted to apply my knowledge to make new advances in medicinal chemistry and drug discovery. In my undergraduate training I was inspired by the science itself rather.

by a particular person. However, I do remember that, as a PhD student, I attended a conference in London on organic synthesis. I was so inspired by a keynote lecture given by Professor Steve Ley (then at Imperial College but later at Cambridge). His lecture was so elegant and eloquent, and I just wanted to do what he did so beautifully. He was my role model going forward, although I only met him in person many, many years later.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I mentioned Professor Steve Ley above. I was also motivated by the enthusiasm of Sir Paul Callaghan, who was a physics professor when I was a lecturer in chemistry at Massey University. He really encouraged young scientists to just get on with it and do great science.

What do you think is your greatest scientific achievement to date?

I discovered the drug candidate NNZ2566 (named Trofinetide by WHO) that is in Phase III clinical trials for Rett syndrome and Fragile X syndrome. Trofinetide has Orphan Drug status and fast track status with the US FDA (see www.neurenpharma.com). I also co-founded the startup company SapVax with US\$5.5 million investment from BioMotiv. SapVax is developing a suite of 'first-in-class cancer vaccines' based on our proprietary novel self-adjuvanting peptide chemistry platform for immuno-oncology

applications (see <https://sapvaxllc.com>). I am named as an inventor on more than 30 patents and have published more than 500 academic papers. I was truly humbled to be the first New Zealand-based female to be elected a fellow of the Royal Society of London.

What motivates you to work as a scientist in Asia?

I love the freedom of living in New Zealand. It is less hierarchical than some parts of the world. New Zealand fosters a real 'can do anything' attitude. I have also had to do more applied/commercial work to fund my academic research in New Zealand as funding for bluesky academic research is minimal. By working in New Zealand, I have learnt that necessity really is the mother of invention and I have had to have a broad mind as to what type of research I undertake.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I have always found that some of my male colleagues don't take me seriously. I have countered this by trying to perform as well as them but in the end, this didn't necessarily gain their respect. I have always dealt with any adversity by just getting on with the job and producing good science that hopefully my international peers will respect. You have to learn to rise above the local petty politics that exist in any academic institution.



What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I hope that scientists can learn to judge other scientists by their work rather than the amount of money they bring to their institution. I would also like to see less use of metrics to measure the performance of scientists, as these are very much dependent on the discipline and some scientists just choose to do research in areas where the metrics are favourable.

What would you say to young women considering a career in science?

Do what you enjoy! You get to a stage in life where you work because you love the work, not the salary. Science is ever-changing, never boring and takes you in directions you never foresee. You also get to meet wonderfully like-minded people and can work on global problems that only scientists can solve.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to ‘Women in Science and Engineering’?

I have been involved with the L’Oréal-UNESCO For Women in Science program. I have supported the journey for New Zealand to establish its first early-career L’Oréal-UNESCO For Women in Science Fellowship. I was also the inaugural chair of the Royal Society Te Apārangi¹ Rutherford Foundation, which I helped to establish to support New Zealand’s young and emerging scientists. I would like to see some special fellowships available for talented women scientists to re-enter the workforce to undertake research after a

period of maternity leave. This would enable them to quickly invigorate their research programs without teaching or administrative duties.

¹ In 2017 the Royal Society of New Zealand changed its name to the Royal Society Te Apārangi. This was done to highlight its Māori name (Te Apārangi), which means ‘group of experts’.

Professor Donna Rose Addis



Psychology

Professor, University of Auckland

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www.memorylab.org

Biography

I am a cognitive neuroscientist based at the University of Auckland. After completing my undergraduate studies at the University of Auckland, a Commonwealth Scholarship took me to the University of Toronto for my PhD. Following a postdoctoral fellowship at Harvard University, I returned to Auckland in 2008 to take up a lecturer position. Since then, I have obtained more than \$10 million in research funding. Together with my team and collaborators, I have published almost 100 peer-reviewed papers and chapters. Our work has been cited more than 13 000 times and featured by media outlets including the BBC and New York Times. I have been recognised with early-career awards, including an inaugural Rutherford Discovery Fellowship and the Prime Minister's MacDiarmid Emerging Scientist Prize, as well as Young

Investigator Awards from the Cognitive Neuroscience Society (the first recipient outside of North America/Europe) and the Australasian Cognitive Neuroscience Society. By 2016, at the age of 38, I was the youngest professor in New Zealand and the youngest ever fellow of the Royal Society Te Apārangi (New Zealand).

When did you know you wanted to pursue a career in science?

I only realised during my undergraduate studies that I wanted to pursue science, although I was captivated by the natural world since childhood (I collected and catalogued more than 800 seashells before the age of 10!). During high school, history became my passion, and I went to university to train as a history teacher. Serendipitously, I took some psychology and in the second year of my Bachelor of Arts had some fascinating classes on the brain and memory with Dr Lynette Tippett. I instantly fell in love with the brain and rearranged my degree to major in both psychology and history.

Who or what inspired your passion and curiosity in science?

I've had a strong curiosity about the natural world since I can remember and I thrive on the process of discovery: finding fragments of information and piecing them together to form a deeper understanding or create something new. This personality,

coupled with my eye for both fine detail and large-scale patterns, means I would have become a researcher in one form or another. It just is who I am. Moreover, my research enables me to weave my love of history into my science as I seek to understand how the human brain constructs rich personal histories.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I'm of Samoan and European heritage and grew up in one of Auckland's poorest neighbourhoods. No one in my immediate family finished high school, so it never occurred to me that I would become a neuroscientist. I lived with my mother, who worked long hours, and my grandmother, who cared for me and my brother. These two women are my greatest role models—they have grit and determination and work hard to achieve excellence in everything they do. And I was lucky to have the guidance of mentors at two pivotal points in my career. My teacher, Anastasia Fidow, made the idea of university tangible and exciting and I realised I could strive to be a scholar. My lecturer, Lynette Tippett, encouraged me to be brave and head overseas to realise my potential. Her integrity and dedication showed me the scientist I wished to be and I'm privileged that she is now my closest colleague.

What do you think is your greatest scientific achievement to date?

My most important finding is that the ability to imagine the future engages the same brain network as remembering the past. This exciting discovery was named one of the Top Ten Breakthroughs of 2007 by *Science*. It has led to a reconceptualisation of memory as more than just reminiscing; bits and pieces of memory can be flexibly rearranged to imagine novel scenarios that help us plan effectively for the future. It also opened the way to consider the role that 'memory' brain regions play in a broader range of psychological functions, from simulating future events to creative idea generation.

What motivates you to work as a scientist in Asia?

Working here has provided me with the opportunity to give back to my community that invested so much in my development and education. When I returned to New Zealand, I was excited to share the knowledge and expertise in cutting-edge neuroimaging techniques I had learnt during seven years in North America with colleagues and students. I involve our students in collaborations with some of the world's top researchers, not only providing them with world-class training but opening them up to the possibilities of where their careers can take them. And I am passionate about being a role model to younger people who may not have considered—or even know about—a career in science.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I find it challenging to be true to my values as a woman and as someone of Samoan heritage, where service to others is key. *O le ala ile pule o le tautua*, 'the pathway to leadership is through service'. My leadership style is nurturing and maternal and I place the needs of my trainees, colleagues and community before my own, so I have had to work hard to balance these competing demands. Also, having a leadership style that is not common in a male-dominated system of science that values competitiveness and individual success, I often feel out of place and that I must change. I have come to realise, however, that I shouldn't have to mould to the system, and by being myself and modelling a different way of 'successfully doing science' to the next generation, I can hopefully make some changes to the system itself.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My goal is to help those who struggle with imagining the future. Individuals with depression show impairments in future thinking, and my plans involve developing behavioural and brain-based interventions to enhance this. I hope to expand the cultural breadth of neuroscience research that is primarily based on data from white Western participants. Training and supporting indigenous and non-Western researchers is critical to this endeavour.

What would you say to young women considering a career in science?

My research tells us that you need knowledge and experience to imagine your future, so seek out role models for your future. It is hard to know how to envision your future as a scientist without seeing other women who are doing great science and having great careers in science. We all need something, and someone, to aspire to.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Although some aspects of gender equity in science are improving in New Zealand, there is a long way to go. Women are still a minority at senior levels of New Zealand science, such as fellows of the Royal Society Te Apārangi and major leadership roles. Moreover, the culture of implicit bias and microaggressions towards women in New Zealand science persists. Having more women on decision-making panels and committees is a start, but this isn't enough. It is very important to have men champion the cause so that the responsibility and the 'work of equity' is not pushed onto women.

Learned academies, professional bodies and institutions need to lead by example and can do so by:

- encouraging men to champion equity in science
- ensuring there is written and publicly available policies with clear diversity targets/quotas in place for selection processes (such as speaking events, nominations/elections of fellows and committees, funding decisions, etc.)
- collecting and making available data regarding gender for selection processes
- providing training on implicit bias
- adopting programs such as Athena SWAN.

I am involved in a number of 'women in science' groups in my institution and within international societies. I was involved in developing an equity charter that put into policy many of the suggestions I outlined above in one new international society.



PAKISTAN

Nominated by the Pakistan Academy of Sciences



Dr Rabia Hussain



Immunology

**Distinguished National Professor,
Aga Khan University**
professorrabiahussain@gmail.com

Biography

I come from a middle-class family with nine siblings. My father imbibed the value of education in all of us. Two of my professional achievements are a gold medal in my master's and a Commonwealth PhD Scholarship for study in Canada. After a fellowship at the Naval Medical Center and Johns Hopkins University, I joined the National Institutes of Health (NIH) in Bethesda, US. My first publication from the NIH was selected for a Berson-Yalow Award by the American Society of Nuclear Medicine. I returned to Pakistan to join the recently established Aga Khan University. Here I developed a state-of-the-art functional immunology laboratory, the first of its kind in Pakistan. A research program in infectious diseases led to more than 100 papers on mycobacterial diseases in international journals. This work was recognised at

institutional, national and international levels, with several prizes and awards, and I was listed among the top 20 most influential women scientists in the Muslim world in 2014.

When did you know you wanted to pursue a career in science?

I was an avid reader and grew up reading magazines like *Reader's Digest*, *National Geographic* and *Time*, all subscribed to by my father. This was my first introduction to the world of science. I went to a missionary school that had a very enabling environment and we had wonderful teachers. I initially wanted to become a medical doctor like my eldest brother but was unable to do so because of family circumstances. I chose microbiology as my major on the encouragement of my second-eldest brother. This was a turning point in life and my career path in science was set.

Who or what inspired your passion and curiosity in science?

My father was an academic with a master's in mathematics from a top university in Bombay and had high expectations for all of us. He was probably the greatest influence in my life. I was always fascinated by science. When I joined the Department of Microbiology at the University of Karachi, microbiology was a relatively new discipline.

The department had lots of young, well-trained faculty just returned from the West with lots of enthusiasm and encouragement for their students. When I obtained the first position in my bachelor's, I was encouraged by one of my teachers who had trained at Duke University to carry out a small research project in immunology during my master's. This project and my mentor played a pivotal role in my science career.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

The first and foremost of my role models was my father, who was a true academic in every sense of the word. He was a mathematician, a religious scholar and a poet. We were nine siblings and I ranked seventh. I never realised until later that I was growing up in virtually an academic nursery. I then had the good luck to go to a top English-medium school that had very talented teachers. My science teacher especially stands out as one who gave us the conceptual understanding of science. The passion and enthusiasm of my teachers and my mentor in university ignited my interest in research, but my true academic fathers were mentors in PhD and postdoctoral programs. I really learnt about real science from them.

What do you think is your greatest scientific achievement to date?

After having worked for 18 years in some top research institutes, I realised that the strength of research is in developing a functional viable laboratory and building a team within a research program.

My decision to return to Pakistan was an agonising and challenging one. There was little understanding of research programs and their management in Pakistan, with many bureaucratic hurdles. Keeping up to date with literature was another uphill task. Overcoming these challenges and developing a functional state-of-the-art immunology laboratory and a research program relevant to the country's need was perhaps the biggest achievement in life. My dream was fulfilled when many of my team members went on to hold key leadership positions and contribute to research nationally and internationally.

What motivates you to work as a scientist in Asia?

Working at the Johns Hopkins University and the NIH made me realise that multifaceted research programs provide the nucleus for training and research. There was an immense need to develop such a nucleus of research in Pakistan, however I was not willing to take this step at the cost of my career. I saw an opportunity at the newly established Aga Khan University, with its mission of setting international standards. My biggest motivation to stay in my country was Dr Ruth Pfau, a German nun who was running a leprosy control program in Pakistan for the preceding 30 years. She made me

realise that research is meaningful only when it contributes to your community. She served as an anchor for me to stay in Pakistan.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

My biggest challenge was being a single female, living with my mother who was old and ill. When I joined Aga Khan University, the first batch of students had to be taught and a curriculum had to be established. Unfortunately, the head of the department had resigned a couple of months earlier and I was asked to also take over the administrative responsibility of the department. This was a monumental challenge for me. There were only four faculty members of whom two were male and three were female, including me. One male member resigned, as he was himself a contender for the position, and the other transferred to another department where there was male leadership. Their resentment had long-term consequences. The key determinant in overcoming the political scenario prevailing at that time was financial independence. Support from my collaborators within and outside helped me stay determined to achieve my goal.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I would have liked to promote the Pakistan Society for Immunology to become a meaningful organisation. I have learnt a lot by being on the council of The World Academy of Sciences (TWAS) and would

like Pakistan's academy to fulfil its role as the country's highest scientific body. However, dedicated time commitment to academic activities is becoming more difficult.

What would you say to young women considering a career in science?

The challenge a woman faces is the balancing act between family and career. Time management and support from immediate family is of utmost importance. With respect to a career, mentors are extremely important in building your scientific vision. A doctoral degree is just the beginning. To be an independent investigator you need both doctoral and postdoctoral training. Choose both the institute and mentors carefully. The most important aspect in science is not the sophisticated tool but the critical questions, and these can only be asked if you are up to date with current literature.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Females are underrepresented in science academies and executive committees globally, and particularly so in Asia and the Muslim world. Meaningful efforts to increase female representation is ongoing, but this inequity starts very early in the developing world where resources

are scarce. Girls are not encouraged to even go to high school as parents feel they will not be breadwinners for the family, but a liability who will marry and leave.

The main message that needs to get through to the masses is that 'by educating a girl you educate the next generation' —His Highness Aga Khan. Electronic media can be effectively used to motivate parents and children alike but there is no replacement for the human touch. This education can be included in the women's health visitors' programs. Free quality education for all at the grass-root level is the first step in this direction and requires government will and finances rather than lip service. Proper utilisation of funds and accountability is of utmost importance.

Finally, the objectives and quantum of a curriculum are out of sync with the needs of the nation and should be designed by educational institutes with relevant skills. I am a council member and regional vice president of The World Academy of Sciences, as well as a member of the International Basic Sciences Program of UNESCO. In both committees my effort is to support deserving women scientists, especially those from the developing world, and wherever possible to increase female representation.



Dr Nudrat Aisha Akram



Botany (plant stress physiology)

**Assistant Professor, Government
College University Faisalabad**
nudrataaiaf@yahoo.com

Biography

Dr Nudrat Aisha Akram is currently assistant professor of botany at the Government College University Faisalabad and a member of the Pakistan Academy of Science (PAS). She started her teaching and research career about eight years ago. She earned a doctorate in 2011 from the University of Agriculture Faisalabad and is a recipient of a cash award for completing her PhD before the due date and a PAS Gold Medal (botany) in 2012. She was selected as a TWAS Young Affiliate in 2015 for Central and South Asia.

She has worked in a variety of research projects funded by different national and international agencies, including PAS, the Higher Education Commission of Pakistan and King Saud University, Saudi Arabia. During this period she carried out extensive research to examine the effects

of different stresses on potentially important cereal crops (wheat, rice and maize), vegetables (carrot, cauliflower, okra, pea, turnip, radish and brinjal), oilseed crops (canola, sunflower and safflower) and grasses. Improvement in crop tolerance to various stresses has been one of her major focuses of research.

When did you know you wanted to pursue a career in science?

About 16 years ago, when I was admitted to my Master of Science in botany. At that moment I really felt that I could do something for other people and connect with the whole world through the field of agriculture.

Who or what inspired your passion and curiosity in science?

Fortunately, in 2006 I joined a research group (plant stress physiology) of well-known researchers and scientists of Pakistan. They are involved in research, international collaborations, conferences related to salinity and drought tolerance in plants. They inspired me initially, as have many scientists in my field over time.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

Norman Borlaug, the 'Father of the Green Revolution'. Science is a field in which you can do something for a common people.



You can add a drop to uplift the knowledge and be remembered in literature forever. I want to explore the strategies to improve water stress tolerance in plants.

What do you think is your greatest scientific achievement to date?

My selection as a young affiliate of The World Academy of Sciences in 2015 and being admitted as a member of the Pakistan Academy of Science in 2016.

What motivates you to work as a scientist in Asia?

In Asia, drought and salinity stresses are severe problems in hindering yield production of any crop. While working with a number of crop species, I found that, in Pakistan and other parts of the world, crop productivity is mainly limited by salt stress and water stress. To understand various mysterious and complex biochemical and physiological processes that are associated with crop productivity, I have actively contributed to comprehensive review articles published in reputable journals, such as the *Journal of Plant Growth Regulation*, *Biotechnology Advances*, *Advances in Agronomy* and *Critical Reviews in Plant Sciences*.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Being a female who travels and the laborious procedure before international travel required by different travel agencies and embassies. However, I tackle it by keeping in mind that I have to do it.



What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I wish to win Nobel Prize in science. Water scarcity is a severe problem in arid and semi-arid regions. Realising maximum crop yields by utilising minimum irrigation water is one of my future aspirations. The barriers in my way are facilities and funding for projects.

What would you say to young women considering a career in science?

Science is the only field where you can implement your ideas for a better future for people. By doing this you will be remembered forever in the literature

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to

address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Yes, gender equity is a problem in society, but I think not in science. Science depends on brains, ideas, problems, research, findings, interpretation and outputs, not on gender, in my view. I am also full member of the Organization for Women in Science for the Developing World.

PHILIPPINES

Nominated by the National Academy of Science and Technology Philippines



Dr Lourdes J Cruz



Biochemistry and toxinology

National Scientist, National Academy of Science and Technology, and Professor Emeritus, Marine Science Institute, University of the Philippines Diliman
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Biography

Lourdes J Cruz obtained a Bachelor of Science in chemistry degree from the University of the Philippines in Diliman in 1962 and a PhD in biochemistry from the University of Iowa in 1968. She worked at the International Rice Research Institute before moving to the University of the Philippines in 1970. Her awards include the Sven Brohult Award (1993), the ASEAN Outstanding Scientist and Technologist Award (2001) and the L'Oréal-UNESCO For Women in Science Award (2010).

She is a founding member and second president of the Philippine Society of Biochemistry and Molecular Biology and was member and chair of the ICSU Regional Committee for Asia and the Pacific from 2012 to 2018. In 2001 she established a program to harness science

and technology to help alleviate poverty in poor rural communities and indigenous tribes in Bataan through conservation, reforestation and bio-resource management. Her newest project is on establishing a Future Earth Philippines program for sustainability.

When did you know you wanted to pursue a career in science?

I first recognised my aptitude and interest in mathematics and science when I was in grade six and this was reinforced by the general science, algebra, trigonometry and physics subjects we took in high school. In college I enrolled for a bachelor's degree in chemistry and enjoyed the required courses in chemistry, physics, mathematics, chemical engineering, electrical engineering and mechanical drawing and the elective course on mineralogy.

Who or what inspired your passion and curiosity in science?

My father was a chemist and he taught my elder sisters how to make vinegar and soap. We played cooking in small clay pots, prepared extract from the leaves of a vine, which gelled when allowed to stand under the sun. My playmates and I unsuccessfully tried to prepare perfume from jasmine flowers. We observed and played with spiders, beetles, cicadas and dragon flies and watched caterpillars eat

leaves. My lead teacher in grades five and six inspired me to be serious with my studies because she was a good teacher, kind and encouraging. Likewise, my high school teachers inspired me to do well in mathematics and science classes. My choice of a Bachelor of Science in chemistry as a course in college came naturally, without pressure from my parents.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My first role model in pursuing a career in science was Dr Clara Lim-Sylianco, my bachelor's thesis adviser under whom I studied the inhibition of trypsin by kidney bean extracts and found the presence of a competitive inhibitor of the enzyme. Then my first boss after college, Dr Bienvenido Juliano of the Cereal Chemistry Department at the International Rice Research Institute, where we studied rice quality as a function of amylose and protein content. Dr Baldomero M Olivera (formerly of the University of the Philippines College of Medicine, now at the University of Utah) showed me the joy and excitement of doing research and served as a collaborator, mentor and role model in scientific productivity. We isolated many *Conus* peptides, some of which are now used as

pharmacological tools for studying how the brain works and models in drug development.

What do you think is your greatest scientific achievement to date?

My greatest scientific achievement (done together with Dr Olivera and other collaborators) is our discovery of the venom of *Conus* marine snails as a cornucopia of highly potent and very specific neuroactive peptides acting in a variety of ion channels and receptors. Among the early peptides isolated were α -conotoxins (specific for acetylcholine receptors on muscle membranes), μ -conotoxins (acting on voltage-gated sodium channels) and ω -conotoxins (specific for presynaptic N-type calcium channels) from *Conus geographus*, the killer snail. The drug PRIALT was developed by Neurex and Elan from a synthetic ω -conotoxin we isolated from *Conus magus*. Today, many research groups in different parts of the world have studied more than 110 *Conus* species and characterised more than 6260 neuropeptides out of a possible 200 000 peptides from more than 700 species.

What motivates you to work as a scientist in Asia?

Asia, particularly the Philippines and Southeast Asia, has a high biodiversity that remains largely untapped. The bio-resources of the region provide excellent opportunities for research and development of natural goods for drugs and other commercial products. Additionally, there are many opportunities, problems and challenges unique to the

Philippines and the region that require the use of a concerted effort in science, technology and innovation for the benefit of the people and countries. About 10 years before my retirement I started working with the indigenous tribe of Aytas at the Bataan National Park with the aim of harnessing science and technology to help alleviate poverty in the community. My recent grant from the government is on establishing a Future Earth Philippines program, enjoining the scientific community and other sectors to work together for the country's sustainable development.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I did not experience any discrimination against females while in college at the University of the Philippines, in graduate school at the University of Iowa or along my career path. I suppose my remaining single and having no children is an advantage in pursuing a science career, but most women scientists must contend with the demands of family responsibilities. At least one of my most talented former students has opted to just do part-time work while her daughter is growing up. Data on women along the science career path in the Philippines indicates a 'leaky pipe', similar to what has been observed in other countries.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I am involved in two projects implemented by the National Academy of Science and

Technology, both relating to the improvement of scientific development. My project on establishing a Future Earth Philippines program aims to use science to contribute to the attainment of the Sustainable Development Goals in the Philippines, considering its vulnerability to natural hazards, loss of bio-resources and high level of pollution.

What would you say to young women considering a career in science?

Science is exciting and if you have an aptitude for it and you enjoy doing research, I advise you to pursue a scientific career. There are many research problems that one can work on and it does not matter whether one does basic or applied research, as long as the science is good. To overcome the hurdles of doing science in a developing country, try to find a support group with whom you can discuss science freely and explore its wonders. While still young, focus on a subject matter that you can pursue in depth.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

The state of gender equity in science depends much on the field of science and the culture of the country. Among the countries in Asia, Malaysia and Philippines

have the highest participation of women in science. The traditional role of women in society is still the predominant factor that limits women's participation in science and technology in many countries. In the Philippines, where we have relatively few researchers per million people compared with other countries, the loss of women along the 'leaky pipe' represents a huge waste of talent and loss of educational investment. We must provide mechanisms that allow women to pursue their scientific career vigorously even when raising a family, by having universities and research institutions provide day care centres for children of faculty members, for example. Institutions should provide a system that will make it easier for women scientists to go back to active research work when the children no longer need full-time attention. Professional organisations can draft policy recommendations for government research institutions and policymakers. They can also be involved in influencing industry to hire more women scientists, provide flexibility in working hours or a work-from-home scheme, etc.

I have given four talks on women in science and technology during women's week and co-organised a symposium to discuss the country report on Women in Science and Technology in Asia.



Dr Maria Corazon Abogado De Ungria

Molecular biology, forensic genetics

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Biography

I was born into a middle-class family to Remigio De Ungria, a chemical engineer, and Segundina Abogado, a dentist, the third of four children and the only daughter. I earned my Bachelor of Science with honours in biology from Macquarie University in Australia and my doctorate in microbiology from the University of New South Wales. When I returned to the Philippines in 1998 I was appointed to head the DNA Analysis Laboratory, a position that I continue to hold today. I received various awards in recognition of the laboratory's pioneering work to promote the use of forensic DNA technology and to study the genetic diversity of different Philippine populations, including small indigenous communities. I presently hold a University Researcher V position, the highest level in the University of the Philippines, and a Career Scientist II rank from the Department of Science and Technology

and Civil Service Commission of the Philippines.

When did you know you wanted to pursue a career in science?

I discovered that I had a passion for science when I studied at the Philippine Science High School, a government-sponsored school designed for scientifically gifted students. Students were required to take 'research' as a subject and were expected to be involved in every facet of a project—from devising a research question to securing funding, doing the research and recording and interpreting the results. I enjoyed the sense of empowerment that research gave me. I knew then that if I pursued a career in science research, I would be at the forefront of exciting discoveries that could potentially help improve the lives of the Filipino people.

Who or what inspired your passion and curiosity in science?

I was inspired to pursue a career in science by my parents who, through example, taught me the value of hard work with a purpose that must be higher than self. As a child, I was always trying to find reasons for everything and searching for order amidst chaos. In those early years, I was able to satisfy my yearnings



for reason and order by immersing myself in science. When my parents realised this, they persevered to provide me with an enabling environment to be the best that I could ever be. They fully supported my personal journey towards finding my path of service to the Filipino people and the rest of the world, through molecular biology and forensic science.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I have two principal role models who contributed to my development as a scientist. First, Professor Adrian Lee, my PhD supervisor at the University of New South Wales, is an inspiring leader who knew how to motivate his students to strive to achieve their goals and aspirations. Under his able mentorship, my passion for scientific discovery was nurtured in a highly dynamic and productive research environment. Second, Dr Saturnina Halos, founding head of the DNA Analysis Laboratory, taught me the value of communication and of taking action. Good ideas will remain as such if they are not taken to the next level, which is action, regardless of the obstacles along the way. Both Professor Lee and Dr Halos are visionaries who work passionately to achieve their dreams of a better tomorrow.

What do you think is your greatest scientific achievement to date?

The most notable contribution of my career is the Rule on DNA Evidence, which was promulgated in 2007 by the

Philippine Supreme Court. I worked tirelessly with the Research Group of the Philippine Judicial Academy to incorporate in the Rule as much relevant science as possible, including a section on post-conviction DNA testing. This Rule recognised the utility of forensic DNA evidence in court proceedings. I am also proud of the development of the DNA Analysis Laboratory, which was created in 1996 to 'support law enforcement agencies, to conduct DNA analysis and forensic diagnostic services, academic research and such other related services'. To date, the laboratory is recognised as a leader in conducting forensic genetics research, training and extension services in the Philippines.

What motivates you to work as a scientist in Asia?

After returning to the Philippines in December 1998, I became aware that relatively few Filipino scientists per million inhabitants were actively engaged in research in the Philippines compared with other countries. Hence, I was personally motivated to work in the Philippines and in Asia in order to address this gap in my own way. I chose genetics for forensic applications and population studies because of their evident contribution to the legal and social arena. Because of my work, I am able to travel and learn about the plight of many Filipinos of all social classes, creeds and ethnicities. I would then review the social relevance of our research and modify the project if needed. I would also link relevant agencies that could assist in addressing some of the problems I observed.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Unlike in some countries, female scientists are well respected in the Philippines and many have occupied key positions responsible for the governance of science and technology. The main challenge I faced in my career, which also affects the scientific community regardless of gender, is the lack of scientific and administrative positions in the laboratory. Scientists are unable to focus on research when they are given too many administrative tasks that could have been better assigned to other personnel. This has been partly addressed by the Scientific Career System of the Department of Science and Technology and the Philippine Civil Service Commission, which encourages scientists to concentrate on research as their principal activity. The dearth of long-term funding, delays in the release of research budgets and the deficiency in the support network for management of research projects also pose significant challenges to the laboratory.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I would like to expand genomic studies to all willing volunteers to characterise genomes across all Filipino populations. I would like to better understand the genetic basis of health and disease, our common origin and adaptations to changing environments. Due to its nature, this research would have to pass an ethics review process to ensure that the subject's rights are protected.

What would you say to young women considering a career in science?

Fall in love with science and work to overcome challenges that you would encounter—patiently and systematically. Let your passion for your work speak for itself and those around you will know that you are a woman of science. Foster an attitude of inclusivity and openness to new ideas in order to find diverse and creative solutions to our nation's problems, so that we can work together to achieve our common goal. Commit to using science for a purpose. In my case, I have defined my role as a changemaker by placing (genomic) science at the service of society.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

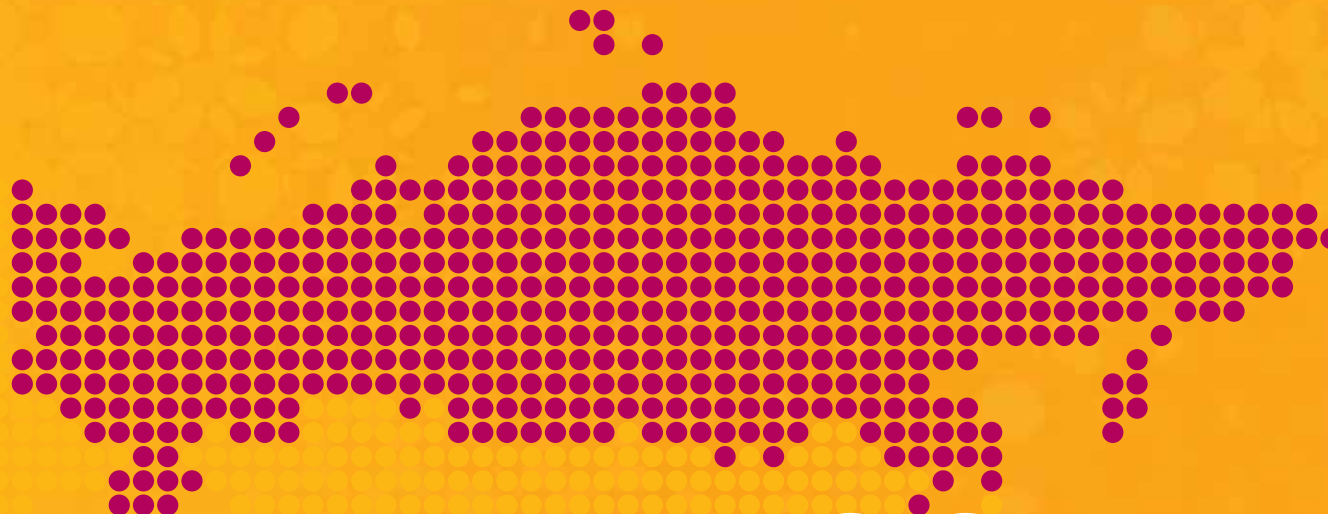
Gender inequity is not a problem in the Philippines, but many female scientists find it challenging to return to active research after starting their families. During this time, opportunities for women scientists to collaborate in scientific research should be made available. Professional societies should strengthen their networks in order to facilitate different platforms for research collaborations. Institutions should recognise the value of these



collaborations during evaluations of the female scientist's performance. In recognising and crediting the contributions of female scientists during different periods of their careers, we will foster an enabling culture for women to continue pursuing rewarding careers in science.

My involvement in the advocacy of women in science has been through my own life story, by providing an example that I hope will inspire young women to pursue a career in science. I received the Outstanding Women in the Nation's Service award in 2007, the Outstanding Woman Researcher in the Life Sciences from the Third World Organization For Women In Science in 2009, was named as a National Fellow of the L'Oréal-UNESCO For Women in Science program in 2011 and one of the Pioneer Women

Scientists during the 'She for We' exhibit of the Department of Science and Technology in 2015. During lectures for young people in different provinces and urban centres, I shared the struggles and victories in my career as a female forensic scientist who returned and stayed in the Philippines to find order where there is none and to help answer life's questions through science.



RUSSIA

RUSSIAN FAR EAST

Nominated by the Far Eastern Branch of the Russian Academy of Sciences

Professor Natalia Besednova



Immunology

Chief Researcher, Research Institute of Epidemiology and Microbiology named after GP Somov

Biography

Professor Besednova is an academician of the Russian Academy of Sciences, a doctor of medical sciences, a professor, an honoured worker of science and laureate of the USSR State Prize. She has authored 15 monographs, more than 250 journal articles and has 22 patents for inventions. She has supervised 27 PhD theses and been consultant of five doctoral theses. For 22 years she was the director of the Research Institute of Epidemiology and Microbiology named after GP Somov. She chairs the Scientific Council for Medical and Physiological Sciences of the Presidium of the Russian Academy of Sciences. She is a recipient of the Order of Honour and the Order of Friendship of Peoples.

When did you know you wanted to pursue a career in science?

I began my scientific career in Vladivostok in 1959 after graduating from the IM Sechenov First Moscow Medical Institute. I started as a junior researcher in the institute and I still work in it (I am 83 years old).

Who or what inspired your passion and curiosity in science?

I had an excellent scientific supervisor, academician GP Somov, who fascinated me and my colleagues with the most interesting problems of infectious pathology. He headed research on a new problem: Far East scarlet fever. For its development (research on aetiology, pathogenesis, clinic, prevention and treatment) as a part of the research team, I was awarded by the USSR State Prize.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

After completing work on the problem of pseudotuberculosis (scarlet fever), my colleagues from the Pacific Institute of Bioorganic Chemistry of the Far Eastern Branch of the Russian Academy of Sciences and I engaged in interesting objects—biologically active substances from hydrobionts of the Pacific Ocean. Most of all I was interested in the issue of

immunity management, related to which the laboratory staff, under my leadership, created and investigated the mechanism of action of a number of new immunomodulators. We derived sulphated polysaccharides of marine algae of new correctors of lipid metabolism, original adjuvants to vaccines and functional food products.

What do you think is your greatest scientific achievement to date?

Results of the study of the immunology of pseudotuberculosis (Far East scarlet fever), fundamental and applied studies of biopolymers from marine hydrobionts.

What motivates you to work as a scientist in Asia?

I am interested in getting new results that will be useful to people. It is interesting to work in Vladivostok because there are large scientific institutions focusing on marine issues, in cooperation with which it is possible to solve interesting and important problems for medicine.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I have never had a problem in science as a woman; we have an equal attitude to scientists of both sexes. As the moment, all Russian scientists have problems with the law on science and scanty funding.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I'm 83 years old. I want to help my students to exist in our difficult world and to write several monographs (I have thoughts and materials for these). I want to finish research on new adjuvants and present them to the scientific community.

What would you say to young women considering a career in science?

Unfortunately, many women doctors are now leaving the profession and working in pharmaceutical companies as agents for the distribution of drugs. I have chaired the State Examination Commission at the Pacific State Medical University for many years. At a solemn meeting dedicated to the awarding of diplomas, I always tell graduate students that science classes are the best in their life. The most important thing is that every day you are happy to go to work and tremble with impatience to look at the results of yesterday's experiments. In the evening have the same joy to go home to your husband, children and parents. This is happiness. I've been happy my whole life.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?



I believe that there should be no discrimination regarding the role of women in science. You can find the smartest and most talented women and men who are not working in science. Both men and women can be generators of new ideas and be excellent executors. The same applies to 'workers'. It's quite another matter that men tend to seek leadership roles, which is why there are so many heads of scientific institutions among them. If women did not need to give a lot of time to raising children or to housekeeping (often very difficult issues for various reasons), there would be many more Doctors of Sciences, academicians and high-level managers among them. Fortunately, in Russia, women are working to combine family responsibilities and research duties.

Dr Yulia Tatonova



Genetics of parasites

Senior Researcher, Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of the Russian Academy of Sciences
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Biography

I obtained my PhD in 2016 and formed a team of responsible colleagues. All of them are still students (bachelor, master or PhD students), but, in my opinion, we carry out more interesting studies together. Now we are working on a project supported by the Russian Science Foundation (project RSF No. 17-65-00004) that deals with epidemiologically significant trematodes, *Clonorchis sinensis* and *Metagonimus* spp., in the Amur River Basin. I am married and my husband helps me at all levels of my career. He believes that I'm smart and I have to match his opinion.

When did you know you wanted to pursue a career in science?

I think I wanted to become a scientist when I was 15 years old, but my first salary as research staff was less than 100 dollars. And, unfortunately, from 2008 to 2010 I had to work as a manager. However, this experience has also become useful in my life.

Who or what inspired your passion and curiosity in science?

Dr Tokmakova Nataliya Pavlovna was the first to open a door to science for me. I remember her lecture about immunomorphology at our high school. It was very interesting, and I asked Dr Tokmakova about where she works. I decided that I would study at a university where there is such a wonderful teacher.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I think this is my mother. She is a strong woman and always says that I can do more. It seems that I always hear her voice in my head that says that I should not relax but move forward. And, of course, a lot of other great people in my life (family, friends, teachers, my students, etc.) have contributed small pieces to the real me. I am a lucky woman because I have a job that I find so interesting. I think it is more a hobby than work.

What do you think is your greatest scientific achievement to date?

I think that my greatest scientific achievement will be in future, but I am proud that I was able to organise several expeditions for the study of parasites in the Amur River Basin. It is a little-studied area, so it is important to focus our attention on it and try to assess the diversity and features of the epidemiologically important parasites of this region.

What motivates you to work as a scientist in Asia?

I love my city, Vladivostok, and want to work here. I think that there are a lot of territories in the Asian part of Russia that remain unexplored. Being able to cooperate with neighbouring countries is very interesting. I have good colleagues and friends from Vietnam, and we are planning various projects. I hope that in the near future I will start working with colleagues from other Asian countries, because we can compare our results to achieve comprehensive studies.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Many people, including women, won't understand why you want to be a scientist, especially if you say that you plan to become doctor of science.

They say that you should want to be a mother. I like children but I am not ready to bear them. Right now, I prefer to study the surrounding world. Generally, I believe there are no special differences between men and women in any profession in my country. We are equal. If you want to be a scientist, you can be. It only depends on you.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

First, I want to cooperate with colleagues from other countries. Secondly, I want to create my own team of younger researchers from my country and help them to be good scientists. We will need to search for new sources of financing for our projects. There are not many serious obstacles to progress a goal if you go step by step.

What would you say to young women considering a career in science?

Do you want to be a scientist? You can! I believe you can be successful in any profession that you choose. Sometimes a goal looks so elusive, but you just have to take the first plunge.

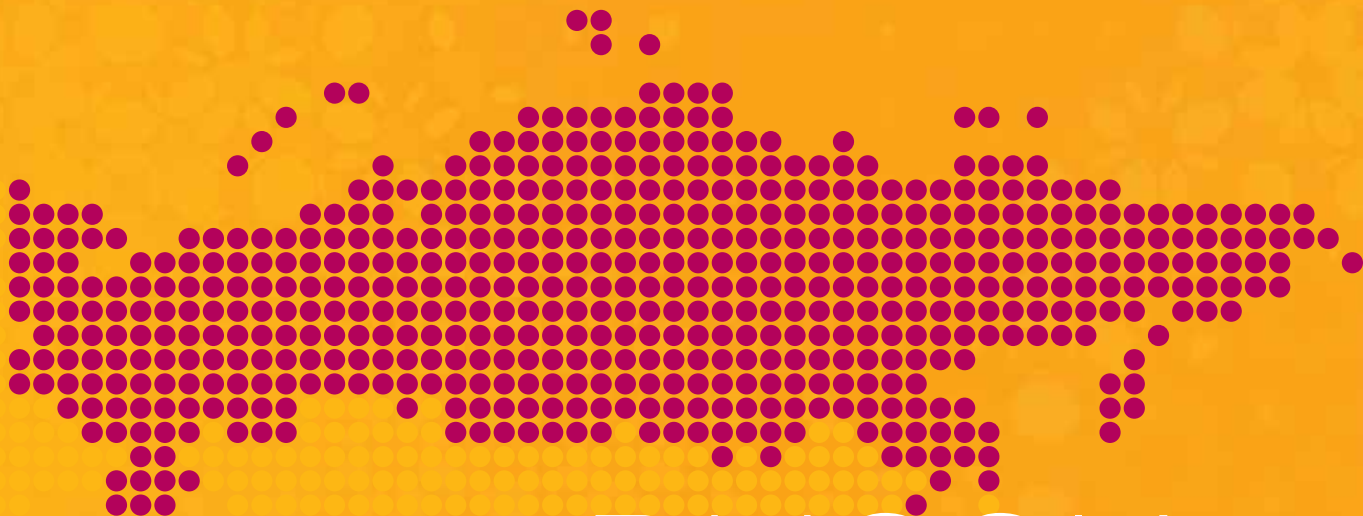
What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the



role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

In my country, in my opinion, there is no problem with gender equity. For example, almost all of my students are girls. They are smart and successful. There is no

doubt that women in Russia and many other countries have additional responsibilities, such as childrearing, cleaning, cooking, etc., and have less time for their career than their husbands. Thus, I believe that it is important to begin gender equality not from science but from family. We should understand that each girl or boy has the right to be happy.



RUSSIA

SIBERIA

Nominated by the Siberian Branch of the Russian Academy of Sciences

Dr Elena Bagryanskaya



Chemical physics

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Biography

I was born in Kyrgyzstan in a family of seven children. I graduated from Novosibirsk State University in 1981, defended my PhD thesis in 1985, habilitation in 1998 and became a professor in 2002. Since 2012 I have been the director of NN Vorozhtsov Novosibirsk Institute of Organic Chemistry and the institute's head of the Department of Physical Organic Chemistry. I specialise in physical chemistry, the development and application of new magnetic resonance methods for the study of mechanisms of chemical reactions. I have authored more than 170 scientific articles, six monograph chapters and more than 400 abstracts at international

conferences. I am member, vice president and president of various expert societies in my field, expert of the Russian Science Foundation and the Russian Federal Property Fund and an awardee of the Japan Society for the Promotion of Science Fellowship. Fifteen PhD theses and more than 25 student diplomas were defended under my leadership.

When did you know you wanted to pursue a career in science?

I have loved physics and mathematics since I was young. When I was in middle school I took a distance learning course provided by Novosibirsk State University, as they provided such courses for motivated youth. I was deeply interested in physics and I enrolled at Novosibirsk State University, majoring in chemical physics. Over time my research topics have shifted, but I believe in the basic joy of being a scientist, that is, to have the possibility to discover something new or to find something that nobody has found before, which is such an exciting challenge.

Who or what inspired your passion and curiosity in science?

I had very good physics and mathematics teachers at school. In addition to school lessons we had tutorials for children who were interested in special subjects, called electives. It was very interesting to build

my knowledge and read additional journals and books on physics and chemistry. There was a special journal for children, *Quant*, that published very interesting articles about achievements in physical and mathematical science. In the USSR we also have special competitions for pupils in different subjects. I always participated in these competitions and was lucky to be win several times, not only in our local region but also in the capital of Kyrgyzstan.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

Most of the professors teaching at Novosibirsk State University are well-known scientists in different fields who combine their university teaching work with research work in the institutes of Russian Academy of Sciences. In the Voevodsky Institute of Chemical Kinetics and Combustion there were several great scientists who contributed a lot to physical chemistry. I was lucky to work on the field of spin chemistry with Professor Renad Sagdeev and Professor Yuri Molin. My knowledge of engineering came from Dr Yuri Grishin, with whom we created several new experimental setups. I collaborate with many scientists all over the world, and several of them are great scientists like Professor Robert Kaptein,

Professor Bargon, Professor Klaus Morbius and Professor Yamauchi.

What do you think is your greatest scientific achievement to date?

The most interesting results are developments of several highly sensitive new techniques for the detection of short-lived radical pairs in solution. One of these methods is based on electron paramagnetic resonance and nuclear magnetic resonance and is called 'stimulated nuclear polarisation'. Another is the observation for the first time of electron-nuclear spin polarisation and our investigation of electron spin relaxation in very low and zero magnetic fields. Recently, we showed for the first time that it is possible to measure nanometre distances in biomolecules at room temperature using pulse dipole electron spin resonance (previously all experiments were performed at nitrogen and helium temperatures). I very much like our results showing that radical-controlled polymerisation can be ruled out using protonation and complexation with metals. It allows for obtaining materials with interesting properties.

What motivates you to work as a scientist in Asia?

I was born in Central Asia (Kyrgyzstan) and then I moved studied in Novosibirsk State University in Akademgorodok, a world-known scientific centre. We have good infrastructure for science and technology and a university of a very high level. The scientific level of Siberian Branch of the Russian Academy of Sciences (which belongs to Asia) is very high and very

attractive to scientists all over the world. I should say that our institute has very diverse international cooperation with the US, Germany, Switzerland, Poland, France, Japan, China and others, funded by many countries—Russia, the US, Japan, the European Union, etc.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

The main challenge is how to combine family and a scientific career. I have two children and five grandchildren. My husband is a professor in plasma physics and heads a laboratory in the Budker Institute of Nuclear Physics. I am very happy that my husband understands me and that we share all duties at home and care about our children. When I had my first daughter in the last year of my

PhD, it was hard to find a PhD position. Finally, I got on and defended my PhD after three and a half years. Until last year I was the only female director of a scientific institute in the Siberian Branch of the Russian Academy of Sciences. I feel there is a difference between me and male directors in our relations with officers of the Academy, but after several years of successful work in this position most of my colleagues are used to me and have respect for me.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

It is a great enjoyment to do scientific work. During the past few years I have started several new projects investigating biopolymers in cooperation with biologists. These are very exciting and



need a lot of time. At the same time, I have to do a lot of administration, which also takes a lot of time, so I work on weekends and nights trying to combine both my duties as Director and scientist.

What would you say to young women considering a career in science?

Science is great and very exciting, and a very enjoyable profession. Every day you can discover something new and you can learn something about nature that nobody knew before. If you are a careful and motivated worker, you will have a chance to be lucky enough to discover something that could change the life of humanity (like the internet, cell phones, aeroplanes and so on). Believe in yourself and be a hard worker. Open your eyes wider—try to find the hottest scientific field most interesting for you.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Gender equity in science has been better in the past few years but is it far from ideal. There are many reasons for that; partly it is determined by nature and traditions—women are responsible for giving birth and taking care of daily life. In Russia the situation is quite good, in chemistry and biology there is nearly equity in students and postdocs, but later



male scientists advance much faster in their scientific career. In mathematics and physics the number of male students and postdocs are significantly higher than females, probably because these fields of science are traditionally a male in Russia.

I am the leader of Federal Organization of Graduate Women of Novosibirsk Region (www.fuwr-nsk.ru), which was established in 2016. Our activities are aimed to motivate girls to enter science and to show scientific achievements successful women in science. We organise the festival 'Academina', where each year such women of Novosibirsk are selected and awarded special prizes. We also organise meetings where successful women and phycologists discuss the problem of how to combine scientific work and family. I also take part in an ICSU Gender Gap in Science project

'A global approach to the gender gap in mathematical, computing, and natural sciences: how to measure it, how to reduce it?'. It is very important to take part in this project and reply to the questions on the website: <https://statisticalresearchcenter.aip.org/cgi-bin/global18.pl>

Dr Elizaveta Alemasova



Biochemistry, DNA repair

Junior Researcher, Laboratory of Bioorganic Chemistry of Enzymes, Institute of Chemical Biology and Fundamental Medicine, Siberian Branch of the Russian Academy of Sciences
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Biography

Dr Alemasova's parents are scientists, her mother in plant biology and her father in physics. She is married and her husband is also a scientist in the field of bioinformatics. She has received the following awards and fellowships:

- Award for winning the 'Academina' contest in the field 'My first scientific discovery', 2018
- FEBS bursary for participation in the 42nd FEBS Congress, 2017
- Science/innovation award for young scientists from the City of Novosibirsk, 2017

- Travel grant from the Mikhail Prokhorov Foundation for participation in the 10th Quinquennial Conference on Responses to DNA damage, 2016
- Educational fellowship from the president of the Russian Federation to young scientists and PhD students for 2015–17
- FEBS Young Scientists' Forum grant for participation in the 14th Young Scientists Forum and 2014 FEBS–EMBO Anniversary Conference, 2014
- Award for winning 'Simply about Complicated' contest, 2013

When did you know you wanted to pursue a career in science?

I was born and live in Akademgorodok, a science city in Siberia founded in 1957 to gather in one area the best scientific minds in Soviet Russia. My parents, both enthusiastic about science, moved to this legendary place and were fascinated by its unique atmosphere: more than a dozen research institutes located almost in the forest, and the majority of residents are scientists from different fields, from nuclear physics to cytology... Growing up here, I never considered a career in science as something extraordinary—it was the normal state of things. Snatches of scientific discussions are heard on the street and the people around are clever, cultured and rapt in their work, their science.

Who or what inspired your passion and curiosity in science?

The most fascinating thing about a scientific career is that your work becomes more and more interesting over time. It may be said that science itself inspires your passion for research. The more you study your subject of research, the more captivating and elegant puzzles it offers for further investigation. It happened to me; I suppose it could happen with anyone who can find and admire the beauty—science is like life itself.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My parents instilled in me a taste for intellectual activity, rationality and a search for simple and elegant solutions. Such personal qualities as independence and creativity of thought are among the traits most appreciated by my family. My elder brother, endowed by these hallmarks, was a role model for me growing up. I feel blessed to have as a role model a top-notch woman in science, my scientific supervisor Olga I Lavrik. She inspires me not only by her very successful career, but most of all by the personal example of an amazing woman striking the perfect balance between unflagging energy, brilliant mind and excellent appearance.

As she says, work should give you joy, and if you want to stay always young, you should live in such a way as to have no spare time.

What do you think is your greatest scientific achievement to date?

My research is devoted to 'the third nucleic acid' of eukaryotes, poly(ADP-ribose) (PAR). The mechanics of lightning-fast PAR synthesis at DNA breaks by PAR-polymerase PARP1, with its following functioning in the organisation of DNA repair foci, is extremely elegant. As one of the key gatekeepers of genome maintenance, PARP1 protein is one of the most promising targets in cancer treatment. The most interesting discovery during my scientific work was finding that PAR metabolism may be regulated by oncoprotein YB-1 at different levels. In particular, YB-1 can be modified by PAR and to significantly increase PARP1 activity. Our finding means that ineffectiveness of DNA-damaging drugs in this case may be due to YB-1 ability to stimulate PAR synthesis and subsequently DNA repair.

What motivates you to work as a scientist in Asia?

I love my country and the pine forest is my greatest love, so I want to live and to work here, especially since young scientists in Russia are now receiving government support. Other than this obvious benefit, the motivation (and the second the most fascinating thing in science!) is the almost unlimited opportunities for the application of different skills and talents within the only profession. Is it not great to design and perform experiments, read a lot of



interesting literature, write and illustrate your own articles, to improve your English and the skill of public speaking, participate in different contests and festivals, to give lessons and travel all over the world—for one job? I think that any work with similar potential for self-perfection in such different areas should be considered at least as magical!

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Traditionally, biochemistry is one of the favourite fields for female scientists and,

accordingly, the number of women working in our institute is significantly higher than the number of men. Maybe this is the reason why I still have not faced any challenges as a female scientist. On the other hand, I can find additional inspiration by participating in special projects for women in science, which are becoming more and more popular nowadays.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I would like to continue my study of YB-1 and poly(ADP-ribose) within the context of intrinsically disordered ‘dancing’ proteins and their role in liquid de-mixing events in the cell, and to learn how to write review articles applicable for publication in top journals.

What would you say to young women considering a career in science?

If you want to have a job that you will love more and more every day—choose science!

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to ‘Women in Science and Engineering’?

I have never met with difficulties due to gender inequity in science. In my opinion, the only problem related to this issue is the following: today young scientists in Russia are holding an advantageous position compared to their elder colleagues, as the government endeavours to attract more talented young people in the area of science and innovation. You can be considered a young scientist until 35 years of age, and for women this interferes with the best childbearing years.

This year (2018) I took part in ‘Academina’, a festival organised by the Federal Organization of Graduate Women of Novosibirsk Region and the Novosibirsk branch of the Federation of University Women. The aim of this event is the promotion of women’s careers in science, professional education and other economic sectors of the Novosibirsk region. I am very grateful to the organisers, as the festival really inspired and motivated me. To be a woman in science—it’s amazing!

SINGAPORE

Nominated by the Singapore National Academy of Science



Professor Jeak Ling Ding

Life sciences

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Biography

My research has focused on host–pathogen molecular interaction and innate immunity since the start of my career in 1984 at the National University of Singapore. I have used experimental models that span an evolutionary distance of 500 million years, from horseshoe crabs to humans. I have led my research projects mainly at the Department of Biological Sciences, with some collaborations among colleagues within the National University of Singapore and overseas. Over the years, I have successfully competed for major research grants, enabling my team to continually train, support and lead students and young researchers. Many of these researchers have become highly successful independent scientists worldwide. While I enjoy unravelling the fundamentals of innate immunity, I maintain a keen interest on translating our discoveries to biomedical innovations and healthcare applications. For example: www.theatlantic.com/science/archive/2018/05/blood-in-the-water/559229/

When did you know you wanted to pursue a career in science?

My childhood was enjoyed in a humble home where games and toys were made with much imagination and creativity from scratch, using simple and recyclable materials such as matchboxes, egg shells, seeds and twigs. A most sophisticated experience was holding an old fallen-out lens over a straw mat that ‘curiously’ focused the sunrays and caused a fire—a very frightening experience, though. I realised then that simple materials developed in a laboratory can hold great promise; it almost created a hellfire at home. That exhilarating experience for

a six-year-old was perhaps the spark to a lifelong research career.

Who or what inspired your passion and curiosity in science?

My home environment, school, college, parents, siblings, schoolmates, teachers and professors have inspired and instilled a great passion and excitement for science. The sense of giving back to society by making novel findings and translating them into real-world applications is very important, that is, being accountable for the financial support provided by taxpayers. The interest aroused in my students and their keenness to learn and emulate was



extremely gratifying and encouraging. An example of curiosity- and hypothesis-driven research is the unravelling of the cryptic immune defence role of haemoglobin (it does more than carry oxygen). This discovery was very rewarding and exhilarating. See more: www.nature.com/doi/10.1038/nr1501

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

- Roslyn Franklin, the dark lady of DNA. Despite gender bias, she made monumental discoveries that lent necessary insights into solving the DNA structure.
- Rita Colwell of the University of Maryland, US, who works on marine biotechnology.

What do you think is your greatest scientific achievement to date?

The first is the genetic engineering of recombinant Factor C (rFC), which has been commercialised as PyroGene. This is a sensitive and specific test for biological pyrogens to provide quality assurance for parenteral drugs for approval by the US FDA, to be used in the healthcare industry. The advent of rFC also assures conservation of the highly endangered horseshoe crab species.

The second is the hypothesis-driven fundamental research that unravelled the molecular and cellular mechanisms underlying host pathogen interactions and innate immunity. We have traced the evolutionary origin of innate immune

defence controlled by complements, NFkB/IkB cascades and the hemocyanin-haemoglobin (over 500 million years, from horseshoe crabs to humans). Our research findings have significantly advanced the field of innate immunity. Our findings are published in *Nature Immunology*, *The EMBO Journal*, *Proceedings of the National Academy of Sciences in the United States of America*, *Blood Journal*, *Trends in Biotechnology*, *PLoS Pathogens*, *The FASEB Journal*, *Free Radicals Biology and Medicine*, the *Journal of Immunology*, *Cell Death & Differentiation* and the *Journal of Biological Chemistry*.

What motivates you to work as a scientist in Asia?

Asia is home. The National University of Singapore is extremely supportive and keen to nurture and help researchers to excel. There are new and competitive opportunities and research funding available.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

A major challenge was building and maintaining a robust laboratory (alongside teaching undergraduate students, training PhD students and administrative tasks) and simultaneously nurturing two children at home. I was very fortunate that I overcame many struggles by having strong and consistent family support. Seeing my students excel, and concurrently seeing my children grow and become responsible humans, greatly diminished the challenges.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

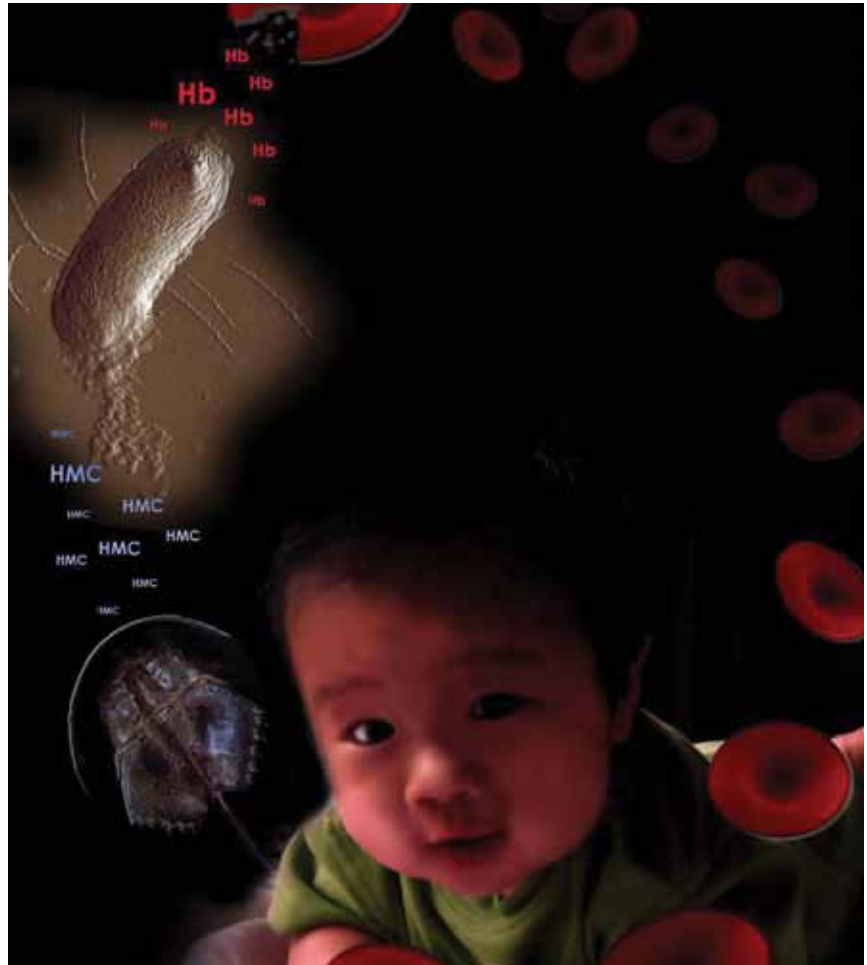
I am applying the knowledge we have accumulated on innate immune/frontline defence to cancer immunomodulation. Infection/injury-mediated chronic inflammation creates a tumour microenvironment even as immune-responsive cells defend the host from microbial invasion. Many of the innate immune responses act in parallel to combat infection and to provoke or suppress tumorigenesis, depending on the fine balance between immune overreaction and suppression. So how can we summon and turn innate immune cells against cancer?

What would you say to young women considering a career in science?

It is not impossible to do good quality research and at the same time bring up a family. Strong family support is, of course, a bonus. Persevere and never give up, even in the midst of challenges. Enjoy each moment of successful and exciting new findings and the next one will be even bigger and better. Make every piece of work a masterpiece.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Overall, we have approximately 10% female academic staff. There are efforts to attract more ladies into the scientific workforce. There are various small communities of 'women in science' who run workshops and seek to promote science and research to women. I was an invited speaker at the WO+MEN fEST, where we shared our research life and experiences to an audience of men and women scientists. I have also taught a freshman module using women scientists as role models. This class was extremely well received, not just by the girls but also the boys. I also mentor junior women assistant professors and encourage and enable them in their early careers, leading to their promotion to associate professors.



Dr Jingmei Li



Human genetics

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Biography

Dr Li's research has been published in internationally acclaimed medical journals such as the *Journal of the National Cancer Institute* and the *Journal of Clinical Oncology*. She is prolific in her quest to fill in the blanks in the DNA 'book of life' with regards to genetic determinants of breast cancer and women's health. She has co-authored more than a hundred peer-reviewed articles in top-tier journals. She is a recipient of a Career Development Award (2013) from the Singapore Agency for Science, Technology and Research Joint Council Office, a L'Oréal-UNESCO International Fellowship (2014–15), multiple institutional grants and awards from private

foundations in Sweden (2016) and a Singapore National Research Foundation Fellowship Award (2017). She received the Singapore Women's Weekly Great Women of Our Time Award (Science and Technology category, 2017) and the Singapore National Academy of Science Young Scientist Award (2017). She credits all the women who contributed to the large-scale studies with time, blood and samples, without whom none of the work would have been possible.

When did you know you wanted to pursue a career in science?

When would I know if I wanted to marry a certain man? There were a few candidates... I went out with a few and decided this choice was for me. Seriously, I believe in giving different careers a chance. I took up many different courses offered by different faculties and interned at various companies before deciding that I was ready to take up science as a career.

Who or what inspired your passion and curiosity in science?

I credit my parents for stashing away a set of children's books on science and engineering in the corner of a very high shelf (why they did it remains a mystery). They were so colourful, so forbidden and so tempting to get my hands on! Day after day I tried to reach those books. Day after

day I failed. Until one day, I finally got my grubby fingers on the boxed set of books. Within the pages were pictures of architectural wonders, cars, rockets and the outer space. I was hooked.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

Kamila Czene: professor, mother of a daughter, fashionista, trend setter and shining example of a woman in science! She is more a friend than one's boss, and she cares about every member of the group. I have been in groups where meetings span hours, leaving everyone drained, but Kamila skims research updates in her own way—'knock knock, how's it going, I kill you!' This was a joke, but she did say it once when I spent too much time on one analysis, and it was funny and effective.

I receive comments from other groups on how we manage to churn out high-impact publications so quickly. The answer that pops into my head is that we have an A-team, led by a formidable principal investigator with amazing scientific prowess, and we all enjoy working with her. If science and women bring hope and foster discovery, Kamila Czene will be the face of the year.

What do you think is your greatest scientific achievement to date?

My goal is to understand the risk factors of breast cancer in the multiethnic Asian population of Singaporean women and to translate the understanding to a more cost-effective breast cancer screening/prevention program. I am intrigued by mammographic density as a risk factor for breast cancer. High mammographic density confers a four- to six-times higher risk of breast cancer compared to low mammographic density, which is not far behind the greater-than 10 times increased risk of smoking that is associated with lung cancer. However, most women have never even heard of this risk factor. I would consider it a scientific achievement if I could improve the lives of women with this new knowledge.

What motivates you to work as a scientist in Asia?

Under the aegis of a National Research Foundation Fellowship carried out at the Genome Institute of Singapore, my studies aim to address the rising breast cancer incidence in Singapore and lukewarm response to mammography screening (low participation and adherence) by integrating mammographic density, lifestyle and genetic data. While lifestyle factors have been studied for many decades in Western populations, the full range of genetic factors for breast cancer and how they can be combined with other risk factors such as mammographic density to best predict risk in Asian populations is still unknown. My research

program will concentrate on understanding mammographic density as a step towards identifying women at high risk of breast cancer in Singapore. These are the women most likely to benefit from regular mammography screenings (early detection) and other early prevention programs.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

‘There is a special place in hell for women who don’t help other women.’ —Madeline Albright. Not all resistance along the path of success will come from men. Among other things, the colour of my skin, cultural and language barriers and communication problems can be the source of frustrations. Patience and effective communication skills are virtues I am learning to cultivate.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

The Nobel laureate Tim Hunt said, during a talk not so long ago, that science teachers at elite schools were given one instruction: make them interested. I was certainly interested. The challenge is to groom research leaders who can, in turn, groom new researcher leaders (and keep them interested!).

What would you say to young women considering a career in science?

While men and women are fundamentally different, science is genderless. Both men and women work together for the good of mankind. Science flourishes because of the different approaches that men and women take to solve problems.



What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

The obvious way to have more women in science or in any industry is to combat some deeply rooted social norms. The ability to multitask is like a badge that many women wear proudly. Women are considered successful if they can be a brilliant scientist and a caring mother and homemaker at the same time. Men are considered successful if they do a good job at work. It seems unfair, but it doesn't have to be. More recognition could be given to men at home so that women are also allowed to rise to their fullest potential in the workplace. And it can be done. For instance, in Sweden women and men are obligated to help one another in responsibilities at home as equal partners. Parents are entitled to 480 shared days of paid parental leave, of which 90 days are reserved for each parent and are non-transferable. It is common for fathers to be pushing prams while out on a run or feeding their babies in cafes or parks. Let both men and women have a chance to shine at home and at work!

SRI LANKA

Nominated by the National Academy of Sciences of Sri Lanka



Professor ADL Chandani Perera



Chemistry

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Biography

I received a Bachelor of Science with honours (chemistry) from the University of Peradeniya, and a Master of Science and PhD from the Tokyo Institute of Technology. I am a professor and the chair of physical chemistry in the Department of Chemistry at the University of Peradeniya. My duties include teaching physical chemistry and some administration. My research interests are in liquid crystals and low-cost, naturally available filter materials for water purification applications. I was elected a fellow of National Academy of Sciences of Sri Lanka and I am the chairperson of the Board of Study in Chemical Sciences of the Postgraduate Institute of Science. My outstanding research achievements have resulted in an h-index of 19, more than 2900 hits for research papers, seven international and local awards, more than 45 peer-reviewed papers and 75

communications. I am married and have one daughter, who is reading for a computer science honours degree at my university. My husband is a businessman running his own business.

When did you know you wanted to pursue a career in science?

In school I had no interest in arts subjects; my favourites were chemistry, physics and mathematics. I liked the teachers who taught those subjects. As I was good at mathematics my teacher always asked me to sit near her table during term tests as other students disturbed me by asking for answers. I got distinctions for pure and applied mathematics in my General Certificate of Education ordinary level and was chosen for the mathematics stream for advanced level. I was admitted to the Faculty of Science at the University of Peradeniya. I then decided to become a scientist and specialised in chemistry.

Who or what inspired your passion and curiosity in science?

Laboratory experiments in chemistry and physics and my school teachers inspired my curiosity in science. My father taught mathematics in the school and motivated me to learn mathematics and science. I am in the position I am due to the strong foundation I had in science and mathematics in school and university. The research on liquid crystals—the fascinating

behaviour of delicate phases of liquid crystals—was very interesting and motivated me to work in liquid crystal science and technology.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

Professor Savithri Kumar, professor of organic chemistry, is the influencing role model in my career. She is now retired and emeritus professor in our university. When I entered the university there were very few female teaching staff in the chemistry department. I was highly impressed by this young lady lecturer's teaching and research capabilities. She is the one who guided and encouraged me throughout my academic career. All other senior professors in our department also motivated me in various ways. All of my Japanese supervisors are very kind and always encouraged and guided me throughout my stay in Japan. I am still continuing collaborative research on liquid crystals with my supervisor, Professor A Fukuda.

What do you think is your greatest scientific achievement to date?

My greatest scientific achievement is the discovery of fascinating tristable switching and antiferroelectric liquid crystals, which have interesting applications in flat-panel

liquid crystal displays that I made during my doctoral studies under the supervision of Professor A Fukuda. Two Japanese companies constructed a prototype antiferroelectric liquid crystal television display. This discovery was recognised globally, opening up many new and exciting research paths. I received the Tejima Kinen Award from the Tokyo Institute of Technology and an award from Japan Display for the discovery. My collaboration with Professor JK Vij and Professor A Fukuda at Trinity College at the University of Dublin led to new discoveries in new subphases in liquid crystals.

What motivates you to work as a scientist in Asia?

I owe to my motherland for giving me a free education in primary, secondary and tertiary levels, and I feel that I am indebted to my country. I selected Japan for my higher studies and after obtaining a doctorate in engineering 1990 from the Tokyo Institute of Technology I returned to Sri Lanka and the Department of Chemistry at the University of Peradeniya. I have been working there enthusiastically ever since. Although I had opportunities to work in other countries, I returned home to serve the country as a successful scientist getting the fullest job satisfaction. I am also a mother and a wife enjoying a happy family life. I got the fullest support from my husband throughout my career. My mother and sister also helped to take care of my daughter when I was away from home.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

The major challenges I faced were lack of funding, equipment and infrastructure to continue liquid crystal research after I returned to the country. However, I received funding from the government to continue research, completed seven research grants and supervised more than 25 Masters of Science, five Masters of Philosophy and two PhD students. I also carried out research by collaborating with professors in foreign universities, especially in Japan and Ireland. I didn't face many problems in my life as I got the fullest support from Japanese professors and colleagues while studying there and from my family here. I feel that I balanced both professional life and family life successfully and managed to do teaching, research and administrative work (as head of chemistry, chairperson of the Board of Study in Science Education of the PGIS, chairperson of the Faculty Research Committee and many other university committees and boards) in maximum capacity. However, sometimes I feel that women's efforts and contributions are not being rewarded and recognised sufficiently by our society, and that adequate numbers of women are not in decision-making posts.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

While continuing my career as a scientist I want to promote science among school children and the young generation and

educate and guide young women for science careers. Some women science graduates do not continue their studies or select a science career after marriage. Awareness programs to reduce attitudinal, social and cultural barriers among young female science graduates should be conducted.

What would you say to young women considering a career in science?

Young women entering a science career should be able to face any challenge, balance career and family life and be able to adapt to any environment quickly. They need self-confidence, leadership qualities and a passion to do research in science. There is a trend of more girls being selected for Bachelor of Science (Honours) degree programs than boys in our science faculty, and also more girls are entering higher studies than boys. Overall admission rate of girls to our university has been higher than boys over the past 20 years. Young women science graduates should overcome structural and attitudinal barriers and advance in their career.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

There is gender equality in the academic staff and non-academic staff in our faculty

of science and no shortage of women scientists in Sri Lankan universities. However, women scientists in leadership roles in administrative positions are limited inside and outside of the university system. It is partly due to the unwillingness of female scientists to take on a massive responsibility while attending to family responsibilities. There is no intimidation but, in general, women scientists in our country are reluctant to take over responsible decision-making posts due to attitudinal, cultural and social barriers and gendered socialisation issues in the society.

We have gender inequality in engineering due to structural barriers. In our country, money for research is limited and there are more prospects for men receiving research funding. There is no gender equity in some workplaces, especially in the private sector. Here, women scientists are discouraged because of shift work, maternity leave, etc. There is no mandatory paternity leave in Sri Lanka. Recently, the University Grants Commission formed a Standing Committee of Gender Equity/Equality



for the simultaneous conceptualisation of gender equity and equality in the university system. We have to introduce gender-friendly policies in the education system and in the whole country. It is necessary to have awareness programs in school and home environments to reduce all types of barriers and make a gender-equitable society.

I am a member of the Sri Lanka Federation of Graduate Women in Kandy. Recently, the Sri Lankan National Chapter of the Organization for Women in Science for the Developing World was established. I became a member of it and hope to work towards society gender equity/equality.

Dr Nadeesha Manohari Wickramage



High energy physics

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Biography

I am the only daughter in my family and I have one brother. I am married and my husband is working at the United Nations Environment Programme in Geneva, Switzerland. I am the mother of seven-year-old daughter and I hold a Bachelor of Science (Special) degree in physics with first-class honours. I was awarded the Wasantha Mohotti Memorial Gold Medal

by Dr J Mohotti, an award for the student who scores the highest marks at the physics special degree examination. In November 2013 I completed my PhD in the field of high energy physics at University of Ruhuna. My research was undertaken in the Compact Muon Solenoid experiment at CERN in Switzerland. This is the first PhD produced from a Sri Lankan university in the field of high-energy physics.

When did you know you wanted to pursue a career in science?

In school I liked mathematics the most, so I chose the mathematics scheme for my advanced level exam. After researching university courses I decided that I wanted to study physics as my degree. Luckily, I got a chance to participate the summer program at the world's largest particle physics laboratory. From then I was eager to see the exciting world creation behind the science.

Who or what inspired your passion and curiosity in science?

My curiosity about science began after visiting the most powerful particle accelerator ever built, the Large Hadron Collider. The purposes of Large Hadron Collider are the study of Standard Model

of particle physics and the search for new physics in the tera electron Volts energy scale.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

Dr Archana Sharma, the woman senior scientist working at CERN, is both the best role model in my life as well as my PhD supervisor. I haven't seen anyone like her; her strength and leadership is amazing.



Witnessing her remarkable strength often has made me motivated to build a path in science.

What do you think is your greatest scientific achievement to date?

I have received the President's Award for Scientific Publication in the consecutive years 2013, 2014 and 2015.

What motivates you to work as a scientist in Asia

My dream was to build a collaboration between CERN and Sri Lanka and this become a reality this year (2018) with the help of Ministry of Science, Technology and Research of Sri Lanka. This is the first time Sri Lankan universities have been involved in high-energy physics research.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I'm the only female student from Sri Lanka who has worked with such on large collaboration. I had the strength to work at the same level as my male colleagues. My supervisor always gave me her courage and motivation for that. I remembered I disappointed her one time during my final year when I learnt that I was pregnant and I was worried about going into the underground tunnel every day. But my mind never says 'NO'. I succeed.



What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I want to make a high-energy physics collaboration in Sri Lanka involving a group of undergraduate students and also school teachers. In 2018 the government of Sri Lanka removed our main barrier by paying the membership fees to CERN.

What would you say to young women considering a career in science?

I'm a woman. I'm a top scientist in Sri Lanka and have the highest h-index. Gender never is a barrier to achieving your goals.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

In Sri Lanka, we now have a similar percentage for both male and female scientists. Our ladies are in the top-ranking positions in the many science-related organisations in Sri Lanka. In the past few years I have seen more female students than male students doing the special degrees in science, especially in physics and chemistry. I think women have entered the correct path by being involved in science and engineering.

THAILAND

Nominated by the Thai Academy of Science and Technology



Professor Emeritus Dr Morakot Tanticharoen



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Biography

After completing biology studies at Chulalongkorn University I was appointed as a research assistant at the University of Rhode Island, where I completed my MSc and PhD microbiology in 1977. Upon returning to Thailand, I was offered a lectureship at what is now King Mongkut's University of Technology Thonburi

(KMUTT), where I co-founded the School of Energy and Materials and the Division of Biotechnology, later transformed into the School of Bioresources and Technology and for which I served as dean. For over two decades at KMUTT I guided more than 100 postgraduate theses and dissertations. I was actively involved as member and executive of several regional and international scientific societies and organisations, and served on the editorial board of many international journals. From 2000 to 2008 I was executive director of the National Center for Genetic Engineering and Biotechnology (BIOTEC), during which time I also served as chairman of the ASEAN Sub-Committee on Biotechnology. Currently I am the senior advisor to the president of National Science and Technology Development Agency and to the KMUTT president.

When did you know you wanted to pursue a career in science?

From an early age, while I enjoyed studying mathematics, I was also eager to learn about life sciences and biodiversity. My family encouraged me to follow my passion, which allowed me to pursue my study in a sciences program in high school. Not only did I do very well in

biology, I was amazed to discover new things from experiments. This made me become even more enthusiastic about biology and I wanted to be a scientist.

Who or what inspired your passion and curiosity in science?

After completing my bachelor degree in 1968, I was offered a position in the Southeast Asia Treaty Organization's Walter Reed Army Institute of Research under the supervision of Dr Smith. Not only had I an opportunity to do research in virology, but I also gained invaluable experience working in dynamic research environments with many foreign experts. I decided to pursue my master's and doctoral degrees at the University of Rhode Island, where I had an opportunity to be both a teaching and research assistant. I helped Dr Carpenter to set up an immunology lab at the university. Studying in the US gave me a strong basic background in science. The environment stimulated my love for study, allowing me to gain better life skills, especially in making sharp decisions.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I worked with a renowned group of engineers at KMUTT led by Professor Dr Prida Wibulsawas, Dr Krissanapong Kirtikara and Associate Professor Dr Sakarindr Bhumiratana. With strong support and encouragement from the group, I started to work in biogas research, eventually developing my research to full-scale industrial application, helping Thailand cope with the energy crisis.

I still remember, once I hosted an international conference costing one million baht. The faculty approved the conference budget even though it was almost the faculty's entire annual budget at the time. The conference went very well and gave me the opportunity to connect with international experts and institutes. I got full support and encouragement to pursue my research interests from the colleagues in the faculty. Thus, I could extend my knowledge to become a pioneer in the field of biogas research in Thailand.

What do you think is your greatest scientific achievement to date?

For over two decades, my research has influenced and raised awareness of the biogas fixed-film technique in the Thai food and agricultural industries, most of which are tapioca starch factories. The technology is applicable to the treatment of waste streams from the production and resulted in a break-even period in only two and a half years. The technique has

been transferred not only to the mainstream manufacturers but also to interested universities, and it was subsequently provided to industrial sectors and factories in rural communities all over the country through consultant services of universities. This also gives opportunities for the universities and industrial sectors to collaborate and strengthen the network in human resource development in the field of bioprocess engineering.

What motivates you to work as a scientist in Asia?

Many Asian countries, especially within Southeast Asia, are underdeveloped. As I am a Thai scientist and have experience with international organisations such as UNESCO, ASEAN, etc., I would like to promote science and

technology for development in CLMV countries (Cambodia, Laos, Myanmar and Vietnam) through human resource development. I established the Human Resource Development Program in Biotechnology for CLMV, which provided annual scholarships for CLMV scientists to conduct their research work at BIOTEC labs under the supervision of BIOTEC scientists. This strategy allowed CLMV scientists to learn about cutting-edge research and apply it in their homeland, and helped establish collaborations between scientists from different countries. Nowadays, resources research networking in Asia is very important; it can be exchanged for mutual interest among the country members and can be used to bargain with other countries for benefit-sharing purposes.



What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Raising awareness in science and technology among policymakers, government and the private sectors is the most challenging task in Asian countries, where science and technology development has not been prioritised and properly used in eradicating the nation's poverty. In order to make people believe in science and technology development, it is necessary to raise awareness about the importance of science and technology among the people. It is crucial that the government establishes long-term plans for science and technology development in order to promote the country's economic competitiveness. Scientists should have been involved in national development policymaking.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

The great barrier is to provide students open access to research lab experiences to increase their knowledge and understanding of the advantages of science and technology development. Moreover, this can inspire students to study science and pursue a career in science in order to prepare for the competitive workforce.

What would you say to young women considering a career in science?

At present there is a serious shortage of devoted scientists. This critical mass crisis reflects the problems in the current status



of research culture in the young generation. I would like to encourage this new generation to be interested in science and technology by creating awareness and incubating a culture of research and knowledge exchange among them. They need to be encouraged to pursue their studies in science. I would like to say that doing research experiments in a lab is fun, getting research results is more fun, but utilising your research results to successfully solve problems is the utmost target as a scientist. Keep doing scientific research and carry on, it is useful for you and your country. Let's study science to have your knowledge breakthrough.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to

address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Gender equity is not an obstacle in doing scientific research in Thailand. In my opinion, the real problem in Thailand is to create more *passion* in science. We should raise an awareness in science education in all sectors, starting at family, school, university and government. To raise this awareness to the national level, we need to promote the benefits and competitiveness that science and technology can bring to the community and industrial and governmental sectors.

Dr Nitsara Karoonuthaisiri



Chemical engineering

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Biography

I was born into a family of teachers in Nakhonsawan, a province three hours from Bangkok. With a prestigious Royal Thai Government Scholarship I studied chemical engineering in the US. Upon obtaining my master's and PhD from Stanford University in 2004, I took a research position at the National Center for Genetic Engineering and Biotechnology, Thailand. I was the founding co-chair of the Global Young Academy and was honoured as Young Global Leader 2013 by the World Economic Forum.

I have received the following accolades:

- L'Oréal-UNESCO For Women in Science Fellowship, 2009

- Foundation for the Promotion of Science and Technology's Outstanding Young Technologist, 2011
- Marie Curie Fellowship, 2011–13
- Named as one of 21 'women who make a difference', one of 9 'working women of the year 2009' and one of 50 'women who will make a change' by various Thai magazines

I am happily married to an orthopaedic professor and we just welcomed our first son, Kirin, last September.

When did you know you wanted to pursue a career in science?

I first fell in love with mathematics at a very young age, when I was selling snacks during summer break at a college where my dad was teaching. As much as enjoying the profit from the sale, I realised also the usefulness of the subject in real life. From my love of logic in mathematics, I automatically love the similar logic in sciences, which was introduced in primary school.

Who or what inspired your passion and curiosity in science?

'Those who control technology dominate the economy. Those who dominate the economy possess power.' —a quote by the late Damrong Lathapipat in the back of a science classroom in my high school. Growing up in a family of teachers, who

fed us from government salaries, I always dreamed to pay back my country one way or another. In the quotation, I realised that I could help to develop my beloved country by using my passion for science as a career to advance the economy of Thailand.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My career has been influenced by three iron women: Professor Camilla Kao, Professor Morakot Tanticharoen and Dr Kanyawim Kirtikara. Professor Kao, my PhD advisor, taught me how to think scientifically as a researcher. Professor Tanticharoen, my first mentor in Thailand, showed me how determination can conquer every obstacle in a professional career and personal life. Dr Kirtikara mentored me in management skills, how to balance my life to stay healthy professionally and personally, and, most importantly, how to pay it forward.

What do you think is your greatest scientific achievement to date?

I have applied microarray, a high-throughput technology, as a diagnostic tool for agri-food applications. I believe that an agri-food sector is a crucial driving force for the Thai economy. For the country to remain competitive in these

fields, it definitely needs to employ enabling technology to reduce cost and improve quality. Our research groups thus innovate several diagnostic platforms to simultaneously detect multiple targets, such as foodborne pathogens, plant pathogens and toxins, by adopting the principle of the microarray. By doing so we can reduce assay time and cost while increasing throughput and accuracy.

What motivates you to work as a scientist in Asia?

I am fortunate to have been given an opportunity by my homeland to study in the US. I feel obliged to give back to my country by using the knowledge and experiences I have obtained. I also believe that Asia is a great place to do science, especially in biotechnology, due to its richness in bioresources. There is a need to apply science and technology to wisely use bioresources for multiple purposes and ensure their sustainability.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I feel lucky to be working in Thailand, where we do not have a gender inequality problem. However, recently I have just faced a major challenge as a female scientist when I become a mother. To juggle work and childcare can be challenging, but my support system at home from my husband and family, and at work from colleagues and my mentors, make life possible and enjoyable. I think if we don't pressure ourselves to have it all, being a mother helps us realise our real potential to be able to complete more than we thought possible.



What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My personal concern is that there are not enough people wanting to do science, so it is doubtful that we will advance the development of the country and the world. My aspiration is to promote science careers. Lack of understanding about STEM careers is a barrier. It is important to have role models who can inspire the younger generation to follow this career path. The media should also help promote this important career choice.

What would you say to young women considering a career in science?

Just do it! Be determined and be optimistic. You will never walk alone.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to

address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

In my opinion, the gender equity in science in Thailand is not a big problem. However, more support should be given so that female scientists do not feel that they have to choose between having a family and excelling in their career. I believe having female role models and established networks would help encourage more women to enter and stay in this challenging career. I personally have been involved in a mentoring system in my organisation and for the Thai Young Scientists Academy. I also give inspiration talks to encourage both women and men to consider a career in STEM in Thailand.

TURKEY

Nominated by the Turkish Academy of Sciences



Professor Hayrunnisa Bolay Belen



Neurology, neuroscience, algology

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Biography

When I was in medical school, the brain and neuroscience always challenged me. After completing my residency in the neurology department I applied for a PhD in neuroscience to learn the scientific basis and mechanisms of diseases that we see in clinical practice. During my postdoctoral period I focused on the neurobiology of migraine headaches and conducted successful studies at Harvard University—a milestone in my career in the field of headache research. I then returned to Turkey where I established my own research lab and worked in a headache clinic. It is very important to do bench-to-bedside translational studies in headache research, which is more relevant to clinical problems. In addition to clinical work and research, I train neurologists, algologists and direct a neuroscience PhD program at my

university. I am married to a neurosurgeon and have two children. My daughter developed an interest in space and wants to be a scientist. She is currently doing a master's degree in astronomy.

When did you know you wanted to pursue a career in science?

I was very curious about the ways things and events happened. When I was 10, I used to imagine myself sitting at a table reading, thinking and writing on paper in a very silent room filled with books. My passion was leading me even at that age. In high school, I definitely knew that I would be happy if I was a scientist and did research. In my medical school years, I joined several research labs and realised that I liked being in the lab even during the weekends. That is the reason why I did a PhD in neuroscience after being a neurologist.

Who or what inspired your passion and curiosity in science?

My father, a professor in philosophy with diverse interests and knowledge. His tendency to discuss and ask my opinions on many different problems was key to driving my curiosity in science. Whenever I asked him a question he always directed me to the books and specific chapters to read that had an opposite view on the subject. I now understand that it was

important to develop critical thinking habits. My father and I used to spend time outside walking and discussing the philosophy of science, scientific achievements in physics and understanding the world we live in. When I was in medical school I knew that I would be working on the brain, which was very challenging for me.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

My mentors during my residency, PhD training and postdoctoral period had a serious impact on the way I pursue experimental studies, work hard, embrace creative thinking, interpret results and failures, foresee problems, write scientific papers through dozens of drafts, run a lab and motivate PhD students. Receiving support from Professor Moskowitz of Harvard University, by way of a collaborative research grant to establish a lab in Ankara, motivated me to become an independent researcher in my career. But I have to confess that the greatest impact was from the people who tried to stop me during my career. Obstacles and negative events were the opportunities to notice and enhance my capabilities to find a solution, sometimes on a different level, leading to the greatest leaps in my career.

What do you think is your greatest scientific achievement to date?

It was the discovery of the missing link between the migraine headache phase and cortical spreading depression, which is an intrinsic mammalian brain phenomenon and is considered a pathophysiological correlate of a migraine aura phase. It was also very important that spreading depression waves in the pain-insensitive cerebral cortex can activate overlying painful cranial layers and headache. In following studies, we focused on the behavioural consequences of cortical spreading depression and searched features of pain and correlated brain area activation. The demonstration for the first time of

thalamic reticular nucleus involvement as a gatekeeper of all sensory modalities to the cortex explained the visual, auditory and tactile sensory disturbances accompanying a migraine attack. We further provided a possible neurophysiological biomarker for a migraine headache attack, which is a temporary disruption of the somatosensory temporal discrimination process.

What motivates you to work as a scientist in Asia?

I realised that life is more meaningful if my hard work and research is directed towards the good of other people. I have conversations with patients I treat, and

share my experiences and educate young people. I can reach my goal perfectly in Asia, by combining my scientific background with the strength and motivation from the wisdom of the East, providing a complete perspective on my life.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

The majority of problems that I faced in my career were independent of gender, probably because of the high proportion of woman researchers the health, where gender equality is already established in Turkey. Still, the desire to conduct research after working hours or during



weekends was misinterpreted as an ambition, just because of my gender. The latter issue was entirely unfair, and I had to defend myself in order to change prejudices. I had to be patient and learnt to ignore the speculations, but it was hard in the beginning. The main challenge is the great responsibility of family and children; being a mother means half of your working memory is always busy with the family and there is no help for that problem, even though support of the spouse and others is invaluable. In time, I learnt to handle both my job and home responsibilities and noticed the advantages of multitasking.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

I would like to establish a national neuroscience centre of excellence for translational research, to understand the human mind and working principles of the brain and develop a more realistic theory for thinking. Such a goal needs a good team who share the same dream, in addition to great financial support.

What would you say to young women considering a career in science?

I would recommend that they focus on the advantages of being a woman scientist. Women see events from a different perspective and have a different way of thinking that is priceless. Being busy with family, friends and being tangled in different parts of life gives a woman more relevant ideas to solve certain problems and provides a good opportunity for creative thinking. I think each scientific

team needs a woman researcher to enrich their brainstorming and ideas. Young woman scientists have to be ready to work harder than men scientists in every moment of their life.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

According to the constitution of Turkey there is no salary gap based on gender. Additionally, women gained the right to give lectures in universities in the 1920s due to the governmental policy for positive discrimination in education. However, those advances are not adequate and women are still not equally represented in physical sciences, engineering and mathematics. This is a very serious problem. Girls' interest to do science, maths, engineering and technology drops dramatically by high school, while they are very interested during the early years of their education. Even girls who choose those areas for university do not continue a career in physical sciences and technology.

Neuroscientific research reveals that there is no biological, genetic, structural or functional brain limit to explain the gender gap in science. Role models and social and cultural interactions are important determinants. Women seem to prefer

biological science and people-oriented careers, while men prefer physical sciences and thing-oriented careers. The participation of women in science and technology can be enhanced by educating parents and teachers about the 'gender similarities' and encouraging girls that there is no neurobiological limit for maths and science if appropriate educational tools are employed. Providing connections between abstract concepts with real-life scenarios and practical laboratory training will enhance girls' success and interest to the STEM areas. Woman scientists have to be encouraged to reach higher goals in their science career and to be represented in top academic positions and decision-making boards.

I have been involved in science education and giving lectures to increase awareness about gender equality and to courage girls into STEM careers.

UZBEKISTAN

Nominated by the Academy of Sciences of the Republic of Uzbekistan



Dr Difuza Egamberdieva



**Agricultural biotechnology,
soil and plant microbiome**

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Biography

I was born in Tashkent, Uzbekistan, and have two daughters and one son. I graduated in biology from the National University of Uzbekistan and received a PhD in agricultural sciences from the Humboldt University of Berlin in 2000. I continued my postdoctoral work at the University of Helsinki, the University of Florence, Manchester Metropolitan University and Leiden University. My research focused on improving crop production and soil health through agricultural biotechnology. I received awards such as the Scopus-TWAS-TWOWS Young Women Researcher Award, the Morrison Rogosa Award, the L'Oréal-UNESCO For Women in Science Fellowship, the Alexander von Humboldt Fellowship and the TWAS Prize in Agricultural Sciences. I have authored

four books and co-authored more than 100 publications. In 2017 I was elected to a working group of the German Council of Science and Humanities and in 2018 as a member of the project team of the UN Committee on World Food Security's High Level Panel of Experts on Food Security and Nutrition.

When did you know you wanted to pursue a career in science?

After completing my study at university I did not know that I would go into science. I began university study during the Soviet Union period, and in 1991 Uzbekistan gained its independence.

The first years of independence were very hard times. In the institution we had limited access to literature and no international scientific networks to draw from. After independence the doors opened to the world and embassies of many countries, foundations and organisations began their activities in the country. I was lucky enough to get a scholarship to study in Germany. The German institution opened the first door into science for me.

Who or what inspired your passion and curiosity in science?

As a child I wanted to become a medical doctor and treat people. I never thought that I would like to be a biologist, but in school I was attracted to natural sciences,

especially flowers, herbal plants and trees. My father loved gardening and we had different fruit trees, vegetables and flowers in our garden. I often helped him garden and care for plants, and since then I have loved to work with plants and soil. Soil feeds us and medicinal plants cure or prevent disease. These are the fascinating research topics in natural science that inspired me to become a soil and plant scientist.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

I began my scientific life in at the Leibniz Centre for Agricultural Landscape Research. During my PhD, the daily routine of being a scientist seemed boring to me and I considered leaving science for a more interesting job. My supervisor, Professor Gisela Hoflich, was a very active scientist who dedicated her life to science. One day she told me 'Difuza, treat science as a hobby and enjoy doing research—it opens a door through which you find all your dreams.' She encouraged me to find joy in research and showed me the opportunities I would have if I remained involved in research.

What do you think is your greatest scientific achievement to date?

One of my most satisfying achievements is development of a salt-tolerant bacterial product that improves crop production in salinated soil. This kind of biofertiliser is very important to Uzbekistan and other countries facing severe ecological problems, such as drought and salinity, with high loss in crop production. The establishment of a R&D company in Uzbekistan was another dream that came true. In a country with limited resources, it is impossible to get success without external help. My supervisor, Professor Ben Lugtenberg of Leiden University, fully supported me and helped me be a scientist and achieve a lot of success. My friend Maksud Saidov is a successful businessman who helped me to establish the R&D centre. My scientific achievements were awarded a L'Oréal-

UNESCO For Women in Science Fellowship in 2006 and TWAS prize in 2013.

What motivates you to work as a scientist in Asia?

I grew up in Uzbekistan and studied at the university when our country was under Soviet rule. The Russian language was our second mother tongue, thus we could not access international literature and were isolated from the Western world. After independence many qualified people and scientists left the country because of financial obstacles and lack of research support. Therefore, very little scientific information is available from Central Asian countries, especially in life sciences. That was the main reason I decided to work on multidisciplinary research and supervise many students and young scientists in soil biology, plant physiology, medicinal plant

research and agricultural production. I believe scientific knowledge can improve the quality of life and bring more advanced technology into the country.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

To manage family life, childcare and pursuing science is not easy. I have three children. Because of my postdoctoral work, I could not have long maternity leave. However, I coped with the difficulties using strong patience and continued my scientific career. I always feel science is a hobby and am relaxed doing research. However, science needs funding, and it was a big challenge for me to struggle for support. Since we did not have research support in my own country, I had to move to European universities to continue my scientific career. That was the biggest challenge that we faced, especially my kids, who had to change their school. I did my postdoctoral work in Finland, England, Netherlands, Italy and Germany. Even though we faced difficulties it was a great opportunity for my children, who studied in different countries and now speak several languages.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

International mobility is becoming increasingly important for a successful career. I established an independent lab that gets funding from international organisations and universities and that brings research results into practice.



I hope it will overcome obstacles and provide research needs for young scientists and help them gain knowledge from universities abroad. The goal of my lab is to elevate high-quality research work from Central Asia to international standards.

What would you say to young women considering a career in science?

It is important to encourage young people into research and provide them with good opportunities and conditions to pursue science that will help to develop their country. In developing countries, the life of women is not easy; they are mostly involved with family, children and household work. Pursuing research will help them to overcome difficulties, get good jobs and help to improve their social life through networking. The best advice I can give young women is for them to believe in themselves, enjoy doing research as a hobby because it strengthens the mind, to follow their dreams and be a model for their kids and society.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

I am involved in Women Scientists of Uzbekistan activities, mainly in



international cooperation. We have various activities—consultation, support and training for girls and young women scientists—that help to increase numbers of women scientists in the country. We are working closely with international scientific organisations who support student and scientist exchange through scholarships. However, the local government and ministries, especially national funding agencies, could do more to support girls and develop new world-class research infrastructure in the country. It is very important to increase women scientists' income and give full support for childcare through mobile working. Bringing more women in as leaders in many sectors and recruiting more women into top-level management positions in business will bridge the gender gap at workplaces. The most important issue is to take steps

to bring experienced Uzbek scientists back to the country through offering good job conditions and support. They could be models for young scientists and encourage them into science through mentoring programs.

Dr Dilnoza Duturaeva



History

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Biography

I am a senior research fellow at the Institute of History of the Academy of Sciences of Uzbekistan. My research interests include mediaeval history of Central Asia and Imperial China, cross-cultural contact, migration and commodity and knowledge exchange in pre-modern Eurasia. I was born in 1983 in Namangan, Uzbekistan, in the family of a lawyer and a doctor. I received my PhD in history from the Academy of Sciences of Uzbekistan in 2011. During postgraduate studies I spent an academic year at the Martin Luther University of Halle-Wittenberg and a term at the University of Wisconsin–Madison. I also carried out postdoctoral research in the School of History at Nanjing University

and at the Department of Sinology of the University of Bonn. My research was supported by different foundations, including the Confucius Institute Headquarters (Hanban), the German Academic Exchange Service and the Alexander von Humboldt Foundation. I have an 11-year-old son called Abdulaziz who accompanied me during long research stays abroad.

When did you know you wanted to pursue a career in science?

I discovered my passion for history, archaeology, foreign languages and cultures as a child in history class at secondary school. At that time I knew that I want to study history and foreign languages and to be a researcher.

Who or what inspired your passion and curiosity in science?

My history teacher told me about a pioneer in archaeology, Heinrich Schliemann, who as a child dreamed of finding the legendary city of Troy. He began his excavations before archaeology had developed as a professional field and managed to discover the location. I learnt about the discovery of a hidden cave library near Dunhuang in China and the legendary hidden library of Ulugh Beg, a Timurid ruler and a prominent mediaeval Central Asian scientist. His library has not been found and its existence remains

debatable. These stories raised my interest and I spent most of my time as a child reading historical adventure novels. Historians have fewer opportunities to pursue research outside of academia than other disciplines, so the decision to stay in academia was obvious. I was inspired by the idea that as an academic I would have more freedom, flexibility and opportunity to travel.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

When I started my research career at the Academy of Sciences of Uzbekistan as a PhD student I worked in the team of Professor Elyor Karimov, who was also my doctoral adviser and the main person who motivated my passion to pursue an academic career. He is a scholar with extraordinary international experience and fluent in several languages, particularly Uzbek, Russian, Persian, English and French. When I joined his team, he had just come back from a long research stay in Paris. I was a young 24-year-old scholar and had never been abroad. In that moment I could not even imagine that my love for history, foreign languages and cultures would open the whole world for me and bring me not only to Paris, but also London, New York, Istanbul, Beijing and many other places.

What do you think is your greatest scientific achievement to date?

My research deals with Sino–Turkic relations along the Silk Road from the tenth to twelfth centuries and examines diplomacy and trade during the Northern Song and the Liao dynasties in China and the first Turko–Islamic dynasties—the Qarakhanids in Central Asia, the Ghaznavids in Northern India and the Saljuqs in Iran and Anatolia—using primary sources. In traditional academic fields any research on the history of mediaeval Central Asia and Iran has been mainly based on Islamic sources. Chinese sources dealing with this period have remained, until now, largely overlooked and, in particular cases, unknown in contemporary scholarship. My research is a detailed study of Chinese records on the first Turko–Islamic dynasties in Central Asia, Iran and India, providing relevant texts with translation and notes. My research fills a gap in the history of the Silk Road and diplomatic relations in Eurasia in the tenth to twelfth centuries.

What motivates you to work as a scientist in Asia?

Uzbekistan is a developing country with limited resources for research funding. However, I am fortunate to be a member of a team of talented scholars at the Academy of Sciences. My home institution provides extraordinary support for young scholars and encourages them to study and conduct research abroad. It gave me an opportunity to carry out most of my postgraduate and postdoctoral research in different foreign institutions while



maintaining my position in Uzbekistan. I also have to mention that Tashkent is the main attraction for any scholar doing research on the history of premodern Central Asia, due to the collection of Central Asian manuscripts in the Al-Biruni Institute of Oriental Studies at the Academy of Sciences of Uzbekistan, which is included in the UNESCO Memory of the World Register.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

I come from Uzbekistan, where it is difficult for a girl to be supported to pursue studies—especially abroad—due to traditional issues, where the woman's role is limited to raising children and serving her husband and his family. There is even a saying among people

in Uzbekistan: 'what can a girl do with her study, will she able to take a city?' In my case, I was fortunate to get enormous emotional and financial support from my parents, but I had to struggle for everything in my personal and academic life. Women who are mostly junior scholars only constitute about a quarter of academia and are without almost any access to decision-making.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

To pursue a successful research career in academia that is dominated by men, living in a society where working mothers are not welcome, requires a lot of sacrifices, but it can be accomplished with effort and desire.



What would you say to young women considering a career in science?

I would say to young women considering a career in academia: forget any doubts—your chances are much better than you may think.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any events or organisations related to ‘Women in Science and Engineering’?

It should be mentioned that social issues in Uzbekistan, such as forming a family and having children, negatively affect women’s careers, and women who have advanced to be full professors,

deans and rectors pay a high price for it. This situation is familiar to any female scholar, not only in Uzbekistan academia. Professional bodies in my country need to do serious structural changes in order to support gender equality, which are quite simple: paid parental leave for mothers and fathers, re-entry policy, childcare assistance, dual-carer support. I have spent a long time working in the German academic system and personally experienced how female scholars with children can benefit from these policies. For instance, I got a fellowship extension for another year as a scholar with a child. Moreover, my host institution in Germany provided a free childcare service when I had to travel in order to attend academic events. These policies will give female scholars a chance to have both a successful research career and children and it will help to support gender equality in academia.

VIETNAM

Nominated by the Vietnam Academy of Science and Technology



Dr Ha Phuong Thu



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Biography

I was born into a traditional family of teachers. So, when standing in front of the university, I chose to follow the education of chemistry to continue the succession of my parents. After graduating from university I was assigned to teach at An Luong Dong High School, 30 kilometres from home. Three years passed; I was a good teacher with great enthusiasm for the pupils of my homeland. But then, learning pushed me further to develop more knowledge to serve the poetic land of Hue. In 2003 I successfully defended my doctoral dissertation and was ranked as excellent. In 2004 I received a postdoctoral fellowship at the French Alternative Energies and Atomic Energy Commission. There I learnt much about the structure of proteins that are biologically active, and my story of the

application of my scientific achievements to practical support for cancer patients was formed during my days in France.

When did you know you wanted to pursue a career in science?

I was born and grew up in Hue, and from early childhood I was oriented to the traditional career of my family, which is teaching. And due to the love of my country, with the desire to develop our national science and to use knowledge for the benefit of society, I decided to pursue my passion for scientific research. In 2003, after successfully defending my doctoral dissertation, I received a postdoctoral fellowship at the French Alternative Energies and Atomic Energy Commission. It was during this time that I realised that my passion for scientific research was wonderful and that it was even stronger than my passion to be a good teacher.

Who or what inspired your passion and curiosity in science?

I have many acquaintances, even my best friend, who have had cancer. I feel cancer carries not only the pain of the illness but also the psychological and financial burden to family and friends. There are many patients who share with me that they only need to live an extra hour, and one day they never give up on being able to cope with cancer. Current mainstream

treatments are effective but cause many side effects, even leading to poor health. Finding a new way to reduce side effects in the course of cancer treatment is not only a matter of concern, but it is also the mission that I set for my research.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

Professor Chu Dinh Kinh, the teacher who guided me to become a PhD student, and Professor Nguyen Xuan Phuc and Dr Tran Thi Minh Nguyet, the teachers who first taught me about nanotechnology—biomedical nanomaterials that play an integral part in my scientific career. They have inspired me in science and pushed my passion for science. Their lectures have helped me understand that, in science, in addition to good knowledge, there must be passion and pursuit for the same passion. The ultimate goal of science is to serve life. My research and my colleagues are all about the community.

What do you think is your greatest scientific achievement to date?

My greatest achievement is the successful research of FGC nanostructures that led to a new era of preventive and therapeutic support for tumours at the end of 2016, after 10 years of dedication.

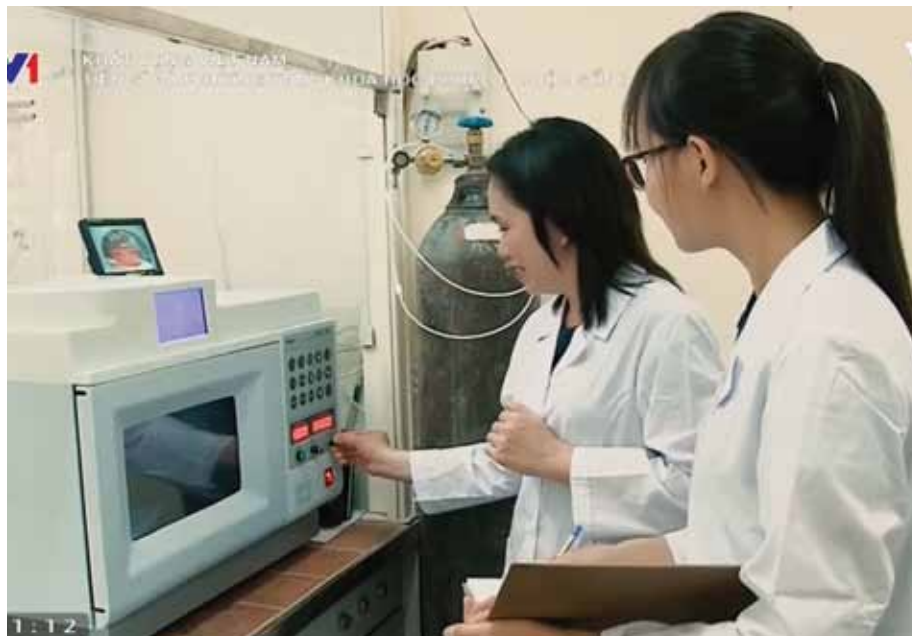
This research was transferred to the company CVI and manufactured into CumarGold Kare products. I feel that CumarGold Kare not only helps people with cancer improve their quality of life but also helps them to have a companion, a hope in the fight against cancer. In addition, I and my colleagues have more than 30 works published in international journals and internationally indexed journals. In the near future, our team are going to transfer to the company nanoparticle products that prevent and support the treatment of shrimp diseases.

What motivates you to work as a scientist in Asia

To me, science is to serve life. A society that is green, clean and good is the ultimate goal that I and my research group want to achieve. All of that has motivated me to work as a scientist in Asia.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

Returning to Vietnam, embarking on a research mission on nanotechnology, I and my colleagues meet a lot of challenges. We were very unfamiliar, our knowledge was limited, equipment not available, financial conditions very tight. In 2009 the Laboratory of Biomedical Nanomaterials was established under the direction of Academician Nguyen Van Hieu and Professor Nguyen Xuan Phuc, and I was one of the first to lay the groundwork for the field of nanotechnology in biomedicine. With the bravery of a scientist, I and my colleagues eliminated the challenges behind the



day-to-day research on nanotechnology, learning from experience in domestic and foreign research teams in Singapore, France and the United States. Most importantly, there was the challenge of how to confirm the team's ability to apply for funding. After three years of effort, we gradually got the project to the institute level, the ministerial level, the state level.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

Our research is geared towards the community. Research results are difficult to transfer to business. This is the biggest barrier to face, which we almost don't overcome. For example, products must be licensed by the authorities. Businesses do not want to register in case they lose money or time, while scientists cannot apply for permission.

What would you say to young women considering a career in science?

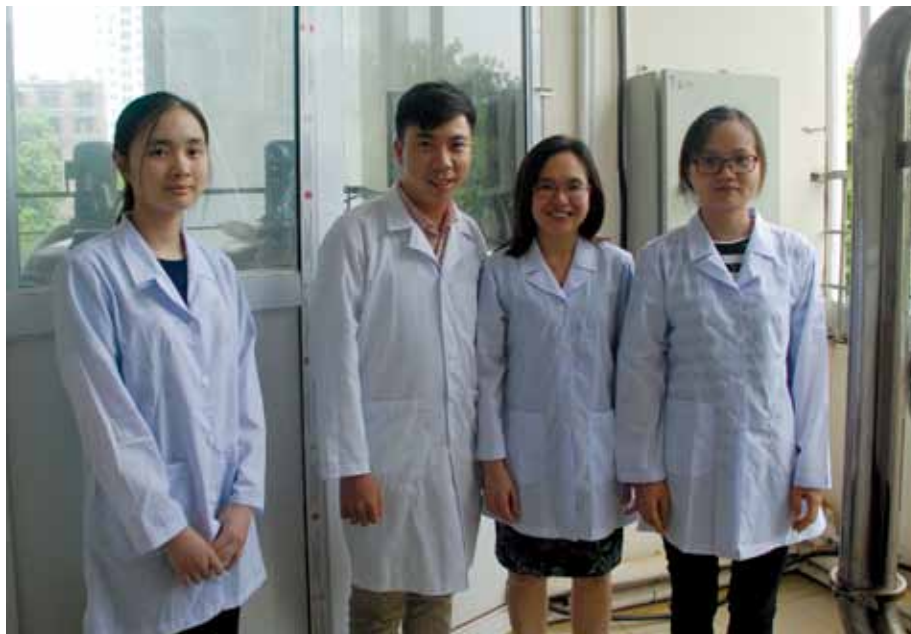
When doing science is difficult, women scientists still must do it. However, if you know how to balance the work of the family and the workplace, women can still achieve success in their scientific research career. What is needed is the passion, and passion that needs to be nourished. Encouragement and sharing with relatives, friends and colleagues is the motivation to promote passion.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of gender equality? Are you involved in any

events or organisations related to 'Women in Science and Engineering'?

Male chauvinism persists in some countries and Vietnam is no exception. The evidence is that women are almost exclusively given the grand prize in women's prizes. As for the other big awards, the percentage of women receiving the award is very small compared to men. Moreover, with women, in addition to research, the time spent with family is not small, so in order to achieve scientific accomplishments women must make great efforts. In order to support a future of gender equality, there is a need for more research funding organisations to give women the opportunity to pursue their passion for scientific research.

I have been active in the Vietnamese Women's Association. In addition, I and my colleagues have provided support to about 15 cancer patients through CumarGold Kare, a product that we researched and transferred to CVI. Ten of these patients are women.



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Biography

My name is Ngoc-Lan Nguyen and I was born in Hanoi, Vietnam, in 1985. I finished

my undergraduate degree at the Vietnam National University of Agriculture in 2008 and then worked for the Center for Experimental Biology at the National Center for Technological Progress.

I received scholarships to study my master's and PhD courses in microbiology in Korea and I obtained my doctorate degree in microbiology in 2016.

Afterwards, I returned to Vietnam and started a career as a researcher in the Institute of Genome Research at the Vietnam Academy of Science and

Technology. I received grants from the National Foundation in Science and Technology Development and Graduated Science and Technology to continue my research in microbiology. I married a computer engineer who I met while I was studying for my doctorate.

When did you know you wanted to pursue a career in science?

In primary school my favourite subject was mathematics and I wanted to be a mathematician. In elementary school,



I was fascinated by chemical experiments and I wanted to become a chemical engineer. When I was in high school and university I was interested in food biotechnology. When I entered my master's course I wanted to be a microbiologist, and I determined then that my life career would be in microbiology.

Who or what inspired your passion and curiosity in science?

In my third year of undergraduate study I took my first microbiology lecture and I was so curious when I saw the diverse morphologies of bacterial cells under a microscope. I chose the subject for my undergraduate degree to be related to the study of bacteria. I worked with *Lactobacilli* spp. isolated from fermented meat. I was up all night to check the amount of acid that bacteria produced. Although the work was hard, the results were rewarding. As the amount of acid increased, the pH value did not decrease. I looked for information to explain the cause and became fascinated with bacteria. I received a master's degree scholarship for study in Korea, identifying and classifying novel bacterial strains. I found that microorganisms are amazing and I had been led to discover them. A main career as a microbiologist appeared in my head from that time.

Who were the influencing role models in your career and how did they inspire and motivate your passion to pursue a career in science?

The first role model is my undergraduate advisor, Dr Doan Thi Lam Nguyen. She

taught me basic microbiology lab techniques. She said to me 'Find English books in the library to learn the principals of experiments.' She inspired me to open my mind. I needed to study seriously, so found microbiology books and seniors' theses for reference.

The second is my master's and PhD research advisor, Dr Yeon-Ju Kim. She is my teacher, colleague and friend. She showed me what a good researcher is: passionate, diligent, persevering, sacrificing, open minded, disciplined, humble and self-respecting. She taught me how to analyse data for publication and spent hours proofreading my first papers. Although she was always busy with proposals and reports, whenever I had trouble she carefully explained and discussed things. She taught me how to work in a team and how to be a leader.

What do you think is your greatest scientific achievement to date?

I was really proud when I achieved my first publication in metagenomics. No one in our lab had experience in metagenomics before, so it was a big challenge for me to study it by myself. I spent several months finding bioinformatic tools to use. I tried again and again. Finally, I overcame obstacles and was accepted for publication. And it was wonderful when I came back to Vietnam and I could share my knowledge of metagenomics with my colleagues. I helped them to resolve their problems, such as grouping of samples, knowing which software should be used and modelling data. I hope we will achieve more in the future.

What motivates you to work as a scientist in Asia?

My love and gratitude motivate me to work in Vietnam. I hope I can share what I learnt abroad to make a difference in my country. I bring home new ideas and experiences in next-generation sequencing to explore microorganism diversity in Vietnam, as well as in Asia. The government encourages young scientists abroad to return, and I hope I am a role model for them to come back. The academic environment motivates me by suiting my skills, developing my career, connecting me with other experts and publishing papers. The workplace environment also motivates me. I developed new research skills with senior colleagues, who taught me how to write full proposals. We spend lunch together and share troubles in life. My boss is nice; he inspires us to show our ideas and encourages us to do it.

What are some of the challenges you have faced as a female scientist and how have you overcome these challenges?

The first challenge is society's culture. In my country, there is a conception that women should not get higher education, that women should do housework. Fortunately, my parents encouraged me to pursue academic science because they believed in my ability. I became the first person in my hometown to get a PhD. When I got married, my husband and my parents-in-law supported my familial responsibilities. My husband encourages me to spend time on research.

The second challenge is lack of funding and specific equipment. Even though I received two grants, the funds were not enough to carry out the particular experiments. My institute has equipment for molecular biology, however lacks machines for the analysis of chemistry. To overcome this problem, I asked for support from international collaborations.

What are your future aspirations related to science? What further barriers do you foresee to reach those goals?

My future aspiration is detecting indicators for soil health through analysis of omics such as metagenomic, metabolomic and proteomic. Achieving my aspirations requires me to develop my skills in bioinformatics. I think I will be in debt due to lack of research funding, essential equipment and reference databases.

What would you say to young women considering a career in science?

UNESCO said 'The world needs science and science needs women.' The American Society for Microbiology said 'Women can succeed in science more and more.' So if you have passion, ability, constancy, elaborateness and endless endeavour, you should pursue a career in science. You will definitely succeed and change the notion of women in science.

What is your opinion on the state of gender equity in science? In your country, what do you think is needed to address this urgent issue? What is the role of learned academies or professional bodies at local, regional and international levels to support a future of



gender equality? Are you involved in any events or organisations related to 'Women in Science and Engineering'?

Gender equity in science has far to go.

The number of women scientists has improved significantly, however the number of those who take part in scientific research is small. For example, in the Vietnam Academy of Science and Technology, 45% of scientists are women but 25% of them hold research projects.

To address this problem, we need solutions as follows:

- set aside a number of projects for female researchers
- promote communication activities to help women recognise the role of their ability in scientific research and that their contribution is equal to men's
- encourage women to always determine what their goals are and accomplish them
- encourage women to improve their degrees.

The learned academies or professional bodies have the following roles at local, regional and international levels to support a future of gender equality:

- have specific guidelines and policies to bring equal opportunities to women and men, such as stipulating an equal retirement age, eliminating gender bias in recruiting and increasing the number of women who undertake training courses
- encourage women to participate in a project, lead research projects and hold positions in the agency
- create and develop a global network of women to share experiences in the field of the education and training of women in science and technology, especially through cooperation projects in developing countries to developed countries.

Abbreviations

AASSA	The Association of Academies and Societies of Sciences in Asia ²⁾
ASEAN	The Association of Southeast Asian Nations
ASSA	The Associations of Academies of Sciences in Asia
BSc	Bachelor of Science
CERN	European Organization for Nuclear Research
FEBS	Federation of the European Biochemical Societies
ICSU	International Council for Science
IEEE	Institute of Electrical and Electronics Engineers
FDA	Federal Drug Administration
MSc	Master of Science
NASA	National Aeronautics and Space Administration
NGO	Non-government organisation
NIH	National Institutes of Health
R&D	Research and development
SETI	Science, engineering, technology and innovation
STEM	Science, technology, engineering and mathematics
TWAS	The World Academy of Sciences
TWOWS	The Third World Organisation for Women in Science
UN	United Nations
UNESCO	The United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
WHO	World Health Organization

² The Association of Academies and Societies of Sciences in Asia (AASSA) launched on 1 January 2012 as a consequence of the merger of AASA (the Associations of Academies of Sciences in Asia) and FASAS (the Federation of Asian Scientific Academies and Societies).



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