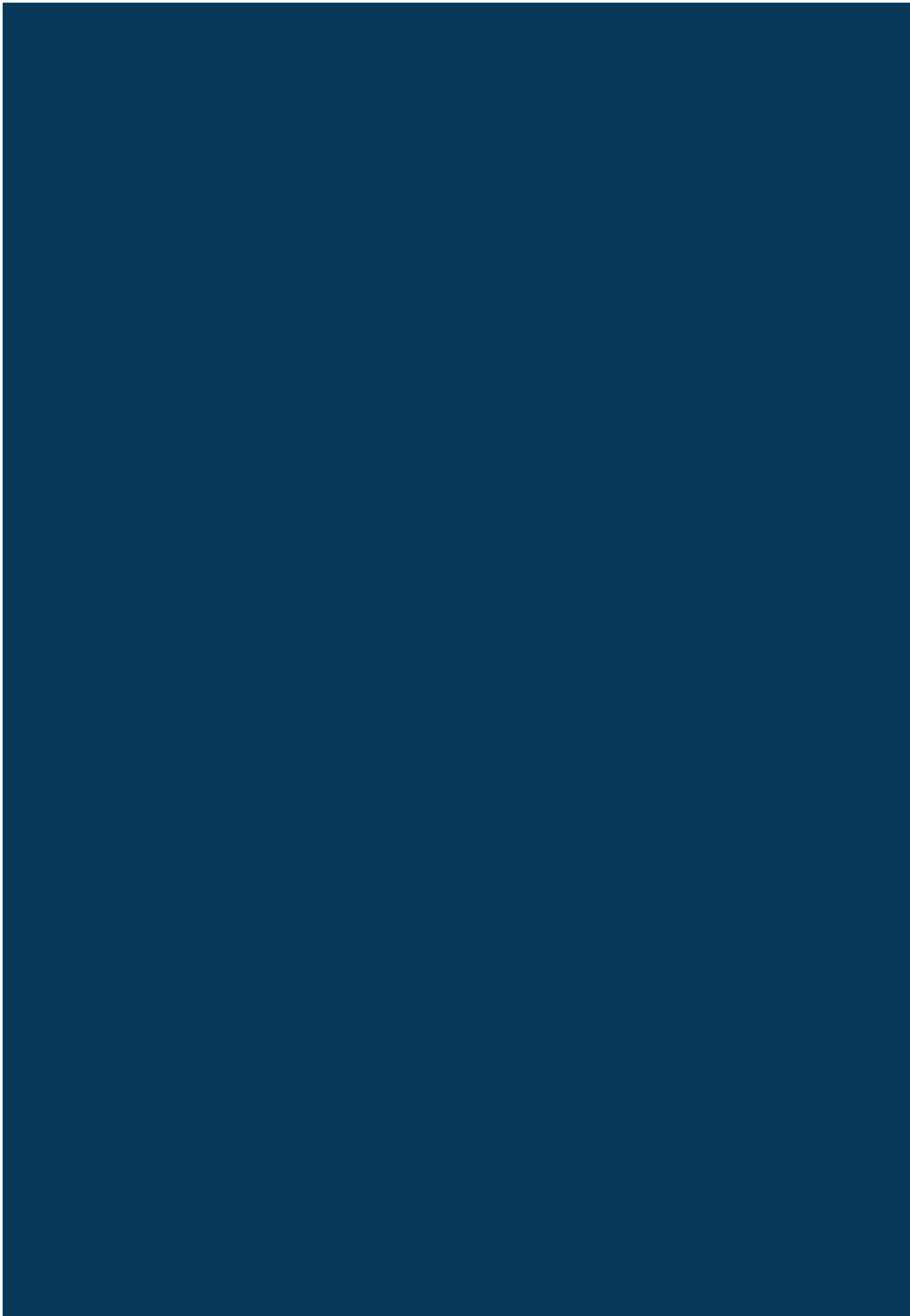


L'ORÉAL-UNESCO
FOR WOMEN IN SCIENCE
2018

INTERNATIONAL
AWARDS





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A 20-YEAR PARTNERSHIP *Supporting Women in Science*

THE WORLD NEEDS SCIENCE.

Science needs women



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Over the past 20 years, we have seen more opportunities for women in our society, with more of them entering the realms of science, business and politics. As an organization that places a high value on scientific understanding and gender equality, L'Oréal established *For Women in Science* in 1998 to empower women in science, recognize scientific excellence, and help talented women scientists gain the recognition they deserve. To fulfil this ambition, we required a partner who shared our vision of promoting inclusion in both science and society. Forging a partnership with UNESCO was a clear step forward. We share the same values and drive to succeed in our pioneering endeavor. For the past 20 years, we have honored five exceptional high-

level scientific women each year, one from each continent, and supported women researchers and rising talents through their careers. UNESCO's contribution has been integral to helping us expand the international reach of our programme.

Together we have supported 3,124 women to date, rewarding 102 laureates and granting 3,022 doctoral and post-doctoral fellowships in 117 countries. Our laureates have gained increased visibility, career opportunities and self-confidence. Three of them – Ada Yonath, Elizabeth H. Blackburn and Christiane Nüsslein-Volhard – have won Nobel Prizes for science.

Each of the five 2018 L'Oréal-UNESCO *For Women in Science* Awards laureates has cast her own brilliant light on scientific understanding, attaining great distinction in her field. I invite you to discover these five exceptional women scientists in the following pages.

However, despite this progress, we recognize that there is still much more to be done to achieve gender equality and solve many of the world's pressing challenges. By harnessing the diverse perspectives and intellectual capabilities of both women and men in advancing scientific understanding and

discovery, we all stand to gain. As we celebrate 20 years of *For Women in Science*, it is important to reflect on the significant milestones yet to be achieved in enabling more women to play leading scientific roles in academia, business and beyond. In particular, we must consider how women and men can collaborate to accelerate this journey.

While the number of women entering scientific research or professions has increased by 12% compared to 1998, this does not necessarily lead to long, flourishing careers. Just 28% of today's researchers are women.¹ Only 3% of Nobel Prizes for science have been awarded to women, with zero in 2017. Women scientists still face barriers in accessing senior roles, permanent positions and funding. Currently, just 11% of senior roles in academic institutions in Europe are occupied by women.²

Our programme has made great strides in helping women to gain recognition within the scientific community, but empowering women scientists is not uniquely a challenge for like-minded women and progressive organizations. It is in the interest of everyone to change mindsets and transform systems if we are to create an inclusive and sustainable world for all of us. Women and men have a role to play.

Indeed, engaging and collaborating with leading men scientists, who currently hold the majority of senior scientific roles, is fundamental to achieving lasting change. That is why we are launching an ambitious initiative through which we are inviting men to join us in catalyzing this transformation.

We will encourage respected male leaders within the scientific community to make specific, measurable commitments to expand access to grants, encourage equal opportunities in hiring, promotion, research publications and award nominations, and offer mentorship to talented women scientists. We will support these men in making progress, celebrate champions and share best practices. Additionally, we will encourage the next generation of men scientists to commit to promoting gender equality in science.

I am delighted to be launching this new initiative on the 20th anniversary of our valuable partnership with UNESCO. With our fragile societies pushed beyond their natural limits and expanding inequality, we must channel the intellectual capacity of both men and women scientists for a better world.

Jean-Paul Agon

Chairman & Chief Executive Officer of L'Oréal
Chairman of the L'Oréal Foundation

1 - UNESCO Science Report Toward 2030, 2015.

2 - BOSTON CONSULTING GROUP Women in Science, 2015.

UNESCO AND THE L'ORÉAL FOUNDATION

supporting Women and Science



For 20 years, UNESCO and the L'Oréal Foundation have been working side by side to support women scientists. Some 3,124 women scientists from across the globe have been celebrated for their outstanding achievements during the past two decades through the L'Oréal-UNESCO *For Women in Science* programme. Each laureate has been recognized for excellence in her respective field of expertise – from quantum physics to chemical engineering, to molecular biology – and they are an inspiration to future generations of scientists.

Since its foundation, UNESCO has firmly believed in unleashing the potential of all

individuals through science and education at all levels. This is why women's talents must be encouraged, nurtured and recognized, in a world in which only one in three researchers is a woman¹.

Our desire for change is shared with the L'Oréal Foundation, and has led to our successful 20-year partnership - the longest between UNESCO and a private sector organization. Since 1998, 102 established women scientists have gained recognition for their pioneering work through the L'Oréal-UNESCO *For Women in Science* award, whilst nearly 3,022 of the most promising women scientists have earned scholarships for doctoral and post-doctoral research.

On the occasion of this 20th anniversary, I am proud to announce the joint launch with the L'Oréal Foundation of a new initiative to involve men in the scientific community in actively engaging to promote equality between men and women. We must, with their support, encourage girls to explore scientific career paths and break down the barriers that prevent women scientists from choosing scientific careers. Their voice is important to break down the barriers that prevent women from pursuing research and

to facilitate women scientists taking leadership roles, whether in academia, business or decision-making bodies.

Their groundbreaking research will contribute to tackling the challenges of our time, in the fields of improving health, adapting to climate change, protecting the ocean, harnessing new forms of energy, ensuring sustainable food production and innovating in industry. These are some of the challenges of the United Nations *2030 Agenda for Sustainable Development*, which recognizes the critical importance of science in driving innovation and change. Inclusion is at the heart of this agenda, as we all stand to benefit from pooling a diversity of perspectives to advance international scientific cooperation.

Finally, I wish to pay tribute to the laureates of this 20th edition. Once again this year, they will astonish and surprise us. They will demonstrate their commitment and their work at the forefront of innovation to create a better future for all and inspire current students.

Audrey Azoulay

Director-General of the United Nations Educational,
Scientific and Cultural Organization

1 - UNESCO Science Report Toward 2030, 2015.

L'ORÉAL-UNESCO

For Women In Science

20 years of commitment in a nutshell



Over the last
20 YEARS,
more than
3,100
women scientists recognized.



102
laureates honored for
excellence in science,
including three who
have gone on to win
the Nobel Prize.



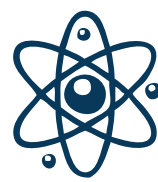
3,022
talented young women
granted fellowships to
pursue promising
research projects.



53 national and
regional fellowship
programmes established in
117 COUNTRIES.



Over **50**
high-level scientific
institutions involved
worldwide.



Over **400**
scientists involved in the
selection process for the
national and regional
programmes.

A NEW INITIATIVE IN 2018

Male champions for Women in Science

The L'Oréal-UNESCO *For Women in Science* programme has recognized outstanding female scientists for the last 20 years. Since 1998, the programme has valued the achievements of more than three thousand women in the field of science, put them at center stage, supported and promoted them in the scientific community and beyond. The L'Oréal Foundation and UNESCO conducted additional actions such as awareness raising on scientific careers for girls in order to generate vocations.

These are important levers in fighting inequality.

But we also have to acknowledge the limits of our action: although the scientific excellence and their contribution to science cannot be subject to any doubt any more, women still do not advance in their careers in the same speed as their male counterparts.

This is not just an issue of gender equality: diversity in science is a global concern with major repercussions and benefits for everyone if successfully addressed.

We want to create a coalition with non-female allies in the scientific community to help accelerate change – to recognize the problem and commit to generate opportunities for women scientists as they progress in their careers.

Male leaders, who occupy the majority of key positions in the field of science, can work with the L'Oréal-UNESCO *For Women in Science* initiative to promote equal opportunities, together with women.

The 20th anniversary of the L'Oréal-UNESCO *For Women in Science* programme is a key opportunity to launch an ambitious new initiative: **Male Champions for Women in Science**, engaging male leaders through a charter of commitments to encourage them to work with their female colleagues to change the system and harness the potential of women for the benefit of all.

Charter of commitments:
www.fondationloreal.com

HOW HUMANITY STANDS TO GAIN *from empowering women in science*

Alexandra Palt

Executive Vice President of the L'Oréal Foundation

Flavia Schlegel

Assistant Director-General for Natural Sciences, UNESCO

L'ORÉAL-UNESCO
FOR WOMEN IN SCIENCE
2018

The 20th anniversary of the L'Oréal-UNESCO *For Women in Science* Awards presents an ideal occasion to take a step back, reflect on progress made in empowering women in science and consider the issue of women's participation in science from different perspectives.

The number of women entering scientific careers has increased by 12% compared to 1998¹, but many women still face obstacles in achieving long, flourishing careers. Typical barriers include accessing senior roles, permanent positions and funding. In Europe, only 11% of leadership positions in academic institutions are occupied by women¹. Meanwhile, less than 30% of today's researchers are women², and only 3% of Nobel Prizes for Science have ever been awarded to women scientists.

There has been much debate over how to boost the number of women entering science and, in particular, how to enable more women to become leaders. Diverse strategies to bridge the gap are being employed. For example, the L'Oréal-UNESCO *For Women in Science* initiative rewards brilliant women scientists, creating role models at the highest level, provides funding to promising women scientists, and encourages girls to consider science as a career through structured educational programs.

*Only 11% of leadership
positions in academic
institutions in Europe
are occupied by women.*

*Less than 30%
of today's researchers
are women.*

While our program has raised the profile of some inspiring scientists and helped women to gain recognition within the scientific community, there is still much to do. It is time to take a deeper look at the challenges faced by women in progressing to leadership roles. Unconscious and conscious bias, breaking the glass ceiling and promoting inclusive working environments remain significant challenges.

*Only 3% of Nobel
Prizes for Science have
ever been awarded to
women scientists.*

Exploring the contributions of L'Oréal-UNESCO *For Women in Science* laureates

Over the past two decades, a number of key contributors to scientific output have been women. Together, the L'Oréal Foundation and UNESCO have awarded 102 laureates at an international level since 1998. These laureates' achievements have contributed significantly to scientific understanding of the world's pressing challenges. They work on all five continents, in biological and physical sciences, and are changing the world not only through their discoveries, but also as role models to encourage more women to pursue their scientific aspirations.

Professor Elizabeth H. Blackburn discovered telomeres and telomerase, shedding new light on the aging process; Professor Ada Yonath's studies on the structure and function of ribosomes have explained how genetic code is translated into proteins; Christiane Nüsslein-Volhard has conducted ground-breaking work on genes controlling embryonic development. All three were awarded Nobel Prizes for their outstanding discoveries. Elsewhere, Professors Jennifer Doudna and Emmanuelle Charpentier, developed the CRISPR/Cas9 gene editing system through a transatlantic partnership; the research of Professor Hualan Chen from Harbin China, has enabled the development of innovative vaccines against bird flu; Professor Jill Farrant from South Africa has conducted studies on resurrection plants, revealing hope for drought-resistant crops in Africa. Meanwhile Professor Ameenah Gurib-Fakim, who inventoried medicinal plants on Mauritius, created the Centre for Phytotherapy Research and, in 2015, was elected President of the Republic of Mauritius. Organic chemist Niveen M. Khashab developed a new generation of nanoparticles that naturally degrade when exposed to light in order to address their potentially harmful effects on the environment; Professor Mildred Dresselhaus pioneered research into the electronic properties of carbon and Professor Michelle Simmons received the L'Oréal-UNESCO Award for her leadership in the area of "super" or quantum computing.

“*Research is still far too deprived of the creative talents and diverse intellectual perspectives of half of humanity.*”

These laureates' achievements have contributed significantly to the scientific understanding of the world's pressing challenges, from pandemics to climate change. Their work has enabled us to explore our universe in ever greater detail, and shed new light on the origin and future of humanity. Their diverse intellectual capabilities help to solve the great social, economic and environmental issues of our time. However, currently, research is still far too deprived of the creative talents and diverse intellectual perspectives of half of humanity.

Gender bias in science

While L'Oréal Foundation and UNESCO are proud to support outstanding women scientists, we know that we must go further. A systemic change is required to truly empower women in science, address global challenges and achieve research outcomes that take into account a gendered perspective. The consequence can be gender bias in research outcomes which should make us all question the current system.

Let's take an example. For a long time, the idea of cardiovascular disease as a men's issue prevailed. Major clinical trials on reducing risk factors were conducted exclusively on men. Even as late as 1999, doctors were found to be conducting investigations of heart disease in women at half the rate of investigations of the disease in men, and women were less likely to receive bypass surgery and angioplasty, standard treatments for blocked arteries. The seminal study of aspirin to reduce the risk of heart attack involved over 22,000 men and no women, which led to inappropriate treatment for women.³

Similarly, new drugs may not be equally effective for women as they are for men, as clinical trials do not always include equal numbers of male and female candidates. One of the reasons may be that including women often requires more tests and therefore higher costs, as their bodies react differently to drugs at different times. A 2007 study led by a woman scientist shows that US researchers had to recall eight out of ten drugs when they repeated trials to include women.⁴

In another example, US and European car crash tests still do not systematically use pregnant crash test dummies, even when 82% of US fetal deaths with known causes result from motor vehicle collisions.⁵

The digital revolution is also proceeding with men at the helm, creating disadvantages for women. In the early days of voice recognition, it was evident that the software was evolving

with a male bias. Even more recently, there was a significantly higher rate of transcription error in women compared to men when using commercial voice recognition applications.⁶

In the field of Artificial Intelligence (AI) and machine learning, studies have also shown that when image databases associate women with domestic chores and men with sports, the image recognition software not only replicates those biases but amplifies them.⁷

Elsewhere, programs designed to "pre-select" candidates for university places or to assess eligibility for insurance cover or bank loans in the UK may discriminate against women and non-white applicants, according to recent research. For example, the prototype program developed to short-list candidates for a UK medical school discriminated against women and black and other ethnic minority candidates.⁸

“*New drugs may not be equally effective for women as they are for men, as clinical trials do not always include equal numbers of male and female candidates.*”

The world needs science and science needs women

This statement has never been more true. Our world is changing rapidly, and the pace of scientific discovery must be maintained, and ideally, accelerated, across all fields of science. But more importantly, women must be empowered to make an equal contribution to this epic scientific journey, and help to solve the great challenges facing humanity. This is not simply an issue of gender equality. It is also about achieving the best possible research, and ensuring beneficial outcomes for men and women.

Consider the issue of AI, which is likely to have a fundamental impact on our future. Unlike humans, algorithms cannot consciously counteract learned biases. And as AI permeates more aspects of our lives, the stakes will only get higher. If robots are soon going to be running the world, it is vital that they are programmed by men and women.

Clearly, getting the gender quality equation right is imperative. Scientific innovation, particularly in academic science, is a key driver of human progress and economic growth. Empowering women in science stands to truly serve humanity's needs in an inclusive society.

“ *Women must be empowered to make an equal contribution to this epic scientific journey, and help to solve the great challenges facing humanity.* ”

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4 - Liu, Katherine A., Dipietro Mager, Nathalie A., Women's involvement in clinical trials: historical perspective and future implications, *Pharmacy Practice* 2016 Jan-Mar; 14(1):708.

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8 - Prof Noel Sharkey, Co-Director of the Foundation for Responsible Robotics; <http://www.telegraph.co.uk/news/2017/08/24/ai-robots-sexist-racist-experts-warn/>.

THE 2018
LAUREATES:
*women scientists
at the cutting-edge*

THE 2018 LAUREATES:
*women scientists
at the cutting-edge*



*Laureate for Africa
and the Arab States*
PROFESSOR
HEATHER ZAR

For establishing a cutting-edge research program on pneumonia, tuberculosis and asthma, saving the lives of many children worldwide.



Laureate for Asia-Pacific
PROFESSOR
MEE-MANN CHANG

For her pioneering work on fossil records leading to insights on how aquatic vertebrates adapted to live on land.



Laureate for Europe
PROFESSOR
DAME CAROLINE DEAN

For her groundbreaking research on how plants adapt to their surroundings and climate change, leading to new ways to improve crops.



Laureate for Latin America
PROFESSOR
AMY T. AUSTIN

For her remarkable contributions to understanding terrestrial ecosystem ecology in natural and human-modified landscapes.



Laureate for North America
PROFESSOR
JANET ROSSANT

For her outstanding research that helped to better understand how tissues and organs are formed in the developing embryo.

2018 LAUREATE

Africa and the Arab States



Professor Heather Zar

MEDICINE AND HEALTH
SCIENCES / PAEDIATRICS

*Professor and Chair, Department of Paediatrics & Child Health,
Red Cross War Memorial Children's Hospital
Director SAMRC Unit, University of Cape Town, South Africa*

For establishing a cutting-edge research program on pneumonia, tuberculosis and asthma, saving the lives of many children worldwide.

In contrast to the aging populations of wealthy, developed countries, in Africa, children make up almost 50% of the population.¹ Too many of them succumb to diseases that could be prevented or treated. Pneumonia affects 36 million children across Africa each year, and is fatal in more than 700,000 children globally, with nearly 60% of these deaths occurring in Africa.² The rate of tuberculosis infection on the continent is among the highest in the world, and asthma affects between 10 and 20% of children.³ Heather Zar has dedicated her career to improving the diagnosis and treatment of these common causes of childhood illness and mortality in her native South Africa. *"I have always felt a strong commitment to work in areas where there is a real need,"* she says.

In a context where resources are in short supply, Dr Zar has adopted a pragmatic approach, focusing on the prevention, diagnosis and treatment of diseases with the greatest impact. She has developed simple tests to diagnose tuberculosis and pneumonia in children from spit and nasal swab samples, which have been integrated into global World Health Organization (WHO) guidelines. She demonstrated that preventative use of a common tuberculosis treatment, the antibiotic "isoniazid", reduced mortality by 50% and tuberculosis incidence by 70% in HIV-infected children who were not undergoing antiretroviral therapy.⁴

Heather Zar is committed to reducing health inequalities in the world. Her drive to become a scientist began the day her aunt and uncle brought her into their laboratory; her preoccupation with social justice came from her own parents. *"Being a paediatrician and clinician-scientist combines my desire to advance knowledge with my need*

to improve children's lives," she reflects.

One of her earliest contributions involved a common impediment to treating children with asthma: the lack of "spacers" that enable small children to breathe in inhaled medication at a natural rate. As a paediatric respirologist who had just returned to South Africa from subspecialty training at Columbia University in New York, Dr Zar adapted regular plastic soda or water bottles for the purpose. She then conducted a random clinical trial to show that the homemade device worked just as well as the commercial spacer.

Heather Zar was the first African and first child health specialist to receive, in 2014, the World Lung Health Award from the American Thoracic Society. Her work encompasses research, clinical care, education, training and advocacy. She is Department Chair at Red Cross Children's Hospital, the largest African hospital dedicated to children, and has led the development of education and research programmes to increase capacities in Africa.

Through her latest project, the Drakenstein Child Health Study, Dr Zar is following women and children in an underprivileged area of South Africa, from pregnancy onwards, to investigate the impact of early life factors on child lung health and adult-onset illnesses. An early study arising from the project, published in the *Lancet Respiratory Medicine* in 2016, points to a novel approach to preventing early childhood pneumonia by immunizing pregnant women. Once again, Heather Zar's dedication to improving the health of Africa's children stands to bring benefits on a global scale.

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2018 LAUREATE *Asia-Pacific*



Professor Mee-mann Chang

BIOLOGICAL SCIENCES/
PALAEOANTHROLOGY

*Professor, Institute of Vertebrate Palaeontology
and Palaeoanthropology*

Member of Chinese Academy of Sciences, Beijing, China

For her pioneering work on fossil records leading to insights on how aquatic vertebrates adapted to live on land.

In evolutionary theory, it was long thought that land mammals, including humans, evolved from fish, through the intermediary of a species called lungfish that had the ability to breathe through gills as well as lungs. It turns out that this was not the case. In fact, lungfish and the amphibian tetrapods from which mammals evolved can be traced back to a marine life form dating back 400 million years: the sarcopterygian lobe-finned fish.

This revision of humanity's distant origins came about thanks to the work of Professor Mee-mann Chang, who has spent decades examining fish fossils, some of which date back to the Devonian period, some 400 million years ago. In 1982, she completed a 3D reconstruction of the skull of a fish, called "*Youngolepis*", from the Devonian era, finding characteristics that identified it as an early relative of the tetrapod, while also sharing features with the lungfish. She later worked on a more lungfish-like "*Diabolepis*". It took some time for other palaeontologists to share her view, but the significance of the discovery to evolutionary theory raised Mee-mann Chang's profile in the field. The American Museum of Natural History placed a replica of one of her specimens, "*Diabolepis*", together with a photo of Chang in the cabinet for "lungfish and relatives", which is on permanent display in the Hall of Vertebrate Evolution.

Professor Chang has contributed many insights into this early evolutionary period. "*My work falls into the category of pure science,*" she says. "*It explores fundamental questions about who we are and where we came from.*" Her discoveries over the past 50 years have helped explain the reasons and timeframe for evolving features in certain species of fish. In 2013, one of her fossil analyses highlighted that 30 million years ago, fish developed thick skeletons to adapt to the high concentrations of calcium that occurred as the waters of the Tibetan Plateau ran dry. The discovery

reflects a dramatic physiological adjustment to severe environmental distress. "*To be able to figure out what the new fossil is, how it is related to other organisms, how it lived, and what it can tell us about the ancient environment is truly a scientific illumination,*" says Professor Chang. "*China is rich in fossil resources, which provides excellent opportunities for research,*" she adds.

A few impediments along Professor Chang's career, notably during the Cultural Revolution after 1966, has interrupted her research for over a decade. However, she has overcome travel issues, for example, to create important international collaborations, and ensured that these contribute to the development of science in China. Professor Chang's longstanding engagement with Beijing's Institute of Vertebrate Palaeontology and Palaeoanthropology has made China a leader in the field of palaeontology and helped to develop a vibrant world-class research environment that is inspiring new generations of outstanding scientists. Now 82, Mee-mann Chang remains active in the field, still just as determined as ever to discover more about humanity's origins and explore the voyage of fish across time and around the globe.



2018 LAUREATE

Europe



Professor Dame Caroline Dean

BIOLOGICAL SCIENCES/
MOLECULAR BIOLOGY

Professor, John Innes Centre,
Norwich Research Park,
United Kingdom

For her groundbreaking research on how plants adapt to their surroundings and climate change, leading to new ways for crop improvement.

The surface of the earth is growing warmer, raising fundamental concerns regarding global food security, and reinforcing the importance of understanding whether crops and ecosystems can adapt to a changing climate, and to what extent. This question has preoccupied Caroline Dean for some time.

Much of Professor Dean's career has revolved around two central questions in plant biology: why do certain plants have to pass through winter before they bloom, and how do they remember their exposure to cold temperatures months earlier? Her interest in these questions was sparked when, in sunny California, the British scientist was advised to put her tulip bulbs in the refrigerator for six weeks before planting. *"That was the trigger for me to start reading about vernalization, the 'winter requirement',"* she says.

Plants change from growth mode to flowering mode according to signals they receive from their environment. Dean discovered how the memory of this signal is retained by the plant's cells. *"My eureka moment,"* Professor Dean says, *"was when I realized that all the major strands of research in my lab were converging on the regulation of just one gene – 'Flowering Locus C' – and therefore, what an important gene that was in the regulation of plant flowering time."*¹

Her research into factors that determine expression of genes has implications beyond plants. For example, it helps to clarify how cells with the same DNA content all behave and respond differently to specific signals – a research field called "epigenetics". The mechanisms in humans and plants are very similar, potentially enabling plant research to catalyse the development of better diagnostics and treatments for human diseases. By clarifying the mechanism behind how genes change in response to environmental cues, she has contributed significantly to our general understanding of gene regulation.

The issue is not merely academic: the ability to breed winter and spring-sown plant varieties with different vernalization requirements could help to extend the geographical range of agricultural crops. Professor Dean's research provides valuable insights into the potential ecological impact of climate change on agriculture, while also pointing to potential solutions.

Caroline Dean is recognized as a world leader in plant biology, and her research group was a central player in the international effort to map the genome of the plant *"Arabidopsis thaliana"*, which has since become an important point of reference for all plant research.

With a love of science inspired by TV shows featuring oceanographer Jacques Cousteau (she once drove to Marseille on a spur-of-the-moment, unsuccessful mission to meet him), Dean took advantage of early career opportunities as they came, and strongly recommends that every scientist move around internationally as they continue their training. *"My five years in California totally changed my scientific horizons and gave me a 'can do' attitude,"* she says. *"We returned to the UK because my husband and I had a wonderful double job offer."* Professor Dean and her husband have both advanced their careers while bringing up their children, and she warmly encourages other women scientists to do the same. In particular, she urges them to "lean in", an expression coined by business woman and author Sheryl Sandberg, meaning to seize opportunities to lead despite the impulse to hold back. Dean says: *"I encourage women to continually expand their comfort zone, so at those key moments, they always lean in."*

1 - Vernalization requires epigenetic silencing of FLC by histone methylation". Nature. 427 (6970): 164–167, 2014.



Professor Amy T. Austin

ECOLOGY AND ENVIRONMENTAL
SCIENCES

Professor, IFEVA-CONICET,
Facultad de Agronomía,
Universidad de Buenos Aires, Argentina

For her remarkable contributions to understanding terrestrial ecosystem ecology in natural and human-modified landscapes.

Sustainable development and climate change represent the greatest challenges facing humanity. To plan for a sustainable future in a rapidly changing environment, we need to understand how these changes are likely to affect basic natural processes. Professor Amy Austin's research in the southern reaches of Argentina fills crucial gaps in knowledge about plant decomposition and soil fertility. Her research has led the scientific community down new paths, pursuing novel hypotheses, and will help better manage and conserve ecosystems affected by global change.

Professor Austin was the first researcher to demonstrate, in 2006, that solar radiation is the dominant process controlling carbon loss in semi-arid ecosystems where biotic decomposition activity is minimal or absent. Her findings countered the prevailing idea that microbial and faunal biotic decomposition dominated carbon and nutrient cycling in all terrestrial ecosystems.

She discovered that, when they fall to the ground, senescent tree and grass leaves can lose a portion of their carbon and nitrogen through photo-degradation by sunlight. Ultra-violet light, which has increased due to ozone depletion, is particularly effective at breaking down lignin, a dominant structural material in plant cell walls. The lignin degradation process then facilitates decomposition on the ground.

Photo-degradation acts to short-circuit the carbon cycle, releasing CO₂ from organic matter directly into the air rather than during biodegradation on the soil surface. Increased sunlight and UV rays, along with drier conditions, may contribute to increasing CO₂ release from plants, thereby potentially contributing to climate change.

Professor Austin credits her father, a NASA engineer, for sparking her early interest in science. *"His passion and enthusiasm for the moon landing invaded our everyday*

life in a way that made it impossible not to feel inspired by the potential of scientific discovery," she says. On the day of the Apollo 11 launch, Austin's father took all five of his children onto the roof to see the actual space launch that eventually landed on the moon. *"The sparkle in my father's eye and the pride of scientific accomplishment is something that has always stayed with me,"* she adds.

In the United States, Austin had witnessed the wonder of scientific discovery in humanity's conquest of space. When she moved to Argentina, where she has pursued her entire scientific career, she focused on understanding the workings of nature in its pristine state. *"I focus on developing game-changing ideas that can be tested in a straightforward, low-tech way,"* she says, explaining that her best insights into the mechanisms controlling ecosystem processes arise in the field.

Environmental concerns prompted Austin to conduct research in Argentina: *"I felt that the future decisions of ecology and conservation in Latin America were going to be critical at the regional and planetary scale."* She has developed regional collaborations in South America to evaluate human impacts, notably nitrogen fertilizer use, on agriculture's nutrient cycles, and participates in international initiatives on the issue. Professor Austin foresees a much greater push to translate ecological sciences into useful tools for decision-making, as climate change becomes an ever greater political priority.

By improving the understanding of terrestrial ecosystem ecology, and of human impact on these ecosystems, Professor Amy Austin hopes to help society strike a better balance between human needs and the conservation of natural ecosystems.

2018 LAUREATE Latin America



2018 LAUREATE

North America



Professor Janet Rossant

BIOLOGICAL SCIENCES/
DEVELOPMENTAL BIOLOGY

Senior Scientist, The Hospital for Sick Children, Toronto, Canada
University Professor, University of Toronto, Canada
President, Gairdner Foundation, Canada

For her outstanding research that helped to better understand how tissues and organs are formed in the developing embryo.

Advances in genetics are opening up new possibilities for treatment and prevention. They also raise important ethical dilemmas: should we use these discoveries to eliminate disease-causing genes permanently from the human gene pool? Or only to fix defects on an individual basis? And where do we draw the line between disease prevention and genetic enhancement? Professor Janet Rossant believes that scientists must be deeply engaged in creating ethical frameworks for their discoveries. In North America, she has played a leading role in developing guidelines for research and practice that are now internationally recognized.

Her influence among scientists and her concern for ethics arose from her own contribution to understanding and altering gene development. With almost 400 publications, Professor Rossant is a pioneer in the field of mammalian stem cells and embryonic development.

Whether the aim is to create replacement body tissue or assure a healthy pregnancy, it comes down to understanding how embryonic cells behave and function. In the first few days after conception, the fertilized egg develops into the blastocyst. Inside the blastocyst is a small group of cells that later forms the embryo, while the outer layer of cells goes on to form the placenta. The embryonic cells divide and develop into all cell types present in the body; they are called “pluripotent stem cells” due to their capacity to self-regenerate into multiple forms. Rossant was the first to identify the stem cells, known as “trophoblasts”, that go on to form the placenta, opening up new ways to address pregnancy disorders such as intrauterine growth retardation.

Professor Rossant’s work has been driven by a desire to understand basic developmental mechanisms. “When I was studying at Cambridge, a lecture by John Gurdon (who went on to win the Nobel Prize in 2012) on

early frog development introduced me to the wonders of developmental biology: how does the single cell — the fertilized egg — develop into a complex organism such as ourselves? I was captivated and have pursued this question throughout my career,” she says.

On the way, she has connected these mechanisms with genetic disorders, birth defects and diseases, laying the foundations for therapeutic innovations. Her research into these mechanisms was made possible by a technique she helped to develop. Rossant’s group was one of the first to make targeted mutations in developmental genes in laboratory models, precursors to today’s CRISPR/Cas9 gene editing system, a method that could be likened to “genetic scissors” (by cutting a specific region of the DNA, it is possible to modify a gene, or to replace it with another). It enabled her to introduce specific mutations into embryos and clarify gene function.

Born and educated in the United Kingdom, Professor Janet Rossant developed her career in Toronto after meeting her husband, a Canadian, while studying at Cambridge. However, her impact now crosses international borders. “One of the best things about being a scientist is the opportunity to travel and interact with scientists elsewhere, who bring different viewpoints and skill sets to bear on a common challenge,” she says. In a complex world facing complex challenges, Professor Rossant highlights the importance of bringing greater diversity to scientific communities, and encouraging young people to enter the world of science. She herself has mentored more than 70 doctoral and post-doctoral students. “Young people have innovative ideas that can transcend the disciplinary boundaries that most of us grew up with,” she says. “We must not lose their skills — they will change the world.”

INTERNATIONAL
*Rising
Talents*

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2018

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Each year, the International Rising Talents programme selects the 15 most promising women scientists among the 275 national and regional fellows of the L'Oréal-UNESCO *For Women In Science* programme. These young women are the very future of science and recognizing their excellence will help ensure that they reach their full potential.

AFRICA AND THE ARAB STATES



Dr. Areej Abuhammad

L'ORÉAL-UNESCO REGIONAL FELLOWSHIP LEVANT & EGYPT

School of Pharmacy, University of Jordan

FUNDAMENTAL MEDICINE

A CRYSTAL FOR A CURE

Chronic venous disease (CVD) affects 57% of men and 77% of women.¹ It is caused by dysfunction in the superficial or deep venous systems of the legs and can lead to varicose veins, skin changes and venous ulcers. Surgical treatment of superficial varicose veins is effective but also expensive, and can involve complications such as infection. Dr. Areej Abuhammad's objective is to develop drug therapies against CVD. "The treatment of many diseases is based on targeting and inhibiting specific active proteins called enzymes," she explains. "We do this by designing small chemical molecules that are structurally compatible with the enzymes. However, we first need to understand the structure of the enzyme we are trying to target." She is working to design a selective inhibitor of the matrix metalloproteinase-9 (MMP9), which is implicated in the tissue degradation that leads to varicose veins. The first step is to establish the struc-

ture of the MMP9 in complex with small chemical fragments using crystallography, a technique to determine the molecular structure of crystalline materials. She describes her introduction to protein crystallography as a defining moment in her own career. "The novel field of protein crystallography has helped to elucidate the shapes and structures of important proteins. Prior to the advancement of this field, very little was known about the physical structure of such small components of the cell." Dr. Abuhammad started the first protein crystallography laboratory for drug discovery in Jordan. Her aim is to establish novel therapies for CVD and other noncommunicable diseases such as cancer, obesity, as well as infectious diseases such as tuberculosis, avian influenza and Middle Eastern Respiratory Syndrome (MERS).

1 - Onida, S., and Davies, A. H. (2016), Phlebology 31, 74-79.



Danielle Twilley

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP SOUTH AFRICA

Plant Science Complex Cell Culture Laboratory, University of Pretoria

BIOLOGICAL SCIENCES, MEDICINAL PLANT SCIENCES

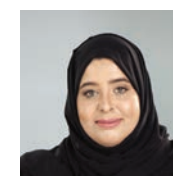
TARGETING ANGIOGENESIS FOR THE TREATMENT OF MELANOMA

Skin cancer is one of the most common types of cancer in South Africa. Melanoma is the most dangerous type of skin cancer with approximately 86% of melanoma cases attributed to sun exposure.¹ "Melanoma, explains Danielle Twilley, spreads by giving off signals that stimulate the growth of new blood vessels, called "angiogenesis", feeding the cancer with oxygen, nutrients and a pathway to various parts of the body." Angiogenesis is becoming an attractive target for cancer therapies, however, according to the NCI there are currently no angiogenesis inhibitors available for the treatment of melanoma.² Danielle Twilley is seeking to find out whether a compound isolated from a South African plant, which she found in previous research

to have significant cytotoxicity (the quality of being toxic to cells) towards melanoma cells, is able to inhibit both angiogenesis and tumour growth. To minimize damage to healthy cells while delivering powerful doses to the tumour environment, she is developing the anti-angiogenic agent into gold nanoparticles to target the delivery to the tumour and its vascular network. Mrs. Twilley explores indigenous knowledge of plant-based medicines for application in skin cancer, finding one traditionally used plant with high antioxidant content that boosts the SPF of a sunscreen. She is highly engaged in product development, undertaking patenting processes that assure benefits to indigenous communities, planning clinical trials and dealing with manufacturers.

1 - Parkin DM, Mesher D, and Sasieni P. 2011. Cancers attributed to solar (ultraviolet) radiation exposure in the UK in 2010. British Journal of Cancer 105, S66-S69.

2 - NCI. 2011. Online. Angiogenesis inhibitors. Available at: <https://www.cancer.gov/about-cancer/treatment/types/immunotherapy/angiogenesis-inhibitors-fact-sheet> (29/07/2017).



Dr. Hanifa Taher Al Blooshi

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP UNITED ARAB EMIRATES

Department of Chemical Engineering, Khalifa University

CHEMICAL ENGINEERING

SUSTAINABLE PRODUCTS FOR MAJOR OIL SPILLS CLEAN-UP

Spills are a regular occurrence in oil exploration and transport, and pose environmental threats. More than 45 significant spills have been reported since 2010; the four that occurred in 2016 released some 6,000 tons of oil into the oceans.¹ Chemical dispersants are used to accelerate oil dispersion and biodegradation in water, and have been found to clean up to 90% of the spill, however, there are concerns about the toxicity of these agents. Work is underway to find environmentally benign and biodegradable-based dispersants. Ionic liquids, also known as designer agents, made from waste may serve this purpose, while making good use of waste products. Dr. Taher Al Blooshi is developing a new oil dispersant compound from sustainable materials, notably waste, which is available in abundance in the United Arab

Emirates. She will formulate, produce and test different products against currently used agents with different types of oil and in different water conditions. The findings of this study could provide a new formulation with the potential to replace traditional dispersants used in oil spill remediation. The positive outputs would benefit both the environmental and marine sectors. Dr. Al Blooshi is pursuing this research alongside her research into automotive grade biodiesel produced from oils extracted from oil-rich compounds. "Both biodiesel production and ecologically sound technologies are hot research topics in chemical engineering generally, and in the United Arab Emirates in particular," she says. Her research will provide sustainable solutions for cleaning up oil spills and help to protect biodiversity.

1 - Oil tanker spill statistics 2016, 2017, The International Tankers Owners Pollution Federation Limited London.



Dr. Ibtissem Guefrachi

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP TUNISIA

Biodiversity and Valorization of Bioresources in Arid Zones, Faculty of Sciences of Gabes in collaboration with the Institute of Integrative Biology of the Cell

MICROBIOLOGY

PLANTS POINT TO WAYS OF OVERCOMING ANTIBIOTIC RESISTANCE

Multi-drug resistant bacteria risk undoing the tremendous progress antibiotics have brought to the fight against infections. An international search for new antimicrobial agents is underway and some scientists are zeroing in on plants. Antimicrobial peptides, found in certain varieties of legume, appear, in laboratory tests, to have potent antibacterial activity. Nodules on the roots of legume plants are symbiotic organs that house within their cells thousands of nitrogen-fixing rhizobium bacteria, called “*bacteroids*”. Cohabitation with bacteria has led these plants to evolve adaptations that prevent cells from succumbing to bacteria and bacteria from succumbing to the cell’s immune response. Dr. Ibtissem Guefrachi found that some species of legume, such as alfalfa, *Arachis* and *Aeschynomenes* (tropical plants), produce nodule specific cysteine-rich peptides (NCR) that house the bacteroids, and has revealed mechanisms that make bacteria sensitive or resistant to them. She

is now investigating the potential activity of chemically synthesized NCR-like peptides against fungal and bacterial pathogens that are common in humans, such as *Candida albicans*, which causes yeast infections or thrush, and *Chlamydia trachomatis*, a common sexually transmitted infection. She also sees potential applications in the food processing industry and agriculture. Dr. Guefrachi is motivated by both scientific curiosity about the symbiotic development of plants and bacteria, as well as a desire to help solve current problems. “*I hope this research will lead to new solutions in health care and agronomy.*” The mechanisms of symbiotic nitrogen fixation seen in legumes may also enable the development of ways to improve nitrogen fixation in non-legume crops, thereby reducing the need for nitrogen fertilizers that contribute to climate change and surface water pollution.

ASIA-PACIFIC



Dr. Weang Kee Ho

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP MALAYSIA

Department of Applied Mathematics, University of Nottingham Malaysia Campus / Cancer Research Malaysia

HEALTH SCIENCES, EPIDEMIOLOGICAL STATISTICIAN

TARGETED SCREENING FOR BREAST CANCER

In Asia, the incidence of breast cancer is expected to increase by up to 50% between 2012 and 2025. Women are often diagnosed with advanced disease, and the five-year survival in some Asian countries is just 49%, compared to 89% in Western countries.¹ A major challenge in the coming years is to increase mammography screening and early detection in underprivileged communities. Dr. Weang Kee Ho is developing a tool that can be used to identify the women at greatest risk and focus screening programmes on this population. There is a pressing need for a risk calculator based on Asian genetic analysis, as existing risk assessments were designed from studies in European people. Dr. Ho is working with combined genetic data sets from a number of major breast cancer studies conducted in Asian countries to identify candidate common genetic markers that are useful

for Asian breast cancer risk prediction. She is setting the bar high: “*Risk prediction models that include only common genetic mutations, but do not take into account rare mutations and other known breast cancer risk factors, would not be comprehensive,*” she emphasizes. However, she believes that with mammoth collaborative efforts with other experts in the team, this ambitious goal is achievable. An epidemiological statistician, Dr. Ho’s first love was mathematics. “*It was during my doctoral studies,*” she recounts, “*that I realized that the mathematical skills I had gained could be a powerful tool to answer many important scientific questions.*” She has been working on the epidemiology and genetics of stroke, diabetes and cardiovascular disease, and is continuing to participate in international collaborations on her most recent work on breast cancer.

1 - The Economist Intelligence Unit, 2016

<http://www.eiuperspectives.economist.com/healthcare/breast-cancer-asia-infographic>.



Dr. Hiep Nguyen

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP VIETNAM

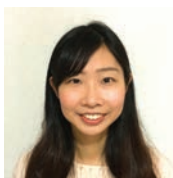
Tissue Engineering and Regenerative Medicine Orientation, Biomedical Engineering Department, International University of Vietnam National Universities - Ho Chi Minh City

MEDICAL ENGINEERING

A 21ST CENTURY FIRST-AID KIT

Better access to health care for people living in remote and rural areas would help to improve quality of life, potentially prevent some degree of migration to cities, and avoid much disruptive travel into cities to treat injuries. “My current work,” Dr. Hiep Nguyen tells us, “focuses on biomaterials such as bio-glue, bio-tape and needleless suturing for wound repair that can be used directly by patients at home.” Her most recent project involves the development of a smart gel that is mainly formed by cross-linking hyaluronic acid (which contributes significantly to cell proliferation and migration) and chitosan (useful in tissue regeneration). It can carry other ingredients such as silver and curcumin nanoparticles for different specific applications. Her team is currently testing the gel to maximize safety and performance. The ultimate goal is a product that can be applied promptly on different types of wounds, helps eliminate bacteria and promotes rapid tissue regeneration. When applied, the gel will form a membrane to stop bleeding,

absorb liquid from the wound and prevent infection from microorganisms. “My research goal,” she says, “is to study and bring new technologies from developed countries back to Vietnam, while also launching biomaterials and medicines originating in Vietnam on world markets.” She has just launched a start-up company to develop commercially viable biomaterials and is committed to developing research capacities in her country. Within the Biomedical Engineering Department, along with the Chair and colleagues, she strengthened the orientation in tissue engineering and regenerative medicine (TERM) by designing new courses, teaching, mentoring, building laboratories and helping to organize international conferences. The success of the TERM orientation contributed to the reputation of the Biomedical Engineering programme, which was ranked first in Vietnam and second among all programmes in the ASEAN (Association of Southeast Asian Nations) network of leading universities.



Dr. Yukiko Ogawa

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP JAPAN

Lightweight Metallic Materials Group, Research Center for Structural Materials, National Institute for Materials Science

MATERIAL ENGINEERING

LIGHTENING THE LOAD: NEXT-GENERATION STRUCTURAL MATERIALS

Lightweight materials are increasingly in demand to improve fuel efficiency in vehicles, make electronic devices more portable and open up new possibilities for medical devices. Magnesium alloys are an appealing material precisely due to their light weight, however their use has been limited as they are difficult to shape into particular forms. Dr. Yukiko Ogawa succeeded in controlling the microstructure and mechanical properties of magnesium by heat treatment, which had previously been considered impossible. She further experimented with adding another element, scandium, to the alloy to arrive at an optimal combination of strength and ductility (the extent to which it can be deformed without breaking). In the process, she discovered that the material exhibited shape memory – it can be bent and deformed but reverts back to its original shape when exposed to heat or electricity. Her

research group is now investigating other properties that the alloy may have: biodegradable and well accepted in the human body, promising to overcome some of the difficulties currently seen with implantable devices such as stents. As a child, Dr. Ogawa wanted to become a scientist so she could develop novel things to help people. “Material science is the foundation of our modern society,” she says. “Improvements in the properties of materials and the development of new materials enables radical innovation.” Her research team is now working to adjust the composition of the alloy and the process employed to induce shape-memory behaviour, in order to enable affordable and scalable production. Her experiments also open new directions for the study of other lightweight alloys for use in more environmentally friendly transportation systems.

EUROPE



Dr. Radha Boya

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP UNITED KINGDOM

Condensed Matter Physics Group, University of Manchester

PHYSICS

MAKING TINY PIPES FOR TRANSPORT AND FILTRATION

Nanostructures are ever present in nature, assuring the passage of substances to where they are needed and filtering out impurities. “Sub-nanometric channels are crucial for the essential functions of life that rely on transport of small ions across cellular membranes,” highlights Dr. Radha Boya who trained in physics in India and is currently conducting research in the UK. “It is only over the past two decades that we have started discovering the importance of the nanodimensions and the rich science hidden behind them.” Replicating these natural structures has potential uses in areas as diverse as water filtration, bioanalytics and drug delivery. Dr. Boya has found a way to make channels, or pipes, as she calls them, that are 10,000 times thinner than a human hair. Using graphene enabled her to overcome

limitations caused by the roughness of other molecules. Her pipes are made by the imprint in the graphene, which can either create a cavity useful for confining a substance, or a tunnel for transporting matter. These can be employed to sieve molecules and ions by size. The technique of making pipes by nanolithography developed by Dr. Boya is reproducible and flexible, providing an important tool for further development of artificial nanochannels with specific properties suited to different requirements. “I dream that my work could lead to better understanding of the natural protein water channels found in cellular membranes,” she says. This work provides the building blocks to new ways of desalinating and filtering water, and new techniques for fuel-gas separation from refineries.



Dr. Agnieszka Gajewicz

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP POLAND

Faculty of Chemistry, University of Gdansk

CHEMISTRY

SAFETY FIRST IN DEVELOPING NEW MATERIALS

Nanomaterials are rapidly changing the landscape of industrial and consumer products, from memory storage in our computers to solar cells to generate electricity and drug delivery systems. However, there are still major gaps in our knowledge on how these tiny particles affect the environment and human health. A proactive approach is needed, given lessons learned from the serious health risks posed by chemicals once considered harmless, such as the impact of asbestos (a mineral often used in insulation) on the lungs, or the insecticide DDT on birthweight. As a specialist in chemical informatics and marathon runner, Dr. Agnieszka Gajewicz is intent on anticipating hazards before they are released into our environment and our bodies. With a great number of new nanoparticles introduced into commercial use every day, it is unrealistic to expect that each one will be subject to comprehensive risk assessment. Dr. Gajewicz is therefore

developing efficient computational methods to establish the properties and toxicity of nanomaterials and accelerate pre-clinical assessment. For regulators, these methods provide a means of evaluating safety at early stages of new nanomaterial development, taking the whole product life cycle into account. "Compared with traditional laboratory work," she explains, "computational methods enable the development of products that are safe by design, sifting through thousands of candidate chemicals." Dr. Gajewicz's work has caught the attention of regulators in Europe looking for ways to ensure effective hazard assessment of manufactured nanomaterials. Dr. Gajewicz sees many commonalities between her scientific passion for cheminformatics and her passion for running: "Running a marathon takes a lot of planning and organization, determination, perseverance and discipline — much like a career in science."



Dr. Anna Kudryavtseva

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP RUSSIA

Laboratory of Postgenomic Studies, Engelhardt Institute of Molecular Biology, Russian Academy of Sciences

BIOLOGICAL SCIENCES

THE MYSTERIES BEHIND TUMOUR MALIGNANCY

In Europe, 22% of all cancer diagnoses involve rare cancers, where treatments are less available and five-year survival rates are 47% compared to 65% for common cancers.¹ Dr. Anna Kudryavtseva is attracted to scientific problems where knowledge is sparse, and was inspired to shift from surgical aspirations to biology following a lecture on single-cell organisms. "The most interesting part is doing something completely new, working on something that has never been properly researched before," she says. In rare cancers called "paragangliomas", especially the cancers of the head and neck on which she is working, she has striven to find a goal to reflect her aspirations. In these rare tumours, driver mutations that would permit targeted therapies are still largely unknown. While most are slow-growing and benign, for between 10% and 15% of patients, tumours become malignant and can metastasize.² They are particularly dangerous as they occur very close to vital structures such as the carotid

artery, and respond poorly to chemotherapy and radiation therapy. These cancers have another distinction, in that the disruption of cells' ability to extract and use energy is a primary cause of malignancy, while in most cancers it is a secondary phenomenon. It therefore provides an ideal focus for Dr. Kudryavtseva, whose prior work has examined energy metabolism in the progression of tumours. She is conducting genetic and epigenetic analysis of tumour samples, along with blood and lymph node samples, in order to identify differences between the three most common forms of head and neck paragangliomas. These genetic alterations will help to define prognostic markers for disease that will become malignant, so that treatment can be initiated and new drugs developed. An important component of the research lies in correlating genetic alterations with clinical characteristics to take into account the interaction between genetic characteristics and external and internal factors.

1 - Gemma Gatta, Jan Maarten van der Zwan, Paolo G. Casali, Sabine Siesling, Angelo Paolo Dei Tos, Ian Kunkler, Renée Otter, Lisa Licitra, Sandra Mallone, Andrea Tavilla, Annalisa Trama, Riccardo Capocaccia, Rare cancers are not so rare: The rare cancer burden in Europe, European Journal of Cancer, 2011; 47(17):2493-2511.

2 - Zhikrivetskaya S.O., Snezhkina A.V., Zaretsky A.R., Alekseev B.Y., Pokrovsky A.V., Golovyuk A.V., Melnikova N.V., Stepanov O.A., Kalinin D.V., Moskalev A.A., Krasnov G.S., Dmitriev A.A., Kudryavtseva A.V., Molecular markers of paragangliomas and Pheochromocytomas. Oncotarget, 2017;8(15):25756-25782.



Associate Prof. Duygu Sag

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP TURKEY

Izmir Biomedicine and Genome Center, Dokuz Eylul University

BIOLOGICAL SCIENCES, IMMUNOLOGY

TRIGGERING THE IMMUNE SYSTEM TO FIGHT CANCER

While our immune system defends us against many diseases, it is less effective against cancer. Recent breakthroughs have found ways to increase the immune system's ability to find and eliminate cancer cells, however, one critical immune cell type within the tumour environment, known as "macrophages", has not yet been targeted successfully for immunotherapy. Macrophages can be either anti-inflammatory and promote tumour cell proliferation, or pro-inflammatory and fight the tumour. The tumour environment is usually dominated by tumour-promoting macrophages. The mechanisms that govern the switch between these two types of macrophage are poorly understood. "We have recently made the exciting discovery," says Prof. Duygu Sag, "that macrophages that lack the cholesterol transporter

ABCG1 become potent tumour-fighting macrophages and inhibit the progression of bladder cancer in pre-clinical studies." Her team is now working to discover the molecular mechanisms that trigger this switch from tumour-promoting to tumour-fighting macrophages. "This may lead to the development of novel immunotherapeutic approaches for the treatment of cancer," she suggests. Prof. Sag's commitment to science began in high school: "While other girls had posters of celebrities on their walls," she says, "I had photos of famous biologists and scientific posters hanging all over my room." She is hopeful that science can help overcome the unprecedented problems facing the world: "Our arsenal of scientific knowledge to tackle those problems is now also unprecedented."



Dr. Ai Ing Lim

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP FRANCE

Mucosal Immunology Section, Laboratory of Parasitic Diseases, National Institute of Allergy and Infectious Diseases, National Institutes of Health, United States

FUNDAMENTAL MEDICINE

THE ORIGINS OF IMMUNE SYSTEM INTELLIGENCE

Our body has a beautiful design with a very precise system. Our immune system can create specific responses to target different pathogens to protect our body. However, today, there are more people suffering from asthma, dermatitis, food allergy and obesity, all of which link to our immune system. This suggests that we are experiencing a certain level of immune dysfunction. While the causes remain a mystery, laboratory studies have shown that a single infection can cause long-term damage to immune system balance. The babies born with microcephaly after their mothers were exposed to the Zika virus represent an alarming reminder of the long-term impact of maternal infection. Pregnancy involves substantial changes in hormone, metabolism, microbiota and immunity. Moreover, pregnant women are more susceptible to a number of infectious diseases, including the influenza virus, listeria and toxoplasma, for example. All of this suggests that the foetal

environment may be related to the immune disorders that we are facing, especially in high-income countries. Dr. Ai Ing Lim believes that maternal-foetal interaction in the uterine environment may hold the key to understanding the complexity of immune disorders. She is exploring how maternal exposure to infections during pregnancy impacts on the baby's immune system. Her research involves laboratory studies on the impact of infections that commonly occur during pregnancy, such as the influenza virus, on immune system development and the baby's susceptibility to inflammatory disease. She is building on previous discoveries on a new type of immune cell known as innate lymphoid cells, which play a crucial role in early immune responses to fight against various diseases. "Ultimately," she says, "I hope that understanding how our immune systems work, especially in the maternal-foetal context, will lead us to resolve many infectious and inflammatory diseases."

LATIN AMERICA



Dr. Selene Lizbeth Fernandez Valverde

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP MEXICO

Advanced Genomics Unit, National Laboratory of Genomics for Biodiversity (UGA-LANGEBIO), Cinvestav

BIOLOGICAL SCIENCES AND GENOMICS

THE SECRETS OF GENOMIC “DARK MATTER”

Proteins are considered to be the fundamental building blocks of life and are receiving much scientific attention. Yet they are contained in less than 3% of our DNA. The vast number of RNAs, polymeric molecules essential in various biological roles such as coding, decoding, regulation, and expression of genes, that do not make proteins (known as “long non-coding RNAs” or lncRNAs) remain the relatively unexplored “dark matter” of the genome. Dr. Fernandez Valverde is intent on understanding the function and evolution of the thousands of lncRNAs that are present in most life forms, some of which are known to control gene expression and have been linked to human diseases such as cancer and diabetes. “This is one of the most exciting times to be involved in biological research” she enthuses. Technological advances enable scientists to obtain a full sequencing of DNA and RNA of an organism and “this wealth of information is allowing

us to use evolutionary theory to identify which molecules are important in different organisms and contexts.” Dr. Fernandez Valverde is developing a framework that will permit studies of individual lncRNAs to identify structural motifs, groups of lncRNAs with shared characteristics, and associate these with functions. She uses computational methods to identify RNA sequences that are under evolutionary selection. “For example,” she says, “we can identify RNAs whose expression increases in particular environments such as high altitude or high sun exposure, and identify how these changes are associated with the appearance and response to disease in humans, animals and crops.” She hopes the tools developed in her laboratory will enable scientists to interpret the impacts of the environment on genetic change by rapidly assigning functions to novel, uncharacterized RNA molecules.



Prof. Rafaela Salgado Ferreira

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP BRAZIL

Laboratory of Molecular Modeling and Drug Design, Computational Biology Group Universidade Federal de Minas Gerais, Belo Horizonte

CHEMISTRY

COMPUTING POWER IN THE SERVICE OF NEGLECTED DISEASES

Diseases that largely affect poorer countries do not always receive sufficient investment from pharmaceutical companies, leaving it to public universities to fill this important gap. Dr. Rafaela Salgado Ferreira leads the Laboratory of Molecular Modeling and Drug Design in Belo Horizonte, Brazil, with a mission to develop new drugs for neglected diseases. “We employ a strategy called rational drug design” she explains. “First, a protein which is essential to the pathogen is chosen as a target, then the structures of this protein are experimentally determined and computational techniques are used to select molecules that are most likely to work against the protein.” Computational selection allows her team to consider millions of potential inhibitors and select only a few dozen to be experimentally evaluated in the

laboratory, in order to verify their activity against the pathogen. These procedures constitute the initial steps in the drug development pipeline. Her current focus is on the parasitic disease, Chagas, which is endemic in Brazil, with as many as three million people affected. Existing treatments are not very effective and have serious side effects. Dr. Salgado Ferreira is targeting the cruzain enzyme, the pathogen responsible for the disease, and is testing a number of cruzain inhibitors identified through rational drug design. Her work on the Zika virus, which struck Brazil very hard two years ago, focuses on a protease inhibitor that prevents viral replication. “Developing drugs is highly challenging” she emphasizes. “The greatest achievement for me, which is a big dream, would be to contribute to bringing a drug to market.”

NORTH AMERICA



Dr. Anela Choy

L'ORÉAL-UNESCO NATIONAL FELLOWSHIP UNITED STATES

Scripps Institution of Oceanography at University of California, San Diego

BIOLOGICAL SCIENCES, OCEANOGRAPHY

OCEAN FOOD WEBS AND HUMAN SOCIETIES

Through the burning of fossil fuels and consumption of seafood, humans worldwide have impacted ocean ecosystems. Understanding how all of the creatures in the open ocean interact and feed on one another is the focus of Dr. Anela Choy's research. Additionally, pinpointing how multiple human impacts influence ocean food webs is critical to ensuring their sustained and healthy existence. For example, more than ten million tons of plastic enter the ocean each year.¹ When ingested by marine animals, these plastics pose physical and chemical risks that are poorly known. In addition to disentangling food web structure and function, Dr. Anela Choy's work contributes crucial knowledge about the ecosystem impacts of marine plastic pollution and will aid in developing strategies to manage and conserve ocean ecosystems. She discovered that giant larvaceans, which are primitive marine animals, play a vital role in transporting plastics from the surface to the depths of the ocean. She is investigating the distribution patterns of con-

taminants like methylmercury and plastics in marine animals from the bottom of the food chain right up to the fish consumed by humans. Dr. Choy works on state-of-the-art undersea vehicles from which she can directly observe and sample animals from deep-sea ecosystems, which represent the largest living spaces on Earth. Having just accepted a position at the Scripps Institution of Oceanography, one of the premier oceanographic institutes in the world, Dr. Choy is preparing to set up her laboratory at the University of California, San Diego in Fall 2018. One of her first projects is to examine the chemical extent of plastic pollution in the deep sea: the small fish, squid and crustaceans she will study are the pillars of ocean food webs and primary food sources for commercially important fish. “I hope my work will raise awareness about the intimate links between human societies and the seemingly disconnected deep ocean environment, which we all ultimately depend on.”

1 - Jambeck et al. 2015, Plastic waste inputs from land into the ocean.

A RIGOROUS
selection process

267 NOMINATIONS FROM HIGH LEVEL SCIENTISTS

FROM 62 COUNTRIES

**EACH NOMINATION IS REVIEWED BY 2 OR 3 SCIENTIFIC EXPERTS
IN THE CANDIDATES' FIELD OF RESEARCH**



51 SHORT-LISTED CANDIDATURES

FROM 15 COUNTRIES

EVALUATED BY A JURY OF 10 EMINENT SCIENTISTS



SELECTION OF THE 5 LAUREATES

1 FROM EACH OF THE WORLD'S REGIONS



INTERNATIONAL JURY

Members

To choose the five laureates, recognized by the international scientific community, each candidate had to be nominated by their peers: Presidents of universities, Academies of Sciences, Nobel Prize winners, or laureates of a previous edition of the L'Oréal-UNESCO For *Women in Science* Award.

An international jury composed of 10 eminent scientists selected the award winners.

Professor Elizabeth H. Blackburn

*President of the L'Oréal-UNESCO International Jury 2009 Nobel Laureate in Physiology or Medicine, Professor of Biology and Physiology, Salk Institute for Biological Studies, La Jolla CA, USA
L'Oréal-UNESCO Laureate 2008*

Professor Raymond N. Dubois MD, PHD

Dalton Professor of Biochemistry, Professor of Medicine; Mayo Clinic College of Medicine, Executive Director of the Biodesign Institute, Arizona State University, USA

Doctor Jacques Leclaire

Scientific Director L'Oréal, Research & Innovation, France

Professor Philip Hieter FCAHS, FRSC

Professor of Medical Genetics, Michael Smith Laboratories, University of British Columbia, Canada

Professor Augusto Rojas-Martínez

Professor of Biochemistry and Molecular Biology, School of Medicine and Centro de Investigación y Desarrollo en Ciencias de la Salud, Universidad Autónoma de Nuevo León, Mexico

Professor Appolinaire Djikeng

*Director, Centre for Tropical Livestock Genetics and Health (CTLGH)
Chair, Tropical Agriculture & Sustainable Development, The Roslin Institute & Royal (Dick) School of Veterinary Studies College of Medicine and Veterinary Medicine, The University of Edinburgh, UK*

Professor Ana Belén Elgoyhen

*Investigator at the Institute for Research on Genetic Engineering and Molecular Biology, National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina
L'Oréal-UNESCO Laureate 2008*

Doctor Kanyawim Kirtikara

Executive Director of the National Center for Genetic Engineering and Biotechnology (BIOTEC), Thailand

Professor Khaled Machaca

Professor of Physiology and Biophysics, Associate Dean for Research, Weill Cornell Medical College in Qatar, Doha, Qatar

Professor Boshra Salem

Department of Environmental Sciences-Faculty of Science Alexandria University Director, International Relations office, Egypt

SELECTION COMMITTEE

Members

The 2018 International Rising Talents Selection Committee is composed of 14 highly regarded scientists chosen from the L'Oréal-UNESCO For *Women in Science* national and regional juries in Brazil, Canada, Chile, China, France, Germany, India, Italy, Lebanon, Morocco, Poland, Russia and the United States of America.

Doctor Marie Abboud

*Associate Professor, Former Director of the Physics Department, Faculty of Sciences, Saint-Joseph University, Lebanon
Member of the Levant and Egypt Regional Jury; 2009 International Fellow*

Professor Abdelaziz Benjouad

*Vice-president in charge of Research and Development, International University of Rabat, Morocco
President of the Maghreb Regional Jury*

Doctor Bruno Bernard

L'Oréal Fellow, L'Oréal Research & Innovation France

Professor Nadia Ghazzali

*Department of Mathematics and Computer Science, Université du Québec à Trois-Rivières (UQTR), Natural Sciences and Engineering Research Council of Canada (NSERC), Chair for Women in Science and Engineering, Canada
Member of the Canadian National Jury*

Professor Aleksey Khokhlov

*Vice-Rector of Moscow State University and Chair of Polymer and Crystal Physics, Physics Department, Moscow State University; Member of Presidium of Russian Academy of Sciences, Russia
Chairman of the Russian National Jury*

Doctor H Krishnamurthy

*Director of the Central Imaging and Flow Cytometry Facility at the National Centre for Biological Sciences, Tata Institute of Fundamental Research in Bengaluru, India
Member of the Indian National Jury*

Professor Ewa Łojkowska

*Head of Department of Biotechnology, Intercollegiate Faculty of Biotechnology, University of Gdansk & Medical University of Gdansk, Vice president of the Committee of Biotechnology at the Polish Academy of Sciences, Professor Waclaw Szybalski Foundation, Poland
President of the Polish National Jury*

Professor Gloria Montenegro

*Professor of Biology and Natural Sciences of the Pontificia Católica University from Chile, Full member of the Academy of Sciences for the Developing World, President of the Scientific Council of Fundación Copec PUC, Chile
President of the Chilean National Jury and L'Oréal – UNESCO Laureate 1998*

Professor Marcella Motta

*Professor of Physiology, Università degli Studi di Milano, Past Scientific Director of Milan University's Centre of Oncological Endocrinology; Past Director of the Institute of Endocrinology; Member of the Istituto Lombardo: Accademia di Scienze e Lettere, Italy
Member of the Italian National Jury*

Doctor Sabrina Stierwalt

*Research Scholar, California Institute of Technology Adjunct Faculty, University of Virginia
Member of the American National Jury*

Professor Yan Shen

*Chinese Academy of Science, Vice President of China Association for Science and Technology, Deputy Director of National Nature Science Foundation of China, China
Member of the Chinese National Jury*

Léo Trembley

Specialist program UNESCO, France

Professor Maria D. Vargas

*Professor at the Department of Inorganic Chemistry of the Federal University Fluminense (UFF), Member of the Brazilian Academy of Sciences and Commander of the National Order of Scientific Merit (2010), Brazil,
Member of the Brazilian National Jury*

Doctor Gerlind Wallon

*Deputy Director of the European Molecular Biology Organization (EMBO), Director at the Christiane Nüsslein-Volhard-Foundation, Germany
Member of the German National Jury*

The L'Oréal Foundation and UNESCO would like to express their gratitude to their partners for the support they bring to the *For Women In Science* programme.

The French Academy of Science helps to build a solid base of recognition for these female scientists by choosing them through a rigorous selection process.

The L'Oréal-UNESCO *For Women In Science* programme is also a campaign of awareness on the place of women in science, throughout the world, thanks to JCDecaux, which has offered a powerful promotion display for a month in 6 main airports worldwide (Beijing, Dubai, Johannesburg, London, New York & Sao Paulo), in the Parisian streets and Paris Aéroport, where the iconic posters have been displayed in March 2018.



All media resources for the 2018 L'Oréal-UNESCO *For Women in Science* programme are available on WWW.FONDATIONLOREAL.COM/MEDIACENTER

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